Investing in Agricultural Development

Information, Knowledge and Communication the ‘Fertilizers’ of Future Research Harvests

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The World Bank has argued that agricultural development depends to a great extent on how successfully knowledge is generated, shared and applied. The same report also suggests that investments in knowledge - especially in science and technology – have to be adjusted to rapid changes in the wider agricultural environment.

Among the changes identified by the Bank are: Markets — not production — increasingly drive agricultural development. Knowledge, information, and technology are increasingly generated, diffused, and applied through the private sector. The exponential growth in information and communication technologies, especially the Internet, has transformed our ability to take advantage of knowledge developed in other places or for other purposes. The question of how to take advantage of new knowledge has become just as urgent as the question of how to generate and diffuse new knowledge. The knowledge structure of the agricultural sector is changing – many people interact to generate new ideas or develop responses to changing conditions. Technical change and innovation have become much more interactive processes. Finally, agricultural development increasingly takes place in a globalized setting.

This paper looks at some changes in the agricultural and informational environments. Using a metaphor of information and knowledge as ‘fertilizers’ that nourish agricultural research, it looks briefly at the information and communication activities of the GFAR community, exploring some trends and directions for information, knowledge and communication investments in the area.

Information, knowledge, communication – fertilizer for research

Let's first begin by thinking about information, knowledge and communication as the essential elements needed to 'fertilize' research and innovation for growth and development. Like the famous NPK fertilizer formula for plant growth, agricultural organizations and institutions require regular doses of the three information, knowledge and communication elements. In the right combinations, and with suitable tools and devices to formulate, spread and apply them, these ‘intellectual fertilizers’ are critical inputs to rich and sustainable research ‘harvests.’

As in plant growth, different situations and environments require different combinations of these intellectual fertilizers, and an effective balance between each. Unlike for crops however, we do not have hard and fast recommendations on which combinations work best in which circumstances. We do know however that each element is needed and that people around the world are experimenting with different doses and dissemination packages, with differing levels of success.


2 NPK represents the key constituent chemical elements Nitrogen (N), Phosphorus (P) and Potassium (K) used in plant fertilizers. www.plantadvice.co.uk
The experiments are taking place in all agricultural sectors and disciplines, in libraries and documentation centers, on the Internet, with farmer groups, as part of extension, by researchers themselves, in regional networks, with data and databases, using traditional knowledge, among CGIAR information technology and information management professionals, in publishing, using geographic information systems, across mobile phones, using participatory video, and as part of knowledge management initiatives. This list can easily be expanded.

A lot of this experimentation is poorly documented – even when successful. Some is captured in various web sites and portals; much experience is shared when people meet at workshops and conferences or through professional networks and communities. A few ‘classic’ stories are widely circulated and appear over and over. Different traditions and communities – information/documentation, ICTs in development, communication for rural development, extension, and knowledge managers - have their own landscapes for sharing.

Bringing all these together and helping to make sense of the different strands is an important role for global connectors like GFAR.

**Cross-fertilizing, advocacy and capacity building – roles for GFAR**

Nurturing and supporting key ‘intellectual fertilizer development communities’ has been a major focus for GFAR through its Global Partnership Programme on information and communications management. In the past 4 years, it has brought national and regional information and communication managers together in a series of dialogues and activities designed to enable greater equity in access to agricultural information.

The focus has been on efforts to:

- strengthen the capacity of research leaders to articulate appropriate policies and strategies and investments in ICT enabled agricultural information systems;
- develop the capacities of different agricultural research for development actors to create, manage, share, exchange and use information;
- catalyze greater and more coherent integration of national and regional agricultural information systems and easier access to them for improved management and more seamless sharing and exchange of information;
- establish appropriate governance and communication structures where different stakeholder can come together at the regional level to promote and support more equitable access, sharing and exchange of agricultural information.

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3 The recently established www.e-agriculture.org portal aims to bring cases and people together. A DFID-funded effort is www.dcrn.org focusing on the evidence base for ICT and communication investments. GFAR's own www.egfar.org has recently been upgraded to make available the knowledge base accumulated in the past ten years or so. The web sites of the regional agricultural information systems affiliated to GFAR are each filling up with case studies and experiences. The IAALD blog – http://iaald.blogspot.com carries news and updates from around the world.

4 The most recent global get together, ‘e-agriculture week,’ was hosted by FAO in Rome in September 2007. Regional meetings have also been organized on a regular basis by agricultural research networks affiliated with GFAR. Information professionals meet through the auspices of IAALD; the CGIAR has its own communities or practice; and online discussions and consultations have been held on different platforms.

5 More information at: www.egfar.org/egfar/website/action/icm_icts/ewekefgfar
Some progress has been achieved in each area. Colleagues from the regional networks supported by GFAR particularly cite the positive results of the project in helping them to clarify their own strategies and goals, providing forums where people can meet regionally and globally to exchange ideas and lessons, strengthening the regional networks and communities, and contributing through advocacy to a more positive climate for information and communication in agricultural research.

At its last meeting in September 2007, members of the GFAR information and communication community also identified some continuing challenges: The lack of impact of some advocacy efforts; the weak capacities of many institutes to generate and manage indigenous digital content; non-existent or weak information and communication policy environments, and challenges linked to the emergence of new research paradigms.

In particular, the emergence of new paradigms and ways of conceptualizing and implementing research, innovation and development creates a new agenda for information and communication managers. This will require different types of intellectual fertilizers and innovative ways to formulate and apply them. Here we take a closer look at some of the issues and concerns forming this new agenda.

**Innovation Systems**

In health as well as agriculture, the ‘innovation systems’ concept is gaining increasing recognition. According to Hall⁶, it fundamentally recognizes that the determinants of innovation, as a process of generating, accessing and putting knowledge into use, are the interactions of different people and their ideas, and the social setting of these interactions and relationships.

This is quite a change in focus from earlier rather linear paradigms with that saw research institutes as the creators of knowledge and technology, extension as the diffusers of advice, and farmers as the (hopefully) adopters of new practices, and where the different knowledge and information systems were often quite separate. Innovation systems thinking recognizes that innovation and change can originate and be catalyzed anywhere in a network of actors involved in a specific value chain or activity and that the relations among the actors are the key to knowledge sharing and application. “Innovation processes can be enhanced by creating more possibilities for actors to interact”⁷.

The ‘collective’ aspect of such innovation systems thinking is emphasized by a new report from IICA⁸: “Overcoming the linear view of the innovation process has led to an understanding that innovation is an entirely collective process, because: (i) it involves different actors with different perspectives; (ii) it looks at a common objective with different concepts, tools and perspectives; (iii) it requires a division of work; (iv) it requires the distribution of property rights; v) it has economies of scale and scope; (vi) it requires coordination.”

Thus, the World Bank⁹ concludes that the “innovation systems concept is attractive not only because it offers a holistic explanation of how knowledge is produced, diffused, and used

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but also because it emphasizes the actors and processes that have become increasingly important in agricultural development."

This same World Bank report defines an innovation system “as a network of organizations, enterprises, and individuals focused on bringing new products, new processes, and new forms of organization into social and economic use, together with the institutions and policies that affect their behavior and performance. The innovation systems concept embraces not only the science suppliers but also the totality and interaction of actors involved in innovation. It extends beyond the creation of knowledge to encompass the factors affecting demand for and use of knowledge in novel and useful ways.”

What does this mean for information and communication management in research? First, the knowledge needs to be sourced from an increasingly diverse set of actors. It is not enough for research institutes to access each others’ reports – they need to tap into all kinds of other information flows, including from farmers themselves, and find ways to document and provide access to this.

Second, researchers need to ensure that their outputs can be accessed and applied by more diverse ‘audiences’ who often do not have access to traditional forms of research communication and may not be accustomed to scientific style and language. Different, collaborative and interactive, forms of sharing and exchange need to be developed.

Third, the intellectual property of the products of such innovation systems is likely to be much less clear-cut. The involvement of all kinds of private and developmental actors in innovation processes is likely to challenge the idea that the results will automatically be in the public domain. Who will own and license the knowledge?

It may also call for different types of innovation ‘communicators’, skilled at tapping into and supporting collaborative activities and interactive processes involving different types of stakeholders, spreading the ‘intellectual fertilizer’ where needed and helping to harvest different kinds of results for different uses. Where do we find and train these people?

It certainly provides opportunities for information and communication specialists to contribute to and be active actors in ‘user generated innovation’ – where specialist skills will be essential to help make the innovation systems work.

**Farmer Knowledge**

Ann Water-Bayer\(^9\) and colleagues from the PROLINNOVA project of GFAR argue that farmers and local communities are key actors in agricultural innovation systems – “the type of innovation that ultimately makes the difference is what farmers decide to do.” However research worlds tend to under-value the indigenous knowledge of farmers and the “practice in most African countries still follows the linear model of technology transfer, in which it is assumed that innovations are developed by scientists and spread by extension workers to be adopted by farmers. Thus, both the farmers and the outside professionals see farmers as receivers of technologies, information and instructions, instead of people who have something to offer.”

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PROLINNOVA promotes participatory innovation development with farmers in an effort to counter this trend, by encouraging ‘farmer-led experimentation’ and the integration of farming communities into innovation systems. The idea is mainly to foster knowledge sharing among farmers and other innovation actors, encouraging farmers to compare and share their experiences and to more critically experiment. Beside this support for tacit knowledge exchange, PROLINNOVA has also begun to examine ‘Farmer Led Documentation’ in which rural communities express their own knowledge, experiences and practices in their own words – often using a mix of traditional and modern media: text, drawings, still photography, video and audio recordings\textsuperscript{11}.

This is one of several initiative focusing at this level – Bioversity International\textsuperscript{12} works with local communities in several locations looking at how their traditional knowledge is documented, IFAD and FAO are supporting a ‘Linking Local Learners’ project\textsuperscript{13} in East Africa in which groups of farmers learn together, exchanging ‘know-how’ and organizing their own knowledge networks and sharing. The ICT for development community has also looked at these issues as part of a concern for ‘local content’ on the Internet\textsuperscript{14}.

A really interesting aspect of this work is the experimentation taking place with different knowledge sharing formats, from drawings to the Internet, from databases to participatory video, and the emphasis on local languages that help to make the information more locally accessible – but perhaps less globally visible.

There is a strong link with the innovation systems perspective that recognizes that all actors, including local communities, have knowledge that can catalyze learning and innovation.

Recognizing the value of the knowledge of farmers poses significant challenge to traditional research and extension ‘experts’ whose new role is perhaps more about catalyzing communication and knowledge sharing among farmers and other groups than it is to bring modern technology to backward communities. Instead of being ‘intellectual fertilizer’ distributors, they need to also become fertilizer ‘prospectors,’ looking in areas that were previously considered barren.

**ICTs for Rural Communities and Livelihoods**

A separate paper is called for to do justice to the many changes now underway concerning the whole area of information, ICTs, and the provision of related services to rural communities. Here we sketch a few experiences and issues.

One major driver of change is the increasing use of information and communication technologies (ICTs) – including mobile phones – to link farmers and producers to markets and credit as well as government services. Increasingly, farmers can receive timely information on markets, prices, and weather as well as technical advice; these services often

\textsuperscript{11} See www.prolinnova.net/fld.php
\textsuperscript{12} See www.bioversityinternational.org/Themes/Communities_and_Livelihoods
\textsuperscript{13} See www.linkinglearners.net/
draw in experts to answer questions\textsuperscript{15}. Farmers, researchers and extension workers are also being brought together through various ICT-based systems and portals. It adds up to an ongoing revolution.

Between February and June 2006, information and communication specialists working in agriculture met online (\url{www.dgroups.org/inars}) to explore different dimensions of this revolution, exchanging ideas and experiences on "knowledge management and sharing in agriculture". Strengthening rural livelihoods through communication, knowledge sharing and learning, and the use of ICTs was one agenda point on this GFAR-supported discussion. Some key points arising were:

- ‘Ordinary communication’ is as important as more sophisticated ‘knowledge sharing.’ Mobile phones are widely used because they satisfy ordinary communications needs.

- Local service providers and telecenter operators play an important role in mediating communications between rural communities and information providers (agriculturists, veterinary scientists, medical doctors and so on). Extension systems need to also transform themselves to make effective use of new ICTs.

- The Internet is no replacement for traditional information sources for farmers. Best results come from a mix of media such as radio, television, telephones, computer based information kiosks, computers, video and digital cameras and through the Internet, web and e-mail based services.

- Farmers have information and communication needs beyond those related to agriculture, hence we need to look holistically at rural community needs for information exchange and sharing.

- To successfully use ICTs to support farmers and rural communities, the first step is to empower farming communities to define their own needs.

While the discussion brought together experience and opinions from a number of people, it does not constitute hard ‘evidence’ on the effectiveness and impact of these activities. Indeed, a recent study for DFID\textsuperscript{16} concluded that “we still lack a substantial body of robust evidence on the impact of communication initiatives in the agricultural sector.”

Despite this lack of hard evidence, the authors, and other sources mentioned above, point to numerous cases where ICTs are actually being applied in rural areas. Some have also been considered to be successes\textsuperscript{17}.

Using ICTs at the interface between farmers, extension and research is one area where there is much innovation.

\textsuperscript{15} There are many places to find information. E-ForAll documents efforts to use ICTs to empower the rural poor - \url{www.e-forall.org}. The DCERN ‘impact of communication in development’ portal has an agriculture section with a review of efforts in this area - \url{www.dcern.org/portal/index.asp?portal=3}. FAO’s ‘Bridging the Rural Digital Divide’ website contains cases and good practice - \url{www.fao.org/rdd/}. The India-based i4online web site has news on ICTs in agriculture - \url{www.i4online.net/news/news.asp?catid=1}. Policy documents from donors also contain examples and discussion. See for example: CIDA. 2004. ‘Linking Agriculture and ICT Sectors in the Context of Poverty Reduction’. Ottawa: CIDA.

\textsuperscript{16} Norrish, P., S. Batchelor, and C. Garforth. 2007. ‘Agriculture, Natural Resources and Livelihoods Policy – the evidence based need for good communication’. Reading: Gamos. \url{www.dcern.org/portal/index.asp?portal=3}

\textsuperscript{17} See for example: Singh, S. 2006. ‘Selected success stories on agricultural information systems’. Bangkok: Asia-Pacific Association of Agricultural Research Institutions. \url{www.apaari.org/documents/publications/ss_2006_01.pdf}
Francisco Proenza\textsuperscript{18} has brought together a number of interesting reports and project material from Latin America and Asia. In terms of projects, VERCON in Egypt\textsuperscript{19} uses the Internet to strengthen research-extension linkages so that agricultural advisory services to farmers can be improved. The Open Academy for Philippine Agriculture has set up the Pinoy Farmers' Internet\textsuperscript{20} as the country's first internet-based extension support system. It is part of a national e-government funded programme – 'Knowledge Networking for Enterprising Agricultural Communities' – to develop and modernize the country's agricultural sector. Something similar is also being developed in the USA\textsuperscript{21} where a National eXtension Initiative is developing an interactive learning environment that will deliver knowledge and “connect knowledge consumers with knowledge providers,” providing data and information as well as solutions and answers to questions.

Another promising area associates the use of ICTs with the availability of credit and financial services in rural communities.

In the Philippines, e-commerce provider b2bpricenow.com\textsuperscript{22} has established an 'E-commerce for farmers program' comprising an e-marketplace where agricultural commodities can be bought and sold online, local 'b2b' (business to business) centers in rural areas, and mobile commerce to help cooperatives and farmers move money around. The programme is based on an innovative partnership between b2bpricenow.com, the Land Bank of the Philippines, and UNISYS, a major IT services company. It aims to help farmers achieve prosperity by lowering the transaction costs of marketing and trading (primarily by supporting the e-commerce efforts of cooperatives affiliated to the Land Bank) and by getting rural people and farmers into the banking system.

In India, the Commonwealth of Learning has supported a ‘Lifelong Learning for Farmers\textsuperscript{23}’ project that brings together community associations in rural villages, ICT ‘kiosk’ operators, an IT company, agricultural universities, and the State Bank of India. The project combines access to information, learning, and credit opportunities, seeking to improve local livelihoods by enhancing capacities (knowledge and skills), providing affordable credit, and generating employment. Like the Philippine example above, this is also an innovative partnership where credit and the banking sector play a major role and where ICTs are used to meet several development objectives: It empowers the communities, especially women; it disburses more and more affordable credit and improves the performance of the loans; and it helps local ICT entrepreneurs build sustainable businesses.

These examples are the tip of a massive iceberg. Countries like India are experimenting on a grand scale with rural telecenters that provide a wide range of services – both from the government and the private sector. In Africa and Latin America, there are also active telecenter movements\textsuperscript{24}. A growth area is the use of ICTs to improve agricultural markets, marketing systems and commodity exchanges\textsuperscript{25}. By making, particularly, price information available to farmers they can be empowered to take better decisions – and earn better returns on their produce.

\textsuperscript{18} See: www.e-forall.org
\textsuperscript{19} See: www.vercon.sci.eg/Vercon_en/vercon.asp
\textsuperscript{20} See: www.openacademy.ph
\textsuperscript{21} See: http://about.extension.org
\textsuperscript{22} See: www.b2bpricenow.com
\textsuperscript{23} See: www.col.org/colweb/site/pid/3993
\textsuperscript{24} See www.telecentre.org for information and updates from around the globe.
\textsuperscript{25} A national governmental example is http://dacnet.nic.in/; a private national example is www.kacekenya.com; a regional example is http://www.wa-agritrade.net. The 'ICT for Rural Livelihoods' project of InfoDev and ODI brings much useful information together on this and related issues - www.ict4rl.info/Applications/Markets. See http://del.icio.us/iaald/markets for more resources.
Increasingly, these investments are driven by efforts to deliver better services to rural communities; also by a desire to empower rural people to better manage their own situations and livelihoods.

Despite an increasing involvement of private and civil groups in such service provision, rural access to information has typically been a public service responsibility of governments who both deliver a range of services and create enabling environments for others to do so.

While this ‘public good’ is still an important factor, it is perhaps ironic in this increasingly connected information society that getting some classes of knowledge into the public domain is not as straightforward as it seems.

**Public Goods**

An ongoing debate is focused on the ‘public good’ nature of international and other research, and the steps needed to achieve this. This discussion on the positioning of research vis-à-vis other development activities is also important for the information and communication agenda.

Research institutes traditionally produce a variety of ‘goods’ from their research activities, typically new knowledge and technology for others to capitalize on.

Depending how a research activity is sponsored and designed, its outputs may or may not be a ‘public good’ – in that the output is non-excludable and non-rival. Much research by public institutions with public funding is not a ‘pure’ public good, as when it is designed to benefit a specific community or local problem, when it is commissioned by an interest group for its own use, when it involves private interests and proprietary knowledge or technology, or when it is otherwise not intended for broad public use. Further, as one moves closer to research users, targeting the specific needs of a specific situation, the public nature of research goods is likely to be diluted, to become ‘privatized’.

The means by which a research output is made available, accessible and applicable also determines whether it will become a public good. A classic example is where publicly funded research outputs are disseminated in limited-access scientific journals that exclude some classes of potential users, or where outputs are only available on web sites that are less accessible to people without good web access. A similar case can be made for outputs made available in one language only, written in a ‘scientific’ style, published in a proprietary format or with restricted intellectual property licenses. These give ‘public’ access to some while, perhaps unintentionally, excluding others.

There are thus many such ways in which the public character of a research output can be limited by decisions taken regarding its dissemination. As the ACIAR recently argued: “Knowledge is a classic club good, available free [only] to those who have the capacity to access (and use) the information.”

Contrary to what many believe, research outputs are therefore not intrinsically public goods; they must be made so. This can be done as part of research design and planning when the outputs, even of location-specific research, can be designed to be public in nature. Individual research outputs – as messages – can also be created, handled and disseminated in certain

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ways to ensure they take on public goods characteristics, and are not just goods with potential.

The CGIAR has been particularly active in these discussions. A recent document on the role of the CGIAR as a player in Research for Development sets out the key arguments why the CGIAR should pursue international public goods in its strategies and activities. The first part of the document is a wide-ranging discussion by Jim Ryan - it includes a valuable 'working definition':

“International public goods are taken to mean research outputs of knowledge and technology generated through strategic and applied research that are applicable and readily accessible internationally to address generic issues and challenges consistent with CGIAR goals.”

The key here is the ready international applicability and accessibility as essential features of public knowledge and technology outputs. In the same report, Phil Pardey sounds a word of caution. He argues that “most research products are not intrinsically public — technically, non-rival and non-price excludable — or private goods; they fall in the ‘shades of grey’ category, have multiple attributes (with some attributes that are more or less rival or excludable than others), and, above all, can be made more or less public (or not) through policy and practical actions on the part of the CGIAR or others.”

This last point is very important as we look at information and knowledge. Information and knowledge are not born ‘public’; they must be worked upon to ensure they become public, i.e.: available, accessible, and applicable.

There is a massive challenge here for information and communication communities - to ensure that the outputs of publicly-funded research become publicly available, accessible, and applicable, now and in the future.

It means that data, information or knowledge assets need to be managed in such a way that they are created and deposited in formats and systems that allow perpetual access; are licensed to allow and encourage widespread use; are described and indexed to allow easy finding and dissemination; and are optimized to enhance understanding and encourage widespread adoption.

It requires a clear understanding of the demands of priority research users and the challenges they face, active use of diverse approaches and communication pathways for diverse purposes, and the adoption of mindsets and incentives that value open publishing and exchange.

We can expect that making a research output into a public good requires that certain steps are taken to address its availability, accessibility and applicability, such as:

a. Make an output available (make the message explicit and documented and described and ‘published’ in an appropriate and long-lasting format and available

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30 CGIAR Science Council. 2006. op cit.
in full). This is the absolute minimum requirement to satisfy the needs of future generations.

b. Make the output accessible (the output is included and indexed in widely known finding systems). It needs to be easy to find.

c. Make the output openly accessible (the output is licensed using creative commons or equivalent as open access). It should encourage use and re-use.

d. Make it applicable or appropriable (related to relevance, the output/message is customized for easy use and re-use). It can be adopted.

It may also require what Land & Water Australia describes as a commitment to 'Knowledge and Adoption' which "explicitly links the knowledge assets generated through research investments with their adoption" – i.e. that the public good is only achieved when the knowledge gets beyond availability and access to actual adoption and use. Focusing on this adoption phase however takes us closer to the 'private' motivations and benefits of groups and individuals and their relationships with the public knowledge provided. It gets more than a little complicated.

Open Content

For many people, the whole issue of public good is encapsulated in efforts to provide 'open access' to the results of research, especially journal articles and reports. There is also a movement to make sure the data generated through research is also made openly accessible. This poses some additional challenges and questions.

The open access debate has raged for several years now, pitting research publishers – whose content is generally only available by purchase – against advocates of ‘free’ access by readers to research content. Research funders and governments tend to sit uncomfortably between them. It has tended to involve fewer researchers themselves than publishers and librarians for whom the financial dimensions of the debate are very pressing.

According to Peter Suber, "open access literature is digital, online, free of charge, and free of most copyright and licensing restrictions."

There are two main mechanisms by which research literature is being made open access. The first is ‘open access journals’ in which the content is made freely available across the Internet, without password or subscription fee. The second is open access ‘repositories’ in which full text materials are deposited for anyone to download. These sometimes also contain, with permission, the texts of articles published in ‘restricted access’ subscription only journals. A variation are initiatives like AGORA and PERI that negotiate free or heavily discounted electronic access by developing countries to some journals and other content that is normally purchased.

32 A good starting point is the web site of Professor Peter Suber - www.earlham.edu/~peters/fos/overview.htm. A good place to locate open access journals is http://www.doaj.org/; open access repositories are listed at http://roar.eprints.org/; this open access can generally be searched online at http://www.oaister.org/
33 www.earlham.edu/~peters/fos/overview.htm
The open access ‘movement’ is keen to encourage researchers, especially working on topics relevant to developing countries, to publish their articles in open access journals – as this ensures they are then freely available to their colleagues in developing countries. It also encourages existing journals to become open access. Needless to say, this is rather complicated – for authors who may prefer their traditional restricted access journals that have established reputations and impact factors, and for journals who see subscription income drying up (who will subscribe to a journal that can be accessed at no costs online?). Barbara Kirsop et al[34] bring a lot of these arguments together to show that open access journals can be a feasible option.

The notion of open access ‘institutional repositories’ is perhaps more relevant to agriculture in developing countries where research, and others, produce many documents and reports that need to be captured, described and made available. As these reports become digital, it makes sense to archive them in repositories that are also accessible online. This approach is gradually gaining momentum around the world and academic repositories, especially, are being set up and gradually ‘populated’ with content[35]. FAO, through its AGRIS initiative, has been particularly active in this area, pursuing a decentralized approach and developing standards through which the content of such repositories located around the world will be cleverly linked and ‘harvested’ to create a bottom-up global exchange system[36].

The underlying idea is that each institution, country and region will take responsibility for its own research outputs – making them available and accessible across the Internet using common standards that allow exchange and ‘inter-operability’, and facilitating searches across organizations. These databases and content will be openly available and accessible.

The Regional Agricultural Information Systems (RAIS) working with GFAR have been particularly active in this area and we are beginning to see various services and portals offering open access to information in different regions. The new FAR website (www.fara-africa.org) for instance, has a searchable knowledge base. In the Near East and North Africa, AARINENA has made available its documents repository (www.aarinena.org); the Agroweb network in Eastern Europe gives country by country access to agricultural information (www.agrowebcee.net). GFAR itself has re-designed its own web site (www.egfar.org) to be an institutional repository and access point to its regional partners. Research centers in the CGIAR are also moving in this direction, as a recent article from IRRI explains[37].

An important dimension of all these projects is that the content mobilized is made openly available. A major challenge is still to document and mobilize the content generated in agricultural research for development, and to make it available through various systems in open digital forms. So far the emphasis has been on texts and reports, similar approaches can also be envisaged for data, images, video and other forms of communication.

The focus so far on this ‘openness’ issue has been on the content of research outputs. An important aspect is to also ensure that the systems and databases and web sites built to provide access are also open. This means making them user friendly, it also means making use of international standards[38] that will allow the content of the databases to be queried and

[34] Kirsop, B. et al. 2007. ‘Access to Scientific Knowledge for Sustainable Development: Options for Developing Countries.’ Ariadne (52) www.ariadne.ac.uk/issue52/kirsop-et-al

[35] The best place to query this content is via www.oaister.org

[36] See www.fao.org/agris/ for information on the new approach as well as links to tools, training, standards, etc


[38] See especially the work of FAO and partners at: www.fao.org/aims
exchanged by others. And it means investing in emerging interactive open features, such as RSS\textsuperscript{39}, that encourage people to re-use information that has been compiled.

There is much to be done technically to get all this content organized, there is perhaps as much to be done politically to sensitize researchers and research policy makers to the value of open content as a vehicle to speed up the dissemination of research outputs, getting them to people and places that other methods won’t. Such open content also has an important role to heighten the visibility of the research being done in developing countries.

**Participation and Interactivity**

One of the key features of the innovation systems perspective is the recognition that many actors are involved. It follows that many different sources, types and forms of knowledge and information need to be circulated, communicated and aggregated to support ‘new-style’ agricultural research and innovation for development.

We are seeing similar trends on and around the Internet. Five to ten years ago, very few organizations had a website. Their libraries held collections of paper documents indexed in electronic catalogues. Researchers, policy makers and practitioners communicated by letter, fax and perhaps by email, and sometimes met face to face. ‘Content’ was mainly text-based, and shared through printed reports, press releases and newsletters. Producing, publishing and disseminating this content was expensive, and much of it was priced to recover costs. Communities communicated through networks and associations that offered well-defined meeting spaces (conferences) and exchange mechanisms (newsletters and journals).

Today, this information flows in different ways. The collections of information, in electronic as well as paper form, are still there. However, there is increasing online access to library and other databases, and many organizations publish the full texts of reports and documents on their websites, without charge. Communities have evolved into virtual networks and e-communities that often interact entirely online via email, chat or internet telephony. More and more people seem to have at least one email address, every organization has its own website, and publishes a variety of digital content – audio, visual and text-based. It is becoming technically more and more easy for an organization, group or individual to publish and disseminate digital content, and deceptively easy to find such information using internet search engines.

This coming change is called ‘web 2.0’ and is characterized by a move towards increasing amounts of ‘user-generated content’ and ‘user-personalized content’ – where different streams of content are brought together by each individual in their own personal ‘mash up.’

The name is less important than some of the underlying ideas. In some ways, it is the ultimate reflection of the innovation systems we talked of earlier. We are starting to see individuals, groups and smaller organizations using the internet to become active creators and producers of information. Inherent in most of the tools are features offering comments and discussion – ‘if you liked this story, other readers recommend this one’; ‘if you care about this issue, join this social networking space’, and so on, usually beyond the boundaries that organizations monitor. Size is becoming less important than creativity and entrepreneurship. People with ideas and messages have very accessible tools with which to

\textsuperscript{39} A tool to automatically publish web content as feeds that people can subscribe to, or re-publish. See description at http://en.wikipedia.org/wiki/Rss
communicate. Larger and more traditional organizations might soon be at a disadvantage as they try to organize and manage these dynamic and semi-chaotic information flows.

The potential anarchy in production is matched by the availability of new tools that allow the various streams to be tracked, aggregated and channeled. Each individual can be a publisher; each individual can also create their own personal – or group – news channel and library, specifying what it should contain, how it should be accessed, and who by. The whole system is dependent however on a critical mass of ‘publishers’ to join, and adopt the open and interactive tools that power the systems.

In agricultural and rural development, the pace of change is still slow. Blogs are appearing, organizations are beginning to make their content available as RSS feeds – more and more are publishing such feeds from partners on their own web sites.

It heralds a completely different approach to information and communication management in which issuing a document’s electronic ‘passport’ to travel is as important as publishing it on a web site in the first place. Information and communication managers need to issue good ‘passports,’ be willing to let the content go wherever it is demanded, and be able to track and assess interesting content ‘traveling’ from sometimes strange and unexpected places in the wider innovation system.

End Note

Like in an innovation system, this is a diverse collection of different issues and trends currently on the information and communication manager’s table.

The choice of topics reflects the fact that the information and communication ‘business’ is itself undergoing major changes – as new actors get involved and as technologies transform processes, products, services, and expectations.

Where information and knowledge in research once comprised rather linear processes managed by specialists, tomorrow’s research harvests will spring from more organic approaches where innovators of all types will themselves become active creators and managers of information and knowledge. It’s already happening as researchers and farmers become bloggers, extension workers build wiki’s and librarians become film-makers.

This paper has illustrated some of the ingredients we can mix in our research ‘fertilizer’ recipes. As the central roles of knowledge, information and communication are recognized, these will surely move on to the agenda’s of research managers and innovation systems catalysts as well as on those of information and communication managers.

The role of GFAR in these processes has been important. It has helped others develop new fertilizer ingredients, it has provided spaces where the fertilizers can be mixed and assessed, it has contributed to discussion and standard-setting so the fertilizers can be openly packaged and distributed and hopefully applied to increase research yields. Agricultural information and communication management can itself be seen as an increasingly complex innovation system - or set of systems – where there is a need for

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40 See for instance the CTA Director’s blog at http://neun.cta.int/; news blogs of IAALD (http://iaald.blogspot.com) and CTA (http://brussels.cta.int/); the agricultural biodiversity blog at http://agro.biodiver.se/; or the science blogs of Nature at www.nature.com/blogs/
41 See www.agrifeeds.org/ which provides an aggregation service
42 FARA is a good example: www.fara-africa.org/knowledge-base/international-news-feeds/; see also the DFID-funded research for development portal at www.research4development.info/researchTopics.asp
different organizations and groups to work together for the common good. It is important that the convening and connecting roles that GFAR and others have played are sustained and that the different actors in this area continue to come together to innovate and support innovation in the application of knowledge to agricultural development.