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ICTs in Knowledge Management: A case of agropedia

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October 2014

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List of Abbreviations

aAQUA	Almost All Questions Answered
APQC	American Productivity and Quality Center
E2F	Expert to Farmer
F2E	Farmer to Expert
FAO	Food and Agriculture Organization
ICAR	Indian Council of Agricultural Research
ICRISAT	International Crops Research Centre for Semi-Arid Tropics
IIM-C	Indian Institute of Management-Calcutta
IIT-K	Indian Institute of Technology-Kanpur
KM	Knowledge Management
KVK	Krishi Vigyan Kendra
M&E	Monitoring & Evaluation
NARS	National Agriculture Research System
Q&A	Question & Answer
SaaS	Software as a Service
SAU	State Agriculture University
SIM	Subscriber Identification Module
SMS	Short Message Service
UNDP	United Nations Development Programme
vKVK	Voice Krishi Vigyan Kendra

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Abstract

ICTs are being increasingly used for Knowledge Management (KM) nowadays. In spite of this, rapid deployment of ICTs for KM is a major challenge. This paper explores the challenges in using ICT for KM using the case of "agropedia" – an ICT mediated knowledge management platform for Indian agriculture. The paper argues that KM is no more a technical challenge, but rather constrained by social and organizational barriers. Without initiating institutional and policy changes in addressing these barriers, KM continues to elude Indian agriculture.

ICTs in Knowledge Management: a case of agropedia

1. Background

Agriculture is a complex enterprise involving millions of small and marginal farmers in India. Many of them are illiterate, resource-poor and have little or no access to modern technologies. Knowledge Management (KM) is therefore a very challenging task in Indian agriculture. Unless everyone connected with agriculture is brought to a common platform for sharing and refining information, finding solutions to local problems through crowd sourcing information is not easy. With the recent advances in Information and Communication Technologies (ICTs), connecting people on a common knowledge platform is not that difficult. The agropedia project implemented by a consortium led by International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) tried to address the challenge of KM in Indian agriculture using the advances in ICTs with funding support from the NAIP (National Agricultural Innovation Project).

Agropedia was aimed as a one stop shop for any information and knowledge (pedagogic and practical) related to Indian agriculture – an audio-visual encyclopaedia, to enchant, educate and transform the process of digital content creation and organization completely. The project was expected to result in significant enhancement of capacity among agricultural experts at various levels in the refinement and management of new knowledge. The project was implemented during 2009-2014 in two phases. Phase I created the basic platform to achieve the objective of agropedia. Phase II focused on updating the existing content, adding new content and disseminating the content to farmers as voice messages.

During Phase I, it became clear that only gathering content from different sources and digitizing it at one place is not going to help Indian farmers who are largely illiterate and with low access to computers and Internet. Moreover, the project team realised that beyond knowledge partners, a strong dissemination channel is also needed to reach the "last man". Phase II was therefore initiated to provide agricultural information to the farming communities at their doorsteps.

This paper is a reflection on the agropedia project, the challenges it faced, and how it addressed some of them. A first-hand account of the project implementation is presented in this paper so that it benefits others, who are experimenting with similar approaches in ICT-mediated KM. The paper is organised as follows. The paper begins with a review of ICTs in KM (section 2). The evolution of agropedia project from a content management system to a delivery mechanism is discussed in section 3. The project faced several challenges during its development phases and these are discussed in section 4. The lessons learnt from implementation of the agropedia project are presented in section 5. Major conclusions are presented in section 6.

2. ICT in Knowledge Management- A Review

Knowledge Management (KM) generally refers to the process of generating, capturing and disseminating knowledge (Sulaiman et al, 2012). Researchers have pointed out two kinds of knowledge: tacit (context-specific personal knowledge embedded in individual experiences and thus, difficult to share) and explicit (that can be easily articulated and transmitted). Explicit knowledge is easy to share or transmit; sharing tacit knowledge is comparatively difficult. Tacit knowledge plays an important role in providing meaning to explicit knowledge as well as contributing to the development of new knowledge (Sulaiman et al, 2011).

ICTs can support the transformation of tacit knowledge to explicit knowledge and vice-versa. The most important ICT tools deployed in KM include organizational web pages and special portals created for specific commodities, sectors and enterprises or for specific activities such as e-commerce. Electronic databases, audio and video recordings, and multi-media presentations are also used widely to capture and disseminate knowledge.

In the agriculture sector improved access to ICT and increased interest in KM led to mushrooming of websites and portals around a single commodity or enterprise. A careful analysis of these websites and portals indicate that these are mostly used for disseminating generic information and there is very little contextualization to convert this to relevant knowledge that could be acted upon. Very few websites and portals are interactive to enable knowledge sharing or exchange (Sulaiman, et al 2011).

As agriculture has become more complex, farmers‘ access to a reliable, timely, and relevant information has become increasingly important. Farmers require access to more varied, multisource and context-specific information, related not only to best practices and technologies for crop production and weather, but also to information about post-harvest aspects, including processing, marketing, storage, and handling. Generalized content often made available through web-portals and other ICTs often has very little value to farmers who cultivate crops in varied agro-ecological settings. An added difficulty is that digitally available public information related to agriculture is generally poor in quantity and generic in quality (Balaji 2009).

Information that is context specific rather than generic could have important impacts on the adoption of technologies and could increase farm productivity for marginal and small agricultural landholders (Samaddar 2006). Despite the potential cost and time associated with generating localized content, access to locally contextualized quality content is more relevant for the poor and more useful to their information needs (Cecchini and Scott 2003; UNDP 2001). Reliable, easily available, quality content that is relevant for farmers‘decision-making could also reduce information-seeking and learning costs (Llewellyn 2007).

The complexities in the process of generating and delivering relevant content mean that content management is a major identified challenge in ICT projects (Chapman and Slaymaker 2002; Colle and Roman 2002; Dossani, Misra, and Jhaveri 2005). Batchelor (2002) stated that many ICT projects tend to supply generic information. On the other hand,

relevant and localized content may not be available or affordable, due to the high cost of generating and managing locally relevant content (Keniston 2002). However, in many instances, technology takes precedence over both content and integrating that content within local information flows.

ICTs have been extensively used in information dissemination in local language to farmers and in training farming communities in better agricultural practices. However, the most frequent criticism that farmers in India had regarding information provided through mobile phone services was that the information was generic and considered old and routine (Mittal et al, 2010). Chapman and Slaymaker (2002) noted that the contradiction between the potential for ICTs to address the challenges faced by rural development and the current failure to harness them for this purpose is striking.

Effective KM typically requires an appropriate combination of organizational, social and managerial initiatives, along with, in many cases, deployment of appropriate technology (Marwick, 2001). Marwick also suggested several technologies that can support or enhance the transformation of knowledge. Disterer (2001), however, argues that knowledge sharing is not a technical challenge but more of a sociological one. Many barriers to effective knowledge sharing exist within and between the organizations. There are empirical results which show that cultural aspects like individual and social barriers are critical for KM initiatives. Culture, rewards and support are also important issues within KM (APQC, 1996).

Ernst and Young (1997) in a survey of executive perspectives on knowledge in the organization, noted “culture” as the far biggest impediment (54%) to knowledge transfer. The next issue on the ranking was top management failure to signal importance (32%), which is an indicator that paradigms of the companies are not well communicated or understood within the companies. The biggest difficulty in managing knowledge is changing people’s behaviour, which is basically their attitude towards sharing knowledge with their colleagues.

Lack of incentives or reward is another challenge in knowledge sharing. According to Kollock, 1999, there are three generally accepted processes to incentivize participation. First, one could create a competition with winners and losers, second, have a system which grants monetary or other forms of rewards for participation, or third, have a system of voluntary participation where people contribute because they believe in a particular cause. As summarized by Lui et al (2002), community contribution can be motivated by individual and interpersonal factors. Individual factors include extrinsic motivations, such as rewards and personal need, and intrinsic motivations, such as reputation and altruism. Interpersonal factors include motivations such as liking and affiliation.

Another major challenge in KM is, digital divide (the gap between haves and the have-nots) which is not merely technological. There is a social divide between the information rich and poor in societies and there is also a digital gap between women and men in society (Huyer and Mitter, 2003). However, the rapid spread of mobile phones in developing countries has contributed substantively to a reduction in the digital divide, something other ICTs such as computers have not yet managed to achieve (Samii, 2010).

All these studies highlight the existence of several barriers in KM and the need to address these.

3. Evolution of agropedia

3.1 About the project

The agropedia project entitled "Re-designing the farmer-extension-agricultural research/education continuum in India with ICT-mediated Knowledge Management" was initiated to address these challenges and to provide a national entry point for agriculture related information (http://agropedia.iitk.ac.in/). The project was implemented by ICRISAT-Hyderabad and Indian Institute of Technology-Kanpur (IIT-K) in collaboration with several national and regional research and development partners. Officially launched in January 2009, the project was originally conceived for 2 years and 6 months with a total budget of 1.41 million US$ with ICRISAT as the lead centre (2007-2010).

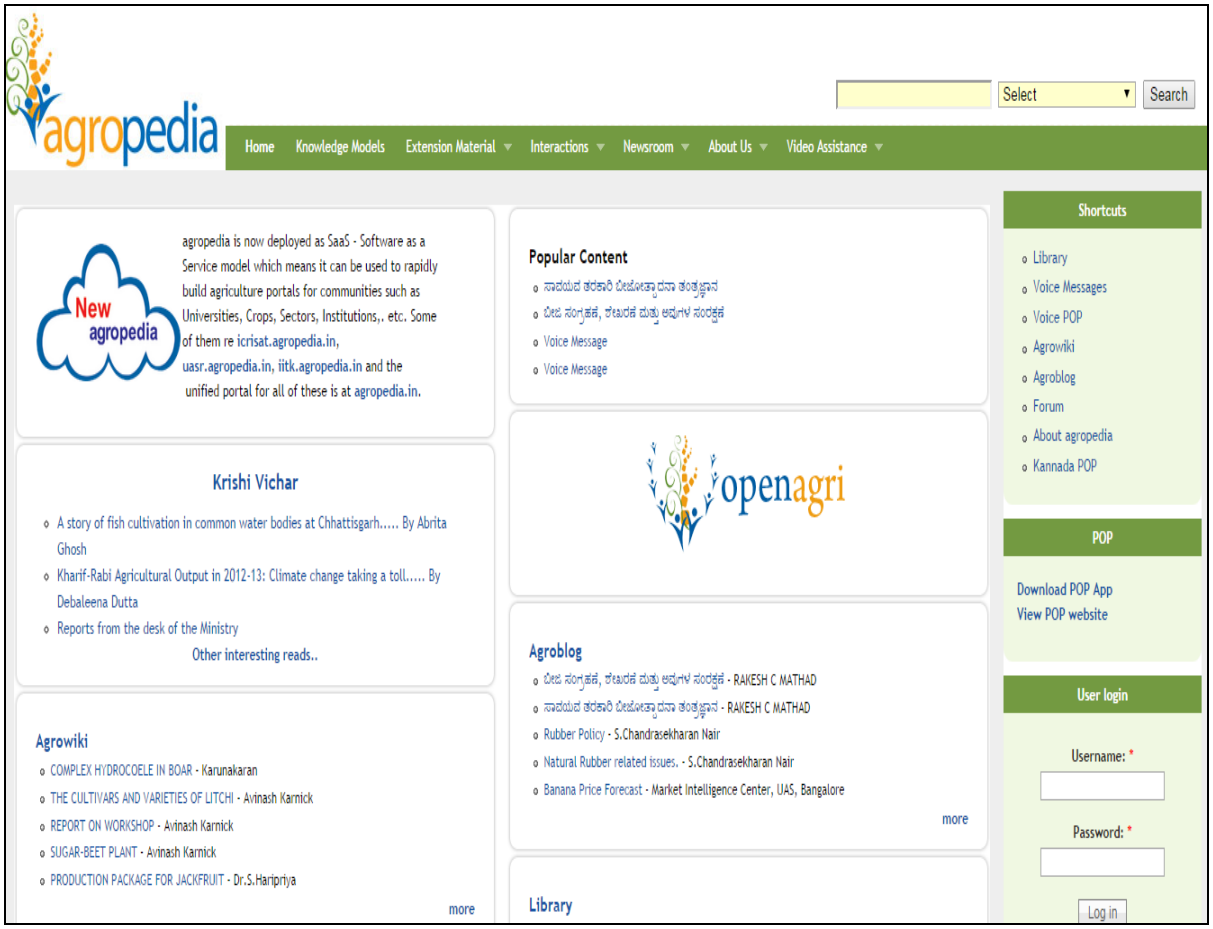

Fig. 1: agropedia Home Page

3.2 Phase 1

During this phase, a consortium of organisations involved in ICT and agricultural research came together to build a comprehensive and integrated set of processes and platforms to

support and promote knowledge flows and exchanges between different stakeholders (Table 1).

Table 1: Partners in Phase I

Phase I Partners	Roles and responsibilities
International Crops Research Institute for the Semi-Arid Tropics, Hyderabad (Consortium Leader)	Consortium coordinator, overall project management and implementation, capacity building, impact assessment, M&E
Indian Institute of Technology, Bombay	ICT provider and host aAQUA
Indian Institute of Information Technology and Management, Kerala	Multi-modal engagement and delivery services and customization of KISSAN approach
National Academy of Agricultural Research Management, Hyderabad	capacity building, facilitator of content sourcing and research support
Govind Ballabh Pant University of Agriculture & Technology, Pantnagar	Content developer, Impact assessment, engaging farmers via KVKs
University of Agricultural Sciences, Raichur	Content developer, engaging farmers via KVKs

3.2.1 Implementation of Phase I

As stated earlier, agropedia was aimed at developing a comprehensive digital content, platform, and tools in support of agricultural extension and outreach. The objective was to make available agriculture repositories of universal knowledge and localized content (built in collaborative mode and in multiple languages such as Hindi, English, Kannada, and Telugu) for a variety of users, with appropriate interfaces.

3.2.2 Framework Development

Two different types of elements proved essential to the system:

Knowledge Models: Mainly used to navigate agricultural knowledge and to organize and search agricultural content. Knowledge models were designed with the intention of using them for indexing and browsing the content, gathered in the repository.

Knowledge Objects: Every type of resource related to agriculture, such as documents in various formats (PDF, word files, and text files), video files, audio files and pictures. The project evolved as follows (Box 1).

After the knowledge models of nine crops (rice, pigeonpea, groundnut, sorghum, chickpea, wheat, sugarcane, litchi and vegetable pea) were developed, the knowledge partners started working on creating the multilingual content for all these crops. The content initially developed in English went through several rounds of verification by the experts. The verified content was then translated into local dialect by professional translators.

Box 1: Technical evolution of agropedia

Knowledge Models are the structural representation of information, developed by using pieces of knowledge and relationships between them. The knowledge models were developed using the freely available IHMC (Institute for Human and Machine Cognition) tools with the intention of using them for indexing and browsing the content, gathered in the repository.
agropedia Indica was a limited instantiation of the agropedia vision, where the emphasis was on Indian agriculture with only the web as the delivery mode, and initially developed in English and Hindi.
agropedia Beta 1.0 was the phase marked by the creation of basic platform to achieve the objectives of agropedia. It primarily involved the development and management of content.
agropedia Open Access: Agricultural research repository makes full text documents visible, accessible, searchable, and useable by any potential user with access to the Internet. Searching and archiving in Open Access is totally free for any user. The only requirement is that authors wishing to submit a document need to register in the system.
agropedia 2.0: agropedia 2.0 is deployed as a SaaS (Software as a Service) platform. There are many agropedias, one for each Institute/organization, crop, sector, university, etc. Each of these agropedias has their own administrator, editors, users, and completely managed by the respective institutes.

However, there is one ICAR agropedia, which is the 'mother' agropedia. The ICAR agropedia is the union of all the knowledge objects in all other agropedia. Every insert into the 'child' agropedia automatically goes into the ICAR agropedia. The automatic tagging technology was also revamped. A more powerful faceted tagger was developed. The earlier Knowledge Models were revamped with *KrishiVoc* - a comprehensive vocabulary of Indian agriculture.

Content was developed in the form of HTML, audio, video and image format. Then it came to digitize the pooled content by all consortium partners onto agropedia site. As a result of the herculean task to collect, verify, translate and digitize the vast information about agriculture, a total of 1,473 web pages of library content was created by the knowledge partners. The outcomes of Phase I are presented in Box 2.

3.2.3 Categorization of knowledge content

The knowledge content on agropedia is categorized as:

- **Certified Content (*Gyandhara*):** This content is available under the section named 'Extension material' on the agropedia website. It contains agricultural information about Do's & Don'ts (what should and should not be done during crop production) for nine crops, text and voice messages sent to registered farmers, and the month wise crop calendar. This content has been created by consortium partners. Knowledge models are used to perform semantic search within the certified content.

- **Contributed content (*Janagyan*):** This content can be seen under the section named 'Interaction', which is further divided into 'agro-wiki', 'agro-blog' and 'Q&A Forum'. The purpose of this content was to harness the collective intelligence of field practitioners, interested individuals and students. The knowledge can be expressed in various forms like text, voice messages etc. These blogs can be viewed by unregistered users but only a registered user can comment/add a new entry. Other features of agropedia are described in Box 3.

Box 2: Products from Phase I

- Agropedia knowledge management platform (http://agropedia.iitk.ac.in/)
- Knowledge Models of 23 crops namely rice, wheat, chickpea, vegetable pea, pigeon pea, sorghum, groundnut, litchi, banana, chilli, cotton, goat, grapes, lentil, mango, onion, pearl millet, pomegranate, potato, safflower, sweet sorghum, tomato, and sugarcane.
- Agrotagger: A software which identifies keywords and tags the content accordingly. The keywords enable searching and quicker retrieval of the content. Use of knowledge models for tagging content and people; useful for searching information and locating people with similar interest.
- Agropedia deployment options: Appliances for off-line/on-line access where the connectivity is poor.
- Openagri (http://agropedialabs.iitk.ac.in/openaccess/): A focused research space for hosting agriculture documents such as journal articles, conference papers, books, book chapters, proceedings, preprints, multimedia content, etc.
- Social networking platform: wikis, blogs, and chat rooms for interconnecting agriculture community.
- Package of Practices: offline application.
- 33,062 published nodes solely dedicated to agriculture.

The project was also intended to enhance the capacity of ICT professionals to develop connections with the NARS organizations to serve farmers. A total of 92 workshops were conducted by all the consortia partners during 2008-2014 to strengthen the capacity of NARS scientists and to sensitize them about use and application of agropedia (IIT-Kanpur, Final Report, 2014).

Box 3: Features of agropedia

agropedia has a comprehensive home page that leads the user to its various features, such as, agrowiki, agroblog, forum, Krishi Vichar and Knowledge Models. The homepage displays popular content and a featured user (one who has made the most contribution in a week) as well, and all this can be accessed even if one is not a registered user. Active participation, that is, commenting or uploading a document, warrants registration. A multilingual editor provides one with the ability to write in his/her own regional language to encourage users to contribute content to the website. Also the last registered user was acknowledged generating a special feeling for the newly joined. Like most, it also has a public and private chat option.

agropedia is semantically enabled making searching of information easier. The contents contributed were sorted into either the library or agrowiki or agroblog. While the users themselves can decide whether their content belongs to the agrowiki (factual) or agroblog (experience-based), the content featured in 'Library' undergoes authentication. Thus, the site provides space for both reliable information as well as for new contemplations open for discussion. A 'Newsfeed' provides links to newspaper articles on agriculture. Video assistance was provided to help newcomers understand how to navigate the site.

Agrowiki was also quite successful among the contributors but agroblog and agro-forum largely failed to attract the attention of agrarian community and even the consortium partners. The emphasis was too much on the content creation and digitization that most of the questions posed on the agro-forum section were never answered by the experts. Lack of clarity within the organisation on who should address these tasks also contributed to this situation.

3.3 Phase II

Phase II was intended to improve the form and nature of content, and its dissemination. As the content was hosted in electronic form it looked possible to make it active and personalised. This led to the initiation of Voice *Krishi Vigyan Kendra*, popularly known as vKVK and *Krishi Vigyan* Knowledge Networks (KVK-Net) emerged.

Phase II was launched largely with the same project management structure as in the first phase. However, some new partners were included (Table 2).

Table 2: Partners in Phase II

Phase II-Partners	Roles and Responsibilities
Indian Institute of Technology, Kanpur (Consortium Leader)	Consortium coordinator, overall project management and implementation, technology provider
International Crops Research Institute for the Semi-Arid Tropics, Hyderabad	Content provider, capacity building, virtual extension activities
Indian Institute of Management, Calcutta	Impact assessment, developing business model for sustainability, ability to replicate, and scalability of agropedia
University of Agricultural Sciences, Raichur	Content provider, capacity building, virtual extension activities
Zonal Project Directorate-IV, Kanpur	Content provider, capacity building, virtual extension activities

3.3.1 Implementation of Phase II

Voice-*Krishi Vigyan Kendra* (http://vkvk.iitk.ac.in/)

vKVK stands for Voice *Krishi Vigyan Kendra*, a unique web and cell phone based multimodal agricultural advisory system. vKVK makes use of existing vast extension network of *Krishi Vigyan Kendras* (KVKs) in the country and allows the extension personnel to send Short Message Services (SMSs) and voice based agro-advisories in local dialect over farmers' mobile phone. In a regular KVK, agricultural experts convey agri-information to their constituent farmers through face-face interactions during field visits, demonstrations and

farmer fairs, etc. Indian Council of Agricultural Research (ICAR) has recently (2014) announced its plans to upscale the technology to cover all the 637 KVKs of India during the 12th five year plan (2012-2017.

vKVK primarily offers two extension services viz. E2F (Expert to Farmer) and F2E (Farmer to Expert). In E2F, the agricultural expert can record and send messages to a set of registered farmers using a web based interface (Web to mobile) or a mobile phone (mobile to mobile). In F2E, a farmer can call back and speak to the expert of their respective KVKs (mobile to mobile). Similar to voice, the agricultural expert can also send short messages (SMS) to the designated farmers of the concerned KVKs.

vKVK is part of the agropedia suite of services and is integrated with the digital library. With the advent of voice KVK system, the extension officer and farmer are not constrained with illiteracy problem. The mobile telephony has bridged the gap that existed between the rural communities and extension agencies. The vKVK service cuts across all the mobile network operators and can be accessed flawlessly on even low end mobile handsets. All vKVK services are provided free of cost to the farmers. All the content was also accessible over a web-based platform.

Initially the agro-advisories were sent in the form of text message but soon it was realized that farmers carry low end mobile handsets which does not support any other fonts except English. While testing these in high end mobile phones, we learnt that many of these high end mobile phones did not even support *Devnagari*. Besides this, most of the illiterate farmers couldn't read text messages, be it in any language. Thus, it was decided to switch over to the voice message services in local language over to the farmers' mobile phone.

The following products were developed during Phase II.

- vKVK information dissemination platform (http://vkvk.iitk.ac.in/)
- KVK-Net, a knowledge networking site for KVK functionaries
- ICAR-agropedia (http://agropedia.in/)
- 35 institutional agropedias for ICAR institutes
- *KrishiVoc*: a vocabulary specifically for Indian agriculture (Box 4)

Box 4: *KrishiVoc*

KrishiVoc is a one stop solution for all the terms and concepts of Indian agriculture. Based on the principles of FAO Agrovoc Thesaurus, the agropedia consortium has compiled 39,000 concepts/terms of Indian agriculture and arranged it in hierarchal order under 12 broad heads of agriculture. It is a compendium of agricultural terminologies with focus on Indian agriculture. The purpose of *KrishiVoc* is to tag a document for its easy retrieval and also for the retrieval of other related documents. *KrishiVoc* provides appropriate terms for tagging of Indian agricultural documents. It also provides intelligent support for human indexes and automated indexing/categorization system.

3.3.2 Workshops

Several workshops were organised during Phase II to promote the concept of agropedia and vKVK.

a. I**nternal workshops:** These were organised to ensure a shared understanding about agropedia among the staff working in the project. The workshops ensured that all the staff carried the same shared vision of agropedia and appreciate the technical and non-technical aspects of the project.

b. T**raining workshops:** 27 training workshops were organised for KVK staff to make them aware of agropedia vKVK and KVK Net. The trainings helped in empowering the KVK scientists and encouraging them to adopt technology in doing their work more effectively and economically. SMS and voice calls for information dissemination was extensively used in all the four states of India (Uttar Pradesh, Andhra Pradesh, Uttarakhand and Karnataka) where it was launched initially.

c. **Sensitization workshops:** These were organised to spread awareness regarding agropedia, vKVK and KVK Net among those associated with agriculture mainly students, agri-experts and faculty. Fifteen such workshops were conducted across various State Agricultural Universities and other Institutes. These helped in augmenting the user base and also helped in understanding their needs and responses. The sessions had provision for hands on training during which the participants created their accounts, browsed and contributed to agrowiki, agroblog, agroforum etc.

d. **Knowledge Model Workshops:** These were organized by the consortia partners to build, improvise and finalise knowledge models for mandated crops. Subject Matter Specialists of the State Agricultural Universities (SAUs) and ICAR research institutes were trained to develop the knowledge models of the mandated crops.

e. **Agribusiness Sensitization Workshop:** This workshop was conducted by IIMC as a preliminary step to understand the relevance of agropedia amongst the industry players. This workshop provided vital inputs to modify this platform to cater to their needs like building of business bulletin boards, price catalogues, guide-modules for better site navigation, presence of “inference oriented" models which can mediate the prevailing informational asymmetry in both the supply and demand side of agriculture sector.

f. **Feedback Workshop**: One feedback workshop was conducted at UAS, Raichur to fathom the effectiveness of training and sensitization workshops conducted by the agropedia team at UAS Raichur. It aimed to diagnose the lacunae in the existing mode of dissemination and workshop methodology and gauge whether there is indeed an increase in usage of the portal, post training.

3.3.3 The spin-off effects

The agropedia architecture for agricultural information has also led to a number of spin-off products such as the AgroTags and the AgroTagger (Balaji et al 2010, Runa et al, 2010). Based on agropedia architecture, two more projects were designed and developed on innovative platforms: Rice Knowledge Management Portal (http://www.rkmp.co.in) and AgriLORE (http://agropedialabs.iitk.ac.in/agrilore/) – a digital repository for Reusable Learning Objects (RLOs). The addition of Openagri, a knowledge repository, has added value to agropedia's capabilities. Openagri (http://agropedialabs.iitk.ac.in/openaccess/), a focused research space, is a content management system based platform for hosting agriculture documents such as journal articles, conference papers, books, book chapters, proceedings, preprints, multimedia content etc. The Openagri application, built on the agropedia platform, allows automatic assigning of keywords called Agrotags (http://agropedia.iitk.ac.in/agro_tag/agro_tree.html) to enable semantic searching and retrieval.

4. Challenges in Implementation

Agropedia faced several challenges during its evolution during the past 10 years. (Fig.2). While some of these were addressed on the way, some are yet to be addressed. The nature of these challenges and how these were dealt with are discussed here.

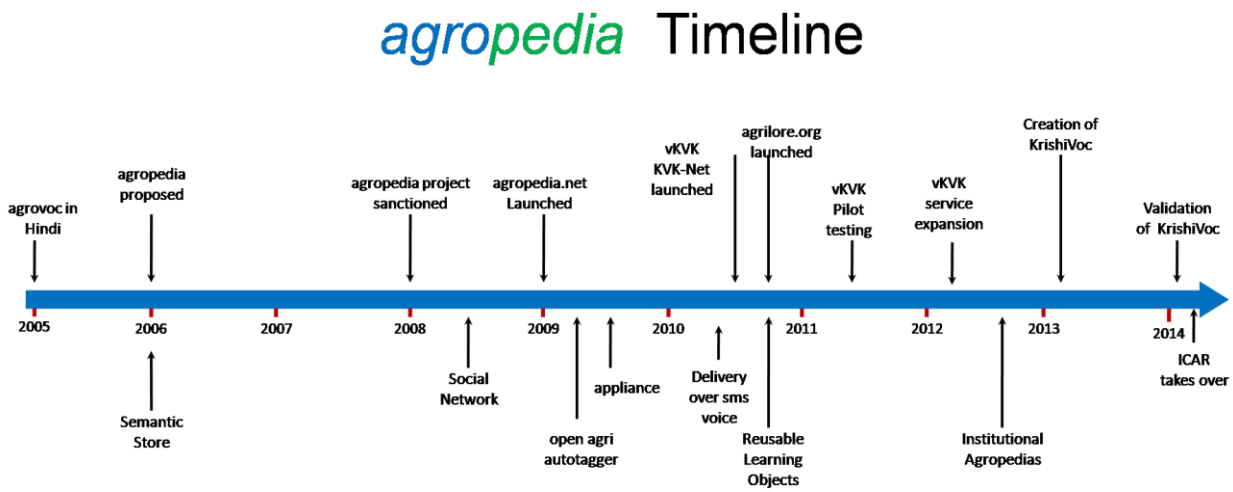

Fig. 2 agropedia Timeline

4.1 Developing knowledge models: One of the first challenges to confront the project was the difficulty in developing knowledge models in agriculture. It was too daunting and complex and partners faced difficulties in understanding the same. To tackle this problem, IIT-Kanpur contacted FAO for support. Thus, a small team from FAO spent 6 months with the internal team to prepare standard agricultural terminology to be used by the consortium partners throughout the process of KM. FAO Agrovoc thesaurus was kept as a basis for this. IIT-Kanpur team came up with a generic crop knowledge model for the consortium partners to use it as a basic skeleton for the entire crop specific

knowledge model. As a result 24 crop specific KMs were developed and these are available on http://agropedia.iitk.ac.in/.

4.2 Frequent change of personnel: The project suffered from frequent change of personnel, especially the coordinators in partner organisations. Project leaders were transferred after receiving orientation about project activities. In one case, term completion of a co-ordinator during the last stages of the project hindered the important winding up activities. A coordinator, who was an entry-level employee, failed to understand the project approach and facilitate activities both in the field and in the lab.

4.3 User contributions: Though built on a similar model as Wikipedia, where users create the content, agropedia has not been as lucky with user contributions. Further, during trainings and workshops, it was observed that though the participants expressed enthusiasm about the concept of agropedia, after the training they did not take part in follow up activities in the website. Though access to Internet was an issue in some cases, lack of motivation to contribute content and also hesitation to interact with others on a public platform like agropedia resulted in sub optimal utilisation of the whole effort.

4.4 Measuring impact: The project never had a baseline to measure its impact. There was no mention of conducting a baseline study in the project proposal. During Phase II, an impact assessment study was planned but never a baseline survey. Had it been planned well in advance the project could have had concrete impact assessment results.

4.5 Lack of infrastructural support: Though vkVK was absolutely a cheaper mode of dissemination of agricultural advisory support facility, it could not get enough acceptances among KVK stakeholders. One of the main reasons was frequent and long power shortages faced by the KVKs and lack of sufficient bandwidth to access Internet. Use of KVK-Net, the knowledge network designed for KVK experts was also significantly low due mainly to lack of motivation and leadership at KVKs. Even organising sensitization workshops was a real challenge in many SAUs due to lack of basic infrastructure and also restrictions imposed on use of computers and internet. This also led to poor utilisation of agropedia. (IIMC-Impact Assessment Report, 2013).

4.6 Mobile use pattern: Frequent changes in contact number of recipients affected the effectiveness of vKVK. Mobile based mode of dissemination is the most accepted feature of agropedia but often due to cheap availability of new SIM cards, farmers changed their contact number without any intimation to the concerned KVKs, thus resulting in disrupted service delivery. Quite often contact number registered with the KVK belonged to the owner who was not the actual tiller as a result the information was not conveyed to the right person and thus the vital information was often lost. Had the KVK experts devoted more time towards addressing these issues and ensuring active participation of farmers, vKVK could have had a greater impact.

vKVK initially performed poorly as the agro-advisories were delivered in text form as the farming community was largely illiterate and the low end mobile handsets did not support local fonts. On realising this, voice based services were initiated. By and large, the voice messages were preferred by the farmers. However, in a small study conducted in four KVKs, farmers reported that they could not grasp the whole information particularly with respect to name and dosage of pesticides. Voice messages therefore should be followed by the same text message for their future records.

4.7 Policy issues

The project faced two major policy bottlenecks:

Firstly, digitization of the Handbook of Agriculture was a major activity proposed in the second phase. But despite sincere efforts of the project team, there was some difficulty in getting it done at the ICAR level. An important objective therefore remained incomplete.

Secondly, after successful pilot testing of the vKVK service in 4 states involving 20,000 farmers, the service was expanded to 191 KVKs covering over 35,000 farmers. ICAR proposed to scale up this service to all 637 KVKs of the country, but this decision came about only after the final closing of the project.

Agropedia is yet to be fully institutionalised. To sustain the initiative and to expand the reach of this facility, research centres and scientists working on specific agricultural domain have to be made responsible for hosting the multilingual content of their mandated crops/area and answering questions.

Sincere efforts were made to institutionalize the agropedia. As a result a total of 34 institutional agropedias and one “mother” agropedia which is ICAR agropedia were developed. But the time was not sufficient to complete the assignment as the project was on its verge of closing. Hence, institutionalization of agropedia for all the research institutes in the country could not be completed.

5. Lessons

As of March, 2014, agropedia had close to 8500 registered users and 33,062 published nodes solely dedicated to agriculture and 24 crop knowledge models. A total of 35 institutional agropedias and a mother agropedia (ICAR agropedia) were created for a better content management system. Consortium partners updated the content twice during the project period. The experiences with agropedia offer two major lessons for use of ICTs in KM.

5.1 KM is mostly a social and organisational challenge

The deployment of ICT in agriculture is a socio-technical process. Even the best technology can fail if the user group does not have the capacity (or the motivation) to use the

technology. Hence, at every step of deployment of ICTs for KM, it is critical to stay connected to the user group to understand their responses to the technology deployed, both in terms of its ease of use as well as in terms of whether it really meets a hitherto unmet need of the user. There were several social barriers such as language, culture, reward and incentives, gender etc that constrained people from sharing their knowledge through this platform.

KM is no longer a technical challenge but mainly a sociological and organizational challenge, As Disterer (2011) argues Information Technology industry offers a lot of tools and techniques to support KM, but despite all these offerings, several non-technical issues hamper KM. Most of the agricultural research and educational institutes do not have a culture of freely sharing knowledge with peers and public. Issues related to organisational culture such as conflict avoidance at work place, bureaucracy and hierarchy, infrastructure also affected participation in agropedia. All these underline the importance of addressing social and organisational barriers in KM.

5.2 Knowledge sharing needs to be incentivized

Most human beings need some incentives to share knowledge. Special rewards and incentives can act as extrinsic motivators, so that users are willing to share and transfer knowledge. Voluntary participation has its limitations. The system of voluntary participation is premised on a collective effort model, which posits that people are more likely to work hard if they feel their contribution is important or identifiable to the group. In the specific case of agropedia, it would be difficult to incentivise users by a simple explanation of exactly what the community benefit of their contribution is, because the inherent value of contributed content is not easily defined. Additionally, at present, contributions do not offer any direct personal benefit to the users, except for the inherent pleasure in sharing with others. What is being done, however, is to incentivise users by drawing attention to their contributions and highlighting those users who contribute the most. However, users have opined that their levels of comfort with participation are still rather low.

Thus, agropedia needs to make it easy for people to contribute and feel a certain sense of gratification about participating in the process through recognition of some kind. Simple measures such as publicising the top rated blog posts or the person who posts/tags most often may be enough to spur some great participation. Simple acknowledgements from a person with authority would send that right signals to users that if they just participate in this network, they are noticed, acknowledged and their contribution is included at the time of professional assessments by the concerned organizations.

6. Conclusion

The ability to manage knowledge effectively is the most important factor in enhancing the productivity and competitiveness of Indian agriculture. Agropedia was a novel attempt to address the huge challenge of KM in Indian agriculture. KM is important for all stakeholders in the Agricultural Innovation System. Platforms such as agropedia that uses advances in ICTs for KM can support development and sharing of appropriate and relevant content for researchers, farmers, industry, traders, and policy makers. While agropedia addressed some of the issues, a lot more needs to be done to take full advantage of this effort.

Experimenting with agropedia clearly revealed the importance of addressing the social and organisational barriers in knowledge sharing. Without initiating institutional and policy changes in addressing these barriers, KM continues to elude Indian agriculture. It is hoped that the ICAR takes appropriate measures to see that an innovative product such as agropedia is adopted fully to serve Indian agriculture well.

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