An assessment of the use of the Internet as perceived by fruit farmers

in Hebei Province, China

by

Chang Liu

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Program of Study Committee:
Robert A. Martin, Major Professor
Constance P. Hargrave
Kenneth J. Koehler
William W. Miller
Scott W. Smalley

The student author, whose presentation of the scholarship herein was approved by the program of study committee, is solely responsible for the content of this dissertation. The Graduate College will ensure this dissertation is globally accessible and will not permit alterations after a degree is conferred.

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DEDICATION

This

dissertation

is dedicated to

my grandmother, Bozhen Han,

who loved me without reservation;

my parents, Jiangou Liu and Meishu Jia,

whose love and support are endless;

my daughter, Beichen Sun,

who lights my life.

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ABSTRACT

The purpose of this study was to ascertain the extent to which fruit farmers from Hebei Province are using stationary and mobile Internet to acquire agricultural knowledge and technologies. Specific objectives of this dissertation were to determine Hebei fruit farmers' use of Internet-related devices and Internet, identify Hebei fruit farmers' perceptions regarding the Internet and its use and the sources of information and its use, evaluate Hebei fruit farmer's opinions regarding the credibility of online agricultural knowledge/information, and identify the obstacles that Hebei fruit farmers face as well as their reactions to these obstacles.

Descriptive research design employed narrative survey methodology. Research data were collected from a structured questionnaire through field distribution. Five hundred and eleven questionnaires were collected from six counties of Hebei province, China.

Results of the narrative survey questionnaire revealed that, even though cellphone ownership for fruit farmers was as high as 98%, mobile Internet adoption rate increased only gradually. Chinese fruit farmers' overall Internet use as a source of agricultural extension and education remained at a low level of efficiency. There was utilization bias among different Internet access formats. There were also questions about the reliability of the Internet disseminated agricultural knowledge and information. Most (52.5%; 57.9%, respectively) respondents verified they obtained knowledge and information via the Internet first with other farmers before actually using it. One third (33%) indicated that they had heard of training programs on how to use the Internet. Only 6% had taken such training. Similar deficiencies were found with online agricultural education courses.

It has been widely assumed that fruit farmers' Internet use with extension and education purposes would grow rapidly, similar to computer and cellphone adoption in rural areas. However, the use of the Internet as a source of agricultural and extension education is not as outwardly evident as has been the adoption of Internet devices, and common Internet surfing is not an indicator of the adoption of Internet-based agricultural extension. The knowledge gained in this study will help people in the field to facilitate the development of essential programs that will more closely match the basic needs of Internet-device utilization as well as Internet surfing.

CHAPTER 1. INTRODUCTION

Hebei is one of thirty-four provincial-level administrative units of China (as shown in Figure 1), Hebei is nearly 16,200 square miles larger than the state of Iowa in the United States. One easy way to identify Hebei on a map of China is to first find the location of capital city Beijing; the geographic region circling Beijing is the Province of Hebei. Most of central and southern Hebei is located in the North China Plain; it borders the Bohai Sea to the east, while the western part rises into the Taihang Mountains and the northern part is overlapped by the Yanshan Mountains and Inner Mongolia grasslands. Such diversified geographical entities have made Hebei a unique province which contains all of the grassland, plain, mountains, seashores, and watershed geomorphology within one province in China, which is also a reason why Hebei's agricultural landscape includes many different formats. (The People's Goverment of Hebei Province, 2015)

Hebei has 871 rural townships and 50201 rural villages, which are administrated under 125 counties, autonomous counties and county level cities. The rural population of Hebei is 53.47 million which comprises 81.4% of the total province population (The People's Government of Hebei Province, 2017). Table 1 provides a breakdown of the administrative regions within Hebei Province.

Agriculture has gradually transitioned from being the only sector that has a rural population engaged in farming, planting, and growing. Nevertheless, in China today, the rural areas are still important to a majority of farm households. Even though it is not hard to get a job in an urban region after a farmer becomes a "migrant worker", farming at rural home sites is still engaged by people who often travel back to their country land to help seeding and harvesting during spring and autumn.

	Administrative Region	Area (In km^2)	Population (2010)	Divisions (2017)			
				Districts	Counties	Autonomous Counties	County Level Cities
	Hebei	187,700.00	71,854,202	44	99	6	20
1	Shijiazhuang	15,848.00	10,163,788	8	11		2
2	Baoding	22,185.00	11,194,379	5	15		4
3	Cangzhou	14,305.28	7,134,053	2	9	1	4
4	Chengde	39,512.98	3,473,197	3	5	3	
5	Handan	12,066.00	9,174,679	4	14		1
6	Hengshui	8,836.90	4,340,773	1	8		2
7	Langfang	6,417.29	4,358,839	2	5	1	2
8	Qinghuangdao	7,791.57	2,987,605	4	2	1	
9	Tangshan	14,334.59	7,577,284	7	5		2
10	Xingtai	12,433.00	7,104,114	2	15		2
11	Zhangjiakou	36,861.55	4,345,491	6	10		

Data Sources: National Bureau of Statistics of the People's Republic of China, 2011.
Data Sources: The People's Government of Hebei Province, 2017.

Figure 1. Hebei Province Divisions and Population

Fruit and Nut Fruit Production in Hebei

Fruit growing is one dominant horticultural production in Hebei that takes an important and special position in provincial agricultural production and the rural economy. Fruit (including nut fruit) growing and processing has been identified as one of the three leading agricultural industries by Hebei government since 2009 (Farmers' Daily, 2009). The province of Hebei covers a region between 36°01' and 42°37' degrees north latitude; the wide span together with a moderate climate provides Hebei with a variety of fruit and nut fruit species. The province has both a traditional and advanced Hebei pear which is well recognized and welcomed by both domestic and international consumers. Plant breeding has resulted in an improved Gold Pear and Yellow Crown Pear as competitive pear species in the pear fruit market; Jingdong Chestnuts account for 1/2 of both national exports volume and foreign exchange in the chestnuts trade; and date, grape, almond and persimmon production rank in front row nationally (Liu, Song, & Chu, 2010). Due to cheap labor costs, the average price of Hebei's pear, chestnut, walnut crop is 40%-70% lower than the average selling price (farmers' price that consumers pay for each product) in the international market, which makes Hebei's fruit products a strong competition to similar products from other countries (Farmers' Daily, 2009).

In contrast to "bulk farm-products" like corn and wheat which have a "minimum price policy" (He, 2010), the price of fruit products is determined completely by the market not only in Hebei province but also nationwide. As such, fruit farmers tend to care about their fruit growing more than farmers who produce other crops. Consequently, fruits have an inherently higher value-added cost than field crops; thus, the better the quality, the higher the price, and the better the market, the more farmers can earn. Due to such reasons, to certain

extent, fruit farmers' willingness to obtain agricultural knowledge and skills is stronger than for other farmer types.

Historical Overview and Current Level of Internet Development in Hebei

There is one traditional and also crucial perspective in China: Innovation occurs in rural residences slower than in urban residence. Along with development, especially after "migrant workers" have been "shuttled" between rural and urban China for two generations, many people have begun to consider this perspective as an "outdated prejudice" (past general perceptions of Chinese thought).

During the past decade, the economic development of China also stimulated the population of "Net-people" to rise dramatically. "Net-people" is a word created by the Chinese media, to combine two words – "Net" and "people" – together. As a portmanteau, the term "Net-people" has the same meaning as "Netizen" in English speaking countries (DeLoach, 2016), which is used to represent Internet users who believe the Internet is an important channel to obtain information and guide their lives. In contrast to the traditional channel for obtaining information and knowledge, the Internet is more capable of distributing large and diverse types of information with efficient transmission at an accelerated speed.

The Internet plays an important and vital role in the development of rural and agricultural informatization construction in China. The national development project for Internet based rural and agricultural informatization construction, entitled "Golden Agricultural" was started as early as 1994. In 2006, the government of Hebei province officially published an instructional guide for agricultural and rural informatization construction (Hebei Provincial Peopel's Government, 2006). This instructional guidance identified the purpose of rural and agricultural informatization construction in Hebei, and

explicitly stated the specific work for Hebei to pursue in the coming years. Following are examples of tasks-specificity at three levels:

1. "Accelerate the infrastructure construction of informatization"

   Make sure all of the incorporated villages of Hebei are Internet deliverable. Make sure all primary and junior middle schools in rural Hebei have Internet access and are capable to start distance education.

2. "Strengthen the construction of integrated information service system":

   Apply information technology to help improve market monitoring and early warning, as well as ensure the quality of broadcasting of the most recent farm product prices and requirements.

   Based on local agriculture characteristics, build professional websites to enhance market recognition.

3. "Strengthen the popularization and application of information technology"

   Encourage qualified enterprises and organizations to develop information technology products and application systems that adapt to the characteristics of rural farmers and agriculture.

   Promote construction of modern rural circulation systems, especially electronic commerce information systems for trade and distribution of agricultural products.

Along with economic development and technical progress, the Internet and related information technology has appeared with increasing frequency in Hebei farmers' living and producing lives. The China Internet Network Information Center (CINNIC)'s statistics identified that, prior to December 2014, the Internet penetration rate of Hebei was 49.1%, more than 36.03 million people in Hebei had access to the Internet, whereas only 32.3% came from rural regions. The ratio in Hebei was 4.8% higher than the national ratio (CNNIC, 2015). From agriculture producing to market selling, information technology and the Internet benefit Chinese farmers from diverse aspects, and it is not hard to find such practices.

By using QQ, which is the most popular instant messaging software service in China, which has 899 million active QQ accounts, with peak concurrent user accounts of QQ at 247

million by 2016 (Tencent, 2016), countless numbers of QQ groups are built particularly for communicating agriculture technology, skills and product information. One can simply type "Corn" or "Rex rabbit", or simply one brief "Agricultural technology" in Chinese characteristics and a search pane of QQ will yield hundreds of QQ groups related specifically to farm futures, agricultural products processing, agricultural products quality control, exhibit and sell, agricultural products purchasing, etc. By adjusting key words and clicking the option of "Geographic range", "Number of member" and "Activity", more specific QQ groups can be found. Every day, innumerable people group chat their agricultural affairs and agricultural education needs with one another. QQ and Internet not only shortens the distance between people and knowledge, but it also saves time. Along with the development of mobile Internet, the cellphone version of QQ and QQ groups have infiltrated the paths and lanes of rural towns and villages.

Even for a person who has little or no research experience or background, it is not difficult to be aware there are more than a few examples revealing the relationship between the Internet and Chinese farmers' lives have become closer, and farmers are learning through the Internet. However, there have been few research studies conducted in addition to the official statistics produced by the government. Many articles from databases covering subjects such as "agricultural education", "information technology" and "farmers" have focused on identifying advocacy opinions or simply analyzing policies. However, most researchers have conducted their own studies from a communication angle of view rather than agricultural education.

Need for the Study

Urban dwellers as well as farmers tend to acknowledge their lives have been changed by the Internet as well as technology. Many people enjoy scientific and technological progress; one aim of information technology progress is to help people benefit from it. However, the sources for change or influence as well as the kind and extent of benefits have not been well established.

In this study an analysis was made of Hebei fruit farmers' current Internet usage related to agricultural extension education and self-empowerment. Information technology has been playing an increased role in many aspects of Chinese people's lives. Knowing the level of Internet usage may serve to provide a deeper understanding of the agricultural extension and education system in China that could be utilized to a greater advantage to assist this population. Today, farmers are able to obtain agricultural education in a timely way and at their convenience by using the Internet. The Internet provides a means for learning new agricultural practices as well as updating current knowledge. Thus, it is beneficial for extension providers to understand how farmers interact with the Internet in various ways, as well as ascertain their perceptions, opinions, and preferences when using this technology.

Research about Hebei fruit farmers' agricultural education usage of the Internet has been virtually non-existent in the Province of Hebei. Gaining insight into the status of Hebei fruit farmers' preferences regarding the Internet usage, their preferences for agricultural extension education, and their perceptions of the Internet-based extension education is central to understanding rural extension education performance in this digital age. Currently there is a paucity of agricultural extension education research addressing these concerns. Thus, it is

worthwhile to assess the current status of Hebei fruit farmers' use and application of the Internet-based agricultural extension education.

On one hand, information technology changes people's lives by providing them with avenues to seek information beneficial to increasing their ability to better themselves, especially in the world of work. By studying Hebei fruit farmers' Internet usage, and knowledge and information obtaining habits, the relationship between Hebei farmers and their Internet usage can be determined. Such knowledge can be used to improve rural extension activities by upgrading or modifying current practices in order to meet farmers' preferences in a digital era. It may even lead to improving agricultural education and rural extension activities that are targeted to effectively serve this population. For example, there is a need to determine the level of the perceived usefulness of the Internet and mobile Internet practices along with appropriate their related devices and specific apps. This information could be valuable in program planning in rural extension education to increase development, sale and trade of current and new agricultural products.

On the other hand, in a country such as China, central, provincial, and even local governments play significant roles in policy making and providing service. The extension departments at each level of government strive to provide policy and service that meet the needs of the farmers. Appropriate policy making requires data gathered for specific purposes by investigation. Thus, there is a need to assess the current situation in the farm society to set forth policies for improving current and future practices. The current study was conducted to assess current practices and trends of rural farmers regarding their preference and use of Internet extension education. The findings can benefit agricultural and rural policy makers to

provide appropriate agricultural extension education that will be adopted and utilized by this population to enhance their practices and become more productive.

Purpose and Objectives

The overall purpose of this study was to ascertain the extent to which fruit farmers in Hebei Province use stationary and mobile Internet to acquire agricultural knowledge and technology. The findings of this study identify perceptions of Hebei fruit farmers regarding the Internet to obtain agricultural knowledge and information. This information can then be used by provincial agricultural education administrators and rural development policy makers at various extension offices to develop and provide online education programs and curricula that meet the needs of Hebei fruit farmers.

The specific objectives of the study were to:

1. Identify selected demographic information of Hebei fruit farmers;
2. Determine Hebei fruit farmers' use of Internet-related devices and Internet;
3. Identify Hebei fruit farmers' perceptions regarding the Internet and its use;
4. Identify the perceptions of Hebei fruit farmers regarding sources of information and its use;
5. Evaluate Hebei fruit farmer's opinions regarding the credibility of online agricultural knowledge/information; and
6. Identify the obstacles that Hebei fruit farmers face as well as their reactions to these obstacles.

Significance of the Study

The findings of this study will be beneficial to Hebei farmers and rural extension in the following ways:

1. Since no study of this subject has previously been undertaken in Hebei, this study may shed light on Hebei fruit farmers' knowledge and utilization of conventional and mobile Internet to gain knowledge and education by generating baseline data to provide a source of information that is currently unavailable.
2. Provide an overall evaluation about Hebei fruit farmers' level of practice using Internet-based agricultural education.
3. Evaluate the development and construction of Hebei's rural and agricultural informatization practices/system for agricultural education.
4. Serve as a source of reference materials for future studies which could be adapted or replicated by other researchers in Hebei or other provinces in China.
5. Results of this study further strengthen the current Internet related agricultural extension and education models or products in Hebei.
6. The findings of this study will assist agricultural education and rural development policy makers to develop new policies or modify and update existing policies to better support Hebei's agricultural development.

Definition of Terms

Selected terms were defined for use in this study:

Agricultural information: General informative content required of farmers for farming or agricultural business or management, such as dynamic market information about crop prices and updated agricultural policies.

Agricultural knowledge: General knowledge, technologies, and skills required of farmers for agricultural producing activities.

Decision-making process: A cognitive process resulting in the selection of a belief or a course of action among several alternative possibilities. In this study, decision-making process refers in particular to the capability farmers have with the assistance of information technology.

Fruit: Generally including tree fruits, such as apple, pear, peach, apricot, cherry, grape; and ground fruit, such as watermelon and strawberry.

Informatization: A process through which new communication technologies are used as a means for furthering socioeconomic development as a nation becomes more and more an information society (Rogers, 2000, p. 71).

Mobile device: A small, handheld computing device, typically having a display screen with touch input and or a miniature keyboard and light weight. Smartphones and tablet PCs are good representatives of mobile devices. Farmers use these mobile devices to get Internet accessibility.

Mobile Internet: A connection through a 3G or 4G mobile phone network. As opposed to land phone line or cable broadband, the Internet can be accessed by any handheld mobile device or any computer with a USB port. Routers, cables or telephone lines are not needed.

Nut fruit: A hard indehiscent, usually one-seeded fruit with a hard shell enclosure, such as chestnuts, walnuts, almond, etc.

Smart phone: A type of cellphone with an operating system. Smartphones typically include the features of a phone with those of another popular consumer device, such as a personal digital assistant, a media player, a digital camera, and/or a GPS navigation unit. Current smartphones include all of these features plus the features of a touchscreen computer, including web browsing, Wi-Fi, 3rd-party apps, motion sensor, mobile payment and 3G. In

this study, smartphones refer in particular to a cellphone which recognizes Wi-Fi, or 3G/4G, users in which the user can browse the web and take photos.

Stationary Internet: Copper phone line or cable broadband, including access format, such as: PSTN, ISDN, DSL (Digital Subscriber Line), HFC (Cable modem), Optical broadband, PON, and PLC (Power Line Communication). The cable Internet could physically at farmers' private houses or other place where reachable by farmers conveniently.

Tablet PC: A kind of mobile computer, usually having a touchscreen or pen-enabled interface.

Wi-Fi: Wireless connectivity which allows a PC, laptop, and many kinds of mobile devices to connect at high speed to the Internet without the need for a physical wired connection. Wi-Fi-enabled the devices like a smartphone or tablet PC receive information from the web in the same way that 3G or 4G mobile phone network works; however, it is different from a 3G or 4G mobile phone network, but converts stationary Internet to a wireless signal by using a wireless transmitter, such as a "hub".

Assumptions of the Study

The researcher distributed questionnaires to Hebei fruit farmers over a period of 1½ months; however, the entire preparation for this study took more than two years. Figure 2 illustrates the research model which guided this dissertation study.

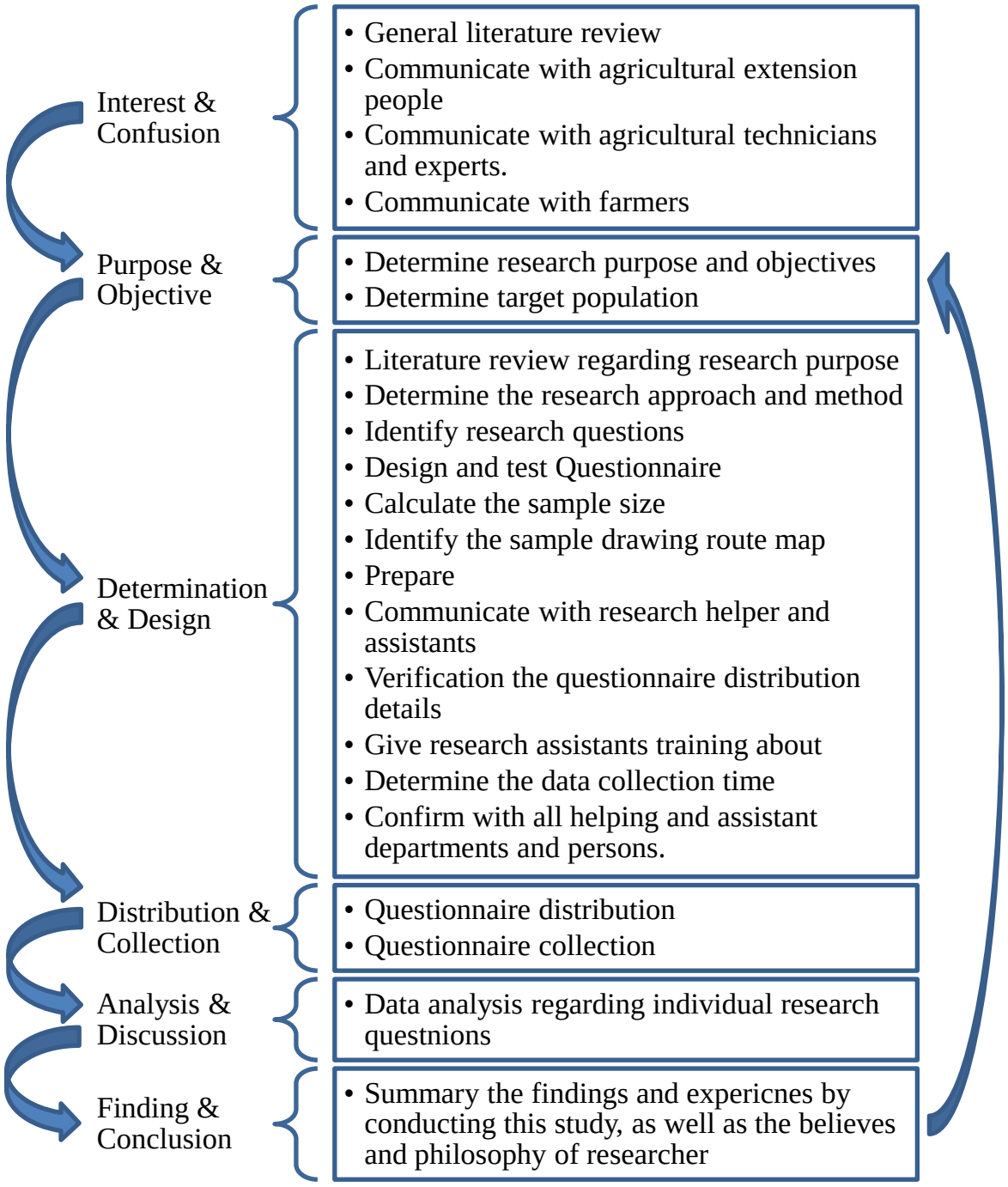


Figure 2. Research Model

CHAPTER 2. LITERATURE REVIEW

The overall purpose of this study was to ascertain the extent to which fruit farmers from Hebei Province use stationary and mobile Internet to acquire agricultural knowledge and technology. This chapter is divided into five parts. The first two parts provide a review of the general literature of the Internet and relevant devices and adoption status by farmers or rural residences in both Internet advanced countries and China. Parts three and four focus on related studies of web-based agricultural education in developed countries and China. The last part addresses theoretical framework in education, andragogy, and distance learning which guided this study.

Internet and Digital Devices Adoption Statutes by Farmers or Rural Residences in Internet Advanced Countries

Researchers in general commonly agree the Internet can be utilized to advance rural regions and population in various ways. Internet-provided communication and information gathering services are generally available at substantially lower costs than conventional technology. The Internet can be used to address negative perceptions of rural life that leads to depopulation and lack of production, provides greater health care access to rural residences; enable farmers to consider new ways, and seek opportunities to acquire new agricultural information (Park & Mishra, 2003); raise the education level of rural residences by providing online classes for credit or professional training (LaRose, Gregg, Strover, Straubhaar, & Carpenter, 2007); and enhance economic opportunities in rural areas by stimulating the development of home businesses (LaRose, Strover, Straubhaar, & Gregg, 2006). When used as a technology, the Internet is widely believed to be able to enhance farmers' capabilities,

and assist them to obtain and process information and knowledge regardless of the location of farm or the information and knowledge that are used.

The Internet has been recognized as having the capability to be used as a tool for empowerment. The development of the infrastructure of high speed, modern Internet in developed countries such as the United States has been ongoing for the past two decades. For example, as early as the Clinton Administration, certain programs such as National Information Infrastructure programs (1992-1993) have been operating with a purpose to reduce the isolation of rural areas and connect rural population to the Internet network for economic development (Clinton & Gore, 1993).

According to Pigg and Crank (2005), many departments and sectors at the national level can be accessed to provide funding to extend the infrastructure to rural America by forming various innovative projects. These include the Department of Commerce, Department of Housing and Urban Development, Department of Education, etc. For example, the Department of Agriculture of United States has funded "Community Connect and Broadband Access programs" to help improve broadband access for rural America by setting up both stationary and wireless technologies. Generally, programs at the federal level have been used to encourage people to adopt information technology and participate in its benefits, and projects operated by private sectors would be "…responsible for managing the main segments of the 'highway'" (p. 65).

In addition to support at the federal level, rural regions in United States began to have their own Internet communication approaches by individual state governments as well (Strover & Berquist, 1999). For example, the State of Iowa has had its own fiber-optic telecommunications system since 1991, a year later, a similar fiber-optic system was

activated after the endpoint was installed per county, and it was soon extended to rural areas. One contribution Iowa Communication Network gave to rural residences was to make specialty care more accessible to rural Iowans and simplify provider education by allowing rural health participants to enroll in educational programs without leaving their communities (Iowa Communications Network, 2017). Similar statutes can also be seen in Nebraska, in which the state of Nebraska has provided rural communities specific funding and technical assistance to help people start using the Internet (Pigg & Crank, 2005).

After decades of development of information technology, one may ask: How do farmers use the Internet? This may no longer be an intriguing subject to the people in agriculture in developed countries. Internet coverage and access to improve rural areas has enabled farmers in agriculturally developed countries to make use of the Internet as an information source in their farming operations, and it has become a fairly common practice. For example, in 2011, as high as 70% of the famers in the State of Iowa had reported that they were using the Internet. Digital Subscriber Line (DSL) connection was the most common method of accessing, at 27%, broadband satellite connection at 14%, wireless and mobile connection at 13%, whereas only 14% of the farmers reported they did not have access to broadband Internet by 2011 (Iowa Farm and Rural Life Poll: 2011 Summary Report, 2011).

Similar statistics revealed an even higher percentage four years later. According to a report by the USDA-NASS (USDA, National Agricultural Statistics Service, 2015), the percentage of farms with computer access had increased to 73%, which was slightly higher than the 70% of the farms that reported using an owned or leased computer in 2011. A DSL (Digital Subscriber Line) connection still appears to be the most common method of

accessing the Internet, with 30% of the farms in the United States using it, with satellite connection at 21%, and wireless connection at 29%.

From the viewpoint of a developing country, the Internet adoption achievement in rural United States is enviable. However, even though the adoption rate of broadband services in rural America has been high, it has still been considered as having "lagged behind that in urban areas" (LaRose, Gregg, Strover, Straubhaar, & Carpenter, 2007, p. 359), when considering other achievements. A USDA Economic Research Report (Stenberg, et al., 2009) identified the share of online households with broadband access between urban households and rural households (Table 1).

Table 1. Share of online households with broadband access, 2007

	Percentage of online households		
	Metro	Nonmetro	Total
Northeast	87.3	68.8*	85.4
Midwest	82.9	70.6*	80.4
South	83.0	67.3*	80.5
West	85.3	75.2*	84.4
Total	84.4	69.7*	82.3

*Metro/nonmetro difference is significant at 0.01.
Source: ERS using Bureau of the Census CPS data.
Sources: Stenberg, et al., 2009, p.7

Discussions about rural regions lagging behind urban counterparts in Internet access formerly captured extensive concern, and the term "digital divide" (Compaine, 2001)was introduced to the public. People began to become aware there was a gap between regions and demographics that have access to modern information and communications technology, and the "gap" has been particularly obvious between rural and urban areas.

Previous research has identified that income and education level are two key reasons for information technology inequality between rural and urban United States. Rural residences tend to have a lower education level and less income than those in urban regions

(Hale, Cotten, Drentea, & Goldner, 2010). For example, data from the U.S. Census Bureau Current Population Survey, Computer and Internet Use Supplement (CIUS) 2007 identified only 27.6% of households in rural areas have Internet access in households with an income of less than $25,000, with the ratio among the same income group in urban regions at 32.9% (U.S. Department of Commerce, 2008a). Compared with the urban residences who have the same level of education background, education is also associated with greater computer and Internet use in rural regions (U.S. Departmetn of Commerce, 2000).

Consequently, many rural communities have lost equal opportunities to raise the economic status and improve the quality of life compared to urban communities based on use of information technology (Civille, Gurstein, & Pigg, 2001). In fact, a similar developmental imbalance due to a lack of information technology equality can also be seen in rural education.

Studies of the association among rural, farm, economic development and social change have identified the difference between rural places that possess or do not possess Internet and communication technologies and applications, have also influenced the development of local business, organizations, and education (Sullivan, et al., 2002). Findings revealed that, when compared with those living in urban areas, rural residence is associated with a decrease in the odds of having looked for information about exercise or diet, or doing other health-related online activities, when holding other factors constant (Hale, Cotten, Drentea, & Goldner, 2010).

One of other major reasons that rural residences in United States adopt Internet less is because many skilled and educated youth have left their country home behind. Studies have identified that the younger generation has either Internet skills or information technology

capability and tend to migrate to urban or suburban regions with education or economic purpose. The people who are left behind have exacerbated the Internet gap in rural areas. As a result, researchers have advocated that enhancing Internet adoption is necessary and there is an urgent need to create community electronic networks in rural areas to raise computer access (Sullivan, et al., 2002).

Finally, the rural-urban digital divide may also be due to the difficulty in acquiring Internet access and connection. When tracing the appearance of the telecommunication system development of the United States in early 2000s, 31.1% of rural dial-up users announced that "expense" was the reason why they did not have broadband Internet at home (U.S. Department of Commerce, 2004). The lack of Internet providers was one major reason leading to the high cost of providing Internet access.

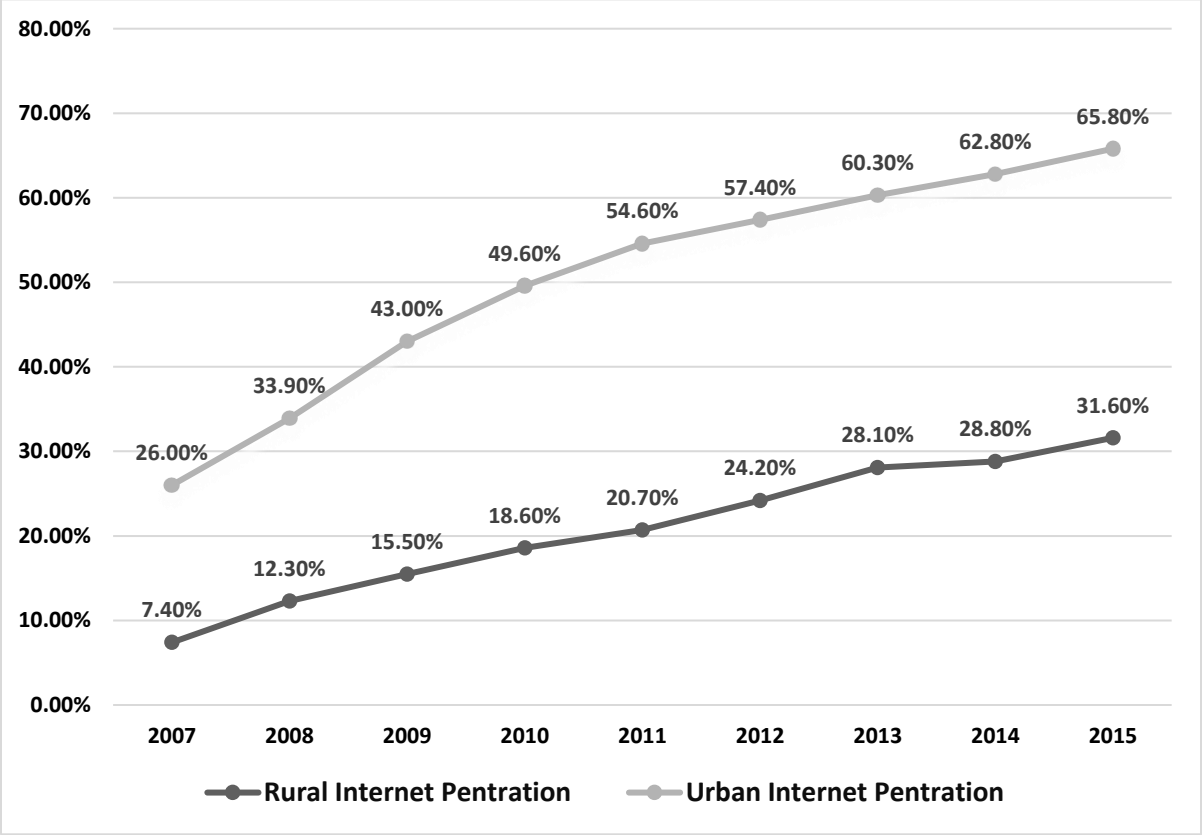
In summary, on one hand, decades of studies on Internet usage has revealed the rural population would be less likely to use the Internet, in part, due to a lower level of income and education, and less access providers; whereas, on the other hand, consistent research findings over several years has indicated enhanced Internet use could contribute to social communication by overcoming time and geographic barriers (Boase, Horrigan, Wellman, & Rainie, 2006); thus, rural residence could be empowered due to their adoption of the Internet. Circumstances related to rural Internet development as well as people's optimistic perspectives and experiences have been well studied and recognized by researchers and rural populations of United States, but not of other countries. The current research was conducted to apply those findings as reference to study rural Internet use in developing countries.

Current Internet and Relevant Devices Adoption Status in Rural China

As the most famous authority of network research in China, since 1997, the China Internet Network Information Center (CNNIC) has issued a China Rural Internet Research Report (CRIRR) annually (CNNIC, 2007), to strategize Internet development for rural China. The latest China Rural Internet Research Report of 2015 was issued in early 2016. According to the report, as of December 2015, the rural scale of Internet users in China had reached 195 million, which indicated a growth of 16.94 million compared with 2014, in which the annual growth rate was 9.5% (CNNIC, 2015), whereas the Internet penetration rate reached 31.6%, while was an increase of 2.8% when compared with 2014 (CNNIC, 2014). The scale of rural users has maintained a rapid growth in 2015 due largely to the continuous development of network infrastructure to improve accessibility with the rapid popularity of smart phones.

During the past twenty or more years, various Internet construction relevant projects have been introduced to the general public in China. All were set up with the purpose due to speed up infrastructure communication to benefit people's lives and work. After years of construction, many projects such as "China's Next Generation Internet" (CNGI, 2011), "Triple Play" (Yuan, Zhang, & Yao, 2010), "Wireless City" (China Mobile, 2011), and "Broadband China" (General Office of the State Council, 2013), have passed through an era of primary construction, and moved into a comparatively mature stage focused on improving technology. As an opportunity for rural China, the development of network has increased Internet adoption in rural areas. For example, as of December 2015, the rural mobile Internet users in China had reached 170 million, compared to 146 million in 2014, a rise of 16.3%. More recently, mobile Internet users accounted for 87.1% of rural overall Internet users (CNNIC, 2015).

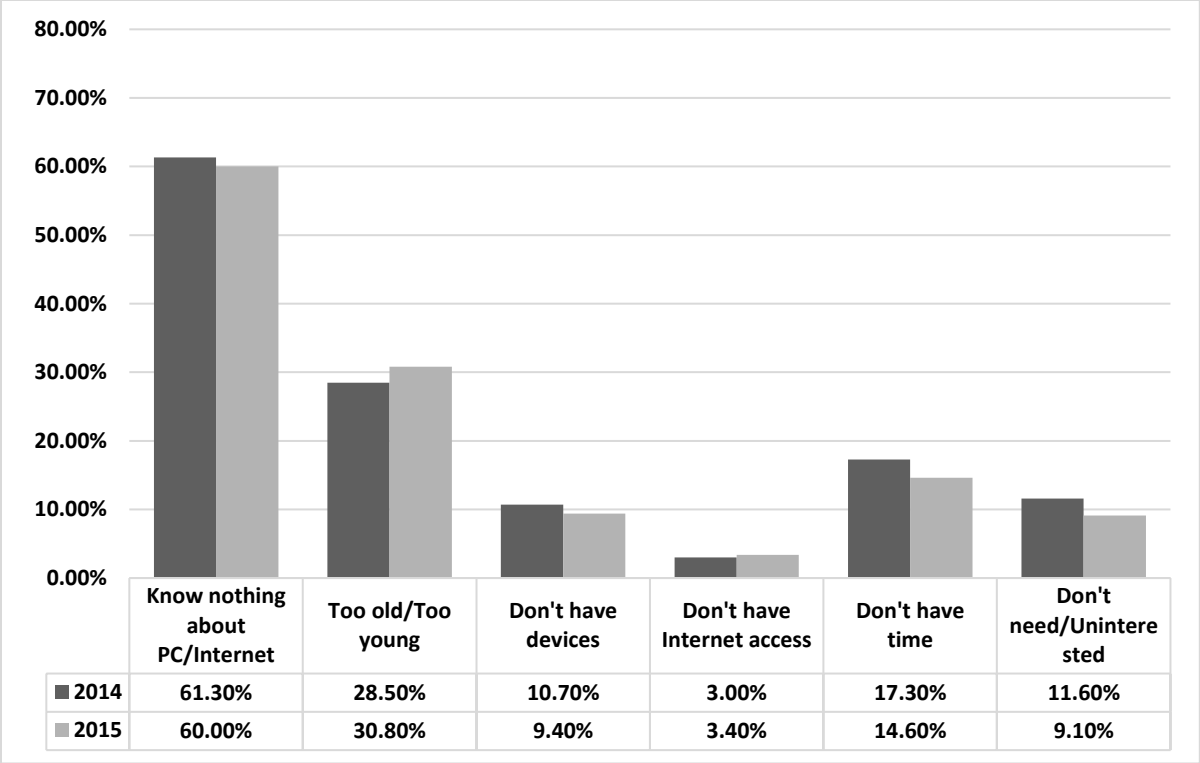
Although rural Internet development progress has been impressive, one indelible statistic is 62.3% of non-Internet users are at rural residences, which comprises 68.4% of the entire rural population. Nevertheless, only 34.2% of urban residences are non-Internet users, thus perpetuating the "digital divide" between rural and urban China (Figure 3).



Sources: China Internet Network Information Center, 2015, p. 8

Figure 3. Rural-Urban Internet Penetration Rate, China, 2007-2015

According to CNNIC's report (2016, p. 6), "lack of Internet adoption knowledge and basic skills" is the main cause of digital divide in China. Two thirds (60.0%) of non-Internet users reported that they "don't know how to use computer and Internet", followed by "too old or too young to adopt Internet", at 30.8%, "doesn't have time" takes 14.6%, "doesn't have adequate devices" takes 9.4%, and "can't get Internet access" takes 3.4% (Figure 4).



	Know nothing about PC/Internet	Too old/Too young	Don't have devices	Don't have Internet access	Don't have time	Don't need/Unintere sted
2014	61.30%	28.50%	10.70%	3.00%	17.30%	11.60%
2015	60.00%	30.80%	9.40%	3.40%	14.60%	9.10%

Sources: China Internet Network Information Center, 2016, p. 7

Figure 4. Reasons for Being a Non-Internet User

According to the Report on China's Education and Human Resources Issues (2003), the average education duration of labor force from China's agriculture was only 6.79 years. The majority (95%) of this group has a literacy level no higher than junior middle school. The reasons for being non-Internet users are associated with less average years of education for China's rural agricultural labor as well as various side effects due to low education. Rural Internet users comprise 70% of rural Internet users and have junior middle school (51.9%) or primary school (20.8%) as their highest education level, or 20.2% and 9.9%, respectively, higher than urban Internet users.

Rural users with a high school or above education level accounted for a smaller ratio than urban users, and rural Internet users with an education level of college degree and above comprise 7.2% and 12%, respectively, lower than urban users (CNNIC, 2015). The overall

lag behind education statutes restricts the Internet users, and eventually reflects a significant difference in cities and towns.

In contrast with urban Internet users, rural users' overall income level was significantly different than urban users'. An income of "2000 yuan" month could be the "watershed" among the differences between rural and urban Internet users. Among the Internet users whose monthly income was less than 2000 yuan, there were more rural residences than urban; once the monthly income exceeded 2000 yuan, urban "netizens" comprise a higher percentage than rural. In terms of income class and Internet use, the "500 yuan and less" income level rural users and "3001-5000 yuan" income level urban users had the largest ratios for each Internet using groups. At the "500 yuan and less" income level, rural user was 6.6% higher than urban users, and in the "3001-5000 yuan" income level, urban user was 7.5% higher than rural users (CNNIC, 2015). Even without further explanation, it is not hard to understand the unaffordability of a several thousand cost devices and a yearly access payment to farmers with lower household income (Zhou, Li, & Zhang, Hebei rural internet application status report, 2012). Fortunately, rural residences' income levels are gradually increasing in recent years, which gives a positive influence to Internet use.

Lack of an up-to-date network infrastructure is another factor that has forced rural Internet adoption. The foundation and construction of rural informatization has made rapid progress; nevertheless, when compared to China's Internet advancement as a developing country, the overall status of stationary Internet infrastructures is in its infancy, and behind goals originally set for the time period. Fiber and the fixed-line telephone technologies have been implemented through a township village project; however, many villages are unable to

surf the stationary Internet with computer devices. According to Zhou, Li, and Zhang (2012), this is partially due to an error estimating network effect and farmers' demands by the government. Thus, the network construction providers failed to consider the primary benefit to farmers' agricultural production and lives. A shortage of concomitant scientific introduction, lack of policy and marketing support as well as inadequate publicizing that eventually resulted in this large scale network infrastructure yielded a less significant outcome to "meet local governments' office work needs" (p. 101). One must also consider that, in China, telecommunication operators are the key force of Internet network construction. Although the three major telecommunication conglomerates – China Telecom, China Mobile and China Unicom – continually invest in Internet capital construction, it is influenced by a broad geographical distribution, weak economic basis, and complicated natural conditions; thus, there is greater investment in urban areas than in rural areas (Li W. , 2014). The telecommunication system is basically an enterprise that relies on commerce and profit; therefore, it is understandable that high cost and low profit statutes delay expenditures on rural Internet infrastructure.

Rural regions basically lack professionals who are knowledgeable in information technology. Ordinary rural residences, and even local government and county committees lack people who are knowledgeable in computer and Internet use as well as application, management and maintenance of IT equipment, development and providing appropriate programs. Therefore, low efficacy in computer application in rural areas is a common issue. Although many rural villages and towns have set up computer rooms, too many computers are treated merely as "collections" rather than tools of modern commerce. Towns and counties that have someone capable and responsible, tend to provide sites with computer

rooms with web services to the public that are perceived as unprofessional. In addition, due to the absence of information auditing and a supervision mechanism, it is difficult to affirm the veracity and legitimacy of information that is released online (Zhou, Li, & Zhang).

When compared to the stationary Internet which took decades to develop, mobile Internet development, which was initiated in 1991, also took more than 10 years to be adopted by the public. However, in contrast to the stationary Internet, which spent 6 years to reach 100 million users from an initial 20 million, the mobile Internet only took 2 years to enlarge its user population from 20 million to 100 million (Yang D. , 2012). Nevertheless, progress is being made with an increase in cellphone usage. As smart phones with mobile Internet accessing functions have shifted from being an expensive item to a commodity, mobile Internet is becoming increasingly adopted by ordinary consumers in China (Liu & Li, 2010).

According to CNNIC's annual research report of China's rural Internet development (2016), the population of rural mobile Internet users had reached 170 million, which was 16.3% higher than in 2014. Data from the 2015 Communication Operators Statistical Bulletin issued by the Ministry of Industry and Information Technology (2016) have been verified according to total amount of the telecommunication service and business revenue growth statues. By the end of 2015, the non-call services revenue ratio had grown from 58.2% to 68.3%, and revenue from mobile Internet data services had increased from 23.5% in 2014 to 27.6% in 2015. By February 2015, 87.1% of the rural Internet users were mobile Internet users, which was 5.2% higher than the previous year but still 4.1% lower than statistics for urban Internet users. Thus, researchers perceived that a rise in farmers' income and a drop in

telecommunication fees in rural regions was due to the popularity of smart phones leading to an increase in rural mobile Internet users (CNNIC, 2016).

According to CNNIC's report (2015), 62.3% of Internet users were from the rural population, accounting for 68.4% of the total rural population in China, compared with 34.2% for urban areas; revealing dramatic growth differences between urban and rural areas. The lower level of internet utilization in rural areas had been affected by factors of income, education, Internet device ownership, perceptions of demand, etc. Internet popularization faced greater challenges in rural areas which led to a gradual increase in Internet users until the advent of smart phones, when the increase became more dramatically.

Related Studies on Web-based Agricultural Education

According to Christensen (2000) who is an American scholar, educator: "Many of the most powerful innovations that disrupted other industries did so by enabling a larger population of less-skilled people to do in a more convenient, less expensive setting things that historically could be performed only by expensive specialists in centralized, inconvenient locations." (p. 105). Agricultural education in China exemplifies Christensen's statement about the effects of worldwide technology.

In many countries, agricultural education and agricultural extension are synonymous. According to Black (2000), "there is no universally agreed definition of extension." (p. 493). Common agreements about this word include: "…extension involves the conscious use of communication of information to help people form sound opinions and make good decisions." (Van den Ban & Hawkins, 1996, p. 9); "…relating to technology transfer, education, perception change, human resources development, and dissemination and collection of information." (Marsh & Pannell, 1998, p. 607); as well as "…the use of

communication and adult education processes to help people and communities identify potential improvements to their practices, and then provides them with the skills and resources to effect these improvements." (APEN, 1999, p. 493). A comprehensive interpretation of the meaning of education and extension has led to diversified studies and research on Internet-based knowledge learning, technology dissemination, and information communication in agricultural education and extension to provide numerous experience and references.

Agricultural Education and Extension in the United States

The Internet was established in early 1980s in the United States (Latour & Meunier, 1999). More than a decade later, the National Science Foundation (NSF) pushed forward to allow the five national supercomputer centers to serve the research community, and to link all U.S. college and university campuses together via a long-distance network (Mitchell, 1994). Thus began the era of Internet-based education.

As an Internet developed country, the United States has time-honored records on providing Internet-based education and extension. This has resulted in numerous examples about how Internet-based extension and education have been introduced in the field of agriculture along the past decades of its history.

In 1994, Purdue University established the Aquaculture Net Work Information Center through funds from Cooperative State Research Education and Extension Service and the Illinois-Indiana Sea Grant Program (Swann & Einstein, 2000). Historical records have identified that over 75% of visitors access the website through an educational domain. According to the strong demand for a high quality poultry Internet resource, Purdue University has also designed a user-friendly poultry website, called AvianNet in history, to

aid in the dissemination of information from the university to county educators, poultry producers, and youth.

Extension education, which includes county-based programming and face-to-face training as typical education formats, has also been designed to provide continuing education and training via the Internet, since the mid-1990s (Jackson, Hopper, & Clatterbuck, 2004). Studies have revealed that the Internet is another tool through which extension can interact with a much broader audience, in both a cost-effective and time-effective manner. Thus, Internet-based learning has been a well-used resource since its advent in the 1990s.

When upstreaming the knowledge and technology of agriculture development, there are also cases about how closely related the Internet and education have become. Many colleges of agriculture are willing to dedicate resources through Internet-based connections to reach new students through distance education (Murphrey & Dooley, 2000). As early as 1993, there were 93 accredited education institutions offering online credit courses, and the number had increased almost tenfold by the new millennium. According to *Peterson's Guide to Distance Learning Programs* (2000), the number of educational institutions that provide online programs has increased to 900, and Internet-based degree and certificate programs have risen to 1,000.

On one hand, people have study demands. However, reasons like family commitments, geographic inconvenience, job requirements, and economic status cause a lag people's motivation to study. Internet based education has long been designed on the premise to create education opportunities to those who might have weak access to school based education (Born & Miller, 1999). On the other hand, colleges and universities have attempted to meet the growing demand for additional curricula and courses by students; consequently,

Internet based distance education has become more accepted as a legitimate form in current education (Lindner, Dooley, & Murphy, 2001). Responding to the rapid change of information technology era, Texas A&M University and Texas Tech University developed and delivered the first doctoral degree in agricultural education offered entirely at a distance (Kelsey, Lindner, & Dooley, 2002). The Master of Agriculture degree in the Department of Animal Science at Texas A&M University is another example of a program of study aimed at providing an education for students in agriculture-related business while allowing a flexible graduate degree schedule (Miller & Powell, 1998). In fact, many other universities have similar programs aimed at serving groups of individuals who have obstacles to participate in campus-based education (Telg & Cheek, 1998).

Current Agricultural Education in China

In China, web-based agricultural extension and education has been categorized as one part of distance agricultural education. One of the purposes of constructing an agricultural distance education service system in China was to extend and outreach fresh farming and agricultural technologies to individual farmers. Thus, agricultural distance education will contain not only professional and vocational agricultural education for students but also for rural residents throughout the country. In developing countries such as China, in which the majority of rural regions are economically less developed, government domination of agricultural distance education construction has been an on-going process (Nan, 2008).

The construction and developing history of China's agricultural distance education system has been a long-term, on-going process. It includes four agricultural distance education platforms: (1) Central Agricultural Broadcasting and Television School; (2) The Open University of China; (3) Modern Distance Education of Rural Middle and Primary

School (referred to as MDERMPS); and (4) Universities of Agricultural Science and Technology League.

China's Central Agricultural Broadcasting and Television School (hereafter referred to as CABTS) was founded in 1980, and is administered by the Ministry of Agriculture and jointly sponsored by 21 other ministries and commissions of Central government. As a comprehensive educational training institution for all villages and farm households, CABTS integrates multiple functions of education, training, technological extension, science popularization, and information dissemination. The CABTS system is comprised of one central school, 39 provincial schools, 346 branch schools at the municipal and prefecture level, and 2,124 county branch schools and 12,000 teaching stations at the township and village level. The general public accesses CABTS as an education and training school of villages and farmer households at multiple dimensions and through channels and modalities based on means and media of radio, television, audio and video materials. Each year, CABTS has 152 hours of air time in programs on the Central People's Radio Station, and 550 hours of air time in the Land of Agricultural Broadcasting on the seventh channel of programs provided by China Central Television (CABTS, 2005).

CABTS delivers degree education with a formal diploma to farmers and agricultural technicians, with the purpose of fostering practical talents of those who plan to remain in rural areas and serve rural development. The degree education program for cooperative higher education was initiated in 1995, post-secondary vocational education (in 1999), and secondary vocational education (in 2005). The non-degree education program delivered by CABTS includes a rural laborers transfer training program, applicable agricultural technology training, professional skill appraisal certificate program, and a Green Certificate

Program which serves rural technician, managers, production supervisors and farmers as target participants, and provides skills training in agricultural production and management (China Rural Distance Education School, 2016). CABTS hosts the China Rural Distance Education Network (www.ngx.net.cn), and 33 provincial schools operating through CABTS have built Internet websites with a unified domain, forming an Internet platform for rural distance education in China. Information about training and education for ordinary farmers is released through this network.

The Open University of China (hereafter referred to as OUC) is a national open university that serves both urban and rural areas (The OUC's Operating System and Mechanism, 2016). Compared to its current name, Chinese residents were more familiar with its old name of "China Central Radio and TV University" (hereafter referred to as CCRTVU) for the past two generations (Yang Z. , 2011). The CCRTVU was a distance education platform which was under direct supervision of the Ministry of Education in China. In 1979, CCRTVU proclaimed to provide service together with 28 provincial level radio and television universities which were under the jurisdiction of their locality in administration, but mainly under the control of CCRTVU's academic management, to offer distance education programs throughout the country. The purpose for establishing CCRTVU was to provide learning opportunities and quality education to both urban and rural residences in Chinese society, "particularly those in grass-roots units, remote and rural areas and ethnic minority regions" (China Central Radio and Television University, 2016).

During the past decades, CCRTU was the main body providing rural distance education system in China, which received tremendous corresponding support at all levels – national, provincial, municipal, and prefecture – by providing educational opportunities and

content for the farmers with a willingness for self-study based on demands from the target rural population. The program was based on several years of experience in agricultural technological training by considering the entire scope of agriculture – rural and farmers as service targets. In 2004, CCRTU organized and implemented the Ministry of Education's project, "One village One undergraduate" (Tan S. , 2005). By 2009, the CCRTU platform had enlarged to one central university, 44 provincial radio and TV universities, 929 municipal and prefecture level and 1,852 county level branch schools, 3,082 teaching-learning units, and over 60,000 classes. The annual number of students at the school reached 3.2 million, with 7.5 million degree and diploma students graduating (Yang Z. , 2011).

In 2012, the Open University of China was established (Ministry of Education of the People's Republic of China, 2017), and eventually took over the duties, responsibilities and obligations of CCRTU. The OUC further strives to provide diverse, high-quality continuing education services and learning opportunities, and make them available to all by promoting education digitization by taking advantage of the old local radio and TV university system using digital and information technology.

The Modern Distance Education of Rural Middle and Primary School (referred to as MDERMPS) is a rural distance education platform which was promoted and formed by the Ministry of Education of China. In order to upgrade rural children's learning environment to a network and multimedia stage (The State Council of The People's Republic Of China, 2016), in 2003, China began to explicitly put forward the construction of a modern distance education platform for rural middle and primary schools to promote quality educational resources by equally sharing its services to rural and urban areas, thus improving the quality and efficiency of rural education (Ministry of Education of the People's Republic of China,

2016). The distance education platform was comprised of computer classrooms in rural junior middle schools, and basic satellite teaching and learning service to rural primary schools (Ministry of Education of People's Republic of China, 2004). Historical data have indicated that, during the early stage of MDERMPS construction, the multimedia teaching and learning resources was distributed through the modern distance education system reaching 8 primary school education subjects and 9 junior middle school subjects, and the video resources covered 7 primary school subjects and 11 junior middle school subjects. In addition, several topic-based educational materials such as safety education were distributed via this platform (Ministry of Education of People's Republic of China, 2005).

The rural distance education platform which was constructed by the Ministry of Education of China was not only MDERMPS. Villages that had quality utility foundations and telecommunications infrastructure were encouraged to set a “Education Discs Play Spot”, provide agricultural planting and growing teaching and training, and also timely updated agricultural education resources as well as practicable scientific technology and economic and market information (Nan, 2008).

The University of Agricultural Scientific Technology Alliance (hereafter referred to as UAST) was founded in 2003 as an alliance which has been led by China Agricultural University, and comprised of Northwest A&F University, Nanjing Agricultural University, Huazhong Agricultural University, Zhejiang University, Bejing Forestry University, Northeast Forestry University, Jiangnan University, by utilizing the Modern Distance Education of Rural Middle and Primary School (MDERMPS) platform and other existing network resources, to build and integrate agricultural education training and science and technology extension services (UAST, 2016). In contrast with the previously identified

distance education platform or system, UAST combines colleges and universities as the main body to integrate higher education research achievements as its core objective by using the existed distance education system, UAST, to provide education and extension services to various provinces of the country as well as continually deliver technical support to the demonstration bases, such as Yanqing Demonstration Base at Beijing, and Longhua and Quzhou Demonstration Bases at Hebei (UAST, 2016).

Distance education in China has not previously been well adopted by farmers and rural residences, despite the promotion of modern distance education for years (Hu, 2013). The majority of rural farmers have preferred face-to-face training and guidance in agricultural education rather than take courses online or by distance (Nan, 2008).

Internet involvement in distance agricultural education to reach rural residences of China can be categorized into three groups. Farmers in the first group lack conceptualization of rural distance education; many have not heard about "distance agricultural education". Farmers in the second group have some ideas about distance agricultural education, but have not participated in distance agricultural education before, and do not know where and how to receive it. Farmers in the third group have had some perceptions about distance agricultural education, and a majority have participated in distance agricultural education (Hu, 2013). Nevertheless, for various reasons, there has been a disintegration of rural farmers' perceptions regarding distance agricultural education.

Compared to urban areas in China, rural areas have less developed informational levels, and very few rural households have purchased a computer and utilized Internet services or, more directly stated, paid the additional fees to obtain agricultural education online (Nan, 2008). Currently, modern distance agricultural education requires equipment to

utilize an intensive education format. For example, the Modern Distance Education of Rural Middle and Primary School system is a satellite network comprised of computers and an Internet network based system in which there are few households with personal PCs at rural residences. The main path for rural students to receive an education from MDERMPS has been at school-owned computer classrooms. However, school-owned computer resources have been limited, which has restricted time spent on computers by rural students (Cui, 2013). A recent study by Cui (2013) indicated that 73.2% of rural primary and middle school classrooms have faced a problem of "equipment shortage", which has been defined as the major obstacle for the MDERMPS.

In order to provide agricultural technology extension to the mass rural public, the teaching contents which are distributed via distance agricultural education were intended to be designed to suit the farmers' actual needs and learning style. However, many current disseminated education materials were designed for formal agricultural education, taking into consideration the needs of higher-educated school graduate learners, with advanced skill levels both professionally and academically (Zhang W. , 2010); consequently, the material was not easily adopted by rural learners, many whose over all literacy level, knowledge and understanding was relatively poor, thus not readily accepted as by urban learners (Hu, 2013). In addition to the lack of unification of the standards, the total amount of multimedia distance teaching courseware for farmers was inadequate at several remote locations; likewise, farmers who had strong preference for rustic educational content, and preferred a teaching curriculum design with only narrative texts or sketch figures, tended to lose interest (Hu, 2013).

The existing rural distance education focuses mainly on providing lecture-type large scale learning methodology, rather than material suitable for individual learning or small study groups (Hu, 2013). In addition, rural residences are relatively scattered, and many farmers do not have schedules suitable for live, mass learning at a specified broadcast time as do urban learners (Zhang W. , 2010). In order to provide learners with a prescribed step-by step order, several distance rural education programs would prefer to have learning activities with a yearlong single schedule displayed in advance. However, the reality, farmers have diversified demands, thus large class size and inflexible schedules not only give negative influence in their enthusiasm to learn, but it also affects their ability of learn (Hu, 2013).

Too many official departments or bureaus have been involved in the operating and management of rural distance education progress. The departments of agricultural science and technology, education, and human resources and social security have sub-branches associated with rural distance education or related projects or items, but the lack an efficient coordination mechanism resulting in redundant construction which leads to great inefficiency, that has indirectly led to the absence of professionals in rural distance education (Nan, 2008). Distance education is a specialized outreach of education that requires educators and administrators to not only have information technology and modern distance teaching equipment operation abilities, but also a grounded theoretical foundation in educational practice. Existing studies have revealed that the majority of educators providing rural distance education lack the educational background, and have less participatory training experiences, as well as less proficiency to apply information technology in daily operations necessary for delivering distance education programs (Cui, 2013).

Existing studies have also indicated that primary and middle school teachers of a modern rural distance educational system are still at the primary stage regarding usage of a distance education platform (Cui, 2013), and the most frequently used function of distance education by rural teachers has been through “lecture preparation” and “lecture note display”, at 78.6% and 70.0% , respectively. Currently, rural distance education providers who teach ordinary farmers as learners may take knowledge and technology extension as an objective; however, too often, terminal equipment operators serve as educators. These “educators” who are capable of collecting related teaching information from the distance education network, lack a background in agronomy and, consequently, are disinterested in agricultural production. The agricultural knowledge possessed by these “educators” tends to be either inconsequential or superficial (Hu, 2013).

Most farmers have not cultivated habits of reading and learning, and many have ceased traditional schooling a long time ago. In addition, many farmers continue to experience “learning frustration” stemming from their school days. Although several may have strong desire to learn due to subjective reasons, objectively, they face many obstacles if they decide to participate in distance learning. Basically, they lack learning motivation and self-confidence, and old fears such speaking in front of a group to share information or an opinion stymies their self-efficacy regarding success. Distance agricultural education does not provide formal learning surroundings, tutors, or class monitors; thus, many farmer learners are not able to experience the learning process as in a conventional learning environment. Their loyalties to distance education are frequently being tested (Li Z. , 2008).

Theoretical Framework

The educational theories of constructivism, distance education and andragogy were utilized in this research as the theoretical framework. These theories justify the researcher's philosophical position when describing the learning that occurred by fruit farmers via Internet-based channels.

Constructivism

Constructivism, as a learning paradigm, was utilized as a learning theory to provide inferences to farmers' Internet-based agricultural knowledge and information obtaining behaviors. In this study, Hebei fruit farmers pursued agricultural education by access to the Internet and mobile Internet through a computer, cellphone or other mobile device. The participants then used their newly obtained knowledge and skills of information technology to pursue additional knowledge and information in farming and agriculture, thus applying the learning paradigm of constructivism.

Constructivism in education is based on the research of Lev Vygotsky (1978), a Soviet psychologist, and Jean Piaget (1973), a Swiss psychologist. Many education psychologists are more concerned about what happens inside a human being's brain than the outcome itself. Vygotsky (1978) and Piaget (1973) were advocates of the constructivism, and believed that learning occurs when the people obtain and apply new knowledge based on existing knowledge which they inherently possess.

Constructivists "prefer" to define knowledge as some kind of "meaning" which is created by the human's mind, when they "acquire" the knowledge/information from the environment (Bendar, Cunningham, Duffy, & Perry, 1992). For this reason, "constructivist educators strive to create environment" (Jonassen, Davidson, Collins, Campbell, & Haag,

1995, p. 10), so that their learners “are required to examine thinking and learning processes; collect, record, and analyze data; formulate and test hypotheses; reflect on previous understandings; and construct their own meaning” (Crotty, 1994, p. 31 as cited by Jonassen, Davidson, Collins, Campbell, & Haag, 1995) . According to Jonassen (1994), “constructivists emphasize the design of learning environments rather than instructional sequences” (p. 35).

Dewey (1916) indicated that there are interactions between learners and their environment; learners are affected by the experiences in the environment, and knowledge is based on these active experiences. Ornstein and Hunkins (2004) posited that educators who take constructivist teaching concepts in which role play involves shaping of the learners’ real experience from the environment, and knowing what surroundings tend to promote experiences that lead to growth.

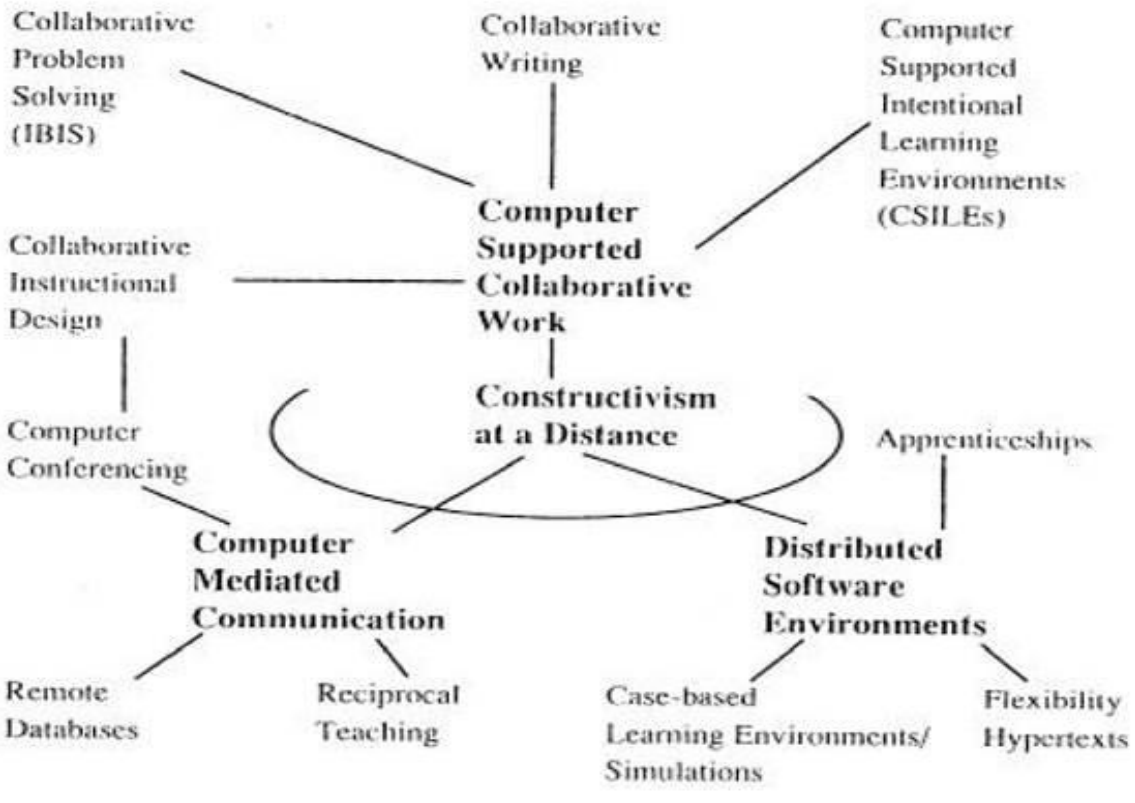
Dewey (1916) also considered that the learners’ ability would be developed after they have been enrolled in a real life problem-solving procedure. He believed problem solving and free discovery are important to learners, because knowledge is built around the process of discovery as a consequence (Huang H.-M. , 2002).

Educational methods that are guided by constructivism provide learners with freedom of learning and learning arrangement. Thus, educators who take a constructivist teaching approach define their learners’ enrollment as “collaborative learning”, “facilitating learning", “authentic learning”, or “learner-centered learning”. Consequently, learners engaged in constructivism guided education progress have more freedom of learning, rather than the instructor conveying a single interpretation of knowledge. This makes computer and

information technology based distance education a good example utilizing the theory of constructivism in education (Figure 5).

Distance Education

There are a variety of ways fruit farmers can obtain Internet-based agricultural education and extension; for example, farmers may participate the online forum to gain agriculture technology and skills, visit the rural extension organization's website for readable materials, receive consultation from online experts, etc. However, despite the way fruit farmers apply them, the learning processes are completed entirely by distance. Thus, Internet-based agricultural education and extension is distance education.



Source: Jonassen, Davidson, Collins, Campbell, & Haag, 1995, p. 14

Figure 5. Constructivism at a Distance

Distance education was originally attempted in English as a theory of transactional distance in 1980 (Moore M. , 1980). A decade later, Moore (1990) refined distance education as: “all arrangements for providing instruction through print or electronic communications media to persons engaged in planned learning in a place or time different from that of the instructor or instructors” (p. xv)

In its infancy, distance education had been restricted to home study or an independent study process that connected learners with distributed learning materials via a post, mail, radio, or television. More recently, distance education grew out of the development of information technology, which embraced distance education with several advantages, such as flexibility of time and location, ability to reach a greater audience and learners, ease of updating of content, etc. (Kerka, 1996). Today, the concept of distance education includes increased elements of information technology.

Theoretical constructs and research studies on distance education have been conducted for several decades (McIsaac & Gunawardena, 2016). Conventionally, they have been considered “in the context of an educational enterprise that was entirely separate from the standard, classroom based, classical instructional model” (p. 4); however, recently there has been justification and even a definitive split from conventional education. In a study conducted in Ireland, Keegan (1996) classified distance education related theories into three categories: (1) independence and autonomy; (2) industrialization of teaching; and (3) interaction and communication, and further classified distance education as a transaction that encompasses the entire process of teaching and learning.

One advocator of distance education theory regarding independence and autonomy category was researcher Michael Moore (1994), who indicated that “distance education had

to be reconceptualized as a more open partnership of teachers and self-directing learners in which individual learners initiated, conducted, and controlled much of the learning process" (p. 1). According to Moore (1994), learner autonomy has been valued as the goal of distance education, an educator who is enrolled in distance education should try to devise ways of supporting and encouraging the learner enrolled in distance education, and it is necessary to design and build up the distance education program by taking stimulating and conserving learners autonomy.

Peters (1994) advocated distance education theory from the "industrialization of teaching" aspects. He described distance education as the most industrialized form of teaching and learning, and believed that planning was important in the development of distance education, as the contents of correspondence units must be adjusted in relation to each other and determined in detail. Peters also noted there is a strong association between good organization and creating general arrangements for purpose-oriented activity in distance education. He posited that good organization ensures learners receive predetermined learning materials during the distance study. By taking adult learner into consideration, as one supporting this theory category, other researchers added that learner needs should be the central focus of the course and a variety of resources should be made available for learner access because the "adults enter educational settings ready to learn" (Blondy, 2007, p. 116). Learners enter an online learning environment for diverse reasons; in order for a learner to be successful online, his or her needs must be satisfied actively and quickly (Burge, 1988).

The Swedist scholar, Börje Holmberg, established distance education theory as a "communication and interaction" category. According to Holmberg (2005), distance

education carries the conversation-like interaction between the learners and teachers on two sides of the educational spectrum.

Holmberg (2016) termed his theory of distance education as "guided didactic conversation" in *Theory and Distance Education*, the central concepts being: motivation; empathy; non-contiguous communication; learner autonomy; and interpersonal communication. Holmberg (1999) assumed "if a course consistently represents a communication process that is felt to have the character of a conversation, then the students will be more motivated and more successful than if it has an impersonal textbook character" (p. 59). The "interaction and communication" characters which were embedded in Holmberg's distance education theory actually involved both conventional real communication and "conversational style" communication between teachers and learners. Submission of assignments, upcoming grading, comments, telephone and email-based information exchange represent the former; whereas presentation of printed and recorded subject-matter to involve the students emotionally, and engage them in the development and exchange of views represents the latter. The authors of the *Essentials of Educational Technology* quoted Holmberg's beliefs about distance education which revealed the essential perspectives of distance education theory (Holmberg, 1986, p. 123 as cited by Mangal & Mangal, 2009):

> …distance teaching will support student motivation, promote learning pleasure and make the study relevant to the individual learner and his/her needs, creating feelings of rapport between the learner and the distance education institution (its tutors and counsellors, etc.), facilitating access to courses contents, engaging the learner in the activities, discussions, and generally catering for helpful real and simulated communication to and from the learner. (p. 789)

Andragogy and Adult Learners

Since all of the fruit farmers engaged in the current study were adults, it is appropriate to review the theory of adult education, and the predominant one is the theory of andragogy. Malcolm Knowles was an American scholar who became famous due to his persistent efforts in the study of adult education (Smith, 2016). Knowles frequently lamented the paucity of "thinking, investigating, and writing about adult learning" (Moberg, 2016, p. 1), and developed the theory of andragogy.

Knowles (1984) introduced the concept of andragogy as "the art and science of helping adults learn" (p. 6) which was initially labeled by European adult educators in his book *Andragogy in Action*. He built this concept upon two central, defining attributes: (1) self-directed and autonomous learners; and (2) teachers as facilitators of learning rather than presenter of content (Pratt, 1998). Reischmann (2004) stated Knowles' perspectives more generally and defined andragogy as: "the science of understanding and supporting lifelong and life wide education of adults" (p. 1). Furthermore, in plain English, andragogy is about adult learning.

Just as the term implies, "adult learning" is a specific educational process which adult learners become engaged. This education process reaches beyond conventional formal education, and encompasses any type of education which may be non-formal or informal, and its duration could be short-term, long-term, or even a lifelong process. The features of adult education are directly determined by the characteristics of adult learners.

According to Long (2004), two conflicting views of adult learners are widespread—one is negative whereas the other is positive. The negative view considers adult learners as less capable than younger learners, which seems to represent the belief of Main Street

Americans, but may not represent that of professional educators. Professional educators hold a more positive opinion about adult learners and consider them as “super leaners”. The fact about adult learners may rest somewhere, as what following researchers summarized Knowles’ opinions, “between the negative stereotype and the super learner idea” (Sharma, 2006, p. 19)

Separate from youth learners, adult learners have a large age span, which brings about the need to consider several variables: physiological, psychological, sociological, and even motivation (Long, 2004). Adult learners may have more easily identifiable physical characteristics than youth learners. Along with their increasing age, some of these physical characteristics may even become disadvantages, such as health condition (Long, 2004). In general, adult learners have greater familiarity with different types of experiences than youth learners, the effect of these experiences to adult learners can be enormous as a part of their personalities may be directly related to these experiences. For example, previous experience may help adults refine what they have learned previously as they reflect upon in their learning activities (Long, 2004). Adult learners many also have greater social role characteristics than a youth learner. For example, the role of many youth learners besides “students” may simply be “daughters/sons”; however, the adult learners’ role besides “students” could be “husband/wife”, “mom/dad”, “soldier”, “manager”, “teacher”, “farmer” etc., (Long, 2004). Adult learners’ motives for learning are diverse. According to Aslanian and Brickell (1980), adult learners’ motivation for learning may include career, family, health, religion, etc., which have been categorized by researchers as “global motives”. Besides these, adult learners may also have “specific motives”, such as to become a better informed person; to prepare for a new job/occupation; to become better qualified for the job

currently held; to meet new and interesting people; to get away from the daily routine; and so forth (Johnstone & Rivera, 1965). For this reason, Long (2004) concluded, "in contrast to childhood schooling, and even university education, much of adult learning is focused on some immediate perplexing conditions or circumstance" (p. 28).

Knowles (as cited by Merriam, 2001) offered five assumptions about the characteristics of adult learners based on his andragogy study. Through these five assumptions, the differences between adult learners and youth learners are identified and categorized as: (1) Adults are self-directed; (2) Adult learners bring a wealth of experience to the educational circumstances; (3) Adults enter educational settings ready to learn; (4) Adults are problem-centered in their learning; and (5) Adults are best motivated by internal factors. Although there are great variabilities among individuals, adult learners have a common tendency to take personal responsibility for their learning, frame their learning with their personal experiences, and have a need for what they are learning to be relevant.

Research Questions

The following research questions were formulated based on the objectives of the study:

1. What Internet-related devices do Hebei fruit farmers have?
2. How frequently do Hebei fruit farmers use stationary and mobile Internet?
3. Are there any differences in Hebei fruit farmers' frequency of use between stationary and mobile Internet?
4. What do Hebei fruit farmers do when they use the Internet?
5. Are there any differences in Hebei fruit farmers' use of stationary and mobile Internet?

6. What perceptions do Hebei fruit farmers have about obtaining agricultural knowledge and information through conventional or mobile Internet devices?
7. Are there any difference between Hebei fruit farmers' perceptions of obtaining agricultural knowledge and information?
8. What are the most frequently applied delivery/distribution channels Hebei fruit farmers use to gain agricultural knowledge and information in a digital age?
9. What online paths do Hebei fruit farmers apply most frequently to obtain agricultural knowledge?
10. Are there any differences in the types of agricultural knowledge Hebei fruit farmers obtain between using the Internet versus conventional channels?
11. What is the level of credibility Hebei fruit farmers place on online agricultural knowledge/information?
12. Are there any differences in the level of credibility between online agricultural knowledge and information?
13. What is the level of usage by Hebei fruit farmers with the agricultural knowledge and information they obtain via the Internet?
14. What difficulties do Hebei fruit farmers generally experience when obtaining agricultural knowledge and information through the Internet; and how do they respond to those obstacles?
15. How well are Hebei fruit farmers trained to utilize the Internet as a tool?
16. Are Hebei fruit farmers informed and participate in any online courses about agricultural education?

CHAPTER 3. METHODS AND PROCEDURES

Purpose and Objectives

The overall purpose of this study was to identify and analyze the degree of Internet use of one agricultural education channel in 2016 by Hebei fruit farmers in China. The specific objectives of the study were to: (1) identify selected demographic information; (2) determine use of Internet related devices and Internet; (3) identify perceptions regarding the Internet and its use; 4) identify the perceptions regarding sources of information and its use; (5) evaluate opinions regarding the credibility of online agricultural knowledge/information; and (6) identify the obstacles as well as reactions to these obstacles. The methods and procedures to carry out the study are presented in the following sections: (1) Research Design; (2) Population and Sample; (3) Development of the Questionnaire; (4) Data Collection; and (5) Data Analysis.

Research Design

The basic motivation for this study was associated with the lack of research about Hebei fruit farmers and agricultural education. A descriptive research design was undertaken employing a survey questionnaire. A narrative survey is utilized by researchers to collect and analyze data collected from a large number of people. Narrative survey is utilized by "researchers who are primarily interested in comparing cases and want a more systematic approach … often use methods that look like survey research and appear to rely on the sample-to-population argumentation to generalize. These studies pull together information on a wide variety of cases, rate the cases in terms of 'variables' and then look at the associations among the variables using displays or even statistics" (Firestone, 1993, p. 20). A narrative survey is also called a descriptive survey, which is used frequently to begin research in a new

area. Descriptive research is conducted by gathering information without making judgements. Descriptive research can lead to the identification of valuable variables which may ultimately be used in upcoming research studies.

Population of Study

Hebei is a large province engaged in fruit growing, in which the annual yield (including nut fruits) comprises one-tenth of China's national fruit and nut fruit yield, both acreage and yield, that is ranked second nationally (Fang J. , 2008). Fruit (including nut fruits) growing and processing has been identified as one of the three leading agricultural industries by the Hebei government since 2009 (Farmers' Daily, 2009). The population of this study was comprised of all fruit farmers who grow berry, nut, stone and kernel fruit in all 11 administrative areas of Hebei province. The ranking of 11 administrative regions based on their regional fruit yields is presented in Table 2. In this study fruit farmers were stratified by administrative areas. Six administrative areas were determined initially, and two or three

Table 2. Fruit yields of 11 administrative regions in Hebei, 2005

Region	Yield (10,000 tons)	Ratio	Rank	Area (10,000 hm^2)	Ratio	Rank
Whole Province	934.90	100.00		141.50	100	
Shijiazhuang	174.78	18.69	1	16.63	11.75	4
Tangshan	142.51	15.24	2	14.57	10.30	5
Cangzhou	118.52	12.67	3	18.66	13.19	2
Baoding	102.91	11.03	4	16.77	11.85	3
Hengshui	78.93	8.44	5	8.68	6.13	8
Xingtai	75.58	8.08	6	9.88	6.99	7
Handan	58.22	6.23	7	7.20	5.09	9
Langfang	53.93	5.77	8	7.12	5.03	10
Qinhuangdao	51.35	5.49	9	5.89	4.16	11
Zhengde	43.98	4.70	10	12.43	8.78	6
Zhangjiakou	34.19	3.66	11	23.67	16.73	1

Sources: Fang J., 2008, P. 13

counties were selected from each administrative area. Fruit farmers from both the plains mountainous regions were included in the study.

Instrumentation

A questionnaire was designed for this study by the researcher. English and Chinese versions of the questionnaire were prepared (see Appendix C). The questionnaire was comprised of six sections based on the research objectives for this study.

The first section of the questionnaire provides demographic information regarding the background information, such as “Age”, “Gender”, “Education level”, and “Occupations besides farmer”. Respondents were also asked to indicate some of the general farming information and perceptions such as species of growing fruit, size of orchard, and perceptions on advanced foreign technology/species.

The second section of the questionnaire provides demographic information of the participants, regarding Internet access devices including mobile internet access services, such as the number of family owned computers, laptops, tablet PCs, and cellphones, and whether they have signed mobile Internet access services. Questions regarding use of the internet for marketing were derived from: *Computer and Internet Use by Great Plains Farmers* (Smith, Goe, Kenney, & Morrison Paul, 2001).

The third section of the questionnaire is comprised of questions derived from the *Investigation and Analysis of Information Infrastructure status and Utilization and Farmers Information Behavior in Rural Areas of Hebei Province* (Yang, Guo, & Zhao, 2013), *Henan Farmers’ Internet Use Survey Research – in Zhengzhou, Jiaozuo, Xinyang as the Objective of study* (Liu D. , 2013), and *Study on the Popularity and Use of Internet in Baoding Rural* (Geng, 2015). Participants were asked to indicate their general Internet use frequency and

their Internet surfing purpose regarding the different Internet access formats. The ordinal scale and items for these questions in Section III were adapted from the aforementioned studies, as well as another two studies of *Sichuan Mobile Media Application Research in the Process of Rural Informatization* (Yi, 2012), *Rural Social Network Development and Farmers' Internet Use: Based on the Investigation and Analysis of County H from North Henan* (Zhang C. , 2012), and *The Research of Farmer Remote Training Model Based on the Internet* (Xia, 2015). The item scales and question items are presented in Table 3.

In the fourth section, participants were asked to indicate their agricultural education and extension obtaining situation regarding conventional channels and Internet-based channels. Questions in this section were derived from Donglin Liu's (2013) survey instrument; items were included but not limited to it, supplementary items derived from the study of *Present Situation, Issues and Suggestions for Improvement for the Agricultural Extension in Qingyuan County*, Baoding (Wang J. , 2016). The questions and items are described in Table 5.

Section V of the questionnaire assessed participants' perceptions of channels regarding agricultural education and actual practices held by Hebei fruit farmers. Questions in this section were derived from Donglin Liu's (2013) survey instrument, *An Investigation of the Current Status of Farmers' Education and Training - A Report Based on Tens of Thousands of Peasants from Hundreds of Villages* (Liu, Chen, & Xie, 2015). Participants were asked to indicate their perceptions of obtaining agricultural knowledge/information through the Internet, as well as their actual training and course taking status regarding the Internet use and the Internet-based education. The relevant ordinal scales and questions are described in Table 6 and Table 7.

Table 3. Description of scale levels in Section III

Questions	Scale
How often do you use Stationary/Mobile Internet?	<1 day per week 1-2 days per week 2-3 days per week 3-4 days per week 4-5 days per week ≥6 days per week
How long do you usually surf the Stationary/Mobile Internet each day?	0 hour <1 hours per day 1-2 hours per day 2-3 hours per day 3-4 hours per day ≥4 hours per day

Note: Ordinal scale adapted from *Investigation and Analysis of Information Infrastructure status and Utilization and Farmers Information Behavior in Rural Areas of Hebei Province.*

Table 4. Description of items in Section III

Questions	Items
If you have only used stationary/mobile accessed Internet, what is the reason that you have not used mobile/stationary accessed Internet before?	Don't have adequate device (smartphone/pc) Can't get service from the telecom operator Cost more Don't know how to use it Don't like mobile Internet Stationary Internet has stable and fast connection Stationary Internet is enough
As farmer, what do you usually do when you surf the Stationary/Mobile Internet?	Contact family members Contact other farmers Contact business partners Obtain agricultural technology and knowledge Obtain farm product information Obtain marketing information Taking online education Watch news/update information Purchase daily groceries Purchase farm materials Sale product (farm production, handcrafts) Watch video Reading Buy stock Play games Others

Note: Items adapted from *Henan Farmers' Internet Use Survey Research – in Zhengzhou, Jiaozuo, Xinyang as the Objective of study; Study on the Popularity and Use of Internet in Baoding Rural; Sichuan Mobile Media Application Research in the Process of Rural Informatization*; *Rural Social Network Development and Farmers' Internet Use: Based on the Investigation and Analysis of County H from North Henan* and *The Research of Farmer Remote Training Model Based on the Internet*.

Table 5. Description of questions and items in Section IV

Questions	Items
Which of the following channels do you usually obtain farming technologies or agricultural information?	Family members Villagers Rural community leader Local farm material dealer Sales man from large scale agro company 12316 hotline Agricultural cooperative Local soil and fertilizer sector Local plant protective station Local seed station City level academy of Ag science Provincial level academy of Ag science Farming experts, technicians from Ag technology sectors Agricultural technology books Agricultural journal Agricultural newspapers Agricultural TV channel Agricultural website Agricultural QQ group Agricultural WeChat group Cellphone text message Free searching online when it is necessary Others
Which of the following channels online do you usually get agricultural knowledge and information from?	Private professional agricultural webpage Private professional agricultural webpage Official webpage of agricultural departments Official webpage of agricultural academic institution Agricultural median's webpage Agricultural company/business' webpage Agricultural cooperative's webpage Join relevant cyber community/forum Free searching online by using key words Join specific QQ group Join specific WeChat group

Note: Items adapted from *Henan Farmers' Internet Use Survey Research – in Zhengzhou, Jiaozuo, Xinyang as the Objective of study*, and *Present Situation, Issues and Suggestions for Improvement for the Agricultural Extension in Qingyuan County, Baoding.*

Table 5. (Continued)

Questions	Items
When you are getting agricultural knowledge from Internet, which of the subjects of agricultural knowledge and information do you usually obtain through stationary/mobile Internet?	Plant disease/pest control Weed control Conventional fertilizer use Farm chemical use Water saving irrigation Organic farming Marketing information of farm material Marketing information of farm product Updated agricultural policy and laws Animal disease control Other (please specify):_____ Never Obtained agricultural knowledge or information via stationary/mobile Internet.

Note. Items adapted from *Henan Farmers' Internet Use Survey Research – in Zhengzhou, Jiaozuo, Xinyang as the Objective of study*, and *Present Situation, Issues and Suggestions for Improvement for the Agricultural Extension in Qingyuan County, Baoding.*

Table 6. Description of scale levels in Section V

Questions	Ordinal Scale
What is your perception of obtaining agricultural knowledge/information through the Internet?	High preference Moderate preference Low preference

Note: Ordinal scale adapted from *Henan Farmers' Internet Use Survey Research – in Zhengzhou, Jiaozuo, Xinyang as the Objective of study*.

Table 7. Identification of questions with dichotomous scale in Section V

Questions	Scale (Yes or No)
Have heard about training farmers to use the Internet.	
Have taken training courses teaching farmers how to use the Internet	
Have heard about online course in agriculture and technology	
Have taken online course(s) on agricultural knowledge and skills	
Have obtained information through the Internet about a training program that you participated in	

Note: Questions adapted from *An Investigation on the Current Status of Farmers' Education and Training - A Report Based on Tens of Thousands of Peasants from Hundreds of Villages.*

In the sixth section, participants were asked to indicate their experiential perceptions and personal judgement regarding the Internet providing a channel for agricultural education and extension. Questions in this section derived from The Credibility Research of Web-based Information: Internet Users Perspectives (Zhang M. , 2005), Donglin Liu's (2013), Ping Yi's (2012) and Xudong Geng's (2015) survey instruments. Using an ordinal scale, questions and items are presented in Table 8 and Table 9.

The questionnaire was structured based on the research purpose. The first draft of the questionnaire was given to the research advisor in the Department of Agricultural Education and Studies at Iowa State University who has a rich experience in agricultural education and extension, and selected senior editors and extension workers of the Hebei Farmers' Newspaper, who were qualified and had a rich experience in rural extension in the Hebei Province. These individuals were asked to assess the survey questionnaire by: (1) reading through it; (2) correcting grammar and typos; (3) checking for the proper language and expression in both English and Chinese; (4) adding and deleting questions; and (5) providing suggestions and comments.

The revised questionnaire was used in a pilot test with 35 fruit farmer participants. These 35 individual fruit farmers selected in the pilot test were excluded in the final sample. This pilot test process provided some understanding of validity. Based on the feedback from this pilot test, some modifications were made to the written forms. For example, instead of using "Yes" or "No" only, the characteristic expression of those scales in dichotomous questions were converted to a format more closely related to "Hebei oral style", which is more detailed, straightforward, and reflects the Hebei fruit farmers. The questionnaire and explanation of the methods which were used in this research were presented to the

Table 8. Descriptions of scale levels in Section VI

Questions	Ordinal Scale
How credible do you think online agricultural knowledge/information is?	Completely reliable (100% credibility) Reliable (75% credibility) Moderate (50% credibility) Unreliable (25% credibility) Completely unreliable (0% credibility)

Note: Scales adapted from *The Credibility Research of Web-based Information: Internet Users Perspectives.*

Table 9. Description of questions and items in Section VI

Questions	Items
What do you usually do with the agricultural knowledge/information you obtain through the Internet?	Trust and directly apply Decided after discuss with other farmer Verify by discuss with local technicians Won't apply, but take as reference Don't trust and won't apply to actual farming Other (please specify): _____
Have you ever met any of the following handicaps when you were trying to obtain agricultural knowledge/information via the Internet?	Don't have appropriate device Don't have Internet access Costs too much Don't know how to use it Don't know how to type Can't find relevant information on the Internet Online Information is inaccurate Other obstacles Never met obstacles
What following response do you usually do when you facing obstacles of obtaining agricultural education and information through the Internet?	Tried to find the solution alone Ask families for help Ask young people for help Give up the Internet and return to traditional ways of obtaining agricultural education, such as call local technicians Other (please specify) _____
By using the Internet, how much do you think you have been improved or changed?	Renewed basic skills and understanding of technology Broadened my farming knowledge Truly solved my problem Increased income Created new communication channels Did not improve or change anything Other (please specify) _____

Note: Items adapted from *Henan Farmers' Internet Use Survey Research – in Zhengzhou, Jiaozuo, Xinyang as the Objective of study*, *Sichuan Mobile Media Application Research in the Process of Rural Informatization*, and *Study on the Popularity and Use of Internet in Baoding Rural.*

Institutional Review Board at Iowa State University for approval before the study was actually conducted (Appendix A).

The Chinese version of the questionnaire was used for data collection. Detailed instructions on how to respond to each section were provided. Each section of the questionnaire was given a code matrix on the Excel document, which ensured each respondent who provided the information to each question would be matched correctly when converting the responses to digital data.

A cover letter, which was developed and co-signed by the researcher and major professor, was written to accompany the questionnaire. In order to avoid misunderstanding and respect the local rule and culture, the cover letter was transferred to a Chinese version, which retained all content including the researcher's name, but researchers' signature, major professor's name and signature, and also removed the name of the researcher's institute. The contact information for the major professor was replaced with researcher's as well. Copies of both English and Chinese cover letter versions are shown in Appendices C, respectively.

Data Collection

All of the questionnaires were printed and personally distributed in early September, 2016, from Shijiazhuang, capital city of Hebei Province to the six selected administrative regions. The distribution over a period of time since the distribution process was not completed by one person. A group of former colleagues of the researcher at the Hebei Farmers' Newspaper and Hebei Safe Production Journal, former co-workers from provincial rural education programs and local county level agricultural extension stations helped to coordinate the local county offices of each selected administrative region, and eventually delivered the questionnaires to the villages in each county. They also acted as the contact

person, and were responsible to deliver the hardcopy instructions to farmer respondents and ensure the farmers who participated the survey understood what they were doing.

The questionnaires were eventually handed to farmers by township or village committees. At most villages, fruit farmers collected the questionnaires from the village committee when they were called together over loudspeakers; at some villages, leaders helped to hand deliver the questionnaire to individual fruit farmer's households and collect them after completion. The research assistants read questions orally to participants who had reading comprehension problems. Most villages returned the completed questionnaires to the contact person within the day they had been distributed, whereas some villages kept the questionnaire for several days and returned the completed ones to the contact person through mail delivery. By the middle of October, 616 questionnaires were returned. The response rate was over 61%. All of the returned responded questionnaires were delivered to researchers' address in Hebei province either by hand or by post mail for analysis. Not all returned questionnaires were usable for analysis. After specifically checking each individual questionnaire, 105 blank questionnaires were removed from the collected sample, and the rest of the 511 questionnaires were retained for analysis.

Data Analysis Methods

All of the data were transformed manually from the questionnaire to computer, and were analyzed by using the statistical computer program: IBM SPSS Statistical Data Editor, version 23.

The statistical analyses procedures which were used in this study are as follows:

1. Descriptive analysis was used to summarize the demographic data from the questionnaire. The statistics consisted in this part of analysis include: frequencies,

percentages, means, and standard deviations. The demographic data including all basic information of respondents: respondents' location, age, education level, and Internet devices and services.

2. Comparative statistics were used to indicate the difference of age for respondents by gender.
3. Descriptive and comparative statistics were used to identify respondents' weekly and daily Internet use frequencies.
4. Descriptive statistics were used to identify the purpose for respondents' stationary Internet and mobile Internet surfing.
5. Descriptive and comparative statistics were used to determine respondents' perceptions for obtaining agricultural knowledge and information via the Internet.
6. Descriptive statistics were used to evaluate the channels which respondents obtaining agricultural knowledge and information from.
7. Descriptive statistics were used to evaluate the path which respondents obtain agricultural knowledge and information on the Internet.
8. Descriptive and comparative statistics were made of the subjects of agricultural knowledge and information regarding the types of Internet use.
9. Descriptive and comparative statistics were applied to indicate respondent's credibility perceptions regarding the Internet disseminated agricultural knowledge and information.
10. Descriptive statistics were used to determine the respondents' reactions to the knowledge and information they obtained via the Internet.

11. Descriptive statistics were used to determine the respondents' actual status of Internet utilization training and online agricultural education course participation.
12. Descriptive statistics were used to determine the obstacles respondents held regarding Internet use as an agricultural knowledge and information obtaining channel.
13. Descriptive statistics were used to determine the reactions of the respondents regarding the obstacles while seeking the Internet Agricultural Knowledge and Information.
14. Descriptive statistics were used to determine the positive changes held by respondents regarding using the Internet.

For the above analyses, several SPSS subprograms were applied as follows:

1. FREQUENCIES was used on demographic characteristics of the respondents, to do the descriptive statistics analyzing.
2. INDEPENDENT SAMPLE T-TEST was used to determine differences of ages for fruit farmers by gender.
3. MCNEMAR'S TEST was used to determine differences in dichotomous scale questions, consisting of purposes for Hebei fruit farmers' stationary Internet and Mobile Internet surfing, as well as the subjects of agricultural knowledge and information regarding the types of Internet using. McNemar's Test is appropriate for repeated measures designs where there are nominal data or dichotomous scored data specifically. It is the equivalent of Pearson Chi-square but for within-subjects or a repeated measures design. The 0.05 alpha level was established a priori, and used as a basis for determine significant differences among mean scores.

4. WILCOXON MATCHES PAIRS TEST was used to determine the differences in ordinal scale questions, consisting of Hebei fruit farmers' perceptions for obtaining agricultural knowledge and information via the Internet, and fruit farmers' credibility perceptions regarding the Internet disseminated agricultural knowledge and information. Wilcoxon Matched Pairs Test is a non-parametric statistical hypothesis test used when comparing two related samples, matched samples, or repeated measurements on a single sample to assess whether their population mean ranks differ. It can be used as an alternative to the paired student *t*-test. The 0.05 alpha level was established *a priori*, and used as a basis for determine significant differences among mean scores.

Scales used in this study were designed according to the following intervals of mean values (Table 10):

Table 10. Intervals of mean values

Questions	Range of mean values		
How often do you use Stationary/Mobile Internet? [a]	<1.49	=	<1 day per week
	1.50 to 2.49	=	1-2 days per week
	2.50 to 3.49	=	2-3 days per week
	3.50 to 4.49	=	3-4 days per week
	4.50 to 5.49	=	4-5 days per week
	5.50 to 6.00	=	≥6 days per week
How long do you usually surf the stationary Internet each day? [b]	<1.49	=	0 hours
	1.50 to 2.49	=	<1 hours per day
	2.50 to 3.49	=	1-2 hours per day
	3.50 to 4.49	=	2-3 hours per day
	4.50 to 5.49	=	3-4 hours per day
	5.50 to 6.00	=	≥4 hours per day
What is your perception of obtaining agricultural knowledge/information through the Internet? [c]	<1.49	=1	No preference
	1.50 to 2.49	=2	Moderate preference
	2.50 to 3.00	=3	High preference
How credible do you think that online Agricultural knowledge/information are? [d]	<1.49	=1	0% credibility
	1.50 to 2.49	=2	25% credibility
	2.50 to 3.49	=3	50% credibility
	3.50 to 4.49	=4	75% credibility
	4.50 to 5.00	=5	100% credibility

Note: [a]:The researcher coded the data as categorical values: 1="<1 day per week", 2="1-2 days per week", 3="2-3 days per week", 4="3-4 days per week", 5="4-5 days per week" and 6="≥6 days per week", and decided to find the mean and S.D. for each of the category's code value. For this question, the researcher defined the mean range as above to measure the average stationary/mobile Internet access days per week;

[b]:The researcher coded the data as categorical values: 1="0 hours", 2="<1 hours per day", 3="1-2 hours per day", 4="2-3 hours per day", 5="3-4 hours per day", and 6="≥4 hours per day", and decided to find the mean and S.D. for each of the category's code value. For this question, the researcher defined the mean range as above to measure the average stationary/mobile Internet access hours per day;

[c]:The researcher coded the data as ordinal values: 1="High preference", 2="Moderate preference", and 3="High preference", after that, the researcher decided to find the mean and S.D. for each of the ordinal scale's code value. For this question, the researcher defined the mean range as above to measure the fruit farmers' overall perception of obtaining agricultural knowledge/information through the Internet;

[d]:The researcher coded the data as ordinal values: 1="0% credibility", 2="25% credibility", 3="50% credibility", 4="75% credibility", 5="100% credibility". The researcher decided to find the mean and S.D. for each of the ordinal scale's code value, and defined the mean range as above to measure the fruit farmers' overall perception of Internet disseminated agricultural knowledge/information credibility.

CHAPTER 4. RESULTS

The study focused on use of the Internet by fruit farmers in six selected administrative regions of Hebei province. In order to assess farmers' use of the Internet as an education channel, a questionnaire was designed that included six sections based on the research objectives for this study, the question types included dichotomous, multiple choice, ordinal scale and open ended questions. Participants' responses were coded, manually transferred to an Excel file with pre-determined criteria assigned for each variable, and then analyzed using an SPSS statistics program. The data collected were analyzed using subprograms in SPSS: Cronbach's alpha reliability test, frequencies and descriptive statistics, independent sample *t*-test and McNemar's test, and Wilcoxon matched pairs test. The results of the analyses are presented in this chapter. The chapter is divided into the following sections: (1) Demographic Characteristics of Respondents; (2) Findings by Research Objective; and (3) Summary.

Demographic Characteristics of the Fruit Farmers

In this study, several types of background information about the respondents were collected through the questionnaire. Respondents were asked to provide information regarding their age, gender, and education level. Results of the analysis for each administrative region, age, gender and education level are shown in Table 12, Table 13, Table 14, and Table 15, respectively.

Administrative District

Table 11 indicates the respondents' place of residence. A total of 511 questionnaires were collected from 6 municipal level administrative regions and 14 counties.

Table 11. City level administrative regions and counties of the respondents

Administrative District/County		n	%
Tangshan			
Qianxi		24	4.70
Zunhua		23	4.50
Caofeidian		16	3.13
	Sub-total	63	12.33
Zhangjiakou			
Yuxian		33	6.46
Yangyuan		45	8.80
	Sub-total	78	15.26
Langfang			
Sanhe		90	17.61
	Subtotal	90	17.61
Hengshui			
Shenzhou		29	5.68
Raoyang		46	9.00
	Subtotal	75	14.68
Shijiazhuang			
Zanhuang		11	2.15
Zhaoxian		38	7.44
Gaocheng		38	7.44
Jinzhou		10	1.96
	Subtotal	97	18.98
Xingtai			
Weixian		96	18.79
Julu		12	2.35
	Subtotal	108	21.14

Note: N=511

Gender, Age, and Education Level

Among the respondents who completed their questionnaires, there were twice as many male farmers enrolled in this study as female farmers (Table 12).

Table 12. Gender of the respondents

Gender	*n*	*%*
Male	354	69.28
Female	153	29.94
Unknown	4	0.78

Note: N=511

Table 13 indicates that the majority of both male and female respondents were between 26 to 65 years of age (*n*=429, 91.58%). Three hundred thirty-two (64.97%) males and 140 (27.40%) females indicated their ages. However, Less than one tenth of the respondents, 7.24% (*n*=37), did not indicate their age.

Table 13. Age of the respondents

	Male		Female		Combined	
Age group	*n*	*%*	*n*	*%*	*n*	*%*
25 and younger	12	2.35	5	0.98	17	3.33
26-35	51	9.98	31	6.07	82	16.05
36-45	76	14.87	46	9.00	122	23.87
46-55	110	21.53	40	7.83	150	29.35
56-65	59	11.55	16	3.13	75	14.68
66-75	23	4.50	1	0.20	24	4.70
76 and older	1	0.20	1	0.20	2	0.39
Unidentified					39	7.63

The mean age of the male respondents was 47.3 years, while the mean age of the female respondents was 43.2 years (Table 14). The average age of male farmers was four years older than the female farmers. The extra independent samples *t*-test was performed by considering GENDER as a grouping variable, and AGE as test variable further confirmed this age difference, by indicating a significant difference between the age of male and female respondents.

Table 14. Independent sample *t*-test for age of respondents by gender

	Male		Female				
Variable	*M*	*SD*	*M*	*SD*	*t*	*df*	*p-value*
Age	47.30	11.99	43.19	10.32	3.54*	470	0.000

Note.*$p < 0.05$; 332 male and 140 female respondents indicated their age.

As demonstrated in Table 15, the largest number (*n*=201, 39.33%) of respondents was those in the "Junior middle school level", and the second largest number (*n*=120, 23.48%) of respondents was in the level of "Primary school"; 4.31% (*n*=22) of the fruit famers didn't indicate their education level or years of schooling.

Table 15. Education level of the respondents

Education Level	*n*	*%*
Never went to school (0 years)	46	9.00
Primary school level (6 years)	120	23.48
Junior middle school level (9 years)	201	39.33
High school level (12 years)	99	19.37
College level (15 or 16 years'	22	4.31
Graduate school level or higher (18 years or more)	1	0.20
Did not identify	22	4.31

Note. n=Subgroup sample size. Accumulated sample size of 511.

Findings by Research Question

This section is comprised of the analyses and findings based on the research questions. The results are presented according to each research question:

Use of Internet-related Devices and Internet

Research Question 1: What Internet-related devices do Hebei fruit farmers have?

Research Question 2: How frequently do Hebei fruit farmers use stationary and mobile Internet?

Research Question 3: Are there any differences in Hebei fruit farmers' frequency of use between stationary and mobile Internet?

Research Question 4: What do Hebei fruit farmers do when they use the Internet?

Research Question 5: Are there any differences in Hebei fruit farmers' use of stationary and mobile Internet?

Among the respondents who indicated their personal Internet-related devices, it was revealed that less than half of the fruit farmers have computers; nearly 98% of fruit farmers

have cellphones; approximately three fifths of the fruit farmers' cellphones are smartphones; and more than half of the fruit farmers have mobile Internet access services from mobile telecom carriers. Laptop and tablet PC ownership rates are both less than 8%.

Table 16. Internet accessing devices and mobile Internet access service

	Responses	
Internet Access to Devices and Services	*n*	*%*
Computer	224	47.97
Laptop	37	7.96
Tablet PC	36	7.74
Cellphone	489	97.80
Smartphone	248	59.90
Have signed mobile Internet access services	264	54.77

A total of 467 respondents answered this question regarding computers. Of that total, 224 indicated they owned a computer; 465 a Laptop, 465 a Tablet PC. A total of 500 respondents answered the question regarding cellphone and Internet access services, and 414 owning a smartphone, whereas 482 respondents said they had also signed up for mobile Internet access service.

A survey of the frequency of stationary and mobile Internet access was conducted at the beginning of the study in order to fill in the gaps in the research about fruit farmers' Internet use and its relationship to agricultural education in Hebei province. The fruit farmers were asked to indicate how many days they use stationary Internet and mobile Internet each week, and how long they surf stationary Internet and mobile Internet each day. The percentage distribution of farmers who indicated their weekly and daily Internet use frequencies regarding the different Internet accessing formats is provided in Figure 6 and Figure 7.

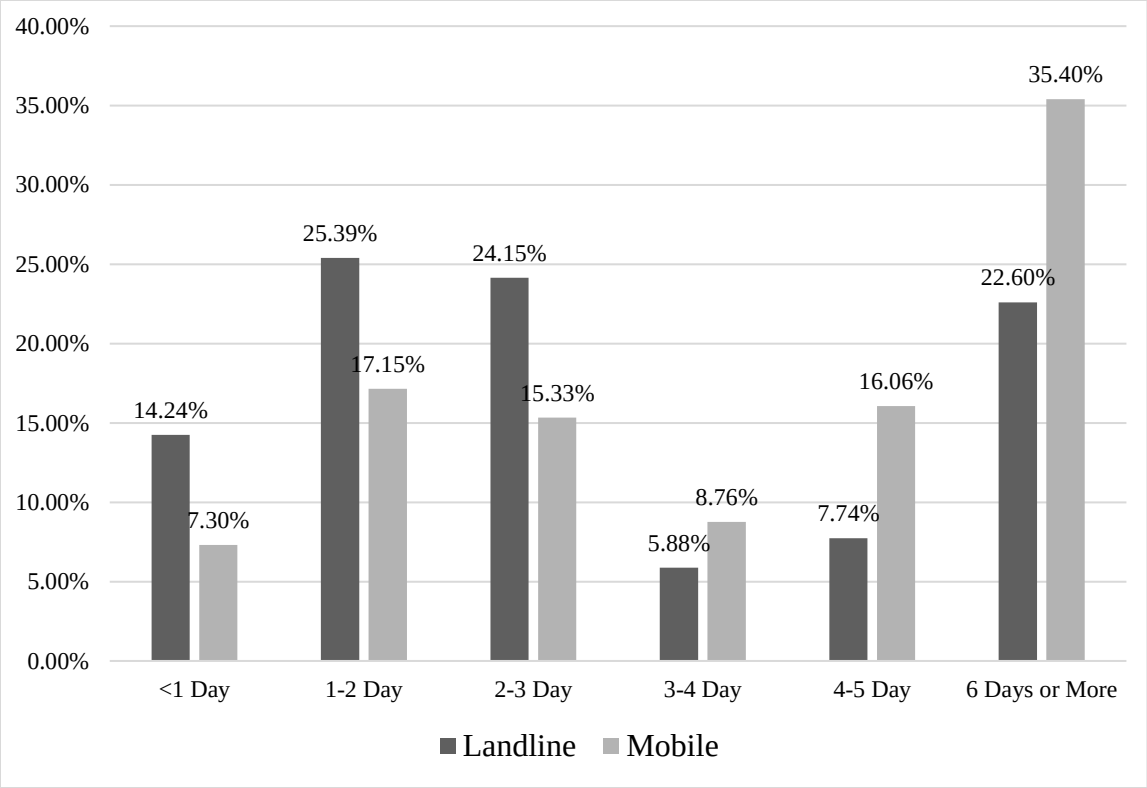


Figure 6. Stationary and Mobile Internet Usage by Days per Week

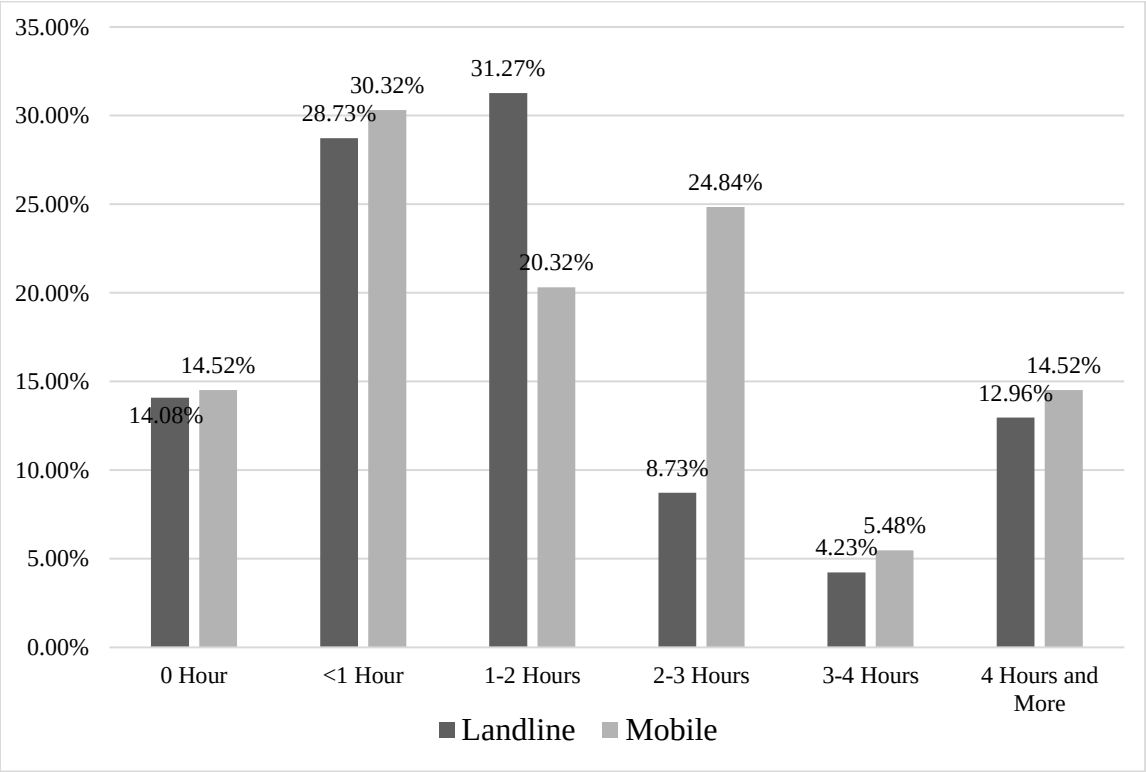


Figure 7. Stationary and Mobile Internet Usage by Hours per Day

Descriptive statistics and comparisons of respondents' daily and weekly Internet using frequencies were performed by using Wilcoxon Matched pairs test (Table 17). The 2-tailed *p*-values from the Wilcoxon Matched pairs test results revealed that fruit farmers were accessing the Internet significantly more through mobile versus stationary Internet regardless of weekly or daily usage.

Table 17. Internet preference for obtaining agricultural knowledge and information

	Stationary		Mobile		
Internet usage	*M*	*SD*	*M*	*SD*	*p-value*
Days per week	3.35	1.764	4.15	1.749	0.000*
Hours per day	2.99	1.510	3.30	1.574	0.005*

*$p < 0.05$.

Descriptive statistics and comparisons of Internet surfing based on purpose of Hebei fruit farmers were calculated based on a scale of "Yes" or "No" regarding stationary versus mobile Internet access using McNemar's test (Table 18)

The Internet surfing purpose of Hebei fruit farmers ranged from 1.9% to 62.8% for stationary Internet access, and from 0.9% to 73.1% for mobile Internet access. The purpose rated highest by fruit farmers was "Contact families", respectively, for stationary Internet access and mobile Internet access, followed by "Watch video" (37.2%), "Obtain farming product information" (31.4%), "Watch news" (28.4%), and "Purchase daily groceries" (28.1%) regarding stationary Internet connection, and "Contact other farmers" (30.3%) "Watch news" (26.9%), "Watch video" (21.7%), and "Obtain agricultural technology and knowledge" (16.8%), regarding mobile Internet connection.

The *p* values smaller than 0.05 indicated significant differences between the proportions of farmers engaging in the specified purposes with stationary and mobile Internet

Table 18. Hebei fruit farmers' stationary versus mobile Internet surfing based on purpose

Purposes	Stationary		Mobile		
	n	*%*	*n*	%	*p-value*
Contact families	230	62.8	253	73.1	0.000*
Contact other farmers	60	16.4	105	30.3	0.000*
Contact business partners	25	6.8	25	7.2	0.815
Obtain agricultural knowledge	90	24.6	58	16.8	0.001*
Obtain farming product information	115	31.4	57	16.5	0.000*
Obtain marketing information	92	25.1	46	13.3	0.000*
Taking online education	29	7.9	17	4.9	0.122
Watch news	104	28.4	93	26.9	0.187
Purchase daily groceries	103	28.1	57	16.5	0.000*
Purchase farm materials	27	7.4	19	5.5	0.327
Sale product	22	6.0	15	4.3	0.263
Watch video	136	37.2	75	21.7	0.000*
Read book/journal	25	6.8	32	9.2	0.324
Buy stock	7	1.9	3	0.9	0.375
Play games	56	15.3	48	13.9	0.568
Others	7	1.9	3	0.9	0.625

*$p \leq 0.05$; N=328.

surfing. For the Internet surfing purpose, significant differences existed at the 0.05 level of significance for 7 Internet surfing purposes. The greater proportion of variable "Contact families" and "Contact other farmers" in mobile Internet access format, "Obtaining agricultural knowledge/information" in stationary Internet access format indicated that fruit farmers' held stationary Internet connection with knowledge and information obtaining purpose, but mobile Internet connection with basic communication purpose.

Perceptions Regarding the Internet and Its Use

Research Question 6: What perceptions do Hebei fruit farmers have about obtaining agricultural knowledge and information through conventional or mobile Internet devices?

Research Question 7: Are there any differences between Hebei fruit farmers' perceptions of obtaining agricultural knowledge and information?

According to the Definition of Terms in the first chapter of this study, agricultural information represents all of the general informative content required of farmers for farming or agricultural business or management, such as dynamic market information about crop

prices and updated agricultural policies. Agricultural knowledge represents all general knowledge, technologies, and skills required of farmers for agricultural producing activities. By using frequency and percentage distribution as a reference (Table 19), it was revealed that 59 (13.95%) respondents held no preference for obtaining agricultural knowledge via the Internet, whereas 54 (12.71%) respondents held no preference for obtaining agricultural information via the Internet. The number of respondents who indicated a high preference for obtaining agricultural knowledge and information via the Internet was 196 (46.34%) and 209 (49.18%), respectively.

Descriptive statistics and comparisons of respondents' preference regarding obtaining agricultural knowledge and information were performed by using the Wilcoxon Matched pairs test. The results are presented in Table 20.

Table 19. Preference frequency for obtaining agricultural knowledge and information by Internet

Preference	Knowledge		Information	
	n	*%*	*n*	*%*
No preference	59	13.95	54	12.71
Moderate preference	168	39.72	162	38.12
High preference	196	46.34	209	49.18

N=423 (Knowledge); *N*=425 (Information)

There is a difference in the mean; the overall preference for obtaining agricultural information (*M*=2.36) online is slightly higher than the overall preference for obtaining agricultural knowledge (*M*=2.32). The 2-tailed *p*-values from the Wilcoxon Matched pairs test results revealed that fruit farmers significantly preferred obtaining agricultural information through the Internet versus obtaining agricultural knowledge.

Table 20. Preference for obtaining agricultural knowledge and information by Internet

	Knowledge		Information		
	M	*SD*	*M*	*SD*	*p-value*
Preference for obtaining agricultural knowledge and information through the Internet	2.32	0.706	2.36	0.698	0.002*

*$p \leq 0.05$.

Perceptions regarding sources of knowledge/information and its use

Research Question 8: What are the most frequently applied delivery/distribution channels Hebei fruit farmers use to gain agricultural knowledge and information in a digital age?

Research Question 9: What online paths do Hebei fruit farmers apply most frequently to obtain agricultural knowledge?

Research Question 10: Are there any differences in the types of agricultural knowledge Hebei fruit farmers obtain between using the Internet versus conventional channels?

Fruit famers were asked to identify the sources they currently used to obtain agricultural knowledge and information as well as which sources were being structured, practiced or deemed suitable to be adopted in agricultural education and extension fields in the Hebei province. Frequencies and proportions of each provided channel option were calculated and presented in Table 21.

The researcher used the proportion scores to rank the agricultural education and extension sources that were used by fruit farmers in the Hebei province. The proportion of currently applied channels for obtaining agricultural education ranged from 0.8% to 65.0%. The top five agricultural education delivery channels were “Family members” (65%), “Villagers” (35.4%), “Agricultural TV channel” (28.3%), “Local farm material dealer” (25.7%) and “Agricultural technology books” (23.6%).

The Internet-based agricultural knowledge and information obtaining channels were all outside of the top ten channels. Among all sources, the most frequently adopted Internet channel was “Free searching online when it is necessary” (13.7%), was ranked 11th. The

Table 21. Sources used to obtain agricultural knowledge and information

Channel	*n*	*%*	*Rank*
Family members	308	65.0	1
Villagers	168	35.4	2
Rural community leader	68	14.3	9
Local farm material dealer	122	25.7	4
Sales man from large scale agricultural company	29	6.1	12
12316 hotline	5	1.1	23
Agricultural cooperative	86	18.1	6
Local soil and fertilizer sector	25	5.3	15
Local plant protective station	18	3.8	19
Local seed station	72	15.2	7
City level academy of Ag-science	10	2.1	22
Provincial level academy of Ag-science	12	2.5	21
Farming experts, technicians from ag technology sectors	69	14.6	8
Agricultural technology books	112	23.6	5
Agricultural journal	27	5.7	13
Agricultural newspapers	68	14.3	10
Agricultural TV channel	134	28.3	3
Agricultural website	26	5.5	14
Agricultural QQ group	22	4.6	17
Agricultural WeChat group	21	4.4	18
Cellphone text message	25	5.3	16
Free searching online when it is necessary	65	13.7	11
Others	4	0.8	24
Never obtained Agricultural technologies or information	17	3.6	20

N=474

"Agricultural website" (5.5%) was ranked as 14th, followed by "Agricultural QQ group" (4.6%) at 17th "Agricultural WeChat group" (4.4%) as 18th.

Focusing on the Internet-based agricultural education channels, fruit famers were asked to identify their frequently used paths for obtaining agricultural knowledge and information and categorized those paths based on the existing agricultural knowledge and information dissemination channels regarding Internet technologies in the Hebei province. Proportion values were calculated and ranked for each online path category based on a scale of "Yes" or "No" (Table 22).

Table 22. Paths used to obtain agricultural knowledge and information on the Internet

Online Paths	*n*	*%*	*Rank*
Private run professional agricultural websites	52	14.0	4
Official websites of agricultural departments	67	18.1	3
Official websites of agricultural academic institutions	22	5.9	10
Agricultural median's websites	79	21.3	1
Agricultural company/business' websites	36	9.7	7
Agricultural cooperatives' websites	37	10.0	6
Join relevant cyber community/forum	24	6.5	9
Free searching online by using key words	78	21.0	2
Join specific QQ groups	36	9.7	7
Join specific WeChat group	42	11.3	5
Others	4	1.1	11
Never obtain Agricultural education or information online	87	23.5	

N=371

One hundred forty farmers did not respond. Eighty-seven farmers indicated themselves as "Never obtained agricultural education or information online". For the remaining farmers who indicated they frequently used online paths for obtaining agricultural education and information, the proportions ranged from 1.1% to 21.3%. The paths for adopting agricultural education and information through the Internet with the highest rating was "Agricultural median's website" (21.3%). The second to the fifth rated online paths were: "Online searching by using key words" (21.0%), "Official websites of agricultural departments" (18.1%), "Private run professional agricultural website" (14.0%), and "Join specific WeChat group" (11.3%).

Descriptive statistics were applied using McNemar's test to compare agricultural knowledge and subjects Hebei fruit farmers used regarding stationary and mobile Internet access. As shown in Table 23, the proportion of the agricultural knowledge and information subjects of Hebei fruit farmers obtained from the Internet ranged 1.5% to 39.6% for stationary Internet network, and from 1.8% to 31.2% for mobile Internet network. The subjects rated highest by fruit farmers as indicated by proportion value was "Plant disease/pest control" for both network formats with proportion of 39.6% and 31.2%,

respectively for stationary Internet network and mobile Internet network. Both the stationary and mobile Internet networks had “Meteorological disaster prediction and prevention” as their second-rated subject (25.6% and 29.7%), respectively. According to the proportion value, the third-rated item in term of stationary Internet access was “Conventional fertilizer use” (21.0%); the third-rated item in terms of mobile Internet access was “Never obtain information through mobile Internet” (22.6%); this ranked 6th regarding stationary Internet access.

Table 23. Comparison between subject and type of Internet use

	Stationary		Mobile		
Subject of agricultural knowledge and information	*n*	*%*	*n*	%	*p-value*
Plant disease/pest control	155	39.6	119	31.2	0.000*
Weed control	69	17.6	54	14.2	0.009
Conventional fertilizer use	82	21.0	63	16.6	0.096
Organic fertilizer use	80	20.5	56	14.7	0.001*
Farm chemical using	79	20.3	46	12.1	0.001*
Water saving irrigation	47	12.0	39	10.2	0.736
Organic farming	36	9.2	19	5.0	0.003*
Meteorological disaster prediction and prevention	100	25.6	113	29.7	0.053
Marketing information of farming materials	71	18.2	52	13.6	0.111
Marketing information of farm product	73	18.7	40	10.5	0.000*
Updated agricultural policy and laws	51	13.0	56	14.7	0.312
Never obtain agricultural knowledge/information through stationary/mobile Internet	78	19.9	86	22.6	0.092
Others	6	1.5	7	1.8	1.000

*$p \leq 0.05$.

The *p* values from the McNemar’s test revealed that there are some statistically significant differences between some agricultural knowledge and information subjects which fruit farmers obtain via stationary Internet networks and mobile Internet networks at the 0.05 level of significance. Fruit farmers significantly preferred obtaining “Plant disease/pest control”, “Organic fertilizer using”, “Farm chemical using”, “Organic farming”, and “Marketing information of farm product” knowledge and information through stationary Internet connection than mobile Internet connection.

Credibility Opinions

Research Question 11: What is the level of credibility Hebei fruit farmers place on online agricultural knowledge/information?

Research Question 12: Are there any differences in the level of credibility between online agricultural knowledge and information?

Research Question 13: What is the level of usage by Hebei fruit farmers with the agricultural knowledge and information they obtain via the Internet?

The proportions and frequencies for the perceptions regarding the credibility of agricultural knowledge and agricultural information disseminated via Internet network were calculated and are presented in Table 24. Descriptive statistics and comparisons were performed by using Wilcoxon Matched pairs test, and the results are presented in Table 25.

Table 24. Percentage of credibility of online agricultural knowledge and information

Perception	Knowledge		Information	
	n	%	*n*	%
0% credibility	6	1.33	6	1.34
25% credibility	21	4.66	20	4.45
50% credibility	207	45.90	236	52.56
75% credibility	203	45.01	169	37.64
100% credibility	14	3.10	18	4.01

N=451 (Knowledge); *N*=449 (Information)

Results from the 2-tailed *p*-values from the Wilcoxon Matched pairs test revealed that there is a statistically significant difference between the credibility perceptions fruit farmers held about agricultural knowledge and information disseminated via the Internet. Fruit farmers considered Internet-distributed agricultural knowledge to have moderate credibility versus Internet-distributed agricultural information.

Table 25. Perception of credibility of online agricultural knowledge and information

	Knowledge		Information		
	M	*SD*	*M*	*SD*	*p-value*
Perception of Credibility	3.44	0.695	3.39	0.698	0.002

*$p \leq 0.05$.

Descriptive statistics of the subjects' expectations were applied for usage of agricultural knowledge and agricultural information obtained via Internet networks (RQ 9) and are presented in Table 26. The reaction rated highest by fruit farmers as indicated by proportion value was "Decided whether or not apply after discussing with other farmers" (52.5% and 57.9%), respectively, for Internet-obtained agricultural knowledge and information. The 2nd and 3rd, rated expectations for Internet-obtained agricultural knowledge and information were: "Verify the knowledge by discussing with local technicians" (42.4% and 39.4%), and "Won't apply, but take as reference" (28.9% and 25.1%).

A total of 425 respondents answered the question regarding agricultural knowledge they obtained via the Internet. A total of 406 respondents answered the question regarding agricultural information they obtained via the Internet.

Table 26. Reaction to agricultural knowledge and information obtained via the Internet

	Knowledge		Information	
Reaction	*n*	*%*	*n*	*%*
Trust and directly apply	68	16.0	57	14.1
Decided after discuss with other farmers	223	52.5	235	57.9
Verify by discuss with local technicians	180	42.4	160	39.4
Won't apply, but take as reference	123	28.9	102	25.1
Don't trust and won't apply to actual farming	18	4.2	29	7.1
Others	12	2.8	8	2.0

Obstacles and Reactions

Research Question 14: What difficulties do Hebei fruit farmers generally experience when obtaining agricultural knowledge and information through the Internet; and how do they respond to those obstacles?

Research Question 15: How well are Hebei fruit farmers trained to utilize the Internet as a tool?

Research Question 16: Are Hebei fruit farmers informed and participate in any online courses about agricultural education?

Descriptive statistics were used to determine the obstacles that Hebei fruit farmers face regarding obtaining agricultural education and information through the Internet. Four hundred respondents responded the first 6 question items and 145 responded to the last question item. The frequency tests results are shown in Table 27. The proportion of the Internet use obstacles ranged from 5.3% to 30.3%. The obstacles indicated by respondents most were: "Don't have appropriate device" (30.3%), followed by "Can't find such information on Internet" (25.0%), and "Online information is inaccurate" (23.3%).

Table 27. Obstacles to gaining agricultural knowledge and information by Internet

Obstacles	*n*	*%*
Don't have appropriate device	121	30.3
Don't have Internet access	62	15.5
Costs too much	51	12.8
Don't know how to use it	67	16.8
Don't know how to type	73	18.3
Can't find relevant information on the Internet	100	25.0
Online information is inaccurate	93	23.3
Other obstacles	21	5.3
Never met obstacles	23	15.9

Descriptive statistics of potential responses that fruit farmers would have to manage these obstacles are presented in Table 28. Three hundred and seventy-six respondents answered these question items. One hundred and forty-nine respondents (39.6%) indicated that they "Tried to find the solution alone", which was the highest rated reaction by respondent. "Asked young people for help" received the second highest reaction by 113 respondents (30.1%). The reaction rated third was "Asked families for help" with a proportion of 29.3%.

Table 28. Reactions to obstacles for seeking agricultural knowledge and information by Internet

Reactions	*n*	*%*
Tried to find the solution alone	149	39.6
Asked families for help	110	29.3
Asked young people for help	113	30.1
Give up on the Internet and returned to traditional ways of obtaining agricultural education, such as call local technicians	86	22.9
Other	14	3.7

Table 29 reveals the results regarding how well fruit farmers are trained to utilize the Internet as a tool. The proportion value was used to indicate the general situation about the training and usage and online agricultural education course participation. One-third (33.26%) of farmers had heard about programs for training farmers to use the Internet; slightly more than one fourth (27.07%) had heard about online courses in agriculture and technology; the proportion of farmers who had taken training course(s) or online course(s) were less than 10%, and the same as the proportion of farmers had obtained information through the Internet regarding offline programs.

Table 29. Status of Internet utilization for participating in training to use online agricultural education courses

Status	*n*	*%*
Have heard about training farmers to use the Internet [a]	153	33.26
Have taken training courses teaching farmers how to use the Internet [b]	27	6.14
Have heard about online course in agriculture and technology [c]	121	27.07
Have taken online course(s) on agricultural knowledge and skills [d]	35	7.81
Have obtained information through the Internet regarding offline program [e]	33	8.09

Note. [a]:*N*=460; [b]:*N*=440; [c]:*N*=447; [d]:*N*=448; [e]:*N*=408

Additional Findings from Chi-Square and Correlation Tests

In addition to the original designed test for research questions regarding the general descriptive statistic research purpose, additional Chi-square and Correlation tests were applied to ascertain whether there is an association between all research objective variables and the three independent variables of gender, education level and age groups individually. These tests were not included in the original research design, but conducted after the data collection ended. Relevant findings indicated there was a statistically significant association and correlation existing between gender and selected research variables (Appendix D), education level and some research variables (Appendix E), and some significant correlation between age group and some research variables (Appendix F).

For example, for the research question: "What are the most frequently applied delivery/distribution channels Hebei fruit farmers use to gain agricultural knowledge and information in a digital age?" a significant association was found between gender and selected extension sources, such as "Local farm material dealer", "Local plant protective station", "Agricultural technology books", "TV channel", and "WeChat groups" (Table 36).

For the research question: "How well are Hebei fruit farmers trained to utilize the Internet as a tool?" a weak positive correlation was found existing between education level and "whether they have heard about training farmers to use the Internet program" (Table 60).

For the research question: "How frequently do Hebei fruit farmers use stationary and mobile Internet?" a weak to moderate negative correlation existed between age group and Internet use frequencies, indicating the older the age group, the lower one's Internet use (Table 66).

Generally, Chi-square and correlation tests indicated that a correlation exists in the sample, but not all of the existing correlations are associated with agricultural and extension education themes. In addition, a majority of the significant correlations have weak ($r<0.39$) or very weak ($r<0.19$) positive correlations in terms of gender and education level; and a majority of the significant correlations observed between age group and research objectives are very weak, weak or have a moderate ($r<0.59$) negative correlation. Since such tests were not involved in the original research design, and the findings are generally weak or very weak. There are no specific sections recording each individual significant finding. All of the Chi-square and correlation test results are found in Appendix D, Appendix E, and Appendix F.

Summary

Most fruit farmers (69.28%) who participated in this study were male. The largest age group among the fruit farmers was between 26 and 65 years, and the mean age for male fruit farmers was 47.3, which was four years older than the female fruit farmers. Nearly two fifths (39.33%) had undertaken nine years of school study, and approximately a quarter (23.48%) had graduated from primary school. Approximately half (47.97%) had computers, and most (97.8%) had a cellphone, in which three fifths (59.9%) indicated their cellphones were smartphones.

The largest proportion of fruit farmers' weekly Internet frequency of use was revealed as "1-2 days per week" for stationary Internet connection, and "6 days and more" for mobile Internet connection. The largest proportion of fruit farmers' daily Internet frequency of use was "1-2 hours per day" for stationary Internet connection, and "less than 1 hour per day" for mobile Internet connection.

Proportion values were used to rank fruit farmers' Internet surfing activities. A comparison of their online activities using stationary Internet versus mobile Internet revealed there were statistically significant differences in seven areas. Hebei fruit farmers used mobile Internet more for communication whereas they used stationary Internet more for obtaining knowledge and information.

Nearly half (46.34% and 49.18%) of the fruit farmers identified themselves as having a high preference for obtaining agricultural education and information via the Internet. A comparison of their preference in obtaining agricultural knowledge and information through the Internet, revealed a statistically significant difference. Farmers' preferences in obtaining agricultural information via the Internet was higher than their preference for obtaining agricultural knowledge via the Internet.

Proportion values of fruit farmers' currently utilizing sources for obtaining agricultural education and information were used to rank the 24 source options. The Internet-oriented channels ranked outside of the top ten. Focusing only on the Internet channels, the most frequently applied online paths for obtaining agricultural education and information revealed, "agricultural media's websites" as the most popular online path, which was followed by "free searching", "official websites of agricultural departments" and "privately run professional agricultural websites".

Proportion values were used to rank agricultural knowledge and information subjects the fruit farmers adopted via stationary Internet and mobile Internet networks. By comparing the subjects focused on agricultural knowledge and information farmers obtained via stationary Internet and mobile Internet networks, a statistically significant difference was revealed in five subjects. Fruit farmers used stationary Internet more for knowledge adoption

regarding “plant disease/pest control”, “organic fertilizer use”, “farm chemical use”, “organic farming”, and “marketing information of farm products.”

Proportion values for fruit farmers’ preference in obtaining agricultural knowledge and information through the Internet were used to identify the perceptions held by the farmers regarding the credibility of agricultural knowledge and information disseminated online. The overall credibility farmers indicated for Internet-disseminated agricultural knowledge and agricultural information was 50%. Statistically significant differences were revealed when comparing the perceptions of credibility fruit farmers held for Internet-obtained agricultural knowledge and agricultural information; fruit farmers considered agricultural knowledge found online to have better credibility than agricultural information found online.

The highest ranked reaction fruit farmers had regarding the agricultural knowledge and information they obtained via the Internet was “Decided whether or not to apply after discussing with other farmers”. The reactions of “Trust and directly apply” were ranked 4th followed by “Don’t trust and won’t apply to actual farming.”

The highest ranked obstacle for fruit farmers regarding agricultural education through the Internet was “Don’t have appropriate device.” One quarter (25.0%) chose “Can’t find relevant information on the Internet” as an obstacle. Less than one quarter (23.3%) indicated “Online information is inaccurate” as an obstacle. When focusing on fruit farmers’ reactions when facing obstacles in using the Internet for agricultural education, nearly two fifths (39.6%) indicated that they would try to find solutions to their obstacles by themselves. Less than one third (30.1%) indicated they would ask young people for help, and nearly the same number (29.3%) indicated they would consult their families for solutions.

One-third (33.3%) of fruit farmers indicated that they had heard of training courses for teaching farmers how to use the Internet although less than a tenth (6.14%) indicated they had undertaken such training. Over one quarter (27.1%) had heard about online courses for agricultural knowledge and technology. Less than 8% had actually taken an online agricultural education course. Over 8% had obtained information via Internet before taking a relevant agriculture education program offline.

The following chapter will be devoted to discussing the findings revealed in this chapter. A discussion of the findings in the current study is also related to previous literature on Internet usage.

CHAPTER 5. FINDINGS AND DISCUSSION

The basic focus of this study was to analyze the extent to which fruit farmers from Hebei Province are using both stationary Internet and mobile Internet to acquire agricultural knowledge and information. In order to explore this focus, the study was designed to: (1) identify select demographic information about Hebei fruit farmers; (2) determine Hebei fruit farmers' use of Internet-related devices and the Internet; (3) identify Hebei fruit farmers' perceptions regarding the Internet and its use; (4) identify the perceptions of Hebei fruit farmers regarding sources of information and its use; (5) evaluate Hebei fruit farmers' opinions regarding the credibility of online agricultural knowledge/information; and (6) identify the obstacles that Hebei fruit farmers face as well as their reactions to these obstacles.

This study was designed using a questionnaire as the survey instrument. The questionnaire was comprised of various types of questions, including open-ended questions, dichotomous questions, multiple questions with/without "select all that apply", and ordinal scale questions.

The results for each research question described in Chapter 4 are presented in the following subsections based on discussion relevant to: (1) Demographic Information; (2) Use of Internet-related Devices and the Internet; (3) Perceptions Regarding the Internet and Its Use; (4) Perceptions Regarding Sources of Knowledge/Information and Its Use; (5) Credibility Opinion; (6) and Obstacles and Reactions.

Demographic Information

Age

Of the sample population, 69.28% of the respondents were identified as male, which is twice that of female respondents. The average age of male fruit farmers was four years older than female farmers. More than half (53.62 %) of fruit farmers indicated their age range was between 36 to 55; the fruit farmers aged younger than 35 represented less than one-fifth (19.38 %) of the total, which has a similar percentage as the fruit farmers aged over 55 (19.45 %). The number of fruit farmers who indicated their education level was no higher than junior middle school level consisted of more than seventy percent (71.8 %) of total respondents. One-fifth (19.4 %) of the respondents indicated they had achieved a high school-level education.

The findings of this study revealed that few new features are different from the old perceptions people have about the fruit farmer in Hebei Province. Previous studies have indicated Hebei fruit farmers' age distribution as reflecting an aging farm population. It was revealed that 94.1% of fruit farmers are older than 45, 35.2 % of the total number of fruit growers are older than 50 years , and only 4.3 % of fruit growers are younger than 40 years old in Hebei (Zhou S. , The Analysis of Pear Production Labor Costs with Different Cultivation Patterns in Hebei Province, 2012). However, according to the findings in this study, the aging problems of Hebei fruit farmers are somewhat less intractable. Less than half (49.32 %) of fruit farmers are older than 45, though the ratio is still high. Fruit farmers between 25 and 45 years old comprised half of the respondents. According to the *Interim Regulations on the Retired and Resigned Workers* which issued by the State Council of the People's Republic of China (National People's Congress, 2016), Chinese people's working-

age had been defined between 16-60 for male and 16-55 for female, which indicates that the ages of 45 to 60 is the dividing stage between early adulthood and old age. This percentage of fruit farmers in the early adult hood group of 45 years and younger can be considered as somewhat optimistic.

Education Level

The education distribution findings in this study are in line with findings in previous studies (Zhou S. , The Analysis of Pear Production Labor Costs with Different Cultivation Patterns in Hebei Province, 2012) that have indicated the labor population enrolled in the fruit growing industry in Hebei has restricted education experience. Seventy-six percent of pear growers with an education level are below 9 years of age, a junior middle school level. In this study, 71.8% of fruit farmers hold a maximum education level no higher than junior middle school, and less than one-fifth of the fruit farmers have an education level of high school and higher. This indicates fruit growers have a very basic knowledge. Fruit farmers with less education may have less ability to obtain agricultural knowledge and information from formal education channels, and maintain an underutilized association with social networks of agricultural knowledge and information dissemination. The relevant adverse effects could impact the intensity of labor input, extent of implementation of updated technology applications, and adoption of novel approaches, to name a few.

Gender

In contrast to many previous research results, one contradictory finding from this study regards the gender distribution of fruit farmers in the Hebei Province. According to the study, the proportion of male farmers to female farmers was approximately 2.31:1, which means nearly 70% of respondents were male fruit farmers, whereas female fruit farmers comprised

no more than one-third of the total. This ratio of male to female fruit farmers is quite different from previous studies' findings that indicated the rural male labor force is frequently engaged in heavy labor industry, such as outfitting, and has migrated away from rural areas and, consequently female farmers have taken over the majority of the farming activities in rural China (Yang, Zhang, Wang, & Zhang, 2017). Another study concluded that "male labors are more part-time engaged in transportation, construction and decoration industries, which lead the female labor force accounts for about 94% of the Hebei fruit growing field" (Zhou S. , 2012, p. 15).

According to the current study, the fruit growing industry in Hebei Province actually engages male farmers twice as much as female farmers. In fact, this finding is reflective of the natural attributes of fruit growing as a labor-intensive industry; it can also be interpreted that farmers are able to get sufficient profit from growing fruit, which attests to the willingness of the male labor force to work in fields instead of migrating to other places.

Use of Internet-Related Devices and the Internet

Devices

Less than half of the respondents in this study indicated that their family has owned personal computers as compared with ownership rates of laptops and tablet PCs at 8% and 7%, respectively. Such ownership rates are high compared with the same statistics only a few years ago (Wang, 2016). By focusing on another Internet accessible device, "cellphones" ownership rates have risen dramatically to 97.8%; two-fifths of cellphone owners have reported their cellphones were "smartphones," and more than half of cellphone owners identified they have signed up for mobile Internet access service with a telecom operator. Notably, during the past several years, the rise in computer use by fruit farmers has not been

as intense as the increase in cellphone penetration; an over 50% mobile Internet-access rate indicates this change has occurred in farmers' Internet accessing habits.

Frequency of Internet Use

The higher frequencies in mobile access Internet surfing at either weekly or daily time frames indicate that fruit farmers are utilizing mobile devices to access the Internet in the Hebei Province. However, this finding should be analyzed with caution because a high number of respondents skipped these questions.

The findings in this study are in line with the findings published by the China Internet Network Information Center in its 2015 China Rural Internet Research Report (2016). The CNNIC found that stationary Internet development met a bottle neck with some difficulties with stationary Internet penetration, but mobile Internet use has risen as the first choice of rural farmers for accessing the Internet. The proportion of farmers using mobile Internet in rural China is much greater than the proportion of PC-Internet users (63.4%) and laptop-Internet users (25.6%).

Utilization Purpose and Differences

The proportional ranking of stationary Internet surfing purposes was revealed to be different than the purposes of mobile Internet surfing. Even though some purposes overlapped in the first five rankings, purpose rankings regarding different Internet access formats were different, though the purpose of "Contact family" remained the first ranking for both formats of Internet access.

Notably, communication and entertainment needs were ranked as the top two for Internet surfing purposes among fruit farmers, no matter whether the access was stationary or mobile. In the mobile Internet access format, the highest-ranked purpose regarding

agricultural education and extension was “Obtaining agricultural technology and knowledge” which was fifth. The highest ranked purpose regarding agricultural education and extension was “Obtain farming product information” at third, followed by “Obtain marketing information” at sixth, and “Obtain agricultural technology and knowledge” at seventh.

Notably, agricultural education- and extension-related purposes constitute higher rankings in a mobile versus stationary Internet access format; however, according to frequency and proportion, more fruit farmers preferred to obtain agricultural technology and knowledge via stationary Internet over the other formats. This consequence may be associated with the characteristics of Internet formats. Previous researchers indicated that mobile Internet devices are very handy and easy to carry by consumers, but are more challenging for inputting or outputting information, and also hold lower “multimedia processing capabilities than do desktop computers” (Chae & Kim, 2003, p. 241).

On the other hand, despite the tremendous growth of cellphones and mobile Internet service, there is a lack of a mobile Internet-based learning framework which may present a new variable resulting in a difference in Internet use. More than 14 years ago, Chae and Kim (2003) found that, compared to the sources provided by the stationary Internet, most mobile Internet systems generate a lower level of available resources. Nearly a decade ago, pioneering researchers in mobile learning concluded that wireless Internet–based and mobile Internet-based learning platforms were still in infancy or an embryonic stage (Motivalla, 2007); such conclusions might still remain valid regarding the findings in the current case study.

The findings of this study also revealed that there were significant differences between the purpose of Internet surfing regarding the types of Internet access. Significant differences

in Internet surfing purposes existed at the 0.05 level of significance for “Contact families,” “Contact other farmers,”, “Obtain agricultural technology and knowledge,” “Obtain farming product information,” “Obtain marketing information,” and “Purchase daily groceries.” Negative *t*-values for the variables “Contact families” and “Contact other farmers” indicated that both of these purposes had greater mean values for mobile versus stationary Internet access format. This finding provides evidence that fruit farmers use mobile Internet more for communication purposes and stationary Internet more for informational and knowledge adopting purposes as well as actual material-obtaining purposes.

The findings illustrated the rankings of Internet surfing purposes and differences regarding the formats of Internet access, but did not identify explicitly the reason such differences exist. Although it may be easy to consider convenience and efficiency as reasons fruit farmers conduct mobile Internet surfing basically as a communication function, it does not indicate any reason that may lead fruit farmers to prioritize stationary over mobile Internet formats for knowledge and information obtaining purposes.

Perceptions Regarding the Internet and Its Use

According to the research design, respondents were asked “What perceptions do you have about obtaining agricultural knowledge and information through conventional or mobile Internet devices?” A greater proportion of fruit farmers preferred to obtain agricultural knowledge and agricultural information through the Internet at a “moderate” level. Based on previous findings, fruit farmers used the Internet on a weekly and daily basis, and indicated their Internet surfing purposes as “Obtaining agricultural technology and knowledge.” Thus, preferences fruit farmers hold for obtaining knowledge via the Internet was neither high nor low, but moderate.

In further analysis of the perceptions held by Hebei fruit farmers regarding preferences for obtaining agricultural knowledge and information via the Internet, significant differences were observed. Fruit farmers' preferences of obtaining agricultural information via the Internet were significantly higher than obtaining agricultural knowledge via the Internet; some factors may contribute to fruit farmers' perceptions of obtaining agricultural knowledge via Internet, which lead fruit farmers to have a stronger preference for obtaining information about agriculture than obtaining agricultural knowledge through the Internet.

Perceptions Regarding Sources of Knowledge/Information and Their Use

Sources

Twenty three education and information-adopting channels were identified after summarizing the current sources fruit farmers use to obtain agricultural knowledge and information in Hebei Province. The proportions and rankings of the currently applied channels regarding farmers' actual adoption indicated that the most commonly adopted channels of agricultural knowledge and information-obtaining were conventional agricultural education and extension channels, such as "Agricultural TV channels," "Local farm material dealer," and "Agricultural technology books." "Family members" and "villagers" took the top two rankings among all channels. Nevertheless, the highest-ranked agricultural knowledge- adopting channel related to the Internet, which was applied most frequently by fruit farmers was "Free searching online when it is necessary," which was ranked 11th among all channels. Such a ranking demonstrates that Hebei fruit farmers have not employed Internet-based channels as a priority for obtaining agricultural knowledge; rather, are fixed firmly in utilizing conventional approaches.

These results on rankings of sources are in the line with current national conditions in China. For a long time, the agricultural education and extension efforts in China have relied

on interpersonal communication as their major format; such a format has an advantage of being convenient and efficient, and enabling strong interactivity, which has been familiar to rural farmers and adopted in the past several decades (Fang, Wu, Jiang, & Liu, 2012; Tan B. , 2016). This precedence may have led farmers to identify family members and village neighbors as priority knowledge sources. In contrast with United States, which provides legislative protection and high support to agricultural education and extension, agricultural education and extension services in rural China have been challenged for a long time with an all-encompassing system with limited financial support. This has led to the development of agricultural media, like agricultural TV channels, radio, and newspapers, to play irreplaceable and elemental roles in education and extension in rural regions, as it is cost-effective and reaches a wide audience (Fan, 2004; Zhang Y. , 2013). Therefore, it is generally understandable that fruit farmers show a high advocacy for agricultural media as extension and education channels. Currently, fruit farmers' preference for agricultural media has extended to the Internet era. Such support and preference has been identified through the frequency assessment conducted in this study, as "Online paths usage" by fruit farmers for knowledge and information adoption.

Online paths

Ten online paths of agricultural knowledge adoption were evaluated in this study. The findings indicated "Agricultural media's website" as ranked 1st among online paths for obtaining agricultural education and information by Hebei fruit farmers, followed by "Freely searching online by using key word," "Official websites of agricultural department," "Private run professional agricultural website," and "Join specific WeChat groups." This 1st ranking matches results that emerged from previous parts of this study, in which agricultural media plays an important role in agricultural and extension education in China. Notably,

agricultural media was identified as having a valuable, even vital, role in fruit farmers' agricultural education and extension processes.

Several active and passive factors may have influenced fruit farmers to choose conducting free agricultural knowledge or information searches online. On one hand, fruit farmers have the right and freedom to search whatever they would like online, an action that could provide concrete and updated knowledge and information with high-efficiency and convenience to the Internet consumer. On the other hand, fruit farmers have less understanding about adequate Internet-based ports and resources for professional knowledge and information adopting, as well as any deficiencies in the professional agricultural-related web portal (Xu & Niu, 2010).

On one hand, it is understandable why fruit farmers have ranked "Official websites of agricultural department" as their 3rd preference for informational sources, as one major purpose of the official websites of the agricultural department is to identify and propagandize agricultural information. On the other hand, the "Official websites of agricultural academic institutions" were ranked far behind (10th) "private run professional agricultural websites," which ranked 4th and is, therefore, worthy of discussion.

There are some clues why Hebei fruit farmers ranked agricultural academic institutions' web portal as low on the list of information sources, and "didn't pay enough attention to web portal setting" which would be one of them. Xu and Niu's (2010) research indicated that "the agricultural colleges' and institutions' website construction in Hebei is still in its primary stage. The majority of agricultural colleges do not have dedicated websites, and many agricultural colleges' websites are either inaccessible or slow to update. Among all agricultural colleges' and institutions' web portals only Hebei Agricultural

University's websites have a wide influence on aspects of personal training, academic research, and distance education with practicable content in technology and information" (p. 10).

In China, the agricultural academic institutions, especially those at provincial levels, carry agricultural education and extension responsibilities, which is why agronomy experts and technicians of individual agricultural subjects from provincial academic institutions frequently visit rural areas and provide face-to-face education and extension programs to farmers. As the conventional education and extension undertaker, agricultural academic institutions in Hebei still stick to traditional knowledge and technology dissemination approaches, despite the fact that fruit farmers do have needs for obtaining education via other channel formats. As a consequence, privately run professional agricultural websites have taken the place of other channels, and fulfill fruit farmers' demands.

Regarding another finding of this study, it was not a surprise to note that Chinese-based WeChat was ranked 5th by fruit farmers as their online path of agricultural knowledge and information adoption. WeChat is a free, cross-platform and instant messaging application developed by the Chinese Internet company Tencent (Wikipedia, 2017). As the most popular and widely used Chinese-made app, WeChat combines different social networking functions altogether, and can support cross-communication operators and cross-operating system platforms by sending videos, voice, pictures, and texts via mobile phone, tablet, and webpage quickly and without charge. Since 2011, such advantages have turned this six-year old app into an extremely significant channel of information and content distribution in China (Li, Luo, & Zhang, 2014). According to *Tencent Announces 2016 Third Quarter Results* (2016), the global monthly active user of WeChat reached 846 million people. With the

encompassing functions and large number of users, WeChat has been applied in information and content distribution with diversified purposes nation wide.

WeChat has also been widely used in the agricultural information service field (Li, Luo, & Zhang, 2014). Studies in recent years have indicated WeChat used in agricultural information services has been found to encompass various subjects associated with agriculture; traditional agricultural hotlines, which mainly provide expert consulting services and agricultural information, have been converted and implanted into WeChat (Li, Luo, & Zhang, 2014). Towns in Guangdong Province have applied WeChat in service trading malls for agricultural products, small-web services for technical advice, and information propagation (Liu, He, Xie, & Cao, 2016).

Establishing a WeChat platform for promoting the development of journals of agricultural science and technology has been put on discussion boards by researchers in recent years (Lin, 2015). Agricultural management scholars have also practiced utilizing WeChat to ensure the collection, storage, and transmission of information about temperature, humidity, and light intensity in traditional greenhouse production is secure (Ye, 2015). These examples support the current study's findings regarding farmers' use of WeChat. By further considering the growing population of rural mobile Internet users and the pervasive lag of WAP (wireless application protocol) web portal establishment in educational institutions (Zhang, Zhang, Zhao, & Wan, 2011), fruit farmers' reliance on WeChat for agricultural knowledge and information adoption can be seen as inevitable.

Types of knowledge and information

Among the summarized types of knowledge and information which Hebei farmers acquired most, 10 knowledge and information types have been identified and evaluated by fruit farmers. The proportional scores of these knowledge and information subjects indicated

the general required elements of the specific knowledge and information by fruit farmers. It seems fruit farmers hold higher demands for agricultural knowledge and technologies than agricultural information. By taking a look at the top five knowledge and information subjects identified by fruit farmers regarding both stationary and mobile Internet access, all of the top five subjects were about agricultural knowledge (except the third ranking subject in terms of mobile stationary access was "Never obtain information through mobile Internet"). The findings of this part of study identified the top five agricultural knowledge subjects as "Plant disease/pest control," "Meteorological disaster prediction and prevention," "Conventional fertilizer use," "Organic fertilizer use," and "Farm chemical use." These knowledge subjects represented fruit farmers' knowledge-obtaining focus, compared with marketing information about either farming materials or farm products. Fruit farmers from Hebei paid more attention to the fruit growing stage, which can be further interpreted as the respondents indicated a strong desire to produce fruit products with a high quality or high yield.

Another discussable finding was "Never obtain agricultural knowledge/information through stationary/mobile Internet" response which was ranked 6th and 3rd for stationary and mobile Internet access categories, respectively. Nevertheless, the aforementioned findings of this study indicated that, compared with obtaining knowledge and information via conventional channels, fruit farmers' willingness and habits using the Internet are comparatively weak. However, findings in this study are in line with those from other studies, which revealed that the overall literacy level of farmers in China is nominally sufficient; this is a serious handicap for farmers who want to freely search information, and it also restricts their abilities to receive novel information (Zhang Y. , 2013).

Significant differences between agricultural knowledge and information subjects regarding the stationary Internet and the mobile Internet were observed in six agricultural knowledge and information subjects. The subjects where significant differences existed at the 0.05 level of significance were “Plant disease/pest control,” “Organic Fertilizer using,” “Farm chemical using,” “Organic farming,” and “Marketing information of farm product.” In other words, farmers rely on stationary Internet access more for these subjects than on the mobile Internet.

As previously mentioned, the web-based knowledge and information obtaining channel has barely been adopted by rural residents in China, whereas mobile Internet channel’s adoption by the farmers was even less. Along with this overall grim situation, several other findings of Wang (2016) and Zhao et al. (2016) also pointed to a few additional predicaments associated with the findings obtained in this part of the study.

Wang (2016) indicated that a farmer’s handicaps lead to weak mobile Internet utilization for obtaining knowledge and information in three ways:

1. *Lack of appropriate mobile Internet-based education solution-planning.* Developing mobile Internet-suitable APPs or WAPs for agricultural education and extension purposes requires large numbers of technicians who are well acquainted with both information technology and agriculture; however, the reality is that while IT technicians know a lot about technologies, they know little or nothing about agriculture. Farmer populations do have potential demands, but they have no capability to investigate APPs or WAPs.
2. *Low profits and target audiences lacking relevant knowledge.* APP developers and staff may not necessarily witness the need for developing mobile APPs or WAPs with

agricultural education or extension purposes, or at least agricultural knowledge and information distribution purposes;

3. *Required regulation is absent.* The agricultural extension APP development and popularization movements are supposed to be based on farmers' actual demands; however, supervision of the project development work has not been conducted well, which has led the focus of many application development teams to divert from the required product. According to Zhao et al. (2016), the agricultural and extension education providers' low Internet penetration has yielded negative impacts on mobile Internet-based agricultural education and extension.

In conclusion, the findings from this study revealed that, compared to the agricultural information subjects, the subjects that fruit farmers access most via the Internet are related to agricultural knowledge, and fruit farmers obtain this knowledge via stationary Internet more than mobile Internet. This finding replicates what has been emphasized in previous studies—although the smartphone is used widely in the countryside, due to a lack of Internet knowledge, agricultural education and extension providers' inadequate awareness as well as many other factors, the benefits and utility of mobile Internet-based agricultural education and extension have not been well established.

Credibility Opinions

Reliability of online agricultural knowledge and information

Even though Internet-based channels have not become a mainstream avenue to Hebei fruit farmers for obtaining agricultural knowledge and information, most people, including farmers, rely increasingly on the Internet. This trend has been acknowledged by China Rural Internet Research Reports released by CNNIC. According to Flanagin and Metzger (2000), information obtained via the Internet is abundant, easily available, and often comprehensive;

however, web-based information typically undergoes a relatively less checked or even unchecked editorial process prior to diffusion to the public. As a consequence, web-based information may be intentionally or unintentionally inaccurate, biased, or misleading, which has subjected the growth of the Internet to potential fraud and misinformation.

As is the same with every Internet user, farmers with agricultural knowledge and information demands must also deal with knowledge and information inaccuracy when they are using the Internet. Fruit farmers' perceptions about the credibility of agricultural knowledge and information distributed via the Internet was studied using descriptive statistics in this research. Fruit farmers were asked to indicate the credibility they would give to the Internet-distributed agricultural knowledge and agricultural information based on their actual experiences and inherent ideas. More than 45% and 52% of the fruit farmers evaluated the agricultural knowledge and information, respectively, disseminated online was reliable with 50% credibility, while 45.01% and 37.64% of fruit farmers considered Internet-based agricultural knowledge and information, respectively, as relatively reliable with 75% credibility.

The Wilcoxon matched pairs test was applied to reveal the overall credibility farmers assigned for Internet-disseminated agricultural knowledge and information at 50%, and also helped identify a significant difference between the credibility of Internet-distributed agricultural knowledge and agricultural information. Hebei fruit farmers considered agricultural knowledge diffused online as more reliable than agricultural information. This finding is interesting, as previous researchers have found that the convergence of information on the Internet is unlike that of conventional print publishing, and that Internet-based information is difficult to be distinguished visually from advertising and actual information

(Tate & Alexander, 1999); consequently, it is "problematic for people trying to establish the credibility of online information" (Metzger, Flanagin, & Zwarun, 2003, p. 273). Another researcher found a positive correlation between the credibility of Internet-based information and users' reliance on the Internet (Zhang M. , 2005); in other words, the more the Internet is used, the higher the trust in Internet-based information and other online content. Recalling the findings from the previous section, which indicated that fruit farmers obtain agricultural knowledge more than agricultural information via the Internet, discussion should be made of whether the credibility difference eventually leads farmers to adopting agricultural knowledge more than information via the Internet, or that farmers' actual demands influence their perspectives of credibility.

Media credibility is another research arena not integrated into this study, as the objective of this study was to reveal fruit farmers' general perceptions of the knowledge and information they could obtain online. Such findings did not surface through procedures regarding the media credibility research approach, although they do illustrate perceptions fruit farmers' may have and echo the following finding about fruit farmers' acceptance of agricultural knowledge and information obtained via the Internet.

Actual reaction

As a whole, in terms of the actual reactions Hebei fruit farmers usually have about Internet-adopted knowledge and information, a majority of fruit farmers treat knowledge and information obtained via the Internet with circumspect and caution. The most frequently applied solution to deal with potentially unreliable information is communicating with other farmers, followed by verifying the knowledge with technicians. Previously in this study, it was revealed that interpersonal communication was ranked as the number one format for agricultural education and extension in China, making the ranking of family members and

village neighbors as the first or second reliable sources of knowledge and information verification an understandable finding as well (Fang, Wu, Jiang, & Liu, 2012; Tan B. , 2016). However, the discussion should not stall at why families and village neighbors are the priority validation sources for Internet-obtained materials. It may be necessary to consider the reason a majority of farmers perceive they need to validate information versus trusting and applying the knowledge directly.

At the very first, perception of credibility seems to induce verification activities of farmers; nevertheless, those actions that cause questionable credibility are worth discussion. The previous findings of this study indicated that authoritative departments and organizations in agricultural and extension education did not take enough effort to develop and construct Internet-based information, whereas the demands of web-based agricultural and extension education have resulted in the discovery inaccurate and unreliable content and material as well as dissemination online. One may perceive the network functions entirely as a chaotic online community, with all kinds of voices from all types of sources encroaching here and there, and it is difficult to distinguish what information is accurate or inaccurate. This stands in contrast to traditional published content on the Internet, where Internet users are "consumers of content created by a relatively small number of publishers" (Kim & Muhammad, 2013, p. 438). Unregulated and self-supervised content complicates the quality of the information online and, as a consequence, "information seekers have to validate the quality of social media content further to personally judge the reliability of the content providers" (Kim & Muhammad, 2013, p. 438).

Obstacles and Reactions

Obstacles

In order to determine the circumstances that impede Internet knowledge and information adoption in this study, fruit farmers were asked to identify the handicaps they encounter by category when obtaining agricultural education and information through the Internet. The means and standard deviations of these identified obstacles indicate that the single top handicap was "Don't have appropriate device." It is worthwhile to discuss this finding.

On one hand, despite the aforementioned findings in this study or other researchers' findings on the same topic, the adoption ratio of stationary Internet-accessible devices, like PCs or laptops, was less than 50% in rural China, which means the finding about the lack of device as an obstacle is understandable. On the other hand, although high cellphone usage rates and rapid development of the mobile Internet have promoted a greater potential for dissemination of agricultural knowledge and information, farmers have not yet accepted cellphones as appropriate devices for obtaining agricultural knowledge online. Farmers' capabilities and critical assessment of the use of cellphones and the mobile Internet remains untapped. Such a finding is in line with those of Zhang X (2012), who observed that most farmers have no idea whether they are using 2G or 3G networks, or WiFi. Farmers do not usually focus on a cellphone-related channel as their access to information is still highly reliant on traditional social networks based on known people within their physical communities. According to Zhang X's research (2012), farmers' utilization of cellphones has not gravitated away from the embedded traditional functions of cellphones, such as regular communication, QQ chat, and game playing.

Findings in this section also revealed that “no appropriate knowledge” or “information deficiency and inaccuracy” were ranked 2nd and 3rd as stated obstacles. This finding does not conflict with the previous findings in this study. Since the Internet has not been accepted pervasively by traditional agricultural education and extension sources, and advisable and reliable agricultural content providers have not made efforts to construct the necessary Internet channels, “inappropriate, deficiency” and “inaccuracy of content disseminated on line” is not as unexpected as it may seem.

According to the findings, “Don’t know how to use it” and “Don’t know how to type” were ranked 4th and 5th as obstacles farmers face when they are trying to use the Internet. These situations have been widely observed in recent years. “Notification of Farmers’ Cellphone Application Skills Training and Information Capacity Enhancement” issued by the Ministry of Agriculture (2016) on October 2015 attested to this occurrence. According to this nationally issued notification, cellphone use training is an urgent need of farmers. Governmental agricultural departments have begun cooperating with various divisions and have attempted to empower farmers in terms of cellphone use by: (1) accelerating the compilation of training materials; (2) focusing on building instructor teams; (3) holding offline competition activities; and (4) selecting agricultural APPs and mobile terminals that are deemed outstanding. According to the current plan, quarterly assessment of this nationwide cellphone training is being instituted in 2017.

Reactions

In the analysis of the farmers’ reactions to facing obstacles using the Internet to obtain agricultural education and information, the mean and standard deviations of the reaction categories selected by fruit farmers indicated “Try to find the solution by self” ranked 1st followed by “Ask families for help” (2nd) and “Ask young people for help” (3rd).

"Completely giving up on the Internet" was ranked 4th. Of those surveyed, 39.36% of fruit farmers indicated that they would figure out the issues by themselves, 29.3% gave positive responses to family-centered solutions, and 30.1% of the famers asked young people for help. These three percentages were higher than "give up" which was 22.9%. This finding actually provides a positive signal that "giving up" on the Internet when facing obstacles was not a primary reaction for the fruit farmers. The finding might be interpreted as the fruit farmers actually value the Internet as one education and information channel, and consider it worthy to reconsider despite the overall circumstances that the Internet has not yet been involved in fruit farmers' daily production and lives to a great extent. However, this might be an arguable finding in this study since there is an absence of research on the reactions of farmers who face Internet impediments in China.

Lack of training

Farmer participants in this study frequently lacked general skills in applying the Internet as a tool and using it to benefit their farming production, despite holding positive perceptions about the Internet as a communication and education source. The findings revealed the farmers' knew very little and lacked opportunity to consider Internet training and online education courses. Approximately one-third of fruit farmers were aware of training courses to use the Internet, and slightly more than one-fourth were aware of the existence of online courses in agricultural knowledge and technology. Only 6% had actually engaged in Internet training sessions designed for farmers, and slightly less than 8% took an online agricultural education and extension course. The proportion of farmers who reported obtaining certain information through the Internet or taking a relevant agricultural education courses offline was 8.2%. As a channel designed to carry information as its mainstream function, fruit farmers revealed minimal usage of the Internet as an education source.

There may be several factors leading to the sparse recognition of Internet training for efficient utilization and low participation in online agricultural courses. This researcher considered possible sources related to the lack of basic training programs and online course instruction to educate these farmers about current agricultural knowledge and information to improve their fruit farming practices. At the time of this study, no specific academic study themes concerning rural Internet utilization were found in one of the primary bibliographic databases, CNKI, in China. Existing studies have covered information technology development and farmers which were conducted by Chinese scholars focusing basically on the following aspects: (1) national and regional rural Internet infrastructure construction, general service conditions, and their influence (Li W. , 2010; Zhang C. , 2012; Liu D. , 2013; Geng, 2015); (2) general importance and discussion and analysis of the relationship between the Internet and farmer empowerment (Chen, 2009; Gong, 2014; Liu & Zhao, 2016); (3) feasibility, formation, and current status discussion of applications of the Internet as a way to train farmers (Zhai, 2013; Xia, 2015; Lv, 2016); and (4) discussion about the format of Internet-based courses on agricultural business, marketing, finance, and farmer's increasing incomes (Huang, 2013).

From these research foci, existing studies have been concerned with "hardware construction" of the Internet and the Internet's "practical effect," but have not provided enough assessment related to how farmers can be trained to apply agricultural practices utilizing information technology instruments currently available to them. This finding from the current study revealed that there was a limited number of farmers who had actually been informed that training on Internet usage is available, and the number of farmers who actually took such training was much less. The Internet could be a valuable instrument for farmers in

adopting knowledge and information, but it has not been readily accepted by the farmers, themselves. A lack of adequate training could be a cause of this. The same situation also has been found in online agricultural courses. If only a limited number of farmers have been informed of such online courses, how can one expect there would be enough farmers to take a course online, much less benefit from it?

Finally, there are currently only a few farmers who have obtained information online and taken a course offline. Possible factors that might have contributed to this finding may be consistent with issues discussed previously. Farmers have not yet accepted the Internet as their mainstream information-adopting channel, and they have reservations about the credibility of Internet-distributed information; therefore, a lack of responses to this question is understandable.

Summary

Findings on the study reveal much about fruit farmers in Hebei Province. When considering age, more than half of the farmers identified their age as between 36 and 55 years; fruit farmers younger than 35 years were of a similar percentage as fruit farmers older than 55 years, and each of these groups represented less than one-fifth of the total. By taking the 45 year age point as one demarcation of early adulthood and adulthood, less than half of fruit farmers older than 45 and the fruit farmers between 25 and 45 constituted the other half of the respondents.

One revealing statistic of Hebei fruit farmers uncovered in this study was that more than 70% had attained an education level equivalent to junior middle school, and less than one fifth attained an education level of high school or higher. Thus, fruit farmers with minimal formal education may have less capacity to obtain agricultural knowledge and

information from educational channels, and may also be challenged when using social networks that disseminate agricultural knowledge and information.

The proportion of male farmers to female farmers was approximately 2.31:1, which means that nearly 70% of respondents were male fruit farmers, thus female fruit farmers made up no more than one-third of the total. This result indicates that the fruit growing industry in the Hebei Province actually engages male farmers twice as much as female farmers. This finding attests to the natural attributes of fruit growing as a labor- and cost-intensive industry. It could also be interpreted that farmers receive sufficient profit from growing fruit, which may guide those in the male labor force as having the willingness to work in such a field instead of migrating to other places.

Less than half of the respondents indicated that their family owned a personal computer, with the ownership rate of laptops and tablet PCs as eight and seven percent, respectively. Cellphone ownership rate of Hebei fruit farmers was 97.8%. Two-fifths of cellphone owners reported their cellphones were “smartphones” that were mobile Internet-accessible. Such a finding might indicate the potential for farmers Internet access habits to change.

Hebei fruit farmers’ average length of Internet use was “three to four days per week” for mobile Internet users and “two to three days per week” for stationary Internet use. The frequency of Internet use per day was slightly greater for mobile Internet access, with “three to four hours per day” versus stationary Internet access at “two to three hours per day.” The higher frequencies in mobile-access Internet surfing on either weekly or daily scales may indicate that fruit farmers are utilizing mobile Internet more frequently in Hebei Province.

When ranking the proportion of fruit farmers' Internet surfing purposes regarding stationary- and mobile-Internet access formats, the agricultural education- and extension-related purposes revealed higher rankings in mobile-Internet access formats than stationary Internet access formats; however, according to the means and standard deviations, more fruit farmers preferred to obtain agricultural technology and knowledge via stationary Internet than the other format.

Fruit farmers associated mobile Internet more for communication purposes, but associated the stationary Internet more for information and knowledge adopting as well as for actual material obtaining purposes.

The findings regarding the channels for obtaining agricultural education and information revealed that Hebei fruit farmers have not used Internet-based channels as their primary method for obtaining agricultural knowledge. Most stood firmly on the use of conventional approaches.

Fruit farmers considering agricultural knowledge diffused online ranked agricultural information as more credible.

The majority of fruit farmers tended to treat their obtained knowledge and information with circumspection and caution. The most frequently applied solution to averting skepticism was communicating with other farmers, followed by verifying the knowledge with technicians.

Only one-third of the fruit farmers had some idea of the training that teaches farmers how to use the Internet, and slightly more than one fourth were aware of the existence of online courses in agricultural knowledge and technology.

Even though cellphone ownership rate is high among fruit farmers, most fruit farmers have not yet adopted the cellphone as an adequate device for obtaining agricultural knowledge online, and farmers' recognition of and capability in using cellphones and the mobile Internet are limited.

An analysis of farmers' reactions when facing obstacles using the Internet to obtain agricultural education and information indicated that the lowest percentage was comprised of fruit farmers who would give up on using the Internet when they encountered obstacles while surfing the Internet. Most fruit farmers actually valued the Internet as one education and information channel, and considered it worthy to learn more about, despite the overall circumstance that the Internet has not been involved in educating fruit farmers' in matters concerning daily production.

The findings of this research reflect the theoretical framework utilized to guide the study. Fruit farmers' basic Internet use abilities directly influence their Internet use for education and extension purposes, which is on the same track as that advocated by constructivism—learning occurs when obtaining new knowledge based on old knowledge. In addition, in contrast to conventional agricultural education and extension processes, Internet-based agricultural education and extension provides fruit farmers with more freedom to obtain agricultural knowledge and information. Farmers who are engaged in Internet-based education processes also have more freedom and autonomy to learn as opposed to following a single instructor who may convey a single interpretation of specific knowledge. Fruit farmers need to show a high degree of responsibility for their conduct regarding the learning program as indicated by distance learning theory for distance learners. Andragogy theory addresses "self-directed", "problem-centered" and "best motivated by internal factors" as

three of five assumptions regarding adult learners. Although other factors may also be considered as reflecting andragogy theory, farmers in this study specifically preferred “free searching” to gain agricultural knowledge.

CHAPTER 6. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The overall purpose of this study was to identify and analyze the degree of Internet use of one agricultural education channel in 2016 by Hebei fruit farmers in China. This chapter contains a summary, conclusions and implications based on an analysis of the findings, and recommendations for further study.

Summary

As a leading agricultural industry that has been identified in Hebei, fruit growing is a dominant horticultural production with that carries an important status in the provincial rural economy. In contrast to "bulk farm products," like corn and wheat, which have a "minimum price policy," the price of fruit products (including nut fruit) is associated with quality and determined completely by the nationwide market. Fruit farmers believe that the better the quality, the higher the price, and the better the market, the more they can earn. Thus, fruit farmers tend to care about their fruit growing more than farmers who produce other crops.

The purpose of this study was to ascertain the extent to which fruit farmers in the province of Hebei use stationary and mobile Internet to acquire agricultural knowledge and technology. The researcher sought to identify perceptions of Hebei fruit farmers regarding the Internet to obtain agricultural knowledge and information. The objectives of the study were to: (1) identify selected demographic information of Hebei fruit farmers; (2) determine Hebei fruit farmers' use of Internet-related devices and Internet; (3) identify Hebei fruit farmers' perceptions regarding the Internet and its use; (4) identify the perceptions of Hebei fruit farmers regarding sources of information and its use; (5) evaluate Hebei fruit farmers' opinions regarding the credibility of online agricultural knowledge/information; and (6)

identify the obstacles that Hebei fruit farmers face as well as their reactions to these obstacles.

A survey questionnaire was designed for this study which was comprised of six sections and contained 67 questions in total. The question types included open-ended questions, dichotomous questions, multiple-choice questions with/without "select all that apply," and ordinal scale question. The focus of each section centered on gathering the following data: (1) demographic information; (2) use of Internet-related devices and Internet; (3) perceptions regarding the Internet and its use; (4) perceptions regarding sources of information and its use; (5) opinions regarding the credibility of online agricultural knowledge/information; and (6) obstacles that fruit farmers face and their reactions to these obstacles.

The respondents of the survey in this study were sampled from six administrative areas in Hebei Province; two to three counties were selected from each administrative area. A total of 616 questionnaires were returned by respondents, and 511 of the returned questionnaires were included in the final study.

The data were transformed manually from the questionnaire to a computer, and analyzed using the statistical computer program IBM SPSS Statistical Data Editor, version 23. The demographic characteristics of the respondents were analyzed using frequencies and percentages, and McNemars' test and the Wilcoxon Matches Pairs test were used to determine differences in the dichotomous scale question and ordinal scale questions. A 0.05 alpha level was established a priori and used as a basis for determining significant differences.

Limitations

There were several limitations when conducting the study that should be addressed when considering the findings, conclusions, and implications. First, the goal of this descriptive study was to provide a general overview of the Hebei fruit farmers' Internet use regarding agricultural and extension education purposes. Six research objectives were developed; however, the objectives were limited by the researcher's prior research experience so not all of the research objectives were met within the scope of the research questions. The individual survey questions and scales on the questionnaire instrument were derived from other researchers' studies, each of which had different research purposes. Therefore, some of the questions and the scales may not perfectly reflect the research objectives. Nevertheless, after the researcher compiled the survey questions, a panel of experts was invited to validate the survey.

Second, each of the statistical tests described in Chapter 4 were applied based on the condition that the participants were obtained from a simple, random sample of farmers in the Hebei region. However, farmers were not selected in such a simple, random way for practical reasons; more administrative regions were selected for this dissertation research, and as many farmers as possible were recruited during the data collection. These data may not completely represent the results of the tests and reporting of the *p*-values. In other words, due to practical reasons, the data collected were not based on simple random sampling. Nonetheless, the relevant SPSS subprograms were applied to treat the data as if data were collected from a simple random sample.

Furthermore, technically speaking, although the fruit farmers' participation in this study was essentially voluntary, the research assistant assembled them all together for a

meeting or gathering to explain the data collection procedure. Therefore, there is a possibility that the group of farmers who eventually participated in the study were not representative of the entire population of fruit farmers in the Hebei province. For example, there is a possibility that the study participants tended to be more progressive than other farmers in their region, and this could bias the results. However, taking rural Chinese culture under consideration, Chinese rural residents are generally willing to participate in whatever is requested by their rural committee. Thus, there is a restriction on potential interpretation of the findings to some extent due to this bias.

Conclusions

Based on the results of this study, conclusions are as follows:

1. Of the large amount of younger farmers participating in the current day fruit growing industry in Hebei, fruit farmers between 25 and 45 comprised half of the study respondents. This is in contrast to the findings of Zhou S (2012) in a study of fruit growers five years ago. The fruit growing industry in Hebei engaged male farmers twice as much as female farmers, though previous studies' findings have indicated that female farmers make up the majority of the labor force in rural China (Yang, Zhang, Wang, & Zhang, 2017). Current male labor forces value fruit growing the same as many other professions to make a living wage. The labor population engaged in the fruit growing industry in Hebei has restricted educational experience, with 71.8% having achieved no higher than junior middle school, which is consistent with the previous findings from the above researcher.
2. Nearly half of the fruit farmers indicated they have computers at home. Most (98%) of Hebei fruit farmers reported they have cellphones, and more than half of the

cellphone users have signed on with mobile Internet services with a telecom company. Hebei fruit farmers surf the Internet via mobile Internet more than by stationary Internet. Communication and entertainment needs were the top two purposes fruit farmers cited for Internet surfing; agricultural and extension education purposes are ranked next. It was found that Hebei fruit farmers more strongly prefer obtaining agricultural knowledge and information via the stationary Internet than from the other.

3. Hebei fruit farmers' perceptions regarding the Internet and its use lingered at the level of "Moderate" preference, and their preference for obtaining agricultural information via the Internet was higher than for obtaining agricultural knowledge. Hebei fruit farmers use the stationary Internet more for information and knowledge adopting purposes, whereas they use the mobile Internet more for communication purposes.
4. Hebei fruit farmers' actual use of the Internet is relatively weak. The majority have not taken Internet -based sources as a main means for obtaining agricultural knowledge and information; instead they are entrenched firmly in conventional approaches for gathering knowledge and information. The highest ranked agricultural knowledge and information adopting channel related to the Internet which has been applied most by Hebei fruit farmers was freely searching online, which was ranked 11^{th} among the rankings of all channels, and far behind the traditional information source channels like "family members," "villagers," "TV channels," etc. Previous studies revealed that interpersonal communication was familiar to rural residences and has been adopted by them throughout a long history in China (Fang, Wu, Jiang, & Liu, 2012; Tan B. , 2016), along with public media, which is cost-effective and

reaches wide audiences agricultural and extension education, too (Fan, 2004; Zhang Y. , 2013).

5. The most commonly adopted online paths for obtaining agricultural knowledge and information by fruit farmers were: “agricultural media’s website,” followed by “freely searching online by using key words,” “official websites of the agricultural department,” “private run professional agricultural website,” and “join specific WeChat groups.” Previous studies have found that fruit farmers have less of an idea of the adequate Internet-based ports designated useful for adopting professional knowledge and information, as well as the actual deficiency of the professional agricultural-related web portal (Xu & Niu, 2010). Compared with marketing information subjects about either farming materials or farm products, fruit farmers paid more attention to the knowledge subjects associated with fruit growing stages and obtained agricultural knowledge via stationary Internet more than the mobile Internet. These findings are in line with some obstacles identified by other scholars, such as deficient planning of mobile Internet-based education, APP development deviation (Wang D. , 2016), and agricultural extension education providers’ lack of understanding of Internet use (Zhao, Zhu, Qin, Yang, & Han, 2016)
6. The fruit farmers rated the Internet-based agricultural knowledge and information as 50% credible. When compared to Internet-based agricultural information, Hebei fruit farmers consider agricultural knowledge as being more credible. Previous researchers have argued that the convergence of information on the Internet is unlike conventional print publishing, as Internet-based information is difficult to be visually distinguished from advertising or actual information (Tate & Alexander, 1999) and,

consequently, can be “problematic for people trying to establish the credibility of online information” (Metzger, Flanagin, & Zwarun, 2003, p. 273). Deficiencies and inaccuracy of authoritative agricultural knowledge or information are troublesome for farmers; furthermore, since the Internet has not been pervasively accepted by traditional agricultural education and extension providers and advisable and reliable agricultural extension education providers have not made efforts to construct Internet-based services, it is not unexpected as it may seem that fruit farmers rated the overall reliability of the Internet-based knowledge and information as only 50% credible. Even though most fruit farmers were inclined to value Internet-based agricultural content as not fully reliable, but worth being applied after verification. The majority of fruit farmers tend to treat their obtained knowledge and information with skepticism and caution, whereas the most frequently applied solution involved communicating with families or other farmers.

7. The Internet could be a valuable instrument for farmers in adopting knowledge and information, but it has not been well accepted by farmers, themselves. A lack of adequate training could be a cause of that. The same situation has also been found with regards to online agricultural courses. It is highly doubtful that farmers would be able to take enough courses online, when the online courses, themselves, are so limited in quantity. Hebei has moderate PC or laptop ownership percentages and high ownership of cellphones; thus, when farmers stated that the top handicap for them to get Internet was “don’t have appropriate device,” this can be interpreted as Hebei farmers not yet considering cellphones as being adequate devices for obtaining, either actively or passively, agricultural knowledge online. Such a situation was not only

found in Hebei, but also nationwide in recent years, and the Ministry of Agriculture (2015) in China has issued appeals to enhance farmers' cellphone application skills.

Recommendations for Practice

The following recommendations are made based on the findings of this research:

1. The findings of this study should be made available to the agricultural education and extension departments in Hebei, such as the agricultural college, agricultural academic institutions, agricultural extension offices at different levels, governmental lead agricultural extension departments, and any organizations or sections with rural extensions and communication initiatives, especially those with extension curriculum instruction responsibilities.
2. Hebei fruit farmers' Internet training is highly demanded to provide fruit farmers a clear and basic instruction for Internet use, especially with in mobile-accessed Internet formats, which is of utmost urgency. Without getting to know their devices well, how could these tools be well-utilized and further assist in agricultural production? Due to the general low education level of Hebei fruit farmers, a training program needs to be designed specifically taking into account the educational variable of the intended audience.
3. The credibility fruit farmers assign to Internet-based agricultural knowledge and information is worth additional discussion and study. Both content supervision authorities and channel operators should sort and verify the current agricultural education and extension content published on the web.
4. It is necessary to "rescue" fruit farmers from less qualified agricultural knowledge and information online, and help provide fruit farmers with clues about where

accurate agricultural knowledge and information can be obtained. More authoritative sources in agricultural knowledge and information should be placed on the Internet and then explicitly introduced to ordinary fruit farmers.

5. Fully respecting fruit farmers' knowledge and information obtaining habits and traditions, their old channels and ways of receiving agricultural education should be valued. New channels of agricultural education and extensions should not be "forced" upon the farmers but, rather, encouragement and assistance to the fruit farmers should be provided.
6. The traditional agricultural media, such as agricultural TV, agricultural radio or agricultural newspapers, should make efforts to better construct their websites, APPs, or WeChat public No. specifically for agricultural education and extension purposes. These traditional media used to play important roles in agricultural education and extension, and have good reputations among rural populations; a strong Internet network application made from them would produce a sufficient outspread of the information. Meanwhile, it would be more useful if agricultural colleges and academic institutions could strengthen their regular websites and mobile Internet-associated WAP website development. Apart from agricultural colleges and academic institutions' intrinsic duties pertaining to rural education and extension, it is a priority demand to broaden rural extension and education formats with the help of the Internet and as quickly and sufficiently as possible.

Recommendations for Further Study

The following recommendations are made for further study:

1. A similar study should be conducted with other farmer groups in Hebei, such as animal raising farmers, grain crop farmers, vegetable farmers, etc., to investigate the similarities and variations among these farmer groups.
2. A similar, but more comprehensive study should focus on the certain objectives of this study, such as concentrating on the perceptions of credibility in Internet-based agricultural knowledge and information, identifying and evaluating the factors influencing fruit farmers' credibility perceptions.
3. This was the first demographic study conducted with Hebei fruit farmers. As such, there were many demographic factors involved in this study. Future studies could simplify these demographic factors, and identify and incorporate research into other demographic variables involving agricultural extension and education perceptions and situations regarding farmers' Internet use.
4. A similar study should be conducted in a few years in Hebei, using fruit-growing farmers as the research population once again. It will be helpful to identify any ongoing changes in the perceptions among the same population regarding Internet-based agricultural education and extension as well as the changing demographic characteristics.
5. This study identified some most frequently applied online paths that fruit farmers commonly use to gather agricultural knowledge and information; however, no study has specifically focused on these online paths. A study to determine the factors leading fruit farmers along these paths should be conducted.

6. A study should be conducted to investigate fruit farmers' opinions on how they would like Internet assistance in their fruit production.

Implications

This study provided a sketch of a general overview of the Internet use and its relationship to agricultural and extension education as perceived by fruit farmers in the Hebei province in China. The research findings indicated that the adoption process of Internet-based agricultural and extension education is just beginning among Hebei fruit growers. It has been widely assumed that fruit farmers' Internet use of extension and education purposes would grow rapidly, as has happened with computer and cellphone adoption in rural areas. However, the use of the Internet as a source of agricultural and extension education is not as outwardly evident as has been the adoption of Internet devices, and common Internet surfing is not an indicator of the adoption of Internet-based agricultural extension. While many fruit farmers own and use family computers and cellphones as well as surf the Internet, they may not utilize these devices and services to assist in adopting agricultural knowledge and information; rather, they prefer to use these means to access the Internet for problem solving or decision making.

The knowledge gained in this study will help to facilitate the development of essential programs that will more closely match the basic needs of Internet-device utilization as well as Internet surfing. It will also help identify the lack of authoritative Internet-based agricultural knowledge and information sources and the absence of websites or APP construction by agricultural extension education departments and organizations. Findings from this study have implications for improving Internet-based agricultural extension and education during a period of development in Hebei's fruit growing agriculture.

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APPENDIX A. INSTITUTIONAL REVIEW BOARD APPROVAL

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Institutional Review Board
Office for Responsible Research
Vice President for Research
1138 Pearson Hall
Ames, Iowa 50011-2207
515 294-4566
FAX 515 294-4267

Date: 6/3/2016

To: Chang Liu
632 Squaw Creek Dr, Unit 5
Ames, IA 50010

CC: Dr. Robert Martin
201 Curtiss Hall

From: Office for Responsible Research

Title: Hebei Farmers' Internet Use and Its Relationship to Agricultural Education and Self-Empowerment

IRB ID: 16-256

Study Review Date: 6/3/2016

The project referenced above has been declared exempt from the requirements of the human subject protections regulations as described in 45 CFR 46.101(b) because it meets the following federal requirements for exemption:

- (2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey or interview procedures with adults or observation of public behavior where
  - Information obtained is recorded in such a manner that human subjects cannot be identified directly or through identifiers linked to the subjects; or
  - Any disclosure of the human subjects' responses outside the research could not reasonably place the subject at risk of criminal or civil liability or be damaging to their financial standing, employability, or reputation.

The determination of exemption means that:

- **You do not need to submit an application for annual continuing review.**
- **You must carry out the research as described in the IRB application.** Review by IRB staff is required prior to implementing modifications that may change the exempt status of the research. In general, review is required for any modifications to the research procedures (e.g., method of data collection, nature or scope of information to be collected, changes in confidentiality measures, etc.), modifications that result in the inclusion of participants from vulnerable populations, and/or any change that may increase the risk or discomfort to participants. Changes to key personnel must also be approved. The purpose of review is to determine if the project still meets the federal criteria for exemption.

  Non-exempt research is subject to many regulatory requirements that must be addressed prior to implementation of the study. Conducting non-exempt research without IRB review and approval may constitute non-compliance with federal regulations and/or academic misconduct according to ISU policy.

  Detailed information about requirements for submission of modifications can be found on the Exempt Study Modification Form. A Personnel Change Form may be submitted when the only modification involves changes in study staff. If it is determined that exemption is no longer warranted, then an Application for Approval of Research Involving Humans Form will need to be submitted and approved before proceeding with data collection.

Please note that you must submit all research involving human participants for review. **Only the IRB or designees may make the determination of exemption**, even if you conduct a study in the future that is exactly like this study.

Please be aware that **approval from other entities may also be needed.** For example, access to data from private records (e.g. student, medical, or employment records, etc.) that are protected by FERPA, HIPAA, or other confidentiality policies requires permission from the holders of those records. Similarly, for research conducted in institutions other than ISU (e.g., schools, other colleges or universities, medical facilities, companies, etc.), investigators must obtain permission from the institution(s) as required by their policies. **An IRB determination of exemption in no way implies or guarantees that permission from these other entities will be granted.**

Please don't hesitate to contact us if you have questions or concerns at 515-294-4566 or IRB@iastate.edu.

APPENDIX B. SAMPLING PROCEDURE

Estimating the Minimal Sample Size for an Unknown Population

A statistical formula given by Cochran (1963, p. 75) has been used to determine the sample size for populations that are large and unknown. The formula is as follow:

$$n = \frac{Z^2 pq}{e^2}$$

Where, *n* = sample size.

Z = Z value which refers to the desired confidence level $(1-\alpha)\%$.

p = estimated proportion of an attribute that is present in the population (0.05, this maximizes the sample size).

q = 1-p

e = the desired level of precision, in this study is 0.05.

In this study, we wish to evaluate a province-wide Internet use extent in which fruit farmers obtain agricultural knowledge and information via the Internet. The actual situation is there is a large and unknown fruit growing population, and the variability in the proportion that will adopt the practice is unknown

Therefore, assume *p*=0.05 (maximum variability). Furthermore, suppose the confidence level is 95% and $\pm 5\%$ precision.

Therefore, $n = \frac{(1.96)^2(0.05)(0.05)}{(0.05)^2} = 385.$

The sample size in this study was 511. It should be noted that, originally, 1,000 questionnaires were distributed due to a concern by the researcher about a low response rate because others in the field were responsible for disseminating and collecting the surveys. However, this concern proved to be unwarranted as extension staff who were research

assistants took responsibility to distribute and collect the questionnaires during scheduled meetings with farmer groups at each location. A total of 616 surveys were actually collected; of which 511 were usable. This sample size was much larger than the originally calculated sample of 385 as the minimal sample size to meet the requirements for this study.

APPENDIX C. COVER LETTER AND SURVEY QUESTIONNAIRE

C-1 – English

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Department of Agricultural Education and Studies
201 Curtiss Hall
Ames, Iowa 50011-1050
Administration and Programs 515 294-5872
FAX 515 294-0530

For: To Whom It May Concern

Re: Letter of Introduction

The purpose of this document is to present a "Letter of Introduction" for your information regarding a research study to be conducted focused on Agricultural Education in Hebei Province, China. This study will be conducted by Ms. Chang Liu, a Ph.D. graduate student at Iowa State University.

In an effort to discover and use the best practices to deliver educational program training, we are preparing to conduct a research study entitled Hebei Farmers: Internet Use and Its Relationship to Agricultural Education and Self-Empowerment. We need your help and cooperation.

The research will be conducted using an interview process and a questionnaire distributed to farmers at group meetings.

Participation in this study is strictly voluntary. Furthermore, participants can skip any questions they prefer not to answer. Responses to all questions will be held in strict confidence and only used for group analysis. Each interview will take approximately 30 minutes to complete.

The findings of this study will be used to complete a Doctor of Philosophy (Ph.D.) degree in Agricultural Education at Iowa State University, U.S.A. This study has been reviewed and approved by the Iowa State University Institutional Review Board for use of information from human subjects.

We expect the findings of this study will provide guidelines to identify training practices and ways to enhance agricultural education programs in Hebei Province, China. Findings from the study will be shared with all interested individuals who may find the results of the study useful.

If you have any further questions regarding the study, please contact Robert A. Martin at drmartin@iastate.edu.

Thank you,

Robert A. Martin, Ph.D.
Major Professor

Chang Liu
Graduate Student

Informed Consent

Introduction:

In an effort to discover and use the best practices to deliver educational program training, we are preparing to conduct a research study entitled Internet Use and Agricultural and Extension Education as Perceived by Farmers in Hebei Province, China.

Procedures:

The research will be conducted using an interview process and a questionnaire distributed to farmers at group meetings and field visiting. You are welcome to participate this study by respond the following questions. There are various types of questions consist this questionnaire, simple instructions about how to responds will be provided along each question when necessary.

Risks

The risks of participating this survey study are very limited. It is possible that you may feel boring when you responding a such high competent long questionnaire, however, we highly encourage you to complete all of the items of this questionnaire, because every piece of your responds worth a lot to us; even though, you are allowed to skip any question that you do not wish to answer or hand this questionnaire back at any time without penalty or benefits losing.

Benefits

The findings of this study will be used to complete a Doctor of Philosophy (Ph.D.) degree in agricultural education. This study has been reviewed and approved by the Institutional Review Board of the researchers' institution for use of information from human subjects.

There will be no direct benefit to you. We expect the information gained in this study will provide guidelines to identify some shortages or weakness of currently applied agricultural education and extension training practices, as well as the training practices and ways to enhance agricultural education programs in Hebei Province, China.

Findings from the study will be shared with all interested individuals who may find the results of the study useful. For example, The results of this study would be directly applied to indicate perceptions and perspectives of Hebei fruit farmers to the Internet distributed agricultural knowledge and farming technologies, and their attitudes and habits of obtain knowledge and information through Internet. This information can then be potentially used by provincial agricultural education administrators and sectors, and different levels' extension officers and extension subject operators to develop useful online education programs or curriculums, as well as agricultural and rural development policy makers in future.

Participant Rights

Participation in this study is strictly voluntary. We are recommending to complete this survey questionnaire by the time you are hand in, and it is okay if you would like to bring it with you and complete it at somewhere else, the research assistant would inform you how the questionnaire would collect back regarding such situation.

Confidentiality

Responses to all questions will be held in strict confidence and only used for group analysis. Even though you are encouraged to leave some of your contact information on this questionnaire, all of your identifying information will be kept confidential to the extent permitted by applicable academic regulations, and will never be public or leak to other people. In order to ensure confidentially to the information gained via this survey, all of the hard copy questionnaires which collected back from you would be stored by the researcher for no less than 5 years, and would be completely shredded once after they have been decided no longer validate. Only the researcher and the advisor can have access to the complete Excel format data which transferred from the questionnaires.

Problems and Questions

If you have any questions about this research, or would like to understanding more about this study, please do not hesitate to contact the researcher by using the following information:

Chang Liu (Researcher, in United States)
Department of Agricultural Education and Studies, cliu1015@iastate.edu
223C Curtiss Hall +1 (515) 708 0250
Iowa State University QQ: 1536376640
Ames, Iowa, 50010

Room 702, Unit 3, Building 2 1536376640@qq.com
No.168 Jianshe South Street +86 15133108850
Shijiazhuang, Hebei, 050000

Section I – Demographic Information (page 1/2)

Part A: This set of questions concerns personal characteristics.

1. Name:

   _____

2. Age:

   _____

3. Gender:
   - ☐ Male
   - ☐ Female

4. Marital Status
   - ☐ Married
   - ☐ Single
   - ☐ Divorced
   - ☐ others

5. Education Level
   - ☐ Never attended school
   - ☐ Primary school
   - ☐ Junior Middle school
   - ☐ High school
   - ☐ Diploma/Degree college
   - ☐ Graduate college

6. Number of families (Including parents):

   _____

7. Number of children:

   _____

Part B: This set of questions concerns your general farming and growing status.

8. Do you grow fruit/nut fruit?
   - ☐ Yes, I grow fruit/nut fruit
   - ☐ No, I don't grow fruit/nut fruit

9. If you do fruit/nut fruit growing, what do you grow?

☐Apple	☐Almont
☐Pear	☐Date
☐Peach	☐Cherry
☐Apricot	☐Plum
☐Persimmon	☐Watermelon
☐Grape	☐Strawberry
☐Walnut	☐Muskmelon
☐Chestnut	☐Other:_____

10. What is the total size of the land you operate (Mu):

    _____

11. Of the total size you operate, how many Mu are using for the fruit/nut fruit growing:

    _____

12. Have you contracted (rent) forest land in particular?
    - ☐ Yes
      (Size of contracted forest land: _____)
    - ☐ No

13. Do you employ full-time workers on your farm?
    - ☐ Yes
      (Number of full-time workers: _____)
    - ☐ No

Section I – Demographic Information (page 2/2)

Part C: This set of questions concerns your personal interests in new experiences.

14. Are you interested in new types of farming/growing technologies developed abroad?
    - ☐ High interest
    - ☐ Moderate interest
    - ☐ No interest

15. Are you interested in new species of livestock/poultry/crop/fruit breeding abroad?
    - ☐ High interest
    - ☐ Moderate interest
    - ☐ No interest

16. Have you ever raised new species from abroad?
    - ☐ Yes, I have raised
    - ☐ No, I have never raised

17. Have you ever planted new species from abroad?
    - ☐ Yes, I have planted
    - ☐ No, I have never planted

18. Have you ever tried to get new growing/raising technologies from abroad by yourself?
    - ☐ Yes, I've tried
    - ☐ No, I've never tried

19. Do you run an e-store to sell your agricultural products through Internet?
    - ☐ Yes
    - ☐ No

20. In recent years, did you market any of the fruit/nut fruit that you produce using the Internet?
    - ☐ Yes
    - ☐ No

21. If you have marketed any of the fruits that you produced using the Internet, what was the total RMB value in the most recent year of the fruit/nut fruit sales?

    _____

Part D: This set of questions concerns your other working experiences.

22. How much is your family's total annual income (Yuan):

    _____

23. How much of your annual income comes from agricultural (from farming/growing/raising)?
    - ☐ 0-1000 Yuan
    - ☐ 1000-2000 Yuan
    - ☐ 2000-3000 Yuan
    - ☐ 3000-4000 Yuan
    - ☐ 4000-5000 Yuan
    - ☐ 5000-6000 Yuan
    - ☐ 6000-7000 Yuan
    - ☐ 7000-8000 Yuan
    - ☐ 8000-9000 Yuan
    - ☐ 9000-10000 Yuan
    - ☐ 10000-15000 Yuan
    - ☐ 15000-20000 Yuan
    - ☐ 20000-30000 Yuan
    - ☐ 30000-40000 Yuan
    - ☐ 40000-50000 Yuan
    - ☐ 50000 Yuan & above

24. How much of your annual income comes from somewhere other than agricultural (Labor force, etc.,)?
    - ☐ 0-1000 Yuan
    - ☐ 1000-2000 Yuan
    - ☐ 2000-3000 Yuan
    - ☐ 3000-4000 Yuan
    - ☐ 4000-5000 Yuan
    - ☐ 5000-6000 Yuan
    - ☐ 6000-7000 Yuan
    - ☐ 7000-8000 Yuan
    - ☐ 8000-9000 Yuan
    - ☐ 9000-10000 Yuan
    - ☐ 10000-15000 Yuan
    - ☐ 15000-20000 Yuan
    - ☐ 20000-30000 Yuan
    - ☐ 30000-40000 Yuan
    - ☐ 40000-50000 Yuan
    - ☐ 50000 Yuan & above

Section II – PC/Laptop/Tablet/Cellphone (page 1/1)

Part E: This set of questions is related to your computer, Laptop, or Tablet PC ownership and utilization.

25. Do you have a computer?
☐ Yes
(If "Yes", when did you buy it: _____)
☐ No

26. Do you have a laptop?
☐ Yes
(If "Yes", when did you buy it: _____)
☐ No

27. Do you have a tablet PC?
☐ Yes
(If "Yes", when did you buy it: _____)
☐ No

28. If you don't have any of the above mentioned equipment, please check: "Yes" on this question.
☐ Yes
☐ No

Part F: This set of questions is related to your cellphone ownership and utilization.

29. Do you have a cellphone?
☐ Yes
☐ No

30. If you have a cellphone, how many do you have?
☐ 1 ☐ 2 ☐ 3 and more

31. Is your cellphone a Smart Phone?
☐ Yes
☐ No

32. How much does your current cellphone usage cost?
☐ 0-500 Yuan
☐ 500-1000 Yuan
☐ 1000-1500 Yuan
☐ 1500-2000 Yuan
☐ 2000-2500 Yuan
☐ 2500-3000 Yuan
☐ 3000-3500 Yuan
☐ 3500-4000 Yuan
☐ 4000-4500 Yuan
☐ 4500-5000 Yuan
☐ 5000-5500 Yuan
☐ 5500-6000 Yuan
☐ 6000-6500 Yuan
☐ 6500-7000 Yuan
☐ 7000 Yuan and above

33. Have you signed a cellphone data plan contract?
☐ Yes
☐ No

34. If you have signed a data plan contract for your cellphone, how many GB do you own each month?
☐ ≤5GB ☐ 5GB ~10 GB ☐ ≥10GB

35. If haven't signed a data plan contract yet, do you have a plan to get it?
☐ Yes ☐ No

36. How much is your monthly cellphone bill?
☐ ≤20 Yuan ☐ 100 ~200 Yuan
☐ 20~50 Yuan ☐ ≥200 Yuan
☐ 50 ~100 Yuan

Section III – Perceptions Regarding the Internet & its Use (page 1/3)

Part G: This set of questions concerns your basic perceptions about Internet and Internet access.

37. Have you ever surfed the Internet?
    - ☐ Yes
    - ☐ No

38. If you have only used stationary accessed Internet, what is the reason that you have not used mobile accessed Internet before? (Please check one)
    - ☐ Don't have smartphone or adequate device
    - ☐ Can't get service from the telecom operator
    - ☐ Cost more
    - ☐ Don't know how to use it
    - ☐ Don't like mobile Internet
    - ☐ Stationary Internet has stable and fast connection
    - ☐ Stationary Internet is enough

39. If you have only used mobile accessed Internet, what is the reason that you have not used stationary accessed Internet before? (Please check one)
    - ☐ Don't have computer (PC/Laptop)
    - ☐ Can't get stationary service from the telecom operator
    - ☐ Cost more
    - ☐ Don't know how to use it
    - ☐ Don't like stationary Internet
    - ☐ Mobile Internet has stable and fast connection
    - ☐ Mobile Internet is enough

Section III – Perceptions Regarding the Internet & its Use (page 2/3)

Part H: This set of questions concerns your overall Internet usage situation.

40. If you know how to use Internet, and have used it before, what following ways do you get on line most? (Please check all that apply)
    - ☐ Use family owned PC at home
    - ☐ Use friends'/relatives' PC at their place
    - ☐ Use public PC at official place
    - ☐ Go to Cyber Café

    - ☐ Use smartphone with mobile Internet service
    - ☐ Use tablet PC/smartphone at home with Wi-Fi
    - ☐ Use tablet PC/smartphone at private place (like friend's/relative's home) with Wi-Fi
    - ☐ Use tablet PC/smartphone at public place with Wi-Fi

41. How often do you use Stationary Internet each week?
    - ☐ <1 Days/Week
    - ☐ 1-2 Days/Week
    - ☐ 2-3 Days/Week
    - ☐ 3-4 Days/Week
    - ☐ 4-5 Days/Week
    - ☐ ≥6 Days/Week

42. How often do you use Mobile Internet each week?
    - ☐ <1 Days/Week
    - ☐ 1-2 Days/Week
    - ☐ 2-3 Days/Week
    - ☐ 3-4 Days/Week
    - ☐ 4-5 Days/Week
    - ☐ ≥6 Days/Week

43. How long do you usually surf the Stationary Internet each day?
    - ☐ 0 hour
    - ☐ < 1 hour
    - ☐ 1-2 hours
    - ☐ 2-3 hours
    - ☐ 3-4 hours
    - ☐ >4 hours

44. How long do you usually surf the Mobile Internet each day?
    - ☐ 0 hour
    - ☐ < 1 hour
    - ☐ 1-2 hours
    - ☐ 2-3 hours
    - ☐ 3-4 hours
    - ☐ >4 hours

Section III – Perceptions Regarding the Internet & its Use (page 3/3)

Part I: This set of questions concerns your current Internet usage conditions.

45. As a farmer, what do you usually do when you surf the Stationary Internet? (Please check all that apply)

☐ Contact family members
☐ Contact other farmers
☐ Contact business partners
☐ Obtain agricultural technology and knowledge
☐ Obtain farm product information

☐ Obtain marketing information
☐ Taking online education
☐ Watch news/update information
☐ Purchase daily groceries
☐ Purchase farm materials

☐ Sale product (farm production, handcrafts)
☐ Watch video
☐ Reading
☐ Buy stock
☐ Play games

☐ Other (please specify): _____

46. As farmer, what do you usually do when you surf the Mobile Internet? (Please check all that apply)

☐ Contact family members
☐ Contact other farmers
☐ Contact business partners
☐ Obtain agricultural technology and knowledge
☐ Obtain farm product information

☐ Obtain marketing information
☐ Taking online education
☐ Watch news/update information
☐ Purchase daily groceries
☐ Purchase farm materials

☐ Sale product (farm production, handcrafts)
☐ Watch video
☐ Reading
☐ Buy stock
☐ Play games

☐ Other (please specify): _____

Section IV – Perceptions Regarding Sources of Information and their Use (page 1/3)

Part J: This set of questions concerns your agricultural knowledge and information obtain habits.

47. Which of the following channel do you usually obtain farming technologies or agricultural information? (Please check all that apply)

☐ Family members
☐ Villagers.
☐ Rural community leader
☐ Local farm material dealer
☐ Sales man from large scale agro company

☐ 12316 hotline
☐ Agricultural cooperative
☐ Local soil and fertilizer sector
☐ Local plant protective station
☐ Local seed station

☐ City level academy of Ag-science
☐ Provincial level academy of Ag-science
☐ Farming experts, technicians from Ag-technology sectors
☐ Agricultural technology books
☐ Agricultural journal

☐ Agricultural newspapers
☐ Agricultural TV channel
☐ Agricultural website
☐ Agricultural QQ group
☐ Agricultural WeChat group

☐ Cellphone text message
☐ Freely searching online when it is necessary
☐ I have never obtained farming technologies or agricultural information
☐ Other (please specify): _____

48. Which of the following channels online do you usually get agricultural knowledge and information from? (Please check all that apply)

☐ Private professional agricultural webpage
☐ Official webpage of agricultural departments
☐ Official webpage of agricultural academic institution
☐ Agricultural median's webpage
☐ Agricultural company/business' webpage

☐ Agricultural cooperative's webpage
☐ Join relevant cyber community/forum
☐ Free searching online by using key words
☐ Join specific QQ group
☐ Join specific WeChat group

☐ Never obtain information online
☐ Other (please specify): _____

Section IV – Perceptions Regarding Sources of Information and their Use (page 2/3)

Part K: This set of questions concerns the subjects of the agricultural knowledge and information which you obtained via the Internet

49. When you are getting agricultural knowledge from Internet, which of the subjects of agricultural knowledge and information do you usually obtain through the Stationary Internet? (Please check all that apply)

☐ Plant disease/pest control
☐ Weed control
☐ Conventional fertilizer use
☐ Organic fertilizer use
☐ Farm chemical use

☐ Water saving irrigation
☐ Organic farming
☐ Meteorological disaster predict and prevent
☐ Marketing info of farm material
☐ Marketing info of farm product

☐ Updated agricultural policy and laws
☐ Animal disease control
☐ Other (please specify): _____
☐ I have never obtained agricultural knowledge or information via Stationary Internet

50. When you are getting agricultural knowledge from Internet, which of the subject of agricultural knowledge and information do you usually obtain through the Mobile Internet? (Please check all that apply)

☐ Plant disease/pest control
☐ Weed control
☐ Conventional fertilizer use
☐ Organic fertilizer use
☐ Farm chemical use

☐ Water saving irrigation
☐ Organic farming
☐ Meteorological disaster predict and prevent
☐ Marketing info of farm material
☐ Marketing info of farm product

☐ Updated agricultural policy and laws
☐ Animal disease control
☐ Other (please specify): _____
☐ I have never obtained agricultural knowledge or information via Stationary Internet

Section IV – Perceptions Regarding Sources of Information and their Use (page 3/3)

Part L: This set of questions concerns your preference of various ways you obtain agricultural education.

51. Which of the following ways do you prefer on obtain agricultural information?
    - ☐ Experience sharing
    - ☐ Face to face learning with agriculture technicians
    - ☐ TV
    - ☐ Radio
    - ☐ News Paper
    - ☐ Journal
    - ☐ Internet
    - ☐ Others (please specify): _____

52. What is your preference for obtaining agricultural knowledge through the Internet?
    - ☐ High preference
    - ☐ Moderate preference
    - ☐ Low preference

53. What is your preference of obtaining agricultural information through the Internet?
    - ☐ High preference
    - ☐ Moderate preference
    - ☐ Low preference

Section V - Opinions Regarding the Credibility of Online Agricultural Knowledge and Information (page 1/1)

Part M: This set of questions concerns your perceptions of the Internet and its dissemination of information and knowledge.

54. How credible do you think online Agricultural knowledge are?
- ☐ Completely reliable (100% credibility)
- ☐ Reliable (75% credibility)
- ☐ Moderate (50% credibility)
- ☐ Unreliable (25% credibility)
- ☐ Completely unreliable (0% credibility)

55. How credible do you think online Agricultural information are?
- ☐ Completely reliable (100% credibility)
- ☐ Reliable (75% credibility)
- ☐ Moderate (50% credibility)
- ☐ Unreliable (25% credibility)
- ☐ Completely unreliable (0% credibility)

56. What do you usually do with the agricultural knowledge you obtain through the Internet? (Please check all that apply)
- ☐ Trust and directly apply
- ☐ Decided after discuss with other farmer
- ☐ Verify by discuss with local technicians
- ☐ Won't apply, but take as reference
- ☐ Don't trust and won't apply to actual farming
- ☐ Other (please specify): _____

57. What do you usually do with the agricultural information you obtain through the Internet? (Please check all that apply)
- ☐ Trust and directly apply
- ☐ Decided after discuss with other farmer
- ☐ Verify by discuss with local technicians
- ☐ Won't apply, but take as reference
- ☐ Don't trust and won't apply to actual farming
- ☐ Other (please specify): _____

Section VI – Obstacles and Reactions (page 1/1)

Part N: This set of questions concerns the changes that have happened by introducing Internet as one agricultural education channel in your life

58. Have you ever met any following handicaps when you were trying to obtain agricultural knowledge/information via the Internet? (Please check all that apply)
    - ☐ Don't have appropriate device
    - ☐ Don't have Internet access
    - ☐ Costs too much
    - ☐ Don't know how to use it
    - ☐ Don't know how to type
    - ☐ Can't find relevant information on the Internet
    - ☐ Online Information is inaccurate
    - ☐ Other obstacles (please specify) _____
    - ☐ Never met obstacles

59. What following responses do you usually do when you facing obstacles of obtaining agricultural education and information through the Internet? (Please check all that apply)
    - ☐ Tried to find the solution alone
    - ☐ Ask families for help
    - ☐ Ask young people for help
    - ☐ Give up the Internet and return to traditional ways of obtaining agricultural education, such as call local technicians
    - ☐ Other (please specify) _____

60. Have you ever heard about any trainings for teaching farmers about using the Internet?
    - ☐ Yes
    - ☐ No

61. Have you ever taken any trainings for teaching farmers about using the Internet?
    - ☐ Yes
    - ☐ No

62. Have you ever heard about any online courses for teaching agricultural knowledge and technology?
    - ☐ Yes
    - ☐ No

63. Have you ever taken any online courses for teaching agricultural knowledge and technology?
    - ☐ Yes
    - ☐ No

64. Have you ever obtained information through the Internet about a training program that you participated in?
    - ☐ Yes
    - ☐ No

65. By using the Internet, how much do you think you have been improved or changed? (Please check all that apply)
    - ☐ Renewed basic skills and understanding of technology
    - ☐ Broadened my farming knowledge
    - ☐ Truly solved my problem
    - ☐ Increased income
    - ☐ Created new communication channels
    - ☐ Did not improve or change anything
    - ☐ Other (please specify) _____

Your Contact Information:

Your Location: _____County, _____Township, _____Village

Would you mind leaving some contact information (answer all that apply) so we may contact you for supplementary information?

Cellphone: _____ QQ: _____

WeChat: _____ Email: _____

Any other contact information (post address, landline phone, AliIM, etc.):

Date you completed this questionnaire: _____

C-2 – Chinese

研究及问卷填写说明

介绍：

本问卷所涉及的研究致力于分析当前河北农民利用有线接入互联网以及移动互联网获取农业知识和信息的实际情况。

步骤：

您参与这项研究的方式是被邀请填写完成本份调查问卷。这份调查问卷包含的问题有多种类型。根据需要，简单的填写指导会附在调查问题的后面。

风险：

您在填写这份问卷时所需承担的风险十分有限。由于这份问卷内容较多，问卷设计较长，您可能会在填写时感到一些厌烦。尽管如此，我们还是恳请您能够完成问卷所含所有题目。因为您的每一份回答对我们来说都十分重要。您可以在填写本份问卷时跳过您不愿意回答问题，您也不会因为没有完整填写本份问卷而受到惩罚或遭受损失。

收益：

本次调研的结果将被直接用于博士研究生的研究。本次调研已经获得研究者所在院校学术审查机构的备案。您并不会从填写本份问卷中直接受益。我们期待本次研究所收集的信息可以对发现河北省现行的农业技术推广工作中的不足，以及相关实践培训和农业教育项目的扩展提供指导。

研究结果将会于所有对本次研究感兴趣，或认为本次研究有用的人或部门分享。例如，本次研究的结果还可以直接还原河北林果种植户对于互联网传播的农业知识和技术的真实想法，以及他们在通过互联网获取农业知识和信息时的态度和习惯。同时，这些信息潜在程度上还能够帮助到河北省的农业教育部门，不同级别的农业推广部门和推广人员，甚至农业相关政策的制定部门，从而在未来更好地制作有用的在线教育课程项目，或制定更有利的相关政策。

参与权利：

您对于此次研究的参与属志愿行为，我们建议您在收到这份问卷的地方即时填写。当然，您也可以将问卷带到其他的地方填写，我们的研究助理会和您沟通收回问卷的方式和方法。

信息安全：

您对于这份问卷的所有回答都将严格保密，并仅被用于分析研究。尽管，本份问卷鼓励您留下您的联系方式，您留在问卷上的所有个人信息都会依照现行的学术规定被严格保密，我们承诺这些信息永远不会被公开或泄露给他人。为了确保所有从本次调研中获取的信息的安全，所有填写收回后的调查问卷都会被研究者保存不少于五年时间，并会在确认不再有效后进行销毁。同时，只有研究者和指导教授有权接触保存问卷信息的研究数据。

疑问：

如果您对这个研究有任何疑问，或希望更多的了解本次研究，请不吝通过下列联系方式与研究者取得联系。

刘畅 （研究者）
美国艾奥瓦州阿姆斯市
艾奥瓦州立大学
科提斯楼，223C 办公室
邮编：50010

Email：
cliu1015@iastate.edu
电话：+1 (515) 708 0250
QQ：1536376640

河北省石家庄市建设南大街 168 号
2-3-702
邮编：050000

邮箱：
1536376640@qq.com
电话：+86 15133108850

第一部分 – 基本信息 （1/2）

A 组：下列这组问题有关被调查者的个人基本情况

1. 姓名：

2. 年龄：

3. 性别：
   - ☐ 男
   - ☐ 女

4. 婚姻状况：
   - ☐ 已婚
   - ☐ 未婚
   - ☐ 离异
   - ☐ 其他

5. 教育程度：
   - ☐ 没上过学
   - ☐ 小学毕业
   - ☐ 初中毕业
   - ☐ 高中毕业
   - ☐ 大学专科/本科毕业
   - ☐ 研究生及以上学历

6. 家庭成员数量（含父母）：

7. 孩子数量：

B 组：下列这组问题有关被调查者的种植及养殖情况

8. 是否进行水果/干果种植？
   - ☐ 是
   - ☐ 否

9. 如果你从事水果/干果种植，下列哪些水果在你的种植行列？
   - ☐苹果　☐杏扁
   - ☐梨　☐枣
   - ☐桃子　☐樱桃
   - ☐杏　☐李子
   - ☐柿子　☐西瓜
   - ☐葡萄　☐草莓
   - ☐核桃　☐甜瓜
   - ☐板栗　☐其他水果：_____

10. 你承包的土地总面积是多少（亩）：

11. 你所种植的水果/干果面积是多少（亩）：

12. 你是否承包林地？
    - ☐ 是
      （承包林地面积：_____）
    - ☐ 否

13. 你是否雇人参与耕种？
    - ☐ 是
      （雇佣人数：_____，或）
    - ☐ 否

第一部分 – 基本信息（2/2）

C 组：下列这组问题有关你对新生事物的兴趣态度

14. 你是否对国外的种植/养殖技术感兴趣？
    - ☐ 感兴趣
    - ☐ 无所谓
    - ☐ 不感兴趣

15. 你是否对国外的家畜/家禽/农作物/果树等农业新品种感兴趣？
    - ☐ 感兴趣
    - ☐ 无所谓
    - ☐ 不感兴趣

16. 你是否养殖过国外的家畜/家禽等新品种？
    - ☐ 是（养过）
    - ☐ 否（没养过）

17. 你是否种植过国外的农作物/果树等新品种？
    - ☐ 是（种过）
    - ☐ 否（没种过）

18. 你是否尝试过自己和国外联系获得新的种植/养殖技术知识？
    - ☐ 是（尝试过）
    - ☐ 否（没有尝试过）

19. 你是否开有网店？
    - ☐ 是（开过）
    - ☐ 否（没开过）

20. 你是否在网上出售过农产品？
    - ☐ 是（出售过）
    - ☐ 否（没出售过）

21. 如果你经营网店或通过互联网出售过农产品，你通过互联网销售的农产品量占所有农产品销售量的多少（百分比）：

_____

D 组：下列这组问题有关劳动和收入情况

22. 你全家的年收入总和大约是多少 (元)?

_____

23. 你的个人年收入中有多少是来自农业生产的？（纯种植养殖）
    - ☐ 0-1000 元
    - ☐ 1000-2000 元
    - ☐ 2000-3000 元
    - ☐ 3000-4000 元
    - ☐ 4000-5000 元
    - ☐ 5000-6000 元
    - ☐ 6000-7000 元
    - ☐ 7000-8000 元
    - ☐ 8000-9000 元
    - ☐ 9000-10000 元
    - ☐ 10000-15000 元
    - ☐ 15000-20000 元
    - ☐ 20000-30000 元
    - ☐ 30000-40000 元
    - ☐ 40000-50000 元
    - ☐ 50000 元及以上

24. 你的个人年收入中有多少是来自农业生产以外的其他经营类型的？（外出务工、农产品加工等）
    - ☐ 0-1000 元
    - ☐ 1000-2000 元
    - ☐ 2000-3000 元
    - ☐ 3000-4000 元
    - ☐ 4000-5000 元
    - ☐ 5000-6000 元
    - ☐ 6000-7000 元
    - ☐ 7000-8000 元
    - ☐ 8000-9000 元
    - ☐ 9000-10000 元
    - ☐ 10000-15000 元
    - ☐ 15000-20000 元
    - ☐ 20000-30000 元
    - ☐ 30000-40000 元
    - ☐ 40000-50000 元
    - ☐ 50000 元及以上

第二部分 – 电脑/手机等智能设备的拥有和使用情况（1/1）

E 组：下列这组问题有关电脑/笔记本电脑/平板电脑等设备的拥有和使用情况

25. 你家是否有台式电脑？
☐ 有
(如果“有”，何时购买的：_____年)
☐ 没有

26. 你家是否有笔记本电脑？
☐ 有
(如果“有”，何时购买的：_____年)
☐ 没有

27. 你家是否有平板电脑？
☐ 有
(如果“有”，何时购买的：_____年
☐ 没有

28. 如果你没有上述三题中提到的任何电脑设备，请在本题选则“是”
☐ 是
☐ 否

F 组：下列这组问题有关手机的拥有和使用情况

29. 你有手机吗？
☐ 有
☐ 没有

30. 如果“有”，你有几部？
☐ 1 部
☐ 2 部
☐ 3 部及以上

31. 你的手机是智能手机吗？
☐ 是
☐ 不是

32. 你正在使用的手机购买时的价格大约是多少？
☐ 0-500 元
☐ 500-1000 元
☐ 1000-1500 元
☐ 1500-2000 元
☐ 2000-2500 元
☐ 2500-3000 元
☐ 3000-3500 元
☐ 3500-4000 元
☐ 4000-4500 元
☐ 4500-5000 元
☐ 5000-5500 元
☐ 5500-6000 元
☐ 6000-6500 元
☐ 6500-7000 元
☐ 7000 元及以上

33. 你的手机是否开通了流量业务？
☐ 是（开通了）
☐ 否（没开通）

34. 如果开通了流量业务，你每月的流量是多少？
☐ ≤5GB
☐ 5GB ~10 G
☐ ≥10GB

35. 如果还没有开通流量业务，你有开通的打算吗？
☐ 有
☐ 没有

36. 你每月的手机话费是多少？
☐ ≤20 元
☐ 20~50 元
☐ 50 ~100 元
☐ 100 ~200 元
☐ ≥200 元

第三部分 – 对互联网的认知及实际使用情况（1/3）

G 组：下列这组问题涉及对互联网的认知和接入情况

37. 你是否上过网？
- ☐ 是（上过网）
- ☐ 否（没有）

38. 如果你只使用过***有线接入***的互联网，你认为是什么原因让你没有机会使用***移动***互联网？（单选题）
- ☐ 没有智能手机或其他可接入移动互联网的设备
- ☐ 无法从电信运营商处获得移动流量服务
- ☐ 费用高
- ☐ 不知道如何上移动互联网
- ☐ 不喜欢移动互联网
- ☐ 有线接入的互联网速度更快更稳定
- ☐ 有线互联网已经足够用了

39. 如果你只使用过***移动***互联网，你认为是什么原因让你没有机会使用***有线接入***的互联网？（单选题）
- ☐ 没有电脑（台式机/笔记本电脑等）
- ☐ 无法从电信运营商处获得有线接入服务
- ☐ 费用高
- ☐ 不知道如何上有线接入的互联网
- ☐ 不喜欢有线接入互联网
- ☐ 移动互联网更方便快捷
- ☐ 移动互联网已经足够用了

第三部分 – 对互联网的认知及实际使用情况（2/3）

H 组：下列这组问题有关你在互联网使用方面的整体情况

40. 如果你知道如何使用互联网，并且曾经上过互联网，你是通过下列那种方式上网的？（多选题）
- ☐ 用自己家的电脑上网
- ☐ 用朋友或者亲戚的电脑上网
- ☐ 用公共场所的电脑上网
- ☐ 去网吧等地方付费上网

- ☐ 使用手机流量登录移动互联网
- ☐ 使用平板电脑/智能手机在自己家，用 Wi-Fi（无线路由器）上网
- ☐ 使用平板电脑/智能手机在朋友或亲戚家，用 Wi-Fi（无线路由器）上网
- ☐ 使用平板电脑/智能手机在公共场所，用 Wi-Fi（无线路由器）上网

41. 你每周使用***有线接入***互联网的天数约为？
- ☐ <1 天/周
- ☐ 1-2 天/周
- ☐ 2-3 天/周
- ☐ 3-4 天/周
- ☐ 4-5 天/周
- ☐ ≥6 天/周

42. 你每周使用***移动***互联网的天数约为？
- ☐ <1 天/周
- ☐ 1-2 天/周
- ☐ 2-3 天/周
- ☐ 3-4 天/周
- ☐ 4-5 天/周
- ☐ ≥6 天/周

43. 你每天使用***有线接入***互联网的时长约为？
- ☐ 0 小时
- ☐ < 1 小时
- ☐ 1-2 小时
- ☐ 2-3 小时
- ☐ 3-4 小时
- ☐ >4 小时

44. 你每天使用***移动***互联网的时长约为？
- ☐ 0 小时
- ☐ < 1 小时
- ☐ 1-2 小时
- ☐ 2-3 小时
- ☐ 3-4 小时
- ☐ >4 小时

第三部分 – 对互联网的认知及实际使用情况（3/3）

I 组：下列这组问题有关你现在的互联网使用习惯

45. 作为农民，下列活动哪些是你经常通过***有线接入***互联网完成的？（多选题）

- ☐ 联络家人
- ☐ 联络其他农民
- ☐ 联络商业伙伴
- ☐ 获取农业技术知识
- ☐ 获取农资信息
- ☐ 获取农产品市场信息
- ☐ 进行网上教育
- ☐ 阅读新闻/更新资讯
- ☐ 上网买日常生活所需
- ☐ 上网买农业生产资料
- ☐ 上网卖东西（农产品、手工艺品等）
- ☐ 看视频/娱乐节目
- ☐ 阅读图书/期刊
- ☐ 炒股票
- ☐ 玩游戏
- ☐ 其他（请简单说明）_____

46. 作为农民，下列活动哪些是你经常通过***移动***互联网完成的？（多选题）

- ☐ 联络家人
- ☐ 联络其他农民
- ☐ 联络商业伙伴
- ☐ 获取农业技术知识
- ☐ 获取农资信息
- ☐ 获取农产品市场信息
- ☐ 进行网上教育
- ☐ 阅读新闻/更新资讯
- ☐ 上网买日常生活所需
- ☐ 上网买农业生产资料
- ☐ 上网卖东西（农产品、手工艺品等）
- ☐ 看视频/娱乐节目
- ☐ 阅读图书/期刊
- ☐ 炒股票
- ☐ 玩游戏
- ☐ 其他（请简单说明）_____

第四部分 – 通过互联网获取农业教育的情况（1/3）

J 组：下列这组问题有关你获取农业知识的习惯

47. 你最常通过下列哪些渠道获取农业技术知识或农业信息？（多选题）

☐ 家庭成员
☐ 其他村民
☐ 村干部
☐ 当地农资销售商
☐ 大型农企的销售商

☐ 12316 热线
☐ 农业合作社
☐ 当地土肥站
☐ 当地植保站
☐ 当地种子站

☐ 市级农业科学院
☐ 省级农业科学院
☐ 农业技术部门的农技专家、技术员
☐ 农业书籍
☐ 农业期刊

☐ 农业报纸
☐ 农业电视频道
☐ 专业农技网站
☐ 农业相关 QQ 群
☐ 农业相关微信群

☐ 手机短信息
☐ 在有技术或信息需求的时候，利用关键词进行网络搜索
☐ 其他（请简单说明）:_____
☐ 从没获取过农业技术知识或信息

48. 你最常通过下列哪些与互联网有关的渠道获取农业知识与技术信息？（多选题）

☐ 私人建设运营的各类农业网站
☐ 国家各级农业部门的官方网站
☐ 各级农业科研院所的官方网站
☐ 农业媒体的官方网站
☐ 农业企业的官方网站

☐ 农业合作社的网站
☐ 加入相关的网上社区/论坛
☐ 用关键词在互联网上搜索想要了解的信息
☐ 加入专门的 QQ 群
☐ 加入专门的微信群

☐ 其他（请简单说明）:_____
☐ 没有从互联网上获取过农业知识与技术信息

第四部分 – 通过互联网获取农业教育的情况（2/3）

K 组：下列这组问题有关你通过互联网获取的农业知识和信息的类型情况

49. 下列哪些知识或信息类型是你通过***有线接入***互联网获取的？（多选题）

- ☐ 植物病虫害防控
- ☐ 杂草防控
- ☐ 化肥使用
- ☐ 有机肥使用
- ☐ 农药使用

- ☐ 节水灌溉
- ☐ 有机/无公害农业
- ☐ 气象信息和农业气象灾害防御
- ☐ 农资市场信息
- ☐ 农产品市场信息

- ☐ 最新的农业政策和法律法规
- ☐ 家畜/家禽疫病防控
- ☐ 其他（请简单说明）:_____
- ☐ 没有从互联网上获取过农业知识和信息

50. 下列哪些知识或信息类型是你通过***移动***互联网获取的？（多选题）

- ☐ 植物病虫害防控
- ☐ 杂草防控
- ☐ 化肥使用
- ☐ 有机肥使用
- ☐ 农药使用

- ☐ 节水灌溉
- ☐ 有机/无公害农业
- ☐ 气象信息和农业气象灾害防御
- ☐ 农资市场信息
- ☐ 农产品市场信息

- ☐ 最新的农业政策和法律法规
- ☐ 家畜/家禽疫病防控
- ☐ 其他（请简单说明）:_____
- ☐ 没有从互联网上获取过农业知识和信息

第四部分 – 通过互联网获取农业教育的情况（3/3）

L 组：下列这组问题有关你通过不同渠道获取农业教育的情况

51. 你愿意通过下列哪些渠道获取农业知识？
（多选题）
- ☐ 经验分享
- ☐ 技术员面对面讲座
- ☐ 电视
- ☐ 广播
- ☐ 报纸
- ☐ 期刊
- ☐ 互联网
- ☐ 其他（请简单说明）： _____

52. 你是否愿意通过互联网获取更多的农业***知识/技术***?
- ☐ 是，我非常愿意
- ☐ 无所谓，试试也无妨
- ☐ 不，完全没有兴趣

53. 你是否愿意通过互联网获取更多的农业***信息***?
- ☐ 是，我非常愿意
- ☐ 无所谓，试试也无妨
- ☐ 不，完全没有兴趣

第五部分 – 对互联网上传播的农业知识和信息的信任情况（1/1）

M 组：下列这组问题有关你对于互联网作为农业知识传播渠道的态度和看法

54. 你认为互联网上传播的***农业知识***的可信度是多少？（单选题）
- ☐ 非常可信 (100% 可信)
- ☐ 比较可信 (75% 可信)
- ☐ 一半可信，一半不可信 (50% 可信)
- ☐ 比较不可信 (25% 可信)
- ☐ 完全不可信 (0% 可信)

55. 你认为互联网上传播的***农业信息***的可信度是多少？（单选题）
- ☐ 非常可信 (100% 可信)
- ☐ 比较可信 (75% 可信)
- ☐ 一半可信，一半不可信 (50% 可信)
- ☐ 比较不可信 (25% 可信)
- ☐ 完全不可信 (0% 可信)

56. 对于从互联网上获取的***农业知识***，你通常会以下列哪些方式对待？(多选题)
- ☐ 相信并直接使用
- ☐ 与其他农户讨论后确定是否使用
- ☐ 和当地技术人员讨论后在确定是否使用
- ☐ 不会直接使用，但会作为参考信息
- ☐ 不相信，也不会应用到生产中
- ☐ 其他（请简单说明） _____

57. 对于从互联网上获取的***农业信息***，你通常会以下列哪些方式对待？（多选题）
- ☐ 相信并直接使用
- ☐ 与其他农户讨论后确定是否使用
- ☐ 和当地技术人员讨论后在确定是否使用
- ☐ 不会直接使用，但会作为参考信息
- ☐ 不相信，也不会应用到生产中
- ☐ 其他（请简单说明） _____

第六部分 – 使用互联网作为农业教育渠道时遇到的困难和应对方法（1/1）

N 组：下列这组问题有关你在选择互联网作为接受农业教育的渠道后产生的变化情况

58. 你在尝试通过互联网获取农业知识/信息时遇到过下列哪些困难？（多选题）
- ☐ 没有合适的设备
- ☐ 没有互联网接入
- ☐ 网费太高
- ☐ 不知道如何上网
- ☐ 不知道如何打字/输入
- ☐ 网上没有相关信息
- ☐ 网上的内容太不准确
- ☐ 其他困难（请简单说明）_____
- ☐ 从没遇到过困难

59. 当你遇到上面提到的困哪时，你通常会采取下列那些应对方法？（多选题）
- ☐ 尝试自己解决困难
- ☐ 找家人帮忙
- ☐ 找村里的年轻人帮忙
- ☐ 其他办法（请简单说明）_____
- ☐ 放弃互联网，回归传统方法，例如：求教当地技术员

60. 你是否***听说过***任何针对农民的网络培训（培训农民使用互联网）？
- ☐ 是（听说过）
- ☐ 否（没有听说过）

61. 你是否***参加过***任何针对农民的网络培训（培训农民使用互联网）？
- ☐ 是（参加过）
- ☐ 否（没参加过）

62. 你是否***听说过***讲授农业知识与技术的网络课程？
- ☐ 是（听说过）
- ☐ 否（没有听说过）

63. 你是否***参加过***讲授农业知识与技术的网络课程？
- ☐ 是（上过）
- ☐ 否（没有上过）

64. 你是否有过通过互联网获得一些信息，然后在线下参加相关农业技术培训的经历？
- ☐ 是（有过这样的经历）
- ☐ 否（没有）

65. 通过使用互联网，下列哪些变化出现在了你的生活中？（多选题）
- ☐ 刷新了许多我旧有的科学基础知识和基本技能
- ☐ 扩展了我的农业知识储备
- ☐ 帮助我彻底解决了一些问题
- ☐ 增加了收入
- ☐ 带给我新的与人沟通的渠道
- ☐ 其他（请简单说明）_____
- ☐ 没有带来什么改变

你的联系方式：

你所在的位置：_____县，_____乡，_____村

（如果是口述后由他人帮助填写，请在此处留下帮助你执笔填写的人的联系方式：）

手机号码：_____ QQ 号码：_____

微信号码：_____ 电子邮箱：_____

其他联系方式（通信地址、电话、旺旺等）：

你填写本份问卷的日期：_____

APPENDIX D. RESULTS OF CHI-SQUARE AND CORRELATION ANALYSIS REGARDING GENDERS

Table 30. Correlation analysis of education level and gender

Devices	Kendall's Tau b	Sig. (2-tailed)	Spearman's rho	Sig. (2-tailed)
Education	-0.052	0.210	-0.057	0.210

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Table 31. Chi-square analysis of Internet accessing devices and services among gender

Devices	Male		Female			
	n	%	*n*	%	χ^2	*p*
HavePC	164	51.4	60	41.4	4.017	0.045
HaveLap	27	8.5	10	6.9	0.355	0.551
HaveTablet	20	6.3	15	10.3	2.314	0.128
Mobile	339	96.9	146	100.0	4.693	0.030
Smartphone	175	63.6	72	52.9	4.341	0.037
MobileData	184	56.4	78	51.3	1.100	0.294

Table 32. Correlation analysis of Internet usage frequencies and gender

Frequency	Kendall's Tau b	Sig. (2-tailed)	Spearman's rho	Sig. (2-tailed)
Days/Week - Stationary	0.150**	0.003	0.167**	0.003
Days/Week - Mobile	0.100	0.067	0.111	0.067
Hours/Day – Stationary	-0.042	0.385	-0.046	0.386
Hours/Day - Mobile	-0.019	0.705	-0.022	0.706

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Table 33. Chi-square analysis of stationary Internet use purpose among gender

Purpose	Male		Female			
	n	%	*n*	%	χ^2	*p*
Contact families	167	65.0	60	56.6	2.248	0.134
Contact other farmers	43	16.7	16	15.1	0.148	0.701
Contact business partners	21	8.2	4	3.8	2.263	0.132
Obtain agricultural knowledge	61	23.7	27	25.5	0.123	0.726
Obtain farming product information	82	31.9	32	30.2	0.103	0.748
Obtain marketing information	64	24.9	26	24.5	0.006	0.940
Taking online education	21	8.2	8	7.5	0.040	0.842
Watch news	71	27.6	30	28.3	0.017	0.896
Purchase daily groceries	59	23.0	44	41.5	12.709	0.000
Purchase farm materials	19	7.4	8	7.5	0.003	0.959
Sale product	11	4.3	10	9.4	3.657	0.056
Watch video	82	31.9	54	50.9	11.608	0.001
Read book/journal	14	5.4	11	10.4	2.844	0.092
Buy stock	5	1.9	2	1.9	0.001	0.970
Play games	35	13.6	21	19.8	2.206	0.137
Others	4	1.6	3	2.8	0.644	0.422

Table 34. Chi-square analysis of mobile Internet use purpose among gender

Purpose	Male		Female			
	n	%	*n*	%	χ^2	*p*
Contact families	178	72.4	74	76.3	0.522	0.458
Contact other farmers	73	29.7	31	32.0	0.172	0.679
Contact business partners	20	8.1	5	5.2	0.911	0.340
Obtain agricultural knowledge	37	15.0	19	19.6	1.053	0.305
Obtain farming product information	43	17.5	13	13.4	0.847	0.357
Obtain marketing information	31	12.6	14	14.4	0.205	0.651
Taking online education	11	4.5	6	6.2	0.434	0.510
Watch news	63	25.6	28	28.9	0.378	0.538
Purchase daily groceries	31	12.6	25	25.8	8.835	0.003
Purchase farm materials	12	4.9	7	7.2	0.727	0.394
Sale product	5	2.0	9	9.3	9.329	0.002
Watch video	48	19.5	27	27.8	2.821	0.093
Read book/journal	18	7.3	14	14.4	4.164	0.041
Buy stock	2	0.8	1	1.0	0.038	0.845
Play games	29	11.8	19	19.6	3.516	0.061
Others	1	0.4	2	2.1	2.199	0.138

Table 35. Correlation analysis of perceptions frequency and gender

Prefer	Kendall's Tau b	Sig. (2-tailed)	Spearman's rho	Sig. (2-tailed)
Prefer Knowledge via Internet	0.096*	0.040	0.100*	0.040
Prefer Information via Internet	0.101*	0.031	0.105*	0.030

** Correlation is significant at the 0.01 level (2-tailed)

* Correlation is significant at the 0.05 level (2-tailed)

Table 36. Chi-square analysis of knowledge/information source among gender

Sources	Male		Female			
	n	%	*n*	%	χ^2	*p*
Family members	212	65.4	94	64.4	0.049	0.825
Villagers	112	34.6	55	37.7	0.423	0.515
Rural community leader	51	15.7	15	10.3	2.492	0.114
Local farm material dealer	70	21.6	51	34.9	9.350	0.002
Sales man from large scale agricultural company	23	7.1	6	4.1	1.553	0.213
12316 hotline	4	1.2	1	0.7	0.289	0.591
Agricultural cooperative	59	18.2	26	17.8	0.011	0.917
Local soil and fertilizer sector	16	4.9	7	4.8	0.004	0.947
Local plant protective station	8	2.5	9	6.2	3.942	0.047
Local seed station	52	16.0	19	13.0	0.723	0.395
City level academy of Ag-science	7	2.2	2	1.4	0.335	0.563
Provincial level academy of Ag-science	6	1.9	6	4.1	2.062	0.151
Farming experts, technicians from ag technology sectors	42	13.0	27	18.5	2.457	0.117
Agricultural technology books	68	21.0	43	29.5	3.997	0.046
Agricultural journal	21	6.5	6	4.1	1.046	0.306
Agricultural newspapers	50	15.4	16	11.0	1.668	0.196
Agricultural TV channel	82	25.3	52	35.6	5.247	0.022
Agricultural website	17	5.2	9	6.2	0.162	0.687
Agricultural QQ group	16	4.9	6	4.1	0.155	0.694
Agricultural WeChat group	7	2.2	14	9.6	13.012	0.000
Cellphone text message	17	5.2	8	5.5	0.011	0.917
Freely searching online when it is necessary	39	12.0	25	17.1	2.214	0.137
Others	2	0.6	2	1.4	0.676	0.411
Never obtained Agricultural technologies or information	8	2.5	9	6.2	3.942	0.047

Table 37. Chi-square analysis of online paths among gender

Online Path	Male		Female			
	n	%	*n*	%	χ^2	*p*
Private run professional agricultural websites	46	18.1	5	4.4	12.242	0.000
Official websites of agricultural departments	44	17.3	22	19.5	0.244	0.621
Official websites of agricultural academic institutions	12	4.7	10	8.8	2.362	0.124
Agricultural median's websites	54	21.3	25	22.1	0.035	0.853
Agricultural company/business' websites	27	10.6	8	7.1	1.143	0.285
Agricultural cooperatives' websites	26	10.2	11	9.7	0.022	0.883
Join relevant cyber community/forum	16	6.3	8	7.1	0.078	0.780
Free searching online by using key words	57	22.4	20	17.7	1.061	0.303
Join specific QQ groups	26	10.2	10	8.8	0.170	0.068
Join specific WeChat group	20	7.9	21	18.6	9.040	0.003
Others	1	0.4	3	2.7	3.709	0.054
Never obtain Agricultural education or information online	46	18.1	40	35.4	13.028	0.000

Table 38. Chi-square analysis of stationary Internet obtained subjects among gender

Subjects	Male		Female			
	n	%	*n*	%	χ^2	*p*
Plant disease/pest control	118	44.4	34	28.1	9.221	0.002
Weed control	46	17.3	21	17.4	0.000	0.998
Conventional fertilizer use	58	21.8	22	18.2	0.610	0.435
Organic fertilizer use	57	21.4	23	19.0	0.297	0.586
Farm chemical using	50	18.8	27	22.5	0.710	0.399
Water saving irrigation	33	12.4	12	9.9	0.501	0.479
Organic farming	26	9.8	9	7.4	0.552	0.458
Meteorological disaster prediction and prevention	63	23.7	37	30.6	2.063	0.151
Marketing information of farming materials	47	17.7	23	19.0	0.101	0.751
Marketing information of farm product	49	18.4	23	19.0	0.019	0.891
Updated agricultural policy and laws	38	14.3	12	9.9	1.411	0.235
Never obtain agricultural knowledge/information through stationary/mobile Internet	43	16.2	34	28.1	7.432	0.006
Others	2	0.8	4	3.3	3.554	0.059

Table 39. Chi-square analysis of mobile Internet obtained subjects among gender

Subjects	Male		Female			
	n	%	*n*	%	χ^2	*p*
Plant disease/pest control	91	34.7	25	21.7	6.334	0.012
Weed control	38	14.5	14	12.2	0.365	0.546
Conventional fertilizer use	43	16.4	18	15.8	0.023	0.880
Organic fertilizer use	43	16.4	12	10.4	2.292	0.130
Farm chemical using	29	11.1	16	13.9	0.615	0.433
Water saving irrigation	27	10.3	11	9.6	0.048	0.826
Organic farming	13	5.0	6	5.2	0.011	0.917
Meteorological disaster prediction and prevention	75	28.6	38	33.0	0.743	0.389
Marketing information of farming materials	37	14.1	14	12.2	0.259	0.611
Marketing information of farm product	27	10.3	12	10.4	0.001	0.970
Updated agricultural policy and laws	40	15.3	15	13.0	0.317	0.573
Never obtain agricultural knowledge/information through stationary/mobile Internet	49	18.7	36	31.3	7.268	0.007
Others	2	0.8	5	4.3	5.635	0.018

Table 40. Correlation analysis of credibility perceptions and gender

Credibility	Kendall's Tau b	Sig. (2-tailed)	Spearman's rho	Sig. (2-tailed)
Knowledge Credibility	0.008	0.868	0.008	0.868
Information Credibility	0.048	0.297	0.050	0.297

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Table 41. Chi-square analysis of reactions to obtained knowledge among gender

Purpose	Male		Female			
	n	%	*n*	%	χ^2	*p*
Trust and directly apply	59	19.3	9	7.8	8.329	0.004
Decided after discuss with other farmers	160	52.5	62	53.4	0.033	0.856
Verify by discuss with local technicians	128	42.0	52	44.8	0.281	0.596
Won't apply, but take as reference	66	21.6	56	48.3	28.971	0.000
Don't trust and won't apply to actual farming	13	4.3	4	3.4	0.144	0.705
Others	7	2.3	4	3.4	0.439	0.508

Table 42. Chi-square analysis of reactions to obtained information among gender

Purpose	Male		Female			
	n	%	*n*	%	χ^2	*p*
Trust and directly apply	49	17.1	8	7.1	6.627	0.010
Decided after discuss with other farmers	160	55.4	73	64.6	2.845	0.092
Verify by discuss with local technicians	108	37.4	52	46.0	2.535	0.111
Won't apply, but take as reference	63	21.8	38	33.6	6.042	0.014
Don't trust and won't apply to actual farming	22	7.6	6	5.3	0.665	0.415
Others	7	2.4	1	0.9	0.984	0.321

Table 43. Chi-square analysis of training and course participating status among gender

Purpose	Male		Female			
	n	%	*n*	%	χ^2	*p*
Have heard about training farmers to use the Internet	96	30.6	56	39.2	3.264	0.071
Have taken training courses teaching farmers how to use the Internet	14	4.6	13	9.6	4.014	0.045
Have heard about online course in agriculture and technology	79	25.8	42	30.4	1.023	0.312
Have taken online course(s) on agricultural knowledge and skills	24	7.8	10	7.4	0.023	0.880
Have obtained information through the Internet regarding offline program	21	7.5	11	8.7	0.173	0.678

Table 44. Chi-square analysis of obstacles among gender

Obstacles	Male		Female			
	n	%	*n*	%	χ^2	*p*
Don't have appropriate device	88	32.0	32	26.2	1.334	0.248
Don't have Internet access	51	18.5	11	9.0	5.823	0.016
Costs too much	32	11.6	19	15.6	1.170	0.279
Don't know how to use it	41	14.9	26	21.3	2.469	0.116
Don't know how to type	44	16.0	28	23.0	2.750	0.097
Can't find relevant information on the Internet	65	23.6	34	27.9	0.809	0.368
Online information is inaccurate	61	22.2	32	26.2	0.772	0.380
Other obstacles	17	6.2	4	3.3	1.422	0.233
Never met obstacles	11	13.6	11	17.7	0.467	0.494

Table 45. Chi-square analysis of reactions to obstacles among gender

Reactions	Male		Female			
	n	%	*n*	%	χ^2	*p*
Tried to find the solution alone	106	42.1	42	34.7	1.847	0.174
Asked families for help	68	27.0	41	33.9	1.882	0.170
Asked young people for help	79	31.3	32	26.4	0.940	0.332
Give up on the Internet and returned to traditional ways of obtaining agricultural education, such as call local technicians	51	20.2	35	28.9	3.478	0.062
Other	12	4.8	2	1.7	2.187	0.139

Table 46. Chi-square analysis of positive changes among gender

Positive Changes	Male		Female			
	n	%	*n*	%	χ^2	*p*
Renewed basic skills and understanding of technology	143	54.4	53	42.7	4.560	0.033
Broadened my farming knowledge	96	36.5	51	41.1	0.766	0.381
Truly solved my problem	44	16.7	27	21.8	1.431	0.232
Increased income	62	23.6	27	21.8	0.154	0.695
Created new communication channels	52	19.8	26	21.0	0.075	0.784
Did not improve or change anything	18	6.8	14	11.3	2.196	0.138
Other	14	5.3	5	4.0	0.301	0.583

APPENDIX E. RESULTS OF CORRELATION ANALYSIS REGARDING EDUCATION

Table 47. Correlation analysis of genders and education level

Devices	Kendall's Tau b	Sig. (2-tailed)	Spearman's rho	Sig.(2-tailed)
Genders	-0.052	0.210	-0.057	0.210

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Table 48. Correlation analysis of Internet related devices and services and education level

Devices	Kendall's Tau b	Sig.(2-tailed)	Spearman's rho	Sig.(2-tailed)
HavePC	0.277**	0.000	0.302**	0.000
HaveLap	0.201**	0.000	0.220**	0.000
HaveTablet	0.145**	0.001	0.158**	0.001
Mobile	0.442	0.319	0.046	0.320
Smartphone	0.486**	0.000	0.530**	0.000
MobileData	0.398**	0.000	0.434**	0.000

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Table 49. Correlation analysis of Internet surfing frequencies and education level

Frequency	Kendall's Tau b	Sig. (2-tailed)	Spearman's rho	Sig. (2-tailed)
Days/Week - Stationary	0.216**	0.000	0.257**	0.000
Days/Week - Mobile	-0.051	0.322	-0.061	0.325
Hours/Day – Stationary	0.401**	0.000	0.475**	0.000
Hours/Day - Mobile	0.310**	0.000	0.371**	0.000

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Table 50. Correlation analysis of stationary Internet use purpose and education level

Purpose	Kendall's Tau b	Sig. (2-tailed)	Spearman's rho	Sig. (2-tailed)
Contact families	-0.028	0.573	-0.030	0.573
Contact other farmers	0.002	0.966	0.002	0.966
Contact business partners	0.059	0.235	0.064	0.236
Obtain agricultural knowledge	0.162**	0.001	0.174**	0.001
Obtain farming product information	0.082	0.099	0.088	0.099
Obtain marketing information	0.142**	0.004	0.153**	0.004
Taking online education	0.157**	0.002	0.169**	0.001
Watch news	0.127*	0.011	0.136*	0.011
Purchase daily groceries	0.195**	0.000	0.210**	0.000
Purchase farm materials	0.118*	0.017	0.127*	0.017
Sale product	0.082	0.097	0.089	0.097
Watch video	0.084	0.090	0.091	0.090
Read book/journal	0.131**	0.008	0.141**	0.008
Buy stock	0.095	0.056	0.102	0.056
Play games	0.047	0.347	0.050	0.347
Others	0.066	0.181	0.072	0.182

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Table 51. Correlation analysis of mobile Internet use purpose and education level

Purpose	Kendall's Tau b	Sig. (2-tailed)	Spearman's rho	Sig. (2-tailed)
Contact families	-0.099	0.053	-0.107	0.053
Contact other farmers	-0.027	0.595	-0.029	0.596
Contact business partners	0.064	0.211	0.069	0.211
Obtain agricultural knowledge	0.147**	0.004	0.158**	0.004
Obtain farming product information	0.158**	0.002	0.170**	0.002
Obtain marketing information	0.114*	0.026	0.123*	0.026
Taking online education	0.133**	0.009	0.144**	0.009
Watch news	0.123*	0.016	0.133*	0.015
Purchase daily groceries	0.128*	0.012	0.138*	0.012
Purchase farm materials	0.165**	0.001	0.179**	0.001
Sale product	0.056	0.249	0.064	0.250
Watch video	0.040	0.435	0.043	0.436
Read book/journal	0.021	0.681	0.023	0.682
Buy stock	0.124*	0.015	0.134*	0.015
Play games	-0.006	0.908	-0.006	0.908
Others	-0.002	0.964	-0.003	0.964

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Table 52. Correlation analysis of perceptions and education level

Prefer	Kendall's Tau b	Sig. (2-tailed)	Spearman's rho	Sig. (2-tailed)
Prefer Knowledge via Internet	-0.352**	0.000	-0.404**	0.000
Prefer Information via Internet	-0.340**	0.000	-0.395**	0.000

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Table 53. Correlation analysis of knowledge/information sources and education level

Sources	Kendall's Tau b	Sig. (2-tailed)	Spearman's rho	Sig. (2-tailed)
Family members	-0.207**	0.000	-0.226**	0.000
Villagers	-0.159**	0.000	-0.174**	0.000
Rural community leader	0.017	0.685	0.019	0.686
Local farm material dealer	-0.106	0.014	-0.116	0.014
Sales man from large scale agricultural company	0.046	0.284	0.050	0.284
12316 hotline	0.025	0.560	0.027	0.560
Agricultural cooperative	0.148**	0.001	0.161**	0.001
Local soil and fertilizer sector	-0.046	0.288	-0.050	0.289
Local plant protective station	0.027	0.534	0.029	0.535
Local seed station	0.093*	0.031	0.102*	0.031
City level academy of Ag-science	0.030	0.491	0.032	0.492
Provincial level academy of Ag-science	0.061	0.158	0.067	0.158
Farming experts, technicians from ag technology sectors	0.143**	0.001	0.156**	0.001
Agricultural technology books	-0.074	0.085	-0.081	0.085
Agricultural journal	0.176**	0.000	0.192**	0.000
Agricultural newspapers	0.046	0.290	0.050	0.291
Agricultural TV channel	-0.058	0.182	-0.063	0.183
Agricultural website	0.123**	0.004	0.135**	0.004
Agricultural QQ group	0.063	0.146	0.068	0.146
Agricultural WeChat group	0.050	0.249	0.054	0.249
Cellphone text message	0.117**	0.007	0.128**	0.007
Freely searching online when it is necessary	0.150**	0.001	0.164**	0.000
Others	0.078	0.069	0.068	0.069
Never obtained Agricultural technologies or information	0.043	0.323	0.047	0.324

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Table 54. Correlation analysis of online paths and education level

Online Path	Kendall's Tau b	Sig. (2-tailed)	Spearman's rho	Sig. (2-tailed)
Private run professional agricultural websites	-0.171**	0.000	-0.187**	0.000
Official websites of agricultural departments	0.141**	0.004	0.154**	0.004
Official websites of agricultural academic institutions	0.100*	0.040	0.109*	0.040
Agricultural median's websites	0.130**	0.008	0.142**	0.008
Agricultural company/business' websites	0.186**	0.000	0.203**	0.000
Agricultural cooperatives' websites	0.120*	0.014	0.131*	0.014
Join relevant cyber community/forum	0.139**	0.004	0.152**	0.004
Free searching online by using key words	0.166**	0.001	0.181**	0.001
Join specific QQ groups	0.135**	0.006	0.148**	0.006
Join specific WeChat group	0.092	0.050	0.100	0.060
Others	0.074	0.129	0.081	0.129
Never obtain Agricultural education or information online	-0.292**	0.000	-0.318**	0.000

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Table 55. Correlation analysis of stationary Internet obtained subjects and education level

Subjects	Kendall's Tau b	Sig. (2-tailed)	Spearman's rho	Sig. (2-tailed)
Plant disease/pest control	0.040	0.408	0.043	0.408
Weed control	0.128**	0.007	0.139**	0.007
Conventional fertilizer use	0.189**	0.000	0.206**	0.000
Organic fertilizer use	0.127**	0.008	0.139**	0.008
Farm chemical using	0.108*	0.025	0.117*	0.025
Water saving irrigation	0.134**	0.005	0.146**	0.005
Organic farming	0.066	0.167	0.072	0.168
Meteorological disaster prediction and prevention	0.233**	0.000	0.253**	0.000
Marketing information of farming materials	0.151**	0.002	0.165**	0.001
Marketing information of farm product	0.175**	0.000	0.191**	0.000
Updated agricultural policy and laws	0.208**	0.000	0.227**	0.000
Never obtain agricultural knowledge/information through stationary/mobile Internet	-0.292**	0.000	-0.318**	0.000
Others	0.153**	0.001	0.166**	0.001

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Table 56. Correlation analysis of mobile Internet obtained subjects and education level

Subjects	Kendall's Tau b	Sig. (2-tailed)	Spearman's rho	Sig. (2-tailed)
Plant disease/pest control	-0.034	0.487	-0.037	0.488
Weed control	0.119*	0.014	0.130*	0.014
Conventional fertilizer use	0.144**	0.003	0.157**	0.003
Organic fertilizer use	0.107*	0.027	0.117*	0.027
Farm chemical using	0.146**	0.003	0.159**	0.002
Water saving irrigation	0.165**	0.001	0.180**	0.001
Organic farming	0.037	0.449	0.040	0.450
Meteorological disaster prediction and prevention	0.206**	0.000	0.224**	0.000
Marketing information of farming materials	0.173**	0.000	0.189**	0.000
Marketing information of farm product	0.088	0.068	0.096	0.068
Updated agricultural policy and laws	0.093	0.055	0.101	0.055
Never obtain agricultural knowledge/information through stationary/mobile Internet	-0.259**	0.000	-0.282**	0.000
Others	0.142**	0.003	0.155**	0.003

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Table 57. Correlation analysis of credibility perception and education level

Credibility	Kendall's Tau b	Sig. (2-tailed)	Spearman's rho	Sig. (2-tailed)
Knowledge Credibility	-0.140**	0.001	-0.158**	0.001
Information Credibility	-0.131**	0.002	-0.149**	0.002

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Table 58. Correlation analysis of reactions to obtained knowledge and education level

Reactions	Kendall's Tau b	Sig. (2-tailed)	Spearman's rho	Sig. (2-tailed)
Trust and directly apply	-0.080	0.081	-0.087	0.081
Decided after discuss with other farmers	-0.062	0.179	-0.067	0.179
Verify by discuss with local technicians	-0.042	0.358	-0.046	0.358
Won't apply, but take as reference	-0.037	0.422	-0.040	0.422
Don't trust and won't apply to actual farming	0.016	0.720	0.018	0.721
Others	-0.008	0.860	-0.009	0.860

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Table 59. Correlation analysis of reactions to obtained information and education level

Reactions	Kendall's Tau b	Sig. (2-tailed)	Spearman's rho	Sig. (2-tailed)
Trust and directly apply	-0.157**	0.001	-0.170**	0.001
Decided after discuss with other farmers	-0.003	0.957	-0.003	0.958
Verify by discuss with local technicians	-0.037	0.432	-0.040	0.433
Won't apply, but take as reference	-0.041	0.388	-0.044	0.389
Don't trust and won't apply to actual farming	0.059	0.211	0.064	0.212
Others	0.053	0.259	0.058	0.259

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Table 60. Correlation analysis of training and course participating and education level

Reactions	Kendall's Tau b	Sig. (2-tailed)	Spearman's rho	Sig. (2-tailed)
Have heard about training farmers to use the Internet	0.218**	0.000	0.238**	0.000
Have taken training courses teaching farmers how to use the Internet	0.106*	0.017	0.116*	0.017
Have heard about online course in agriculture and technology	0.165**	0.000	0.180**	0.000
Have taken online course(s) on agricultural knowledge and skills	0.127**	0.004	0.138**	0.004
Have obtained information through the Internet regarding offline program	0.235**	0.000	0.257**	0.000

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Table 61. Correlation analysis of obstacles and education level

Obstacles	Kendall's Tau b	Sig. (2-tailed)	Spearman's rho	Sig. (2-tailed)
Don't have appropriate device	-0.121*	0.011	-0.131*	0.011
Don't have Internet access	0.046	0.336	0.050	0.337
Costs too much	0.043	0.358	0.047	0.359
Don't know how to use it	-0.081	0.086	-0.088	0.086
Don't know how to type	-0.156**	0.001	-0.170**	0.001
Can't find relevant information on the Internet	0.069	0.147	0.075	0.147
Online information is inaccurate	0.221**	0.000	0.240**	0.000
Other obstacles	0.031	0.514	0.034	0.515
Never met obstacles	0.035	0.672	0.037	0.674

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Table 62. Correlation analysis of reactions to obstacles and education level

Reactions	Kendall's Tau b	Sig. (2-tailed)	Spearman's rho	Sig. (2-tailed)
Tried to find the solution alone	0.083	0.091	0.090	0.091
Asked families for help	0.125*	0.010	0.136*	0.010
Asked young people for help	0.038	0.442	0.041	0.443
Give up on the Internet and returned to traditional ways of obtaining agricultural education, such as call local technicians	-0.166**	0.001	-0.181**	0.001
Other	-0.016	0.744	-0.017	0.745

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Table 63. Correlation analysis of positive changes and education level

Positive Changes	Kendall's Tau b	Sig. (2-tailed)	Spearman's rho	Sig. (2-tailed)
Renewed basic skills and understanding of technology	0.109**	0.022	0.119*	0.022
Broadened my farming knowledge	-0.004	0.936	-0.004	0.936
Truly solved my problem	0.166**	0.001	0.180**	0.001
Increased income	0.130**	0.007	0.142**	0.006
Created new communication channels	0.185**	0.000	0.202**	0.000
Did not improve or change anything	-0.260**	0.000	-0.283**	0.000
Other	-0.001	0.976	-0.002	0.976

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

APPENDIX F. RESULTS OF CORRELATION ANALYSIS REGARDING AGE GROUP

Table 64. Correlation analysis of education and age group

Devices	Kendall's Tau b	Sig. (2-tailed)	Spearman's rho	Sig. (2-tailed)
Education Level	-0.356**	0.00	-0.421**	0.000

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Table 65. Correlation analysis of devices and services and age group

Devices	Kendall's Tau b	Sig. (2-tailed)	Spearman's rho	Sig. (2-tailed)
HavePC	-0.168**	0.000	-0.186**	0.000
HaveLap	-0.105*	0.016	-0.116*	0.016
HaveTablet	-0.199**	0.000	-0.220**	0.000
Mobile	-0.119**	0.005	-0.132**	0.004
Smartphone	-0.480**	0.000	-0.530**	0.000
MobileData	-0.436**	0.000	-0.482**	0.000

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Table 66. Correlation analysis of Internet surfing frequencies and age group

Frequency	Kendall's Tau b	Sig. (2-tailed)	Spearman's rho	Sig. (2-tailed)
Days/Week - Stationary	-0.434**	0.000	-0.519**	0.000
Days/Week - Mobile	-0.341**	0.000	-0.410**	0.000
Hours/Day – Stationary	-0.207**	0.000	-0.254**	0.000
Hours/Day - Mobile	-0.311**	0.000	-0.385**	0.000

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Table 67. Correlation analysis of stationary Internet use purpose and age group

Purpose	Kendall's Tau b	Sig. (2-tailed)	Spearman's rho	Sig. (2-tailed)
Contact families	0.104*	0.035	0.116*	0.035
Contact other farmers	0.062	0.213	0.068	0.213
Contact business partners	0.024	0.634	0.026	0.635
Obtain agricultural knowledge	-0.016	0.742	-0.018	0.742
Obtain farming product information	-0.039	0.427	-0.044	0.428
Obtain marketing information	-0.032	0.518	-0.036	0.519
Taking online education	-0.012	0.807	-0.013	0.807
Watch news	-0.040	0.423	-0.044	0.424
Purchase daily groceries	-0.274**	0.000	-0.273**	0.000
Purchase farm materials	-0.025	0.614	-0.028	0.614
Sale product	0.010	0.837	0.011	0.837
Watch video	-0.262**	0.000	-0.290**	0.000
Read book/journal	-0.033	0.504	-0.037	0.505
Buy stock	-0.019	0.699	-0.021	0.700
Play games	-0.186**	0.000	-0.206**	0.000
Others	0.037	0.454	0.041	0.455

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Table 68. Correlation analysis of mobile Internet use purpose and age group

Purpose	Kendall's Tau b	Sig. (2-tailed)	Spearman's rho	Sig. (2-tailed)
Contact families	-0.103*	0.044	-0.114*	0.044
Contact other farmers	-0.178**	0.000	-0.198**	0.000
Contact business partners	0.021	0.683	0.023	0.684
Obtain agricultural knowledge	-0.016	0.749	-0.018	0.750
Obtain farming product information	-0.083	0.105	-0.092	0.106
Obtain marketing information	-0.058	0.255	-0.065	0.255
Taking online education	-0.024	0.640	-0.027	0.640
Watch news	-0.230**	0.000	-0.255**	0.000
Purchase daily groceries	-0.252**	0.000	-0.280	0.000
Purchase farm materials	-0.064	0.209	-0.071	0.209
Sale product	-0.028	0.585	-0.031	0.586
Watch video	-0.283**	0.000	-0.313**	0.000
Read book/journal	-0.173**	0.001	-0.191**	0.001
Buy stock	0.045	0.383	0.049	0.384
Play games	-0.126*	0.014	-0.140*	0.014
Others	0.034	0.505	0.038	0.506

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Table 69. Correlation analysis of perceptions frequency and age group

Prefer	Kendall's Tau b	Sig. (2-tailed)	Spearman's rho	Sig. (2-tailed)
Prefer Knowledge via Internet	0.226**	0.000	0.263**	0.000
Prefer Information via Internet	0.236**	0.000	0.274**	0.000

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Table 70. Correlation analysis of knowledge/information sources and age group

Sources	Kendall's Tau b	Sig. (2-tailed)	Spearman's rho	Sig. (2-tailed)
Family members	0.056	0.193	0.062	0.193
Villagers	0.063	0.142	0.070	0.143
Rural community leader	0.124**	0.004	0.138**	0.004
Local farm material dealer	-0.108*	0.012	-0.120*	0.012
Sales man from large scale agricultural company	-0.033	0.442	-0.037	0.443
12316 hotline	0.002	0.966	0.002	0.966
Agricultural cooperative	-0.008	0.858	-0.009	0.859
Local soil and fertilizer sector	0.032	0.466	0.035	0.467
Local plant protective station	-0.042	0.333	-0.046	0.334
Local seed station	0.050	0.250	0.055	0.251
City level academy of Ag-science	0.057	0.190	0.063	0.191
Provincial level academy of Ag-science	0.045	0.303	0.049	0.303
Farming experts, technicians from ag technology sectors	-0.011	0.807	-0.012	0.808
Agricultural technology books	-0.055	0.201	-0.061	0.202
Agricultural journal	-0.001	0.978	-0.001	0.978
Agricultural newspapers	0.090*	0.038	0.099*	0.038
Agricultural TV channel	-0.113**	0.009	-0.125**	0.009
Agricultural website	-0.057	0.188	-0.063	0.188
Agricultural QQ group	-0.009	0.831	-0.010	0.831
Agricultural WeChat group	-0.154**	0.000	-0.170**	0.000
Cellphone text message	-0.005	0.899	-0.006	0.899
Freely searching online when it is necessary	-0.156**	0.000	-0.172**	0.000
Others	0.013	0.765	0.014	0.766
Never obtained Agricultural technologies or information	-0.069	0.108	-0.077	0.108

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Table 71. Correlation analysis of online paths and age group

Online Path	Kendall's Tau b	Sig. (2-tailed)	Spearman's rho	Sig. (2-tailed)
Private run professional agricultural websites	0.174**	0.000	0.192**	0.000
Official websites of agricultural departments	-0.036	0.459	-0.040	0.460
Official websites of agricultural academic institutions	-0.030	0.544	-0.033	0.544
Agricultural median's websites	-0.030	0.538	-0.034	0.539
Agricultural company/business' websites	-0.026	0.600	-0.029	0.600
Agricultural cooperatives' websites	-0.020	0.687	-0.022	0.688
Join relevant cyber community/forum	0.037	0.454	-0.041	0.455
Free searching online by using key words	-0.084	0.090	-0.093	0.090
Join specific QQ groups	-0.067	0.175	-0.074	0.175
Join specific WeChat group	-0.188**	0.000	-0.208**	0.000
Others	0.017	0.738	0.018	0.738
Never obtain Agricultural education or information online	0.031	0.528	0.034	0.529

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Table 72. Correlation analysis of stationary Internet obtained subjects and age group

Subjects	Kendall's Tau b	Sig. (2-tailed)	Spearman's rho	Sig. (2-tailed)
Plant disease/pest control	0.019	0.695	0.021	0.696
Weed control	-0.121*	0.012	-0.134*	0.012
Conventional fertilizer use	-0.015	0.748	-0.017	0.748
Organic fertilizer use	-0.141**	0.003	-0.156**	0.003
Farm chemical using	-0.004	0.928	-0.005	0.928
Water saving irrigation	-0.007	0.881	-0.008	0.881
Organic farming	0.002	0.974	0.002	0.974
Meteorological disaster prediction and prevention	-0.088	0.067	-0.097	0.067
Marketing information of farming materials	0.042	0.382	0.046	0.382
Marketing information of farm product	-0.047	0.323	-0.053	0.323
Updated agricultural policy and laws	-0.040	0.404	-0.044	0.405
Never obtain agricultural knowledge/information through stationary/mobile Internet	0.034	0.483	0.037	0.484
Others	-0.050	0.300	-0.055	0.301

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Table 73. Correlation analysis of mobile Internet obtained subjects and age group

Subjects	Kendall's Tau b	Sig. (2-tailed)	Spearman's rho	Sig. (2-tailed)
Plant disease/pest control	0.032	0.506	0.036	0.507
Weed control	-0.157**	0.001	-0.174**	0.001
Conventional fertilizer use	-0.039	0.428	-0.043	0.429
Organic fertilizer use	-0.082	0.092	-0.091	0.092
Farm chemical using	-0.052	0.282	-0.058	0.283
Water saving irrigation	-0.024	0.616	-0.027	0.617
Organic farming	0.044	0.363	0.049	0.364
Meteorological disaster prediction and prevention	-0.146**	0.003	-0.162**	0.002
Marketing information of farming materials	-0.076	0.115	-0.085	0.115
Marketing information of farm product	-0.072	0.136	-0.080	0.136
Updated agricultural policy and laws	-0.217**	0.000	-0.240**	0.000
Never obtain agricultural knowledge/information through stationary/mobile Internet	0.051	0.294	0.056	0.294
Others	-0.051	0.298	-0.056	0.299

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Table 74. Correlation analysis of credibility perception and age group

Credibility	Kendall's Tau b	Sig. (2-tailed)	Spearman's rho	Sig. (2-tailed)
Knowledge Credibility	0.073	0.087	0.085	0.084
Information Credibility	0.129**	0.003	0.149**	0.002

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Table 75. Correlation analysis of reactions to obtained knowledge and age group

Reactions	Kendall's Tau b	Sig. (2-tailed)	Spearman's rho	Sig. (2-tailed)
Trust and directly apply	0.104*	0.022	0.116*	0.022
Decided after discuss with other farmers	-0.086	0.060	-0.095	0.060
Verify by discuss with local technicians	-0.052	0.254	-0.058	0.254
Won't apply, but take as reference	-0.253**	0.000	-0.281**	0.000
Don't trust and won't apply to actual farming	-0.021	0.651	-0.023	0.652
Others	0.026	0.565	0.029	0.566

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Table 76. Correlation analysis of reactions to obtained information and age group

Reactions	Kendall's Tau b	Sig. (2-tailed)	Spearman's rho	Sig. (2-tailed)
Trust and directly apply	0.129**	0.006	0.143**	0.006
Decided after discuss with other farmers	-0.155**	0.001	-0.172**	0.001
Verify by discuss with local technicians	-0.058	0.212	-0.065	0.212
Won't apply, but take as reference	-0.202**	0.000	-0.225**	0.000
Don't trust and won't apply to actual farming	0.006	0.897	0.007	0.897
Others	0.023	0.625	0.025	0.625

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Table 77. Correlation analysis of training and course participating and age group

Reactions	Kendall's Tau b	Sig. (2-tailed)	Spearman's rho	Sig. (2-tailed)
Have heard about training farmers to use the Internet	-0.131**	0.003	-0.145**	0.003
Have taken training courses teaching farmers how to use the Internet	-0.050	0.258	-0.056	0.259
Have heard about online course in agriculture and technology	-0.085	0.054	-0.095	0.054
Have taken online course(s) on agricultural knowledge and skills	-0.020	0.657	-0.022	0.658
Have obtained information through the Internet regarding offline program	-0.050	0.268	-0.056	0.269

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Table 78. Correlation analysis of obstacles and age group

Obstacles	Kendall's Tau b	Sig. (2-tailed)	Spearman's rho	Sig. (2-tailed)
Don't have appropriate device	0.066	0.162	0.073	0.162
Don't have Internet access	0.039	0.412	0.043	0.412
Costs too much	0.012	0.792	0.014	0.793
Don't know how to use it	0.062	0.193	0.068	0.193
Don't know how to type	-0.008	0.868	-0.009	0.868
Can't find relevant information on the Internet	-0.108*	0.022	-0.120*	0.021
Online information is inaccurate	-0.082	0.082	-0.091	0.082
Other obstacles	0.104*	0.028	0.115*	0.028
Never met obstacles	-0.056	0.514	-0.062	0.517

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Table 79. Correlation analysis of reactions to obstacles and age group

Reactions	Kendall's Tau b	Sig. (2-tailed)	Spearman's rho	Sig. (2-tailed)
Tried to find the solution alone	-0.197**	0.000	-0.218**	0.000
Asked families for help	-0.057	0.246	-0.063	0.247
Asked young people for help	-0.053	0.283	-0.058	0.283
Give up on the Internet and returned to traditional ways of obtaining agricultural education, such as call local technicians	0.094	0.055	0.104	0.055
Other	0.096	0.050	0.106*	0.050

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Table 80. Correlation analysis of positive changes and age group

Positive Changes	Kendall's Tau b	Sig. (2-tailed)	Spearman's rho	Sig. (2-tailed)
Renewed basic skills and understanding of technology	-0.150**	0.002	-0.165**	0.002
Broadened my farming knowledge	-0.044	0.354	-0.049	0.355
Truly solved my problem	-0.075	0.115	-0.084	0.116
Increased income	0.082	0.086	0.091	0.086
Created new communication channels	0.007	0.876	0.008	0.876
Did not improve or change anything	0.229**	0.000	0.254**	0.000
Other	0.100*	0.036	0.111*	0.036

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)