KNOWLEDGE TO THE POOR
REVOLUTION TAKING HIGH-END SCIENTIFIC KNOWLEDGE TO THE FARM FIELDS THROUGH INNOVATIVE ICT TOOLS AND KNOWLEDGE SHARING APPROACHES FOR A FOOD SECURE FUTURE

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Introduction

The world's population is exceedingly growing at a faster pace and is expected to reach 9.1 billion by 2050. To meet the growing needs of the world's population, a 70% increase in food production is required. In a world where, millions of food insecure farmers' livelihoods, rise and fall with the fate of agricultural produce every year, food security will continue to pose a critical challenge for years to come, reminding us that innovative solutions will be needed if we are to achieve global food security.

To achieve the desired goals, it is important to review the cause of problem and find the solutions to questions like;

How can we improve productivity and feed 9.1 billion people by 2050?

How can we take the impressive gains in productivity found in some parts of the world and make them the norm across the developing parts of the globe?

How can we empower the smallholder agriculture to contribute to global food security?

There are a lot of factors which are resulting in the growth of food insecurity and widespread poverty; it is in this context of globalizing agriculture, where the need for information becomes most intense. The smallholder farmers, who provide a significant portion of world's food, need access to right information at the right time to advance their work on an equivalent scale, so as to match the industrial-scale producers. Information and technology has become a forte of the industrial producers, with the help of internet, phone, digital tools, and other technological aids smallholder farmers can garner various information on various topics related to agriculture, etc.

In this paper, the author will analyze and present the experiences from a few select pilot projects of knowledge sharing innovation programme of ICRISAT on ICT for agriculture and will discuss potential new strategies and policies needed to enhance and sustain adoption of ICT based novel knowledge sharing approaches that contributes to the sustainable agriculture development, especially of resource poor farmers and other actors in market and value-addition chains. The presenter will also provide an outlook for a new paradigm for bringing

together food security and ICT innovations in Agriculture for a food secure future through "knowledge to the poor revolution."

Towards food security: Challenges and opportunities

For a more food-secure world, it is imperative that millions of resource-poor small farms in developing countries raise their agricultural productivity significantly by making them resilient to shocks and increasing their incomes. Farmers in developing countries are plagued by the lack of information or scientific knowledge regarding the right agricultural techniques, crop and soil profile, weather data, market price information etc. With traditional extension systems failing, there is an immediate need to bridge the information gap between research labs and farmer fields.

Agricultural extension services played a crucial role in advancing food security during the 'Green Revolution' by enhancing agricultural productivity through high yielding varieties, high end scientific knowledge and support from research labs to farmer fields. Most of these traditional extensions systems are fast becoming obsolete and at best, they are woefully inadequate in terms of infrastructure and human resources. For example, there is just one Agricultural Extension Officer for every 2000 farmers in India and the situation is far worse in some parts of Africa. Or else, consider the dismal fact that an average farmer in India receives less than 45 minutes of extension support per year even if the extension officer devotes his/her time fully for extension activities.

Unlike during the green revolution, today's agriculture is entangled in a myriad of challenges such as climate change, land degradation, loss of biodiversity, energy crisis, population explosion and the complexities multiply when considering that the resources from federal and state agencies in support of traditional extension systems are dwindling. However, advances in the information and communication technologies; open data and knowledge solutions which did not exist during the green revolution, currently provide new opportunities to address these pressing global challenges.

Knowledge sharing and innovation programme at ICRISAT

The KSI program at ICRISAT is positioned as cross cutting area with an aim to transform research results into data, information and education services to satisfy the information needs of various stakeholders thereby improving ICRISATs capability to inform, dialogue with, and serve its stakeholders.
KSI executes its activities along three tracks:

(i) Knowledge Management (KM) for Cultural Change,

(ii) KM for enhanced Organizational Effectiveness

(iii)Innovations in knowledge sharing for impact.

And five different units and one interdisciplinary platform:

(i) Information Systems Unit (ISU) – Sustains ICRISAT's technology edge

The primary role of ISU is to strengthen and enhance ICRISAT's technological edge in IT through the innovative adaptation of ICT software and

services. Modernization of IT infrastructure contributes for enhanced interaction and participation of ICRISAT scientists, scholars and staff in various partnership-based activities.

(ii) Data Management Unit (DMU) – Access to Data to get Successful Results

In 2012, DMU was established, to mainstream, support and manage research data preservation and publication across the institute, covering all locations and thematic/program areas. The primary role of DMU is to develop strategies and systems to aggregate research data that are produced across the institute, and organize it efficiently in a "central data repository" to provide access to the global scientific community. The DMU does not replace the stewardship of scientists in data gathering and analysis, nor the use of such data in publications or training. The DMU is a support unit to assist scientists in providing efficient data management tools and platforms for enhancing and expediting the data analysis and report generation activities of scientists.

(iii) Library and Information Services (LIS) – Available access to research publications

The Library and Information Services (LIS) units' primary responsibility is to connect ICRISAT researchers with information that they need to carry out their research assignments. One of the key services of the library is Selective Dissemination of Information to ICRISAT scientists. ICRISAT adopted an Open Access policy to share and disseminate the publications of the Institute's research. This was adopted to more systematically assemble and preserve the scientific output of the institution; provide scientific information services to external users, with special focus on universities, researchers, and research institutions in the developing countries; provide easier access to the entire range of scientific publications of ICRISAT in full text; enhance the profile of the researchers and the institution; contribute to increasing the impact of outcomes; and provide tangible and consistent indicators for the performance evaluation of the staff and the institution.

(iv) Learning systems Unit (LSU) – Learning by doing

Capacity building of scientists, students and scholars plays an important role in the pursuit of ICRISAT's vision. LSU contributes to ensuring that all partners have the required capacities to effectively contribute to the research programs. The approach of 'learning by doing' modality through scholarly studies, joint project attachments, and specialized courses for scientists and students is continuously pursued and sustained. Since the inception of the ICRISAT capacity building program, LSU has continuously build on the research skills of research fellows, scholars, and interns (referred to as Learner-Participants) from various partner institutions worldwide.

(v) ICT for development (ICT4D) – Taking science knowledge to the farmers

ICT4D aims at turning the latest technological innovations into real world success stories for smallholders' farmers.

All these five units have been contributing to the knowledge sharing and innovations by global dissemination of ICRISATs research data, knowledge and information. The need for having an interdisciplinary platform encouraged ICRISAT to open a Center of Excellence in ICT Innovations for Agriculture to design and develop new ICT tools and innovations in knowledge sharing approaches.

Center of excellence in ICT innovations for agriculture

In the year, 2012, on the occasion of ICRISAT's 40th anniversary, an interdisciplinary platform, i.e. the Center of Excellence (COE) in ICT innovations for Agriculture was launched, with an objective to integrate science, technology and value chain approaches to design and develop affordable technologies, new tools, platforms, methods etc. The products (or) deliverables of COE contribute to enhancing knowledge transfers, extension and capacity building activities, while capitalizing on a coalition of strategic partnerships from diversified areas to work on a specific global issues / problems – ranging from climate change to global food security, enhancing traditional extension and education systems, access to markets and quality inputs etc.

Together with its partners, COE designs and develops ICT solutions that link farmers with other agricultural stakeholders. Some of the notable initiatives tested and refined by COE include:

Open Data and Knowledge Solutions

i. **Open Access Repository** (OAR) – Provides an easy interface for researchers, practitioners, or web-connected farmers to use, build on and share research conducted at ICRISAT. Any participants or non-participants can access the OAR which provides free, immediate, permanent access to the full text of all the publications. There are more than 8, 163 records. The repository witnessed 625,930 downloads from 105 countries.

In general, Open access means the freedom one enjoys in accessing any sort of information, anywhere and at any time. It is basically the freedom to read and download the papers on any topics which are published on the particular website. ICRISAT is one the very first centers among all CGIAR centers that adopted the open access policy of its learning resources.

ii. The **Open Data Repository** enables the availability of open data to global community. There are 464 data files in more than 9 dataverse with 59 studies.

The Open Data movement provides a leveraging effect on data, collaboration, and innovation that have been proved useful in accelerating crop improvement for sustainable food production particularly in the marginal environments of Asia and sub-Saharan Africa.

iii. The **KSI C*onnect:*** A Virtual Knowledge Series Platform from ICRISAT highlights the most important projects, cutting edge research and fascinating success stories to a global audience in the form of open information and

educational video resources, face to face virtual training and learning sessions and virtual expert-farmer interactions.

Talks given by the experts from all different fields are live streamed and recorded. Since its launch in July 2012, more than 443 videos have been uploaded with around 20,224 views and around 10,300 unique users from more than 166 countries.

iv. The **AgED Open Courseware platform** - offers a research infused curriculum providing life-long learning opportunities to students, faculty members, extension agents, smallholder farmers etc. through open educational resources- anywhere and anytime — in a cost effective manner. It is an innovative learning platform for global learners, which engages them in lifelong learning mode.

AgED Open CourseWare is developed using an open source learning management system called **Moodle.** The platform not only hosts ICRISAT courses but also allow partners to host their courses. It has become very popular among educators around the world as a tool for creating online dynamic web sites for students.

Currently, the AgEd Open Courseware has **7 ICRISAT Courses**, **11 FAO Short Courses**, **1 SEWA Learning Modules** and more than **6300 Learner-Participants** from around **160 Countries**.

Empower Smallholder Agriculture through ICT Mediated Extension Systems

The current yields in the smallholder farmers' fields are well below their potential; the yield gaps vary by anything between 100-300% across different crops. An important factor is the lack of awareness of, and lack of access to, high quality inputs such as seed, fertilizer, and agro-chemicals. Furthermore, smallholder farmers do not employ improved crop management practices and their post-harvest management strategies are inadequate primarily due to a lack of knowledge. Farmers are also marginalized from participating in markets due to unreliable productivity, a lack of market information, and weak market linkages.

Farmers need to be able to access and effectively use the right information at the right time. Although classic traditional extension system failed to meet this need, the rise of new ICT tools and devices have enabled modern ICT mediated extension more efficient and farmer-friendly, with real-time advice.

The COE has developed many information systems, linking research, extension and markets. For example, "Krishi Gyan Sagar and Krishi Vani powered by the GreenSIM" brings out the best of affordable technologies, knowledge solutions, availability of quality inputs, credit and insurance at the doorsteps of smallholder farmers, anchored on public-private partnership.

Krishi Gyan Sagar is a pull based ICT mediated extension system, which supports both tablet/smart phone as well as web. The app for tablet/ mobile consists of various modules for providing several personalized information and input delivery services to the farmers. In addition to this, the web based

application helps to generate quick reports, market intelligence, intelligent decision support system and acts as a proficient Monitoring and Evaluation (M&E) tool.

Krishi Vani is a Push based, mobile mediated agro-advisory platform that delivers 35 free voice messages per week per farmer in 16 categories (weather, market, crop information, government schemes, nutrition, health etc.) in regional languages. Through this application, generic advisories are delivered to groups of farmers in a location on the mobile phone owned by them and enabled by Green SIM.

The project observed great impacts on the smallholder farmers. More than 40,000 smallholder farmers in 171 villages have been receiving benefits from this project in a span of six months. It contributed to bringing forward info-entrepreneurs as new professionals to strengthen the traditional agricultural extension system. It also provided an opportunity to the rural women/youth to gain additional income as info entrepreneurs. The project received the Flame Award 2013, instituted by the Rural Marketing Association of India (RMAI) for showcasing innovative use of technology of the decade.

Next Generation Innovations

The rise of new ICT devices such as tablets and smart phones will certainly create new opportunities for user-friendly information tools for better agricultural advice services and inform farmers about quality inputs and market access. They will also create job opportunities for info-entrepreneurs that can create crucial added value for farmers. KSI, at ICRISAT strongly believes in a financially sustainable 'backbone communication network' that can be developed with advanced ICT tools anchored on people-public-private partnerships to improve the quality and convenience of information (crop, market, weather and user's choice) dissemination to smallholder farmers and transparency within the value chains.

ICRISAT has recently launched two next generation initiatives:

Green PHABLET powered **by the Green SIM** is an electronic device integrated with phone and tablet (Phablet) technology, coupled with other required components for use of agriculture data- information-knowledge aggregation and dissemination and also support for many other usages. The device comes with unique features like water resistance, dustproof, shockproof, break proof, sunlight readability etc. The GreenPHABLET powered by the Green SIM is an ICT mediated tool for modernizing agriculture extension to address the challenges of infrastructure and human resources by creating info-entrepreneurs, to deliver knowledge solutions and quality inputs at smallholder farmer's doorsteps through voice advisory services and mobile money.

One Agriculture-One Science (OA-OS) is a common platform to comprehensively address gaps in agricultural education with the latest advancements in technology and knowledge flow strategies. One Agriculture One Science aims to bring various disciplines in agricultural education such as crop,

livestock, fisheries, natural resource management, etc. under one roof with strategic partnerships across the globe.

The basis for the inception of this initiative arises from the question, "How do we make agriculture education more attractive to the youth and also more employable?" which has been asked in several forums, conferences and meetings in the recent years.

To address this challenge an international partnership across India, Africa and the USA has formed the 'One Agriculture-One Science: A Global Education Consortium' initiative aimed at revitalizing global agricultural education, capacity building and technology transfer. This has been made possible with the collaboration of the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and top universities from all these continents.Global collaborative partners from a wide range of interdisciplinary expertise and experience gathered for the launch of the initiative in an expert consultation workshop jointly organized by ICRISAT, the University of Florida (UF), Michigan State University and Iowa State University, held at UF, Gainesville, Florida, USA on 17-18 July 2014. A partnership framework under the 'One Agriculture-One Science' umbrella was developed during the workshop with all participating partners that includes land grant state universities in the USA, the Indian Council of Agricultural Research (ICAR), the African Green Revolution Alliance (AGRA), the Regional University Forum for Capacity Building in Agriculture (RUFORUM, a consortium of 42 universities in 19 countries in Africa), US Department of Agriculture, US Agency for International Development, and CGIAR centers.

The group of internationally-minded educators subsequently organized a second meeting in India and launched a pilot project for One Agriculture-One Science's involvement for Indian agriculture education. Further the meeting at the World Food Prize symposium, Iowa demonstrated mounting support, as academics and other food leaders attended a panel discussion held as part of the Borlaug Dialogue proceedings.

Replicating and up-scaling proven successful experiences

ICRISAT strongly believes in replicating and up-scaling impressive gains in productivity found in some parts of the world and making them the norm across the developing parts of the globe.

To bring this idea into reality, ICRISAT Governing Board collaboratively launched ICRISAT South-South Initiative that provides a platform for focused and systematic international relationships critical for a more effective and inclusive development cooperation between India and Africa.The key mission of IS-SI is to create better policies, more effective institutions, improved infrastructure, and better access to markets and to higher quality inputs for dry-land farmers in South Asia – Sub Saharan Africa.

The IS-SI initiative was announced in the 64th Governing Board meeting held in ICRISAT, Patancheru on 21-24 March, 2011. The partnerships further

strengthened with the national and international institutes, round table meetings were organized with the ambassadors of various embassies and exchange visits also encouraged. An execution framework has been developed and approved by ICRISAT Governing board to further strengthen the IS-SI activities. ICRISAT South-South Initiative (IS-SI) as a platform for focused and systematic partnership towards stronger and inclusive development cooperation between the two continents.

IS-SI in the coming years focuses to open up more opportunities for increased financial and technical support and enhanced public-private-people partnerships on research-for-development.

KSI contributions towards knowledge to the poor revolution

The KSI team at ICRISAT has been executing novel ideas that have had global implications, impacting communities of farmers, researchers, scientists, students etc. For example, users of the KSI Connect platform come from 166 countries, cutting across regional and national boundaries. Several services, such as the mobile advisory services, are provided in regional languages – ensuring that language is not a barrier.

Initiatives like KrishiGyan Sagar and Krishi Vani has benefited several smallholder farmers in the drought prone regions of Adakkal and Ananthapur, of South Central India. With the help of agro-advisory voice mediated ICT extension services, the farmers were able to save their crops from harsh weather conditions.

Similarly, the web-based learning services touch different levels of users ranging from the tech-savvy farmer to experts and scientists – for example, virtual expert to farmer sessions link the source of the knowledge with its beneficiary.

Implementation of various innovative knowledge sharing platforms like KSIConnect, AgED Open Courseware, Open Data and knowledge repositories; GreenPHABLET powered by the GreenSIM, and the next generation of ICT innovations will be beneficial to the smallholder farmers and several other stakeholder, by going beyond the norm and providing them with various services ranging from agro-advisory information to providing quality inputs (on seeds, fertilizers, pesticides, credit and insurance) and other services such as, access to markets and information on farmer and agri-business entrepreneur support systems.

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Providing these knowledge services could be financially viable for info-entrepreneurs through provision of incentives for their services either through private sector corporate social responsibility or business models by bringing reforms in the supply and distribution channel for a win-win situation.

"ICRISAT's ICT-enabled information services have been successful increating para-extension workers out of a rural youth/women, with only marginal investment and has led the world in a new direction to address the inadequate infrastructure and human resources challenges being faced by the traditional extension systems " stated by several experts across the globe.

The humankind has made great technological strides in various sectors such as medicine, defence, travel, energy, communications etc. In this scenario, it is imperious that advances in ICTs be brought in to transform agriculture, one of the most basic and traditional sectors in the world. ICT has the potential to bring information to the fingertips of farmers, a key notion to food security on a global scale. Modern agriculture needs such foresight – or a vision to strengthen core scientific research and make it available to the smallholder farmer fields through the application of ICTs.

Knowledge Sharing and Innovation program at ICRISAT over the years has successfully demonstrated the ways to create a sustainable "backbone communication network" that will improve the quality and convenience of information dissemination and knowledge sharing to various stakeholders that include smallholder farmers thereby contributing to 'knowledge to the poor' revolution.

References

Dileepkumar Guntuku. "Appropriate Technologies and Innovative Approaches for Agriculture Knowledge Sharing". ICRISAT. http://ksiconnect.icrisat.org/wp-content/uploads/2014/09/Capacity-Development-Program.html

Dileepkumar Guntuku. New AgriculturistAppropriate Knowledge and Tools for Smallholder Agriculture. http://www.new-ag.info/en/research/innovationItem.php?a=2898

Dileepkumar Guntuku. ICTUpdate The Right Information at the Right time. http://ictupdate.cta.int/mobileen/Feature-Articles/The-right-information-at-the-right-time

Dileepkumar Guntuku. SATrends Linking farmers to research. – ICRISAT's Newsletter, Issue 110, August 2013

http://www.icrisat.org/what-we-do/satrends/satrends-2013/satrends-august-2013.htm#2

Dileepkumar Guntuku. GCARD Appropriate Knowledge for the Smallholder Farmers will Make the World More Food Secure. http://gcardblog.wordpress.com/2012/11/08/appropriate-knowledge-for-smallholder-farmers-will-make-the-world-more-food-secure/

Dileepkumar Guntuku. Appropriate Technologyhttp://www.researchinformation.co.uk/apte.php Use and Sustain ICT Innovations for Bringing Research into Practice. Appropriate Technology Vol. 40 (2)

Tablet to bridge farm extension work https://ph.news.yahoo.com/tablet-bridge-farm-extension-163926142.html

ICRISAT expert shares knowledge sharing innovations in India http://www.bar.gov.ph/chronicle-home/archives-list/223-april-2013-issue/4570-icrisat-expert-shares-knowledge-sharing-innovations-in-india

The Matabeleland Agriculture Business Chamber (MABC), Zimbabwe, to introduce ICT Innovations in Agriculture for Zimbabwe agriculture development (2014). http://bepa.co.zw/news/topix/zimbabwe/dr-guntuku-dileepkumar

Governing Board honours Director General WD Dar. September 2014. http://www.icrisat.org/newsroom/latestnews/happenings/happenings1642.htm#6

Mildorf, Tomas &Charvat, Kaneljr. 2012. "ICT for Agriculture, Rural Development and Environment". Czech Centre for Science and Society

Palmer, Niel. 2012. "Using ICT to enable Agricultural Innovation Systems for Smallholders". CIAT

Reports and materials prepared by Learning Systems Unit (LSU). 2010, 2011. 2012. KSI earlier history, Learning Systems Unit and Trends LSU.

Reports and materials prepared by Information and Communication technology for Development (ICT4D). ICRISAT. One Agriculture-One Science: A Global Education Consortium, IS-SI ICRISAT South-south initiatives, Green SIM KrishiGyanSagar and KrishiVani.

"Strengthening Rural Livelihoods - The impact of information and communication technologies in Asia". Produced by IDRC, ENRAP and IFAD. http://idl-bnc.idrc.ca/dspace/bitstream/10625/45947/1/132419.pdf

Stienen, Jac, Bruinsma, Wietse&Neuman, Frans. 2007. "How ICT can make a difference in agricultural livelihoods". International Institute for Communication and Development (IICD). www.iicd.org

Ubels, Jan, Acquaye-Baddoo, Naa-Aku& Fowler, Alan. (2010). "Capacity Development in Practice". Washington, DC: Earthscan LLC.

"Working towards a CGIAR Capacity Development Community of Practice". 01 November 2013. http://www.icrisat.org/newsroom/latestnews/happenings/happenings1595.htm#6