OPENING ACCESS TO AGRICULTURAL SCIENCES AND TECHNICAL INFORMATION IN GHANA, KENYA AND ZAMBIA[1]

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ABSTRACT

Agricultural innovation systems in Africa need to have access to both local and global agricultural sciences and technical information if they are to have an impact on agriculture and food security initiatives on the continent. While access to global agricultural information resources and innovations is relatively easy, local agricultural content is generally not visible and easily accessible. Providing access these important resources, through institutional repositories of metadata records and associated full-text documents, is one pathway of ensuring that the content generated locally is easily accessible within the country, region and around the globe. This paper highlights three initiatives implemented by national research institutes in Ghana, Kenya and Zambia aimed at opening access to agricultural information and knowledge resources. It also presents the major challenges faced in the implementation of the initiatives and the key lessons learned that could be useful when implementing similar initiatives.

Keywords: open access, institutional repositories, agris, ciard, kainet, gains, zard4din

INTRODUCTION

To increase the quality and impact of research and innovation on agriculture and food security in Africa, it is important that actors in agricultural innovation systems have access to

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global, regional and local scientific and technical information, and share knowledge on innovations. While much of outputs of the international agricultural innovations are easily accessible via online systems, the outputs of agricultural innovation in Africa are generally not visible and easily accessible. Opening access to outputs of agricultural research from Africa and building digital institutional and national repositories accessed online is one pathway of making these important resources visible and easily accessible, and ultimately increasing their impact.

The Food and Agriculture Organization (FAO) and partner organizations, under the AGRIS (International Information System for the Agricultural Sciences and Technology) and the Coherence in Information for Agricultural Research for Development (CIARD) global initiatives, are supporting the National Agricultural Research Systems (NARS) in Africa to build institutional and individual capacities in order to enhance the visibility and accessibility of agricultural content. This paper highlights three initiatives implemented by the FAO in collaboration with national, regional and international partner institutions and organizations in Ghana, Kenya and Zambia aiming at opening access to agricultural information and knowledge resources. It also presents the major challenges faced in the implementation of the initiatives and the key lessons learned that could be useful when implementing similar initiatives.

GLOBAL INITIATIVES - AGRIS AND CIARD

AGRIS

In 1975, the FAO initiated AGRIS with the aim of building a common information system for science and technology in agriculture and related subjects, based on a collaborative network of institutions (FAO, 2002). Participating institutions (called AGRIS Input Centres) contributed bibliographic data of documents, especially grey literature, to the central AGRIS database. For most organizations involved in agricultural research and innovation in Africa, the AGRIS database, distributed on SilverPlatter CDs and now accessible online (http://agris.fao.org), was and is the only means through which their research outputs are made visible to the outside world. However, providing access to entire full-text documents has been a major challenge faced by such organizations.

In 2002, the FAO proposed a revised AGRIS strategy which, among others included a focus on management of *full-text documents* of agricultural science and technology information resources (FAO, 2002), as opposed to focusing only on metadata records. The new strategy also called for the development and coordination of standards, methods and tools for agricultural information management, specifically for metadata exchange and provision of access to associated full-text documents. The new strategy set the stage for institutions participating in the AGRIS network to go beyond processing of metadata and to start providing access to full-text documents in digital format. It also allowed individual institutions in the countries to participate in the initiative and contribute bibliographic records directly to the AGRIS central database as opposed to doing so through the national AGRIS Input Centres.

CIARD

The CIARD initiative[2] came about as a result of a series of regional and global workshops and consultations, initially organized under the umbrella of the AGRIS initiative, of institutions and experts to address the goal of developing coherence in international information systems for agricultural science and technology. The initiative was launched in 2008 by global partner organizations among them the FAO, the Global Forum on Agricultural Research (GFAR), the International Association of Agricultural Information Specialists (IAALD), the Forum for Agricultural Research in Africa (FARA) and the Consultative Group on International Agricultural Research (CGIAR). From the onset the CIARD partners agreed on a vision "*To make public domain agricultural research information and knowledge truly accessible to all*". To this effect the partners coordinate their efforts, promote common formats for information sharing and exchange, adopt open information systems approaches, and work towards creating a global network of accessible outputs of agricultural research and innovation, thus greatly increasing the chance that these important resources can be put to use, locally, nationally and globally.

The CIARD partners subscribe to the CIARD Manifesto which outlines the initiative's Values, and have developed a Checklist of Good Practices providing guidelines on *Developing Institutional Readiness* and *Increasing the Availability, Accessibility and Applicability of Research Outputs*; and several Pathways to making agricultural research

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[2] CIARD website is accessible at http://www.ciard.net

outputs *available*, *accessible* and *applicable*. The CIARD initiative also encourages participating national institutions to subscribe to international standards, and to adopt policies on intellectual property and archives that encourage access to outputs of research and raise awareness on accessibility options.

In Africa, the CIARD initiative has been endorsed by the General Assembly of the Forum for Agricultural Research in Africa (FARA). The Assembly, in July 2010, in Ouagadougou, Burkina Faso, recommended that CIARD should advocate for more coherent approaches to knowledge sharing and communication of the outputs of agricultural research support development of national capacities for all types of stakeholders (Rudgard, 2012). In April 2012 the initiative was introduced to the Ministers of Agriculture and their representatives at the Second Annual Ministerial Dialogue organized by FARA in Accra, Ghana.

Now, AGRIS activities fall under the CIARD initiative through which FAO and partners are supporting national initiatives in Africa to make agricultural information and knowledge generated on the continent visible and truly accessible.

NATIONAL INITIATIVES – GAPP, KAINET AND ZAR4DIN

In 2006, the FAO started supporting national pilot initiatives in Africa aimed at implementing the new AGRIS strategy and later the CIARD vision. To date three initiatives have been supported in Kenya (Kenya Agricultural Information Network - KAINet), Ghana (Ghana AGRIS Pilot Project - GAPP) and Zambia (Zambia Agricultural Research for Development Information Network - ZAR4DIN). The main goal of the initiatives was to develop national networks of institutions and individuals involved in agricultural research for development (AR4D) information/knowledge generation, management, dissemination and exchange in order to facilitate access to AR4D information and knowledge, including metadata and full-text documents, through interlinked institutional repositories linked to national AR4D portals. The specific objectives included:

- Strengthening partner institutions through effective institutional collaboration in order to build a basis for strong national networks of institutions involved in the generation and management of agricultural sciences and technology information;
- Developing institutional policies and strategies for information and communication management (ICM);

- Strengthening human resource and institutional capacities in the management of agricultural sciences and technology information;
- Developing frameworks for knowledge sharing in the networks;
- Building *institutional repositories* of public domain scientific and technical information on agricultural sciences and technology at *selected pilot centres* based on common information management standards, guidelines and tools to promote and facilitate information sharing and exchange;
- Building national portals for agricultural sciences and technology information

Kenya Agricultural Information Network

KAINet came into being as a result of the Kenya AGRIS Pilot Project which was initiated in April 2006 following consultations on how to promote information exchange and access among stakeholders in the agricultural sector. With funding from the UK Department for International Development (DFID), the Kenya Agricultural Research Institute (KARI) worked on the development of KAINet with support from FAO, CAB International and the Association for Strengthening Agricultural Research in Eastern, Central and Southern Africa (ASARECA). The pilot institutions on KAINet were KARI headquarters, KARI-National Agricultural Research Laboratories (KARI-NARL), Kenya Forestry Research Institute (KEFRI), Jomo Kenyatta University of Agriculture and Technology (JKUAT), and the Ministry of Agriculture Kilimo Library.

Ghana AGRIS Pilot Project

Also supported with funding from DFID, GAPP was implemented from 2007 to 2010 by the Council for Scientific and Industrial Research (CSIR) – Institute for Scientific and Technological Information (CSIR-INSTI), as an activity of the Ghana Agricultural Information Network System (GAINS). The pilot institutions on the project were INSTI, the Cocoa Research Institute of Ghana (CRIG), the CSIR Forestry Research Institute of Ghana (FORIG), the CSIR Food Research Institute (FRI), the CSIR Animal Research Institute (ARI), the Ministry of Food and Agriculture Information Resource Centre (MOFAIR), and the College of Agriculture Education (Ashanti-Mampong) of the University of Education, Winneba. GAINS member institutions not involved in the project were consulted on several issues and took part in training workshops and conferences organized under GAPP. This approach ensured that they were kept up to date on the activities of the project and the

decisions that were being made to be implemented by the GAINS members. Involving other GAINS member institutions in GAPP activities led to the Soil Research Institute of the CSIR to take the initiative and source for funds and start working on its institutional repository.

Zambia Agricultural Research for Development Information Network

The Zambia Agricultural Research Institute (ZARI), with technical support and funding from FAO and the Forum for Agricultural Research in Africa (FARA), implemented ZAR4DIN from January 2010 to October 2011. The national partner institution was. The pilot institutions on the project were ZARI, the National Institution for Scientific and Industrial Research (NISIR) and the National Agricultural Information Service (NAIS) of the Ministry of Agriculture and Cooperatives (MACO). Like in the case of GAPP, other institutions such as the National Science Technology Council (NSTC), Livestock Development Trust (LTD), the University of Zambia Library and the Copperbelt University Library were invited to all stakeholder consultations and to some training workshops organized by the project. This approach resulted in NSTC to initiate activities towards developing a national repository of science and technology information, of which once implemented, ZAR4DIN will be a component.

KEY OUTPUTS TOWARDS OPENING ACCESS

The key outputs of the three initiatives, contributing directly to opening access to the countries' agricultural sciences and technical information, were the institutional repositories and national portals of agricultural sciences and technical information.

Institutional Repositories

Almost all the institutions on the national initiatives developed institutional digital repositories using the following FAO supported international standards, tools and methodologies for agricultural information management:

- AGRIS Application Profile (AGRIS AP) – a metadata standard for describing, exchanging and retrieving Document-Like Information Objects;
- AGROVOC Thesaurus – a multi-lingua thesaurus for data indexing;
- Software tools for repositories:

- WebAGRIS software – a tool for creating, managing and disseminating metadata compliant with AGRIS AP;
- AgriDrupal – a digital repository management system built on the Drupal Content Management System.

In Ghana and Kenya[3], the WebAGRIS software was used in almost all the pilot institutions for creating metadata while in Zambia[4] the institutions installed and used AgriDrupal. Some institutions in Kenya and Ghana are now considering migrating to AgriDrupal which provides more functionality than WebAGRIS.

The content in the institutional repositories, depending on the major activities of the institution, largely include journal articles, conference papers, research reports, annual reports, theses and dissertations, extension materials, and articles in conference proceedings. Tables 1, 2 and 3 below give the number of metadata and full text-documents available in the institutional repositories.

Table 1: GAPP - Metadata and Full-text Documents in Institutional Repositories
November 2012

Institution	Metadata	Full-Text Documents
CSIR-ARI	328	170
CSIR-FRI	291	291
CSIR-INSTI	1178	1152
CAGRIC	589	587
CSIR-FORIG	503	503
CRIG	158	145
MOFAIR	520	40

Table 2: KAINet - Metadata and Full-text Documents in Institutional Repositories
November 2012

Institution	Metadata	Full-Text Documents
KARI HQ	1500	750
KARI-NARL	770	350
KEFRI	1332	100
JKUAT	240	12
Kilimo Library	1905	167

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[3] JKUAT later opted for DSpace as a result of the new University policy on the tool for the University repository
[4] Initially NISIR was using Access and later also installed AgriDrupal

Table 3: ZAR4DIN - Metadata and Full-text Documents in Institutional Repositories
January 2012

Institution	Metadata	Full-Text Documents
ZARI[5]	850	100
NISIR	420	420
NAIS	120	45

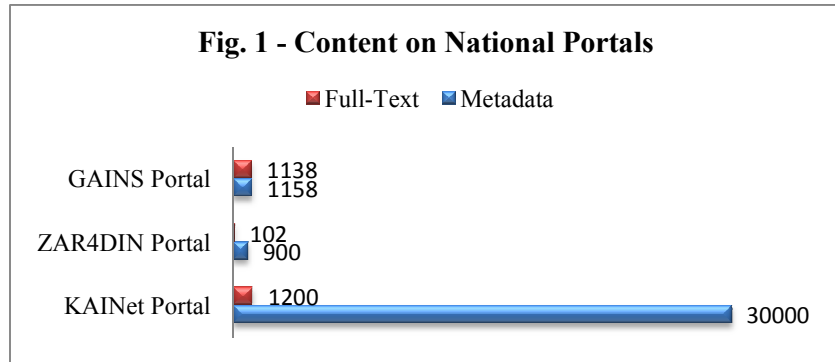**National Portals and Access to Content**

Due to various factors, among them the lack of reliable and dedicated internet access, lack of funds to host content/repositories on external web hosting services, inadequate ICT skills, and issues relating to copyright and licensing of digital content, most institutional repositories are largely accessible to users within the institutions (on the intranets). Only institutional repositories at KARI (KARI e-repository) and Kilimo Library are accessed via the institutions websites. The KARI e-repository is also registered with the Directory of Open Access Repositories (DOAR). Therefore, to enhance the visibility and accessibility of content in the institutional repositories and to make the metadata records easily harvestable by other service providers, the initiatives included developing the following national portals:

- KAINet Portal (http://www.kainet.or.ke): was developed using Typo3 Content Management System with WebAGRIS running in the background as the metadata management software. Over 30,000[6] metadata records and about 1,200 full-text documents are accessible on the portal.

- ZAR4DIN Portal (http://zar4din.org): the AgriDrupal was used to develop the portal. It provides access to about 900 metadata records and 102 documents harvested mainly from ZARI and NISIR repositories.

- GAINS Portal (http://gains-instigh.org): the GAINS portal is also based on AgriDrupal and provides access to about 1158 metadata records and 1136 full-text documents. The records are harvested from WebAGRIS-based institutional repositories and integrated into the portal using AGRIS AP.

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[5] Scanning of documents at ZARI moved faster than the creation of metadata
[6] The figure includes records harvested from the old CDS/ISIS based Kenya Agriculture Research Database (KARD)

Data for the national portals is harvested from institutional repositories in participating institutions and is exposed for harvesting by service providers both as XML files using the AGRIS Application Profile and through an OAI-PMH interface. Due to the challenges discussed in the next section, the number of full text documents accessible on these portals is significantly low (Figure 1) compared to the number of metadata records that have been created.

Fig. 1 - Content on National Portals

■ Full-Text ■ Metadata

GAINS Portal: 1138 / 1158
ZAR4DIN Portal: 102 / 900
KAINet Portal: 1200 / 30000

MAJOR CHALLENGES

The major challenges faced in the three initiatives were the:

- lack of motivation and incentives for researchers to submit their works to the institutional repositories;
- absence of institutional policies and strategies to support open sharing of information resources,
- absence of clear copyright and guidelines for licensing digital content,
- lack of knowledge about publishers policies on open access and self-archiving.

Lack of Motivation and Incentives

In most pilot institutions, researchers are the main generators of much of the content which should go into the institutional repositories. Their main goal, in most cases, is to have their works published in national or international peer-reviewed journals or present papers, based on their works, at international conferences. These activities count towards their promotion and recognition. Unfortunately, there is no motivation or tangible incentives for them to deposit their publications in the institutional repositories or in the institutions' physical

library or documentation centres. The result is gaps in the number of metadata created and the associated full-text documents added to the repositories. The collections in the libraries or documentation centres are incomplete due to non-contribution of information resources by the researchers. To some extent, this challenge was addressed through sensitization, awareness and advocacy activities on the benefits of open access to the researchers and to the institutions.

Absence of Institutional Policies and Strategies

The problems caused by lack of motivation and incentives for researchers to contribute to the institutional repositories were exacerbated by the absence of and/or non-implementation of appropriate policies and strategies to support open sharing and dissemination of information resources in digital format.

Recognizing that enabling policies/strategies are critical, locally led consultative processes to develop these were taken forward in all three pilots to various stages of completion. In Ghana, these were developed through a series of write-shops hosted by the pilot institutions; in Kenya, KAINet organized workshops to discuss and draft the policy/strategy documents; and in Zambia, institutional seminars to discuss revisions of existing policies and strategies that have an impact on information activities in the pilot institutions were held.

While in Ghana some pilot institutions (i.e. College of Agricultural Education, CSIR-INSTI and CRIG) formally approved and launched their policy/strategy documents (although they are yet to be implemented), in Kenya and Zambia, these are either yet to be approved or finalized. The process to develop policies/strategies in KAINet pilot institutions involved mainly staff (researchers, library and information professions, ICT specialist, etc) implementing the project activities. As result senior management appeared not be keen on endorsing policies/strategies developed in a bottom-up approach, without their active participation. In Zambia, the process delayed because initially senior managers in the pilot institutions felt that the idea to revise or develop appropriate policies and strategies was seen and being imposed on the institutions by the project. Although later, the position of senior managers changed, after detailed consultations, it was too late to finalize work on the policy/strategy documents during the time span of the project.

Copyright and Licensing Guidelines

Existing copyright regulations in most institutions mainly cover print based-documents. Digital documents placed online can be accessed anywhere and at any time and as result they require a new way of handling related copyright issues. Placing documents on open access also entail lifting some of the restrictions placed on the documents by copyright regimes. The absence of clear copyright and licensing guidelines for digital documents contributed and is still contributing to the low numbers of full-text documents that are being made accessible to external users. ZAR4DIN addressed this challenge by holding consultations and drafting copyright guidelines to govern submission of documents to the ZAR4DIN portal.

Publishers Policies on Open Access and Self-Archiving

A number of publishers have developed policies on open access and self-archiving (see SHERPA/Romeo initiative[7]). These outline what the publishers can allow or not allow to be included in the institutional repositories, or when PDF copies of the journal articles could be made available in the repositories. The lack of knowledge about such policies meant that documents that are allowed, i.e. pre- and post-prints by some publishers, to be included in the repositories where not being made available for the repositories.

Poor Working Relations Between IT and Information Staff

Developing and managing institutional repositories require several different skills. Therefore, from the onset, in all the three pilots, information technology specialists and information professionals were actively involved in the projects' activities. However, despite this being the case, in some institutions, due to historical reasons and internal politics, the two categories of staff could not support each other. There were cases in which requests for technical support from staff working on metadata were ignored by IT staff and could only be addressed by staff based at the lead institutions; and instances in which the IT equipment purchased for the institutions was kept/installed in the information centres/libraries when the ideal location was the IT Unit. This situation had a negative impact on the development and management of institutional repositories.

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[7] http://www.sherpa.ac.co.uk/romeo/

KEY LESSON LEARNED

Two key lessons learned from the initiatives were the need to initially focus on internal access to information resources, and the need to deal with the perceptions that lead national institutions or individuals are the ones who benefit the most from externally supported initiatives.

Need to Initially Focus on Internal Audiences

Open access initiatives mainly focus on providing access to local content to external users. Therefore, when institutional repositories are being developed, the immediate goal is to make the content visible online for access by external users. Although there are several benefits to be accrued to the institution by providing access to its content, the initiatives showed that this approach results in resistance, both active and passive, to opening access to content, especially in public funded institutions. Therefore, initially focusing on ensuring that content is widely accessible within the institution and by trusted partners, with a long-term plan to scale-out to external users, appeared to be a better approach. This approach also gives the institutions enough time to address any internal issues that may arise because of the repository. It also gives the content generators enough time to gain confidence in the new system.

Lead Institutions Benefit More

In Kenya, external funding distorted the local situation to some extent resulting in "conflicts" among the pilot institutions. Pilot institutions on the project saw KARI, the lead institution, as getting the majority of the resources. This was despite KARI hosting the project and making available resources and facilities such as office space and staff (i.e. information technology specialists) at the disposal of the project and at no cost to the project. The conflict undermined efforts to broaden the ownership on the initiative. External funding has to be very carefully applied and channeled.

Also worth noting is that within the pilot institutions, and this was the case in all the three pilot projects, the lead units or champions (individuals) for the projects were also perceived to be benefiting more from the projects. These perceptions resulted in other units or individuals within the institutions contributing less to the initiatives or delaying the implementation of the project activities. To some extent, this situation could be avoided if

projects are implemented in a transparent way, i.e. by sharing information about the projects widely within the lead institutions.

CONCLUSION

The broad range of stakeholders in agricultural innovation systems in Africa need to have access to both local and global agricultural scientific and technical information if they are to have an impact on agricultural development and food security initiatives on the continent. Opening access to locally generated resources is an essential step in ensuring that as broad a range of actors as possible can use those assets to support innovation. The three initiatives highlighted in this paper show that there are several factors that have to be taken into account when implementing open access initiatives on the continent. Research scientists should be motivated to contribute content to the repositories; policies and strategies that encourage sharing of innovations should be implemented, staff capacities to manage digital information resources, taking into account institutional, national and international copyright regulations, should be developed, among others; and external support to local initiatives should be very carefully applied and channeled.

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