Assessment of Information and Communication Technologies in Chinese Agricultural Extension

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August 2014
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This document was developed under the auspices of the larger Cornell-managed China Apple project, which is funded by the Walmart Foundation and implemented by the International Programs Office of the College of Agricultural and Environmental Sciences at the University of California Davis from 2013-2016.

The primary purpose of the assessment was to inform project efforts and build organizational knowledge. The results have been positive in this regard, and we therefore provide the document to others with the aim to inform organizations seeking to employ information and communication technologies in Chinese agricultural development.

While we have attempted to be as thorough and objective as possible, the information in this report is not based on systematic field surveys; consequently, we refrain from making concrete recommendations. Rather, this report should be viewed as an introduction to information and communication technologies for agricultural development in China.

Readers should also be aware that the project landscape as well as the ICT landscape in China is changing very rapidly. Consequently, the information herein is highly time-sensitive and should be corroborated before utilization. The statements expressed herein are solely that of the authors, and do not necessarily represent the International Programs Office, the College of Agriculture and Environmental Sciences, the University of California Davis, or the United States Department of Agriculture.

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# Table of Contents

1. Executive Summary ................................................................. 2

   Background ........................................................................... 3
      Economy ............................................................................. 3
      Gender ............................................................................. 4
      Languages/ ethnicities ...................................................... 4
      Previous ICT Research ...................................................... 5
      Disclaimer ........................................................................ 6

2. ICT Landscape .......................................................................... 5
      Regulatory Policies and Institutions ..................................... 5
         ICT Highlights of 5-Year Plans ........................................ 6
         Other Policies and Programs ............................................ 7

3. General ICT Notes ..................................................................... 8

4. Electricity Services ................................................................... 8

5. Radio Services .......................................................................... 8

6. Television Services ................................................................... 9

7. Mobile Phone Services .......................................................... 10

8. Internet Services ...................................................................... 12

9. Social Media Services ............................................................ 14

10. Rural Information Centers ..................................................... 14

11. Agriculture and ICTs ............................................................... 16

12. ICT Analysis .......................................................................... 16

13. Summary of ICT Initiatives ..................................................... 17

14. Promising Options ................................................................. 20

15. Challenges ............................................................................. 20

16. Opportunities ......................................................................... 21

17. Conclusions .......................................................................... 21

18. References ............................................................................ 23
Rationale

This assessment aims to inform organizations seeking to employ information and communication technologies in agricultural development in China. Specifically, this report focuses on apple production in Shandong and Shaanxi Provinces, although draws on relevant information outside these parameters. The information in this report is not based on systematic field surveys; consequently, we refrain from making concrete recommendations. Rather, this report should be viewed as an introduction to information and communication technologies for agricultural development in China.

Executive Summary

China has the second largest economy in the world and is home to more than 2 billion people, or more than 25% of the world’s population. Although, China has developed rapidly since adjusting their Communist regime to be more market-oriented in the 1970s. A complex nation with a rich history dating back more than 5,000 years, China mobilizes resources quickly, setting time-specific targets for various branches of the government and private sector companies to accomplish in whatever way they deem appropriate. In the past, this has led to successful development, although resources have not always been used wisely as a lack of a unified plan leads many branches to attack the same situation, often duplicating the work of one another, which as led the government to begin incorporating an emphasis for unity in their policies. China is rapidly evolving and complex to understand.

In ICT adoption and use, what comes first, the content or the infrastructure? China has seemingly chosen to take the approach of creating infrastructure first, which may indicate why many in rural areas see little use for ICTs and technologies such as the internet to answer their questions. In addition, in order to use these technologies, one must know pinyin, a Romanization of Chinese, to type letters into cellphones and laptops in order to select the appropriate character. Pinyin was not created and taught in schools until 1950(60), making these technologies difficult to adopt and use for older individuals, who make up a majority of farmers in the countryside as young adults migrate to work in urban areas. That said, China has more than double the applications enjoyed by those in Western countries.
Including the development of rural informatization since 2001, China has made great progress in improving ICT infrastructure, including broadband internet to more than 80% of administrative villages. Similarly, it is common for all adults to have a phone, although often received as gifts from relatives working in urban areas, these gifts may not have the features that the end-user would like and therefore doesn’t get the same value out of it. Similarly, many ICTs, such as radio, internet and TV are used primarily for entertainment, with few accessing these tools primarily for information and some only using these devices for communicating and entertainment, doing little to no information seeking on their devices.

Economy

Starting in the 1970s, China began moving towards a more capitalist, market-oriented economy, with reforms phasing out collective agriculture although, “economic development has progressed further in coastal provinces than in the interior” (CIA World Factbook 2014). Since the 1990s the PRC has defined the main problems with rural development being: agriculture, peasants, and rural communities (Yu & Yu 2013).

China’s current hukou system provides rural families farmland and legally classifies a person based on where their parents were born. This classification ignores migration, causing the statistic that more than half of Chinese are farmers to be inaccurate. For example, a young couple may move to live and work in an urban area, but if their hukou is an a rural area, they must return to receive free healthcare and education as paying for these services is prohibitively expensive for most. In general, rural areas have lower quality education and healthcare, carry a lower socio-cultural status, and have fewer economic opportunities than urban areas (Wong 1973).

China, the second largest economy in the world, became the world’s largest exporter in 2010, leading in industrial and agricultural output. In 2012 and 2013, China’s real growth rate was 7.7%, dipping form 9.3% in 2011. GDP per capita was $9,800 in 2013, up from $9,100 in 2012. Although, 33.6% of the labor force works in agriculture, they only receive 10% of the country’s GDP, indicating relative rural poverty. Six percent of the population lives below the poverty line, set at RMB 2,300 (US$383) (CIA World Factbook 2014).

China’s GDP per capita rose from RMB 825 (US$133, adjusted for inflation) in 1952 to RMB 22,698 (US$3,250) in 2008. In 2008, the annual disposable income per urban resident reached RMB 15,781 (US$ 2,500) and RMB 4,761 (US$ 750) for rural residents (Yong et al.
2012). The disposable income of urban residents is three and four times that of people in rural areas. In 1999, urban residents made 2.2 times as much as their rural counterparts, and this rose to 3.2 times by 2005 (Yu & Yu 2013). The eastern region accounted for 68.9 percent of total industrial output value, while the central and western region accounted for 19 percent and 12.1 percent, respectively (Gov.cn 2013).

Gender

Research has documented that agricultural labor in China is gendered with more than 70% of women serving as the agricultural labor in 2006 and apple farming being no different (Song & Zhang 2009) (Yuan 2013). Female farmers in China are increasingly the heads of households dependent on agriculture, yet have less access to agricultural assets (including land rights, extension information, and mobility) than male farmers (De Brauw 2012). As greater numbers of rural Chinese young adults and men migrate to urban centers for non-agricultural work, elderly, children, and women are left behind in the villages (Matondo 2012). These women have less access to agricultural resources and extension services (Manfre et al. 2013). They also have limited access to female extension agents (<30% of extension agents in China) (Hao et al. 2008).

While legally women have equal rights to land tenure, cultural expectations limit opportunities for women to access land in practice. As a result, women are more likely to remain on the farm and less likely to leave land uncultivated for fear of forfeiting their tenuous claim to the land. In addition, women taking on the agricultural responsibilities of their migrant husband see an overall increase in their labor hours (Mu & van de Walle 2011). Even young females who migrate to urban areas for work reveal their reservation towards ICTs, which they view as being more for men to use (Lang et al. 2010). Additionally, with the implementation of the one-child act, the country has seen an overall increase of males in all age brackets below 65 and has one of the most rapidly aging populations in the world (CIA World Factbook 2014).

Language/ Ethnicity

China is home to 56 ethnic groups with the Han Chinese, at 91.6% of the population, the dominant ethnic group. Mandarin is the official language of China, based off of the Beijing
dialect, but China is also home to 160 dialects and 130 minority languages (Yong et al. 2012). Dialects alone range widely between those in urban and rural areas and among more geographically and ethnically diverse Southern China, making it near impossible for native Chinese speakers from different regions to speak with one another. See General Population Distribution Map (right) for a visual representation of languages in China.\(^1\) Note the dark red areas of Chinese are centered on major metropolitan areas that speak a more standard form of Chinese (Dartmouth 2003).

Previous ICT Research

A review of Chinese ICT studies form 1989-2012 consisted of 1,705 articles, 501 of which were from overseas (Qui & Bu 2013). Most research focused on text messages and the internet. Also noted were groups that have been neglected in their use of ICTs that include: women (1% of overseas studies), farmers (1% domestic, 3% overseas), migrants and left-behind groups (1% domestic, 3% overseas), and senior citizens (0.2% domestic, 1% overseas). Additionally, 69% of “domestic publications are dialectical essays that hypothesize theories and concepts without empirical evidence” (ibid, p 142).

ICT Landscape

Regulatory Policies and Institutions

Since the 1950s, the PRC has relied heavily on 5-year-plans to establish communist principles, plan economic development, set growth targets and launch reform projects. While

\(^1\)Discussions with colleagues (Oreglia 2013) and notes in published papers (Yu & Yu 2013), indicate that Chinese statistics
these plans state areas of current importance and focus, they do not provide specifics, including who or how targets are to be accomplished.

In addition to 5-year plans, the PRC releases policies and documents, like No. 1 policies, which emphasizes to central government branches areas of high importance. These plans, policies and documents are often heavily politicized, used to gain citizens favor, and are not necessarily well-funded, organized or sustained over the long run (Yong et al. 2012).

Since 2001, 5-year plans have included rural informatization, a phrase popularized in Europe to indicate the use of information via communication technologies to leverage the next wave of development. In 2004, the PRC released a No. 1 policy, indicating high priority, dedicated to rural development. Nine more No. 1 documents were released between 2015-2013, with a 2005 No. 1 document being the first such policy to stress rural informatization (Yu & Yu 2013). Interestingly, China continues to lack a clear definition of what agricultural informatization means (Liu 2012).

The Bureau of Telecom Administration of the Ministry of Industry and Information Technology, indicated three overall ICT strategies of the Chinese government (Yongtao 2009).

1) Universal access focusing on strengthening communication infrastructure through optical/copper lines, cellular/wireless networks, and satellite telecommunications.

2) Improve telephone service, including the platforms for fixed phones, mobile phones, and dial-up internet.

3) Promote information services in rural areas by providing access to broadband and content specific to villager’s information needs in business, agriculture technology, health, etc.

**ICT Highlights of 5-Year Plans**

10th 5-year plan: 2001 – 2005 (Yu & Yu 2013)

- Rural market information services
- Rural information systems
- Modern Distance Learning of National Party Cadres in Rural Areas Project (03-06, lead by Central Committee of PRC) (6)
- Telecommunications to every village, led by State Administration of Radio, Film and TV (SARFT) by digitize China’s communications via Direct Broadcasting Satellite, ending analog broadcast in 2015. (Although, implementation across the country has varied in pace and standard.) (Yong et al. 2012)

11th 5-year plan: 2006-2010 (Rui & Zhiyong 2007)

Theme: Harmonious society, scientific and people-centered approach
• Integrate agricultural resources
• Strengthen rural economic information systems
• Promote agricultural services and mechanization
• Encourage farmer groups
• Improve the organization of agriculture

Successes
• 3.5 million rural households acquire electricity
• Agricultural taxes rescinded in 28 provinces
• Number living in poverty reduced by 2.45 million

12th 5-year plan: 2011-2015 (Britishchamber.cn)

Theme: Science and Technology
• Develop, integrate and manage agricultural technology, mechanization, and information (Lagos & Lei 2011)
• Promote development of women: legally, economic contributions and social management
• Increase rural net incomes from RMB 5,919 (2010) to RMB 8,310 (2014)
• Comprehensive improvement of informatization:
  o Plan and promote interconnectedness among mobile, internet, digital broadcast and TV networks
  o Accelerate construction of broadband in rural areas
  o Promote e-business to small and medium enterprises

Other Policies and Programs

National programs for Science and Technology (China Internet Information Center n.d.)
• Key Technologies Research and Development Program - launched in 1982, the greatest funded national economic and social development program focusing on: agriculture, electronic information, energy, transport, environment, medical, etc.
• 973 Program - launched in 1998, is a multi-disciplinary for: agriculture, energy, information, resources, population, health and materials.
• Spark Program - launched in 1986 to revitalize rural economy through science and technology, conducted more than 140,000 science-technology demonstration projects in 90% of China’s rural areas.

State Informatization Development Strategy (2006 - 2020)
Outlines the approach to developing rural areas through informatization, including:
• Improved rural network (mobile and broadband) coverage
• Integration of agricultural information resources
• Provision of appropriate information to farmers about: markets, science and technology, education, healthcare, etc.
• Orderly flow of surplus labor
General ICT Notes

While speaking and dialects pose a communication problem, China is united through a system of simplified characters and *pinyin*. *Pinyin*, the Romanization of how characters sound, was created in the 1950s. Since then, it has been taught widely in schools (About Pinyin 2014).

Typing Chinese characters on a computer or cellphone requires one to type in *pinyin* followed by a selection of the corresponding character (Oreglia et al. 2011). This provides the greatest challenge to individuals who completed their formal education before the 1950s and did not learn *pinyin* (specifically those age 65+, which corresponds with the lowest cellphone users and a majority of apple farmers/laborers). In China, all broadcast media (more than 2,000 radio and TV stations) are owned by the PRC. The PRC can approve all domestic programming and foreign programs must be approved before broadcast (CIA World Factbook 2014). While social and online media are increasing in popularity, traditional media (i.e. newspapers, radio, and TV), maintain a credible status (People’s Daily 2010).

For example, farmers in Sichuan Province, which is less economically developed than Shandong or Shaanxi Provinces, saw households spend RMB 241.49 (US$40.25) on communication each year, which most households can barely afford (Li 2012).

Electricity Services

**Coverage:** The 11th 5-year plan saw 3.5 million additional rural households acquire electricity (Rui & Zhiyong 2007). A recent report indicates that all villages located in the eastern half of China have access to electricity (Mings et al. 2014).

**Cost:** Around 80% of China’s energy comes from coal and as prices are increasing, concerns over meeting growing demands have developed (Rutkowski 2014). In 2001, electricity in China cost $0.08/kWh (compared to $0.12 in the US or more in most other countries) (Wilson n.d.).

Radio Services

**Coverage:** There is one official national radio station in China, with the rest being local, although still government controlled. A recent study indicated 74% of villages have radio coverage (ibid).

**Usage:** Sources contradict one another on radio usage. Some argue radio has never really been popular, although some indicate radio in rural areas remains popular with professional radio
broadcasting schools that provide trainings to farmers among others (Yong et al. 2012) (Zhang & Kempenaar 2009). Although, both sources could be correct as those in rural areas may be more likely to use radio than their urban counterparts. Similar to U.S. development, radio use seems to be on the upswing with the increase in personal vehicles.

Radio has been noted as being a passive activity, one sometimes left on the background during summer informal village gatherings (Oreglia Personal Communication 2013), and has been found to be a weak source for agricultural information and market prices (Mings et al. 2014).

**Content:** Of radio listeners, those under 40 listen primarily to music, while those over 40 prefer current affairs, and regardless of age, those with cars listen to traffic updates. Talk radio has recently become topic and popular, especially as callers usually don’t have to identify themselves and can have more frank discussions (National Radio Industry 2007, cited in Hu 2012).

**Television Services**

**Coverage:** Similar to radio, the government strictly controls television broadcasting rights (Law and Chu 2008). In the 1980s, China began to decentralize TV broadcasting, a policy known as the “four-level development policy for the broadcast industry,” as it ran out of money to support stations. This allowed TV stations at the central, provincial, municipal, and local/county levels. This has led to more than 3,000 stations throughout the country (Yong et al. 2012).

A 2012 report indicates more than 98% of households have a TV and 84% of villages have access to TV stations (ibid), while an estimated 100 million households ignoring the ban on satellite dishes (Chunyong 2011) exist in areas without access to TV stations. Additionally, cable set-top boxes using a standard TV can access information such as weather, traffic and news updates. The Qingdao business model provides television users a free STB, charging an additional RMB10 (US$1.60) monthly (ibid).

**Cost:** Legal TV receivers cost around RMB 550 (US$87), while illegal satellites range from RMB 100 (US$15) to RMB 300 (US$45) (ibid).

**Usage:** Also, 81% of rural individuals indicated they got their agricultural information from TV. Specifically, each province has a channel, CCTV7, dedicated to providing agricultural content

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2 Note: this is only feasible for those who have access to cable.
Traditionally the most popular TV station, CCTV is starting to see competition from provincial stations, especially as audiences begin to demand timely, informative and responsive news, similar to print media (Yong et al. 2012). Recently, TV audiences have begun to diversify in their interests, some based on geography and dialects, although rural (900 million) and senior citizens are becoming increasingly marginalized in this arena. Marginalization continues to increase with gaps in education and economic access to TV (Shi 2008).

Mobile Phone Services

Coverage: In 2012, more than 1.1 billion mobile phone subscriptions were estimated in China (CIA World Factbook 2014). In 2009, China Mobile provided services to 800 million farmers (Qiang et al. 2009).

Mobile broadband currently does not meet consumer demands of speed and app variety, which was also seen to be an issue when piloting cellphones with extension agents outside of Beijing, who would lose connection before they could finish reading items, leading them to prefer printed materials (Yong et al. 2012; Li 2013).

Cost: While cellphones are often expensive and the selection sparse at the village level, many rural residents receive cellphones from family members who have migrated to urban areas as gifts. While this may lead to sufficient cellphone coverage, phones may not have the features the end-user wants (Oreglia & Kaye 2012). An Apple iPhone is two months’ salary for an urban worker (or 6 months for a rural worker), but China Unicom is subsidizing their own smartphone for consumers, which is about half a month’s urban age at RMB 1,000 (US$158). However, phones can be bought for less. The author of this report purchased a Samsung smartphone for RMB 600 (US$100) and RMB 100 in minutes and 2G data (US$16). Chinese smartphones can be purchased even more inexpensively.

Usage: Chinese user their mobile phones for more activities, primarily entertainment and communication, than those in Brazil, Russia, India, the US, or Japan (Michael and Zhou 2010).

Interesting cultural notes, the concept of “face” has increased cellphone adoption, although women have tended to be left out. Similarly, Chinese are less trusting, carefully
guarding their cellphone numbers. Studies have found that 84% of phone users instant message, through applications like QQ, which are more popular than SMS (Law and Chu 2008).

For farmers, each province has an agricultural hotline they can call for support. Hotline operators direct questions to relevant experts, either by connecting the farmer with the expert directly or serving as a third-party facilitator (Zhang & Kempenaar 2009). These hotlines, developed by China Mobile, also accept SMS and answer non-agricultural questions as well, including health, government benefits, etc. (Mings et al. 2014).

Telecom Companies from 1994 Onward

In 1994, the PRC decided to privatize telecom (phone and internet) companies, which were all previously government owned. While all three companies have stock on the Hong Kong stock exchange, it is widely held knowledge that they are still partially government owned and heavily influenced by government demands/requests (Huddleson 2013). What started as six companies has since been consolidated into the big three, which have been tasked by the PRC to share obligations of providing telephone services based on geographic divisions. This limits competition between the telecom providers.

**China Mobile**

China Mobile is the largest telecom company in China with 775.6 million subscribers, or 63% of the total cellphone market. They provide cellphone, internet, 3G and 4G access, as the first and currently only company to provide 4G as a way to maintain their competitive edge (Jingtting 2014). One of the largest companies in the world, China Mobile rates a C+ in disclosure to investors. After deciding to extend cellphone and internet access throughout the country announced via the One Village Project, the PRC informally instructed (guanxi) China Mobile to begin the costly task of extending access to rural areas. Although, in the end this has served China Mobile well as they ultimately hold a monopoly in the countryside, China’s largest growing telecom market segment of the population. A Businessweek article in 2009 noted that for the three previous years, half of China Mobile’s new customers were from rural areas (Yu 2009). Meeting expectations of corporate social responsibility being 26% publicly owned, in 2013, China Mobile trained more than 48,000 primary and secondary principals in rural areas in Central and Western China how to use various technologies.
China Unicom

The second largest telecom company, China Unicom has 285.7 million subscribers, 22% of the market and the most fixed-line phones of the three telecom companies. They provide fixed and mobile phone, internet, digital TV, and 3G access. As of 2013, China Unicom rural presence included service provision to 400 natural villages in 9 provinces, broadband in 2,551 administrative villages, and 770 schools. In addition, they provide integrated information services platforms for farmers in approximately 300,000 areas (e.g. agrimachine).

China Telecom

China Telecom has 185 million subscribers, 15% of the cellphone market, and is the official provider of iPhones in China. Similar to China Unicom, China Telecom provides fixed and mobile phones, internet, digital TV and 3G access. China Telecom stated their involvement in rural areas includes “building broadband networks to bridge the ‘Digital Divide’ between urban and rural areas as the main force of the national information drive” (China Telecom 2010). Granted, Businessweek notes China Telecom’s fixed lines lack profits similar to mobile networks (Yu 2009).

Internet Services

Mobile phones have been found to spur internet use. Of the 591 million internet users (44% penetration), 78.5%, or 464 million, access the internet from their phones (CNNIC 2013). In 2013, mobile became the number one source of new internet users, with 70% of new internet users accessing via their phones in that year. Computer access to internet currently sits at 70%, but is decreasing (ibid).

Figure 1: Internet Users by Age

Source: CCNIC 2013
Improvements in Wi-Fi and 3G infrastructures, 80% of administrative villages had broadband in 2010, is increasing the use of mobile internet in fragmented chunks, and while entertainment and online games are stagnant or decreasing in popularity, e-commerce is growing. (Yu & Yu 2013; Qiang et al. 2009)

The four main uses for internet in China are: communication, acquiring information, business transactions, and entertainment (CNNIC 2012). While 71.5% of users get their news from the internet, websites often rely on traditional media posting online, which they then synthesize, instead of creating their own content (Yong et al. 2012; CNNIC 2013). In 2012, CNNIC projected time spent on the internet would overtake time spent watching TV, although the internet is out of reach for 800 million Chinese who continue to rely on TV for information and entertainment.

In 2007, accessing the internet cost approximately RMB 900/year (US$150). At that point in time, 7% of rural areas and 27% of urban areas used the internet, with urbanites accessing the internet 20 hours/week, compared to their rural counterparts’ 13.7 hours/week. Also, 54% of rural internet users used internet cafes to access the internet (Qiang et al. 2009). Although, Law and Chu noted in 2008, that the internet hadn’t changed production, organization or work or consumption patterns much (Law and Chu 2008).

In 2000, there were 0.5 computers/100 households, increasing to 18 computers/100 households in 2011 (Yu & Yu 2013). Urban areas tend to use personal computers 10 times more than rural households, with 59 computers/100 users in urban areas and 5.4/100 rural households in 2009 (Yong et al. 2012).

Major internet users by age: 20-29 (30%), 30-39 (26%), 10-19 (23%), 40-49 (13%), 50-59 (5%), and 60+ (2%) (see Figure 1 above). By gender, they are 56% male, 4% female. Internet users are 28% rural, and increasing as 54% of new users in 2013 were rural, even though the rural population continues to decrease due to migration. In total, 80% of the population uses the internet at least once a day (CNNIC 2013). In 2011, of internet users surveyed, 89% access the internet from home, 33% from work, 28% at internet cafes, 19% at school and 14% in other public areas (ibid).
**Social Media Services**

In social media, instant messaging, such as QQ, is the number one application, outpacing SMS text messages. Similarly, social interactions and life service apps outrank news apps in popularity (CNNIC 2013).

**Rural Information Centers**

As rural information centers were established widely throughout the country, issue began to arise with a lack of coordination and it became common for there to be multiple access points being created in one village, or as a local saying goes: “thousands of threads at the top come into one needle at the bottom.” In 2009, the Ministry of Industry and Information began regulating the centers with the 5 “One” Standards of having a(n):

- Stable venue
- ICT equipment (computer, phone, internet)
- Information officer (training, consulting, information search)
- Management regulations
- Long-term development mechanism (i.e. free-based services: e-commerce, retail, proxy bill payments)

The overarching goal of the centers was to provide information on: the internet in general, agriculture science and technology, markets, education, media and healthcare, cultural sharing and distance education resources. Functions included websites, a call center and SMS/MMS services (Yu & Yu 2013).

Rural information center establishment should cost no more than RMB 30,000 (US$5,000) the first year, with initial hardware investments costing RMB 8,000-15,000 and annual expenditures of RMB 15,840 (Li et al. 2012).

The Nationwide Modern Distance Education of Rural Cadres Project (2003-06, Central Committee of PRC) committed to having a rural information center in all administrative villages by 2010, targeting primary and second schools to explore ways to deliver quality educational and information resources using ICTs. As of 2013, the central government has invested RMB 1.3 billion and local governments RMB 4 billion. More than 700,000 (almost all of) administrative villages had an access point. Granted, the author saw access points in Shandong Province that were noted as local training spots and were equipped with satellites to transmit lessons, there
were no computers or telephones for farmers to determine their own information gathering (Yu & Yu 2013).

In general, most centers go unused, with developed regions that have active information centers seeing at most 10 people per day when they are equipped with 20 computers. While the success stories are rare, they do exist. In a village with more than 1,000 mu (165 acres), making up 1/3 of the town’s land, growing artichoke, a graduate student participating in civil service (where college graduates work in remote areas of China for one year in return for a government job) actively engaged in information and training sessions, posting marketing information at harvest, helping farmers with seed purchasing and bookmarking useful websites for farmers to access. While promising, this situation is rare as students often lack the motivation to help farmers in this way. In another village, four local families realized that they could use the computers to communicate with their migrant children and found use in the centers (ibid).

The biggest issue with the service centers has been sustainability. While money may be invested in the creation of rural information centers, coming from the central and local governments, local governments are in charge of upkeep and maintaining, which has led many centers to fail (Li et al. 2012). Also, many times initial funding is diverted from the center to improve the local government’s ICT hardware instead. Initially, the project operated as planned, with a center being established. UNDP helped market services of the center to increase awareness and use. The site became popular with many farmers access the center during non-farming seasons. The centers included training on how to use the resources and information could be printed free-of-charge. After UNDP funding ended, there was no money to maintain the center and hardware was moved for local government officials to use, away from the public (Zhao 2007).

**Agriculture and ICTS**

In a 2014 World Bank Report, studies found that farmers get their agricultural information from the TV (81%), neighbors and relatives (55%), internet (12%), SMS (9), experts (6%), government authorities (5%), newspapers or magazines (5%), radio (4%), colleagues/coworkers (3%), books (1%), and community organizations, like cooperatives (1%). Rural internet users also went online to chat (19%), use search engines (17%), download music/videos (15%), play games (13%), get news (11%), upload music/videos (7%), social
networking (6%), to blog (4%), shop (4%), email (3%), get agricultural information from a government source (1.6%) and get information from a non-governmental source (1%).

The most marginalized groups for using ICTs in rural areas was found to be women and senior citizens. The groups were intimidated by information centers that were heavily attended by young men for entertainment and there is little information specifically for them to engage them non-farming activities online, decreasing their opinion of the technology and its use in general (Mings et al. 2014).

ICT Analysis

As noted by Oreglia (2013), ICTs in China are often made by urban individuals for urban individuals, and even when products are made for those in rural areas, they are still produced by those in urban areas with urban, not rural, needs in mind. Yu and Yu agree, noting “the communities’ lack of participation in decision making and content creation has serious implications for the relationship between them and the resulting ICT intended to serve them… Communities are not fully engaged in shaping the local public access points on the basis of their history, cultural heritage, institutions, social network structure, development needs, or demographic characteristics” (2013, p. 50-51).

While a top-down approach focuses on quick and efficient deployment of resources to achieve a target and has made universal access possible, communities aren’t often empowered, either through provision of resources (“The value of ICT is not in the hearts or minds of community members”) (Yu & Yu 2013) nor do they have the knowledge to design community-based systems and services. Liu (2012) see’s the issue with low ICT use as being two-fold, first better education and training are needed and agricultural information services should have easy-to-understand designs. Also, quality of information indicates usability. Focusing on what information to share, how to share it, and work with farmers to use these tools are necessary for adoption and use.
Summary of ICT Initiatives

China is unique country with stronger government influence than many other countries. While the non-profit sector in China is growing, it is still small and in-country NGOs can be fraught with corruption scandals, giving them a bad reputation among the general public in China. Development-based projects are initiated by the central government and implemented by a branch of the government (as noted in the table below). Generally, the most detailed expectations are set at a national level, with townships and villages excluded from the decision making process (Yu & Yu 2013). Although, organization mandates have little apparent coordination, which can lead to duplicated efforts and inefficient use of resources (Qiang et al. 2009).

Most projects are first piloted in a few provinces, varying in economic stature. Shandong is a common province for pilot projects at it is relatively wealthy and has the infrastructure to implement most projects.
<table>
<thead>
<tr>
<th>Program Name (Region)</th>
<th>Years</th>
<th>Government Sector/Implementer</th>
<th>ICTs Used</th>
<th>Source</th>
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<tr>
<td>Distance Learning in rural primary and secondary schools</td>
<td>2003</td>
<td>Ministry of Education; Ministry of Finance</td>
<td>Three models: DVD and television training package for rural elementary schools; DVD and TV training plus advanced satellite technology for televised broadcasts (also receiving education programs broadcasted by central and local television stations) for intermediate schools in administrative villages; DEPRS model containing provisions for computer rooms equipped with high-speed Internet and multimedia classrooms (with access to download extended web-based materials) and satellite television, a DVD player, and a set of DVDs for rural junior high schools.</td>
<td>Qiang, et al. (2009); McQuaide (2009)</td>
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<td>Extend Broadcasting Coverage to Every Village</td>
<td>2006-2010</td>
<td>State Admin of Radio, Film, and TV</td>
<td>Extended radio and television services</td>
<td>Qiang, et al. (2009).</td>
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<td>Extend Telephone Coverage to Every Village</td>
<td>2004-2005</td>
<td>Ministry of Industry and Information</td>
<td>Village Access Project; Added telephone networks to more than 130,000 administrative villages (total: 623,669)</td>
<td>Yongtao, Shen (2009).</td>
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<tr>
<td>Home Appliance to Countryside</td>
<td>2007-2009</td>
<td>Ministry of Industry and Information</td>
<td>ICT terminals are a prerequisite for ICT application for rural residents, therefore, communication terminals should be made available through home electronics equipment at lower prices. 10 main household electrical appliances were subsidized by 13% (including mobile phone, computer, TV, and refrigerator).</td>
<td>Yongtao, Shen (2009).</td>
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<tr>
<td>Subsidies for Equipment</td>
<td></td>
<td>State Admin of Radio, Film, and TV, implementer: telecommunication providers</td>
<td>Cable set-top boxes with access to information using TV and remote control; The Qingdao business model provides television users a free STB, charging an additional RMB10 (US$1.60) monthly.</td>
<td>Yong, et al. (2012).</td>
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<tr>
<td>Rural Information Programs</td>
<td>Years</td>
<td>Government Sector/ Implementer</td>
<td>ICTs Used</td>
<td>Source</td>
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<td>Comprehensive Culture Station</td>
<td>2006-2010</td>
<td>Ministry of Culture Central Committee of the Community Party of China; implementers: government pilot projects, telecommunication providers, NGOs.</td>
<td>Digitize and disseminate current and new Chinese cultural resources via internet, CDs, mobile storage devices, TV. Establish public access points/reading rooms – 98% admin villages, 67% townships. Village access points in more than 700,000 villages were established to provide: party and government policies, laws and regulations, ethics, science and technology, culture, technical skills, for the purpose of: teaching, learning and referencing. More than 8,850 hours of teaching materials created. Each station had at minimum: internet, TV, projector; extended: computer.</td>
<td>Yu &amp; Yu (2013). Yu &amp; Yu (2013).</td>
</tr>
<tr>
<td>Rural Comprehensive Agricultural Informatization Service Project</td>
<td>2006</td>
<td>Ministry of Industry and Information</td>
<td>5 “one” standards: venue, equipment (computer, phone, internet), information office (training, consulting, information search), management regulations, long-term development/sustainability mechanism. Information services provided include: general internet, market, agriculture science and technology, medical and health care, cultural sharing. Functions include: website, call center, SMS/MMS.</td>
<td>Yongtao, Shen (2009).</td>
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</table>
Promising Options

Challenges

Using ICTs in agriculture in China has become a key priority for the central government. ICT-based projects began to impact the agriculture sector in 2002 and have been increasing in quantity and quality since, especially as developing the countryside to decrease the urban-rural income gap has become a priority. This provides opportunities to work with various branches and levels of government as projects are piloted. While cellphones are owned by nearly everyone in China, radio has never been as popular as television, which has been effective in conveying agricultural information via CCTV. Other ICTs, such as computers and internet are more of a financial barrier for farmers and their recent introduction to the countryside also reveals lack of experience with new technologies and their possibilities. Many farmers comment that they don’t use new communication technologies, such as the internet, but feel these tools are better utilized by younger farmers.

To date, these government-led projects have focused on ICT infrastructure and access, but even if ICTs can be obtained, using them for agricultural purposes can prove challenging, for the following reasons:

1. Lack of technology literacy to use ICTs (cellphones, computers) to their maximum potential.
2. Building off technology literacy, many farmers are unaware of the information their ICTs can provide access to, and the benefits they may produce, for example useful websites may be unknown to the end user.
3. Overall, online content for topics such as apple production lack detailed and up-to-date information for farmers’ use. Even university personnel refer to U.S. and European websites when looking for basic production information as this is not available in Chinese websites.
4. If farmers know a resource exits online, this source is often produced to appeal to urban users more than rural users as individuals at the county and village levels are rarely asked their needs, and market research on target audience demographics seems uncommon. This cases information to be presented in a way that is not convenient or intuitive for farmers.
5. Quality agricultural content is difficult to come by and while some private or government websites have video and agricultural content, one must have a log-in that is not available to the general public or pay a fee.

Opportunities

These challenges provide ample opportunities for engagement:

1. As ICT access increases in rural areas, providing trainings through village information centers can help increase farmers comfort and familiarity with their devices and what they are capable of. While some advanced farmers are getting agricultural SMS updates and accessing information on their cellphones, this does not seem wide spread, but indicates an opportunity for growth.

2. Posting quality information on the internet in a user-friendly presentation, can provide farmers a source to access information from. Although, once established, these sources of information need to be shared widely with farmers so that they may know they exist and marketed in a way that indicates how this information may be useful to the end-user.

3. Agricultural institutions need to see the value in producing information for free for farmers and commit to keeping information up-to-date. A starting point may even include translating useful content from other countries into Chinese for farmer’s to access.

4. Knowing how farmer interacts with websites and ICTs can inform information providers of how to better produce information in a user-friendly manner. Common techniques include surveying, interviewing and observing farmer’s ICT use. In addition, usability tests can be used to determine how to best share information in a manner that is intuitive and engaging for the end-user, farmers. As noted, assessing rural needs and preferences is uncommon, leaving a wide gap where a little market research can go a long way.

5. For institutions that already have agricultural information online, releasing aspects to be free to all users can enable farmers with financial limitations and high risk adversity to access websites they are not likely to subscribe to otherwise.

6. Many of the above opportunities referred to websites and online tools, but similar advice can be made for cellphones. While hardware access isn’t the greatest issue, knowing how to use a cellphone to obtain agricultural information, and how this can be useful, can
impact farmers’ ability to access and desire to seek out agricultural information using their phone.

Conclusions

China is a rapidly developing economy, although this growth has been felt more in coastal urban areas, leading farmers’ incomes to be lag further and further behind their urban counterparts (earning approximately 1/3 as urban workers). As one looks to ICTs as a route, practically everyone in China owns a mobile phone, although depending on the status of a farmer, even a RMB0.05 (US$0.008) text message can add up, assuming farmers are familiar with pinyin to use this technology. Granted, even within rural areas of China, economic status, and access to ICTs, can vary greatly.

On average, farmers in China are 55-65+ years old and as the younger generation begins farming, they bring with them new technologies to use in their daily lives. Although these challenges can seem great, they are being challenged by individuals across the nation who are adopting new communication technologies to improve their livelihoods, breaking through the traditional top-down approach, with village-level decisions made at the city-level, without consultation of those it’s impacting the most.

The central government’s current emphasis on ICT infrastructure development will put in place tools for all to use, but the next step will be creating farmer-friendly content, which is currently in short supply and even using the internet to find the daily weather forecast can be challenging, even for more advanced farmers. Cultural, political and economic aspects will continue to change the ICT landscape and with the central government’s push to informatize the countryside, it’s likely farmers will be able to use well-developed ICT infrastructure to access agricultural information, sooner than later.
References


