

Research Application Summary

**RUFORUM trains the next generation of scientists for Sudan: The case of the
Agricultural Research Corporation, University of Gezira and University
of Kordofan**

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Abstract

The Regional Universities Forum for Capacity Building in Agriculture (RUFORUM) is a regional network of 60 member universities operating in 25 countries that fosters collaboration, coordination, training and research amongst member universities in Africa. Amongst these RUFORUM universities are the University of Khartoum, University of Gezira, University of Kordofan and Peace University in Sudan. This paper is a case study of the capacity strengthening activities supported by RUFORUM in Sudan between 2008 and 2016. During the period RUFORUM has supported three institutes in Sudan namely; Agricultural Research Corporation (ARC), University of Gezira and University of Kordofan to rebuild agricultural science and human resource capacity by sponsoring faculty development and research opportunities. The capacity strengthening projects and agricultural revival programs at the national research and educational institutes were launched in Sudan by RUFORUM in cooperation with Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA) and Forum for Agricultural Research in Africa (FARA) in 2008. Presently, 68 students are being supported through RUFORUM for MSc and PhD degree training in various agricultural fields in and outside Sudan. Additionally, 50 academic staff from University of Kordofan and 40 from the University of Gezira were trained in eLearning concepts and the MOODLE learning management system during 2011 and 2015, respectively. Also, under the RUFORUM umbrella, senior staff in both universities were actively engaged in identifying and creating supportive environment for eLearning development. In 2015, 65 Deans and Principals from RUFORUM network were hosted by University of Gezira and University of Kordofan and the Agricultural Research Corporation to deliberate on the future direction of RUFORUM and higher agricultural education in Africa. The RUFORUM support has helped to equip Sudanese scientists and academics with high- level research and analytical skills and techniques. However there is still further need to adapt and innovate in order to rebuild agricultural science and strengthen agricultural research system in Sudan.

Key words: Agriculture, Agricultural Research Corporation, capacity building, RUFORUM, Sudan

Résumé

Le Forum des universités régionales pour le renforcement des capacités en agriculture (RUFORUM) est un réseau régional de 55 universités membres opérant dans 22 pays qui favorise la collaboration, la coordination, la formation et la recherche entre les universités membres en Afrique. Parmi ces universités membres du RUFORUM, on compte University of Khartoum, University of Gezira, University of Kordofan and Peace University in Sudan. Ce document est une étude de cas des activités de renforcement des capacités soutenues par le RUFORUM au Soudan entre 2008 et 2016. Au cours de cette période, le RUFORUM a soutenu trois instituts au Soudan à savoir; la corporation de la recherche agricole (ARC), l'Université de Gezira et l'université du Kordofan par le subvention des projets de développement des facultés et des opportunités de recherche dans le but de redynamiser la science agricole et la capacité en ressources humaines. Les projets de renforcement des capacités et les programmes de relance du secteur agricole dans les instituts de recherche et d'enseignement nationaux ont été lancés au Soudan par le RUFORUM en coopération avec l'Association pour le Renforcement de la Recherche Agricole en Afrique de l'Est et Afrique centrale (ASARECA) et le Forum pour la Recherche Agricole en Afrique (FARA). A l'heure actuelle, 59 étudiants sont subventionnés pour les programmes de maîtrise et de doctorat dans divers domaines agricoles à l'intérieur et à l'extérieur du Soudan. En outre, 50 membres du personnel académique de l'Université du Kordofan et 40 de l'Université de Gezira ont été formés dans les concepts d'apprentissage en ligne et le système de gestion de l'apprentissage MOODLE, respectivement, en 2011 et 2015. Aussi, sous l'égide du RUFORUM, les cadres supérieurs dans les deux universités ont été activement engagés à identifier et à créer un environnement favorable au développement de l'apprentissage en ligne. En 2015, soixante-cinq doyens et directeurs du réseau du RUFORUM ont été accueillis par l'Université de Gezira, l'Université de Kordofan et de la Coopération de recherche agricole pour se prononcer sur l'orientation future du RUFORUM et de l'enseignement supérieur d'agriculture en Afrique. Bien que le soutien RUFORUM offre aux scientifiques et universitaires soudanais l'opportunité de faire des recherches de qualités, des compétences et des techniques d'analyse, il y a encore le besoin d'adapter et d'innover afin de reconstruire la science agricole et de renforcer le système de recherche agricole au Soudan.

Mots clés: Agriculture, corporation de recherche agricole, renforcement des capacités, RUFORUM, Soudan

Introduction

Sudan is the third largest country in Africa with an area of about 1.88 million km² (FAO, 2015). The country has a special geopolitical location, bonding the Arab world in Northern Africa to the rest of Africa south of the Sahara. The country is generally flat with three ecological zones: the desert, the semi-desert and the low rainfall savannah (ARC, 2007). Its soils features are mainly the clay deposits in the central and eastern parts, the stabilized sand dunes in the western and northern parts, the red ironstone soils in the south, and alluvial soils along the Nile and other rivers and deltas (FAO, 2013). In recent years, the cultivated land was only about 9% of the total land area (Mahgoub, 2014). Permanent meadows and

pastures cover over 915 thousand km² and extend over most of the ecological zones. Annual herbaceous plants with scattered trees and bushes dominate in the north, while perennial herbaceous plants increase southward with dense stands of woody cover. Sudan has a tropical sub-continental climate, extending from desert climate in the north through a belt of summer-rain climate to semi-dry climate (ARC, 2007). The population of the Sudan was estimated to be about 24.9 million people in 1993, and about 33 million people in 1998 and 37 million people in 2013 with an annual growth rate of nearly 2.6% (Central Bureau of Statistics, 2013). About 80% of the population works in various aspects of agriculture.

Since independence in 1956, Sudan has been keen to promote agricultural education and qualifying managerial agricultural scientists, as the country is primarily an agricultural country (Mahgoub, 2014). Sixty percent of graduates of colleges who are employed in government are males. About 90% of Sudan's exports are agricultural products such as cotton, Gum Arabic, cattle, meat, oil seeds, sorghum, vegetables and fruits (World Bank, 2012). However, an estimated 4.6 million people were food insecure in Sudan in 2014 (FAO, 2015). Food security deteriorated in the last years is due to multiple reasons: influx of refugees, poor harvests, restrictions on trade and assistance, conflicts, increased prices of agricultural products, and climate change (recurrent drought) resulting in the most vulnerable people struggling to access enough food (FAO, 2015). Agricultural sustainable development and advancement of rural societies and community services squarely depend on generation and adoption of knowledge and resultant technologies and efficient and rational management of natural resources. This in turn is hinged on having in place well-trained human resource and functional institution arrangements. This is the basis of the partnership between the Regional Universities Forum for Capacity Building in Agriculture (RUFORUM) and Sudan Agricultural colleges and research institutions. It is aimed at assisting the Sudan to strengthen its human and institutions capacity in support of agricultural development in Sudan.

Agricultural higher education in Sudan

The public and private education systems inherited by the government after independence were mostly designed to provide civil servants and professionals to serve the colonial administration rather than to educate the Sudanese. Moreover, the distribution of facilities, staff, and enrollment were biased in favor of the needs of the administration and a Western curriculum. Schools tended to be clustered in the vicinity of Khartoum and, to a lesser extent, in other urban areas, although the population was predominantly rural. Since World War II the demand for education has exceeded Sudan's education resources. At independence in 1956 education accounted for only 15.5 percent of the Sudanese budget, to support 1,778 primary schools (enrollment 208,688 student), 108 intermediate schools (enrollment 14,632), and 49 government secondary schools (enrollment 5,423). Higher education was limited to the University of Khartoum, except for less than 1,000 students sent abroad by wealthy parents or on government scholarships. The adult literacy rate in 1956 was 22.9%, and despite the efforts of successive governments, by 1990 it had risen only to about 30% in the face of a rapidly expanding population. Traditionally, girls' education was of the most rudimentary kind, frequently provided by *alkhalwa*, or religious school, in which Quranic studies were taught. Such basic schools did not prepare girls for the secular learning

mainstream, from which they were virtually excluded. Expansion was slow, however, given the bias for boys and the conservatism of Sudanese society, education remained restricted to the elementary level until 1940. It was only in 1940 that the first intermediate school for girls, the Omdurman Girls' Intermediate School, opened. By 1955, ten intermediate schools for girls were in existence. The then government announced sweeping reforms in Sudanese education in 1990.

The oldest university, the University of Khartoum, which is an evolution of Kitchener School (1924) and the Memorial College of Gordon (1945), became operative in 1956. In 1990 it enrolled about 12,000 students in degree programs ranging from four to six years in duration. The University of Gezira and University of Juba were established in 1975 at Wad Medani City in Central Sudan and Juba City in South Sudan, respectively, as the first universities in the country to be built outside the capital Khartoum. The University of Gezira is close to the Gezira scheme, one of the biggest agricultural projects in Africa, and was established with the main objective of supplying the project with high-caliber graduates (Ahmed, 2011). In 1990 other universities were established to serve other needs in specific regions of Sudan. For example University of Kordofan, one of the biggest universities in Sudan is located in Elobeid City in North Kordofan State; the university has a Center for Intermediate Technology in Agriculture. Currently, the mandates of Sudanese universities as part of African universities have considerably changed from their traditional teaching and research roles, to greater active involvement in the development agenda of their countries (Kimani, 2014). Thus, in addition to capacity building, Sudanese institutes are engaged in conducting research and developing products in partnership with regional and international institutes so as to provide solutions for national and regional development agenda.

Agricultural research in Sudan

Following the successful pilot schemes and experiments on cotton in the Gezira region, the Gezira Research Farm was established near Wad Medani in 1918 to cater for the problems of long staple cotton in the irrigated central clay plains. Since that time the Gezira Research Farm has served as a headquarter for organizing agricultural research that have gone through evolutionary changes in names and in scope. It was called the Agricultural Research Service during the period 1931-1938, the name was changed to Agricultural Research Institute during 1939-1943, to Research Division during 1943-1953 and to the semi-autonomous Agricultural Research Corporation (ARC) in 1967. Though agricultural research in Sudan started in 1902 (Ahmed, 2003) presently most agricultural research in Sudan is carried out by the Agricultural Research Corporation (ARC) of the Ministry of Agriculture, and the Animal Resources Research Corporation (ARRC) of the Ministry of Animal Resources. Some research carried out by the Institutions of Higher Education such as Khartoum University, the University of Gezira and Sudan University for Science and Technology. It is, however important to disseminate agricultural information to ensure farmers have adequate knowledge and skills to address their needs and sustain production (Musa *et al.*, 2013). Accordingly, research institutions have a responsibility to ensure that the information they disseminate is packaged in a way that makes it easy for the end-users to understand (El-Siddig and Musa, 2008). Researchers need to use appropriate dissemination channels that will make the information accessible to the end-users. Thus, ARC has units to address this need.

RUFORUM capacity strengthening support to Sudan

Postgraduate scholarships. In 2008 a program Strengthening Capacity for Agricultural Research and Development in Africa (SCARDA) was established with DFID support and was coordinated by the Forum for Agricultural Research in Africa (FARA). It was run in three sub-regions and in the Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA) region. The capacity development component was managed by the Regional Universities Forum for Capacity Building in Agriculture (RUFORUM). A key component of SCARDA was to strengthen research capacity by training master students in the region in various fields in agricultural sciences (FARA, 2013). Accordingly, ARC was granted five master scholarships, three scholarships for students to be trained in plant breeding and seed systems at Makerere University, one in agricultural information and communication management at Egerton University and one in range management at University of Nairobi (Table 1). Additional 10 master students were trained at the Sudan Academy of Science in plant breeding and biotechnology, soil science and plant nutrition, water science and management and tissue culture. This was also coordinated by RUFORUM. All students graduated and returned to their work stations and were promoted from the then assistant research scientist positions to higher research scientist posts. Some of them actively embarked on research work including leading national projects for different crops in ARC; some later joined PhD programs in or outside the country (Table 2).

Virtually all the SCARDA students published one or more papers in refereed journals and the summaries of their Master research work undertaken show a clear grasp of the science discipline involved (ARC, 2012; 2013; Blackie, 2012). For example; Mr. Ahmed Babiker, in his MSc research, designed a drip irrigation technology (combining water and fertilizer through drip irrigation) that increases water use efficiency by applying water directly to the immediate vicinity of the plant roots through a network of pipelines and water emitters. The low cost drip irrigation system is easy to install and simple to use. Using this method of combining water and fertilizer through drip irrigation, more food and more nutrition from the vegetables has been made available for hundreds of farmers. Upon finalizing his MSc thesis, Mr. Babiker was promoted to a position of research scientist and posted to Kassala Research Station in eastern Sudan. He was subsequently selected to lead a project in collaboration with the International Atomic Energy Agency (IAEA). He has continued to promote adoption of the drip irrigation technology to small scale farmers in eastern Sudan. This technology has since been adopted by hundreds farmers in the region. His success was recognized by the IAEA (www-naweb.iaea.org/nafa/swmn/sudan, retrieved on 1st May, 2016). The impact of the SCARDA students, which was regionally recognized (ASARECA, 2011; Blackie, 2012), encouraged RUFORUM to collaborate again and grant ARC 20 in-country master scholarships in 2014. Accordingly, ARC selected 20 assistant research scientists to be trained on crop science, soil and water science, horticulture and agricultural engineering at the University of Gezira and University of Kordofan.

Sharing capacity to build capacity for quality graduate training in agriculture in African Universities project. The INTRA - ACP academic mobility scheme a program that was funded by the European Union, supported higher education institutions to promote

Table 1. Master students supported under SCARDA program outside Sudan during 2008 - 2011

Name	Previous degree and name of the university	Previous position and name of home institution	Current position
Dr. Mayada Mamoun Beshir	MSc Plant Breeding and Seed Systems and PhD Plant Breeding and Biotechnology, Makerere University, Uganda	Assistant research Scientist, Biotechnology and Biosafety Research Centre, Agricultural Research Corporation, Sudan	Plant breeder/Geneticist, Agricultural Research Corporation, Sudan
Ms. Nada Siddig A. Musa	MSc Agricultural Information and Communication management, University of Egerton, Kenya	Technical scientist, Information Technology Unit, Agricultural Research Corporation, Sudan	PhD candidate, Agricultural and Rural Development, Makerere University, Uganda
Dr. Yazan A. M. Elhadi	MSc and PhD Dry lands Resource Management, University of Nairobi, Kenya	Part time teaching assistant, University of Kordofan	Part time lecturer, University of Nairobi and Founder of Agriculture and Resource Economist Adaptation Consortium Secretariat, Kenya

Sources: RUFORUM

Table 2. Master students supported under SCARDA program inside Sudan during 2008 - 2012

Name, Research Station and City	Position	Current responsibilities
Mr. Ahmed B. A. Khalifa, Kassala and Gash Research Station, Kassala	Horticulturist	Modern irrigation system and pomology
Mr. Ali Alkhazin A. Yosif, Kassala and Elgash Research Station, Kassala	Soil scientist	Effect of organic manure on tomato and onion
Ms. Amel Ahmed Ali, Sennar Research Station, Sennar	Soil scientist	Crop water requirement and use of irrigation models to schedule irrigation for crops
Ms. Amel Osman A. Idris, Gezira Research Station, Wad Medani	Soil scientist	PhD candidate, University of Khartoum
Mr. Atif Ahmed Musa, Efolia Research Station, Efolia	Plant breeder	Establishment of cereal breeding program at a new research station in west of Sudan
Mr. Ezeldeen A. Banaga, Damazin Research Station, Damazin	Soil scientist	Effect of nitrogen and phosphorus rates and sources on yield of maize under rain fed irrigation
Mr. Khalid H. M. Ibrahim, Elobied Research Station, Elobied	Soil scientist	Improve soil fertility to increase production rates vertically
Ms. Mariam A. M. Elmahdi, Shambat Research Station, Shambat	Plant tissue culture scientist	Genetic variability of ornamental plants using tissue culture
Mr. Mohammed Y. Balla, Hamadab Research Station, Elmoltaga	Plant breeder	Genetic variability of oil crops for yield and yield components
Mr. Sufian S. Mohammed, Shambat Research Station, Khartoum North	Plant breeder	PhD candidate, University of Khartoum

Sources: Personal communication with the Sudanese scientists in ARC

mobility of students (Masters and PhDs), researchers and university staff from Africa, Caribbean and Pacific (ACP) countries. The scheme aimed to promote sustainable development and poverty alleviation by increasing the availability of trained and high - level qualified professional manpower in the ACP countries. Consequently, with support from RUFORUM, Makerere University won a grant to support training of 20 PhD and 40 MSc. students. Under this project Sudanese applicants from University of Gezira were granted six master study positions in Makerere University, Haramaya University, Jomo Kenyatta University of Agriculture and Technology, Lilongwe University of Agriculture and Natural Resources and University of Cape Coast, Ghana. In addition, three PhD students (two from University of Gezira and one from ARC) were granted scholarships to pursue their postgraduate studies at Makerere University. The study areas of these students covered aquaculture and fisheries science, agro-meteorology and risk management and soil and water sciences, agricultural and rural development, plant breeding and biotechnology and agricultural extension.

Institutional support to Sudan. RUFORUM has employed a range of funding windows to support the training of research scientists for Sudan. To date, four institutional grants have been awarded to University of Gezira (2) and University of Kordofan (2). In addition, RUFORUM has supported University of Kordofan to access funding under the DFID Delphe project to fund training of eight MSc students (at Kenyatta University and Sokoine University of Agriculture), all of who have completed their studies and returned to Sudan. In total about 60 MSc students have been trained through these efforts.

Apart from the training being conducted in Sudan, the Sudanese students were distributed in seven countries namely, Ethiopia, Ghana, Kenya, Malawi, Sudan, Tanzania, and Uganda to pursue their postgraduate studies at the RUFORUM universities network (Fig. 1). In addition, the program 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 found to be a challenge for the Sudanese and consequently the universities made special arrangements for them to get enrolled in English classes delivered by experienced facilitators. This helped to give exposure to the students and to network them with other students in Africa. Additionally, RUFORUM provided support to bring the students together in Sudan, to enable them share experiences and know each other.

The biennial conference is RUFORUM's most comprehensive meeting because of the diversity of the attendant stakeholders in agriculture (RUFORUM, 2015). It is especially dedicated to graduate students and their supervisors, grantees in RUFORUM member universities and alumni. The Biennial conferences provided a platform for the agricultural scientists from Sudanese institutes to meet with other stakeholders in Africa and beyond to actively exchange findings and experiences. Sudanese grantees attended the 2nd, 3rd and 4th biennial conferences where they were able to peer review their work and had the opportunity to network and share lessons and experiences with other students and research from other countries.

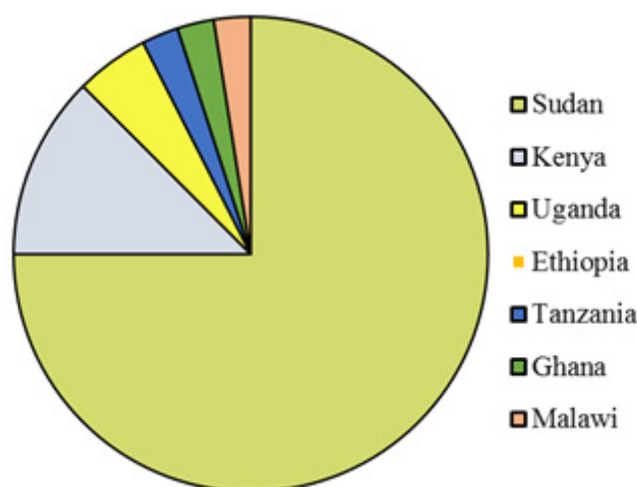


Figure 1. Frequency distribution of students supported by RUFORUM from ARC and University of Gezira during 2014 - 2016

Sources: ARC, University of Gezira and University of Kordofan

A major challenge that most young researchers face is how to make effective public presentations. Under the RUFORUM scholarships, each student had a chance to attend at least one major conference to present their research work findings. The biennial conferences provide 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, criticize and appraise each other's work, learn from senior scientists and invited keynote speakers. Such opportunities were instrumental in transforming the junior scientists into functional professionals at the early stage of their career paths.

The Sudanese students worked in various fields of agriculture based on the needs of ARC and Universities of Gezira and Kordofan. The distribution of students by gender and agricultural fields are presented in Table 3.

Other benefits of joining RUFORUM network

eLearning training courses. A series of eLearning workshops were held at the University of Kordofan and University of Gezira, which are both RUFORUM member universities in Sudan. Fifty academic staff from University of Kordofan and 40 academic staff from University of Gezira were trained in eLearning concepts and the MOODLE learning management system in 2011 and 2015, respectively. At both universities time was also spent in engaging the senior university staff on how they could create a supportive environment for eLearning development. Both universities acknowledged that the RUFORUM support helped them achieve their goals to support their staff to implement technology-mediated teaching and learning and improve the quality of learning delivery. This leads to graduation of quality students who in turn contribute towards solving Sudan's development challenges.

Table 3. Student gender distribution and agricultural fields of MSc and PhD students from ARC and University of Gezira and Kordofan during 2008 2016

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Field of study	MSc		MPhil		PhD		Study field percentage
	Female	Male	Female	Male	Female	Male	
Agrometeorology and Risk Management	2	0	0	0	0	0	2.9
Agricultural Economics	4	0	0	0	0	0	5.9
Agribusiness	0	2	0	0	0	0	2.9
Natural Resources Management	0	2	0	0	0	0	2.9
Drylands Resource Management	0	1	0	0	0	0	1.5
Agricultural Extension and Research Methods	1	1	0	1	1	0	5.9
Agricultural Engineering	2	3	0	0	0	0	7.4
Crop Science, Plant Breeding and Tissue Culture	8	11	0	0	1	1	30.9
Crop Protection	1	3	0	0	0	0	5.9
Plant Nutrition	1	0	0	0	0	0	1.5
Forestry	0	3	0	0	0	0	4.4
Entomology	1	2	0	0	0	0	4.4
Animal Production	3	2	0	0	0	0	7.4
Aquaculture and Fisheries Science	0	1	0	0	0	0	1.5
Soil Science and Reclamation	1	5	0	0	0	0	8.8
Water Science and Management	1	3	0	0	0	0	5.9
Gender percentage	36.8	57.4	0.0	1.5	2.9	1.5	100

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Sources: ARC, University of Gezira and University of Kordofan

Strengthening partnerships with other Institutions. A number of Memorandum of Understanding documents (MOU) were signed between the Sudanese institutes and the RUFORUM universities network. For example Makerere University in Uganda and University of Gezira signed an MOU to foster cooperation in the field of research and higher education in 2014 (www.uofg.edu.sd/en/). As part of the implementation process of the MOU between Makerere University and University of Gezira, a delegation from the University of Gezira led by the Vice Chancellor Prof. Mohammed Warrag Omer visited Makerere University in 2015. During the visit, the two parties discussed how the signed Makerere-Gezira MOU can be implemented and agreed on areas of collaboration including research, outreach and training (www.mak.ac.ug, retrieved on 29th May, 2015).

The Deans meeting. Sixty five Deans and Principals from 22 African countries had the opportunity to meet in Khartoum and deliberate on the future direction of RUFORUM and Agricultural Higher Education in Africa in 2015 (RUFORUM, 2015). This meeting was hosted by the Agricultural Research Corporation and Universities of Gezira and Kordofan. The Deans and Principals discussed the issue of strengthening the quality of higher education in Africa and measures that needed to be taken to ensure greater engagement of African universities in implementation of the Comprehensive African Agricultural Development Programme (CAADP) and the Science, Technology and Innovation Strategy for Africa (STISA). The meeting called for strengthening of Academic Mobility, institutionalization of Credit transfer systems and greater connectedness between universities and farming communities, private sector, Governments and other actors. On the other hand, this event gave opportunity for the University of Gezira, University of Kordofan and ARC to showcase potential areas of partnerships, collaboration and clearly demonstrated how the Universities and ARC were linking with Communities and Agri-business.

Conclusion and future prospects

Agriculture is the core of the Sudanese life and the main driving force for the national economy. Sudan's agro-ecological zones support a variety of food, cash and industrial crops. Vast natural pastures and forests support large herds of livestock including cattle, sheep, camels and goats. The main exported crops are sorghum, cotton, groundnuts, sesame, sugarcane, Gum Arabic, fruits and vegetables; this is in addition to livestock which consists of mainly sheep, cattle and camels. In pre-2011 Sudan, it was the sole source of income for about 60 - 80% of households and constituted about 80% of the country's export. But since 2011 its share in the economy and livelihood of the people has declined being usurped by the oil industry and related services. The oil boom was short-lived and continued for only a decade as it was terminated by the secession of its source, South Sudan in July 2011. This resulted in the loss of about 75% of Sudan oil resources thus throwing a heavy blow to the national economy. The Government realizes that the only way out to ease the resultant tense economic situation and help defuse the impending food security crises was through going back to agriculture and refocusing on Agricultural investment. The Government has put up an agricultural strategy with policies geared to satisfy domestic food needs and realize large surpluses for export via diversification of Agricultural crops and multiplication of crop produce. Understandably, the strategy has assigned a specific priority to human

capacity building and research and development in agriculture. The government departments affiliated with enacting this strategy together with the Agricultural Research Corporation (ARC), the University of Gezira (UofG) and University of Kordofan (KU) are spearheading the efforts to realize the set government objectives viz - a -viz the food and agriculture and export situation. They found in RUFORUM the strong support they needed to achieve the objectives via enhanced capacity building and training. The collaboration between the three institutes and RUFORUM has helped train more than 70 postgraduate research scientists and lecturers. Already 20 M.Sc. and two PhD students have finished their studies. Their research topics addressed broad thematic areas including topics that addressed problematic issues in the Sudan's agricultural sector including research methodologies, implementation processes, and strengthening engagement with communities and industry. The research outputs thus generated are disseminated through appropriate channels which intentionally promote wider adoption both at the national and regional levels. Additionally, 50 M.Sc. and 3 Ph.D. students are still working towards completing their degrees training in universities in Sudan and others in eastern, southern, and west African countries.

The Agricultural sector in Sudan via Agricultural Research Council (ARC), University of Gezira (UofG) and Kordofan University (KU) have continued to benefit from the regularly convened regional learning events organized under the auspices of the RUFORUM Network. The convenings have given international exposure to Sudanese students and researchers, and to research and University leaders. Moreover, the caliber and expertise of individual research and faculty members of the institutions have been strengthened and thus enabling better output performance. Moreover, the collaboration and networking of faculty and units among Agricultural Research Council, University of Gezira and Kordofan University have been enhanced. Being well aware of the importance of the RUFORUM network to the welfare of Sudan and other African countries, the Government of Sudan in collaboration with the three institutes organized the 2015 RUFORUM meeting in Khartoum and both the Minister of Higher Education and Scientific Research and the Minister of Agriculture and Forestry addressed the member universities of RUFORUM. Recently, because the Government appreciated the benefits of Sudanese Universities being members of the RUFORUM network advised the University of Khartoum, the oldest university in the country, to join the RUFORUM network for its own good and the good of the country. Although Sudan is presently a poor country, because of amongst other causes social conflict and civil war, its future holds much promise as its economy is expected to recover gradually. The Government is well aware that the main factors enabling progress are research and development in the country and capacity building of the human resources resulting in well trained caliber of leaders capable of innovation and facilitating change processes is critical. It is with this mind that the Government of Sudan is putting high commitment on its association and collaboration with RUFORUM.

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References

- Ahmed, A.E. 2011. Risk sources and attitude among the tenants of the Gezira Scheme Sudan. *J. Saudi Society of Agric. Sci.* 10:71-75.
- Agricultural Research Corporation (ARC). 2007. Managing risk, reducing vulnerability and enhancing agricultural productivity under a changing climate. Country report: Sudan. Agricultural Research Corporation (Land and Water Research Center and Sudan Meteorological Authority). <http://www.arcsudan.sd/English.html>.
- Agricultural Research Corporation (ARC). 2012. Agricultural Research Corporation. Sorghum research program annual report. <http://www.arcsudan.sd/English.html>.
- Agricultural Research Corporation (ARC). 2013. Agricultural Research Corporation. Sorghum research program annual report. <http://www.arcsudan.sd/English.html>.
- Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA). 2011. SCARDA: Improving capacity for agricultural research. Published on ASARECA (<http://asareca.org/~asareca>).
- Blackie, M. 2012. A report to RUFORUM: SCARDA funded graduates: Case studies and commentary. bT-Associates: Smallholder Agricultural Development, UK.
- Central Bureau of Statistics (CBS). 2013. Central Bureau of Statistics. 2008. The 5th Sudan population and housing census: Population and Housing Census, Retrieved September 22, 2009, from www.CBS.gov.
- El-Siddig, K. and Musa, A.I. 2008. Report on the National Agricultural Information System (NAIS) of the Sudan. Proceedings of the Regional Workshop for Strengthening National Information Communication Management Focal Units in Near East Region, Muscat, Oman, 8-10 January, 2008.
- Food and Agriculture Organisation (FAO). 2013. Sudan. FAO in emergencies. Food and Agriculture Organization of the United Nations. Rome, Italy.
- Food and Agriculture Organisation (FAO). 2015. Sudan. FAO in emergencies. Food and Agriculture Organization of the United Nations. Rome, Italy.
- Forum for Agricultural Research in Africa (FARA). 2013. Science agenda for agriculture in Africa: Connecting science-A science agenda for transforming agriculture in Africa. A report of an expert panel. Forum for Agricultural Research in Africa (FARA), Accra, Ghana. 56pp.
- Higher Council for Environment and Natural Resources (HCENR). 2008. National capacity self-assessment: Report and action plan. Higher Council for Environment and Natural Resources, Khartoum.
- Kimani, P.M. 2015. Role of universities in development of improved crop varieties, seed production, dissemination and impacts: Case studies of dry, canning, snap and runner beans, pigeonpea and onions Agricultural research in Sudan. In the Proceedings of the 4th Regional Universities Forum for Capacity Building in Agriculture Biennial Conference. held 19-25 July, 2014, Maputo, Mozambique. pp. 267-272.
- Mahgoub, F. 2014. Current status of agriculture and future challenges in Sudan. Nordiska Afrikainstitutet, Uppsala. Lightning Source UK Ltd. ISSN 0280-2171.
- Regional Universities Forum for Capacity Building in Agriculture (RUFORUM). 2015. Press Release: RUFORUM expands its mandate to now a 55 member universities network. Website: www.ruforum.org.
- World Bank. 2011. World Bank supports sustainable livelihoods and landscapes in Sudan. Press Release 19 December 2013. Washington DC.