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A Survey on Development of "Internet + Farmer Cooperative" in China^{*}

Guo-peng Zhang¹, Jie-ling Zou¹, Jing Hua¹, Li-ming Wang¹, Jing-shun Du²,
Yu-bin Wang¹(✉)

¹China Agricultural University, Beijing, China

piratelo@126.com

²Shenyang Agricultural University, Shenyang, China

86896295@163.com

Abstract: As a new production mode, "Internet+" helps achieve innovative development and mutual benefits by providing online and information-based functions of traditional industries. In spite of the numerous explorations and practices of "Internet+" that have been made so far in China, for farmer cooperatives, it is still a new thing requiring much development. In this paper, current conditions of "Internet + farmer cooperative" business pattern in China are studied through field investigations and literature review. Four existing modes are summarized from the perspective of industrial chain. Also, issues and challenges confronted by farmer cooperatives during use of "Internet+" are analyzed on three levels: society, industry, and entity. Finally, corresponding policy recommendations are proposed with the intention of boosting development of "Internet + farmer cooperatives" in China.

Keywords: Farmer Cooperatives, Internet +, Agriculture, Industry Chain

1 Introduction

"Internet+" is a product of the fourth industrial and technological revolution. Backed by Internet platforms as well as information and communication technologies, it combines Internet with various industries including traditional ones to create a new ecology characterized by shared economy and innovative development in new fields. It helps achieve online and information-based operation of traditional industries. "Internet+" is not at all a new thing in China. A number of traditional Internet + businesses have appeared, including online markets like Taobao and TMALL, banking platforms like Alipay, matchmaking platforms like www.jiayuan.com, and taxi agencies like Didi Taxi.

In 2015, Chinese government launched "Internet+" program, and issued Guidelines on Actively Promoting "Internet+" Program, explicitly presenting the concept of "Internet + agriculture". By using information as an important productive force, "Internet + agriculture" will take advantage of Internet, Internet of Things, big data, intelligent terminals, and other platforms to drive changes of agricultural development modes. It is intended to realize upgraded agricultural circulation and distribution systems and to create new industrial patterns, thus achieving more optimized scale economy and scope economy. "Internet + farmer cooperative" serves as an critical part of "Internet + agriculture". Farmer cooperative, as an important agricultural operation entity, is expected to make a better use of "Internet+" and the achievements of the fourth industrial and technological revolution. The targets with

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this regard include common prosperity among farmers, integrated development in villages, agricultural innovations, and leap development in rural areas. As this topic deserves in-depth discussion and research, with the support from 2016 Agriculture Standardization Implementation & Demonstration Project Fund of Ministry of Agriculture, the research team has started specific investigations in regions like Beijing and Shandong based on complete sorting of existing data.

2 Current development conditions and analysis of "Internet + farmer cooperative" in China

"Internet + farmer cooperative" development pattern is not just a sum of the two components. In fact, it calls for integration of multiple productive elements including such as information, knowledge, technology, and entrepreneurship. In this pattern, information streams are expected to drive flow of capital, technologies, talents, and products to achieve balanced timing and spatial optimization in all production, distribution, and consumption links. It will therefore have great implications for reforms of organization, production, and consumption modes. Physical and virtual functions will be highly integrated, thus highlighting the high level of consistency between consumer value, enterprise value, and network value. From the perspective of industrial chain, "Internet + farmer cooperative" pattern exists in different upstream, midstream, and downstream links in China for the time being. It's more frequently seen in the upstream link of agricultural material purchase and downstream link of agricultural product distribution, and less frequently seen in midstream intelligent agricultures and business forms that cover the whole industrial chain.

2.1 Upstream of industrial chain: creation of "agricultural material + Internet + farmer cooperative" pattern focused initially on agricultural material

Agricultural materials represented by seed, fertilizer, pesticide, and agricultural film are one of the fields with earlier, more frequent, and more comprehensive use of "Internet+" for farmer cooperatives. A great number of issues have arisen from traditional purchase and sales of agricultural materials such as local price protection, excessive levels of sales channels, differentiated quality information, and non-transparent price information, leading to countless cases of high price, inferior quality, product shortage, or even fake products in some areas. Farmers have suffered a lot from such drawbacks. To address such issues, "Internet+" has gave birth to various types of O2O agricultural material e-business platforms such as B2B and B2C based on communication technologies, information data, and network platforms. These platforms provide the benefits of more horizontally arranged sales channels, more accessible quality information, more transparent price information, more reasonable product competition, and a increasingly higher level of market transparency and lower level of transaction cost. With the agricultural material e-business platforms, farmer cooperatives can break the information barriers, existing sales hierarchy, and market monopoly to purchase production materials with super quality and competitive price, thus creating an "agricultural material + Internet + farmer cooperative" pattern that helps effectively reduce production cost and improve productivity. The "agricultural material + Internet + farmer cooperative" pattern is no longer limited to low-value agricultural production materials such as seed, fertilizer, pesticide, and agricultural film. It is gradually spreading to high-value fields like large agricultural machinery and tools and high risk agriculture credit.

"Tiantianquan" is an Internet O2O service platform invested by Shenzhen Noposion Corporation. By integrating upstream agricultural material manufacturers and midstream distributors and retailers, it

has a solid agricultural material operation network and a concrete base of physical entities. It provides both online functions, including technical consultation, experience exchange, agricultural material purchase, information publication, and agriculture finance services, and offline functions such as soil testing formula, agricultural material supply, and technical guidance. In 2015, Jiangsu Xuzhou Suining County Supply & Sales Cooperative cooperated with Shenzhen Noposion Corporation to set up a "Tiantianquan" agricultural material e-business service center, which was followed by establishment of 21 modern "Tiantianquan" agricultural service stations in different towns. Over 300 planting experts were recruited, and over 6800 farmer members were admitted. The operation and service pattern combining online and offline functions has gained popularity among farmers.

2.2 Midstream of industrial chain: creation of a "farmer cooperative + Internet + production" pattern starting from production

The production mode driven mostly by intelligent agriculture is an important application of "Internet+" for farmer cooperatives, in which field a number of beneficial researches have been carried out. As opposed to the production methods of traditional agriculture characterized by great reliance on experience and weather, time and labor consuming processes, and lower productivity, intelligent agriculture focuses on modern agricultural production technologies with support from talents and the platform created by Internet of Things. By integrating information perception, intelligent decision, automatic control, and precise management, it helps achieve automated, standard, and intelligent agricultural productions, thus saving a large amount of labor cost, reinforcing the ability of crops to resist natural risks, and improving quality of agricultural products. Backed by intelligent agriculture systems, farmer cooperatives can introduce advanced planting and breeding technologies, perform real-time monitoring of production processes, consult online experts in time, and provide remote control & diagnosis to create a "farmer cooperative + Internet + production" pattern. The benefits include lower labor intensity, higher productivity, and better product quality.

Wangtuan Village and Green Village Cooperative in Jiaolai Town, Jiaozhou City, Shandong invested over RMB 2 million in 2013 to introduce the first intelligent agricultural control system based on Internet of Things in Jiaozhou. The system allows remote and real-time monitoring of temperature, humidity, and sunlight exposure in greenhouses. Synchronized operations such as greenhouse skylight opening, shading screen adjustment, wet curtain arrangement, and automatic watering are achieved via computers. In addition, this system can monitor parameters like outdoor temperature, humidity, wind direction, and wind speed, thus allowing wind prevention and heat preservation measures to be taken in advance based on weather conditions. After introduction of the intelligent control system based on Internet of Things, technicians only need to press a mouse or buttons to complete complicated operations. This change translates into less workload and higher production efficiency.

2.3 Downstream of industrial chain: creation of a "farmer cooperative + Internet + market" pattern by regarding consumers as the key link

Sales of agricultural products, especially fresh and characteristic ones, is one of the main application of "Internet+" for farmer cooperatives. In the traditional sales mode of agricultural products, due to slow information transfer, lengthy product circulation circles, and insufficient coverage of target groups, it is often difficult for farmers to sell their products and for consumers to purchase products. The high transaction cost prevents farmers from making significant profit while causing much

inconvenience to consumers. In contrast, "Internet+" can change the market situation of agricultural products both temporally and spatially. It reduces loss and deviation of market information during transmission, and achieves a shift from production-oriented consumption to consumption-oriented production. The following benefits are created: optimized and innovative agricultural product purchase & sales mode, closer relation between producers and consumers, better customer experience and consumer stickiness, wider sales coverage, higher level of market transparency and competitiveness, lower transaction cost, and higher transaction efficiency. "Internet+" enables farmer cooperatives to adopt new sales modes, including order form, group purchase, crowd funding, preemptive purchase, and subscription. Sales channels are simplified to completely bridge the gaps between agricultural products and consumer groups. The "farmer cooperative + Internet + market" pattern created in this way breaks through geographical restrictions while expanding market horizons. In this pattern, it's easier to build a scale economy, and more product information is made available to the market, which means the consumers can get access to more information and options, and consequently more benefits.

As a major brand operating rice and other products at TMALL, "Valley of Green Agricultural Products" has many affiliated farmer cooperatives. In 2014, "Valley of Green Agricultural Products" concluded through a data analysis that queries and demands for Wuchang rice would continue to increase in the next year, and pointed out that a new rice variety of higher quality should be developed to replace the declining Daohuaxiang. In this background, "Valley of Green Agricultural Products" cooperated with WuchangHailong Rice Planting Farmer Cooperative to jointly develop "Gulu No. 1", an upgraded variety of WuchangDaohuaxiang. The "Gulu No. 1" rice planted by Hailong Cooperative had a purchase price 30% higher than normal Daohuaxiang. During the sales season of 2015, over 1200 tons of this rice was sold. Assuming a unit sales price of RMB 17 per Jin, the total income of the members of the cooperative was RMB 16.66million, which corresponded to an income per capita of RMB 57.6 thousand for the 289 farmers involved.

2.4 Full industrial chain: creation of a "farm + Internet + farmer cooperative + Internet + dining table" pattern centered around products

Building a full industrial chain "from farm to dining table" will be one of the main applications of "Internet+" for farmer cooperatives. The full industrial chain will be market oriented and center around products to gain a wide coverage. It requires barrier-free transmission of information, seamless integration between different links, and quality control throughout relevant processes. Data collection, analysis, and monitoring will be core functions to achieve the above targets. With this regard, "Internet+" enables real-time and lossless online information transmission, calculation and analysis of big data, and dynamic monitoring, feedback, and control. With "Internet+", farmer cooperatives can integrate different industries and different links in the industrial chain both horizontally and vertically, analyze market demand, adjust production input, monitor production process, track product origin, and therefore create a full industrial chain pattern consisting of "farm + Internet + farmer cooperative + Internet + dining table". This pattern realizes general industrial convergence that contributes greatly to quality control and product demand, thus laying a solid foundation for developing and reinforcing cooperatives.

Jiangxi ShangraoDexingXiangtunAgricultural Cooperative has also introduced "Internet +" to their agricultural production by allowing online subscription of superior private vegetable fields and offering offline happy farmhouse services, thus bringing fresh and pollution-free vegetables from

farmland to dining tables of citizens. So far over 200 urban households have subscribed vegetable fields here, which add up to nearly 400 Mu. As the "landlords", they entrust planting to the cooperative. All they need to do is scanning their mobile phones and clicking to choose vegetables from over 50 species available on the online cloud platform provided by the cooperative, including such as lettuce, celery, spinach, Chinese cabbage, sweet potato, and cucumber. They may also perform online monitoring on growth of the crops in their fields through cameras 24 hours a day, which means each stage of planting is well controlled. The services provided by the cooperative also cover home delivery of fresh ripe vegetables. "Internet+", as a win-win strategy, has not only changed living style of citizens, but also increased income of farmers.

3 Issues and challenges faced by "Internet + farmer cooperative" pattern in China

3.1 Social perspective: weak software and software basis

The first challenge is lack of infrastructure. "Internet+" underlines interconnections, which require material flows driven by information streams. Information streams and material flows rely on networks and roads respectively. However, in Chinese rural areas, the penetration rate of Internet is only 30.1%, which is 34.1% lower than that in cities and towns. Among all Internet users in China, only 27.9% live in rural areas, which are not in proportion to total rural population. Access to Internet by farmers is limited by insufficient network infrastructures. In recent years, road construction in China has improved greatly, and the road network has nearly covered all administrative villages. Issues to be addressed in this field include low construction standards, narrow roads, and frequent damages. Insufficient and inferior roads are unfavorable for product transportation with trucks. This is a major obstacle to economic development in remote rural areas.

The second challenge is lack of a credit system. Most farmer cooperatives lie on the production end of food. Food industry requires the producers and other players to have a great sense of responsibilities and a high level of credit. Due to lack of a proven social credit system in China, dishonest producers and operators are often not adequately restrained or punished. Their illegal behaviors, such as adulteration and cheating, endanger public health and impair confidence of consumers. Honest producers and operators also suffer from such ill conducts because of the profound effect of "bad money driving out good". In view of the low entrance threshold and virtual nature of "Internet+", the impact of absence of a social credit system will be further amplified, which will in turn substantially raise market transaction cost and weaken the advantages of "Internet+" in market transactions. Farmer cooperatives naturally have to face this challenge as well.

3.2 Industrial perspective: multiple limitations

The first challenge in this field is lack of industrial standards. Industrial standards serve as criteria for measuring quality of products and services and maturity level of an industry. Favorable industrial standards can effectively regulate industrial development and order while promoting its rapid growth and full competition. For cooperatives, industrial standards are basic regulation guidelines. For consumers, industrial standards are important quality measures of products and services. Classification and grading standards are now absent for many agricultural products. In physical markets, consumers can make their selections based on tangible objects. But in the virtual markets created by "Internet +", the only source of information comes from perceptual descriptions by sellers, which can easily cause

disputes and is not good for long-term development of "Internet+".

The second challenge is high logistics cost. High logistics cost has become a bottleneck that prevents further development of agricultural product e-business operators, especially those dealing with fresh agricultural products. According to statistical data, logistics accounts for 25%-40% in total cost of orders for fresh agricultural products, while this proportion is only about 5% in total cost of orders for electronic products. This phenomenon is related to both unique nature of agricultural products and current conditions of agricultural product production, warehousing, and logistics systems. First, agricultural products have a short shelf life and are easy to decay and deteriorate. In particular, fresh types are liable to serious loss during storage and transportation, thus leading to drastically higher cost. Second, the value of agricultural products per unit weight or volume is low, but storage and transportation costs are typically calculated based on weight or volume. This fact leads to the high proportion of logistics in sales price. Third, fresh agricultural products require cold chain transportation. The heavy investment and high operation and maintenance cost of cold chain equipment further boost logistics cost. Fourth, agriculture operators in China are typically small in scale and scattered, making it difficult to achieve economy of scale and lower logistics cost.

3.3 Entity perspective: lack of awareness of talents and funds

The first challenge in this field is insufficient talents. For an organization, talents are its hardware and software at the same time. Talents are both carriers and origins of technologies and ideas. Since most members of farmer cooperatives are husbandmen, lack of talents with diversified background is common. Operators of farmer cooperatives are often characterized by lower education degree, less technical knowledge, weaker marketing and management capabilities, and backward concepts. The need for highly skilled talents can therefore hardly be met by members from the cooperatives. The situation is further complicated by the fact that most farmer cooperatives find it hard to attract and retain talents, especially young people, as they are far from cities and unable to offer a satisfactory salary and a broad development space. The serious problems related to talent attraction and retention have become a major bottleneck against use of "Internet +" and development of many cooperatives.

The second challenge is fund shortage. Fund shortage is now a common concern for almost all farmer cooperatives. On one hand, farmer cooperatives have limited ability to raise funds as farmer alliances. On the other hand, agriculture industry generates lower comparative income due to its weak position, which results in limited profit space of farmer cooperatives and slow capital accumulation. What's more, because many farmer cooperatives are not qualified for commercial credit, they often find it hard to obtain loans from financial institutions. For example, many financial institutions would not lend money to cooperatives as they fail to provide effective mortgage. Some other financial institutions are unwilling to take lending risks considering factors such as unstable membership of cooperatives (members can withdraw from cooperatives freely) and non-transparent fund loan channels (transactions without bank accounts).

The third challenge is lack of preparation for adversity. Some farmer cooperatives are satisfied with past achievements and completely rely on existing production modes and sales channels. Not fully aware of the development trends of "Internet +", they lack the initiatives to learn and use "Internet+". In the highly competitive and dynamic market, he who does not advance loses ground.

4 Policy recommendations

Farmer cooperatives are not exactly the same as enterprises. Established to serve members, they have certain positive externality. From economic point of view, matters with positive externality need policy support and financial compensation. Besides, the farmer cooperatives in China are still in their initial stage with small scale, slow development, and low cost-effectiveness. Hence, in theory and from the perspective of long-term development, effective supporting policies are required to boost growth of cooperatives and improve their competitive ability in the market.

4.1 Physical and intangible infrastructure

To reinforce infrastructures for interconnection, the "Broadband China" strategy has been launched. It is expected that by 2020, broadband networks will generally cover all rural areas, thus completing the "last mile" for network infrastructure construction. In view of the complicated geographical environments and scattered population in some rural and remote areas, broadband construction, operation, and maintenance will require higher investment and cost, and generate lower income. Due to this obvious positive externality, the government should reinforce subsidies and policy supports to network infrastructures to improve the construction quality and speed. In the meanwhile, more efforts should be made in construction of rural roads so that work related to rural areas, agriculture, and farmers can be greatly facilitated by networks and roads.

Construction of the credit system should be accelerated across the society. The credit system is an intangible infrastructure that resembles roads and networks in a sense. In spite of its virtual nature, it provides a high level of positive externality. Similarly, the government should reinforce subsidies and policy supports to the credit system. Specifically, a loan mortgage and warranty mechanism suitable for cooperatives should be built, and the credit rating system should be adapted to the characteristics of cooperatives. Financial institutions should be encouraged to launch special loans for cooperatives with low interest rate or discount and appropriately extended loan term. Those financial departments and institutions providing active support to cooperatives should be awarded.

Relevant standards should be drafted at a faster pace, because standardization is a premise for achieving specialized production, eliminating transaction barriers, and promoting market development. A new standard system combining general guide standards drafted by the government and specific standards formulated by market participants should be built to achieve synergies and balance. The standardization work will be characterized by government guidance, market driving, public participation, and coordinated efforts. The standards are expected to provide a solid foundation for economic development.

4.2 Momentum created by innovations

Among the top priorities are fundamental research, technical development, and promotion application. As a common knowledge, science and technology are primary productive force. However, scientific researches, technical developments, and promotion applications feature heavy investment, long lead time, and slow payback, which means they are subject to a strong spillover effect. The risks related to market application are too high to be assumed by enterprises alone, especially in the field of fundamental theoretical study. Hence the government should further reinforce relevant investments with a focus on researches of high-quality and high-output varieties, planting and breeding

technologies, storage and preservation technologies, and cold chain transportation technologies, including development of storage and preservation facilities and cold train transportation equipment. Proven technologies should be promoted in a timely and effective manner to achieve wide coverage. As storage and preservation facilities and cold train transportation equipment can be regarded as infrastructure with certain public properties similar to roads and networks, the government should provide certain subsidies and preferential policies for their construction and operation. Or alternatively, new operating modes like PPP (Public-Private Partnership) and BOT (Build-Operate-Transfer) can be explored.

4.3 A constant focus on talent cultivation

Development and introduction of talent resources are both important. Competitive ability or an organization ultimately depends on its talents. Talents can develop production, innovate technologies, change a system, and create leading ideas. Cultivation of talents will benefit both their organizations and themselves, and contribute to national development. For farmer cooperatives, the first step for talent development is to improve talent cultivation mechanism by mainly providing training for leaders, operators, managers, and instructors. The second step is to adopt favorable policies to attract college graduates. College graduates should be encouraged to lead and create farmer cooperatives. A flexible incentive mechanism that attracts and retains talents with reasonable rewarding systems should be put into place as well.

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