



**Sci-Tech Empowering Rural  
Transformation Report**

**2022**

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Agricultural Value Chain  
Development**





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## Digital Technology Empowers Agricultural Value Chain Development

### Foreword

The COVID-19 pandemic is a major challenge to food security and agricultural production. According to the latest report by the United Nations,<sup>[1]</sup> as many as 828 million people were affected by hunger in 2021, and the number has grown by about 150 million since the outbreak of COVID-19.

Practices such as “cloud classroom,” drone spraying of pesticides and live-streaming sale of agricultural products in the wake of the pandemic have demonstrated Chinese wisdom in utilizing science and technology to promote rural development. As to how to use science and technology to energize rural development, narrow the “digital divide,” cultivate skilled farmers and safeguard food security, China has made many fruitful explorations, which have provided valuable inspirations for global pandemic control and poverty alleviation.

Jointly initiated by **China Internet Information Center (CIIC), Food and Agriculture Organization of the United Nations (FAO) Representation in China, International Fund for Agricultural Development (IFAD) China Office, World Food Programme (WFP) China Office and the Centre for Sustainable Agricultural Mechanization of the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP-CSAM)**, the **Thematic Study and Knowledge Sharing on Sci-Tech Empowering Rural Transformation** aims to sort out and summarize the development trends of empowering rural areas through science and technology, and select best practices, especially innovative ones that are sustainable and replicable. Through field visits, theme reports, media coverage, forums, seminars, and sharing of best practices, this initiative aims to share China’s solutions in utilizing science and technology to empower rural areas, and promote knowledge and experience sharing between developing countries.

This report is jointly compiled by **CIIC, FAO Representation in China, IFAD China Office, WFP China Centre of Excellence, ESCAP-CSAM, AliResearch and Chinese Academy of Financial Inclusion**. Practical new technologies and the latest practices in empowering agricultural value chain development are highlighted in this report.

## Chapter 1 Relevant Policies

Agriculture is the bedrock of national economy, and rural economy is an integral part of the modern economic system. China's rural vitalization strategy is a continued endeavor to consolidate and expand the achievements made in poverty alleviation, and also an important task for building a modern economic system and realizing the Second Centenary Goal. "Digital countryside" is an essential part and strategic direction of the rural vitalization strategy.

### 1.1 From "internet plus poverty alleviation" to "digital countryside"

At the end of 2014, poverty alleviation through e-commerce was included in the 10 targeted poverty alleviation programs. In 2015, the rural e-commerce demonstration program was launched.

In October 2016, China released the *Action Plan for Internet Plus Poverty Alleviation*,<sup>[2]</sup> and has made notable progress since then:

- The "network coverage program" and "rural e-commerce program" have effectively strengthened communications and logistics infrastructure in remote rural areas;
- The "internet-based capacity-building program" has taught rural users how to use the internet to learn and work.
- The "information service program" has built a service network for rural areas and accumulated a massive amount of data for poverty alleviation; and
- The "internet-based philanthropy program" has diversified the communication channels between urban and rural areas.

In addition, the 10 targeted poverty alleviation programs lay solid groundwork for rural digitization by providing entrepreneurship training and microcredit loans for poverty alleviation, etc.

### 1.2 The Digital Countryside Strategy

The *Opinions on Implementing the Rural Revitalization Strategy* issued in 2018 vows to "implement the digital countryside strategy, ensure sound overall planning and design, accelerate the coverage of broadband networks and 4G networks in rural areas, develop information technologies, products, applications, and services that suit the characteristics of agriculture, rural areas, and rural people... to bridge the digital divide between urban and rural areas."<sup>[3]</sup>

The *Outline of the Digital Countryside Strategy* released in 2019 defines "rural digitization" as "an endogenous modernization and transformation process of agriculture and rural areas accompanied with the application of the internet, information and digital technologies in rural socioeconomic development, agriculture and with the farmers' ever-improved IT skills."<sup>[4]</sup> The digital countryside strategy would be implemented in four steps, and the goal is that "by the middle of the 21st century, a digital countryside will be built, and rural vitalization will be achieved in all respects, with strong agriculture, beautiful environment and prosperous farmers."

The *Guidelines on the Construction of the Standards System for Digital Countryside*<sup>[5]</sup> released in 2022 sets forth seven national standards, including basic and general standards, standards governing digital infrastructure, agricultural and rural data, IT application in agriculture, rural digitization, construction and management, and security and support.

### 1.3 Key tasks of the digital countryside strategy

The digital countryside strategy mainly entails the following three tasks:

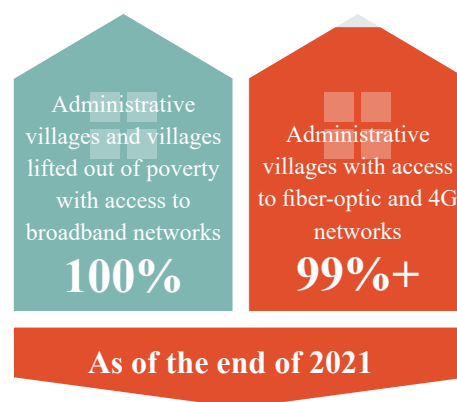
- Strengthening rural digital and logistics infrastructure;

- Digitizing traditional rural industries and expanding the application of digital technology in rural areas; and
- Enhancing rural governance capacity and supporting dynamic judgement and the exercise of supervision.

As of the end of 2021, all administrative villages and villages lifted out of poverty in China had access to broadband networks, over 99% of administrative villages had access to fiber-optic and 4G networks, 57.6% of people living in rural areas had access to the internet, and the gap in internet accessibility between cities and rural areas narrowed by 11.9 percentage points.

As of the end of 2021, courier services had been available to more than 80% of villages in China. In 2021, the number of parcels collected and received in rural areas reached 37 billion, bringing more than RMB1.85 trillion worth of agriproducts to cities and industrial products to rural areas. Rural online sales amounted to RMB2.05 trillion, and online sales of agriproducts reached RMB422.1 billion.

This report consists of three parts: the application of digital technology in agricultural production, in value chain development for smallholders and rural e-commerce, and in rural digital financial services in recent years. Through case studies, it hopes to share China's good practices with other developing countries in the stage of rural and agricultural transformation.



## Chapter 2 Science and technology innovations for agricultural production

### 2.1 Introduction

Smart farming solutions are optimizing production, increasing productivity by reduced costs, providing better market opportunities and increasing value chain traceability. E-Agriculture platforms and applications are connecting researchers with extension agents and other ecosystem players to improve access to knowledge and implement sustainable farming or livestock management practices.

In this section, you can find sci-tech innovations and case studies in two areas, which display the opportunities of ICT interventions in the agricultural value chain with a special focus on agricultural production. The first is the development and application of digital agricultural mechanization, which illustrates the application practices and development trends of smart agricultural equipment, covering the entire process of rice cultivation from plowing and planting to management and harvesting. The second is the status quo of precision agriculture technologies, which introduces the applications in flower, tea, aquaculture and other fields. Finally, based on the relevant work conducted by UN agencies in China and the Asia-Pacific region, we take a look at how to promote South-South cooperation to further tap into the potential of agricultural sci-tech innovations and support the sustainable transformation of the agrifood system of other developing countries.

### 2.2 Cases on agricultural production

As summarized in FAO's *Scaling up inclusive innovation in agrifood chains in Asia and the Pacific*<sup>[6]</sup>, agricultural drones and precision agriculture (PA) are two digital-based solutions reshaping farming in the region. These technologies help farmers produce more with less water, land, energy and labor, while protecting biodiversity and reducing carbon emissions.

#### 2.2.1 Digital agricultural mechanization

##### 2.2.1.1 Development and application of digital agricultural mechanization

The cutting-edge digital technologies used in agricultural mechanization mainly include intelligent perception, satellite navigation and positioning, navigation-assisted autonomous driving, path planning and complex trajectory reuse. The development and application of such technologies are summarized as below.

##### (1) Intelligent perception

Intelligent perception includes off-board perception and on-board perception. Off-board perception refers to the perception of information parameters of the operating environment and objects of agricultural machinery, including perception of crop growth, plant diseases, pests and weeds, the operating environment and obstacles. On-board perception refers to the perception of the operating parameters and status parameters of agricultural machinery itself. Common on-board parameters of agricultural machinery mainly include engine information, power output, torque information, slip ratio, attitude information and safety hazard information. At present, information on engines and power output can be viewed through the CAN BUS according to the ISO 11783 protocol, and attitude information can be obtained through the Beidou module and gyroscope, which has been widely applied in high-end tractors and harvesters in China. In contrast, perception technologies for torque information and the slip ratio are not yet mature.

##### (2) Satellite navigation and positioning

Satellite navigation and positioning is one of the most widely used technologies in agricultural mechanization. The satellite positioning information and the existing mapping system can be combined through algorithms

to achieve real-time navigation. At present, the accuracy error of the satellite navigation system for autonomous driving used in agricultural machinery can be kept within 2.5 cm. In view of the high-precision differential navigation and positioning technologies adopted in China, RTK signals are mainly provided through the base stations of the three major ISPs, which can cover most parts of the country. By the end of 2021, China had a total of over 60,000 agricultural machines equipped with high-precision satellite navigation systems for autonomous driving, covering a wide range of machinery categories such as tractors, harvesters, rice transplanters and plant protection equipment.<sup>[7]</sup>

### (3) Navigation-assisted autonomous driving

Navigation-assisted autonomous driving technology can greatly improve the operational quality and efficiency of agricultural machinery. To achieve the quality and efficiency, agricultural machinery should be made available to automatically adjust its attitude based on the satellite navigation path. Take wheeled agricultural machinery as an example. At the present time, the way to achieve the automation is to use attitude and angle sensors to perceive the attitude of the machinery and the steering wheel angle, and subsequently calculate the satellite navigation information and the current operating state parameters, and control the moving routes of the machinery through hydraulic or electric power steering wheels to achieve autonomous driving. This technology has been widely used in a variety of agricultural devices in China, such as rotary tillers, seeders, transplanters, spray equipment and harvesters. Here the automatic navigation system of machinery for paddy field operations is among the leading ones in the world. In particular, during operations on large tracts of farmland, the automatic navigation system can significantly improve the land utilization rate and reduce the production costs thanks to its high precision, high stability and prompt

error correction. Research finds that agricultural machinery with automatic navigation systems can increase crop yield by 2% to 3%, reduce fertilizer and pesticide consumption by 5% to 10%, and lower the production costs by 5% to 10%.<sup>[8]</sup>

### (4) Path planning and complex trajectory reuse

Automatic path planning and complex trajectory reuse technology is a prerequisite for agricultural machinery to achieve autonomous driving. At present, the moving paths of agricultural machinery generally take the shape of “S”, “几”, “回” or their combinations. The trajectories of smart agricultural machinery performing operations along the predetermined paths can be uploaded to the remote management platform for future reuse. Currently, full coverage path planning algorithms for regularly shaped parcels of land are relatively mature, and future research should focus on full coverage multi-constrained, multi-obstacle path planning algorithms for ir-



“Honghu” smart agricultural machinery released by the Chinese Academy of Sciences in Dahewan of Heilongjiang province, September 2022. The equipment comes with a smart electric control system and automatic driving system and can perform whole-process smart operations through the smart control system for field operations. The power of its main drive motor is up to 300KW.

regularly shaped parcels of land.

Based on the above-mentioned digital technologies and the big data analysis and agricultural expert decision

making systems, features such as autonomous operations, precision operations and smart remote management can be achieved for agricultural machinery.

### Case 1: Application and development trends of smart agricultural machinery in rice cultivation

Rice production is crucial to the development of sustainable agriculture, rural development and poverty alleviation. In China, rice is one of the major food crops, with largest cultivation areas, biggest total output and highest yield. Rice is the staple food for over 65% of the Chinese population. China's rice output accounts for nearly 40% of the world's total, ranking first worldwide. Therefore, rice cultivation holds a strategic position in China. As agricultural mechanization started from the production of grain crops, especially rice, the applications of smart agricultural machinery in rice cultivation gives a picture of the development of digital agricultural machinery technology in China.

Since the 1990s, satellite navigation technology has been applied to agricultural machinery in some foreign countries. Smart agricultural machinery in China emerged around 2010. With technological revolution and industrial transformation, a large number of well-known agricultural equipment manufacturers have been breaking into frontier fields such as advanced agricultural equipment manufacturing, agricultural Internet of Things, agricultural big data and agricultural robots. Digital agricultural machinery now has more diverse varieties, improved functions and more stable performance. For example, cutting-edge products for rice cultivation such as rice transplanters, plant protection equipment and harvesters have been rolled out, covering the entire process of rice cultivation from plowing and planting to management and harvesting. These machines are now being applied on an ever-expanding scale.

**Plowing:** In recent years, Chinese enterprises have made significant breakthroughs in the innovation and development of smart tractors, and successively developed unmanned smart tractors with such features as autonomous path planning and autonomous operations. Their key operating parameters can be monitored throughout the process and recorded in the backend, and there is an alarm system to guarantee efficient, stable and safe operations. In the future, smart tractors are expected to develop in two directions. First, hydromechanical continuously variable transmission (HMCVT) technology will be further applied to satisfy the needs of operations on large fields and with heavy loads. Second, they will be increasingly powered by new energy to meet tightened carbon emission requirements.

**Sowing/Transplanting:** Due to climate conditions, planting systems and other factors, regions that adopt rice-wheat rotation or double rice cropping systems all face problems in cropping modes. The optimal planting time of rice is short, so is the suitable leaf age for machine transplanting. Since transplanting is labor-intensive, smart rice transplanters, especially unmanned transplanters, offer an effective solution to a large extent. With the help of automatic path planning and autonomous navigation, work can be fulfilled by a single person in loading seedlings with high operational quality which enables the consistency of planting depth and row spacing so that proper planting density can be achieved, better chance of seedling survival can be attained, and ultimately high yields can be realized. In 2019, China successfully developed the first full-fledged unmanned smart rice transplanter, which has already



been put into production. Currently, smart rice transplanters are moving from six rows to eight rows, and satellite navigation assisted driving systems are being increasingly applied to ordinary rice transplanters.

**Plant protection:** Traditional mechanical plant protection methods have various drawbacks such as skin exposures, uneven spray and overspray, which not only harm human health but also lead to air, water and soil pollution. These problems can be solved by adoption of smart plant protection equipment. Electric multi-rotor plant protection UAVs boost operational speeds, cause no harm to seedlings and avoid contact with human skin. At present, the maximum load capacity of homegrown plant protection UAVs is 40L, and the plant protection UAVs developed by some Chinese enterprises have been widely used for pesticide and liquid fertilizer spraying operations for different crops. Precision pesticide application technology has been used in more than 60,000 villages in China. Compared to plant protection UAVs, smart self-propelled plant protection machines that have emerged in recent years have better atomization effects, less spray drift and more accurate boundary control. In the future, smart plant protection equipment will feature greater load capacity and more accurate control of droplets.

**Harvesting:** Rice harvesting involves unfavorable conditions, complex operating scenarios and heavy labor. Equipped with various sensors, collectors and other devices, smart rice harvesters have higher operational efficiency and a higher degree of match with crop production, and can synchronously collect such parameters as yield and moisture content, which can provide valuable data for subsequent cultivation, grain drying and processing. In the next two to three years, loss reduction and other technologies will be further improved.

### 2.2.2 Precision agriculture

This farm management strategy collects and uses data about soil, weather, crop yields and health, among others, to feed into a decision support system for optimizing farm returns on inputs while preserving resources. To capture and handle data, PA uses specific hardware, software and services in an integrated manner. The hardware it uses includes yield monitors, irrigation controllers, drones, satellite-remote sensing and tractor auto-guidance systems.

Depending on the technological intensity of the operation, PA can be classified as “soft” or “hard.” On the one hand, hard PA is more suitable for large farms, as it involves applying complex technologies and big data analytic skills. Hard PA is still in the early stages of adoption in the region, except in Japan, nationally owned farms in China, and in some plantations and large farms

producing high-value crops.

Soft PA, on the other hand, relies on visual observation of crops and soils, and on low-cost tools such as digital soil testing kits and chlorophyll meters. Its services are typically offered through apps or text messages, such as for weather forecasting. It is gradually becoming available for smallholders through innovative digital-enabled business models.

In China, urban areas are not the only ones benefiting from data and innovative technologies; rural areas are catching up to reboot their economy and modernize their inhabitant’s livelihoods, embracing a more sustainable future. The three cases below demonstrate how China is delivering digital services and developing innovative solutions in agricultural production.



## Case 2: Digital jasmine traceability and e-commerce: The case of Shijing Village, Nanning City, Guangxi Zhuang Autonomous Region

Shijing is a traditional village famous and prosperous for jasmine flowers. By promoting the digitalization of the jasmine industry, beautiful jasmines bring a better life to the residents in Shijing Village, Hengzhou City. Known as “the capital of jasmine flowers”, Hengzhou is the world's largest jasmine flower production and jasmine tea processing center whose output accounts for more than 80% of China’s total and over 60% of the world’s total. Shijing Village is the heart of the jasmine planting area in Hengzhou, with an area of about 300 hectares and more than 5,400 farmers, producing 5,000 tons of jasmine flowers in 2020.

Shijing Village has used the “digital Jasmine” platform to trace the quality of jasmine products and strictly control the quality and safety. In 2018 and 2019, the availability rate of key technologies for the quality and safety of jasmine production, the coverage rate of unified control of diseases and insect pests, and the qualified rate of sampling inspection of jasmine tea all reached 100%. Strict supervision has guaranteed the quality improvement of the jasmine industry.

Through technological innovation, jasmine wine, jasmine cakes and other products have been produced, extending the jasmine industry chain. As a result, the “1+9” industry belt has taken shape, i.e., jasmine plus scented Tea, potted plants, food processing, tourism, daily necessities, catering, medicinal, sports and health care. Employing the tourism resources of the village, Shijing Village, hailed as “China Jasmine Garden”, has bolstered the “cultural tourism economy” and guided villagers to participate in tourism services, sales of agricultural products and other businesses to obtain operational benefits.



Taking advantage of Hengzhou City as a national comprehensive demonstration county for e-commerce in rural areas, local e-commerce enterprises and village-level service stations enormously expand jasmine tea products sales.



### Case 3: Digital technology empowers Tieguanyin tea industry development: The case of Xiping Town, Anxi County, Fujian Province

Xiping Town, located in Anxi County, Quanzhou City, Fujian Province, covers an area of 145.5 square kilometers and governs 27 administrative villages (communities) with a total population of about 65,000. Anxi County is the birthplace of Tieguanyin, the world-famous Oolong tea. The village has given birth to significant cultural and agricultural heritage. It is the core site for preserving the tradition of cultivating Tieguanyin tea, and has also been designated by FAO as a site of Globally Important Agricultural Heritage Systems (GIAHS).

As of 2021, 60,000 mu of ecological tea plantations had been built in Xiping Town, with an annual tea output of 50,000 tons, and over 90% of the working population engaged in tea-related industries.

Since 2017, Anxi County has made active explorations in digital management of tea plantations. Xiping Town has used IoT devices to monitor the environment and pest situation in its smart tea plantations. A smart pest control system has been developed to effectively monitor and control the threat of pests to the tea leaves. In addition, a miniature, automated meteorological station has been established, which enables the farmers to stay on top of the weather conditions of the mountainous plantations.



The ERP production data system has been applied for dynamic surveillance and smart production, facilitating clean, continuous, smart and standard processing. Generally speaking, to improve the quality of tea, it takes a combination of three factors: right time, right place and right person. In the past, it all depended on the personal management experience of farmers. Now, farmers of smart tea plantations can digitally manage and analyze the ecology in tea plantations and the tea processing process to improve the quality of tea.

Through the quality and safety traceability system for agricultural products promoted by the Fujian Provincial Department of Agriculture and Rural Affairs and the “digital tea industry cloud platform” launched by Anxi County, Xiping Town has integrated data on the “digital landmark supervision platform”, “county-wide agricultural materials supervision and logistics tracking platform” and “QR code platform for the tea capital trading market”. Thus, it has established a tea safety and quality management mode featured by traceability of production processes and quality management and accurate product recalls.



**Case 4: Digitalization becomes the new “net” for fisheries:  
The case of Digang Village, Huzhou City, Zhejiang Province**

Traditional fisheries are profoundly affecting the world’s environmental sustainability because of overfishing and shrinking aquatic habitats. Against this backdrop, digital fishery offers a new solution to the trade-off between the growing supply of aquatic products and the degrading ecosystem. The practice at Digang Village in China’s southeastern Zhejiang Province is at the forefront of the digital fishery field, as well as other digital explorations in rural China.

Digang is known as the “Ancient Fish and Mulberry Town of China” and is also the heritage site of “Huzhou Mulberry-dyke & Fish-Pond System”, one of the Globally Important Agricultural Heritage Systems (GIAHS).

**First, digitalization promotes the transformation of fishery production.** Fish ponds are monitored and controlled in a digital and intelligent way, being equipped with automatic feeding machines, remote automated control systems, water quality monitoring devices, etc.

**Second, socialized services protect fishermen from related risks.** The grid-based smart farming service standards have been established, and a digital monitoring and service system that combines farm attendants and online AI-enabled management has been improved. This enables farmers to monitor the water quality (dissolved oxygen, ammonia nitrogen, nitrite, PH value, etc.) in an accurate, efficient and standard manner. These services greatly reduce the risk in breeding, mitigate labor intensity and improve the production efficiency.

**Third, the e-commerce platform helps secure the supply of aquatic products.** The platform connects farmers and retailers, e.g., online retailers, traditional supermarkets and restaurants. It has a variety of features, such as supply and demand matching, online order management, transaction management, supply chain information management, payment management and quality traceability, and provides a highly reliable aquatic product sales channel for farmers.

**Fourth, digital fishery facilitates big data decision making.** The mobile application “Qing Yu Tang” is a region-wide aquaculture information and big data analysis platform that provides farmers with technical guidance and professional big data consulting services in fisheries. The platform can also assist local governments with fisheries management by providing such information as the distribution of fishery resources and development trends



Digitalization can promote the high-quality development of fisheries. To upgrade the fishery industry and keep pace with China’s social and economic development, Digang Village has introduced several high-tech fishery enterprises. The new mode of fisheries fostered by digital services has driven the farming transformation of more than 2,000 households. By integrating agricultural resources, the digital supply chain allows city dwellers to buy aquatic products online conveniently. This gives a boost to the sale of local aquatic products, facilitates brand building and propels the development of modern fisheries in surrounding areas.

in fisheries. In short, it can significantly improve farmers' managerial and technical capacities while increasing the government's management efficiency. In the future, the adoption of digital technology will bring about greater changes to the way of production and lifestyle of farmers.

### 2.3 Digital technology empowers agricultural production: China's experience inspirations

With data and knowledge as the core elements, digital agriculture, especially smart agricultural machinery, can effectively facilitate operations such as planting and harvesting in the optimal period, achieve precision placement of seeds, fertilizers and pesticides, reduce grain loss and harm to human health, control non-point source pollution, save energy conservation and reduce carbon emissions, and solve the problems in unmanned operations. Therefore, it can greatly improve labor productivity, yields and resource utilization, and promote sustainable development of agriculture.

As a latecomer in digital agriculture, China still faces various challenges such as a weak basis for IT application in rural areas, limited R&D capacity for high-end smart equipment and deficiencies in agricultural resources for digital agriculture. In response, China has in recent years rolled out the *Digital Countryside Development Strategy 2019* and the *Development Plan for Digital Agriculture and Countryside (2019—2025)*, among others. It can be expected that the potential of cutting-edge technologies such as smart agricultural machinery, blockchain, IoT, big data and AI will be further unleashed in China. China's practices in the adoption of digital technology in agriculture, especially its achievements in promoting agricultural development with smart agricultural technology and machinery, can provide valuable experience and inspirations for other developing countries.

First, increase financial support and taxation incentives. A new system should be put in place to

increase subsidies and other types of financial support for sci-tech innovation by smart agriculture and agricultural machinery enterprises, especially R&D of high-end products with independent intellectual property rights and original technology. Meanwhile, enterprises should be encouraged to scale up inputs in R&D.

Second, formulate complete talent support policies. A new innovator system conducive to the development of smart agriculture and smart agricultural machinery should be established. More support should be granted to higher education institutions and research institutes to cultivate more specialists. The policy environment should be improved to encourage the flows of high-calibre talents in electronics, information, software and other fields to smart agriculture and smart agricultural machinery enterprises. In addition, education and training for farmers should be strengthened, and the adoption of smart agricultural technology and smart agricultural machinery should be further promoted among people engaged in agricultural production or operations.

Third, improve intellectual property protection and incentive mechanisms. Efforts should be made to keep the agricultural machinery industry and digital agricultural technology market in order, strengthen the management and protection of trademarks, patents and intellectual property rights, and guide the industry to develop innovative smart products and technologies with market demand in mind.

Fourth, strengthen the construction of digital and information infrastructure. It is necessary to improve Internet services in rural areas, promote the digital and smart transformation of water conservancy, roads,



electricity and other infrastructures, and foster digital technology talents to lay solid groundwork for the development of digital agriculture.

Fifth, advance the construction of smart agriculture and smart agricultural machinery demonstration zones. The construction of pilot and demonstration zones for agricultural machinery and smart agricultural

technology should be strengthened to pave the way for testing, demonstration and promotion. On this basis, it is necessary to build platforms for collaboration between industries, universities and research institutes, and innovate in the management system and promotion system to further promote scientific and technological progress and the application of technology.

## Chapter 3 Digital technology empowers agricultural value chain development

### 3.1 Overview

Digital technology is now penetrating into every part of the social and economic spheres, bringing about significant changes in economic development and becoming a major driving force of rural vitalization. New-generation information technologies such as “Internet Plus”, cloud computing and big data are playing a growing role in extending, improving and connecting the industry chain, promoting the wide adoption of digital technology in agricultural production and operations and optimizing the smallholder value chain, thus enabling more smallholders to share the benefits of digital technology.

Practices show that thanks to government investment, transportation, logistics and other infrastructures in rural areas have been improved rapidly. While commending digital technology empowering agricultural value chain development, e-commerce has become an important instrument to arouse demand in rural areas, continuously

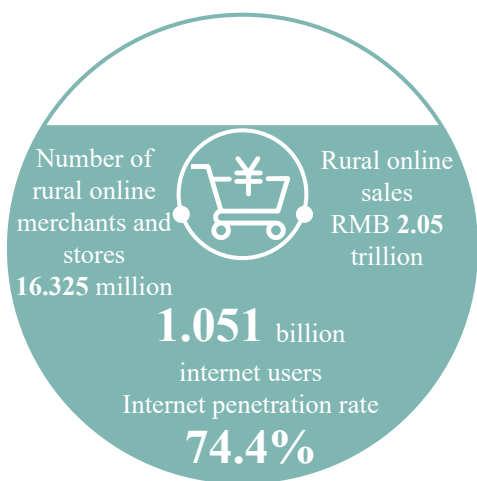
helping increase farmers’ income and advancing rural vitalization in all dimensions. Digitalization has played an important role and achieved remarkable impacts in promoting rural vitalization in western China and rural transformation in eastern China, and provided valuable aspirations for other developing countries.

This section first looks at some paragons of “internet plus poverty alleviation” and the wellbeing improvement in countryside of western China., followed by in-depth case analysis and rural development trend in eastern China from the perspectives of supply chain, branding, production and marketing that benefit from digitalization. Based on the analysis, experience and best practices are extracted in the hope of providing useful reference for other developing countries in a South-South perspective.

### 3.2 Western China Empowered by Digital Technology

Digital technology is empowering agricultural value chain development in China, and the public service system to support rural e-commerce continues to grow. The government is working together with various market entities to expand scenarios of digital technology while motivating the development of agro-industry and value chain, thus guiding smallholders to catch up the chance in modern agro-industry growing via e-commerce. This helps solve various practical problems in the process of rural vitalization, such as labor shortage, incomplete value chain, fund shortfalls, insufficient service, and limited marketing channels.

Compared to the coastal eastern regions, western China has less prominent advantages in natural environment and geological locations. Many counties, towns (townships) and villages are beset by lag-behind transportation and logistics infrastructure, facing



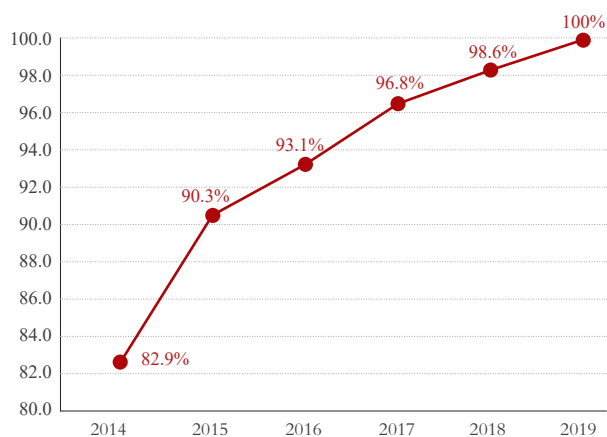
As of June 2022, China had 1.051 billion internet users, and the internet penetration rate reached 74.4%. According to statistics from China’s Ministry of Commerce, as of December 2021, there were a total of 16.325 million online merchants and stores in rural areas, and rural online sales reached RMB2.05 trillion, an increase of 11.3% over 2020.

challenges in diversified agricultural operations, value chain development and access to market. Over the past dozen years, the western regions have made great headway in informatization, and digital technology has created ample opportunities for agricultural development. By empowering the agricultural value chain for smallholders, digital technology is expected as a new channel connecting smallholders and market, serving as an effective tool in poverty alleviation and value chain development, promoting development of rural economy while ensuring a sustained growing of farmers' income.

Smallholders in western China benefit from digital technology empowerment in value chain development. This is mainly attributed to:

- Government's investment in infrastructure;
- Joint force of the "top-down pattern" led by government and the "bottom-up" rural entrepreneurship growing;
- Public-private partnership on farmer training and entrepreneurship fostering;

Beside of the aforementioned attributors, human resource is the fundamental force of capital investment for rural value chain development. To achieve a best result from digital technology empowerment, farmer training and capacity building is the origin of agricultural value chain



Rate of villages with paved roads in economically challenged areas

dynamics for smallholders in western China. In particular, digitalized application injects strong momentum for rural vitalization and poverty alleviation in the west.

### 3.2.1 Farmer Training and Capacity building

Driven by the "Internet Plus" initiative, e-commerce development for agro-produce has been booming. From the emergence of "Taobao villages" and the earliest entrepreneurs to today's trillion-level rural online retail sales, empowering agriculture production, rural transformation and farmers through the Internet and related ICT has become a major path to advance modernization and transformation of agriculture development in rural areas. E-commerce has greatly reduced farmers' cost to gain market access, connecting farmers with market more closely and easily. E-commerce has helped extend the agricultural value chain. E-commerce for agro-produce helps solve problems multiple by widen marketing channels and strengthen linkages of farmers in agricultural value chain. More to it, rural e-commerce brings about significant improvement of farmers' skills and capacities

Digital technology empowers rural value chain started from farmer training, which requires efforts to build special brands with local characteristics for agro-produce to serve the development of agricultural value chain upscaling and rural transformation. Training on rural e-commerce in western China focuses on policy briefings, online marketing, short video development, brand building and other related learning courses, aiming to help smallholders learn about the development trends of rural e-commerce, acquire knowledge about new media, and improve their ability to use e-commerce platforms. The purpose is to foster and support rural e-commerce entrepreneurship and enable farmer business persons for a better wellbeing. The rapid development of rural e-commerce well in track will create more jobs for villagers and help people out of poverty, while enabling farmers better access to market to



increase income. The farmers receiving trainings mainly include rural entrepreneurs on agro-business, leading persons of farmer cooperatives, family farm operators, and those who return to hometown for rural entrepreneurship and help rural development.

The objectives of farmer training on e-commerce mainly prioritize:

- Training for rural e-commerce practitioners to help create the e-commerce pioneers in countryside;
- Guiding farmers to start e-business; and
- Coordinating rural-commerce and the development of value chain, aiming to achieve an integrated development of primary, secondary and tertiary industries.

### Case 5: Digital technology empowers smallholder value chain in western China

E-commerce helps local specialities from mountainous areas go wider: Longnan City, Gansu Province

From 2019 to 2020, Longnan City of Gansu Province provided rural training on e-commerce for 29,000 participants, benefiting 45,000 smallholder farmers and rural residents. E-commerce training enhanced to highlight regional experience and correspondently improved quality, efficiency and structure of agricultural production, propelled establishment and development of e-commerce service system in countryside. Eventually it contributes to the continuous growing of rural development as well as the value chain.

Longnan City proactively encouraged and organized trainings on e-commerce knowledge and e-business management skills. The City government established a talent tool of e-commerce lecturers, and deployed experts on e-commerce from public and private sectors to conduct various training activities. For example, the City set up E-commerce Expert Station by inviting well-known experts in the country as advisors or tutors for farmer training. Also established was a human resources online platform for e-commerce training. Experts from the local bureau of commerce, and local bureau of agriculture and rural affairs are invited, along with other government agencies to deliver policy-related trainings on e-commerce.

**Diversified training themes.** The City government organized trainings on various themes and topics in different formats, such as tiered trainings, theory and policy lectures by professionals, systematic training programs, and online training for e-business management, and brand building for agro-produce and local specialities.

**Ad hoc training.** The examples include live streaming e-commerce, key talent training, live streaming e-commerce training for first secretaries and officials fielded in villages, and cross-border e-commerce key talent training.

**Special talents fostering.** In 2015, Longnan E-Commerce Vocational College was established in an effort



to foster entrepreneurship on e-commerce, which is much encouraged to support sideline with local poverty alleviation.

**Talent pool and business incubation.** The City has carried out the E-commerce Talent Pool Program and Young E-commerce Talent Incubator Program to nurture talents with managerial capacity and operational skills, attracting rural youth to shape a highly competent group of pragmatic talents.

### 3.2.3 Digital Technology Empowers Rural Poverty alleviation

In the economically less developed rural areas of central and western China, digital technology plays an important role in targeted poverty alleviation through smallholder value chain development. Poverty alleviation empowered by digital technology means to provide service to support e-commerce development and improve information service to enable local people for innovation, and even to run a business upon internet technology.

As a new poverty alleviation pattern, poverty alleviation via rural e-commerce facilitates various market players to make full use of the “Internet plus technology”. Based on e-commerce, such a pattern can provide a range of service of information, technology and capital, to help people in less developed areas gain market access for local agro-produce, promote leisure agriculture and rural tourism, or purchase agro-inputs and daily necessities from internet. The goal is to increase local people’s income, minimize the gap between urban and rural, along the efforts on poverty alleviation. Meanwhile, by transcending the geographic distance between regions, e-commerce lowers the transaction costs for agro-produce for market value even in less developed areas. Digital empowerment for agricultural value chain development is more fair, inclusive and at much lower cost for information service, among others, demonstrating enormous potential for poverty alleviation.

The main functions of poverty alleviation upon digital rural value chain are,

- **Provide new chances for innovation and entrepreneurship.** E-commerce breaks off geographical constraints, changes the traditional value chain patterns and further expands the marketing chain for agriproducts. E-commerce

platforms integrate information into the supply and demand of agro-products. People in less developed areas can engage in innovative practice and business management through the Internet and e-commerce, which provide new pathways and opportunities.

- **Change the mindset to learn “how to fish.”** Digital technology offers an effective pattern to help low-income people build aspirations and enhance their ability to develop on their own. For example, people might start their own business after participating in the vocational training on e-commerce. Digital technology empowers not only production but also business operation, which can be used to support and track low-income groups. This is a prominent added-value effect of poverty alleviation by means of e-commerce development.
- **Optimize allocation of resources.** The adoption of the Internet technology increases people’s access to information, enable farmers in remote areas to get market information in a more timely and comprehensive manner, so as to optimize arrangements of value chain, while be able to use available resources by forestalling relevant risks. As a result, strengths of west China in terms of ecological resources can be effectively translated into income via agricultural value chain enhancement.
- **Digital rural governance helps identify people in need.** By analysing the reasons of causing local development problems, and seeking favourable enabling conditions improve value chain for smallholders, so as to reinforce the achievements on poverty alleviation, which in turn contributes to rural vitalization.

## Case 6: Digital technology for rural value chain contributes to poverty alleviation

### Rural E-commerce Comprehensive Demonstration Project

The “Rural E-commerce Comprehensive Demonstration Project” was piloted in 2014 and officially launched in 2015. Since then, the project has been targeted at registered low-income households, villages and counties, and focused on developing e-commerce infrastructure with government funding support, establishing county-level service and logistics systems, fostering specialists and facilitating online market of agriproducts. As of 2019, the project has covered all 832 low-income counties across China. In recent years, rural e-commerce has been flourishing. Many localities have developed rural e-commerce system from the ground up, and rural online business began to grow rapidly. So far, rural e-commerce has been unprecedentedly growing in terms of market size, supply and demand pattern, as well as economic impact.

## Case 7: Digital empowerment contributes to poverty alleviation

### E-commerce gives impetus to high-quality development: Wugong County, Shaanxi Province

Recent years witnessed the vigorous booming of rural e-commerce initiative in Wugong County of Shaanxi Province, on purpose of supporting the targeted poverty alleviation and rural vitalization. The initiative helped ensure a stable income for low-income people, reinforce the achievements on poverty alleviation, while fostering new e-commerce pattern which leads to poverty alleviation motivated by more consumption needs. Despite the COVID-19 pandemic, e-commerce sales surged to RMB5.059 billion in 2021, playing a vital role in increasing farmers’ income and stimulating rural consumption.

Wugong County invested RMB10 million to build a live streaming base in northwest China, serving as a centre for training and business incubation by displaying and marketing of agro-produce and local specialties through live streaming e-commerce. The base has attracted a cohort of e-commerce platforms and is now home to over 580 merchants. It has incubated a number of influencers and farmer live streamers who now use mobile phones as a new “farm tool”, opening up new channels for online sale of agriproducts and local specialties.

A total of 91 online and offline training sessions on e-commerce have been organized in the county, with



An influencer at a live streaming base in northwestern China



Staff packaging agriproducts in preparation for shipment in Wugong County

186,600 participants. The county joined hands with Shaanxi Provincial Committee of the Communist Youth League of China to launch the “Qing Tao Yun Ke” e-commerce talent training program. So far, over 20 school-enterprise cooperation agreements have been signed, a college-based operations team of about 6,000 people has been built, and 20,000 college students have engaged in e-commerce practices.

Aimed at supporting poverty alleviation through consumption, e-commerce has connected the market and producers, promoting agricultural production to shift from “sell what is grown” to “grow what market needs.” Management of cropping, quality control, packaging and transportation has been further strengthened. A total of 298 products in nine categories from 92 enterprises have been most state-recommendable for poverty alleviation. By marketing products grown by low-income households to support poverty alleviation, e-commerce has effectively promoted the development of agricultural value chain.

### 3.3. Digital empowerment in eastern China

Compared to the central and west regions of China, the east part of rural China entered a more mature rural e-commerce development stage with more explorations and innovations in supply chain, brand building and digitalized integration of production, supply and marketing. Digital technology helped advance agricultural transformation, boost rural prosperity and promote rural vitalization, and enabled more farmers to raise income.

#### 3.3.1 Online sales channels for agro-produce

Empowered by digital technology, urban-rural supply chain has been further optimized. Through direct shipment from the place of origin, cold chain development and other measures, an efficient and convenient rural logistics service network has been

built to facilitate the online sale of agro-produce. With continuous capital and technological inputs, patterns such as “warehousing at production site (cold chain) + county-wide distribution (rural logistics)” have emerged, contributing to an open digital rural circulation infrastructure. Smart technologies have been adopted to logistics service at county, township and village levels. More than 1,000 county-wide distribution centers have been built in over 1,000 counties across China’s 29 provinces or regions. More than 50,000 distribution locations at township and village levels have been set up. All these help reduce regional logistic cost by 20% to 30% and increase the efficiency by 30%. In addition, the warehousing at production site allows higher gains than through distributors, therefore brings more profits to lower-income people.

#### Case 8: Warehousing at production site drives industrial upgrading: Nanhe District, Hebei Province



In Nanhe District, Hebei Province, 80,000 out of its 390,000 people are engaged in the pet food industry, which accounts for a market share of 60% in the country. Hailed as the “town of pet food in China,” Nanhe is home to over 4,000 online stores, with total e-commerce turnover reaching RMB1.4 billion in 2019. Facing the weaknesses in warehousing and logistics, local governments and private sectors worked together to build a systematic value chain upgrading plan based on field surveys, trying to promote warehousing at production sites to foster synergy with talent

training, market branding and live streaming e-commerce. In June 2020, a warehouse of 11,200 square meters was put into use. With a designed peak capacity of 100,000 orders, the warehouse handled an average of over 20,000 orders per day within six months after it came into operation. The logistics costs of enterprises declined by 20%, and their operating costs were effectively controlled. Direct shipment from the warehouse has also greatly improved the logistics efficiency. In addition to the basic functions like sorting, inspection and quarantine, warehousing and logistics, the warehouse in Nanhe has also served as an operating platform for e-commerce live streaming and brand marketing, laying solid groundwork for the upgrading of the local pet food industry



Warehousing at production site in Nanhe District. “Warehousing at production site” means that large retail and logistics enterprises establish a warehouse adjacent to the place of origin and suppliers transport goods to the warehouse, which helps reduce logistics costs.

### 3.3.2 Brand building

Agro-produce brand building is crucial to development of regional pillar industries, and can help promote agricultural value chain development, advance rural transformation, create job opportunities for farmers and increase income. Digital technology further empowers the development of local specialities, market

access through multiple channels as well as marketing planning and brand building, thus increasing the competitive edge of rural products. Moreover, through online-offline integration, direct sales, direct purchase and distribution can be completed at one stop, upgrading the omni-channel production and sales model.

### Case 9: “Long Quan Nong Shi” brand improves promotional effects: Longquan County, Zhejiang Province

“Long Quan Nong Shi” is a brand for tea, vegetables and fungus in Longquan County, Zhejiang Province, and also the secret to the county’s success in selling its agro-produce to the whole country. The brand follows the famous agrotechnician Ji Dawei in the Tang dynasty, a native of Longquan County. Through brand culture and image design, stories about agro-produce in Longquan are shared through mass media channels to form consistent unified brand features and foster a unified brand culture. Growers can apply for licensing in order to benefit from the marketing effects and brand premium. Currently, there are 12 varieties of agro-produce under this brand, being adopted by 11 agro-businesses through licensing. The effects of brand empowerment



have come into play. Thanks to the brand value added and supply chain service, shitake, a featured product, gains a brand premium of 25%.

### 3.3.3 Production/supply/sales digitalization

By empowering the production, supply and marketing, digital technology gives a strong impetus to the digitalization of the entire value chain development. It facilitates the make-to-order (MTO) production pattern, supply chain optimization, brand building, targeted

marketing through diversified channels, intellectual property protection, blockchain-enabled traceability and so forth. Farmers are encouraged to produce high-quality products and sell them at the best prices possible. This ensures that branded agriproducts have high quality and good prices.

#### Case 10: Whole-process digitalization empowers “Hong Mei Ren” high-end citrus brand of Xiangshan County



“Hong Mei Ren” is a high-end citrus variety cultivated in Xiangshan County, Zhejiang Province in 2001, and was awarded as the national geographical indication certificate in 2021. The adoption of digital technology throughout the value chain from growing and marketing, to supply and branding, has strengthened the influence of Xiangshan “Hong Mei Ren” geographical indications on consumers. On one hand, targeted digital platforms and tools facilitate a smooth marketing channel. Production and selling are bonded upon consumers’ preference in line with traits of each marketing platform. The first-class “Hong Mei Ren” fruits are directly delivered to supermarkets for high-end consumers across the country. On the supply side, strict grading criteria are set to ensure fruit quality and economic efficiency. Specifically, fruits are graded according to size, shape, colour and other indicators. Graded fruits are supplied through different channels in different packages for differentiated prices, thus a multi-tiered marketing is reached. Digital protection is applied to prevent legitimate rights and product brand of citrus varieties from being compromised. Backed by Alibaba Cloud and AntChain, a farm-to-table traceability system has been established, and the tracing information linked to a specific QR code is tamper-proof. What’s more, the Xiangshan County Citrus Industry Alliance is committed to cracking down on trademark infringement. In terms of planting, growers are encouraged to conduct standard and scaled operations and embrace digital transformation. The retail price of “Hong Mei Ren” fruits has soared from RMB5 per kilogram in the beginning to RMB50 today and even to RMB120. “Hong Mei Ren” accounts for 15% of the county’s total citrus output but 60% of the total output value, and digitalization has directly raised the farmers’ income by over 30%.



### 3.4 Digital technology empowers agricultural value chain development: China's experience and inspirations

The adoption of digital technology in rural transformation and development, the rise of e-commerce and the rapid development of agricultural value chain have brought about enormous changes to the east and west of China. They have created a large number of jobs, opened up new channels for income increase, and unlocked new opportunities for urban-rural integration and rural transformation. Digital technology has given a strong impetus to agricultural value chain development, accelerated the all-round transformation and help scale-up rural economy, greatly improved farmers' livelihood, and fostered new business patterns as a new engine for overall development.

For agricultural value chain development in western China, public investment has played a pivotal role in improving transportation, logistics and other infrastructures, lowering access thresholds and expanding financial service.

First, capacity building and training bolsters the development of rural e-commerce. People-centered training helps smallholders learn about the trends of rural e-commerce, acquire knowledge about new media, and improve their ability to use rural e-commerce platforms, thus fostering and supporting a number of rural e-commerce entrepreneurs.

Second, digitally-enabled smallholder value chain development featuring fairness and inclusiveness reduces the information acquisition costs and plays an enormous role in poverty alleviation. Digital technology provides new channels to help low-income households start a business. It offers an effective model to help them build aspirations and enhance their ability to develop on their own. It helps optimize the arrangements for the industry

chain and allocation of resources to forestall relevant risks, laying a solid foundation for rural vitalization and sideline the endeavor to consolidate the achievements made in poverty alleviation.

The comparatively economic-developed eastern region in China has a relatively mature rural e-commerce development, and the role of digital technology in empowering agricultural value chain development is mainly reflected in supply chain development, brand building and digitalized production, supply chain and marketing.

- Empowered by digital technology, the urban-rural supply chain has been further optimized. Through direct shipment from the place of origin, cold chain construction and other measures, an effective rural logistics service network has been built to facilitate the online sale of agriproducts.
- Digital technology facilitates production and sales connection, marketing planning and brand building, enabling growers to establish their own competitive edge.
- Digital technology empowers different sections of agricultural value chain, placing a strong boost to the digitalization of the entire value chain.
- E-commerce practitioners are encouraged to start businesses and tap into their talent, and a favourable business environment is created for e-commerce platforms and private sectors to invest and operate in rural areas.

In future, digital technology is expected to play an ever greater role in empowering agricultural development, especially agricultural value chain development. It will help advance agricultural upscaling and rural transformation, boost rural prosperity, promote rural vitalization and raise farmers' income.

## Chapter 4 Digital finance boosts rural vitalization

### 4.1 Overview

In the No. 1 central documents from 2016 to 2022, China further stresses the significance of rural finance to agriculture, rural areas and farmers. Over the same period, the digital economy has been flourishing, playing a vital role in catalyzing the healthy development of micro-, small and medium-sized enterprises (MSMEs), keeping employment stable, promoting mass innovation and entrepreneurship, raising farmers' income, etc. Therefore, it has become a new driver of economic development.

In terms of digital financial services, the penetration of mobile internet and rapid development of e-commerce have accelerated the adoption of digital payments. They have also found way into value-added financial services such as digital financing, digital wealth management, digital insurance and digital credit reference. Subsequently, the coverage of financial services has been continuously expanded, the market pattern has been reshaped to some degree, and continued progress has been made in financial business innovation and rural financial inclusion.

### 4.2 Practical applications of digital finance in rural development

Practical applications are the best realization of digital finance, especially from the perspective of the country's financial inclusion policy goal of supporting rural development through finance and meeting the financial needs of MSMEs and the under-served groups. With the country's positive financial inclusion policy and relatively flexible and lenient financial regulatory arrangements, traditional financial institutions and new-type rural financial institutions have taken the initiative to embrace technology. Internet financial enterprises have

exploited their industry advantages to provide financial services. Finance digitalization has become a widely recognized industry trend, and also provides new paths and solutions for supporting rural development.

#### 4.2.1 Enabling financial infrastructure for rural digital finance

The rapid development of digital finance depends on the construction of communication networks, payment and clearing systems, credit systems and other infrastructures. In recent years, China has scaled up the construction of financial infrastructure and the national digital financial service system, making financial services available to a broader range of regions and groups in a more secure, reliable and cost-effective manner. In terms of credit systems, the coverage of the credit reporting system and the basic financial credit information database have been further expanded. In addition, the combination of IT and big data has intensified the sources and types of credit information. Progress has been made in credit records of small and micro-enterprises and the construction of the rural credit system, and the social credit environment has improved significantly.

In 2021, the number and volume of transactions of online and mobile payments both grew at double-digit rates over the previous year. Currently, China has more than 900 million online payment users, accounting for about 90% of its internet users<sup>[9]</sup>. The discrepancies between eastern and western regions are insignificant, and about 80% of mobile users in rural areas adopt online payment. Thanks to continuous innovations in retail payment business, non-cash payment tools and methods have increasingly diversified. In the retail sector, bank card payments are giving way to card-free payments, of which mobile payments make up a major chunk.



In coordination with the construction of the rural payment system, China's central bank launched the rural cash withdrawal service with bank cards on a large scale in 2011. By the end of 2020, 99.31% of administrative villages had access to the payment service.

#### 4.2.2 Diversified applications of digital technology

The adoption of big data credit reporting technology quickly fills the gaps in traditional credit reporting methods involving credit risk caused by information asymmetry, allowing a large number of potential inclusive finance customers without traditional credit to become credit customers. With the advancement of big data credit reporting, its interconnection with live scenarios have become even closer. Personal credit diversification not only promotes financial behaviors like lending but also finds its way into many application fields, such as scenarios requiring deposit services. Big data credit reporting services employ a host of financial technologies, placing higher requirements for information transmission and data security. The major credit reporting models such as the central bank's credit reporting system, the internet-based model and the "traditional plus internet" model cover a large number of organizational users and natural persons. The upgrading of digital credit reporting business has propelled the expansion of financial services, especially financing services. For example, the Credit Reference Center of the People's Bank of China covers more than 60 million organizational users and 1.1 billion natural persons.

The development of credit reporting technology sustains the rapid growth of online credit, eliminating physical barriers and extending credit services to rural and remote areas and to individuals and SMEs without traditional collateral and credit records. Through digital platforms and technological means, commercial banks provide online loan application, contract signing and repayment services, allow for automated approval and

form a closed loop of risk management integrating offline post-loan management, thus making credit services more convenient and efficient.

#### 4.2.3 Business model innovations in rural digital finance

The People's Bank of China has taken the lead in launching the demonstration project of financial technology empowering rural vitalization in nine provincial-level regions. The project aims to leverage next-generation information technology to provide farmer-friendly financial products and services according to local conditions, advance agricultural modernization across the board, and improve rural financial carrying capacity and the availability of financial services to farmers. The central bank has actively promoted the mortgage loan business with the contracted management right of rural land, encouraged financial institutions to provide mortgage loans backed by insurance policies, warehouse receipts, accounts receivable, enclosures, breeding facilities and the like according to applicable laws and regulations, and expand the scope of rural assets used as collateral.

User profiling and collateral information based on big data are used by many banks to facilitate credit decision making through smart credit evaluation. This not only reduces the costs and improves the efficiency but also extends the breadth and depth of credit services.

Postal Savings Bank of China has launched cashflow-based credit services for the grain industry, providing large-amount credit loans for grain dealers in the grain circulation field to help them address cash flow problems. In the process, the bank creatively provides "online plus offline" loan services based on big data and agricultural machinery operation data from competent provincial-level agricultural departments, and uses technology to streamline the business process. In this way, grain purchasers, grain and oil processing enterprises and other customers can acquire loans in just

10 minutes.

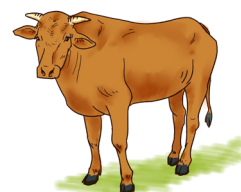
Leveraging satellite remote sensing, big data, AI and cloud computing technologies, MYbank has developed the “Da Shan Que” risk management system. Through remote sensing of croplands, the system can collect information on a number of indicators such as crop type and growth status. Farmers only need to identify their cropland on a mobile phone to quickly get online credit services. As of mid-2021, the system had been used in 28 provinces, municipalities and autonomous regions across China. Through deep learning and neural network-based mapping, it is now applicable to over 20 staple food crops, as well as apple, kiwifruit and other cash crops. It has helped more than 600,000 large-scale growers acquire credit loans. Another typical example is MYbank’s “310” credit model, that is, online loan application in three minutes, loan issuance in one second, and zero manual intervention.

JD Technology, the fintech unit of China’s e-commerce giant JD.com, released an innovative fintech solution for agricultural digitalization in September 2022. Through the digitalization of planting and breeding scenarios, the solution can translate agricultural production data into indicators of concern to financial institutions. Thus, it effectively lowers the threshold for farmers to get financing and enables financial institutions to reduce credit risk and provide farmers with agricultural loans efficiently, thus contributing to rural vitalization.

Based on the information perception of the subject matter of insurance from the IoT, remote sensing and meteorological monitoring platforms, digital agricultural

insurance can help monitor, warn against and evaluate meteorological incidents and improve the ability to prevent disasters and reduce losses while protecting agricultural production from risk. For example, China Pacific Insurance (Group) Co. Ltd. (CPIC) provides agrometeorological index insurance in Guangdong, bringing digital technology and weather big data solutions to insurance products. In addition, the agricultural insurance business process is taken online to address various problems facing farmers such as difficulties in claim settlement and low efficiency in traditional agricultural insurance, so as to streamline the process and increase the efficiency of claims settlement in the wake of a disaster. As of 2021, Ping An Property Insurance had more than 330 index insurance products, covering the weather index, price index, production index, carbon sink remote sensing index and other new agricultural insurance business scenarios. The subject matters insured include nearly 50 varieties such as pigs, eggs, potatoes and forests.

Some provincial-level regions have established comprehensive agricultural insurance information platforms to take traditional offline operations such as insurance purchase and announcements online, which simplifies the collection of agricultural insurance data. The platforms improve the digital management of government affairs, significantly enhance the government’s ability for agricultural insurance supervision and management, increase the efficiency of fund allocation and provide effective support for decision making by governments at various levels.



### Case 11: IoT technology facilitates live animal mortgage loan: Huangping County, Guizhou Province

With a long history of cattle raising, Huangping County of Guizhou Province has been granted the geographical indication status for its cattle. Cattle raising involves enormous investments, and even an ordinary calf can cost over RMB10,000. Thus, cattle farmers and small and medium agribusinesses have dire needs for financing, but they often have trouble seeking loans from banks due to their lack of collateral. This poses a serious barrier to the development of the industry.

With the help of 5G, physical network and other technologies, Agricultural Bank of China has launched the innovative “live animal mortgage loan” product. The electronic ear tags attached to cattle has a variety of features such as digital livestock management, online automated inventory, loan subsidy application and alarm push. The loan product provides financing support for the high-quality development of the animal husbandry industry. So far, 1,600 sets of electronic ear tags have been distributed in Huangping County, which have secured low-interest loans with a total amount of RMB20 million.

On the cattle raiser side, electronic ear tags can be used to collect and manage the variety, source, immunity, health status and other information of each cow, and whole-process electronic records can be established. These measures, coupled with appropriate breeding and disease prevention and control practices, can effectively improve the breeding efficiency and reduce the costs. The managing staff can stay up to date on the temperature, feed intake, exercise volume and other indicators of each cow on their mobile phones (or computers). Alarms will be automatically triggered in case of any abnormalities, and sick cattle can be identified as early as possible. This enables farmers and small and micro-enterprises to transform towards digital standard breeding operations at scale.

On the bank side, the electronic ear tag with a dedicated QR code serves as the unique digital identity of each live animal. It enables real-time monitoring and analysis of the live animals’ physical signs, locations and movements, helping reduce potential risks and losses caused by the missing or death of live animals. The adoption of digital identification, management and monitoring methods guarantees the authenticity and controllability of the mortgage data on biological assets, and addresses the timeliness and accuracy problems in traditional post-loan management.



Full-lifecycle biological asset management with the aid of digital technology

### 4.3 Experience summary and inspirations

Promoting rural development through digital finance can't be achieved overnight. Instead, it is a gradual process that moves towards overall financial inclusion with the advances in digital infrastructure and digital technology and pertinent government policies. In this process, some necessary and sufficient conditions are required, and various problems and challenges should be taken into account. It is recommended that developing countries promote digital financial services in light of their socioeconomic and technological realities, and a safe way is to carry out pilot projects in specified regions and then extend the projects to other regions. China's experience in this regard is summarized as below.

- Good timing and necessary conditions: Technology applications and business models must be aligned with customers' living and production scenarios,

suit their immediate financial service needs and solve urgent problems. Only in this way can digital financial services be sustainable and serve a wider range of customers.

- Government policy and regulation: The government should exercise moderately easy regulation over the development of digital finance and leave sufficient space for the development of digital financial inclusion while emphasizing fund, platform and information security.
- Technology and innovation: Efforts should be made to fully tap the application of digital technologies, and constantly improve the design and application of business models to better serve practical needs. Inappropriate business models and operations may result in liquidity, credit, interest rate and compliance risks.

## Chapter 5 Digital technology empowers rural development-China's experience and inspirations for other developing countries

Over the years, China has seen significant improvements in rural development, agricultural transformation and farmers' livelihoods. Digital technology has played a tremendous role in advancing agricultural production, empowering agricultural value chain development and improving rural financial services.

China has gained a lot of practical experience and blazed a trail in boosting rural transformation with digital technology, which are expected to provide valuable inspirations for other developing countries.

### 5.1 Digital technology empowers agricultural production

The remarkable achievements and best practices of smart agricultural technology and machinery in promoting agricultural development technologically depend on the construction of information infrastructure, especially the internet infrastructure in rural areas. This is the prerequisite and foundation for the development of digital agriculture. In terms of policy support and conditions for technological development, it is recommended that developing countries focus on the following areas of work:

- Establishing a sci-tech innovator system conducive to the development of smart agricultural technology and machinery;
- Building various types of demonstration zones for smart agricultural machinery and smart agriculture to pave the way for testing, demonstration and promotion;
- Putting in place a sci-tech innovation system in support of smart agriculture and agricultural machinery enterprises; and
- Keeping the digital agricultural technology and agricultural machinery market in order and

strengthening intellectual property protection.

### 5.2 Digital technology empowers agricultural value chain development

The eastern and western regions of China vary considerably in terms of economic development and show different characteristics in the process of digitalization and rural development. Their experiences may offer some inspirations to other developing countries.

The economically developed eastern region has a relatively mature rural e-commerce industry, and the role of digital technology in empowering agricultural value chain development is mainly reflected in supply chain development, brand building and production/supply/sales digitalization.

- Digital technology helps optimize the urban-rural supply chain and develop the rural logistics service network to facilitate the online sale of agriproducts.
- Digital technology facilitates production and sales connection, marketing planning and brand building, enabling producers to establish their own competitive edge.
- Digital technology boosts the digitalization of various processes in the entire agricultural chain, including production, supply and sales.
- E-commerce practitioners are encouraged to start businesses and tap into their talent, and a favorable business environment can be created for e-commerce platforms and enterprises to invest and operate in rural areas.

Thanks to digital technology, the economically underdeveloped western region of China has demonstrated latecomer advantages. The role of digital technology in empowering value chain development for smallholders has provided unprecedented momentum for

rural development and poverty reduction.

- People-centered capacity building and human resources training bolster the development of rural e-commerce by fostering and supporting a number of rural e-commerce entrepreneurs and specialists.
- Digitally-enabled value chain development for smallholders featuring fairness and inclusiveness reduces the information acquisition costs, strengthens the weaknesses in regional development and plays an enormous role in poverty alleviation.

### 5.3 Digital finance boosts rural vitalization

It is proposed that developing countries advance digital finance in light of their actual conditions in social, economic, technological and other spheres, carry out pilot

## Epilogue

Facilitating the attainment of various objectives, digital and precision agriculture, e-commerce, rural digital finance, and other forms of digital technology can fundamentally enhance the ecology of rural economies, complement booming urban economies, and help achieve coordinated rural-urban development. Digital progress, when accompanied by sustained improvement in physical and social infrastructure and the policy environment, contributes significantly to realizing the goal of ensuring that everyone is able to benefit from development.

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projects in specified regions and then extend the projects to other regions.

- In order to be more sustainable, digital financial services should revolve around customers' living and production scenarios, suit their immediate financial service needs and address urgent problems.
- Moderately easy regulation should be exercised over the development of digital finance to leave sufficient space for the development of digital financial inclusion.
- Efforts should be made to fully tap the application of digital technologies and constantly improve the design and application of business models to better serve practical needs.

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## Appendix: Supporting Policies for Digital Countryside

Time	Policy	Main Content
November 2015	Decision on Winning the Tough Battle Against Poverty	Redouble efforts in poverty alleviation through the “Internet Plus” initiative; improve the compensation mechanism for universal telecommunications services, and step up efforts to bring broadband networks to impoverished villages; carry out the program on poverty alleviation through ecommerce; strengthen training on rural ecommerce specialists in poverty-stricken areas; provide internet access subsidies, microloans, and other forms of support for online stores operated by poverty-stricken households; provide convenient internet services for rural people, improve internet finance services for poverty-stricken rural areas, and make information services accessible to more villages and rural households
October 2016	Action Plan for Internet-Based Poverty Alleviation	Carry out the five programs on network coverage, rural ecommerce, capacity building through the internet, information services, and internet philanthropy
November 2016	Poverty Alleviation Plan for the 13th Five-Year Plan Period	Foster ecommerce market entities and improve the environment for rural ecommerce development
January 2018	Guidelines on Implementing the Rural Revitalization Strategy	Implement the digital village strategy, ensure sound overall planning and design, accelerate the coverage of broadband networks and 4G networks in rural areas, develop information technologies, products, applications, and services that suit the characteristics of the work related to agriculture, rural areas, and rural people, and further popularize telemedicine, distance education, and other applications in an endeavor to bridge the digital gap between urban and rural areas
May 2019	Outline of Digital Village Development Strategy	Carry out ten key tasks, namely accelerating the construction of rural information infrastructure, developing the rural digital economy, strengthening scientific and technological innovation for agriculture and rural areas, building smart green villages, cultivating the rural internet culture, modernizing rural governance capacity, advancing information services for the benefit of the people, unleashing the endogenous power for rural revitalization, pushing forward poverty alleviation through the internet, and boosting IT application in urban and rural areas in a coordinated manner
January 2020	Guidelines on Key Tasks Concerning Agriculture, Rural Areas and Rural People to Achieve All-around Moderate Prosperity as Scheduled	Leverage resources available to establish agricultural and rural data centers, and accelerate the application of IoT, big data, blockchain, AI, 5G, weather intelligence, and other modern information technologies in the agricultural sector. Conduct national digital village pilot projects.

May 2020	Digital Village Development Highlights for 2020	By 2020, the digital village strategy will achieve the following objectives: basically make fiber-optic networks and 4G available to all administrative villages, and greatly increase the internet penetration rate in rural areas; boost the rapid development of the rural digital economy, and accelerate the digital transformation of agriculture and rural areas; give rural people more convenient access to information services, and further expand the coverage of digital inclusive finance in rural areas; fulfill the objectives and tasks of poverty alleviation through the internet, and continuously consolidate the achievements
July 2020	Circular on the National Digital Village Pilot Project	Carry out pilot projects in selected regions to accumulate replicable practices and experiences in overall planning and design, institutional and mechanism innovation, integrated technology application, development environment, and other aspects, thus laying solid groundwork for promoting the development of the digital villages in an all-round manner
January 2021	Guidelines on Comprehensively Advancing Rural Revitalization and Accelerating the Modernization of Agriculture and Rural Areas	Implement the digital village initiative; coordinate the planning and construction of gigabit-capable fiber-optic networks, 5G, and mobile IoT in rural and urban areas; improve the compensation mechanism for universal telecommunications services, and support the construction of information and communications infrastructure in rural and remote areas; accelerate the construction of space-based facilities such as remote sensing satellites for agriculture and rural areas; boost the development of smart agriculture, establish the agricultural and rural big data system, and promote deeper integration of next-generation information technology and agricultural production and operations; refine the comprehensive agrometeorological monitoring network, and strengthen the ability to guard against agrometeorological disasters; and advance the digital and smart transformation of rural public services and social governance
April 2021	Rural Revitalization Promotion Law of the People's Republic of China	Encourage IT application in agriculture, strengthen the IT-enabled monitoring and warning service and comprehensive services for agriculture, and promote the adoption of information technology in agricultural production and operations
November 2021	Circular on Issuing the Plan to Advance Agricultural and Rural Modernization during the 14th Five-Year Plan Period	Increase scientific and technological support for agricultural modernization; strive for breakthroughs in core and key agricultural technologies, and enhance the building of strategic science and technology capabilities for agriculture; and promote deeper integration of technology and industry Step up the building of digital villages; strengthen the construction of information infrastructure in rural areas, develop smart agriculture, and promote the digital transformation of rural management and services



December 2021	Circular on Issuing Digital Economy Development Plan During the 14th Five-Year Plan Period	Elevate the digitalization of agriculture, promote comprehensive information services for agriculture, rural areas, and rural people, boost the innovation-driven development of smart agriculture, and encourage digitalization in agricultural production, processing, sales, logistics, and other links Speed up the extension of smart urban facilities to rural areas, improve information services in rural areas, promote the two-way free flow of urban and rural factors of production, allocate public resources rationally, and foster a new pattern of urban-rural integrated development empowered by digital technology, where urban areas support rural areas, and collaborate and share the benefits with rural areas
January 2022	Guidelines on Key Tasks on Advancing Rural Revitalization in 2022	Press ahead with the building of digital villages; boost the development of smart agriculture, and promote the integration of information technology into agricultural machinery and agronomy applications; strengthen digital literacy and skills training for rural people; empower rural public services with digital technology, and extend the “Internet Plus Government Services” to rural areas; expand the application scenarios of agricultural and rural big data, with a focus on solving practical problems; accelerate the setting of digital village standard, devise an evaluation index system for development, and carry on with digital village pilot projects; and strengthen the construction of information infrastructure in rural areas
January 2022	Digital Village Development Action Plan (2022-2025)	Carry out eight campaigns aimed at upgrading the digital infrastructure, pushing forward the innovation-driven development of smart agriculture, fostering new patterns and models, strengthening digital governance capacity, cultivating the rural internet culture, building smart green villages, improving the public service efficiency, and advancing poverty alleviation through the internet
April 2022	Digital Village Development Highlights for 2022	By 2022, make greater headway in the building of digital villages, continuously improve the rural digital governance system, provide extensive and convenient information services for rural people, strengthen their digital literary and skills, and achieve preliminary results in the development of digital village pilot projects
August 2022	Guidelines on Digitalization of Demonstration Zones for Agricultural Modernization	Require localities to promote the digitalization of demonstration zones in light of their actual conditions of development, local resource endowments, digital development basis, and level of industrial development
September 2022	Guidelines on Developing Digital Village Standards System	Basically establish a digital village standard system by 2025

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