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The formation of agricultural e-commerce clusters: A case from China

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Abstract

Agricultural e-commerce clusters are new phenomena that have emerged in rural China. In examining the case of Shuyang County in Jiangsu Province, this paper puts forward an integrated model revealing the formation mechanism of agricultural e-commerce clusters. The paper shows that the formation of agricultural e-commerce clusters involves four processes of technology introduction, technology diffusion, quality crisis, and industrial agglomeration based on elements such as industry bases, e-commerce platforms, network facilities, logistics services, entrepreneurial talent, local government, and market demand. Rural social networks and imitation behaviors promote technology diffusion by reducing the cost of technology introduction, and industrial agglomeration is found in the economies showing a deepening of labor divisions and geographic agglomeration. Throughout the formation process, a quality crisis may occur due to a race to the bottom and the opportunistic behaviors of local farmers. This work suggests that regional e-commerce development is a systematic project. Governments of developing countries should not only realize the positive impacts of e-commerce for the development of the agricultural industry but also recognize the premise and logic of how e-commerce can play a prominent role.

1 | INTRODUCTION

Difficulties associated with the sale of agricultural products heavily restrict agricultural development and farmers' incomes in developing countries due to conflicts between smallholders and the

broader market (Markelova, Meinzen-Dick, Hellin, & Dohrn, 2009; Poulton, Dorward, & Kydd, 2010; Wiggins, Kirsten, & Llambí, 2010). E-commerce serves as an effective means to address issues related to product circulation and marketing (Baorakis, Kourgiantakis, & Migdalas, 2002; Montealegre, Thompson, & Eales, 2007). In recent years, with the joint effects of various favorable conditions, agricultural e-commerce in China has entered a new period of rapid development (Zeng, Jia, Wan, & Guo, 2017). In some rural areas, e-commerce is widely integrated with local characteristic agricultural industries, giving birth to a group of professional e-commerce villages specialized in the production of hairy crabs, pecans, flowers, trees, honey, apples, tea, and other agricultural products. As most farmers in these villages use Taobao as a trading platform, these specialized villages are often referred to as Taobao Villages.[1] In some areas, these villages have achieved continuous development, resulting in the formation of numerous online business, express companies, e-commerce service enterprises, suppliers, accessory manufacturers, and training institutions, which result in large-scale clustering. In Shuyang County of Jiangsu Province, for example, 22 Taobao Villages specialized in selling flowers and trees online in 2015, resulting in the formation of the earliest and largest agricultural Taobao Village cluster in China. Faced with this new phenomenon, we could not help but explore why a region such as Shuyang County can form such a cluster of agricultural e-commerce.

Some scholars have attempted to determine why e-commerce clusters like Taobao Village have emerged and how they have formed (Avgerou & Li, 2013; Zeng & Guo, 2016; Zeng, Qiu, Shen, & Guo, 2015; Zou & Liang, 2015). Related works present the following features. First, they are conducted from a certain perspective, adopting a focus on relational networks, government support, development processes, e-commerce associations, etc. Second, the cases explored in these studies mainly refer to those involving the sale of manufactured products (e.g., the villages of Dongfeng, Junpu, and Qingyan Liu) while few focus on Taobao Villages specializing in agricultural products. Third, studies have been limited to a focus on villages while few have focused on cluster phenomena in Taobao Villages that have achieved multi-village development. Through a case study, this paper explores an integrated model to fully deconstruct formation mechanisms of agricultural e-commerce clusters represented by the Taobao Village cluster in Shuyang County. Unlike other studies, this work highlights three points. First, it proposes that when studying a specific type of industry cluster, one must comprehensively use dynamic mechanisms, formative elements, and development processes to explain its formation mechanisms. Second, it pioneers an integrated model to reveal the formation rules of agricultural e-commerce clusters, thus furthering the understanding of this new phenomenon and identifying differences between agricultural e-commerce clusters and general industry clusters. Finally, from practices observed in Shuyang County, we present recommendations for developing countries on the development of agricultural e-commerce systems.

The rest of the paper is structured as follows. Section 2 presents a brief theoretical background. Section 3 describes the research method used and introduces the case and data collection methods applied. Sections 4 presents our findings and is followed by a discussion given in Section 5. Section 6 concludes.

2 | THEORETICAL BACKGROUND

There has been a long history of research on the formation mechanisms of industry clusters. From a review of existing literature, we found that most of such works have focused on three factors: dynamic mechanisms, formative elements, and development processes.

Dynamic mechanisms are also known as motivations. The studies conducted from this perspective focus on what economic benefits the economic subject obtains to analyze the causes of a social

phenomenon. Rather, they show that industry clusters arise to offer economic benefits to relevant subjects. Marshall (1890) held the belief that corporations gather in certain regions to secure external economies through agglomeration via labor sharing, knowledge spillovers and the development of specialized investment and supporting industries. According to transaction costs theory, the industry cluster is defined as an intermediate organization operating between markets and bureaucracies that reduce transaction costs incurred through the specialized division of labor (Scott, 1986; Walker & Weber, 1984; White, 1981). Porter (1990) insisted that industry clusters could promote a company's innovation to achieve more market competitiveness. Furthermore, some scholars have argued that as a regional innovation system, an industry cluster enables enterprises of a group to share the benefits of large-scale production, technological, and organizational innovations that could not be achieved by out-of-group companies (Lundvall, 1992; Nelson, 1993). Generally, classical theories mainly focus on dynamic mechanisms and illustrate the economic nature of industry cluster formation. As a result, these theories can be widely applied to identify commonalities between various types of industry clusters, but they cannot at the same time explain why different types of industry clusters form.

Studies on formative elements are mainly focused on conditions that must be in place for industry cluster formation related to natural conditions, geographic locations, professional markets, entrepreneurial talent, government behaviors, industrial traditions, regional cultures, market demands, etc. (Dana & Winstone, 2008; Feldman, 2001; Kurokawa, Tembo, & Dirk, 2010; Sterns & Spreen, 2007; Visser & Langen, 2006). Agricultural and industry clusters differ in their reliance on natural conditions. The former cannot form without unique local resources and geographical advantages related to climatic patterns, sunlight levels, precipitation levels, and humidity and soil features while the latter are less dependent on these factors (Mueller & Sumner, 2006). Studying the formation mechanisms of industry clusters based on elements can reveal the differences between industry clusters and provide a reference for other regions and practical guidance. However, frameworks based on formative elements have a narrow scope of application, as the combination of elements involved varies in different types of industry clusters.

Studies focused on development processes tend to divide these processes into several evolutionary stages in order, and then discuss factors that play a role in each stage or clarify the motivations for moving into each stage. Taking Bruso's (1990) two-stage growth model as an example, according to his studies of Italy, clusters almost emerge spontaneously. He defines spontaneous growth without government intervention as the first stage. When a cluster grows to a certain scale, government or industry organizations begin to interfere with the cluster's growth by, for instance, providing socialized services, resulting in the start of the second stage. Otsuka and Sonobe (2011) examined the growth of 19 industry clusters in Asia and Africa and applied the two-stage evolution rule to show that the development of industry clusters first undergoes a stage of quantitative expansion (Smithian growth), followed by the stage of quality improvement (Schumpeterian growth). In general, studies on development processes analyze formative elements or dynamic mechanisms while the literature focused on formative elements or dynamic mechanisms may not adopt a procedural perspective to describe the formation of clusters. From a stage-focused perspective, the formation of industry clusters is simplified into a dynamic evolution model allowing one to easily grasp the key facets of cluster formation and as a result develop a clearer understanding.

We argue that only when the above three perspectives are comprehensively used can formation mechanisms of a specific type of industry cluster be fully explained; rather, they constitute indispensable and complementary components of the formation of industry clusters. When we only discuss one of them or even an aspect of one, conclusions drawn will be limited and less convincing. Based on the

above theoretical background, we adopt this premise in a case study of Shuyang County to describe the formation of an agricultural e-commerce cluster as comprehensively as possible.

3 | RESEARCH DESIGN

3.1 | Methodology

According to Yin (2003), the case study method should be adopted when studying the formation of a phenomenon that involves various background conditions, multiple sources of evidence, and changing dynamics. A case study can be considered a form of empirical and phenomenological research. Its ultimate purpose is to deduce general rules from phenomena and create new knowledge. Agricultural e-commerce clusters constitute an industry cluster in essence. Therefore, to study their formation mechanisms, one must draw lessons from the existing theoretical achievements of industry clusters and especially from common parts of agricultural e-commerce clusters and industry clusters. Of course, agricultural e-commerce clusters also differ from general industry clusters, which will be explored in our case analysis. The case study presented in this paper follows a "theory-practice-theory" research approach. First, from the existing literature on industry clusters, this paper summarizes analyses on the formation of clusters, combines perceptual knowledge formed through pre-investigation, and constructs a preliminary theoretical model through theoretical deduction. Then, from a large amount of data collected by formal investigation in Shuyang County, a preliminary theoretical model is continuously tested, modified, and polished. In this process, the model will be enriched and refined until it reaches theoretical saturation. Our final theoretical model should effectively explain cluster phenomena, take full advantage of case data and be recognized by information providers (Pan & Tan, 2011; Strauss & Corbin, 1998). Finally, from the final model constructed, we provide a discussion on its practical implications.

3.2 | Case introduction

Shuyang County in the city of Suqian, in the northwestern region of Jiangsu Province, China is a county belonging to the Taobao Village cluster of agricultural products, which included 38 "Taobao Village" clusters[2] as of August, 2016 (Figure 1). Shuyang County is known as "the hometown of Chinese flowers and trees." At the end of 2015, the county's planting area and sales volume reached 480,000 mu[3] and 8.5 billion RMB, respectively, rendering it the largest county for flower and tree planting in Jiangsu Province. In 2006, a collection of local farmers began to actively explore online marketing opportunities using Taobao or other e-commerce platforms and entered a new online market, which later attracted more villagers to join the ranks of e-commerce entrepreneurship. In 2013, the first group of Chinese Taobao Villages was announced and Yanxia Village in the Yanji Township was successfully selected. In the following year, in addition to the village of Yanxia, the village of Zhouquan of the Xinhe Township was included among the second group of Chinese Taobao Village. In 2015, 22 villages in the Xinhe Township, Miaotou Township, and Yanji Township were added as the third group of Taobao Villages in China. Among them, 11 villages under the jurisdiction of the Xinhe Township were all Taobao Villages. Also in this year, Shuyang County was awarded the title of "National Rural E-commerce Demonstration County." In 2016, the number of Taobao Villages in Shuyang County added up to 31. It has been reported that almost 30,000 e-businesspersons were active in June 2016, among which about roughly 80% were engaged in flower and seedling sales, which accounted for 40% of whole Taobao market sales. According to information released by AliResearch,
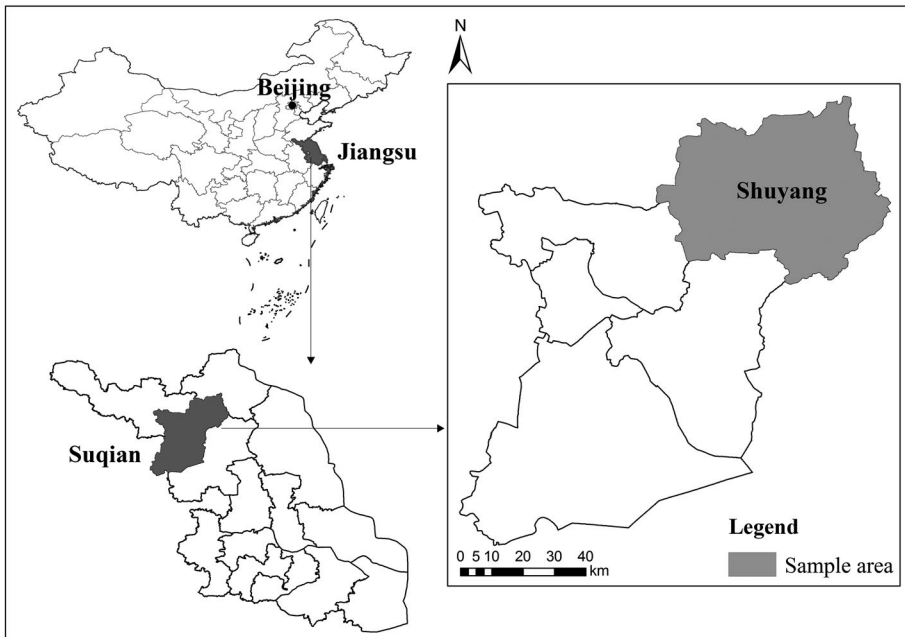
FIGURE 1 Location of Shuyang County

Shuyang County has been ranked among the top 3 for trading volumes of agricultural products on the Alibaba retail platform for three consecutive years.[4]

3.3 | Data collection

All data provided in this paper were collected through three rounds of field investigations conducted in May and June, 2016. We collected observations and conducted scheduled interviews. From carefully collected field observation, data can be obtained and investigators can further their understanding of respondents' working environments and behaviors (Whyte, 1943). For the scheduled interviews, we mainly interviewed county-level cadres; grass-roots cadres of the township level; representatives of Internet businesses; and other industrial entities, including local leading enterprises, foreign suppliers, and logistics and express companies. We then conducted a questionnaire survey. We randomly issued 500 questionnaires to 22 Taobao Villages, and 347 questionnaires were effectively recovered. Finally, we collected secondary data. To complement the first two methods, relevant secondary data were collected from internal documents assembled by the Shuyang County Bureau of Commerce.

4 | FINDINGS

4.1 | An integrated evolution model

As noted above, we argue that studies on the formation of agricultural e-commerce clusters should adopt three perspectives focused on the development processes of agricultural e-commerce clusters, dynamic mechanisms, and key elements of such formation. Through theoretical deduction and our case analysis of Shuyang County, the integrated evolution model shown in Figure 2 was developed.
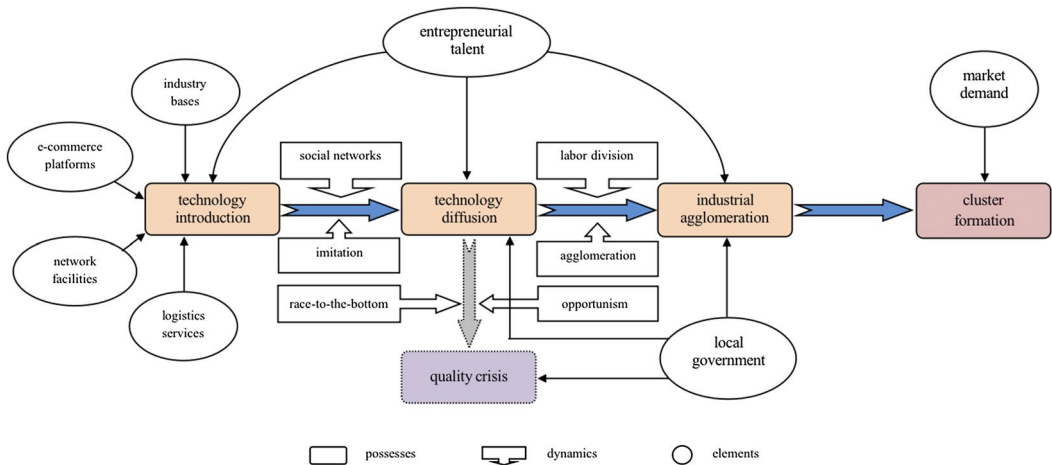
FIGURE 2 The formation of agricultural e-commerce clusters: an integrated evolution model

Regarding development processes, the formation of agricultural e-commerce clusters involves technology introduction, technology diffusion, quality crisis, and industrial agglomeration, which is in line with original industry clusters and especially with those found in rural China. However, the occurrence of the same path of development does not denote that the same facets of development are involved. For example, for industrial agglomeration, the agricultural e-commerce cluster involves both online and offline agglomeration, which means that there is not only an offline supply chain, but also an e-commerce service chain. As a result, a new form of cluster development with a mutually promoting double-chain emerges.

Regarding key elements, the formation of agricultural e-commerce clusters is inseparable from industrial bases, e-commerce platforms, network facilities, logistics services, entrepreneurial talent, local government, and market demand. For many original industry clusters, their formation did not initially require an industrial base which developed gradually. The formation of agricultural e-commerce clusters, however, relies heavily on the presence of a well-developed industrial base. For hardware facilities, the formation of normal industry clusters used to largely depend on road construction and transportation. Nevertheless, in addition to these basic traffic conditions, the formation of agricultural e-commerce clusters requires the presence of other elements such as network facilities, logistics services, and e-commerce platforms. Different types of entrepreneurial talent are specialized in different facets of agricultural e-commerce cluster development, including initiative, imitative, improvement-oriented, R&D, and service talent. The role of local government is mainly to promote technology diffusion, to enhance industrial agglomeration, and to address quality crises. Finally, online market demand serves as an external source and necessary condition for the formation of a cluster, which fundamentally determines the size of an agricultural e-commerce cluster.

In terms of dynamic mechanism, the diffusion of agricultural e-commerce clusters has benefited from rural social networks and imitation behaviors in reducing technology adoption costs and risks and in improving the success probability of successful entrepreneurship. Industrial agglomeration results from the various economic benefits brought about by a deepening of division of labor and geographical agglomeration. During cluster formation, a quality crisis may occur mainly due to a race to the bottom and to opportunistic behaviors among local farmers.

4.2 | Technology introduction: Industry bases, e-commerce platforms, network facilities, logistics services and initiative talent

The formation of agricultural e-commerce cluster begins with the introduction of technology, which is promoted through initiative talent with the support of an industrial base, e-commerce platforms, network facilities, and logistics services. In Shuyang County, the earliest e-commerce farmers ZC and ZX, who are regarded as initiative talent, first started to use the Taobao platform in 2006. At first, as conditions for e-commerce entrepreneurship were not as developed, online operations involved dedicating considerable time and energy. Therefore, initiative talents needed to be hard-working, persevering, patient, and open to exploration.

An agricultural e-commerce cluster reflects a dual realization of farmer e-commerce and e-commerce clustering in the sale of agricultural products. Farmers' e-commerce activities manifest in clusters and must depend on a certain number of industries. A strong industrial foundation can effectively reduce material costs, levels of risk, and learning costs for local farmers' e-commerce start-ups, increasing the probability of entrepreneurial success. Meanwhile, local beliefs and business acumen generated from the industrial foundation have an important impact on farmers' entrepreneurial decision-making. For instance, Shuyang has a long history of planting flowers and trees. The cultivation of flowers and trees began in the Tang Dynasty and flourished through the Ming and Qing Dynasties. As a result, the planting, enjoyment, and admiration of flowers are central to the cultural makeup of Shuyang.

Local natural conditions and human factors have benefited the flower and tree industries in Shuyang County. Located 34 degrees north latitude, Shuyang is positioned with the north–south climate transition zone and belongs to the warm temperate monsoon climate. The local climate is mild with an annual average temperature of 14.1°C, and both sunshine and rainfall are abundant with annual average relative humidity levels of 75%, creating very suitable conditions for growing and cultivating various types of flowers and trees. As a result, the area is also recognized as an ideal transitional location for flower transport from north to south, or vice-versa. Many rural residents of Shuyang County have less than 1 mu of average per capita cultivated land. In other words, the relationship between local residents and the land is strong. When people's communes were in operation, farmers were only concerned with grain outputs, and Shuyang had always been a poverty-stricken county, relying on grain from other regions. With the opening of China, to address poverty and lagging development, individual farmers began to use their spare time to plant flowers and trees, and they travelled extensively to sell them to their increase household income. After years of development, planting areas Yanji, Xinhe and Miaotou Townships have developed into large entrepreneurial conglomerations, including dozens of villages specialized in flowers and trees, and multiple flower markets. The solid industrial foundation that developed also made it easy for the earliest e-commerce farmers to select trees and flowers as products for their online stores.

Objectively, the realization of e-commerce development by farmers requires the emergence of a third-party e-commerce platform that is compatible with farmers' grassroots entrepreneurial tendencies. Similar to an industrial base, the e-commerce platform offered by Taobao reduces the net material, risk, and learning costs of business start-ups. Taobao is an entrepreneurial e-commerce platform for small and medium-sized enterprises and individual entrepreneurs attracting clients with low barriers to entry, low levels of risk, and ease of operation. The platform's low initial investment requirements provide grassroots entrepreneurs with access to the market and provide them the opportunity to test online sales. Most of the earliest Taobao entrepreneurs started their online store operations as a trial. After this trial, they discovered business opportunities made available through the platform and increased their level of investment to achieve a virtuous cycle. In addition, as it is

not difficult to establish and operate an online Taobao store, this is not a privilege available to only highly educated and professional persons. Furthermore, Taobao has a large consumer base, ensuring that farmers' e-commerce start-ups can eventually evolve into clusters. Taobao' large consumer base provides the platform with broad market capacities and a great potential for market segmentation. In a cluster, while all members sell the same types of products, competition concentration is weakened through a diversity of offline product types and specifications, and Internet businesses tend to distinguish themselves through personalized store design and customized operations and promotions, to attract a unique consumer base, which is why a large number of network merchants can survive and develop simultaneously.

Network facilities serve as the most basic infrastructure for engagement in e-commerce. When network facilities are not available, local farmers cannot connect with e-commerce platforms or complete online transactions with consumers let alone create an agricultural e-commerce cluster. The construction of communication network facilities started earlier on the industrial zone for flowers and trees in Shuyang County. In 2001, a broadband access network was first introduced. After accessing this broadband network, some farmers began to use online forums to sell flowers and trees on the Internet. As this approach represents the most primitive form of e-commerce, only entailing information release and acquisition, it has played a limited role in the sale of flowers and trees in Shuyang County. In 2006, some seedling farmers began to actively explore the potential of e-commerce platforms for online marketing. By 2007, broadband networks had been distributed to every village of Shuyang County, laying solid foundations for network facilities to develop agricultural e-commerce clusters.

The logistics and express sectors maintain a close relationship with the development of e-commerce, and both co-evolve and promote one another. For an e-commerce startup, geographic location and traffic construction are central to logistical conditions. Shuyang is located a 45-min drive away from Huaian Lianshui Airport, a 50-min drive away from Lianyungang Baitabu Airport and 1.5-hr drive away from Xuzhou Guanyin Airport. The Beijing–Shanghai Expressway passes through five interchange entrances and exits, and National Highway 205 and provincial highways 324, 326, and 245 run through it. The Xinchang Railway includes a freight station in Shuyang that is directly connected to the Longhai, Jiaoxin, Suhuai, and Ningqi Railways through the hinterland. From the start of the 21st century, the flower and tree industries in Shuyang have adopted a development model to keep pace with road construction. For example, the construction of Zhaxin Road in 2002 and of Xintong Road in 2007 led to the expansion of planting areas along both sides of these main roads, so that Shuyang's flower and tree sectors could maintain steady development and form a transportation network with both internal and external connections. Although early express logistics outlets were not directly based on flower and tree production areas, sufficient road infrastructure provided support for the practices of early e-commerce farmers or at least an absence of rigid constraints on logistical conditions.
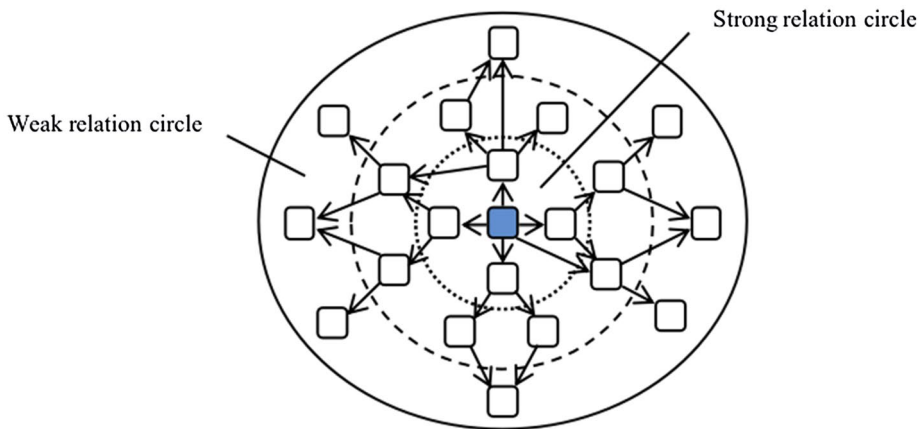
4.3 | Technology diffusion: Social networks, imitation behaviors, imitative talent, improvement-oriented talent, and local government

The passage from the introductory stage to the diffusion stage of e-commerce technologies benefits from the dynamic role of social networks and imitation behaviors in enhancing the expected benefits and reducing the costs of technology adoption. Rural China is an acquaintance society, in which rural residents operate within a closely intertwined social network. They frequently come into contact with people with kinship, friendship, geographic and industrial ties, supporting a fast rate of information dissemination. In areas with established industries, industrial links between internal subjects are more closely related. The term imitation refers to the imitation of the successful behaviors of technological pioneers of the same field, reflecting a form of social learning and conformity. By mimicking

e-commerce pioneers, imitators can mitigate the uncertainties related to starting a new business, obtain relevant information according to the real experiences of pioneers, improve their judgments of outcomes and opportunities for technological adoption, shorten trial periods and reduce errors. Generally, acquaintances of e-commerce pioneers are more likely to imitate than non-acquaintances, as acquaintances enjoy stronger net benefits from imitation than non-acquaintances. Rather, acquaintances have stronger incentives to engage in imitation behavior (Zeng et al., 2015). First, acquaintances are more aware of the actual profits of imitators than non-acquaintances. Second, acquaintances are more likely to succeed at imitation than non-acquaintances, since with the help of earlier entrepreneurs, acquaintances face much less barriers to imitation and can maintain stronger information flows to solve problems that emerge throughout the process of imitation. Third, acquaintances incur lower learning and risk costs than non-acquaintances. The success of initiative-focused talent represented by ZC and ZX soon attracted the attention of the villagers who were close to them and then continually triggered imitative learning effects, forming a wave-like diffusion pattern (Figure 3).

As is shown in Table 1, 29.19% of the e-commerce farmers was in frequent contact with the first Taobao entrepreneur in the village before opening their online stores, and by the time they were surveyed, their online stores had been operating for an average of 48.08 months. In total, 52.31% of the e-commerce farmers noted being in occasional contact with the village's first Taobao entrepreneur and stated that their online stores had been operating for an average of 44.44 months. Only 18.50% of the e-commerce farmers said that they had never been contacted before and that their online stores had been operating for 41.12 months on average. Hence, most e-commerce farmers maintain a certain level of contact with the village's first Taobao entrepreneur and the stronger this level of contact is, the more likely they are to have been affected and the earlier on they have been to open an online shop as

FIGURE 3   The wave-like technology diffusion pattern based on social networks

TABLE 1   Familiarity with the first Taobao entrepreneur and online operation period

Question	Group	Ratio (%)	Average online shop operating period (month)
Degree of contact with the first Taobao entrepreneur in the village	Frequent contact	29.19	48.08
	Occasional contact	52.31	44.44
	No contact	18.50	41.12

the first entrepreneur in the village did. The questionnaire also shows that 85.8% of the e-commerce farmers reported being influenced by their relatives and friends.

In processes of e-commerce technology diffusion, not all imitative behavior can be successful. Only those farmers who exhibit initiative and spiritual qualities and who imitate successfully can be regarded as imitative talent. In addition, imitative talent does not simply copy the successful model, as it can sometimes act as improvement-oriented talent at the same time. For Shuyang, innovations that improvement-oriented talent are embodied in three areas. The first relates to the improvement of logistics packaging. Some individual e-commerce farmers have explored effective packaging methods such as triangular carton packaging, air column coil packaging, and succulent fastening packaging, which can protect flowers and trees from pressure and keep them intact in packaging. The second relates to the expansion of categories of online goods. Through imitation management, some farmers have chosen to offer new products, resulting more than 3,000 flower and tree products being offered online from Shuyang including bonsai trees, household plants, succulents, freshly cut flowers, dried flowers, materials, seedlings, etc. The third factor relates to the improvement of online store management services. For example, while the first e-commerce farmers only used one picture to advertise a certain variety of bonsai on their online stores even though they offered different bonsai trees, later on some e-commerce farmers started to take pictures of each bonsai tree offered and to encode them to allow customers to purchase a specific bonsai pictured.

The local government has also played an important role in promoting the diffusion of e-commerce technology. While relying on rural social networks to achieve a spontaneous dissemination of e-commerce, the Shuyang government has further promoted the diffusion of e-commerce technologies by encouraging publicity, promoting entrepreneurial models, creating an entrepreneurial atmosphere, organizing training, providing credit support, upgrading network facilities, and applying preferential network fees along with other measures.

4.4 | Quality crisis: A race to the bottom, opportunism, and local government

Any developing industry cluster, especially in early stages, can encounter a quality crisis, and if it is not supported by effective governance, the cluster will tend to disappear (Ruan, Shi, & Zhang, 2014). Agricultural e-commerce cluster formation processes also create a race to the bottom, leading to quality crises. In Figure 4, Curve R shows an initially slow and then accelerated increase in online store
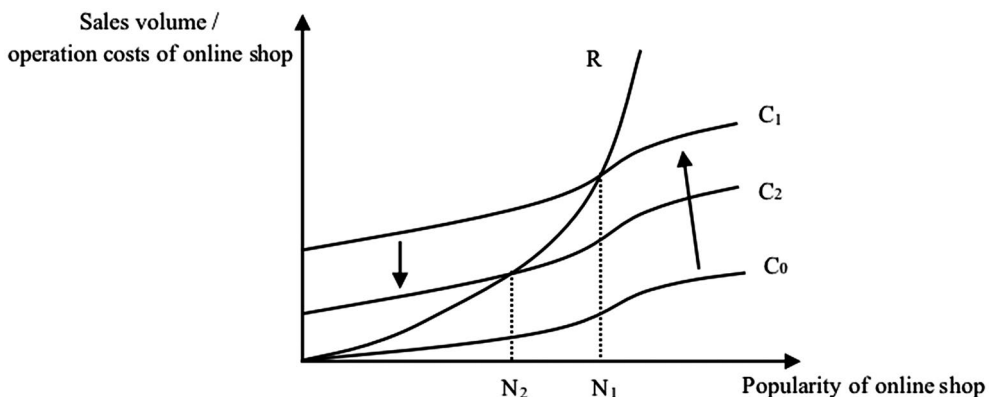

FIGURE 4 Race-to-the-bottom of late-model e-shops in early stages of operation

sales following the growth of online store popularity. For a newly created online store, its online store popularity accumulation costs should be relatively low, as there are fewer competitors in early periods of e-commerce. While cost curve C_0 is observed in the early period, thereafter, with an increasing number of households operating online stores, popularity accumulation costs should continue to rise, causing curve C_0 to transform into curve C_1. This means that only when the popularity of online stores increases to more than N_1, online stores start to generate profits. In reality, some late-model farmers seek low-grade, low-price products in early stages of online store development with the purpose of achieving lower costs of online store popularity accumulation. This decrease in online store popularity accumulation costs converts the cost curve from C_1 to C_2 and shifts the profit point from N_1 to N_2. As a result, race-to-the-bottom competition has become a profitable and rational model in early stages of late-model online store operation. However, such continuous competition can result in the development of inferior products and destroy a cluster's reputation.

Another mechanism that can result in a quality crisis in the formation of an agricultural e-commerce cluster pertains to opportunistic behavior. Opportunism refers to the fact that people do not disclose all available information and engage in other self-interested activities at the expense of others under conditions of information asymmetry. In an agricultural e-commerce cluster, some e-commerce farmers may use consumers' (especially first-time consumers) ignorance of product information or limited abilities to measure product quality and sell low-quality products rather than high-quality products. For example, the introduction of e-commerce has led to a sharp increase in demand for local specialty products, resulting in a shortage of supply. At this point, some e-commerce farmers may sell consumers similar products from other areas as substitutes for local specialty products. When there is no standardization, unified certification or supervision on the quality of local products, customers cannot effectively distinguish between products of varying quality over the short term and with limited and similar product descriptions and images alone. Under such conditions, opportunistic behavior can easily occur or even prevail in the market.

In the case of Shuyang, with the rapid spread of e-commerce technologies, more and more farmers have joined the ranks of e-commerce entrepreneurship. As product diversification has occurred, inconsistent product quality, an increased availability of low-grade and inexpensive products, individual online merchants selling fake seedlings (most serious from 2014 to 2015), and resulting complaints from consumers and negative comments given on the Internet have compromised Shuyang's reputation as "China's Hometown of Flowers and Trees." To put an end to the sale of fake goods and to guard against quality crises and the cluster recession that has resulted, the Shuyang government has taken various measures. It has first endeavored to establish a special organization responsible for supporting the long-term standardization of network transactions and for improving the network environment. It has also posted enterprise credit information on the Internet to make credit information on e-commerce enterprises more readily available. At the same time, through the implementation of the abnormal list management and blacklist systems, credit-breaking e-commerce enterprises in the network are now restrained based on trading platform qualification reviews, bank loans, honors obtained, or other aspects. Third, the local government also guided enterprises and farmers in establishing trade associations and industry associations including the Shuyang Flower and Tree Association, Shuyang Bonsai Association, Shuyang Seedling Chamber of Commerce and Shuyang Network Entrepreneurs Association, to improve self-discipline and credit management in the sector, to encourage honest online credit management measures, and to organize the annual selection of honest enterprises. Fourth, large-scale events such as the "China Shuyang Flower and Wood Festival," "China Bonsai Exhibition," "China Flower Exposition" and "China Taobao Village Summit Forum" have improved levels of regional popularity. In addition, a special fund of 10 million yuan has been allocated for online transactions especially used to settle disputes. By the end of March 2015, 342 Taobao disputes had been

managed across Shuyang County, involving 6,431,000 yuan in payments and causing the settlement rate to reach 100%. Under the local government's administration, the sale of fake products in Shuyang has been effectively curbed, and no further large-scale quality crises have occurred.

4.5 | Industrial agglomeration: Economies of labor division, economies of agglomeration, R&D talent, service talent, and local government

Industrial agglomeration occurs when a large number of leading and supporting industrial bodies come into being or concentrate in the same area. This process is central to the formation of all industry clusters. Agglomeration essentially involves the organic combination and cyclical accumulation of division and agglomeration economies. A direct consequence of the local spread of e-commerce technologies involves an increase in the number of farmers engaged in e-commerce in the same region. To a certain extent, this produces an economy of labor division, which involves the division of labor in enterprises and industries based on a group of farmers engaged in e-commerce that is constantly deepened, through labor involving cultivation, planting, processing, packaging, transportation, R&D, operations, marketing, customer service, art design, editing, photography, training, graphic modeling, and so on. The degree of specialization is constantly deepened, to improve the competitiveness of e-commerce. Deepening the division of labor helps promote the development of e-commerce farmers, but different industrial bodies will always choose to concentrate geographically while dividing labor, as the deepening of labor division leads to higher organizational and transaction costs. First, the deepening of the technical division of labor strengthens internal links of labor division and lengthens the management chain, which increases organizational costs. When the organizational cost exceeds the market transaction cost, an enterprise will outsource some links for the technical division of labor, deepening the social division of labor. Second, a deepening of the social division of labor will increase transaction costs between enterprises. To cope with this, many related enterprises choose to concentrate in space, which can accelerate transaction rates and reduce location costs, rendering the trading space and trading object relatively stable, making it easy to overcome transaction uncertainties, and saving costs required in searching for market information. As spatial agglomeration reduces transaction costs for enterprises, the deepening of labor divisions can evolve further, forming a positive feedback cycle.

The industrial agglomeration of agricultural e-commerce cluster formation in Shuyang County is characterized by three features. It is first characterized by the construction of supply network in specialized county, township, and village markets. With the rapid spread of e-commerce technologies and the deepening of labor division among farmers, some local flower and tree planting farmers (and enterprises) have started to act as suppliers for e-commerce farmers. Among them, some farmers (and enterprises) have not entered specialized markets or industrial parks, and have come to supply or tacit agreements with individual e-commerce farmers. Other farmers (and enterprises) have entered trading markets or industrial parks, while supplying to a number of e-commerce farmers. Due to prominent effects of the local market, a large number of external planting or material enterprises have come to Shuyang to invest in professional markets or industrial parks, providing products through local e-commerce sellers. Based on original markets such as the World of Flowers and Trees, Zhouquan Bonsai Market, and Xinhe Flower Market, Shuyang has created demonstration parks and specialized markets including the Sutai Flower and Tree Industry Demonstration Park, Gengwei Succulent Cultivation Park, Xinhe Wocai Internet Horticultural Base, Miaotou Flower and Seedling Market, and Jieqiao Flower and Tree Material Professional Market, forming supply networks at the county, township, and village scales (as is shown in Figure 5). These high-quality flower and tree cultivation enterprises from across the country have created R&D talent that has supplied large quantities of
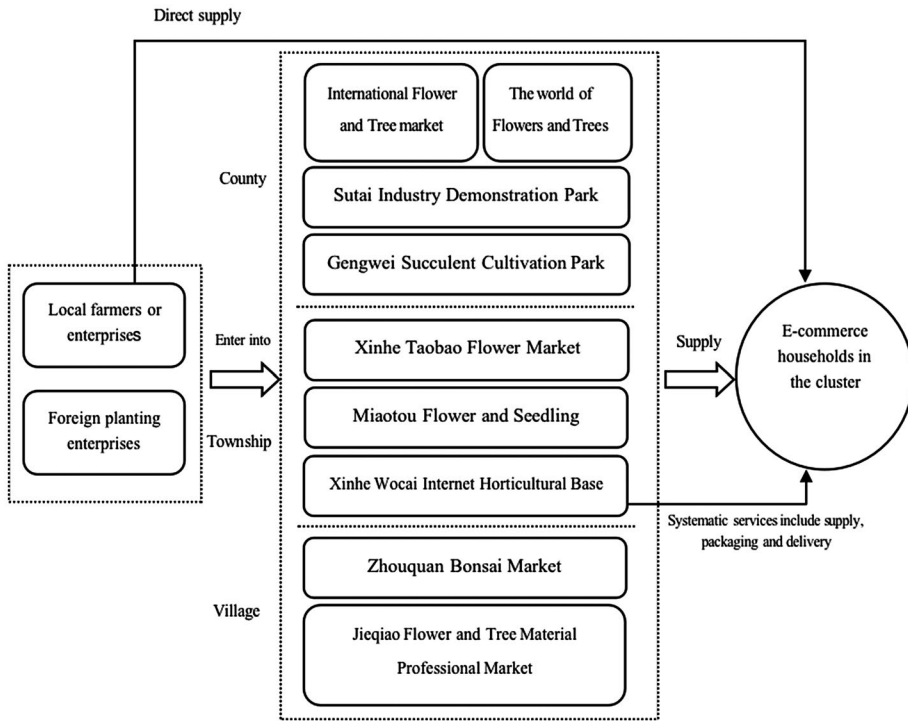
FIGURE 5 Unprecedentedly developed supply networks of flowers and trees in Shuyang

specialized cultivation products for local e-commerce farmers in the process of competing with one another. Various different conventional flowers, imported flowers, rare flowers, and so on are now provided. Some entrepreneurs have even developed a new e-commerce channel for directly supplying products through consignment sale.

Second, a relatively well-developed logistics express service system has been established. Along a major street within the Xinhe Township, an express street has been developed since 2012. The street hosts more than 20 express companies, including Zhongtong, Huitong, Guotong, Shunfeng, Postal, Homestead Express, and Longbang. However, the express street is increasingly being affected by storage space shortages, traffic congestion and poor environmental hygiene. To properly support express delivery companies and facilitate the circulation of goods through the Internet, the Xinhe Township began to build an e-commerce express delivery park in August 2015 of 11,000 m^2 with a construction area of 7,500 m^2. The park has attracted major express delivery companies across the township, governed by unified management systems, and allocates automated and standardized large-scale packaging equipment, accelerating package processing speeds and carrying capacities and supporting the shipments from the Xinhe Township to all regions of the country.

Third, service systems for business development and upgrades have been put in place. In addition to flower and tree planting, material production and express logistics enterprises, Shuyang attracts many professional personnel and business service enterprises that support business development and provide technical training, store design, product photography, visual art, trademark design, and other supporting services in succession, forming a service system that promotes e-business development and upgrading (as is shown in Figure 6).

The government also plays a positive role in industrial agglomeration. To support e-commerce development, the Shuyang government has accelerated the speed and breadth of industrial agglomeration
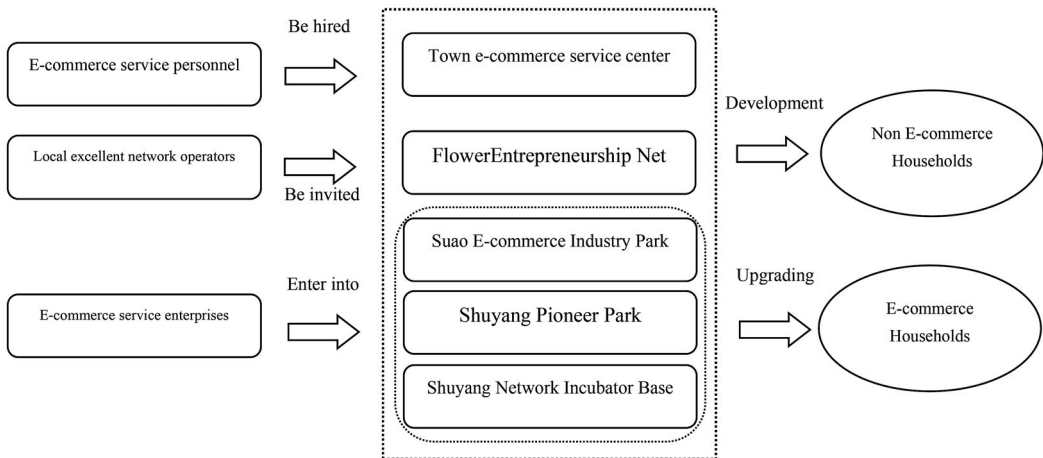
FIGURE 6   E-commerce business development and upgrading service systems in Shuyang

and has enhanced agglomeration effects by broadening major logistical trunk roads, supporting the construction of industrial parks and professional markets, introducing preferential policies for talent introduction and investment promotion, and encouraging talent that has left the area to return home and start their own businesses.

Finally, it should be noted that the formation of agricultural e-commerce clusters in Shuyang County is inseparable from the presence of sufficient online market demand. Such online market demand is related to both external and internal factors. External factors include the steady development of the national economy and increasing resident income and consumption levels, rapid growth in the number of Internet and mobile phone users, an expanding scope of logistics and distribution services, and higher operating costs of physical stores since online prices similar commodities are significantly lower than the retail prices of physical stores. The main internal factors involved include the presence of flower and tree products in Shuyang suited for customer to customer (C2C) business models (as packaging problems have been effectively overcome), that cover a large segmentation area, and that enjoy a strong regional reputation.

5 | DISCUSSION

Overall, the Taobao Village cluster is an e-commerce cluster where in farmers act as the main adopters and agricultural products act as the main products and that realizes multi-village development. The main connotations and characteristics of this e-commerce cluster are as follows. First, past industry clusters have involved offline agglomeration while this e-commerce cluster is both online and offline. The main industry engaged in e-commerce has served as an indispensable part of the cluster, carrying out online marketing on one or more third-party e-commerce platforms. Second, products of this cluster mainly include agricultural products. In other words, agricultural products are its main products with the largest trading volumes. Third, the main actors engaged in e-commerce are farmers, including ordinary farmers, farmers registered as individual businesses and agricultural small and medium-sized enterprises registered as companies. These entities have achieved C2C e-commerce, sidestepping numerous intermediaries of the original chain, such as farmers' brokers, wholesale markets in the production area, first- and second-tier wholesale markets in the sales area, community

farmers' markets, etc. and directly connecting with end consumers and thus greatly reducing the circulation costs of agricultural products. Finally, this e-commerce industry cluster can pass the geographic scope of one village and achieve multi-village development.

Our case study of Shuyang County shows that the development of regional agricultural e-commerce is a systematic project, requiring the participation of entrepreneurs, net goods suppliers, supporting product manufacturers, express logistical enterprises, e-commerce service enterprises, local governments, industry associations and other relevant subjects to ultimately construct a healthy e-commerce system to realize mutual promotion and development both online and offline. Such development upgrades the entire agricultural industry by introducing e-commerce systems, enhancing the competitiveness of agricultural products, expanding regional popularity, and ultimately increasing farmer incomes and promoting rural development. By contrast, when a product is simply transferred to online sales and the offline industry has not undergone much improvement or change, a region has not truly achieved e-commerce development. In the end, the Internet is only a tool, online platforms are simply channels, and the offline industry is the source. However, in reality, in pursuit of superficial political goals, some local governments only care about the number of local online shops in operation and the scale of e-commerce transactions without developing a systematic development plan for the e-commerce industry and while neglecting the construction of offline industry support system and product competitiveness, which is not desirable.

The original industrial base has been a key factor in the formation of agricultural e-commerce cluster in Shuyang County, showing that e-commerce serves as "icing on the cake" instead of "turning trash into treasure." Local governments should not only be aware of the positive influence of e-commerce development for regional agricultural industries, but must also correctly recognize the premise and logic of how e-commerce can play a significant role. The blind development of e-commerce regardless of basic conditions actually reflects an overestimation and exaggeration of the role of e-commerce. Only safe, high-quality, stable, and trustworthy agricultural products can be connected to a broad market by means of e-commerce, thus ensuring better prices and higher sales. Over the short-term, agricultural production areas with Chinese characteristics will present clear advantages in the development of e-commerce, including the Zhejiang Anji white tea production area, Shandong Qixia apple production area, Ningxia Helan Chinese wolfberry production area, Heilongjiang Wuchang rice production area and other agricultural production areas with well-known characteristics, which in theory all exhibit the potential for e-commerce development. Local governments with distinctive agricultural production areas should make full use of the advantages of existing industrial bases in introducing e-commerce, adjust industrial support and development strategies in a timely manner, actively embrace the new Internet economy, and strive to foster a positive environment for e-commerce development in the main section of the cluster. Meanwhile, e-commerce development, the construction of offline support systems and the promotion of product competitiveness should always be a top priority to prevent quality crises, a loss of cluster reputation or industrial decline. For agricultural production areas in general, local governments should follow a long-term vision; exhibit patience and avoid pushing for premature success; and not attend to trivialities neglect fundamentals or blindly follow the "e-commerce craze" and instead focus on the optimization of offline industries and on vigorously promoting the standardization, quality and branding of agricultural products.

The formation of the agricultural e-commerce cluster in Shuyang County demonstrates the creativity of rural talents and rural social learning effects that can emerge from information technologies. In addition, e-commerce can achieve cross-village development through the widespread segmentation of product classifications or by using product heterogeneity to offset the transparency and competitiveness of e-commerce markets. Our study of Shuyang County also highlights the importance of clustering to the development of regional e-commerce. For rural household e-commerce, relative to

a decentralized non-clustering state, the realization of e-commerce clustering helps further reduce transportation and transaction costs, attract external resources, form cluster networks, enhance regional popularity, and achieve strong development. For industrial agricultural areas in development with potential for e-commerce clustering, local governments can meet development needs by improving infrastructure, expanding industrial and logistics parks, and introducing policies for talent introduction to accelerate industrial agglomeration and enhance the economic effects of agglomeration.

In addition, it should be noted that while we focus on a single case study, the authors hope to construct a generalized theoretical model based on the case of Shuyang County that can explain similar phenomena. The authors have also attempted to make this theoretical model reflect more useful information on the case rather than sacrificing or simplifying a large number of related factors. We sought to strike a balance between abstraction and detail with our model. While Shuyang County has unique characteristics, it presents socioeconomic and external development patterns similar to those observed in other regions of China. The development of agricultural e-commerce clusters is thus not only viable for Shuyang County. To verify the external validity of our theoretical model, we conducted a comparative analysis on another agricultural e-commerce cluster located in the Linan District of the city of Hangzhou in Zhejiang Province, which mainly produces processed dried agricultural products such as hickory nuts. We found the model to be applicable to this case as well. Moreover, practices and experiences of the Shuyang County government in the formation of its agricultural e-commerce cluster have been widely promoted and have had a strong effect. Several government officials from other counties have traveled to Shuyang to discuss and learn from such experiences.

In particular, the Taobao Village e-commerce cluster in Shuyang County reflects only one form of regional agricultural e-commerce cluster development, and not all modes of agricultural product e-commerce development are the same. Other regions can also explore their own development mode according to their local conditions. Theoretically, in addition to entrepreneurship-driven modes of development, there are cooperative-, agricultural association-, e-commerce service provider-, and platform enterprise-driven modes of development, for instance. However, regardless of the mode of development involved, local governments should ensure that the dividends of e-commerce development ultimately benefit the majority of farmers.

6 | CONCLUSION

In recent years, in some developing countries, and in China in particular, there has been a rapid proliferation of digital dividends originating from online resources in rural and agricultural areas with the continuous popularization of network infrastructure and with the rapid development of information industries, creating new entities such as agricultural e-commerce clusters. Thus, the Internet is increasingly becoming a powerful means to enhance farmers' abilities to access to the broader market. From a theoretical review of industry clusters, we propose that when studying a specific type of industry cluster, formation mechanisms should be examined based on three factors: dynamic mechanisms, formative elements, and development processes. From our case study of Shuyang County, an integrated evolution model is also proposed to illustrate agricultural e-commerce cluster development. As we can see from our model, agricultural e-commerce cluster formation involves technology introduction, technology diffusion, quality crises, and industrial agglomeration. The formation of agricultural e-commerce clusters cannot be separated from development elements such as industrial bases, e-commerce platforms, network facilities, logistics services, entrepreneurial talent, local government, and market demand. E-commerce technology diffusion benefits from rural social networks and imitation behaviors, which reduce costs of technology adoption. Industrial agglomeration occurs

in economies showing a deepening of labor division and geographical agglomeration. During cluster formation, a quality crisis may occur mainly from a race to the bottom and due to the opportunistic behaviors of local farmers. The process observed in Shuyang county shows that the development of regional e-commerce is a systematic project. The development of e-commerce lies in industrial upgrading resulting from the systematic renovation of the entire agricultural industry. At the same time, e-commerce involves addressing difficulties associated with selling agricultural products and not all agricultural products offered in all regions can be supplemented with e-commerce to solve this problem. The governments of developing countries should not only realize the significance of e-commerce for the development of regional industries, but must also recognize how e-commerce can play a prominent role in this process. In any case, our study of Shuyang, China serves as a positive demonstration of how the developing world can use information technologies to address problems related to agricultural product sales and small farmers' development in different regions and can show policy makers how information technologies can shape and transform rural areas. We anticipate that in the near future, with the continual narrowing of differences in Internet accessibility between urban and rural areas and with the rapid development of courier, finance, training, and other supporting industries, it will become more common for farmers to access markets through the Internet.

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ENDNOTES

[1] The concept of the Taobao Village was first defined by AliResearch (founded in April, 2007 and belonging to Alibaba Group) to refer to a large number of e-businesses in a village using Taobao as their main trading platform, based on the Taobao e-commerce system, thereby forming an Internet business cluster with agglomeration effects. A Taobao Village must have the following three features: first, businesses must be based in rural areas where the administrative village is used as a measurement unit; second, annual e-commerce transactions originating from the village much reach 10 million yuan; third, the number of active online shops must exceed 100 or the proportion of active online shops must represent more than 10% households in the village. According to these three standards, AliResearch creates an annual list of Taobao villages called the *China Taobao Village* Research Report, released at the end of each year. Villages meeting these standards are awarded an honorary *China Taobao Village* plaque.

[2] Based on the concept of the Taobao Village, AliResearch further defined the Taobao Village cluster, in which there are no less than 10 Taobao Villages.

[3] Mu is commonly used in the calculation of farmland in China. One hectare is equal to 15 mu.

[4] Data source: AliResearch's official website, *Ali Agricultural Product E-commerce White Book 2014*, and *Ali Agricultural Product E-commerce White Book 2015*.

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