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# Innovation of China's Grass-Root Agricultural Extension Team With ICTs

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## Abstract

Agricultural extension plays a very important role in the technology transformation. Many researchers are committed to innovate the agriculture extension system with ICTs and there has been a remarkable progress in the use of ICTs in agricultural extension. This paper gave a brief introduction about the chinese agricultural extension system and focused on improving the service capacity of the grass-root agricultural extension team with ICTs. Some experience from what we have done is shared and the problems we have encountered are also discussed.

**Key words:** ICTs; Grass-root agricultural extension team; Agricultural extension information platform; 3G network

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## INTRODUCTION

Farmers are more desirous and anxious to get agricultural technology information in the changing scenario of agriculture at global level. **Information and communication technologies** (ICTs) have become increasingly integrated into agricultural technology information dissemination to farmers. As deficiency of knowledge and poor learning ability, farmers lack the competence to flexibly ICTs master. Hence, the dissemination of required and latest agricultural technology information to the farmers is still a difficult task.

Agricultural extension, especially the **grass-root extension organization**, is an essential pillar for transfer of technology to farmers. Agricultural extension supports farmers in becoming more professional growers and diversifying their income sources. An extension practitioner is responsible for several farmers and most extension practitioners have developed a level of expertise in one or more specialized areas. What is more, extension practitioners have high qualities and are much easier to master ICTs. To arm agricultural extension team with ICTs will be more effective for the transfer of agricultural technology.

ICTs includes of a number of components including skills of accessing, recording, arranging, manipulating and presenting data or information using tools and software. Communication technology, literacy technology and intermediate technology are all considered as ICTs (Samah et al., 2009). Today, ICTs developed rapidly and new technologies, such as smart phones, cloud computing and 3G, spring up at an increasing rate. With the rapid development of ICTs, our life changes dramatically and the world is getting smaller and more interconnected. With the rapid increase of smart devices, people are now able to access information anywhere, anytime.

We have always tried to serve agriculture with ICTs and practiced a lot. Eventually we found the breakthrough point on agricultural extension. We armed the grass-root extension practitioners with the latest information technology and helped them provide more effective services on agriculture technology transfer and promotion. After years of exploration, we've made some achievements and accumulated several experience. We would like to share them in this paper.

The rest of the paper is structured as follows. An introduction to Chinese agricultural extension system, especially the grass-root extension team, including the existing problems; what do we do with the latest information technologies, such as 3G network, cloud computing and smart-devices; some practices during our demonstration of the agricultural extension information platform are discussed; the effects we have achieved and some problems we have encountered are also introduced; and finally some concluding remarks.

## 1. BACKGROUNDS

Agriculture extension is considered crucial for farmers to improve their production, productivity and marketing efficiencies. The extension system in China is charged with spreading new agricultural technologies to rural inhabitants. China has the largest extension system in the world. The state engendered extension system includes five levels (Gao, 2008) (central government, province, prefecture or city, county and town). Among them, the county and town-level extension sections are grass-root extension institutions which are run by the local governments and provide service to local farmers directly. According to the statistics provided by Ministry of Agriculture (Du, 2003), by the end of 2003, the county and town level extension departments had 1,005,000 staffs with 334,000 in the county and 671,000 in the town respectively. The extension functions of grass-root extension organization were categorized into four types by agricultural departments according to their character (Du, 2003): a) the functions of law enforcement and administration; b) pure commonweal services; c) intermediary services; d) dealing services.

In the last 50 years, great achievement has been accomplished in extension system in China and many lessons have also been accumulated. However, extension system still faces a lot of problems, especially the grass-root agro-extension system (Wang, 2011). Firstly, the extension methods need urgent innovation to change the traditional model of "Two Legs and One Mouth". Because of the lack of funds, most of the working conditions in the township or regional level extension station are generally poor. Promotion means are very backward and transportation is far less advanced. Secondly, the methods of managing agricultural extension need improvement to optimize the performance evaluation of staffs in agricultural extension. Thirdly, the quality and capacity of staffs require immediate improvement to update their unitary and stale knowledge. There are few opportunities for old staff to renew their knowledge and skills. Some of agricultural technicians cannot extend the latest technology to farmers effectively due to the lack of training opportunities.

## 2. METHODOLOGIES

Cloud computing , which is based on virtualization, distributed, clustering technology, is a model (Peter, 2011) for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. This cloud model is composed of five essential characteristics (Peter, 2011), such as on-demand self-service, broad network access, resource pooling, rapid elasticity and measured service. As cloud computing grows in popularity, thousands of platforms based on cloud are beginning to emerge.

3G, short form of third Generation, is the third generation of mobile telecommunications technology and it indicates any collection of technology what facilitates data transfer at higher speeds. People can perform a lot of functions such as sending information and data and acquiring these via wireless access. You can to have data regardless of the time and location. 3G is growing so well, with an estimated 160 million active users of Android, and 80 million on iOS in mainland China at the end of 2012.

Smart-phone is a mobile phone with more advanced computing capability and connectivity. As most of smart-phone is 3G capable, they can transfer high-speed data through the 3G network.

3G-capable smart-phone, a mobile phone with more advanced computing capability and connectivity, is able to conduct high-speed data transfers using 3G network. With 3G-capable smart-phone, users could access the Internet, conduct video calls and watch TV without a wireless network. Due to performance improvement and price drop, users with a 3G-capable smart-phone have proliferated.

Based on these new ICTs, we built the agricultural extension platform under the Cloud plus Client model. On the one hand, we adopted the cloud computing facilities for handling and storing massive agro-data; on the other hand, we developed plenty of APPs about agricultural extension based on Android and armed the agricultural extension practitioners with 3G-capable smart-phones.

### 2.1 Construction of Agro-Extension Cloud Computing Platform

Cloud computing platform provides the basic facilities for application deployment and data storage. We build a

virtualized environment and agro-extension applications are deployed onto virtual servers. Resources allocated to agro-extension application can be increased or decreased in real time and on-demand. We build a cloud storage environment based on client-server model, providing storage capacity of more than 100 Terabytes.

### 2.2 Development of Agricultural Extension Applications Based on Browser and Android

Agricultural extension applications meet the demands of grass-root extension practitioners by providing information services with text, voice, video and other kinds. There are three major categories of applications. The first category focuses on information exchange, knowledge sharing, self-learning and self-improvement for the grass-root extension practitioners; the second category pays close attention to management and performance appraisal of the agricultural technician based on WEBGIS technologies; the third category follows information collection, such as the coverage of crop, the situation of crop pests and animal diseases, the market supply and demand of agriculture products and materials etc..

### 2.3 Collection of Data Resources About Agricultural Technology

Data resources are very important part of our platform. Plenty of resources can be shared with agricultural extension practitioners from different regions. Resources come from two sources. Firstly, we cooperate with universities and companies to collect resources, such as agricultural kind books, videos and images. Some information resources are processed into technical paper or image so that they can be understood easily by the agricultural extension practitioners. Secondly, agricultural extension practitioners can also get involved in the construction of information resources. They can upload first-hand experience and knowledge to the platform without restriction.

### 2.4 Selection of 3G-Capable Smart Devices

Agricultural extension practitioners use agro-extension information services with smart devices. Because agricultural extension practitioners spend most of their time in the fields, the practicality of smart device is very important, such as waterproof, dustproof, drop-proof and shockproof. The price of smart device is also an extremely important factor and most of the device price is lower than 1,000 yuan. Corresponding applications are also built into the devices in advance, considering the compatibility.

### 2.5 Information Technology Training for Extension Practitioners

To be proficient with the latest information technology is a key to carry out the technology extension for agricultural extension practitioners. Most of them have had a certain base, for example, they used a computer and smart-phone in daily life. However, there are still problems, such as, somebody cannot type. The content of the training includes how to use the smart devices, how to use the information platform, how to retrieve the data resources etc.. We offer on-site, online and video training and build an exchange platform for extension practitioners if there is any question.

## 3. PRACTICES

The platform allows grass-root agricultural practitioner to get timely and detailed problem-solving information. So the farmers can solve the production problems with help of experienced and knowledgeable practitioners. Through 3G terminal, practitioners can educate themselves about the new agricultural technology and ask for help from experts by video conference. Moreover, technicians can be managed efficiently by problem-solving record and GPS location. In 2009, the construction of agricultural extension information platform was finished. 2010，we carried out demonstrations in Daxing Beijing and Xinghua Jiangsu. 2011, Luohe Henan and Turpan Xinjiang were included into the demonstration. 2012, 360 agricultural practitioners are fully covered by the platform in Miyun Beijing. 2013, two other countys were joined into the demonstration.

The following services provided by our platform are very popular by the agricultural extension practitioners.

### 3.1 Problem-Solving Without Leaving the Fields

When agricultural extension practitioner encounters problems that he can't solve by himself in the process of extension service, he still has three options without leaving the field. Firstly, he can search the information related to the problems to find the answer with the help of agricultural extension information platform. Secondly, he can pose a question on the platform to ask for help from the other peers. Thirdly, he can ask for help from remote experts with smart terminals.

### 3.2 Manageing Agricultural Extension Team Efficiently

In order to manage the agricultural extension team efficiently, a database was built to record extension practitioners' basic information, such as age, gender, professional, expertise and so on. Manager can send messages and make the announcement with our platform. What's more, they can locate the extension practitioner with GPS technology so as to confirm the serving scope of an extension practitioner.

### 3.3 Collecting Data Quickly and On-Demand

Agricultural extension practitioner uploads data to platform in real-time and reduce the conventional challenges associated with remote data collection. They can collect data by taking a picture or logging a record. There are several methods of data acquisition. Extension work takes notes every day for market prices of agricultural products and gathers crop growth condition

regularly. In addition, the higher authorities can assign a specify data collecting tasks to the agricultural extension team.

## 4. EFFECTS

3G terminal built-in agricultural extension platform is being used by Agricultural Information Institute, Chinese Academy of Agricultural Sciences (AII-CAAS), to equip the grass-root agricultural technician for problem-solving of agricultural production. Now AII-CAAS has set six demonstration sites. In these demonstration sites, local farmers were benefited from the real time agricultural knowledge transmission by local agricultural technicians equipped with 3G terminals and good effects are obtained.

### 4.1 The Efficiency of Agricultural Extension and Management Is Significantly Improved

Using information technology platforms and mobile terminals, agricultural extension staff may deliver vast, professional and individualized agricultural information to farmers. Managers can accurately manage and scientifically evaluate the workload of staff members through daily service records positioned by GPS and logs written by staff members. This method greatly improves the overall efficiency and level of the agricultural service.

### 4.2 The Capacity of the Agricultural Extension Team Is Enhanced

By making full use of the rich and applicable multimedia teaching materials for agricultural production, online classrooms and videos,not only can agricultural extension staff study the latest agricultural knowledge and skills, but they also can have a video communicate with experts or other staff members face-to-face. Thus their capacities and qualities are significantly enhanced.

### 4.3 The Functions of Agricultural Extension Are Expanded

The information platform provides efficient means of information collection. Using the networked extension staffs, managers can quickly obtain information about meteorological disasters, pests and diseases, animal epidemics, market information. Moreover, the information platform makes a linkage between agricultural research and agricultural extension.

## 5. PROBLEMS

During the process of the project implementation, there are still some problems.

### 5.1 The Subscription of 3G Network Is Relatively High

In our program, we cooperate with the China Unicom by purchasing a 3G subscription packages which cost 96 yuan per month. This kind packages offer 450 min and 1 GB data plan. For most technicians, nearly 100yuan's cost is hard to accept. Especially when playing a video, 3g data is easily to exceed the standard of the packages which means more money.

### 5.2 The Coverage Rate of 3G Network in Rural Area Is Low

As China telecom operators underinvested in rural 3g network, the coverage rate in countryside was low. Unstable signal is a big barrier for grass-root extension practitioner to carry out services with our platform. We have attempted to solve the problem of optimizing the traffic but the effect is not obvious. With the development of 4G technology, things may improve.

### 5.3 Some Functions of the Platform Are Imperfect

The agricultural extension information platform includes more than 30 modules and some functions of the platform are imperfect. For example, there are plenty of resources in our platform but the most important information is not highlighted; the page display is unfriendly and data processing is not flexible; interfaces for different users are the same.

### 5.4 Personalized Resource Is Insufficient

Currently, the resources in the platform are mainly collected by the manager. The target of these resources is to serve the whole nation and localized information is relatively small. Although, our platform provides interfaces for users to upload material by themselves, the regional resources still expanded slowly as the number of users is not very big.

## CONCLUSION

Through constantly efforts, we found ICTs has a great impact on the agriculture extension to further improve the agricultural production. We had won the praise from all walks of life. In 2013, the Ministry of Agriculture started to promote the cloud platform to a whole nation and provided agricultural services to grass-root agricultural extension team.

In future, we will focus on the perfection of our platform, to further expand the functions, scale the demonstration scope and cooperate with friends both at home and abroad. We will commit to exploit ICTs serving the agriculture.

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