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INTERNET PLUS AGRICULTURE

A NEW ENGINE FOR RURAL
ECONOMIC GROWTH IN
THE PEOPLE'S REPUBLIC OF CHINA

SEPTEMBER 2018

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Abbreviations

ADB	Asian Development Bank
CNY	yuan
GDP	gross domestic product
GIS	geographic information system
GPS	global positioning system
ICT	information and communication technology
IOT	Internet of Things
PRC	People's Republic of China
R&D	research and development
UAV	unmanned aerial vehicle

Executive Summary

Introduction

This publication is based on the findings of field surveys conducted in five provinces in the People's Republic of China (PRC), namely, Gansu, Hubei, Shandong, Yunnan, and Zhejiang. The survey was part of a technical assistance funded by the Asian Development Bank (ADB), the *Rural Economic Transformation and Upgrading by the Integration with Internet Plus*, which lined up recommendations for policies, mechanisms, and investments for an Internet Plus rural economy in the PRC.

The structure of the agriculture system in the PRC is characterized as “small-sized” and “highly scattered.” With family-operated farms focusing on the production stage at the expense of other value chain services, the market status of farmers is at a competitive disadvantage because of high production costs, low profit margins, and problems with nonpoint source pollution and food safety. With the rapid development of internet technology in the country since the beginning of the 21st century, a set of “Internet Plus” technologies have made influential impacts on the economic system as a whole, which have trickled down to the rural economic sector. The internet has shown great advantage in the integration, transformation, and upgrading of the PRC's rural economy, especially in the agriculture industry chain.

“Internet Plus rural economy” refers to an economic phenomenon of applying internet technology—e.g., the mobile internet, Internet of Things (IOT), cloud computing, and big data—to improve the efficiency of the rural economic sector, such as the production, processing, and trade of agriculture products; agriculture social services (agriculture finance, agriculture precise operation, technical services); leisure agriculture and rural tourism; and farmers' daily consumption.

The Internet Plus rural economy has become an important force of the PRC's Internet Plus economy blueprint. First, the application of internet technology to the rural economy has transformed and upgraded many traditional industries into modern production modes, thereby enhancing rural productivity and efficiency. Second, internet technology has subverted the traditional concept of time and space, making distances smaller, time periods shorter, and information more symmetrical. This has facilitated the provision of fast, real-time, and reliable information on agriculture production, and has promoted both local and global sales of high-quality agriculture products. Third, internet technology has opened new opportunities for rural entrepreneurship and innovation, and has thus motivated young people to actively engage in rural e-business ventures. Finally, the Internet Plus connects small farmers to the modern economic system via electronic information, which provides them with more cost-effective and efficient channels for selling their agriculture products, increasing their income, and lifting them out of poverty.

Government Support through Policies and Projects

In efforts to promote the development of the Internet Plus rural economy model, the PRC government (from national to county levels) has issued successive series of policy documents for guidance. Numerous demonstration projects have been funded for the implementation of intelligent agriculture projects using IOT applications. These include (i) the Beidou modern agriculture project in Hubei Province, which uses the Beidou Satellite Navigation System that combines high-precision positioning technology with sensor technology to realize accurate monitoring of soil moisture, farm machinery auto-pilot control, and direct seed precision planting; (ii) the intelligent rice bud production system in Heilongjiang Province, which conducts real-time data collection through temperature and moisture sensors in greenhouses to achieve intelligent micro-spraying and electric shutter ventilation control; and (iii) the quality and safety traceability system of agriculture products, which applies blockchain technology in the whole agriculture value chain.

Other pilot projects have focused on improving access to e-commerce platforms, mobile information, and universal telecommunication services for rural households and rural administrative villages. The establishment of these data platforms encourages data sharing on agriculture production, processing, and logistics, including information on soil testing and formulated fertilization, pest prevention and control, agriculture insurance services, product packaging, quality tracking, and e-commerce training, among others. From 2014 to 2016, the central finance department cumulatively allocated a total of 8.4 billion yuan (CNY) to support the launching of a comprehensive rural e-commerce demonstration in 496 counties in 26 provinces, autonomous regions, and municipalities across the country. The Thirteenth Five-Year Plan, 2016–2020 has indicated an investment of over CNY140 billion in building broadband villages in rural areas and remote regions.

Application of Internet Technologies in the Rural Economy

Rural E-commerce

Among the application structures of the PRC's Internet Plus rural economy model, rural e-commerce is the most active, boosting the sales of agriculture products through new sales channels, reduced transaction costs, and simplified trading procedures. The rural e-commerce industry chain covers a range of activities, from the production, processing, storage, and marketing of agriculture products; to shipment and after-sales services. These activities provide employment and entrepreneurial opportunities as well as diversified sources of income for farmers; returning migrant workers; young unemployed graduates; and other disadvantaged groups (e.g., the poor, women, elderly, and disabled) in the rural areas.

In developing e-commerce for agriculture products, the provinces adopted a three-tier service facility system, which consists of county service centers, township service stations, and village service sites. Each service facility performs different functions. Villagers can sell their agriculture products, purchase goods online, make online payments, and pick up purchased goods at the

service facilities without leaving their respective villages. Nonetheless, rural e-commerce has faced a general lack of professional internet-savvy personnel. Thus, farmers' cooperatives and enterprises usually resort to utilizing third-party e-commerce platforms, such as Alibaba, Jingdong, Suning, Taobao, and Tmall, in starting their online businesses. But these platforms are observed to tender low profits and maintain prohibitive access conditions (e.g., collection of security deposit upon registration and high fees for marketing activities).

According to the Ministry of Commerce, the 2016 national trade volume of e-commerce for agriculture products increased by 46.2% from 2015 and about four times the total volume in 2013. In 2017, the PRC's overall e-commerce market ranked first in the world in both sales and growth, far outpacing the United States, the world's second-largest e-commerce market.

Agriculture Logistics

Lack of rural logistics support makes upstream movement of agriculture products difficult. In the medium and less developed areas, weak road transport infrastructure and logistics support renders the costs of doing online sales very pricey. In the developed rural areas, inadequate and oftentimes flawed cold chain logistics cannot guarantee that agriculture products remain fresh during shipment. Improper handling, storage, and changes in climate conditions during transport can easily cause spoilage of highly perishable agriculture products. When spoiled products reach the customers, online sellers pay steep penalties to protect consumer rights and the reputation of the e-commerce platform.

Extension Services and Farmers' Participation

The construction of online agriculture information platforms in the PRC focuses on implementing the 12316 hotline, a specialized agriculture information service system project of the Ministry of Agriculture, which aims at fast and effective dissemination of information such as agriculture technology, market, and policies. In 2006, the project created the public welfare 12316 Information Service System for Agriculture, Farmers and Rural Areas. This is a comprehensive agriculture information service platform that integrates the 12316 hotline with multiple media channels and forms, such as websites, agriculture TV programs, mobile phone short messages, and multimedia messages. The online version of 12316 gets about 8.6 million visits daily, while the hotline takes more than 20 million phone calls annually. The PRC has also built agriculture information service stations in villages, called "Farmer Friendly Information Station." According to the Ministry of Agriculture, approximately 80,000 stations have been built as of the end of 2017. The target is to cover 80% of the PRC's administrative villages by the end of 2020.

Agriculture products sold online undergo regulated production, processing, packaging, and branding procedures that follow specific product standards. With inadequate capacity to carry out all these processes, a single farmer needs to collaborate with other farmers to form a cooperative, enterprise, or family farm. E-commerce enterprises prefer to work with cooperatives, rather than with individual farmers, to handle the production and supply side of online sales. Hence, rural e-commerce promotes the establishment of farmers' organizations and facilitates farmers' participation in the Internet Plus agriculture program.

Traceability System for Product Safety and Quality

The China Food and Drug Administration and its local branches oversee food sold in the market, ensuring that they meet national food safety standards. Otherwise, these products cannot enter the market (including the online market). Use of the internet has fostered the establishment of a tracking system for the quality and safety of agriculture products. For example, in Shandong Province, the Shouguang Municipal Bureau of Agriculture created a quality tracing system for peppers and other vegetables, which farmers can avail of for free. Using a mobile app to scan the quick response or QR code, customers can access information such as cultivation base; sampling time; results of pesticide concentration test planting (pruning, splitting, and watering); harvest; and sales transaction data. Access to such information helps strengthen customers' confidence in the product's quality and brand.

E-commerce for agriculture products has facilitated the online sales of local specialty food and has given farmers a new channel to augment their income. However, for local specialty food to be sold online, particularly through the large network platforms, a "QS" (i.e., the PRC's quality and safety mark for food products) food production license must first be obtained, which involves a tedious process of securing a high-standard processing equipment, passing complex examination procedures, paying hefty professional fees to agencies handling the issuance of required documents, and undergoing yearly inspection. A white paper entitled the *Quality and Safety of Food in China* and issued in August 2007 by the Information Office of the State Council of the PRC states that products produced and processed in small food workshops cannot be sold beyond county-level administrative area; such products are subject to strict limitation of being sold in shopping malls, supermarkets, and similar places.

Yet, the traceability system for the quality and safety of agriculture products lacks incentive for commercial application. National laws and regulations do not require the provision of traceability labels because one, consumers currently do not have a strong demand for the traceability system; and two, the inclusion of traceability labels on agriculture products has little effect on their prevailing quality and prices. In addition, the establishment of a traceability system requires huge investments to cover links to production, processing, storage, trade, delivery, and others. Hence, most enterprises are not motivated to acquire nor apply this system. Only a few pilots are supported by the government; similarly, only a small number of enterprises have independently set up their own traceability system.

Intelligent Agriculture

In 2011 and 2013, the National Development and Reform Commission and the Ministry of Finance allocated funds to implement intelligent agriculture projects for two batches of national demonstration projects for IOT applications. Around 234 leading enterprises and farmers' cooperatives in Anhui Province established and applied IOT; for example, in monitoring wheat and other crop fields and for agriculture precision planting management. In Beijing, a 5,000 *mu* (333.3 hectares) core demonstration area of facility agriculture in eight districts and counties applied IOT technology for bioenvironment sensing system and low-cost wireless broadband transmission system. Jiangsu Province developed 30,000 *mu* (2,000 hectares) of standard demonstration area for aquaculture IOT, which used wireless network sensing data to achieve automatic and remote control of oxygen production devices. Shanghai launched demonstration projects for the quality and safety traceability of agriculture products using bar codes, QR codes, and other IOT technologies.

The application of intelligent agriculture practices also helps mitigate the contribution of the agriculture sector to global climatic changes—i.e., the optimized use of fertilizers and pesticides translates into less soil pollution and less greenhouse gas emissions. This is consistent with the PRC's undertaking of a low-carbon agriculture development in accordance with the 2015 Paris Agreement on Climate Change.

Main Policy and Institutional Issues

Less efficient management of government departments. The degree of internet application for public services of agriculture departments, such as agriculture product quality inspection and reporting, is low. Because of the limited classification of agriculture products in terms of homology of medicine and food, drug administration departments in many regions prohibit the online sales of some special agriculture products that are both medicinal and edible. National and local food supervision documents also prohibit the online sales of local specialty food products that are processed in small workshops.

Incomplete public services. The traceability system for the quality and safety of agriculture products discourages commercial application because of its huge investment requirements and negligible effect on prevailing prices and quality of products. Accessibility and costing issues also undermine the efficiency of certification service for the three-criteria-certified or one-geography-certified farm products. Deficiencies exist in public training services mainly due to the lack of professionals qualified to handle internet and e-commerce trainings.

Low infrastructure and equipment support. Rural infrastructure and logistics support, including cold chain logistics, are insufficient. In natural villages, network coverage is low, network speed is slow, and the use of special broadband lines is costly. The incentives for research and development (R&D) and the promotion of agriculture IOT devices remain weak.

Inferior external environment for the development of an Internet Plus rural economy. Policies are imperfect and weakly support rural internet users. From the perspective of finance, it is difficult to implement rural property mortgage loans, and financial products suitable for rural e-commerce operators are lacking. From the perspective of land policies, operators applying internet technology generally face land use difficulties.

Recommendations

The recommendations for policies, mechanisms, and investments for an Internet Plus rural economy are as follows.

Enhance the management efficiency of government departments. It is important to optimize the process of formulating policies for the Internet Plus rural economy, improve the coordination mechanism of major departments, clearly specify their roles in the formulation of the Internet Plus rural economy policies, and cultivate an internet-based thinking and working style among government departments. The catalog of both medicinal and edible agriculture products needs to be scientifically revised, and standards for their online sales established. In addition, methods

should be explored for small food workshops to meet food safety requirements for the online sales of local specialty products.

Improve public services. The establishment of a traceability system of agriculture product quality and safety should be expedited along with the rural economy's big data platform. Local governments should improve not only the efficiency of public training on internet-related technologies and rural e-commerce practices, but also the certification efficiency of the three-criteria-certified or one geography-certified farm products. Likewise, establishment of a market for rural property rights trading should be accelerated.

Strengthen infrastructure and equipment support. The government should strengthen the construction of rural logistics infrastructure and rural information network facilities, as well as bolster incentives for R&D of agriculture IOT devices.

Improve the external environment for the development of the Internet Plus rural economy. Building the underlying support system for rural internet users, especially in terms of finance and land use, is crucial. The government should regulate the market of large e-commerce platforms to promote the formation of highly efficient and reasonable market structure of fair competition among multiple giants.

Increase investment of the public and private sectors in the Internet Plus rural economy. Government financial investments in the Internet Plus rural economy should focus on the following areas: villages with no coverage of rural broadband facilities; building rural roads in medium and less developed areas; providing internet equipment and application software to agriculture-related government departments; establishing public big data platforms involving the rural economy and public platform for safety traceability system for agriculture product quality; setting up cold chain logistics facilities in places of origin; and instituting a rural credit system platform. The private sector, on the other hand, is encouraged to invest in areas where application of internet technology are already profitable—e.g., e-commerce, logistics, and distribution of rural products, agriculture IOT equipment, Internet Plus agriculture social services, leisure-oriented agriculture, and rural tourism.

Implications of the Internet Plus Rural Economy for Other Developing Countries

Through its sovereign and nonsovereign operations, ADB has been supporting the PRC government in reviewing practices and policies of Internet Plus agriculture business models, and in implementing the country's Internet Plus agriculture program. The PRC's experiences and lessons learned from implementing policies and pilot projects on Internet Plus agriculture have valuable implications for other developing countries. E-commerce platforms have been accelerating regional trade in agriculture products by extending their services and access to farmers and customers in Asia. Public and private investments in establishing value-chain linkages to access this regional e-commerce have a high potential to create further employment and income in rural areas of other Asian countries.

Concluding Remarks

The Internet Plus rural economy is developing into a new agricultural organization framework. It is becoming the farmers' new production and management tool, and presents as a new hub for comprehensive rural development. It is a foundation to revitalizing the countryside, and key to achieving agricultural modernization. E-commerce platforms are its driving force. The government plays an increasingly important role in regulating the e-commerce market to establish highly efficient market structures and promote fair competition.

Farmers' access to the benefits of e-commerce requires support from both the private and public sectors, such as providing agriculture extension services and building logistics capacity in remote and poverty-stricken areas. E-commerce access investments demand the adoption of a farm-to-market, value-chain approach to create value for poor farmers, local agro-enterprises, and consumers. ADB has already gained much experience in designing and implementing projects for public sector-financed, value-chain investments through dragonhead agro-enterprises in the PRC. Linking future value-chain investment projects with access to e-commerce will accelerate rural transformation and integration into the wider economy. Also, the application of information and communication technology and IOT can significantly improve traceability, promote food safety, and reduce nonpoint source pollution.

Overview of the Internet Plus Rural Economy

1.1 Characteristics, Challenges, and Trends of the Rural Economy

The internet is exerting a profound influence on the global economy and plays an important role in economic restructuring. At the micro level, the internet can open a new and more efficient path of resource allocation; at the midlevel, it can facilitate the transformation and upgrading of global and traditional industries; and, at the macro level, it can regulate macroeconomic fluctuations and effectively balance supply and demand.

Since 2000, the People's Republic of China (PRC) has been following the trend set by developed countries, such as Japan and the United States, and Europe, where internet information technology has quickly entered every aspect of their economic and social arenas. With the rapid development of internet technology in recent years, the number of internet users in the PRC has increased and is now reported as the highest in the world.

Since its economic reform and opening-up policy, the PRC has been swiftly growing to become the second largest economy in the world as of 2010. During 1978–2012, the average annual growth rate of the PRC's gross domestic product (GDP) was about 10%. In 2013–2016, GDP's annual growth rate dropped to about 7% as the country's economy shifted from rapid to medium growth. In 2016, to promote its economic restructuring and development, the PRC government launched the "Internet Plus economy" model. Considered as a great economic engine, the model intends to integrate the Internet of Things (IOT), cloud computing, and other big data technologies with traditional industries to strengthen information sharing, reduce costs, improve efficiency, and promote the innovation and integration of different industries.

Since the 1978 economic reforms in the PRC, the agriculture sector has contributed significantly to the national economy, despite the sector's structural unit being generally small-sized and highly scattered. Average farm size in the country is still smaller than 1 hectare,¹ which is many times smaller than the average farm sizes across the member countries of the Organisation for Economic Co-operation and Development. This difference has profound implications in terms of technology choices, particularly with respect to the degree of reliance on mechanization, farm-level infrastructure, and other factors where economies of scale are important.

As production has primarily been the focus of family-operated farms, services along the value chain have somehow been neglected, thus resulting in high production costs, low profit margins, and disadvantaged status of farmers in market competition. Misaligned interests and actions

¹ X. Ji, S. Rozelle, J. Huang, L. Zhang, and T. Zhang. 2016. Are China's Farms Growing? *China & World Economy*. 24 (1). pp. 41–62.

of stakeholders along the value chain have generated negative externalities, such as nonpoint source pollution and food safety problems. Agriculture production activities are sometimes not friendly to the environment nor safe to public health, and they likewise lack accountability and traceability.

With the rapid development of internet technology in the PRC since the beginning of the 21st century, a set of Internet Plus technologies has made influential impacts on the national economy and the rural economic sector. The internet has demonstrated great advantages; and the urgent need for integrating, transforming, and upgrading the rural economy, especially the agriculture industry chain, leisure agriculture, and the agriculture social service system.

The “Internet Plus rural economy” model refers to an economic phenomenon of applying internet technology—e.g., mobile internet, IOT, cloud computing, and other big data applications—to improve the efficiency of the rural economic sector, from farmers’ daily consumption to the production, processing, and circulation (trade) of agriculture products. The coverage of internet application encompasses the following main areas: (i) establishment of e-commerce platforms and associated business processes and models; (ii) streamlining of agriculture logistics; (iii) provision of extension and coordination services to farmers; and (iv) strengthening of coordination and traceability of product flow from farm to fork (or from farm to table—i.e., from harvest to the point of consumption) through a traceability system that is enhanced by information and communication technology (ICT).

The continuous development of the Internet Plus rural economy model is becoming an important force in the PRC’s overall Internet Plus economy blueprint. First, the application of internet technology to the rural economy has fuelled a new engine for the transformation and upgrading of the traditional rural economy. Through a set of IOT, mobile internet, big data applications, and cloud computing technology, many traditional industries have been transformed to modern production modes, which, in turn, have enhanced the efficiency and productivity of the rural economy. Second, internet technology subverted the conventional concept of time and space—space has become smaller, time periods have become shorter, and information has become more symmetrical. The fast, real-time, and reliable information provided by the internet benefits agriculture production, particularly high-quality agriculture products sold within and outside the country; as well as influences the effective supply of agriculture products. Third, internet technology has provided a new platform for rural entrepreneurship and innovation, and has encouraged a large number of aspiring young people to actively engage in rural e-business enterprises. Finally, the Internet Plus program builds an electronic information bridge for small farmers to dock to the modern economic system, which provides them with more cost-effective and efficient platforms for the sales and distribution of their agriculture products. This also opens a new channel to increase farmers’ income and lift poor households out of poverty.

The different application structures of the Internet Plus rural economy model include (i) Internet Plus agriculture (agriculture IOT); (ii) Internet Plus processing of agriculture products; (iii) rural e-commerce (e-commerce platform, logistics of agriculture products, industrial consumer goods downstream, etc.); (iv) Internet Plus agriculture social services (agriculture finance, agriculture precise operation, technical services); (v) traceability system for the quality and safety of agriculture products; and (vi) Internet Plus leisure agriculture and rural tourism. In short, the model is becoming a new framework for agriculture organization and production, a new tool for farmers for production and management, and a new hub for comprehensive rural development. Given that the Internet Plus rural economy covers all

aspects of agriculture production, management, and services, it provides a good foundation for the promotion of a countryside revitalization strategy and the achievement of agricultural modernization in rural areas.

1.2 Internet Development and Application in Rural Areas

The internet has become one of the key driving forces to accelerating economic development in the PRC. According to the China Internet Network Information Center, the number of internet users in the country has grown significantly, reaching 772 million in December 2017, with an internet penetration rate of 55.8% (up by 2.6% from the end of 2016). For the same period, the proportion of internet users from the PRC's rural areas is 27%, equivalent to 209 million users (4% more from the end of 2016). The number of mobile internet users has reached 753 million (8.2% higher from the end of 2016). The ratio of internet users making online payments via mobile phones has increased from 50.3% (2016) to 65.5% (2017) at the national level; and from 31.7% to 47.1% among rural internet users. The government's thrust to promote the construction of internet infrastructure has substantially increased rural internet coverage. According to data from the National Statistics Bureau, by the end of 2016, 90% of administrative villages in the PRC already have broadband access.² The Ministry of Industry and Communication will invest 140 billion yuan (CNY) during 2015–2020 to achieve 98% broadband coverage in these administrative villages.

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1.2.1 Building of Agriculture Informatization

In the five surveyed provinces, informatization efforts mainly involve the provision of agriculture information through the construction of information platforms and information service stations. Agriculture information covers the whole industry chain of agriculture production, including preproduction, production, and postproduction.

The construction of agriculture information platforms in the provinces focuses on implementing the 12316 specialized agriculture information service system project of the Ministry of Agriculture,

² A "village" in the PRC can be classified as a natural village (which exists naturally) or an administrative village (which is a bureaucratic entity).

³ Informatization is the process of utilizing the new communication technologies to promote development as the country gradually transforms into an information society (E. M. Rogers. 2000. *Informatization, Globalization, and Privatization in the New Millennium*. *Asian Journal of Communication*. 10 (2). pp. 71–92).

which aims at effectively spreading such information as agriculture technology, market, and policies. In 2006, in cooperation with local agriculture departments, the Ministry of Agriculture created the public welfare 12316 Information Service System for Agriculture, Farmers and Rural Areas. This is a comprehensive agriculture information service platform with multiple channels, forms, and multimedia that integrate the 12316 hotline for agriculture, farmers and rural areas; agriculture information websites; agriculture television programs; and mobile phone short messages and multimedia messages. The 12316 online information gets about 8.6 million visits daily, while the 12316 hotline receives more than 20 million phone calls annually. The PRC has also built agriculture information service stations in villages, called “Farmer Friendly Information Station.” By the end of 2017, a total of 80,000 stations have been built. According to the Ministry of Agriculture, the target is to cover 80% of the PRC’s administrative villages by the end of 2020. The Ministry of Agriculture and its branches at local levels are responsible for the establishment and operation of the 12316 platform, and cover all related costs through fiscal funds, although some of the information technology services may be contracted out to the private sector.

1.2.2 Use of the Internet of Things

The general level of IOT application in agriculture is relatively low and is still at the demonstration and marketing stages in the PRC. Usually, stronger agriculture enterprises use IOT and rely on government subsidies. IOT is mainly used for cash crops of high economic value or large-scale cereal crops. However, different regions display different IOT features, with a higher level of application in developed and plain regions than in underdeveloped and mountainous regions. According to the Ministry of Agriculture, by the end of 2017, the regional IOT demonstration programs had expanded to nine provinces; and 426 new products, technologies, and models on agriculture IOT had been invented. The target is to increase the application of IOT from its 2015 ratio of 10.2% to 17.0% by 2020.

1.2.3 Rural E-commerce

All over the PRC, the Internet Plus rural economy model has displayed a shared feature, i.e., e-commerce for agriculture products is the most active application structure, particularly in terms of sales. E-commerce has provided new avenues for sales of agriculture products, reduced transaction costs, and simplified trading procedures. It has also built a two-way platform for the flow of consumer goods to villages and agriculture products to cities.

Building a three-tier e-commerce service system in counties, townships, and villages, along with the corresponding logistics delivery system is the primary measure adopted by provinces to develop rural e-commerce for agriculture products. The three-tier service facility system consists of county service centers, township service stations, and village service sites. Public services, corporate incubation, technology training, product demonstration, and brand marketing are among the functions of the county service centers. The township service stations serve as the transitional link, resource coordination post, logistics reception, and dispatch units; whereas, the village service sites perform such functions as information collection, production supervision, and convenience services. Villagers can now make online payments and buy clothes, household appliances, production tools, and other goods at any of these three service facilities without getting out of their respective villages. Purchased goods will be delivered to the service facilities. In addition, villagers can sell their own agriculture produce at these facilities.



Rural e-commerce. The three-tier service facility system of rural e-commerce, which includes county, township, and village-level service centers, helps boost sales of local agriculture products and allows villagers to shop online for consumer goods without leaving the village (photo by Libin Wang).

How is quality of online goods assured and how are customer complaints handled? The e-commerce platform will first hold the payments made by online customers. After the customers receive their ordered goods and are satisfied with the goods, the customers then inform the platform to make payments to the online shops. However, if the customers are not satisfied with the goods, they need to give a valid reason and provide supporting evidence, such as photos, to the online shops. If the shops agree, they will inform the platform to return full or part of the payments to the customers. If the shops disagree to returning the payments, the customers can ask the platform to get involved to solve the disputes.

E-commerce displays a rapid growth trend in the PRC. The Ministry of Commerce reports that the 2016 national trade volume of e-commerce for agriculture products increased by 46.2% from 2015, and about four times the total volume in 2013. In 2017, the PRC's e-commerce retail sales crossed the \$1 trillion mark, validating the country's status as the world's leading e-commerce market.⁴ According to the PRC's Ministry of Commerce, retail e-commerce sales in 2017 reached CNY7.18 trillion or around \$1.15 trillion, a 32% growth from 2016. In terms of e-commerce sales and growth, the PRC outperforms the United States, the world's second-largest e-commerce market, whose e-commerce retail sales in 2017 was estimated to grow by approximately 15% to \$455 billion. Also, in 2017, the PRC ranked first in the world in terms of e-commerce sales as percentage of total retail sales at 23.1%, followed by the United Kingdom (19.1%), the Republic of Korea (16.0%), Denmark (12.6%), and the United States (9.0%).⁵

⁴ F. Tong. 2018. Online Retail Sales in China Soar Past \$1 Trillion in 2017. *Digital Commerce 360*. 8 February. <https://www.digitalcommerce360.com/2018/02/08/online-retail-sales-china-soar-past-1-trillion-2017/>.

⁵ Statista: The Statistics Portal. E-commerce Sales as Percentage of Total Retail Sales in Selected Countries in 2017. <https://www.statista.com/statistics/255083/online-sales-as-share-of-total-retail-sales-in-selected-countries/> (accessed 24 July 2018).

Government Support through Policies and Projects

To promote the development of the Internet Plus rural economy model in the PRC, the national, provincial, and county-level governments have successively issued a series of relevant policy documents for guidance, and funded several pilot projects. These pilot projects focus on improving access to e-commerce platforms and information for villages and rural households. The target is to extend the scope of these pilot projects to one-tenth of all counties and, by 2018, to over 100,000 administrative villages and 100 standardized and replicable county-level service stations for agriculture production and farm life services.

Some pilot projects supported the IOT application for agriculture machines, e.g., establishment of regional platform services that provide needed information on quantities and locations of available agriculture machines equipped with global positioning system (GPS), and nearby repair stations. These projects offer platform services to over 30,000 agriculture machines and popularize the application in regions with total area of 70 million *mu*,⁶ to boost the innovation and development of the “Internet Plus agriculture machine precise operation” model.

In Hubei Province, the Beidou modern agriculture project, which uses the Beidou Satellite Navigation System that combines high-precision positioning technology with sensor technology, has been piloted in Jiangling, Laohekou, Shayang, Xiangzhou, and other regions since 2013. By 2016, 674 sets of Beidou subsoil monitoring equipment and 33 sets of agriculture machinery autopilot systems had been installed; while, machine transplanting, direct seed precision planting, land cultivation, and pest prevention and control for over 200,000 *mu* had been completed.

In 2011 and 2013, the National Development and Reform Commission and the Ministry of Finance allocated funds to implement intelligent agriculture practices to two batches of national demonstration projects for IOT applications. In 2013, the Ministry of Agriculture allocated funds to launch the regional pilot projects for agriculture IOT. Among them, Heilongjiang Province established an intelligent rice bud production system with a daily output of 150 tons, which conducted real-time data collection through temperature and moisture sensors in greenhouses to achieve intelligent micro-spraying and electric shutter ventilation control.

Around 234 leading enterprises and farmers’ cooperatives in Anhui Province established and applied IOT, including the systems for monitoring wheat and other crop fields, and the systems for agriculture precision planting management applied in 3.265 million *mu* of land. Beijing established 5,000 *mu* as core application demonstration area of IOT technology for facility agriculture in eight districts and counties, and deployed the bioenvironment sensing system for facility agriculture, low-cost wireless broadband transmission system, and other IOT devices. Tianjin launched IOT application demonstration in 70,000 square meters of industrial culturing plants and in more than 30 large enterprise pastures and farms.

⁶ A *mu* is a Chinese unit of land measurement (1 *mu* = 0.0667 hectares).

Jiangsu Province established a traceable pig herd management system based on radio frequency identification electronic ear tags. Jiangsu also set up 30,000 *mu* of standard demonstration area for aquaculture IOT, which used wireless network sensing data to achieve automatic and remote control of oxygen production devices. At present, these devices have been promoted in more than 10 provinces and cities in the PRC and applied in 20,000 *mu* of land.

Shanghai launched the IOT application demonstration for quality and safety traceability of agriculture products; established more than 100,000 *mu* of demonstration base for grain crop traceability; built more than 60,000 *mu* of safe production and quality traceability system for leafy greens that used bar codes, quick response or QR codes, and other IOT technologies; and built the cold chain logistics information systems for ambient temperature and humidity of cold storage as well as vehicle routes for fresh agriculture products, from the time these goods exit the warehouses to the time they are delivered to users.

The application of “intelligent agriculture” practices helps mitigate the contribution of the agriculture sector to global climatic changes: the optimized use of fertilizers and pesticides means less soil pollution and greenhouse gas emissions. In fact, the agriculture sector accounted for about 12% of the PRC’s greenhouse gas emissions in 2012 (20% if agriculture-related energy generation is included). This is consistent with the PRC’s pledge to “promote low-carbon development in agriculture, making efforts to achieve zero growth of fertilizer and pesticide utilization by 2020” in its Nationally Determined Contributions to the Fulfillment of the 2015 Paris Agreement on Climate Change.

In 2017, some enterprises in Beijing, Heilongjiang Province, and other regions started to apply blockchain technology in the whole agriculture value chain process (from production to logistics and sales) to ensure that food quality and safety can be traced. Likewise, Tsinghua University participated in a project applying IBM’s blockchain technology in quality and safety management of Wal-Mart’s food on shelves. The PRC government needs to provide policy and project support for future agriculture blockchain technology.

Demonstration projects for mobile information services on soil testing and formulated fertilization, together with expert consultation systems, have been initiated throughout the country. Data collected from these projects were made available through comprehensive service centers, called platforms. Technologies such as IOT, cloud computing, and satellite remote sensing were used to build a data monitoring system. Various types of market operators were encouraged to fully tap into the newly established data platforms to develop soil demand-based fertilizers, conduct centralized pest prevention and control processes, and provide agriculture insurance services. The platforms also contributed to ensuring the quality and safety of agriculture products. Data-sharing mechanisms on agriculture production; logistics; and processing made origins of products (seeds, pesticide, and chemical fertilizer) traceable and trackable, with accountability measures instituted at the different stages.

From 2014 to 2016, the PRC central finance department cumulatively allocated a total capital of CNY8.4 billion to support 496 counties in 26 provinces, autonomous regions, and municipalities in launching a comprehensive demonstration of e-commerce entry into the rural areas. The areas covered by the funding support were (i) establishment of rural e-commerce public service system, credit cooperatives, and bases to carry out disintegration, packaging, and quality tracking; (ii) development of the circulation (trade or flow of goods) in the rural areas to address the problems of high logistics cost and poor networks; and (iii) personnel training to address talent shortage in rural e-commerce.



Quality tracing system for agriculture products. A village vegetable testing center in Shandong examines pepper produce to check if they meet quality standards (photo by Libin Wang).

The Ministry of Industry and Information Technology worked together with the Ministry of Finance to launch the pilot projects on universal telecommunication services and increase corporate investment through financial capital guidance. Open bidding was adopted to encourage the involvement of basic telecom enterprises, broadcasting and radio companies, and the private sector in the pilot projects for universal telecom services and jointly promote the access of administrative villages to optic fiber networks. At the same time, the National Development and Reform Commission identified projects under the special construction funds, including “broadband villages”⁷ and basic network improvement for small and medium-sized cities (counties), to support the engagement of various types of social capital in the installation of fiber-optic networks in rural areas.

In 2015, subsidies worth CNY3.7 billion from the central finance department was allocated for the construction of infrastructure needed to install and upgrade broadband connections in about 50,000 administrative villages. In May 2016, the second group of pilot projects was launched. The Thirteenth Five-Year Plan, 2016–2020 indicated an investment of over CNY140 billion in building broadband networks in rural areas and remote regions.

The China Food and Drug Administration and its local branches oversee that food sold in the market meets national food safety standards. Three systems apply specifically to processed food. First is the food production license system, wherein a food production license is issued to eligible food production enterprises to allow them to manufacture products within the scope of the production license. Second is the compulsory food inspection system, which safeguards

⁷ The project on “broadband villages” refers to the expansion of internet broadband coverage to the villages and other remote and underserved areas of the PRC.

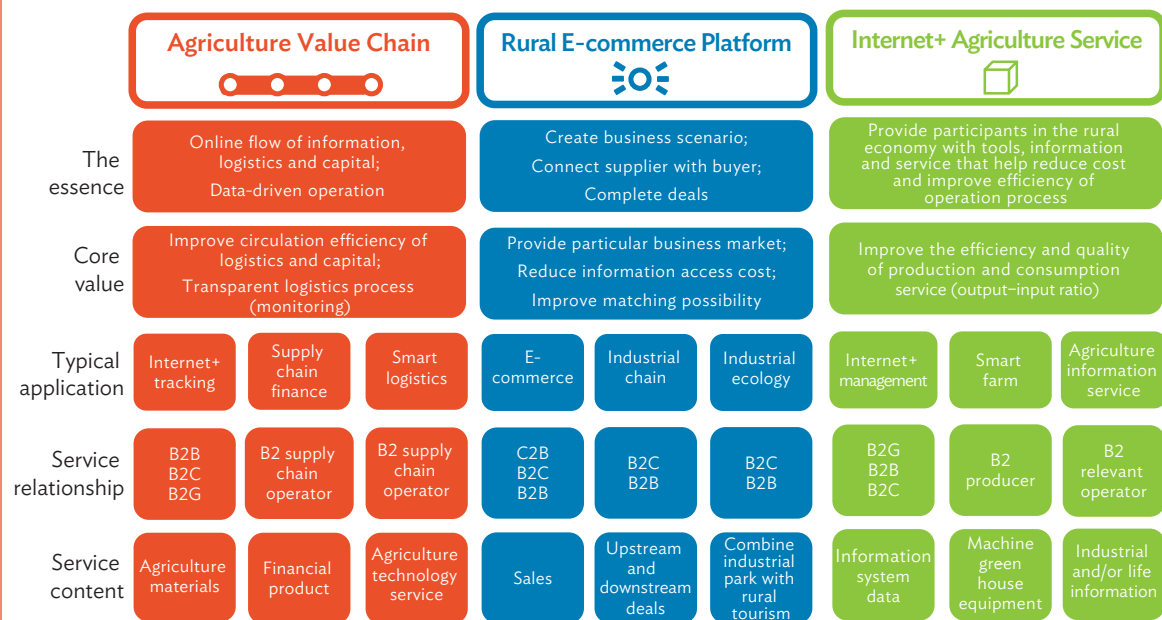
against the distribution and sales of uninspected food, or food failing the established quality and safety standards. Third is the food market access sign system. For food under the food production license system, the market access sign “QS” (quality and safety) must be printed or labeled on the package or logo of products produced by companies that have not updated their 2015 Sheng Chan (SC) certification, which contains a 14-digit production license code. (Since 1 October 2015, the PRC has implemented a new food production license system, which requires food production companies to change their QS certification into SC certification.) Without the QS label, products cannot enter the market (including online market) for sale. No access sign is required for products produced by factories that have updated their SC certification. The QS certification signs will be abolished by 1 October 2018. Moreover, the certification system of “one product, one certificate” should be replaced with “one company, one certificate” before 30 September 2018.

As for the operation and maintenance arrangements for these government demonstration projects, in general, the eligible enterprises purchase the machines from government-approved companies or from the market, and then present the purchase receipts for government reimbursement. As owners of the purchased machines, the enterprises are responsible for their maintenance. Warranty and replacement of these machines follow the regular business rules in the market. In terms of data management, the government departments either manage the data directly, or designate private companies to manage the data with government funding support.

Development Models of the Internet Plus Rural Economy

The field surveys in the five case study provinces (Gansu, Hubei, Shandong, Yunnan, and Zhejiang) were undertaken from January to April 2017. Consultation workshops were held both at the province level and county level. In-depth interviews were also conducted with more than 100 internet users, including farmers' specialized cooperatives, family farm owners, ordinary farmers, and leading enterprises and e-commerce operators of agriculture products. Over 60 internet technology users were likewise investigated, including e-commerce industrial parks, major agriculture enterprises, specialized cooperatives, family farms, professional investors and online stores, among others. Furthermore, literature analysis was carried out using 1,000 Internet Plus agriculture enterprise value chains.

Figure 1: The Three Major Development Models of the Internet Plus Rural Economy



B2 = business origin of the supply chain, B2B = business-to-business, B2C = business-to-consumer, B2G = business-to-government, C2B = consumer-to-business.

Note: Service relationships are classified as B2, B2B (a process of selling products and services to other businesses), B2C (a process of selling products directly to consumers), B2G (a process of selling products directly to government and its agencies), and C2B (logging online to make a purchase).

Source: Adapted from G. Dan. 2017. Model Analysis and Suggestion about Internet Plus Agriculture. Presentation in the International Midterm Workshop on Agriculture Service System Development to Promote Rural Economic Transformation and Upgrading through Internet Plus. 21–23 July. Hua Xia International Hotel, Dun Huang, Gansu Province, People's Republic of China.

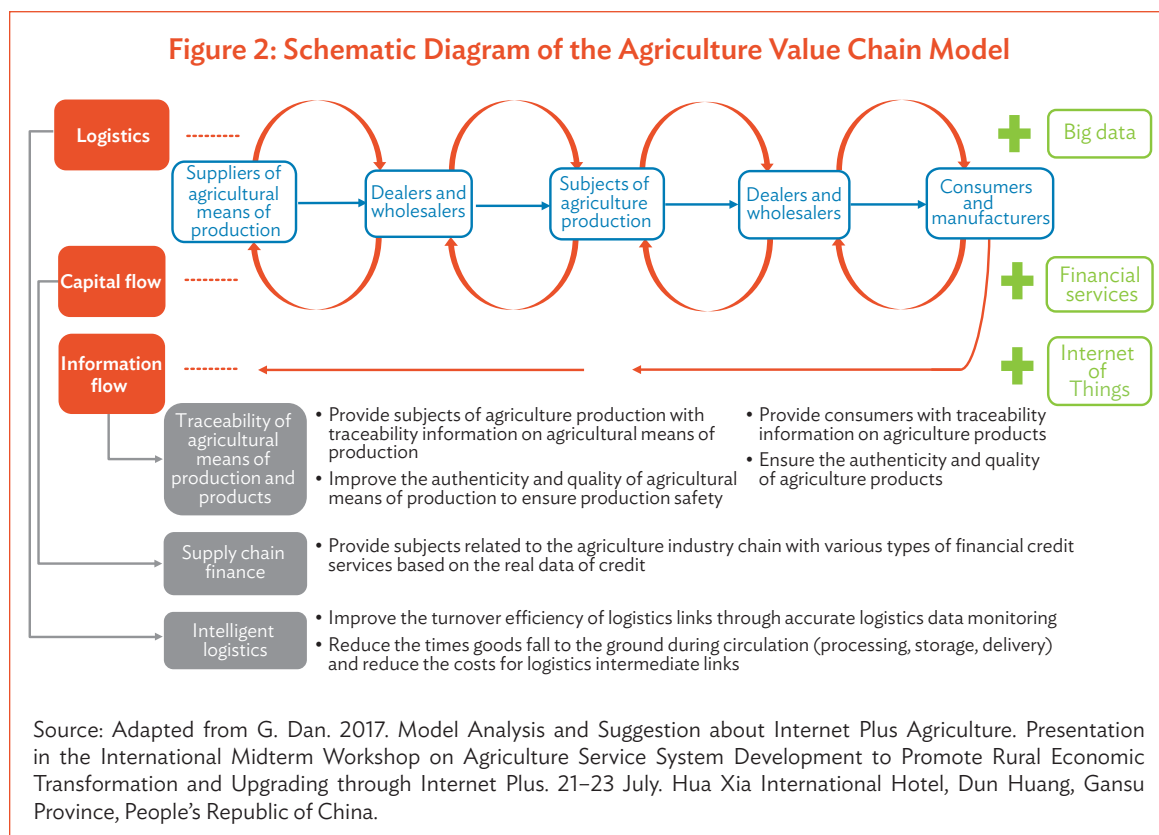
Through these field investigations and literature analysis, three development models of the “Internet Plus rural economy” can be summarized: the agriculture value chain model, the rural e-commerce platform, and the Internet Plus agriculture service model (Figure 1).

3.1 The Agriculture Value Chain Model

The agriculture value chain model (Figure 2) links the components of the traditional supply chain (such as the “integrated supply-research-production-sales mode”) through ICT (such as the mobile internet, IOT, and big data). The objective is to derive a series of value-added services to agriculture production, rural life, and consumption patterns, thereby enhancing the efficiency of agriculture-related supply chains.

Through the collection and analysis of information on agriculture production, processing, storage, trade, distribution, and other processes, the supply chain can be better managed. This is the core value of the agriculture value chain model, which allows all aspects of the supply chain to have clearer division of work and smoother connections. The model also helps to maximize the production capacity; reduce risks and transaction costs; improve the efficiency of agriculture production, management, and processing; and stimulate rural consumption.

To realize this model, appropriate hardware and software facilities need to be in place in all possible links throughout the agriculture production. Through mobile internet, IOT, and other forms of



technology, information from the production, processing, transportation, and distribution links are collected into databases. These databases are processed by software systems and algorithm models targeting agriculture production and rural consumption, and are then presented in relevant systems using icons, tables, and diagrams for decision-making purposes. This model also requires Internet Plus organizations, or service providers and business models, to provide and sustain services and maintain equipment, systems, and innovations.

Actual case examples demonstrating the use of the agriculture value chain model in the field are discussed in Box 1 (Da Bei Nong Group) and Box 2 (Cainiao Smart Logistics Network).

Box 1: The Core Enterprise Model of Da Bei Nong Group— Enabling Farm Credits through Informatization Activities

Da Bei Nong Group (DBN) is a leading enterprise on the agriculture value chain and serves the agriculture sector, rural areas, and farmers. DBN started out with the vision of solving the financing problem of upstream and downstream customers of core enterprises through access to small loans. This vision developed into a goal of creating a dedicated credit system and forming a third financial operation mode that is different from the commercial banks and the traditional capital market. With its accumulated credit data of partners and farmers, the company established the industry's first new system of rural financial services that has rural credit as the core and integrates commercial sustainability and inclusiveness. At the beginning of the credit evaluation system for farmers, DBN submitted to banks its recommendation of farmers with the best credit rating according to the corresponding data obtained. In 2013, customers of DBN secured more than CNY300 million worth of bank loans without any warranty. The process becomes more convenient if the enterprises lend money directly to farmers. Thus, DBN gradually entered the field of small loans.

Source: Asian Development Bank and National Development and Reform Commission of the People's Republic of China. 2017. *Rural Economic Transformation and Upgrading by the Integration with Internet Plus*. Final Technical Assistance Report. Manila (TA 9132-PRC).

Box 2: Cainiao Smart Logistics Network

Established in May 2013 in Shenzhen, People's Republic of China (PRC), Cainiao Network Technology Co., Ltd. is a logistics information platform that connects a network of logistics players, including warehouses and distribution centers. It is an internet-connected logistics platform that adopts a collaborative approach to span rural and cross-border logistics. The platform provides a more effective system of data collection and analysis and allows collaborating partners to have real-time access to and confidentially share information on orders, delivery and pickup status, and customer feedback. Its goal is to achieve efficient delivery within 24 hours anywhere in the PRC and within 72 hours across the globe.

As part of its expansion program to the rural areas, Cainiao Village (the group of farm producers who link with Cainiao for the sales of their produce) launched the Cainiao County Smart Logistics project in September 2016. In collaboration with Cainiao's local logistics partner, the project plans to build a platform-based integrated service network covering the country's vast county and rural areas within

continued on next page

Box 2 *continued*

3 years. It aims to provide an integrated solution for urban and rural consumers, small and medium-sized enterprises; and, through e-commerce platforms, provide links to village and intercounty distribution, storage, and sales of agriculture products as well as various types of installation and maintenance services.

For this project model to succeed, it requires the so-called package service, wherein orders coming from the same county are aggregated and sent through the unified logistics system. It works as follows: buyers in the same county make their orders via the electronic business platform; and, when a certain number of orders are accumulated, the goods from different companies are together sent to the county level service center of Cainiao. This strategy can effectively control the cost of logistics.

Cainiao Village also plans to launch the Cainiao Agriculture as the primary provider of warehousing services, which will be based in various places of origin, for the whole supply chain links of agriculture products. Quality control and inspection services of warehoused goods will also be provided. The provision of warehouses in places of origin can save farmers an average of 15% of logistics costs. As warehouses are accessible and within reach, agriculture cooperatives will be able distribute and sell agriculture products on low inventory. In collaboration with members of the Cainiao Alliance, Cainiao can transport goods quickly “to B (businesses)” or “to C (consumers)” from one warehouse to anywhere in the country.

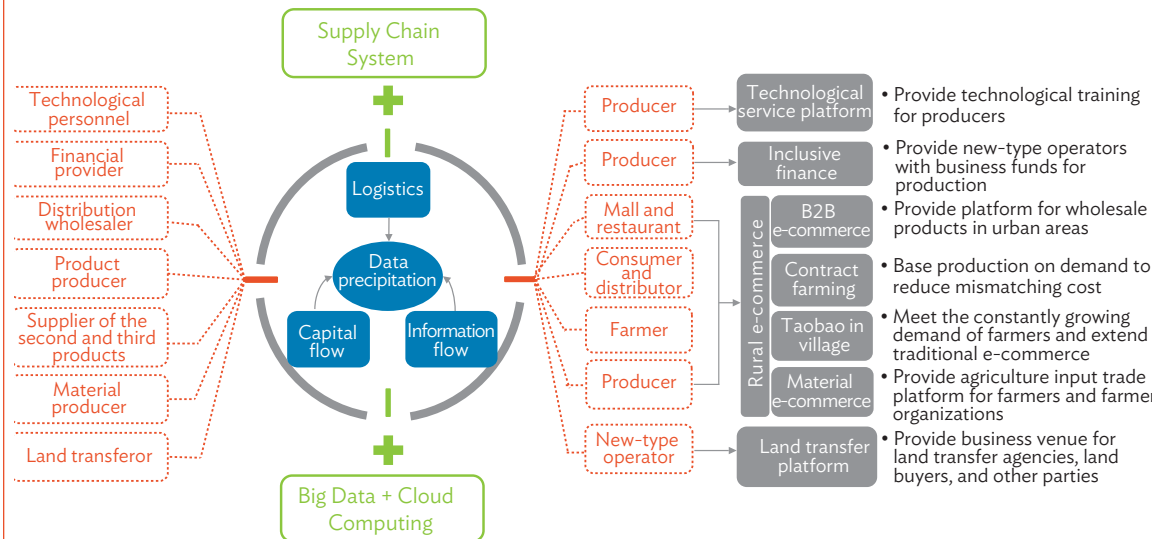
Source: Asian Development Bank and National Development and Reform Commission of the People's Republic of China. 2017. *Rural Economic Transformation and Upgrading by the Integration with Internet Plus*. Final Technical Assistance Report. Manila (TA 9132-PRC).

3.2 The Rural E-commerce Platform Model

The rural e-commerce platform model is composed of a system of computer hardware and software that carries out e-commerce business and its operating environment. The application of Internet Plus in the agriculture sector is typified in this model, which has as its core value the provision of specific market transactions where information acquisition cost is reduced, and the supply-demand sides are linked and matched accordingly (Figure 3).

The e-commerce platform model has a diversified classification based on the traditional agriculture industry chain involving production, distribution, and consumption (Figure 4). The first classification simply controls the production end of the value chain and operates as follows: with producers as the main body and agriculture specialty products as its base, the e-commerce platform connects consumers with producers, and delivers the products to consumers through affiliate shipping agents. The second highlights both the production and distribution ends and runs as follows: with the enterprises that can control the distribution end as the main body, the e-commerce platform connects consumers with producers through the establishment of the production base or through contacts of these enterprises with producers. The third classification allows e-commerce to upgrade the whole industry chain and ultimately transform the regional economy. In a mature and ecologically developed district where producers, distribution parties, and consumers connect offline through conventional means and have already built a stable link, the birth of the e-commerce platform will just work by itself.

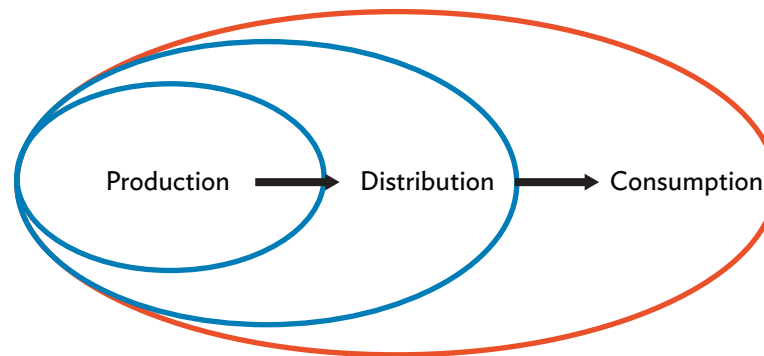
Figure 3: Platform Overview of Rural E-commerce



B2B = business-to-business.

Source: Adapted from G. Dan. 2017. Model Analysis and Suggestion about Internet Plus Agriculture. Presentation in the International Midterm Workshop on Agriculture Service System Development to Promote Rural Economic Transformation and Upgrading through Internet Plus. 21–23 July. Hua Xia International Hotel, Dun Huang, Gansu Province, People's Republic of China.

Figure 4: Classification of the E-commerce Platform Model According to the Traditional Segments of the Industry Chain



Source: Adapted from G. Dan. 2017. Model Analysis and Suggestion about Internet Plus Agriculture. Presentation in the International Midterm Workshop on Agriculture Service System Development to Promote Rural Economic Transformation and Upgrading through Internet Plus. 21–23 July. Hua Xia International Hotel, Dun Huang, Gansu Province, People's Republic of China.

Box 3: Xinjiang–Bachu Fragrant Melon

The fragrant-type melon of Bachu County in the Xinjiang Uygur Autonomous Region of the People's Republic of China (PRC) has long been renowned for its good quality. However, due to market information asymmetry, Bachu melons and other local agriculture products are just sold in nearby markets. During the melon harvest season in August, prices of melon can go as low as CNY0.07 per kilo. Hence, local farmers store part of their melon harvests in their pits so they can sell their produce in winter when melons fetch a higher price. Unfortunately, stored melons are highly perishable, and the uncontrolled cellar temperature has caused a lot of these melons to rot.

At present, the locals have engaged in contract-farming with “Sweet Farm” via Rural Taobao, Alibaba's customer-to-customer online marketplace established to help improve living standards in the PRC's countryside. Through e-commerce access, the branding of melons from Kukebaire of Bachu district as “Bachu Fragrant Melon” has been built and strengthened. This would directly connect the consumer market all over the country with plantation, production, and sales of melons in Tangnuer district, Yingwusitang village, Bachu. In terms of delivery, the locals have collaborated with Jiuye Supply Chain Management Co., Ltd. for its cold and segmented supply chain logistics. The shipment and distribution of melons to Jiuye's cold storages located around the PRC will help reduce the wastage rate of melons from 10% to 3% and make possible farm-to-fork delivery within 48 hours.

In addition, big data technology can be used to inform the e-commerce merchants about the current demand of consumers for fresh agriculture products from Xinjiang Uygur Autonomous Region. This allows merchants to either export the fresh agriculture products to the region's trading capital of Kashi or set up warehouses in different cities to address the shipment of fresh agriculture products out of Xinjiang Uygur Autonomous Region.

Source: Asian Development Bank and National Development and Reform Commission of the People's Republic of China. 2017. *Rural Economic Transformation and Upgrading by the Integration with Internet Plus*. Final Technical Assistance Report. Manila (TA 9132-PRC).

Box 3 highlights the successful case of using the rural e-commerce platform to improve the sales and marketing of a highly seasonal and distinct local agriculture product, the fragrant-type melon of Bachu County.

The basic model of a production warehouse comprises “a warehouse nearest to the consumers + on-site quality control + unified service + unified sales channel.” Box 4 describes the transformation and upgrade of the agriculture industry of Yanbian in Jilin Province. Through the establishment of the central warehouse, the model upgrades the upstream function of Rural Taobao, introduces government's quality control resources, integrates online marketing resources, and develops and expands the local agriculture products of Yanbian.

The PRC is a vast country with significant agriculture production and consumption. Its wholesale market has been developed as the main channel for the marketing and distribution of these agriculture products, with functions including trading, pricing, purchasing, logistics, testing, information, and packing, among others. Still, the wholesale market lacks the needed information and mechanism to diversify its products, stabilize prices, regulate the market, and enhance competition. Box 5 presents the agriculture products trading platform in Shouguang City, Shandong Province.

Box 4: The Production Warehouse—Yanbian, Jilin

On 18 April 2017, Alibaba Group Holding Ltd., a leading multinational e-commerce company in the People's Republic of China (PRC), set up the country's first central production warehouse for its online platform initiative, Rural Taobao, in Yanbian, Jilin Province. The plan is to build the production warehouse into the largest agriculture central warehouse in the northeastern part of the PRC in 3 years to address the two pressing issues afflicting the upstream movement of agriculture products, particularly rice sales in Yanbian: high logistics cost and inconsistent quality standards. Logistics costs include the expenses for the transportation, packaging, and storage of the products.

In terms of quality control of agriculture products, the warehouse brings in the government's quality and safety supervision and testing center in Yanbian to provide free quality inspection for agriculture products in upstream movement. With its advanced equipment, the testing center can fully detect pesticide residues, heavy metal pollution, and other toxic and harmful ingredients in agriculture products, such as rice, to ensure that each bag delivered to consumers meets the approved standards. The rejected and poor quality products will be returned to the producers.

Source: Asian Development Bank and National Development and Reform Commission of the People's Republic of China. 2017. *Rural Economic Transformation and Upgrading by the Integration with Internet Plus*. Final Technical Assistance Report. Manila (TA 9132-PRC).

Box 5: Dili Agriculture Products Trading Platform—Shouguang City, Shandong

In 2009, Shouguang City in the province of Shandong made use of an electronic settlement system in a logistics park for agriculture products, covering the whole range of trading transactions from registration and bargaining, to payment and shipment. The system standardized the transaction process and made it more transparent, convenient, and efficient for all parties concerned, particularly for the sellers and buyers.

The logistics park works as follows. Customers entering the park will register their relevant information in the settlement center that handles the market transaction card. The integrated circuit cards or IC cards (sometimes called smart cards or intelligent cards), are bought and paid for by customers in advance at the settlement center. Inside the park, buyers and sellers are free to negotiate the prices of goods. Once they have agreed on the price, goods are weighed on an electronic scale and the buyer's IC card is placed on the card reader sensor, which summarizes the transaction information (e.g., total weight, total amount to be paid). If everything is in order, the payment button is pressed to complete the transaction. The buyer's payment is automatically transferred to the seller's account. Meanwhile, the transaction fee charged by the logistics park is also automatically transferred through the card. Upon exit, buyers present their purchase orders to the park management personnel, who then check and release these orders. The sellers can claim the monetary equivalent of their sales either through the settlement center at any time, or through electronic bank transfer.

Source: Asian Development Bank and National Development and Reform Commission of the People's Republic of China. 2017. *Rural Economic Transformation and Upgrading by the Integration with Internet Plus*. Final Technical Assistance Report. Manila (TA 9132-PRC).

3.3 The Internet-Based Agriculture Service Model

The Third Plenary Session of the 18th Central Committee of the Communist Party of China gave farmers the right to occupy, employ, gain earnings from, and transfer their contracted lands, as well as mortgage and guarantee their right to the management of the contracted rural lands. It also allowed farmers to develop an industrialized agriculture operation by becoming shareholders through their managerial rights of contracted lands. To develop the various forms of scale operations, farmers are likewise encouraged to transfer their managerial rights to large-scale professional investors, family farm owners, farmers' cooperatives, and agriculture enterprises in public markets. By the end of 2015, transferred lands accounted for 33.3% of the total area of arable lands contracted by family households, enabling farm operations to transition from small-scale to moderate-scale management.

Initial estimates suggest that there are about 2 million new types of business participants with more than 100 *mu* of planting areas. However, beyond the moderate-scale type of farm operations, no new business entrants have the capabilities of independently completing the whole agriculture production process—from plowing to planting, management, and harvest. Hence, more agriculture service providers are inevitably required to assist in the process.

Internet-based farmland management. Using technologies like satellite remote-sensing images, GPS, geographic information system (GIS), and IOT, real-time information and projected data relating to the plowing, planting, management, and harvest of farmlands can be provided to farmers to guide them on how to maximize their yields and reduce potential losses. Box 6 discusses the electronic data project of Qianmo Technology for precision agriculture in Wuhu City, Anhui Province.

Box 6: A New Model for Precision Agriculture of Qianmo Technology—Wuhu City, Anhui

The application of the Internet of Things (IOT) systems and technology by the Research and Development Center of the Chinese Academy of Sciences over the last decade has gone a long way in improving the agriculture industry in the People's Republic of China (PRC). Using IOT technology for agriculture, Qianmo Technology Co., Ltd. rolled out its farm management application model called “Love Farmlands,” which integrated a vast resource of online data on farmlands from numerous links and sources, such as farmer households, agriculture technicians, salespersons of agriculture products, rural agents, etc. This gave the company a competitive edge in terms of real-time online information on key agriculture production processes, especially precision agriculture.

Through advances in key technologies and constant theoretical testing of remote sensing technology, as well as geographic information system and global positioning system technologies, Qianmo Technology introduced an innovative satellite imaging information system in areas such as agriculture output assessment, growth monitoring of crops, analysis of soil nutrients, disaster warning, etc. The company is gradually improving its support for new farm operators in terms of farm management and planning, including planting suggestion, early warning, and harvest guidelines. It also provides these operators with value-added services, such as soil testing and fertilizer preparation, application for government subsidies, and financial guarantees. By drawing digital plots of farmland, the company has established the use of identification cards for all plots (see box figure).

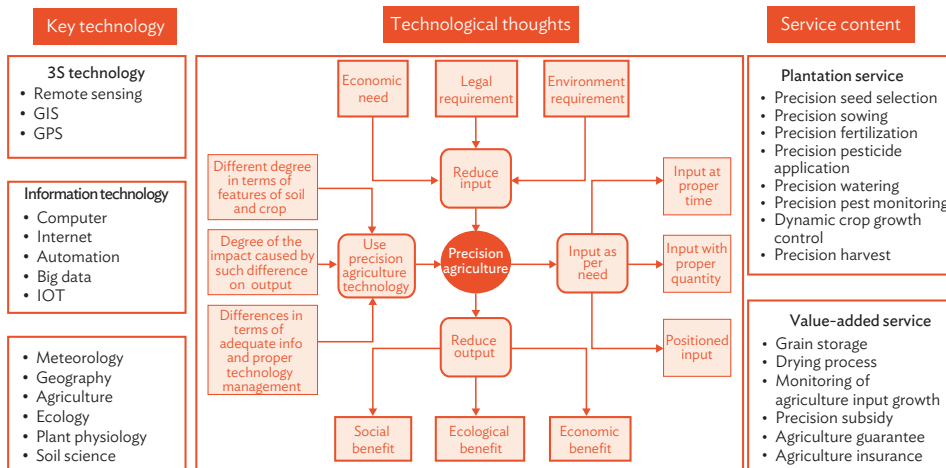
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Box 6 continued

Technology System of Anhui Qianmo Field Precision Planting



Solution from Qianmo



GIS = geographic information system, GPS = global positioning system, IOT = Internet of Things.

Source: Adapted from G. Dan. 2017. Model Analysis and Suggestion about Internet Plus Agriculture. Presentation in the International Midterm Workshop on Agriculture Service System Development to Promote Rural Economic Transformation and Upgrading through Internet Plus. 21–23 July. Hua Xia International Hotel, Dun Huang, Gansu Province, People's Republic of China.

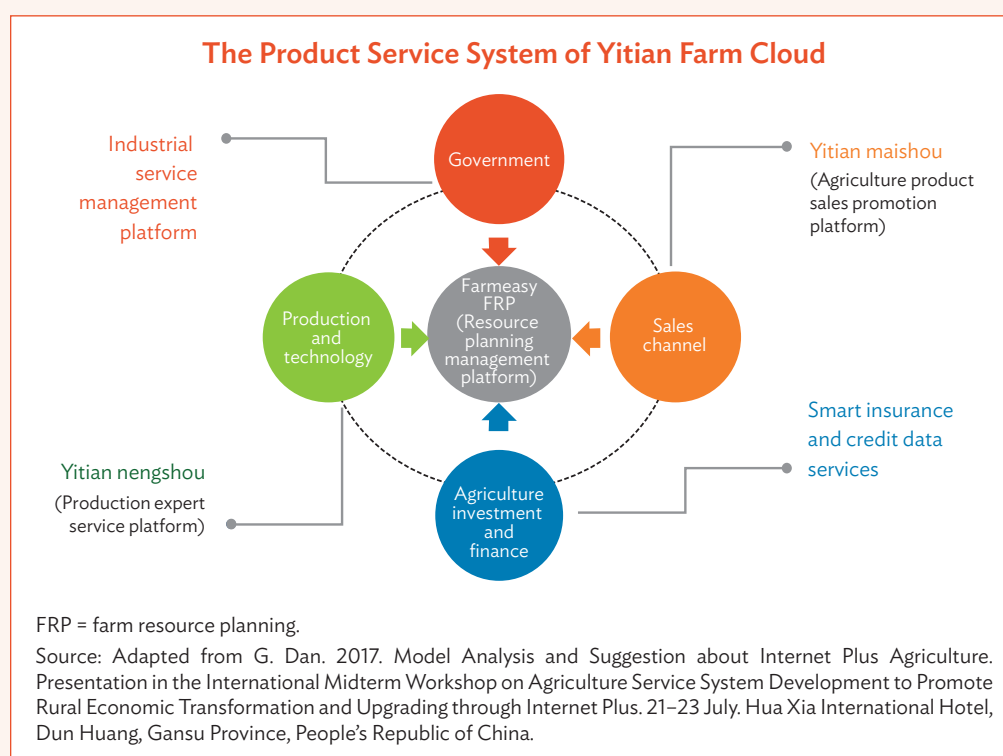
Large farmer households can adopt the system to better manage a large area of farmland, build their own brands, and get bigger yields from sales of high-quality products. The system works with farmers entering the basic information of their plots, crop data, farming methods and activities, agriculture input (e.g., fertilizer) usage, etc., and then combining them with the information collected by the IOT devices—soil, water, air, and other data on crop growth environment—to form a source-traceability information in the production link, which is vital in monitoring anticounterfeiting and source traceability of agriculture products. The IOT devices are owned by Qianmo Technology.

Source: Asian Development Bank and National Development and Reform Commission of the People's Republic of China. 2017. *Rural Economic Transformation and Upgrading by the Integration with Internet Plus*. Final Technical Assistance Report. Manila (TA 9132-PRC).

Smart farm. Smart farms maximize the use of modern information technology by integrating applied computer and network technology, IOT, video monitoring, wireless communications, and 3S (GIS–GPS–Remote Sensing) technologies with agriculture information and support systems to realize visual remote monitoring and control, early-warning for disasters, and other features needed for the smart management of farms. An example of a smart farm management platform is given in Box 7.

Box 7: Automatic Control and Smart Machine— Yitian Farm Cloud Service System

Yitian Farm Cloud Service System is the largest cloud-based smart farm management network in the People's Republic of China. Based on the Yitian Bangzhou (Farmeasy) farm resource planning (FRP) solution, the cloud service system operates under four platforms: (i) Yitian maishou, the agriculture product sales promotion platform; (ii) Yitian nengshou, the production expert service platform; (iii) the government–industry service management platform; and (iv) the agriculture investment and finance–smart insurance and credit data service platform. The network was built to improve the efficiency of farm resources management and branding of agriculture products, and promote the development of smart and industrialized agriculture (see box figure).



By September 2017, the Automatic Control and Smart Machine had built up Yitian Farm Cloud Service System, with services covering cash crop areas and large-scale crop fields in about 1,000 counties of 32 provinces, achieving a unified management of over 3,000 farms spread across the country, and employing the Yitian 4S standardized and transparent production management system. Service support (e.g., production management, resource planning management, marketing, and quality traceability) were introduced, while order-based production models (such as pre-selling, customized production between producers and distributors) were promoted.

Source: Asian Development Bank and National Development and Reform Commission of the People's Republic of China. 2017. *Rural Economic Transformation and Upgrading by the Integration with Internet Plus*. Final Technical Assistance Report. Manila (TA 9132-PRC).

Agriculture information service. A specific task of the agriculture information service is to promote government efforts in the agriculture sector to the public, including the construction of a new socialist countryside. Its basic service scope is the timely publication of unified, standardized, and accessible information on agriculture production, farming methods, business operations, crop protection, and a wide array of other fields such as aquaculture, animal husbandry, forestry, laws and regulations on agriculture, agriculture machinery and technology, etc. The system also encourages the use of smart communications to extend its service scope to consultation with agriculture and legal experts, civil mediation, and e-commerce.

To improve information sharing from the Ministry of Agriculture to the rural households, the 12316 platform in Hubei Province has been upgraded into a comprehensive service system for agriculture information to provide farmers with diversified and customized information relating to agriculture production, market conditions, agriculture policies, farm management, and other services that would generate a lifestyle change among farmers and improve their well-being. The smart-sharing channel for the Internet Plus modern agriculture service has been developed as a major means for reforming the agriculture sector and for supporting modern agriculture development via information technology. Upgrading of the agriculture information service had narrowed the digital divide between urban and rural areas and harmonized their development.

Five-in-one service platform: the provincial 12316 hotline center. The rural information service telephone hotline number 12316 was initiated by the Ministry of Agriculture to provide rural users with a 24-hour voice-based telecommunication service (via manual or automatic voice system), which they can call for consultations with experts or public service agents for their agriculture-related questions and concerns. Efforts had been made to integrate the 12316 hotline service of the provincial agriculture system and expand it into a provincial 12316 hotline center covering agriculture technology promotion, rural affairs publication, land distribution, quality security of agriculture products, and rural tourism. A comprehensive information service system featuring a five-in-one service platform has been established linking the province with the cloud service platform and management center, city and county service center, township service station, and village service station.

By the end of 2016, the 12316 platform had been opened in 17 cities and 8 counties (districts) including Jiangxia District, Dangyang City, Songzi City, and their townships and villages. Government continued to lead efforts in building 410 new 12316 information stations, recruiting 470 messengers (call center staff), and regulating 66 agriculture experts, with services reaching 635,000 rural households.

3.4 Summary of the Models

Through field research and literature analysis, three typical Internet Plus rural economy models in the PRC emerged: Internet Plus agriculture value chain model, Internet Plus e-commerce platform model, and Internet Plus agriculture service model. The magnitude of internet application in the agriculture sector can be generally summed up as follows: “life > circulation (trade) > production.” In the early stages of internet usage, when penetration rate was just growing from 15% to 50% across the PRC, farmers had already used the internet for recreation and access to information, even for online payments. The internet is likewise already influencing the whole value chain of the agriculture sector; however, its application is still in the transition stage.

The extent of internet application of the three models is uneven across regions. In the rural e-commerce platform model, the application level varies from low to high: core product sales only (everywhere); established value chain (some provinces); formed industry ecology (very few provinces). The online environment and traceability feature of agriculture are now in the trial and demonstration stages (e.g., online traceability of the production process, food safety, and branding of high-quality agriculture products); however, only sporadic cases were observed during the field visits and there was no scale operations. Branding is promoted and supported by logistics and financial services. With respect to the application of IOT and big data technologies in the production process, it is still confined in the cash crop areas, as promoted by the government. The application of precision agriculture is almost nil in the grain crop areas.

Opportunities and Constraints for Farmers and New Agriculture Operators with Internet

4.1 Opportunities

Observations and results from the field surveys conducted in the provinces of Gansu, Hubei, Shandong, Yunnan, and Zhejiang noted the positive impacts that the internet has brought to the farmers and new agriculture operators. For example, the internet has opened opportunities for farmers to expand sales of their agriculture produce, increase their income, and accelerate rural economic transformation.

4.1.1 Expanding Sales Channels for Agriculture Products

An e-commerce platform provides a solution for consumers who have difficulty finding the goods they want to buy or for producers who could not sell their produce. It expands the distribution channel of agriculture products and helps increase the income of farmers, especially those living in far-flung and inaccessible areas. Box 8 presents a successful case of an e-commerce initiative for agriculture products in Cheng County.

Box 8: Cheng County E-commerce Development and Support

Before the onset of e-commerce, farmers in the remote mountain community of Changgou in the town of Jifeng, Cheng County of Gansu Province used to carry their produce on their shoulders and walk 20 kilometers or more to town to sell them. Sometimes, they were not able to sell their products, leaving these farmers in dire poverty. In 2013, the local committee of the Communist Party of China, worked together with the local village head, Xuan Zhang, in setting up via Taobao the “Jifeng Local Specialty,” an e-commerce initiative that sold eggs, honey, walnuts, and around 30 different types of agriculture products online. When Xuan Zhang introduced the cage-free feeding for free-range chickens in 2014, more than 10,000 chickens were sold at higher than 20% of average market prices. Xuan Zhang later became the town’s associate officer and spearheaded the creation of e-commerce shops (or e-shops) for all local products, with the help of county farmers. At present, the 27 administrative villages in Jifeng have a total of 34 Taobao shops and 42 WeChat shops.

The relevant government departments encouraged and supported the young village officials, rural leaders, young rural returnees, and college graduates to open and operate these online shops. To help aspiring online entrepreneurs finance the acquisition of agriculture and forestry products, the local government of Cheng County provided access to farmer-friendly loans and women’s microcredit.

continued on next page

Box 8 *continued*

Various micro-media marketing tools were also fully tapped to promote the online sales of Cheng County's agriculture products, including the launching of the three-level (county, township, and village) government micro-blogs and 3,186 individual government micro-blogs. Two county WeChat public platforms were likewise opened to disseminate product information. Finally, the government invested in the construction of needed infrastructure (roads and broadband), and engaged the enterprises to provide logistics support services.

In 2015, Alibaba launched its “thousand counties and millions of villages” program. It is expected to invest CNY10 billion in 3 to 5 years and establish 1,000 county operation centers and 100,000 village service stations. The program will set up an e-commerce operation center in each pilot county and integrate all express logistics to each township. Every county-level electronic business operation center will support the village service station, create a two-way circulation system (i.e., “consumer goods to the countryside, rural products into the city”), and provide comprehensive services including finance. At the same time, every county's e-commerce operation center is also responsible for the expansion and training of village-level shops, which will give farmers alternative sources of income and, thus, improve their living standards. Cheng County has been identified as the first pilot county in the western region. This will bring historic changes to the comprehensive upgrading and development of the county's e-commerce.

Source: Asian Development Bank and National Development and Reform Commission of the People's Republic of China. 2017. *Rural Economic Transformation and Upgrading by the Integration with Internet Plus*. Final Technical Assistance Report. Manila (TA 9132-PRC).

4.1.2 Transforming Local Agriculture Resources and Products of Comparative Advantage into Economic Opportunities

The five provinces visited during the field research—i.e., Gansu, Hubei, Shandong, Yunnan, and Zhejiang—all have their distinct, high-quality agriculture resources and products. Some of these local specialty products are cultivated in small farms and, thus, have lower yields as mass scale production and economies of scale cannot be applied. With the entry of the internet, small producers can be pooled online so they can command better prices for their goods. Logistics hurdles, such as storage and shipment, are also addressed through the e-commerce platform thereby reaching more customers and improving sales and income of farmers. E-commerce, therefore, facilitates trade of agriculture products and transforms the comparative advantages of these local resources into economic opportunities.

4.1.3 Incorporating High-Quality Production and Traceability System in Farms

Among the typical features of many agriculture products traded online are superior quality, higher prices, and middle to high-end target consumers. Online goods are usually sold to individual customers in smaller quantity yet with high packaging and posting costs; hence, these goods need to be priced higher. To justify the high price, online agriculture products should have higher quality and special features. With the growing demand of consumers for green pollution-free foods, there is a need to standardize the agriculture products sold online to better ensure their quality and safety.

Internet technology has been applied in the development of a traceability system for agriculture products. In Zhejiang Province, over 19,000 large agriculture producers have entered their information in the database of the provincial traceability platform, with more than 890,000 quick-checking stored data and over 4,700 producers participating in the product traceability process. In Pinghu, Zhejiang Province, a vegetable processing factory sticks QR codes onto their vegetables. By scanning the code, consumers can now readily obtain information on production and food processing procedures, which ensures that the produce meets quality standards, and also strengthens the brand reputation. The government contracts the private companies to set up the traceability system and maintain the system. These companies then sell the traceability equipment to the producers to make profits. The government may support the producers by reimbursing them the equipment's purchase cost.

In Shouguang, Shandong Province, a quality tracing system for agriculture products has been developed by the Shouguang Municipal Bureau of Agriculture and utilized by farmers free of charge. Using a mobile app to scan the QR code posted on the wall of the greenhouse, customers can get detailed information about testing, sales, picking, and planting of the color peppers that farmers cultivate. The “Testing” function of the app specifies the planting base, sampling period, and test results of the farmed peppers. For example, before picking, vegetables are tested for pesticide concentration. If results fail to meet standards, vegetables are required to undergo a pesticide degradation process and then retested. Vegetables can only be harvested when they pass the testing standards. The “Sales” function of the mobile app shows the amount of sales, buyer, and transaction record keeper; the “Picking” function gives information about the harvest data and record keeper; and the “Planting” function identifies the service operators for pruning, splitting, and watering. Scanning the QR code also gives customers access to other information, such as a series of specific notes.



Employment opportunities for women. E-commerce has opened job opportunities for women, such as this packaging workshop in Hubei Province (photo by Libin Wang).

4.1.4 Including Farmers into the Whole Agriculture Industry Chain

Farmers usually figure at the bottom of the production link of the industry chain and, with small profit allocation, they have a weak status as participants in the industry chain. However, with the development of e-commerce, farmers are no longer confined to just planting agriculture products, as they can now participate in the classification, processing, packing, shipping, procurement, and sales of these products. Not only do farmers engage actively in the whole industry chain, they also reap the benefits from all the other links, hence increasing their profits.

In Guangshui, Hubei Province, Legend Parking, a company that sells succulent plants online, has set up a one-stop service business model that covers planting, packaging, and sales. Farmers can get involved in any of these processes, not just in the planting link of the chain. Legend Parking established its succulent plantation base in Quanshui village, Changling in an area covering over 50,000 *mu*. Farmers can opt to cultivate succulents in the plantation base or to pack harvested succulents, according to the orders received, in the workshop. The packaging workshop employs around 300 to 400 workers, majority of whom (90%) are women from a nearby village and with average monthly earnings of CNY3,000.

4.1.5 Promoting Brand Building of Agriculture Products

To promote brand building of local agriculture products, goods sold through e-commerce platforms are required to have their own brands. In 2013, Yunan Chenxiao Commerce and Trade Ltd. of Jinghong City, Yunnan Province, opened its online business of producing and selling, among others, honey, black sugar, tea, and meat (wild boar) under its registered brand name “Ban Na Ren.” Through brand building and the internet, the company’s online sales rose to CNY10.64 million.

4.1.6 Applying the Internet of Things for the Modernization of Agriculture

Agriculture production efficiency can be improved with the application of IOT. But current IOT users are mostly large-scale agriculture companies that employ IOT to reduce their costs, replace labor in the long run, and improve the quality control of their products.

Jianfeng Huang, owner of Pinghu Jianfeng family farm, operated a 250-hectare property in Pinghu City, Zhejiang Province primarily for the cultivation of rice and wheat. The farm utilizes IOT technology in its operations: (i) online monitoring of the food dryer, with an automatic warning system sent through phone messaging when dryers break down; (ii) installation on tractors of video screen with GPS to remotely monitor drivers of agriculture machinery; (iii) installation on tractors of precision operation balance devices to aid in the flattening of lands and removal of weeds (this could save the farm an average of CNY20 for every *mu*); and (iv) acquisition of four unmanned aerial vehicles (UAVs), which are primarily used for spraying pesticides and helps lower labor cost. All the internet applications are being subsidized by the government under the project called “upgrading the traditional industry.” The project targeted the technology upgrades of traditional and labor-intensive industries in Pinghu City, such as clothes making and luggage production. Qualified enterprises must be officially registered in Pinghu, should have good market influences and reputation, and must submit a good proposal for technology upgrades. A total of 28 enterprises got the subsidies in 2013, according to the government website.

At Yiyuan County, Zibo, Shandong Province, the demonstration park of Zhongyi Fruit Ltd. applies highly advanced and modern agriculture technologies, such as an intelligent integration facility for irrigation and a protected cultivation system using net houses. Through the intelligent integration facility for irrigation and fertilization, the optimum combination of water and fertilizer absorbed by soil for crops is achieved, as irrigation water and fertilizer are automatically controlled. Compared to traditional methods, fertilizer usage has been reduced by 60% and pesticide application by over 80%, thereby significantly reducing agriculture pollution. The 300-*mu* park could now be managed well by only six persons. Prior to the IOT application, 60 laborers were required, with each laborer working for about 300 days annually. The demonstration park proves that the use of IOT lowers and saves labor costs by about 90%. The displaced rural labor can usually find employment in Internet Plus service industries in rural areas. Real-time systems for monitoring, reporting, allocation, and trade have been established in the park through IOT. Likewise, ideal growing conditions can easily be calculated and problematic planting areas accurately located using the IOT technologies. The precise calculation feature of the IOT's big data system transforms previously time-consuming agriculture processes into a simple mouse-click task. Although the IOT devices are fully automated, some staff are authorized to manually control and override these devices. Based on actual operations, there are cases when the IOT devices break down or display error functions due to technical glitches. During these times, the devices need to be manually adjusted and manipulated to correct the problems.

4.1.7 Organizing Farmers for Shared Production Factor Use

E-commerce strengthens the piloting role played by new agriculture enterprises, enhances the market competitiveness of farmers, and advances the systematization and collectivization of the agriculture sector. For online transactions, agriculture products undergo regulated production, processing, packaging, and branding procedures that follow specific product standards. Given the inadequate capacity of a single farmer to carry out all these processes, he needs to collaborate with other farmers to form a cooperative, enterprise, or family farm—with support from rural experts—especially since e-commerce enterprises prefer to work with cooperatives to handle the production and supply side of online sales. In Caishenmiao village, Yicheng City, Hubei Province, for example, Zhang Yuquan, the shopkeeper of Hanhuo Yicheng service center, established the Fruit and Vegetable Specialized Cooperative in September 2016. This was after much prodding from his affiliate e-commerce platform to establish the cooperative for production retailers to improve their e-commerce credibility, guarantee product supply with online stores, and improve farmers' competitiveness.

4.1.8 Providing Farmers and Disadvantaged Groups with Job Opportunities

The industry chain of rural e-commerce covers a range of activities from production and processing to marketing and after-sales services. From these activities, various job positions are created to provide employment opportunities and diversified sources of income to farmers and other disadvantaged groups (e.g., the poor family, women, elderly, and the disabled) in the rural areas, which include online shop owner, online shop operator, courier, sorting clerk, online customer service agent, web designer, online marketing representative, etc.

In Chengxian County, Gansu Province, more than 4,120 low-income individuals were mobilized by the rural e-commerce industry, either directly or indirectly, through business startup or gainful



Entrepreneurial opportunities for returning migrants. E-commerce platforms, like Taobao, provide incentives to migrant youths to return home and open their own online business (photo by Libin Wang).

employment. By 2015, of the 917 online shops established all over the county, 85 were run by poor families. About 350 of these online stores have also signed agreements with 3,682 low-income families to lift them out of poverty and increase their income by helping them sell their agriculture products—by the end of 2015, online sales have already reached CNY13,702,000. Approximately 31,000 poor people experienced an increase in their annual per capita income by an average amount of CNY442, while poverty incidence went down from 25.4% in 2013 to 14.1% in 2015.⁸ Countywide data show that 395 online stores are being operated by women, 50 of which by poor women; of the 43 partners of rural Taobao, 16 are women; 11 of the 40 express logistics companies are established by women; and over 3,600 women are employed in different sectors of the e-commerce industry.⁹ In Xintai City, Shandong Province, e-commerce has helped 3,650 poor families increased their average monthly income to CNY1,580 per capita, and supported the opening of 870 online stores.

4.1.9 Providing Entrepreneurial Opportunities to Returning Migrant Workers, Young Graduates, and Unemployed Graduates

Returning migrant workers, unemployed college graduates, and young middle-school graduates (i.e., those from poor families who have no means of pursuing further studies after middle school) have higher educational attainment than the ordinary farmer. Being relatively young and open

⁸ Figures were gathered from the Chengxian County E-commerce Center, PRC.

⁹ Data were provided by the Vice Chairman of the Women's Federation of Chengxian County, PRC.

to adopting new things, these groups can be tapped as pools of higher-quality human resources for rural development. During this research, many cases have been observed of migrant youths drawn by e-commerce development to return home to start their own business.

For example, Zuo Chenming, the young man known as the “King of Sweet Potato,” returned to his hometown in Xintai, Shandong Province, after 12 years in Qingdao baking sweet potatoes. Using the money he earned while working in Qingdao, Zuo Chenming cultivates sweet potato seedlings and sells them online through Alibaba, with annual sales averaging CNY1 million. Through the Alibaba online platform, he can advertise his products nationwide and do online transactions with customers from different provinces. He also helps other seedling growers pool together their production using his own storage tank and trade their produce online via 1688, Taobao, WeChat, and other e-commerce platforms. This increased annual sales to CNY10 million—60% of which are from online transactions with China Resources and 40% from final consumption market.

Another example is Wang Yunlong of Xintai City who opened an online business for his Dongdu Jiutai brand of chili products (Box 9).

Box 9: E-commerce Promotes Entrepreneurship—Xintai City, Shandong

E-commerce has encouraged a lot of rural returnees to start their own business. It has also opened development opportunities for village officials who are college graduates. Wang Yunlong, a village official of Dongdu Town, Xintai City from the Fire Engineering Program, joined his classmates in Hunan in setting up an online business on pepper and chili sauce. Upon securing a production permit under the registered brand “Dongdu Jiutai,” he opened a specialized e-shop in Taobao. This propelled the industrialization of peppers, garlic, and other agriculture products, as well as provided employment to low-income families. Based on the Kangwangtai Fruit and Vegetable Specialized Cooperative, he also formed a food company limited, which cultivates high-quality plant varieties such as the highland red toona, Jinzhuizi Pear, nectarine, and the Tianhongzi hawthorn. He adopted the “company + base + farmer household + internet” operational approach. Through the e-commerce platforms of Alibaba, Taobao, and others, Wang Yunlong’s food company was able to penetrate the markets of medium-sized and big cities including Beijing, Shanghai, and Qingdao. Annual revenues reached CNY15 million, while income per household increased to CNY40,000 per year.

Source: Asian Development Bank and National Development and Reform Commission of the People’s Republic of China. 2017. *Rural Economic Transformation and Upgrading by the Integration with Internet Plus*. Final Technical Assistance Report. Manila (TA 9132-PRC).

4.1.10 Providing Opportunities for Training and Capacity Building on E-commerce Transactions

During the development of the Internet Plus rural economy, provinces have paid much attention to providing e-commerce training to personnel of relevant agencies and departments, farmers, and operators of new agriculture enterprises. The government generally engages and pays for the services of e-commerce enterprises and occupational training schools to undertake the tasks of e-commerce training and capacity building (Box 10). Some e-commerce firms also independently organize their own training programs.

Box 10: An E-commerce Training Company—Suichang City, Zhejiang

In Suichang City, Zhejiang Province, the “51ganjie.com” was established to provide specialized e-commerce training to government agencies. Government gives training subsidies for basic and advanced e-commerce courses in the amount of CNY500 and CNY800, respectively. An e-commerce training strategic cooperation agreement has been signed between 51ganjie.com and Zhejiang’s provincial Human Resources and Social Security Department, with the aim of honing around 50,000 e-commerce talents; assisting 40,000 aspiring online entrepreneurs set up their own businesses; and opening job opportunities for 150,000 residents of Zhejiang Province within 5 years. Upon completion of the training and assessment courses, elementary and intermediate talent certificates will be awarded by Zhejiang’s Human Resources and Social Security Department.

Source: Asian Development Bank and National Development and Reform Commission of the People’s Republic of China. 2017. *Rural Economic Transformation and Upgrading by the Integration with Internet Plus*. Final Technical Assistance Report. Manila (TA 9132-PRC).

4.1.11 Providing Opportunities for New Business Development

The Internet Plus rural economy program has revitalized the rural economy with the opening of new business ventures to different economic operators. Take for example the use of UAVs for agriculture applications and for other purposes (Box 11).

Box 11: Agricultural Applications of Unmanned Aerial Vehicles in a Family Farm—Pinghu City, Zhejiang

Jianfeng Huang, owner of the 250-hectare Pinghu Jianfeng rice and wheat farm in Pinghu City of Zhejiang Province, hired four people to operate the family farm’s newly acquired unmanned aerial vehicles (UAVs). Three of these operators are bachelor’s degree holders, and their job entails operating UAVs to primarily spray pesticides on an average farm area of 1,200 *mu* daily. Jianfeng Huang also leases his UAVs to other big farms for pesticide spraying for a fee of CNY10 per *mu*, which is expected to raise additional earnings of CNY300,000. Besides spraying pesticides, he plans to rent out the UAVs for the conduct of waterway patrol, remote sensing, cabling, and even for use in shooting wedding pictures.

Source: Asian Development Bank and National Development and Reform Commission of the People’s Republic of China. 2017. *Rural Economic Transformation and Upgrading by the Integration with Internet Plus*. Final Technical Assistance Report. Manila (TA 9132-PRC).



Unmanned aerial vehicle (UAV). An important application of the Internet of Things for modern agriculture is the use of UAV for pesticide spraying (photo by Haiping Jiang).

4.1.12 Providing Opportunities for Enjoying Social Services

With e-commerce services penetrating the villages, it is now possible for farmers to perform many of their daily tasks online—such as purchasing goods or selling their agriculture produce, paying bills, performing bank transactions (deposits and withdrawals), reserving railway tickets, logistics and express posts—without going to the designated establishments.

Box 12 provides an example of the benefits of online agriculture information system, whereas Box 13 gives an example of e-commerce service application.

Box 12: Online Agriculture Information System—Pinghu City, Zhejiang

The internet offers farmers and operators of new agriculture ventures a more convenient way of carrying out production and taking heed of government policies. Jianfeng Huang, for example, the owner of Pinghu Jianfeng farm, is able to access the latest information from pertinent government departments on project application in the agriculture sector through the Farmer Mailbox APP. All he needs to do is fill out and send the application forms electronically through a computer without visiting these government offices. He was also able to consult with online experts via “Zhibao Online” on the latest technology that allows the interplanting of potatoes in greenhouses.

Source: Asian Development Bank and National Development and Reform Commission of the People’s Republic of China. 2017. *Rural Economic Transformation and Upgrading by the Integration with Internet Plus*. Final Technical Assistance Report. Manila (TA 9132-PRC).

Box 13: E-commerce Service Company—Ganjie in Suichang City, Zhejiang

The development of the internet has enabled farmers and new agriculture operators to access and enjoy e-commerce services such as packaging design, product branding, and skills training. Zhejiang Ganjie Corporation Ltd., which was formed in 2013, offers rural e-commerce services for upstream agriculture products, downstream consumer goods, and public service training. For its upstream services, Ganjie focuses on basic-level product quality control, logistics, marketing, and package design, while promoting online sales and rural tourism using its own mobile shopping platform. For downstream services, Ganjie sets up village-level service stations in rural areas, appoints station leaders especially in populated locations, and trains them on how to assist villagers make online transactions, such as purchases, bills payment, micro-loans application, etc.

Ganjie actively seeks out cooperatives and large-scale farmers as partners. The company conducts regular on-site visits to planting and breeding bases to check that production reaches certain scales, agriculture produce meets online sales standards and customers' demand, and final products can be packaged and transported. Once products pass the inspection, Ganjie negotiates with their principal contacts on marketing details such as packaging design and product branding.

A 10-person quality control group was formed by the company to establish business standards, based on local conditions, for the main agriculture products of Suichang. Thus far, standards for 70–80 local products have already been established. Ganjie is in discussions with relevant government agencies on converting these business standards into industry-level standards, so their products can be marketed to larger areas. It has also partnered with local governments in the provision of e-commerce trainings at the provincial and national levels.

Source: Asian Development Bank and National Development and Reform Commission of the People's Republic of China. 2017. *Rural Economic Transformation and Upgrading by the Integration with Internet Plus*. Final Technical Assistance Report. Manila (TA 9132-PRC).

4.2 Negative Impacts of Internet Plus on Farmers and New Agriculture Operators

While the internet has greatly been beneficial to farmers and new agriculture operators, it has also brought some adverse effects. First, the lure of e-commerce as advocated by some preferential national policies has driven farmers and new agriculture business entities to blindly jump into the e-commerce bandwagon or open their own online shops. Later, some of them would discover that their abilities and experiences in online marketing and supply chain management are gravely insufficient, resulting in serious losses and unsalable products.

Second, with the development of information technology, online shopping has gradually become part of the daily consumption habits of farmers. As online shops offer more choices at cheaper prices, especially for some industry and consumer goods, they have negatively affected the market performance of real physical stores in some rural areas. These physical stores encounter financial difficulties since they are not making profits as they used to; some have even closed shop. This, in turn, has affected the economic environment of the countryside.

Third, internet-based financial transactions have begun to infiltrate the countryside. Compared to urban residents, the information of farmers is relatively limited, and farmers are highly vulnerable to the risk of their personal data being leaked and used for fraud. Many farmers are deceived by the enticement of high interest rates. In rural areas, internet financial fraud often takes advantage of the society's chain of acquaintances, such as finding personal endorsement in the village or promoting sales by subcommission. Once consecutive defaults happen, the social harm is relatively greater because of this so-called small-world phenomenon.¹⁰ These financial frauds lead to disintegration of the value of trust among acquaintances as they loot villagers of their money.

4.3 Constraints Faced by Farmers and New Agriculture Operators

Although the internet opens new opportunities to farmers and new agriculture operators, the following constraints need to be taken into consideration before fully applying the internet to advance rural economic transformation and development.

4.3.1 Lack of Network Infrastructure

Internet usage—particularly in mountainous zones, regions with low population density, and less developed areas—has been plagued with problems relating to small area coverage, low access rate, narrow network bandwidth capacity, and high telecommunications network costs. In Pu'er, Yunnan Province, for example, since 90% of its total land area is situated in mountainous regions, a massive network investment of roughly around CNY1 million is needed to build a base station. However, the village population is small, and not everyone may be using the network. Such low consumption may not be able to justify the construction of a base station and network broadband infrastructure, much more support its maintenance fees, which would likely deter would-be investors.

4.3.2 Absence of Quality and Safety Food Production License and Industry Quality Standards for Local Specialty Products

The development of e-commerce for agriculture products has promoted sales of local specialty foods in a wider market and opened new opportunities for farmers to augment their income. But for local specialty foods to be sold on large network platforms, a QS food production license is needed. Requirements for getting this license include acquiring high-standard processing equipment, undergoing complex examination procedures, disbursing sizeable amount of funds to cover fees charged by various agencies for the issuance and handling of vital documents, and submitting to annual inspections. Products produced by local farmers using traditional approaches are mostly specialty foods with indigenous historical and cultural features and are unlikely to get a QS food production license. Since applicable enterprise or industry standards have not been set yet, online sales of these local specialty products remain restricted.

¹⁰ The small-world phenomenon refers to the fundamental issue in social networks, which links all individuals by short chains of acquaintances, up to “six degrees of separation”—i.e., all of us are connected to someone else in just six steps (J. Kleinberg. 2004. The Small-World Phenomenon and Decentralized Search. *SIAM News*. 37 (3). April).

4.3.3 Poor Practicability of Internet of Things Devices

The current application of IOT is still in the pilot and demonstration stages and has not been rolled out for large-scale application. Also, IOT devices can be very expensive and their operating cost can run higher than labor cost. More importantly, the technology of IOT devices has not been properly linked yet to agriculture production technology, hence the devices encounter insufficient functions when used to support precision agriculture production. These drawbacks are disrupting the usage of IOT devices and upsetting the confidence of farmers and new agriculture operators in these devices. Research and development (R&D) on these IOT devices face difficulty in designing different types of models that fit the PRC's vast and diverse regions. In monitoring greenhouse production, for example, factors like humidity, light, moisture, and temperature can be programmed into IOT device sensors that monitor just a single variety of plant rather than multiple varieties. This makes it impossible to adjust the plant varieties cultivated in the same greenhouse according to the market demand.

Box 14 demonstrates some of the difficulties of IOT applications in the field.

Box 14: The Practical Difficulties of the Internet of Things—Pinghu City, Zhejiang

The Internet of Things (IOT) facilities and equipment used in agriculture have high maintenance costs and are of poor quality and stability standards. In Pinghu City, Zhejiang Province, for example, the Jiaxing Baimei Ecological Agriculture Science and Technology Park has encountered several IOT-related problems in its smart vegetable greenhouse. These include poor network signals, regular power failures, and breakdown in its automatic roller blinds. Unfortunately, the park's staff were unable to resolve the problem promptly as the failed devices could not be operated manually. A soil data monitoring sensor acquired at CNY3,000 also tends to break down regularly. The IOT devices installed in the smart greenhouse has cost the park an annual maintenance fee of CNY5,000 per *mu*.

Source: Asian Development Bank and National Development and Reform Commission of the People's Republic of China. 2017. *Rural Economic Transformation and Upgrading by the Integration with Internet Plus*. Final Technical Assistance Report. Manila (TA 9132-PRC).

4.3.4 Lack of Professional E-commerce Staff

The lack of e-commerce staff is a common problem faced by operators of internet-based businesses. Even the agriculture departments are in dire need of cadres who are knowledgeable in both agriculture and the internet so they can promote the Internet Plus rural economy program. According to the Hubei Provincial Department of Agriculture, the current and primary function of the agriculture departments remains educating farmers on how to farm well. Teaching farmers to use the internet to adapt to the changes of the information age has been a challenging task as these government officials themselves lack the know-how to do so. Only a few cadres in the agriculture departments are both skilled in agriculture and experienced in using the internet.

Farmers' cooperatives, agriculture enterprises, and e-commerce service companies share the same problem of lack of e-commerce experts. For online businesses, besides skills in e-commerce marketing, it is also important to be familiar with software (e.g., Adobe Photoshop) and other network techniques needed for online store development and design, product photography,

and promotional efforts. These skills are difficult to acquire, especially for the less-educated and non-internet adept shop owners, who are ill-equipped to implement more complex levels of marketing, promotion, and art designs.

4.3.5 Difficulty in the Use of E-commerce Platforms

Farmers and new agriculture operators engage third-party e-commerce platforms such as Alibaba, Jingdong, Suning, Taobao, and Tmall to open their online shops, in accordance with the platforms' respective rules. However, many farmers and new agriculture operators complain about the strict conditions for access and low profit margins imposed by these platforms. Online shop owners must pay an annual registration security deposit of more than CNY100,000 for Jingdong Mall; CNY100,000 for Tmall; CNY5,000 for Taobao; and CNY1,688 for Alibaba. Fees are also collected for marketing activities, e.g., opening a direct channel or accessing Taobao's diamond exhibition. These expenses greatly reduce their profit margins.

To illustrate, online sales volume of Zhejiang Pinghu Green Island Food Co., Ltd. grew between 30% and 50% annually; however, their online sales profit was only 10% because of the high costs of e-commerce platforms. The company pays CNY20,000 to CNY30,000 yearly to participate in Alibaba's e-commerce training in Hangzhou, where the latest rules and trends in e-commerce operations are taught. In Pu'er City, Yunnan Province, Shengyuantang Industry of Zhenyuan County purchased an e-commerce process flow in Baidu to implement network promotion, which cost more than CNY800,000 in 1 week. Although it was able to track its customers flow and achieved the target number of customer visits, sales volume did not increase that much because many customers generally just browse the site without consummating an actual purchase. In 2016, online sales of Hubei's Chuda Duck Industry reached CNY20 million, but its profit margin was stuck at barely 10%. Chuda spent about CNY300,000 on advertising when it started its e-commerce operations.

Online shop operations require high levels of technologies, management skills, and large sums of capital, which are more suitable for trained professionals rather than for common farmers or their regular cooperatives. Despite the incentive measures provided by local governments to promote e-commerce and the active efforts of farmers' cooperatives to participate in e-commerce, online sales of local specialty agriculture products still fell short of expectations. This is because, after opening their online shops, storeowners discover that they face very tight competition from numerous other online shops selling similar products, thereby making it even more difficult to attract customer flow. Some local specialty agriculture products are of high quality and should fetch a high price. However, online customers, particularly those in large e-commerce platforms such as Taobao, are extremely price-sensitive. Such behavior triggers price war among online businesses and creates a market impediment for the online sales of high-quality agriculture products at high prices.

E-commerce might help cut down the costs of intermediaries, but logistics, packaging, and marketing costs escalate. If competitive leading enterprises find it difficult to profit from e-commerce, how much more for ordinary farmers and farmers' cooperatives. Since farmers and farmers' organizations are generally confined in the production link of the agriculture industry chain, the internet just opens an additional channel for sales.

4.3.6 Imperfect Cold Chain Logistics

Cold chain logistics for rural areas are oftentimes flawed as the preservation of the freshness of agriculture products cannot always be guaranteed during shipment. Improper handling, storage, and changes in climate conditions during transport can easily cause spoilage of agriculture products, as these goods are highly perishable. When these spoiled products reached the customers, the online sellers are accountable and liable to pay high penalty fees for damages caused to protect the reputation of the e-commerce platform as well as uphold consumer rights. Thus, many sellers shy away from selling agriculture products online, but instead use online advertising and marketing in conjunction with offline negotiations and sales.

A merchant from Yicheng City, Hubei Province, for instance, advertises products of his online incubation center via Hunan Huinong Network to draw more customers, but completes the sales transaction offline. He believes that customers prefer to be able to check the actual products prior to delivery.

4.3.7 Inadequate Incentives for Using the Traceability System for Agriculture Products

In the absence of specific legal provision concerning the traceability system for agriculture products coupled with the low demand of consumers for such system, there is very little incentive for farmers and new agriculture operators to utilize the traceability system for product safety and quality. Besides, the system does not affect the quality and prices of their products. For now, the traceability system has only been made mandatory by the Ministry of Agriculture for veterinary drugs. The Agriculture Department of Zhejiang Province recommends the use of the traceability system for agriculture products sold in the market, but it is not required. Thus, agriculture production and wholesales companies are not obliged to have traceable QR codes. Promoting the usage of the traceability system for product safety and quality can be quite tricky without a unified standard.

4.4 Summary of Opportunities and Constraints

Internet Plus has promoted the integration between the primary, secondary, and tertiary industries; accelerated the extension of the agriculture industry chain; fostered the transformation and upgrading of the rural economy; and given rise to a new industry format and new business models. Thus, farmers and new agriculture business entities can benefit from the extension of the industry chain. Internet Plus has the advantages of breaking the information asymmetry and reducing the cost of public services, providing farmers access to convenient and low-cost information and services on production and lifestyle. E-commerce has changed the traditional spatial and temporal layout of the economy, opening opportunities for backward communities in the rural areas to participate in the large cooperative value network. Farmers and new business operators have also begun to think about how to broaden their sales channels, build their own brands, and promote their products through the internet. Because of the national policy emphasis on “Internet Plus poverty reduction,” e-commerce projects targeting the poor areas have played positive roles in helping poor farmers sell agriculture products, increase their income, and access new entrepreneurship and employment opportunities.

E-commerce is the most active area of the Internet Plus rural economy model, with the number of business operators growing at very large scales and the use of major e-commerce platforms escalating. For farmers and new business operators who lack online marketing skills and industry chain management abilities, blindly opening online stores makes it very difficult for them to gain profit.

The theme on “revitalizing the countryside” of the No. 1 document of the Communist Party of China in 2018 points toward the direction of e-commerce development: “focus on solving the outstanding problems in the sales of agriculture products; strengthen the postharvest classification of agriculture products, packaging, marketing, construction of modern agriculture products cold chain logistics and warehousing system; build a public service platform for the sales of agriculture products; support the supply and marketing cooperatives, the postal service enterprises, and all kinds of enterprises to extend the postal service network to the countryside and improve the stable convergence mechanism for production and marketing of agriculture products; vigorously construct infrastructure to promote rural e-commerce; and encourage and support all types of market players to develop innovative agriculture industry modes based upon the Internet.”

Therefore, farmers and new business operators need to convert their rural e-commerce entrepreneurial thinking by not confining themselves to opening online shops. Rather, they should look into the vast rural e-commerce industry and value chain system, select a link, and do in-depth work on areas that would bring them new profits, such as the agriculture products supply chain, postharvest classification, packaging, warehousing, cold chain logistics, brand planning, packaging design, quality traceability, etc. At present, the whole business has been transformed from the selling side to the supply chain, industry chain, and value chain—i.e., from business-to-consumer (B2C) to consumer-to-business (C2B). The upstream movement of agriculture products cannot continue to grow and sell products without the support of big data technologies. Application of these technologies will improve production and business models from the perspective of the consumers and vigorously develop new business formats such as customization, crowd-raising, adoption, and sharing of agriculture.

Main Policy and Institutional Issues

5.1 Less Efficient Management of Government Departments

The degree of internet application for public services of agriculture departments is low. In the provision of public services such as agriculture product quality inspection and reporting, the agriculture departments rarely use the internet platform. They continue to primarily use paper materials rather than go paperless via the internet in handling and transferring files of farmer households. In terms of giving guidance and instructions on mechanization, the agriculture machinery department also rarely uses the internet. In developed areas, internet application in public services of the agriculture departments is affected by their weak internet awareness and knowledge. In medium-developed and less developed areas,¹¹ low internet application is affected not just by poor internet awareness and know-how but also by the lack of local financial resources to support the needed internet hardware and software.

The imperfect and limited classification of agriculture products in terms of homology of medicine and food hinders the online sales of some products. Some special agriculture products are both medicinal and edible, but drug administration departments in many regions simply treat them as medicinal materials and prohibit their online sales without recognizing them as food products. In Gansu Province, drug administration departments strictly limit *Astragalus membranaceus* and *Codonopsis pilosula* (dang shen or poor man's ginseng) as medicinal materials without allowing them to be sold online.

Food products with special local features processed in small workshops cannot be sold online. According to a white paper entitled the *Quality and Safety of Food in China* and issued in August 2007 by the Information Office of the State Council of the PRC, products produced and processed in small food workshops cannot be sold beyond county-level administrative area; such products are subject to strict limitation of being sold in shopping malls, supermarkets, and similar places.¹² In 2016, Shenzhen likewise released a document stipulating that food products processed in small food workshops cannot be sold online.

¹¹ The five field study provinces in the PRC (Gansu, Hubei, Shandong, Yunnan, and Zhejiang) were grouped by their level of economic development based on per capita gross domestic product.

¹² *China.org.cn*. 2007. White Paper on Food Quality and Safety. State Council Information Office of the PRC. 17 August. <http://www.china.org.cn/english/news/221274.htm>.

5.2 Incomplete Public Services

The traceability system for the quality and safety of agriculture products lacks motivation for commercial application. Consumers currently do not have a strong demand for the traceability system of agriculture product quality and safety. Hence, national laws and regulations do not require the provision of traceability labels. The inclusion of traceability labels on agriculture products has little effect, if at all, on the prevailing quality and prices of these products, so most enterprises are not motivated to acquire nor apply this system. In addition, the establishment of this traceability system requires huge investment to cover links to production, processing, storage, trade, delivery, and others. But there are only few pilot projects supported by the government. Therefore, only a small number of enterprises have independently set up their traceability system for the quality and safety of agriculture products.

The certification service efficiency is low for the three-criteria-certified or one-geography-certified farm products. Because the institutions providing certification service for the three-criteria-certified or one-geography-certified farm products are generally set up in provincial capitals or large cities, many counties and cities do not have easy access to such service. The service institutions are situated far from the customers, influencing the long lag time of certification service. In addition, there are just a few existing certification institutions and majority of them are public ones with nearly no market-oriented certification companies. So basically, these institutions have regional monopoly of the certification service and, like any other monopolies, are plagued with poor service efficiency, lack of services, high cost, and other outstanding problems.

There exist deficiencies in public training service. There is scarcity in terms of qualified professionals for the handling of e-business training. Internet trainings conducted in some areas usually do not factor in differences in trainees' age, educational background, experience and exposure to modern technologies, and occupations. These trainings are still in the initial stages of raising awareness about computers and internet applications and do not tackle practical application problems. In addition, trainings for e-commerce entrepreneurship are not effective enough as the benefits of training are rarely reflected in the profits made from opening online stores. Also, the technical trainings provided by the agriculture department focus more on offline sales of common agriculture products, which do not match farmers' demand of producing agriculture products suitable for online sales.

5.3 Low Infrastructure and Equipment Support

The support for rural logistics is not enough, making upstream movement difficult for agriculture products. In medium and less developed areas, the construction of road transport infrastructure seriously lags. Due to weak infrastructure and logistics support in these areas, costs of doing online sales run very high. In the developed areas, logistics support and cold chain logistics are the weakest links, and these also make selling agriculture products, especially fresh fruits, challenging.

Villages encounter low network coverage, slow network speed, and difficulty in using the special line. First, network coverage is low. Due to the inconspicuousness of internet infrastructure such as fiber optic networks, local governments believe that the construction of rural internet-based information infrastructure is not as tangible as building railways and roads. In the administrative

villages of some areas, the coverage rate of the internet has grown rapidly; whereas, in natural villages, progress in coverage rate has been very slow. Second, the network speed is slow. In Gansu Province, many service cameras installed in the supply and marketing cooperatives are idle due to slow broadband speed—i.e., just around 4 megabits per second. Third, costs associated with the use of special broadband lines are high. Although these lines are fast and stable, they cost five to six times higher than household networks in residential areas and require special devices which cost even more. Most of the rural internet users cannot afford these special lines.

The incentives for research and development and the promotion of agriculture Internet of Things devices are weak. The current application of agriculture IOT in developed areas is in the demonstration and pilot stages; whereas, in medium and less developed areas, application is still in the initial stage. R&D for key technologies of agriculture IOT requires huge investment, with high risk yet low returns. Because agriculture IOT has the features of quasi-public products, enterprises are not motivated enough to carry out R&D and the government lacks financial support for it, resulting in the low integration of IOT expert management system and IOT devices. Further, agriculture IOT devices have high associated production costs and are quite expensive. Most agriculture production operators cannot afford these devices, and the technologies used for agriculture IOT devices are still not that developed and tend to frequently malfunction.

5.4 Inferior External Environment for the Development of the Internet Plus Rural Economy

Policies for financial and land use support are imperfect and give weak support for rural internet users. From the perspective of finance, it is difficult to implement rural property mortgage loans. The PRC government has been advocating for rural property mortgage loans, but financial institutions are reluctant. The amount of credit loan is small and there is lack of financial products suitable for rural e-commerce operators. Likewise, the approval of government financial support has too many links and a high threshold, and takes a long processing time. From the perspective of land policies, because the progress of the PRC's rural collective construction land reform is slow, the open trading market has not been established yet and the construction land quota is scarce; therefore, operators applying internet technology generally face land use difficulties.

Natural monopolies need to be watched to avoid unfair market practices. Online operators sell agriculture products using large e-commerce platforms to attract more consumer attention. They also pay these platforms promotional fees to win sales volume. It is thus important to examine whether agriculture e-commerce market platform enterprises have formed a barrier to entry resulting in higher marketing costs and whether the amount of promotional fees charged by large e-commerce platforms manifests a market dominant position. Private e-commerce platform companies must compete fairly. Ensuring fair competition through adequate regulation is a public sector responsibility. The private sector is obliged to comply with competition law and trade rule practices of corporate social responsibilities, along with proper payment of taxes, protection of the environment, and provision of jobs to disadvantaged groups, etc.



E-commerce agriculture product demonstration center. By improving the safety and quality of local agriculture products, e-commerce has transformed and revitalized the rural markets (photo by Libin Wang).

Recommendations for Policies, Mechanisms, and Investments

6.1 Basic Conclusions

The economic development stages and the cost-effectiveness comparison of internet technology determine the extent of internet application in the rural economy. The higher the level of economic development in a region, the more internet technology is applied in the rural economy. At present, in terms of application in the PRC's rural economy, internet technology is most extensively applied in the e-commerce of agriculture products. It is also widely applied in facility agriculture, livestock and poultry breeding, and other areas with high added value. However, it is rarely applied in field crops, processing of agriculture products, leisure-oriented agriculture, means of agriculture production, and other agriculture production service industries.

The PRC has many policies calling for support for the Internet Plus rural economy, but only a few of these policies are with high value. For now, the central government policies related to the Internet Plus rural economy are mainly action plans, guidance opinions, and planning of principle, framework, and advocacy. As for the ministry policies with obvious local impact, there is the comprehensive demonstration project of delivering e-commerce into rural areas, along with the pilot project of broadband entry into villages and households supported by government funds. There are also systems for food production licensing in the category of regulations. Local government policies for the Internet Plus rural economy are mainly a series of policies for promoting the development of agriculture products and rural e-commerce. Overall, the Internet Plus rural economy suffers from low financial investment, insufficient subsidy, and unreasonable structure; thus, its approaches need to be improved. By drawing on the experiences of developed countries, the governments at all levels should provide simple and clear policies to support the Internet Plus rural economy and promote the policy-based projects or engineering with future financial support, supplemented by relevant regulatory policies.

6.2 Policy Proposals and Specific Recommendations

According to the strategic goal of rejuvenating the rural areas proposed by the 19th National Congress of the Communist Party of China, the government should realize the goal of industry development by applying Internet Plus technology to promote rural economic transformation and upgrade. It is important to clarify the government and market positions in this regard. The government should provide public goods and services for market order supervision with positive external effect in the links where the market malfunctions. Exploration of new markets with high risks, low economic benefits, and high ecological and social benefits in terms of risk protection should likewise be supported.

Market operators can play the role of investors. Investment targets will be in profitable areas such as e-commerce of agriculture products, Internet Plus facility agriculture, Internet Plus breeding industry, Internet Plus agriculture product processing industry, Internet Plus leisure agriculture, Internet Plus agriculture social services, and agriculture IOT devices. The currently effective series of policies in areas related to the Internet Plus rural economy should continue to focus on improving the management efficiency of government departments, increasing financial investments, optimizing the structure and methods of subsidies, improving the efficiency of subsidies and public services, enhancing infrastructure and equipment support, improving the external environment, increasing credit support of multilateral banks, and guiding private economic operators to increase their investments. These initiatives will help promote the transformation and upgrading of the PRC's rural economy through the wide application of internet technology.

6.2.1 Enhance the Management Efficiency of Government Departments

Optimize the process of formulating policies for the Internet Plus rural economy. The central leading organization shall authorize the departments responsible for policy formulation to represent the central leadership in coordinating with relevant departments in policy formulation according to the law. The responsible departments are entitled to refuse unreasonable policy opinions of relevant departments. When relevant departments refuse to sign but the responsible departments believe that there are justifiable grounds to pursue the rejected policy options, then the responsible departments can submit the policies for deliberation by the superior leaders in a special meeting, wherein the departments refusing to sign can state and validate their reasons for doing so. In the process of soliciting opinions of relevant departments, if a relevant department asks for postponement without any valid reason, it will be deemed as no opinion once a deadline has passed. There is no need to ask for opinions of the department again.

Improve the coordination mechanism of major departments for the Internet Plus rural economy. Enhance the position and role in the Internet Plus economy sector of the Office of the Central Leading Group for Cyberspace Affairs and the Cyberspace Administration of China by giving them economic functions and increasing their coordination function in the Internet Plus rural economy transformation. Also, upgrade the function of the Internet Plus activity office setup in the development and reform commission, and strengthen the organization and coordination functions of the rural economy department in said commission.

Specify the role of departments in the formulation of the Internet Plus rural economy policies. Through the joint conference of the Internet Plus activity, it has been further specified that commerce, agriculture, industry and information technology, poverty alleviation, and other departments shall strictly follow the division of responsibilities in the formulation of policies for the Internet Plus rural economy in their own fields. Commercial departments are responsible for formulating standards and policies on agriculture product logistics, e-commerce platform operation regulations, and credit system building. Agriculture departments are responsible for formulating standards and policies on smart agriculture, agriculture product quality, and quality and safety traceability. The departments of industry and information technology are responsible for formulating standards and policies on agriculture network infrastructure construction and agriculture product processing; meanwhile, poverty alleviation departments are responsible for building public welfare donation platforms and special agriculture product promotion platforms in poor regions. If cross-departmental cooperation is involved for policy formulation, all the departments are required to issue a joint document. The rural economy and high-tech institutions

in the development and reform departments are jointly responsible for the formulation of comprehensive policies for the Internet Plus rural economy. The internet information office focuses on the coordinated formulation of information security policies.

Cultivate the internet thinking and working style of government-related departments.

Broaden internet awareness training in government departments. In particular, encourage local governments to provide more trainings on internet awareness to agriculture-related department staff and boost internet use in the agriculture service departments. Establish the internet office system by supporting local governments in speeding up the transformation of office models for the agriculture and public service departments in qualified regions. Lastly, adopt multiple forms of public service provision by combining traditional models with the internet.

Scientifically revise the catalog of both medicinal and edible agriculture products and establish the standard for their online sales.

Food and drug administration departments should organize relevant experts, industry associations, and vital enterprises to revise the catalog of medicinal and edible agriculture products. Check whether some medicinal and edible products may be inaccurately classified as traditional Chinese medicinal materials. Support industry associations in formulating the quality grade standard for the online sales of medicinal and edible agriculture products. Also, strengthen the quality of supervision of the online sales of these products and boost the transformational upgrade of this industry with the help of information on consumer demands from the internet. Support industry associations to establish a national traditional medicinal material traceability platform to standardize their labeling according to the requirement of unified standards for basic information, with some flexibility for special information.



Local specialty products. E-commerce has facilitated the online sales of local specialty agriculture and food products (photo by Libin Wang).

Methods should be explored for small food workshops that meet food safety requirement to sell food products with special local features online. The State Food and Drug Administration urges provincial governments to come up with regulations to manage the production licenses of small food workshops, so licenses can be legally issued to workshops meeting the relevant requirements. One or two pilot provinces may be chosen, where small food workshops given production licenses can sell their food products with special local features online, on the condition of producing their quarterly, semiannual, or annual food safety test report.

6.2.2 Improve Public Services

Speed up the establishment of the traceability system of agriculture product quality and safety. First, create a business atmosphere for the application of the traceability system of agriculture product quality and safety. Adopt methods, such as the use of public media and the celebration of the March 15 Consumer Rights Day, to accelerate the regulation and promotion of consumers' consumption of only agriculture products with the traceability system logo. For now, the system should focus on agriculture food products, but agriculture nonfood products can be included later. In principle, the products included will be chosen by enterprises based on demands of their customers. In the stipulated transition period of 1–2 years, the traceability system shall be implemented progressively by stages, i.e., from large supermarkets and comprehensive e-commerce platforms, to small supermarkets and specialized platforms; and by food classifications, i.e., from vegetable, fruit, meat, eggs, and milk, to grain and oil. The relevant departments of the central government shall facilitate the establishment of the system and encourage multilateral development banks and even policy banks to extend loans to local governments.¹³ This joint support by the central government and banks will enable local governments to support those enterprises that independently establish their own traceability systems, by covering a portion of the cost of setting up such a traceability system after the system is completed and approved.

Second, carry out pilot projects that establish and launch the traceability system of quality and safety of food for network sales. Qualified regions in the developed areas will be selected to carry out the pilots, with the required condition that food for network sales shall have the traceability logo. The scope of the pilot projects can be gradually expanded using the principle of “establish first and norms later.” In the early stages of the pilots, the government can provide financial subsidies and technical guidance to help e-business operators of agriculture products reduce their costs and improve efficiency.

Establish rural big data platforms. It was earlier suggested that multilateral development banks and/or policy banks set up a special fund for loans to local governments to support the development and use of rural economic data. Local governments shall organize agriculture producers and operators, data companies, research institutions, and consumers to jointly build the rural economic information platform. Social capital can be allowed by local governments to participate in the construction and maintenance of the rural public data systems by applying the government procurement services method. Enterprises shall also be encouraged to independently establish rural databases and promote the protection of data and associated intellectual property rights.

¹³ In 1994, the PRC established its three policy banks—namely, the Agricultural Development Bank of China (ADBC), China Development Bank (CDB), and the Export–Import Bank of China (Chexim). These policy banks assume the policy-oriented operations of the country's state-owned commercial banks, particularly in overseeing the spending of government-directed financing earmarked for trade and economic development, social benefit provision in poor areas, and local industries development.



Agriculture big data. Enterprises such as Qianmo Technology Co., Ltd. in Anhui Province recognize the benefits of big data system in modernizing the agriculture value chain from farm to table (photo by Libin Wang).

With the guarantee of confidentiality, the central and local governments shall be encouraged to disclose their pertinent data (e.g., e-commerce trade amount and value, financial subsidies, land areas and land use, investment projects from different government agencies). Provincial governments shall take the lead in identifying responsibilities and existing data accountabilities of various departments. Problems related to multidepartment coordination and interdepartment data incompatibility will require interdepartment discussions and coordination. Data governance and data management initiatives can help establish accountability and transparency mechanisms that would promote interdepartment data sharing, compatibility, and disclosure.

Increase certification efficiency of the three-criteria-certified or one-geography-certified farm products. Relevant departments can offer certification authority for “pollution-free agriculture products, green food, organic agriculture products, and geographical indication” to public institutions and quasi-public or private enterprises endowed with the needed certification ability. These departments should strengthen their supervision of certification authorities and strictly penalize those institutions that issue fake certificates by permanently canceling their certification qualification. Certification institutions are encouraged to adopt electronic certification letters, shorten certification processing time, and attach importance to anti-fake identification of reports.

Governments should improve support for training. Encourage local governments to motivate ordinary farmers to use the internet by having internet-savvy personnel conduct demonstration and training. With regard to the e-commerce entrepreneurship training, training departments are expected to distribute half or one-third of the training subsidies to students who passed

the training test, while the remainder can be given to training institutions or teachers as bonus according to how much sales profit the students have made 1 year after opening their online stores. When organizing and conducting trainings on production techniques and operational and managerial capacity building, agriculture departments should take into account the primary goal of farmers of selling agriculture products online. Leading companies and specialized cooperatives should also be given bonus for conducting such trainings. Local governments should customize their e-commerce training modules according to the different levels and categories of trainees, as well as persuade training institutions to buy advanced e-commerce training courseware. For trainees with special needs, training methods such as the centralized viewing and remote reviewing of courseware can be adopted.

Accelerate the establishment of the market of rural property rights trading. The General Office of the State Council should adopt the reward and punishment mechanism to motivate local governments to accelerate the establishment and improvement of the rural property rights trading market. The departments of land and resources and agriculture have organized the Wuhan Rural Comprehensive Property Exchange, Chengdu Rural Property Exchange, and other experts to train relevant departments of all local governments and encourage them to learn from the experiences of these two rural property exchange markets in order to carry out a strategic cooperation. Local governments shall adopt the model of “Internet Plus basic module standardization plus localization of specialized module” to establish the rural property rights trading markets and prepare for future interconnectivity and compatibility with other rural property rights trading markets nationwide. The departments of land and resources and agriculture can then rely on the rural property rights trading markets established in all provinces and districts to lead the creation of both regional and national rural property rights trading markets.



E-commerce training. Farmers participate in e-commerce training to familiarize themselves with internet-related technologies and rural e-commerce practices (photo by Libin Wang).

6.2.3 Strengthen Infrastructure and Equipment Support

Strengthen the construction of rural logistics infrastructure. The government shall increase investments in the construction of rural road infrastructure. Multilateral development banks as well as policy banks will be tapped to provide loans to local governments for the construction of rural roads in the medium and less developed areas. The government shall expand the coverage of the comprehensive demonstration project on e-commerce conducted by the commerce departments to include rural areas. Local governments shall likewise be supported in accelerating the construction of the logistics and distribution system, including the setting up of freight buses in rural areas and the establishment of the rural mechanism of Didi freight transport (an online booking of trucks). Local governments should work with logistics platform enterprises to carry out a free-ride type of Didi freight transport business, much like a taxi service in the rural areas. Moreover, intelligent cold chain logistics enterprises are urged to form industry alliances so that their associations can create real-time databases of regional cold storage and cold chain cars. These databases can be used to accurately match cold chain supply and demand information. In addition, local governments should include cold chain cars into the scope of the agriculture machinery subsidy.

There are opportunities, while upgrading infrastructure, to shift to less polluting or totally renewable energy-fueled technologies (e.g., solar irrigation pumps, e-vehicles, etc.), consistent with the PRC's pledge for low-carbon agriculture.

Strengthen the construction of rural information network facilities. The central government shall increase financial investments, together with loans from multilateral development banks and policy banks to local governments, to support the construction of rural internet infrastructure. Natural villages with conditions suitable for broadband access shall be included in the scope of the special fund subsidy for the national broadband access project. The central government thus needs to increase its efforts in assessing natural villages that meet the required broadband access conditions. It is also important that telecom operators be provided with financial subsidies to support them to further increase the speed and reduce the expenses of internet connection in rural areas, particularly the expenses of dedicated access. At the same time, costs of internet communication and internet connection of poor households should also be reduced.

Strengthen incentives for research and development of agriculture Internet of Things devices. Multilateral development banks and policy banks will again be tapped to provide low-interest loans to local governments to set up special funds for R&D of key technologies and devices of agriculture IOT. Technical parameters for the agriculture expert systems shall be supported and embedded into IOT devices. Projects on agriculture smart equipment innovation and promotion can be set up to focus on major cash crops, with industry leaders or associations taking the lead in R&D. The agriculture scientific research institutions and IOT device enterprises can conduct supplemental R&D related to the needs of producers, and integrate the technical parameters of automatic production control of leading crop varieties in regional facility agriculture into the modular model. Application of agriculture IOT devices by the main market players shall be duly supported by the government. In the early stages of application when agriculture IOT devices are deemed high-risk and of unstable technology, the adoption of project demonstration utilizing government-procured agriculture IOT products will help R&D enterprises address the problem of low usage and product sales. In the middle and later stages of product usage, the government can provide subsidies for high-value agriculture IOT products to make them affordable to users.

6.2.4 Improve the External Environment to Develop the Internet Plus Rural Economy

Build the financial and land use support systems for rural internet users. Financial support for the Internet Plus rural economy should be reinforced by establishing the credit system of rural internet users. Loans from multilateral development banks and/or policy banks can be used by the local governments to set up special funds for the development of rural credit system in selected pilot areas. The system will focus on collecting key information of rural internet users, establishing a database of rural e-business operators, and evaluating credit ratings.

Mechanisms for transferred loan and large credit loan amounts should also be explored. It is suggested that the multilateral development banks, the PRC's policy banks (Agricultural Development Bank of China, China Development Bank), and other institutions make use of their comparative advantages, including low interest and long-term loans, to cooperate with large comprehensive e-commerce platforms, provincial rural credit cooperatives, and other institutions for the issuance of directional loans to operators applying internet in the form of subloans. Transferred loan agencies are encouraged to offer credit loans of CNY100,000 to CNY300,000 to each user based on its credit rating. Local governments are encouraged to set up risk compensation for agriculture-related loans.

Agriculture-related internet financing should be strongly supported through either subsidies or rewards. Reasonable supervision and endorsement by the government can be used to encourage qualified enterprises to carry out agriculture crowd-funding activities. Financial institutions shall be encouraged to provide rural payment platform and insurance services, and guide farmers to use online payment, mobile payment, online insurance, and mobile insurance. The use of subsidies and rewards can help convince agriculture-related banks to explore the implementation of chattel mortgage loans according to online trading data and other information of new agriculture operators on large brand e-commerce platforms. Large e-commerce platforms shall be persuaded to adopt the methods, such as customer big data and agriculture product pledge, to carry out online loan services.

Support for land requirements should be reinforced in the Internet Plus rural economy. The government should allow the use of abandoned rural schools, factories, warehouses, and other collective construction land for business, and give preference to internet users with strong driving force in terms of land use. It is likewise crucial to reform the rural homestead system. Public institutions or independent third-party institutions can be commissioned by relevant government authorities to start the timely evaluation of the effectiveness of rural homestead system reform in the pilot areas. Results of such evaluation will, in turn, be utilized to summarize lessons learned, improve the system, and accelerate the reform process.

Optimize the competition environment of e-commerce platforms. The government should consider market regulation options for large e-commerce platforms to ensure fair competition, and promote the formation of highly efficient market structure of fair competition among multiple e-commerce enterprises. Qualified areas are encouraged to focus on special agriculture products to build specialized e-commerce platforms of these goods. It is suggested that the commerce departments organize experts to compare the experiences of other countries and assess whether agriculture e-commerce market has formed barriers to market entry; or whether large local e-commerce platforms are engaged in unfair competition and other activities that

abuse their market dominance. If any or all of these situations occur, the government shall launch an investigation to maintain the market order of fair competition.

6.2.5 Increase Investment of the Public and Private Sectors in the Internet Plus Rural Economy

Government financial investments in the Internet Plus rural economy should focus on the following areas: villages with no coverage of rural broadband facilities, rural roads in medium and less developed areas, internet equipment and application software of agriculture-related government agencies and public service departments, public big data platforms involving the rural economy, public platform for safety traceability system for agriculture product quality, cold chain logistics facilities of the places of origin, and rural credit system platform. Multilateral development banks can support the public investment areas by giving loans to state-owned investment institutions of the central or local government. In addition, it is recommended that the multilateral development banks coordinate with the PRC's provincial rural credit cooperatives, Jingdong, Alibaba Group, and other institutions in issuing directional funds in the form of subloans to operators applying the internet. The private sector is also encouraged to invest in the Internet Plus rural economy, especially in areas that are already profitable. These areas primarily include, among others, e-commerce; logistics and distribution of rural products; Internet Plus facility agriculture; Internet Plus livestock and poultry breeding; agriculture IOT equipment; Internet Plus agriculture social services (including agriculture information, commercialized application of the traceability system for quality safety of agriculture products, agriculture machinery dispatching, UAV pesticide spraying, etc.); leisure-oriented agriculture; and rural tourism.

Implications of the Internet Plus Rural Economy for Other Developing Countries

Through its sovereign and nonsovereign operations, the Asian Development Bank (ADB) is supporting the Government of the People's Republic of China in the implementation of its Internet Plus agriculture program. ADB has extended a policy advisory technical assistance project to review practices and policies of Internet Plus agriculture business models, and identify constraints and opportunities for the participation of farmers and farmer organizations in the Internet Plus rural economy.¹⁴ Moreover, through a project loan, ADB has proposed to provide assistance to the Provincial Government of Gansu to develop agriculture logistics capacity and ICT-enhanced extension services in the province, which are vital to catalyze rural transformation through e-commerce.¹⁵ Experiences and lessons learned from implementing Internet Plus agriculture policies and pilot projects in the PRC have valuable implications for other developing countries.

7.1 Regional Trade of Agriculture Products through E-commerce Platforms between the People's Republic of China and Other Developing Countries

Rapid growth of e-commerce is contributing significantly to the expansion of regional trade in Asia and the Pacific. The region is where the most dynamic growth in cross-border e-commerce takes place, with the PRC as one of the two largest global players. The volume of cross-border business-to-consumer (B2C) e-commerce transactions in the region is expected to escalate from \$71 billion in 2014 to \$476 billion in 2020.¹⁶ An obvious driver of this massive growth originates from the expansion of e-commerce giant companies. For instance, Alibaba has been expanding the reach of its e-commerce platforms into South Asia and Southeast Asia by rigorous acquisition of e-commerce companies and their associated logistics and payment tool companies, such as Tokopedia in Indonesia; Lazada in Southeast Asia; Daraz in Pakistan, Myanmar, and South Asian countries; bKash in Bangladesh; and Quantum Solutions International, a SingPost subsidiary.

¹⁴ ADB. 2016. *Technical Assistance to the People's Republic of China: Rural Economic Transformation and Upgrading by the Integration with Internet Plus*. Manila. <https://www.adb.org/projects/documents/prc-rural-economic-transform-upgrade-internet-plus-tar>.

¹⁵ ADB. 2017. *Country Operations Business Plan: People's Republic of China, 2017–2019*. Manila. <https://www.adb.org/sites/default/files/institutional-document/295836/cobp-prc-2017-2019.pdf>.

¹⁶ International Trade Centre. 2018. *What Sells in E-commerce: New Evidence from Asian LDCs*. Geneva.



Agriculture product transaction center. Agriculture trading markets operate as centers for the sales and distribution of agriculture products, both locally and internationally, via affiliated e-commerce platforms (photo by Libin Wang).

Based on the memorandum of understanding with the Government of Thailand, Alibaba is also participating in a new digital free-trade zone development, under which the Thailand government launched a flagship rice store at Alibaba's online platform T-Mall, and signed a \$428 million deal to sell Thai durian.¹⁷

7.2 Agriculture Logistics Support

The expansion of digital platforms needs to be supported by the development of efficient transport and logistics to realize e-commerce business transactions. Particularly for perishable agriculture products, such as fruits and vegetables, the postharvest interventions for temperature-controlled logistics and delivery and for the use of protective and small packages are key to reduce postharvest losses and maintain quality along the value chains from harvest to the point of consumption. Several studies on postharvest practices in horticulture value chains in South Asia found 2%–19% loss in food quantity and values during each of the harvest, wholesale, and retail stages.¹⁸ Hence, cold chain facilities including shading and cooling facilities at harvest, primary processing facilities, reefer transfer vehicle, and other logistics infrastructure as well as their efficient connections to minimize transaction distance, time, and cost are required to support the successful high-value agribusiness transactions generated by e-commerce.

¹⁷ Xinhua. 2018. Feature: Alibaba Helps Thailand Sell Agriculture Products Online to China. 20 April. http://www.xinhuanet.com/english/2018-04/20/c_137123399.htm.

¹⁸ L. Kitinoja and M. Cantwell. 2010. *Identification and Appropriate Postharvest Technologies for Improving Market Access and Income for Small Horticultural Farmers in Sub-Saharan Africa and South Asia*. World Food Logistics Organization. Grant Final Report (Grant Number 52198). Alexandria, VA.

7.3 Extension Services

The deployment of digital technologies and IOT has facilitated the access of the wider farming communities to relevant and real-time knowledge transfer and services required for commercial agriculture, including (i) financing; (ii) machinery and services; (iii) quality inputs, farming technologies, and advisory services; and (iv) risk management measures to mitigate exogenous risks of macroeconomic, market, disaster, and climate change. This improved access to such information and service helps farmers in effectively responding to growing market demand and increasing farming income. As most digital technology services are provided via mobile phone apps, they present good potential for cost-effective upscaling to serve millions of farmers with highly diversified profiles.

Digital agriculture services to produce more quality food with less. With the use of artificial intelligence, crop modeling, satellite, and other remote sensing technologies, various private agriculture data platforms have started providing customized and real-time advisories to farmers in critical cropping phases via mobile app, text messages, or videos. Some of their services have already been proven effective in maximizing crop yields, reducing climate and market risks, and lowering production costs and market transaction costs for farmers.

Input distribution outreach. In addition to agriculture output markets, the growing e-commerce network is also changing the outreach of agriculture inputs and advisory services. Many input companies participate in emerging agriculture service platform, which provides combined on-farm advisory, distribution of quality inputs, prefinancing of inputs for farmers, harvesting planning and monitoring, distribution logistics arrangements, and other supply chain management for food companies and other off-takers.

Financial means for technology adoption. Many agribusiness service platforms, such as SatSure and Agribuddy, collaborate with financial institutions and provide credit profiling services for crop loans. The services of digital profiling of farmers, who do not have any formal credit history, combined with the risk analysis of their farming activities, will help extend crop loans from financial institutions to farmers. As financial institutions find credit appraisal of rural population costly and too risky, they do not proactively expand their rural clientele on their own. Yet, banks need to satisfy the quota for agriculture lending portfolio, and many of them welcome partnerships with agribusiness service providers that analyze the creditworthiness of rural clients and the viability and risks of their agriculture activities for fees. Nonbank institutions, such as warehouse receipt financing providers and farming equipment leasing companies, are also expanding their presence both in cyberspace and in rural areas, extending critical means for many farmers to diversify into commercial agriculture and increase farm profits.

Conclusion and Way Forward

The Internet Plus rural economy model is becoming a new agricultural organization framework, a new production and management tool for farmers, and a new hub for comprehensive rural development. It provides a starting point to promote the strategy of revitalizing the countryside, as the model covers all aspects of agriculture production, management, and services. An Internet Plus rural economy is likewise the key to achieving agricultural modernization in the rural areas.

E-commerce platforms are the driving force behind an Internet Plus rural economy. While e-commerce platforms are already well-established by the private sector, the government has an increasingly important role to play in regulating the e-commerce market to promote fair competition through the formation of highly efficient market structures.

Access of farmers to the benefits from e-commerce requires support from both the private and public sectors for agriculture extension services to standardize production, organize farmers, and build logistics capacity in remote and poverty-stricken areas. Investments in e-commerce access demand the adoption of a farm-to-market, value-chain approach to create value for poor farmers, local agro-enterprises, and consumers. ADB has already gained much experience in designing and implementing projects for public sector-financed value-chain investments through dragonhead agro-enterprises in the PRC.¹⁹ Linking future value-chain investment projects with access to e-commerce will accelerate rural transformation and integration into the wider economy.

Application of ICT and IOT offers high potential for improved traceability, food safety, and reduced nonpoint source pollution. Additional public sector institutional reforms and investments in supporting and facilitating these systems are still required to enhance the public good of food safety.

¹⁹ ADB. 2008. *Report and Recommendation of the President to the Board of Directors: Proposed Loan and Administration of Grant to the People's Republic of China for the Dryland Sustainable Agriculture Project*. Manila; ADB. 2016. *Report and Recommendation of the President to the Board of Directors: Proposed Loan to the People's Republic of China for the Fujian Farmland Sustainable Utilization and Demonstration Project*. Manila; ADB. 2017. *Report and Recommendation of the President to the Board of Directors: Proposed Loan and Technical Assistance Grant to the People's Republic of China for the Shanxi Inclusive Agricultural Value Chain Development Project*. Manila.

Internet Plus Agriculture

A New Engine for Rural Economic Growth in the People's Republic of China

This publication reviews the practices and policies of Internet Plus agriculture business models in the People's Republic of China (PRC). It analyzes the agriculture value chain model, rural e-commerce platform, and Internet Plus agriculture service model. The Internet Plus rural economy is an emerging driver of comprehensive development in the PRC as a new production management and marketing tool for farmers and farmers' cooperatives. Its potential is seen as a foundation for vitalizing the countryside and key to achieving agricultural modernization.

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