Diffusion of Scientific Knowledge in Agriculture: The Case for Africa

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Agenda

• Introduction
• Related Work
• Methods
• Results & Discussion
• Conclusion
Introduction

• In 2012, Sub-Saharan Africa is the region with the second fastest-growing economy in the world

• There are improvements in food security thanks to a number of initiatives by governments and NGOs

• The role of scientific knowledge and innovation capacity cannot be overstated
Introduction...

• However:
  • Almost 50% of the World’s population depend on agriculture (FAO, 2013a)
  • Agriculture is the mainstay of the economies of most African countries (Adekunle et al., 2012; FAO, 2012; Webersik & Wilson, 2009)
  • Climate change is affecting agricultural production and the continent’s economy (Sayeh, 2013)
Introduction...

• To sustain the economic growth in Africa:
  • There should be continued investment in innovations and research or knowledge creation
  • Communication and translation/diffusion of the innovations and knowledge to practice is also crucial
  • For this, partnerships among researchers, extension agents, farmers, traders, policy makers, non-governmental organizations (NGOs), and those in industry and manufacturing are necessary
Introduction...

• Currently:
  • existing scholarly communication is largely among researchers and scientists
  • the research-to-application or knowledge-to-decision pathway tends to be linear
  • findings and ideas flow from the research community to the agricultural community via intermediaries such as extension agents
  • when implemented properly, extension programs produce positive impacts in diffusion of agricultural knowledge
Introduction...

• The communication and interaction between agricultural research communities, extension services, and farmers in Africa need re-conceptualizing to facilitate effective diffusion of knowledge and innovation

• Knowledge diffusion frameworks need to factor-in the existing local or indigenous knowledge

• There is need for embedding indigenous knowledge with scientific knowledge to achieve better results

• Knowledge diffusion, as opposed to knowledge transfer, is multidirectional
Introduction...

• In this paper, we focus on the diffusion of scientific knowledge from the research and scientific community to the farmer as the end-user

• Specifically, we focus on exploring translational research (TR) as a model/strategy to effectively communicate research findings from the scientific and research community to the farming community

• Translational research has gained wider recognition in medicine and clinical settings as a strategy to benefit patients
Introduction...

• First, we review the nature of existing agricultural extension services throughout sub Saharan Africa (SSA)
• We then propose a working knowledge diffusion model that has translational research practice at its core
• In the proposed framework:
  1. an extension service system engages farmers to understand their needs, concerns, and priorities
  2. in addition to well utilized channels, will include recent advances in social communication tools and mobile technologies
  3. we conceptualize the role of the extension agent as a knowledge broker; and, most importantly
  4. an extension service system that bridges the knowledge-to-action gap
Introduction...

• More specifically, we aim to find answers to the following three questions:
  • What best practices exist to build partnerships between researchers, their institutions, and practice constituencies in the agricultural sector in Africa?
  • To what extent can translational research augment existing agricultural knowledge diffusion and extension service in sub Saharan Africa?
  • What is the potential of ICT in extension services, learning, and knowledge diffusion efforts in sub Saharan Africa’s agricultural practices?
Related Work

Knowledge Diffusion & Innovation Adoption models

• In SSA context, it is traditional government led extension service programs (see, for example, Davis, 2008).

• More recently focus has shifted to - national innovation systems approach – as a new paradigm based on multi-stakeholder, bidirectional, participatory, and collaborative approaches (Ayele, Duncan, Larbi, & Khanh, 2012; Edquist, 1997; Nelson, 1993).
Related Work...

• More models
  – scientific and technological capacity building (Ayele & Wield, 2005; Hall, 2005);
  – knowledge networks and social learning (Ingram, 2010);
  – peer-to-peer learning among equals (Topping, 2005);
  – change agent approach (van den Ban & Hawkins, 1996), and
  – learning networks (Riddell, 2001)
Related Work...

- Channels employed are equally diverse, e.g.
  - one-on-one meetings,
  - demonstrations,
  - community radio,
  - farmer field schools,
  - training, and visits

  - (Davis, 2008; Manning, 2013).
Related Work...

• Face-to-face interactions are found to be significant modes of knowledge exchange (RAND Corporation, 2011).

• Knowledge diffusion in agriculture also includes discussions about Indigenous knowledge (IK).

• Although IK is internal, tacit, unsystematic, and derived from local experiences, it is the primary resource and social capital that shapes how local farmers engage with the natural environment and develop problem-solving strategies (Lwoga, Ngulube, & Stilwell, 2011)
Related Work...

• Because of the importance of IK, knowledge diffusion activity needs to start with the community’s knowledge base (Johnson & Segura-Bonilla, 2001).

• The rate of adoption, the speed with which new ideas and innovation are embraced by individuals and groups, is predicated by five factors - (1) relative advantage, (2) compatibility, (3) level of competency, (4) trialability, and (5) observability - Rogers (1995).
Related Work...

- In general, the following four knowledge transfer/exchange models were identified, adapted from (Rural Economy and Land Use [RELU], 2007)
Related Work...

Extension Service and Knowledge Diffusion

• The current state of knowledge diffusion in Africa (especially in SSA) is dominated by extension service that is largely coordinated by the ministry of agriculture (and their equivalent institutions) in respective countries.

• Extension service is often characterized as the conduit between the research community and the farmer (Marsh, Pannell, & Lindner, 2000).

• Extension service plays a significant role in introducing new ideas and innovations to the farmer during initial stages of adoption (Marsh, Pannell, & Lindner, 2000).
Related Work...

• Extension agents as
  – process-facilitating role (Manning, 2013).
  – opinion leaders (Rogers, 1995, p.27)

• A detailed discussion of extension approaches (guiding the structure, leadership, program, resources), models (schematic account of the system), and methods (such as visits, demonstrations) is given in Ponniah, Puskur, Workneh and Hoekstra (2008).
Related Work...

Translation science/research

- RAND Corporation Europe (2011) defines translational research as:
  - “the new scientific methods and technologies, interdisciplinary approaches, and collaborative institutional arrangements being developed to narrow the gap between basic science and its application to product and process innovation.”
Related Work...

• As the evidence-based medicine (EBM) practice gained momentum, the knowledge-to-action (KTA) or the engagement paradigm became more significant in healthcare.

• The framework that is often cited to overcome the limitations of existing knowledge communication in healthcare is the integrated knowledge translation approach, one that engages knowledge users as partners in the research process (Bowen & Graham, 2013; Cargo & Mercer, 2008).
Related Work...

• RAND Corporation in Europe (2011) produced a comprehensive report to promote translational research and knowledge exchange in the U.K. agricultural sector, using wheat production as a test case.

• The report lists the following enablers of translational research and knowledge exchange:
  – Targeting end-user
  – Involving key actors
  – Multi-disciplinarity
  – Fora to facilitate knowledge exchange and translational research
  – Policy, legislation, and regulation
  – Availability of funding for translational research
Related Work...

ICT and Agricultural Knowledge Diffusion in SSA

• Under the umbrella name “ICT for development, ICT4D,” information and communication technology is increasingly used for development activities, including in agriculture sector in Africa.

• For example:
  – the World Bank is funding a program called “infoDev,”
  – the use of an e-voucher system in Zimbabwe;
  – electronic wallets in Nigeria where farmers receive fertilizer and seed support through their mobile phone; or
  – a similar mobile app called ‘iCow’ that allows dairy farmers in Kenya to track the gestation periods and progress of their cows

• Information and communication technology (ICT) has the potential to play a significant role in the agricultural innovation effort in Africa.
Methods

• Exploratory study
• We reviewed relevant literature from sources such as:
  • AGRICOLA, web of science (WOS) and Science Direct databases, and
  • And Websites of appropriate regional and international organizations such as:
  • Forum for Agricultural Research in Africa (FARA), Consultative Group on International Agricultural Research (CGIAR), Food and Agricultural Organization (FAO), etc.
Results and Discussion

Best Practices for Scientific Knowledge Diffusion— in SSA Agriculture

• The current understanding and best practices in scientific knowledge diffusion in agricultural practices demand:
  
Results and Discussion...

• Best practices demand:
  – participatory, peer-to-peer, and collaborative communication, knowledge diffusion and/or knowledge exchange.
  – seek feedback NOT about the outcome, but on the process (RELU, 2007).
  – effective utilization of knowledge that involves activities in knowledge synthesis, translation, and integration.
Results and Discussion...

• This is our depiction of the best practices (at a more abstract level):
Results and Discussion...

Extension Service in SSA Agriculture

• The extension model in SSA is predominantly linear, hierarchical, centralized, poorly funded, and government led.

• Both the problem and the solution to the existing extension model is widely documented in the extant literature.

• The limitation (Bembridge, 1987; Linder & Dolly, 2012; Marsh, Pannell, & Lindner, 2004)

• Suggestions to overcome the bottlenecks were also suggested (DFID, 2013; Linder & Dolly, 2012).
Results and Discussion...

• We observe that there are a multitude of initiatives and practices that are happening in SSA countries

• Example:
  – farm input promotions (Africa);
  – Learning, Innovation, Knowledge (LINK);
  – national innovation councils in the SIX CPA countries;
  – partnership for agricultural innovation and development (Sierra Leone);
  – national agricultural research system (Nigeria);
  – crop intensification program (Rwanda); etc.
Results and Discussion...

• Now, integration of efforts at national and regional levels is critical.
• We argue that integration is a necessary condition for knowledge diffusion – and here is how we conceptualize the process
Results and Discussion...

• In general the major findings in extension service related to best practices and contemporary understanding include the following:
  – Instead of the public and government controlled extension services, the national innovation systems approach is gaining more foothold (Adekunle et al., 2012; Ayele et al., 2012; Hall, 2005; Johnson & Segura-Bonilla, 2001; Ponniah et al., 2008).
  – The significance of public private partnerships, integrated knowledge exchanges that engage multi-stakeholder and multi-disciplinary actors are emphasized across the board (Marsh et al., 2000; Delmer, 2005).
  – Training and visit (T&V), farm field schools (FFS) focused on training, mentoring, and education are preferred methods of contacts to reach farmers (Blanckenburg, 1982; Davis, 2008; Manning, 2013).
Results and Discussion...

• In general...
  – Extension needs to be designed with the farmer but not for the farmer – requiring participation in both research and extension, including the use of technological solutions (Bembridge, 1987; Blanckenburg, 1982).
  – When national and regional level knowledge networks and extension services are built - country, culture and politics-specific situational factors need to be taken into account. (Davis, 2008; DFID, 2012; Linder & Dolly, 2012; Ponniah et al., 2008).
  – Extension agents/professionals are considered knowledge brokers, linking farmers and researchers and when designed properly extension services played a positive role (Marsh et al, 2000; Marsh et al., 2004; RELU, 2007).
Results and Discussion...

• In general ...
  – Educational function of the extension service should be given more priority (Blanckenburg, 1982; Navarro, 2006).
  – One-on-one consultation, coaching, group advice, peer-to-peer learning, face-to-face extension, learning networks, and the use of community radio are found to be relevant and appropriate methods of contacts (Lwoga, 2010; RAND Corporation, 2011; Riddell, 2001; Scarborough et al., 1997; Topping, 2005).
Translational Research

- How do we augment existing knowledge diffusion model from lessons in translational research in healthcare.
- The role of translational science for agriculture is already considered by few studies, especially in biotechnology, genomics, and plant biology (Delmer, 2005; RAND Corporation, 2011; Reynolds & Tuberosa, 2008).
Results and Discussion...

• The relevance of incorporating translational research in the overall knowledge diffusion activity in agriculture can be seen from the perspective of bridging the gap and speeding the diffusion, use, and impact of scientific knowledge in the entire agricultural value chain.

• Delmer’s (2005) testimony from her personal experience in academia and food security at the Rockefeller Foundation is quite telling: “...there exists a high degree of disconnect between those who work at the lab bench and those who work in the field.”
Results and Discussion...

- Translational research in healthcare offers significant insights into agricultural practices in various ways:
  1. offers a methodological approach to translate knowledge and findings from research to application so it can be readily used by the intended audience, the end-users,
  2. offers an awareness across the agricultural value chain on how to package and re-package knowledge, and
  3. offers an opportunity for training in translational research methods for agricultural scientists and extension agents.

- (CIHR, 2004; Davis, Jadad, & Perrier, 2003; RAND Corporation, 2011).
Results and Discussion...

ICT and Knowledge Diffusion in African Agriculture

• The potential of ICT for development activities, including agriculture, indeed exist in SSA
  – Over 650 million mobile phone subscribers
  – some 676,739 km of fibre-optic backbone infrastructure under sea and inland in an effort to connect the entire continent.
Results and Discussion...

• Major findings regarding effective diffusion and utilization of research knowledge include:

  (1) engage knowledge users in prioritization, definition, interpretation, and application of research

  (2) the significance of starting with indigenous knowledge,

  (3) the critical role of packaging and re-packaging new ideas, findings, and innovation to produce readily-usable guidelines and manuals (knowledge synthesis),
Results and Discussion...

- Effective diffusion ...
  (4) the need for national and regional integrated knowledge networks, innovation platforms,
  (5) continuous professional development of the extension agent and re-conceptualizing their role as effective knowledge brokers,
  (6) taking advantage of the existing relevant and appropriate information and communication technologies, including mobile and social communication tools,
  (7) the need to create lean and robust communication infrastructure that serves both vertical and horizontal interactions.
Results and Discussion...

• Finally, we propose the creation of national and regional internetwork of *Agricultural Knowledge Clearinghouses (AKC)* – framework is shown next slide.

• The framework incorporates knowledge integration and translation at its core.
Detailed framework of knowledge diffusion in African agriculture
Results and Discussion...

• Following knowledge products from evidence-based healthcare such as clinical practice guidelines (CPG), systematic reviews, we propose the following knowledge products to come out of the AKC activities:
  – Agricultural practice guidelines – e.g., for specific crop or for specific input.
  – Farming factsheet – e.g., for pesticide or spray application.
  – Expert panel reports – e.g., no-till or tillage.
  – Systematic reviews – e.g., literature review of genetically engineered crops.
  – Extension demonstration/experiment registries together with the results – e.g., reports from field experiments, tests.
  – Systematic documentation of indigenous knowledge – e.g., externalizing or documenting local knowledge.
Conclusion

• Significant advances have been made in the agriculture sector globally – spanning crop, livestock, dairy, fruit, vegetable, and organic farming.

• Such advances result in large amount of knowledge being generated and stored in repositories across the globe.

• We argue that the most important task now is not to re-create new knowledge, but to acquire and effectively use existing knowledge to fuel further knowledge creation and spur more innovation.
Conclusion ...

• Because of the above argument, we believe translational research will play a role in strengthening traditional extension service in the effort to disseminate refined, synthesized, and ready to use knowledge in the hands of the farmer.

• The creation of national and regional level “agricultural knowledge clearinghouses,” where knowledge synthesis and knowledge translation of existing stock of knowledge occur, is the core of the activities.
Any Questions?