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Xiaoshan Yang, Yan Jiang, Xiaowei Chen, Fu Jia

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ICT-empowered rural e-commerce development in China: an adaptive structuration perspective

Xiaoshan Yang

Newhuadu Business School,
Minjiang University,
No. 200 Xiyuangong Road, Shangjie Town,
Minhou County, Fuzhou City 350108,
Fujian Province, China
Email: yangxiaoshan@nbs.edu.cn

Yan Jiang*

Newcastle University Business School,
Newcastle University,
5 Barrack Road,
Newcastle Upon Tyne NE1 4SE, UK
Email: yan.jiang2@newcastle.ac.uk
*Corresponding author

Xiaowei Chen

School of Civil Engineering and Architecture,
Zhejiang Sci-Tech University,
Hangzhou, China
Email: chenxiaowei@zstu.edu.cn

Fu Jia

The York Management School,
University of York Heslington,
York YO10 5GD, UK
Email: fu.jia@york.ac.uk

Abstract: The emergence of e-commerce has rejuvenated China's backwards and poor remote rural areas. However, knowledge about how information and communication technology (ICT) develops e-commerce business in rural areas is still limited. From the perspective of adaptive structuration theory (AST), we conducted an in-depth case study of four typical e-commerce companies in China's rural areas. The findings suggest that, facilitated by ICT, the development of rural e-commerce consists of the formation of platform strategy (including quality management and revenue structure) and the enactment of related services (including supply chain management (SCM) and marketing services). This process is influenced by firm-specific characteristics and ultimately leads to the intended/unintended outcomes for e-commerce companies and rural development. This study contributes to the information

systems (IS) literature by explaining how e-commerce companies utilise ICT to develop their e-commerce business in rural areas from a novel AST perspective.

Keywords: ICT; e-commerce business; case studies; adaptive structuration theory; AST; China.

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Biographical notes: Xiaoshan Yang is an Associate Professor in Management at Minjiang University, Fuzhou, China. She obtained her PhD at the Fujian Agriculture and Forest University in China. She published extensively at both international and Chinese journals such as: *International Journal of Environmental Research and Public Health (SSCI)* and *International Food and Agribusiness Management Review (SCI)*. Her research interest lies in e-commerce business model innovation and business ecosystem.

Yan Jiang is Lecturer in Operations and Supply Chain Management at the Newcastle University Business School, Newcastle University, UK. She obtained her PhD and MSc at the University of Rome 'Tor Vergata' in Italy. Her main research interests are sustainable global sourcing, sustainable SCM, and e-commerce innovation. She has published in leading international journals such as *British Journal of Management*, *International Journal of Production Research*, *Industrial Marketing Management*, *Journal of Business Research*, and *SCM: An International Journal*.

Xiaowei Chen is an Associate Professor in Urban Planning, School of Civil Engineering and Architecture, Zhejiang Sci-Tech University, China. She obtained her PhD at Zhejiang University, and conducted her post-Doctoral study at China Academy for Rural Development (CARD), Zhejiang University, China. She is the Visiting Research Fellow of the University of York Management School, UK, a member of Expert panel in the field of Zhejiang Village Construction and Development Research Institute, China. Her main research interests include rural development and planning, rural governance and rural E-commerce. She has published in leading international journals such as *SCM: An International Journal*, *Industrial Marketing Management*, *Business Strategy and the Environment*, *Journal of Cleaner Production* and *International Journal of Logistics Research and Applications* among others. She serves as a regular reviewer to *Journal of Cleaner Production (JCP)* and *International Food and Agribusiness Management Review (IFAMR)*.

Fu Jia is a Chair (Full) Professor of SCM and Director of Sustainability and Resilience Theme at the University of York Management School, England. He is also the Director of Business, Nature and Value (BNV) Research Centre at York and currently leads a number of projects funded by Newton Fund, ESRC, EPSRC and industrial sources related to SCM and e-commerce both in the UK and in China. He has published extensively in leading international OSCM journals such as *JOM*, *IJOPM*, *JBL*, *IJPE*, *IJPR*, *TRE*, *SCMIJ*, *JPSM*, *JCP* and *IBR* among others.

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1 Introduction

Currently, many rural residents in emerging economies continue to live in a deprived condition, which often leads to out-migration to cities for better opportunities (IFAD, 2011). This not only causes social impacts such as rural hollowing and empty-nest family issues but also perpetuates a vicious circle, in which growth is concentrated in cities and urban–rural rifts deepen (United Nations, 2013). Since the early 1990s, the development of information and communication technology (ICT) has been promoted as a way out of such deprivation of rural communities by offering rural communities access to, for example, education (distance learning), healthcare (telemedicine), and markets (e-commerce) (Tim et al., 2021; Leong et al., 2016; Njihia and Merali, 2013; Urquhart et al., 2008; Tsiligirides, 1993). As the developing country containing the largest rural population in the world (554 million by 2019) (World Bank, 2020), China has increasingly emphasised the role of ICT in rural development and revitalisation (e.g., the '2019–2025 Development Plan' issued for digital agricultural and rural development) (State Council of China, 2020).

Such rural development enabled by ICT has traditionally been driven by governments (Tim et al., 2021), following the top-down development approach (Kretzmann and McKnight, 1993; Madon, 1992), e.g., the aforementioned distance learning and telemedicine. Although it has been proven to be powerful, disadvantages have also been found to be associated with this approach, such as dependency of rural communities on external actors, including government, NGOs, and social enterprises (Leong et al., 2016; Sen, 2008). Meanwhile, long-term and sustainable rural development requires the emergence of local leaders who can effectively encompass the potential of ICT to create e-commerce businesses and further-reaching impacts (Pan and Zhang, 2020; Cui et al., 2019; Ersing, 2003). Hence, the other approach is proposed and acknowledged whereby rural development is led by local e-commerce enterprises (Leong et al., 2015; Mansuri and Rao, 2004). The emergence of e-commerce in China's rural area is considered a typical epitome of this approach. However, empirical evidence of such an approach is limited. There have been calls for studies to determine ''how'' to do this.

Exploring the local-led approach for which local e-commerce enterprises are also platform leaders requires the understanding of two key challenges: technological challenges and business process challenges (Gawer and Cusumano, 2015). First, ICT is the key to platform-based e-commerce; the features of ICT that are adopted by local e-commerce enterprises provide the preconditions for developing the rural e-commerce process (Wu et al., 2020; Leong et al., 2016). Second, ICT capability must be translated into a higher-order process capability to achieve the desired outcomes (Boudreau and Hagiu, 2009; Rai et al., 2006). Such process capability includes both intraorganisational processes, such as platform strategy (Kim, 2016), and interorganisational processes, such as supply chain services (Lin et al., 2015). Unravelling these processes is the essence of understanding rural e-commerce development. Accordingly, our study aims to examine the features of ICT that are adopted by local e-commerce enterprises and the rural e-commerce process enabled by ICT. The research question set in this study is as follows:

- How do Chinese e-commerce companies utilise ICT to develop e-commerce processes for rural development?

To answer this question, we conduct in-depth case studies of four e-commerce enterprises in rural China from the perspective of adaptive structuration theory (AST) (DeSanctis and

Poole, 1994). This study makes three contributions to the information systems (IS) literature. First, it provides empirical evidence of rural e-commerce development led by local e-commerce companies. Five themes of developing rural e-commerce led by e-commerce companies are revealed, i.e., ICT, influencing factors, platform strategy, related services, and intended/unintended outcomes. This can be generalised for developing rural e-commerce in other rural areas in China or even in other emerging economies. Second, through the AST lens, the ways in which the aforementioned themes interact with each other are further elaborated, which deepens the knowledge of ICT-empowered rural e-commerce business. Third, to the best of our knowledge, this study is the first attempt to investigate the impact of ICT on rural e-commerce from the perspective of AST. By extending AST from a group decision-making context to a rural e-commerce context, AST is proven to be a powerful lens through which to investigate ICT-related development, such as e-commerce.

The rest of the paper is structured as follows. Section 2 provides a review of relevant bodies of literature and the underpinning perspective (i.e., AST). Section 3 presents the methodology of case studies, which is followed by a within-case analysis and cross-case analysis in Section 4. Section 5 further discusses the case findings through the AST perspective and develops a conceptual framework consisting of a set of propositions. Finally, this study concludes in Section 6 with a summary of the contributions and limitations.

2 Literature review

2.1 ICT: infrastructure and capabilities

E-commerce can be investigated from the perspective of the infrastructure of its ICT and the capabilities created by this infrastructure (Sun et al., 2018; Rai et al., 2006; Zhu, 2004). Such infrastructure is represented by the intensity of ICT, which is based on several levels of an organisation's data processing architecture and networks (Zhu, 2004). The utilisation of ICT by an e-commerce business is often reflected on its digital platform. A well-established digital platform is more than individual physical components; it requires standards for the integration of data, applications, and processes to be negotiated and implemented to achieve real-time connectivity (Rai et al., 2006; Ross, 2003; Weill and Broadbent, 1998). The capabilities created by such infrastructure measure the functionalities of a company's website, as the internet is a new channel for reaching customers, and the web serves as a gateway for dealing with customers and suppliers in the internet age. These functionalities may range from static information to online order tracking and from digital product catalogues to personalised features tailored to customers' needs (Zhu, 2004; Kalakota and Whinston, 1997).

The infrastructure of the digital platform and the capabilities created mirror a company's strategic intent to use the internet to share information, facilitate transactions, improve customer service, and strengthen back-end integration (Kohtamäki et al., 2019; Coreynen et al., 2017; Leong et al., 2016). The platform functionalities created by digital infrastructure can help build customer and supplier relationships across the supply chain (Zhu, 2004). In a two-sided market, a well-established digital platform enables the consistent and real-time transfer of information between platform-related and supply chain-related applications and functions that are distributed across partners (Rai et al.,

2006). Overall, the digital infrastructure and capabilities created indicate a firm's ability to interact with its customers and business partners and to conduct e-commerce business over the internet.

2.2 E-commerce

E-commerce has become one of the most important topics in IS studies (Cui et al., 2019; Singh et al., 2018). It is considered to play a critical role in sustainable rural development in developing countries (Cui et al., 2017; Datta, 2011; Avgerou, 2002). E-commerce, enabled by ICT, encompasses a series of processes by which to achieve consumerisation and reformation (Sun et al., 2018; Lin et al., 2015; Rai et al., 2006). According to Rai et al. (2006), the infrastructure of ICT represents a lower-order capability but can be leveraged to develop a higher-order process capability, which reflects both intraorganisational processes and interorganisational processes (Lin et al., 2015; Rai et al., 2006; Mentzer et al., 2001).

The intraorganisational process of e-commerce is represented by platform management (Kim, 2016; Eisenmann et al., 2009). According to Evans and Schmalensee (2007), platforms play a decisive role in the ICT, distribution, and finance industries, etc., and especially in e-commerce. The proper management of platforms can offer a firm significant potential for innovation (Cooke, 2012). Kim (2016) maintain that platform management is vitally important in creating value for platform providers through quality management and marketing services. Developing a suitable strategy of platform management can enable a firm to take the lead in its market (Eisenmann et al., 2009). Hence, platform management is considered a critical process when adopting the infrastructure of ICT to develop e-commerce.

The interorganisational process of e-commerce is represented by supply chain management (SCM) (Lin et al., 2015; Rai et al., 2006; Mentzer et al., 2001; Strader et al., 1999). Studies of SCM require a firm's understanding of the unbundling of the three complementary flows of materials (Stevens, 1990), information (Lee et al., 1997), and finances (Mabert and Venkatraman, 1998) and the integration of each of them with supply chain partners. In recent studies, SCM theory has been advanced by the suggestion of a differentiation between the physical chain and support chain (Bals and Tate, 2018; Carter et al., 2015). The physical chain indicates the flow of materials in which products move from the supplier to the focal firm to the customer. The complementary support chain concerns the movement of information and finance. For e-commerce, the physical chain and support chain not only characterise the interorganisational process but also serve as a precondition for other related services.

2.3 Adaptive structuration theory

The stream of e-commerce research in IS studies can be divided into two categories, and different theoretical lenses have been adopted in each category (Cui et al., 2019). The first category focuses on the investigation of the inhibitors and determinants of e-commerce. The theoretical lens adopted in this category includes the technology acceptance model, organisational and environmental framework, resource orchestration perspective, resource-based view, and institutional theory, among others (Rahayu and Day, 2015; Lawrence and Tar, 2010; Molla and Licker, 2005). The second category concerns the examination of the e-commerce development procedure by adopting the

theory of reasoned action, the theory of planned behaviour, and the diffusion of innovation theory as the theoretical foundation (Grandón et al., 2011; Avgerou, 2008).

This study spans these two categories. On the one hand, e-commerce emphasises the enabling role of ICT that lies in its infrastructure and capabilities (Xiao et al., 2013). On the other hand, the deployment of ICT within and across an organisation to develop an e-commerce business involves the use of technology to both automate existing processes and help change these processes (Singh et al., 2018; Chaffey, 2007). Therefore, we adopt an innovative theoretical lens that originates in social science discipline and later on is adopted by e-commerce studies, i.e., AST (Rains and Bonito, 2017; Holweg and Pil, 2008; Lewis and Suchan, 2003). It particularly focuses on the role of advanced technologies in developing the competitiveness of organisations and shaping the new structure of businesses.

An AST consists of three main segments: advanced technology (as an initial structure source), decision-making in action, and new social structure (DeSanctis and Poole, 1994). Advanced technology offers a social structure consisting of features and spirits. The features of technology indicate the specific capabilities of a given technology, and the spirits of technology refer to the preferred set of actions and interpretations of technologies (Rains and Bonito, 2017). Decision-making in action indicates the act of bringing the characteristics of technology into specific decision-making activities through the appropriation of technology (DeSanctis and Poole, 1994). Rains and Bonito (2017) further adapt this segment into an e-commerce context and propose that e-commerce in action is the extent of the use of web technology in facilitating e-commerce strategies and activities. E-commerce strategies are consequences of structured behaviours that utilise web technology in strategies for attracting new customers and creating new channels. E-commerce activity indicates the use of web technology for enabling customer-facing activities such as sales, marketing, service, and distribution, among others (Chatterjee et al., 2002).

By adopting AST, we will focus on:

1 the explanation of ICT (i.e., the characteristics and capabilities of digital platforms)

2 e-commerce strategies and activities enabled by ICT (i.e., platform strategies and related services)

3 the outcomes as new structure sources.

3 Methodology

The interpretive case study approach is adopted as the research methodology, whereby the data are collected from semi-structured interviews and archival data. According to Eisenhardt (1989), by analysing the context of a case study, the theory being examined can be brought to light. Yin (2009) suggests that the case study method is appropriate for exploring real-life phenomena and contemporary events with the use of multiple data sources. As this study aims to answer how Chinese e-commerce companies utilise platform technology to implement e-commerce processes for rural development, the case study method is meaningful in providing explanations in empirical and real-life contexts. We apply a multiple case study approach because it provides more compelling and robust evidence compared to a single case study (Eisenhardt and Graebner, 2007).

3.1 Case selection

Among a number of rural e-commerce service providers in China, we preliminarily selected six companies (Lecuntao Network Technology Co., Ltd., and Xun Wei Network Development Co., Ltd., in addition to the following four companies) that were the earliest adopters of rural e-commerce in China and have been developing rapidly. After conducting a pilot study of all six companies, four typical cases were selected for final analysis based on a theoretical sampling approach grounded in the AST perspective. They have similar types of ICT but act differently on the utilisation of these technologies (we detailed these in Section 4). These similarities and differences can enhance the reliability of our findings. However, Lecuntao and Xun Wei act similarly on the utilisation process as the four selected case companies possessing similar technologies, which does not contribute much to our findings. The four selected case companies are Ganjie Electronic Commerce Co., Ltd. (Ganjie), All-City Electronic Commerce Group Development Co., Ltd. (All-City), Wenyuan Science and Technology Co., Ltd. (Wenyuan), and Minyu Electronic Commerce Co., Ltd. (Minyu).

These four case companies represent the pioneers of China's rural e-commerce, as they are being recognised by the Chinese government as the national exemplars of rural e-commerce. China's rural e-commerce service providers can be categorised into two types: private platform operators and public service-based platform operators. The four case companies selected are the latter type; they cooperate with the government and provide agriculture-based service for a large population in given rural areas. The basic information of the four case companies is shown in Table 1.

Table 1 Basic information of the four cases

	Ganjie	*All-City*	*Wenyuan*	*Minyu*
Started in	2010	2014	2013	2015
Coverage				
Province	17	8	14	7
County	43	9	67	15
Village	12,000	700	6,000	941
Number of service stations	12,000	700	6,000	/
Service population	16,000, 000	8,000,000	6,800,000	1,230,000
Uplink platform turnover	180,000,000	20,388,000	16,000,000	9,000,000
Downlink platform turnover	10,000,000	30,612,000	/	250,000
Others (service fee)	20,000,000	30,000,000	36,000,000	5,000,000
Overall turnover (in Chinese Yuan)	210,000,000	270,000,000	52,000,000	14,250,000

Notes: The slash (/) symbolises the inexistence of corresponding business. The coverage, number of service stations, and service population information are data accumulated until December 2017. The information on turnover is the annual data in 2017.

3.2 Data collection

The data were collected between June 2016 and May 2018. Semi-structured interviews were conducted as the primary data source. Eisenhardt and Graebner (2007) propose that interviews are a significantly efficient way to collect in-depth and empirical data, especially when the phenomenon of interest is highly episodic and infrequent. The face-to-face interviews were conducted in the Fujian, Jiangxi, and Zhejiang Provinces of China. To reduce respondent bias, a diverse group of interviewees, including e-businessmen/women, experts in e-commerce, government officials, related stakeholders (e.g., farmers) and managers of the four firms, were interviewed because they were either directly or indirectly involved in the case companies' e-commerce practices and could provide various perspectives on how these companies develop their e-commerce business.

In total, 42 interviews from the four case companies were conducted. A selective list of interviews is shown in Table 2. The average time for each interview was approximately one hour. The interviews were conducted in a structured manner. First, an interview protocol of 16 questions was prepared to guide these interviews and keep them in line with the research questions. Second, field notes and photos were taken wherever permitted to serve as reminders and references. Third, all interviews were recorded and transcribed. The interviews were conducted in Mandarin. The data were coded and analysed in the interview language. The researchers visited the sites of all four companies and key stakeholders, including those of their major suppliers, some customers, and the local governments.

In addition to the interviews and observations, we also collected archival data from company websites, news, internal company documents, and public reports to triangulate the information collected from interviews. All the data were saved in a database associated with any further information provided by the interviewees (Eisenhardt, 1989).

3.3 Data analysis

After the data collection, the data were coded and analysed. Our coding and data analysis followed Gioia et al.'s (2013) approach to concept development and theory articulation. A within-case analysis and a cross-case analysis were carried out successively, through which the data were analysed in an iterative process and common patterns were compared. On many occasions, we consulted the interviewees and archival information in case of ambiguity.

The aim of the within-case analysis is to identify the constructs and the relationships between constructs. To do this, we tried to understand each company's background and the development of its own rural e-commerce in the first round of coding. The summarised descriptions of the four cases were developed at this stage (Section 4.1). We further identified and categorised the company's utilisation process of the infrastructure of ICT in developing its e-commerce business. During the coding and data reduction process, we found that the companies' platform operations and SCM activities were intertwined and gradually generated revenue and outcomes. We also noted some organisational factors influencing the utilisation process. Such observations provided us with the informants' terms and became first-order concepts.

Table 2 List of interviewees

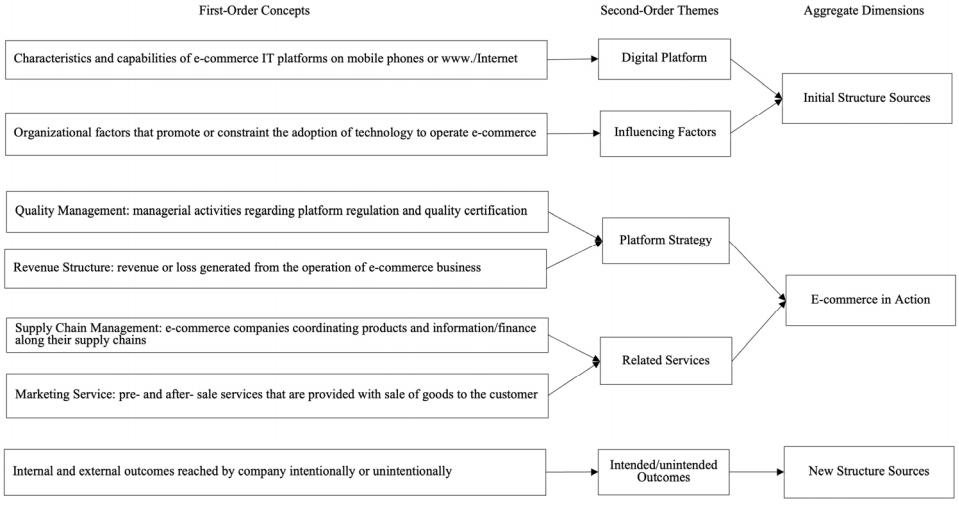
Case	*Company*	*Site*	*Interviewee's job title*	*No. of interviews*
Wenyuan	Hangzhou Wenyuan Science and Technology Co., Ltd.	Hangzhou, Zhejiang	Chairman	1
	Linan Wenyuan Science and Technology Co., Ltd.	Linan, Zhejiang	Financial Director	1
	Linan Wenyuan Science and Technology Co., Ltd.	Linan, Zhejiang	Secretary	1
	Linan Wenyuan Science and Technology Co., Ltd.	Linan, Zhejiang	Clerk	2
	Linan Yungu Electronic Commerce Co., Ltd.	Linan, Zhejiang	Platform Manager	1
	Linan Yungu Electronic Commerce Co., Ltd.	Linan, Zhejiang	Operation Manager	1
	Bainiu Cun Electronic Commerce Association	Bainiu Cun, Zhejiang	General Secretary	1
	Sheng Kee Nut Co., Ltd.	Bainiu Cun, Zhejiang	Chairman	1
	Hangzhou Wenyuan Science and Technology Co., Ltd.	Hangzhou, Zhejiang	Operation Director	1
				Total 10
All-City	All-City Electronic Commerce Group Development Co., Ltd.	Nanchang, Jiangxi	Chairman	1
	All-City Electronic Commerce Group Development Co., Ltd.	Nanchang, Jiangxi	General Secretary	1
	All-City Electronic Commerce Group Development Co., Ltd.	Xinjian, Jiangxi	Operation Manager	1
	All-City Electronic Commerce Group Development Co., Ltd.	Xinjian, Jiangxi	Platform Manager	1
	All-City Electronic Commerce Group Development Co., Ltd.	Xinjian, Jiangxi	Clerk	2
	All-City Electronic Commerce Group Development Co., Ltd.	Nanchang, Jiangxi	Distributor	2
	Qiaoshe Service Station	Qiaoshe, Jiangxi	Station Agent	1
				Total 9

Table 2 List of interviewees (continued)

Case	*Company*	*Site*	*Interviewee's job title*	*No. of interviews*
Ganjie	Zhejiang Ganjie Electronic Commerce Co., Ltd.	Suichang, Zhejiang	Vice Chairman	2
	Zhejiang Ganjie Electronic Commerce Co., Ltd.	Suichang, Zhejiang	Director	1
	Zhejiang Ganjie Electronic Commerce Co., Ltd.	Suichang, Zhejiang	Platform Manager	1
	Zhejiang Ganjie Electronic Commerce Co., Ltd.	Suichang, Zhejiang	Clerk	2
	Jinzhu Village Service Station	Jinzhu, Zhejiang	Station Agent	1
	Ganjie Cunhuo	Suichang, Zhejiang	Opration Manager	1
	Zhejiang Ganjie Electronic Commerce Co., Ltd.	Suichang, Zhejiang	Distributor	2
	Maidelong Supermarket	Suichang, Zhejiang	Manager	1
	Rural Electric Business School	Suichang, Zhejiang	Manager	1
				Total 12
Minyu	Quanzhou Minyu E-commerce Co., Ltd.	Quanzhou, Fujian	Chairman	1
	Quanzhou Minyu E-commerce Co., Ltd.	Quanzhou, Fujian	Vice Chairman	2
	Quanzhou Minyu E-commerce Co., Ltd.	Quanzhou, Fujian	Platform Manager	1
	Quanzhou Minyu E-commerce Co., Ltd.	Quanzhou, Fujian	Operation Director	1
	Quanzhou Minyu E-commerce Co., Ltd.	Quanzhou, Fujian	Clerk	3
	Qian-xian-nong-hui	Jianning, Fujian	Platform Manager	1
	Qian-xian-nong-hui	Jianning, Fujian	Distributor	2
				Total 11

Cross-case analysis aims to compare and contrast common patterns in distinct settings to ensure the external validity of the findings. Through cross-case comparison, we developed second-order themes as findings (Section 4.2). The cross-case results were thoroughly discussed with one of the co-authors who was not involved in the data collection and played the role of the 'resident devil's advocate' to provide a more objective view (Sutton and Callahan, 1987; Jia et al., 2014). These findings eventually led to aggregated dimensions and a model that described how these dimensions explain the utilisation process of ICT in developing e-commerce business. To illustrate the overall coding process, a data structure is provided in Figure 1.

Figure 1 Data structure



4 Findings

4.1 Within-case analysis

4.1.1 Ganjie

Ganjie was founded in 2010 in Sichuan Province by Mr. Pan Dongming. Facing a lack of information, logistics, finance, and other service systems in rural areas, Ganjie built its own e-commerce system based on the so-called internet plus, i.e., the realisation of all the above systems on the internet, which provides a new solution for providing agriculture-based services and increasing income for rural areas.

In its early stage (2010–2013), Ganjie created a service provider-driven rural e-commerce system, of which the core business was developing an uplink channel to sell agricultural products from rural areas to urban customers. Serving as the platform connecting farmers and distributors, Ganjie provided warehousing, delivery, quality inspection, marketing, and packaging services. The professional functional division of agricultural e-commerce was initially achieved.

During its development stage (2013–2016), Ganjie characterised its business as exploring the downlink channel to bring agricultural inputs (e.g., pesticides, fertilisers, seeds, machinery, agricultural tools) from urban to rural areas. Through its online platform, Ganjie worked with a two-level (county and village) service station system to overcome the 'last mile' issue in agricultural e-commerce by providing platform services to villages.

During its leadership stage (2016–2017), Ganjie focused on a transformation strategy by shifting from an agricultural e-commerce platform to a rural living service platform. Based on the mobile internet platform, Ganjie set up a three-level partner system linking counties, towns, and villages and innovated the two-way logistics system for both uplink (supply chain from agricultural production to consumers) and downlink channels (supply chains of consumer goods and agricultural inputs flowing into the villages).

4.1.2 All-City

All-City was founded by Mr. Xu Xiaobo in Jiangxi Province in 2014. After only four years of development, All-City rapidly evolved into one of the leading rural e-commerce companies in China and was awarded the title of 'National E-Commerce Best Service Provider' by the China E-Commerce Association.

During its early stage, with the awareness that developing an uplink channel for agricultural products is complex and difficult because rural cooperatives are specialised only in the cultivation of agricultural products, All-City developed its own online platform for both mobile devices and the web, i.e., TMOSS mobile and TMOSS web, and was the first to develop the uplink channel. This channel works in a partnership with local cooperatives to select products with great market potential and further establishes a mature SCM system based on TMOSS mobile and TMOSS web for selling these products from rural areas to urban customers.

During its development stage, All-City was committed to building up the downlink channel to bring agricultural inputs back from urban areas to rural areas. To do so, in addition to TMOSS mobile and TMOSS web, All-City further developed another platform, All-City Coupon, which provides coupons for goods sold on TMOSS. Afterwards, the company set up a three-level online to offline (O2O) e-commerce service station system for serving farmers that was based on the All-City Coupon. Thus, All-City not only successfully transformed local advantages into profit but also significantly promoted rural employment.

During the leadership stage, while aiming at continually upgrading an integrated e-commerce service and finally achieving the e-commerce market-shifting goal, which refers to translating every business in the real market into e-commerce, All-City advanced a diversified service support system composed of its three core platforms, i.e., TMOSS mobile, TMOSS Web, and All-City Coupon. Together, these powerful platforms of technical support built a solid foundation for All-City to provide a variety of services, including channel construction, franchised partnership, logistics, storage, and marketing.

4.1.3 Wenyuan

Wenyuan was founded by Mr. Xu Bin in Zhejiang Province in 2013. With its founder's rich experience in e-commerce business, Wenyuan has rapidly grown as a mature and

unique e-commerce service provider that combines agricultural e-commerce, rural service, and rural tourism.

During its early stage, Wenyuan started by building an uplink channel, and the transactions of agricultural products were mainly done via Wenyuan's online platform, the Original Taste. The agricultural products were selected and packaged, and they were sold via four channels, including distributors, an O2O tourist centre, an O2O restaurant, and an e-supermarket. To link an agricultural product to its platform, a selection procedure was also conducted by Wenyuan through a field trip.

During its development stage, in the exploration of the downlink channel, Wenyuan innovatively developed an 'airport model' using a partnership approach. In this model, each offline e-supermarket represents a terminal that centralises larger e-commerce platforms, including Tmall, Taobao, and JD.com, to serve rural areas together. The local youth are recruited as partners who are responsible for operating the e-supermarkets. The e-supermarket partners aid local farmers in choosing their needed products online from these platforms.

During its leadership stage, committed to exploring an innovative path for rural e-commerce development according to local conditions, Wenyuan cooperated with local governments, farmers, and various third-party organisations to build a more established structure for their e-commerce business, which drives the continuous innovation of agricultural products and facilitates the sustainable development of e-commerce in rural areas.

4.1.4 Minyu

Minyu was established by Mr. Huang Dehong in Fujian Province in 2015. Adhering to the business philosophy of 'win–win' and 'growing together', Minyu built up a rural e-commerce platform for agricultural products and expanded the local group of e-commerce service providers.

During its early stage, Minyu focused on developing an uplink channel. To link agricultural products to its online platform, Qianxian Nonghui, Minyu had a product selection process that operated by sending out teams to research the featured products that had complete supply chain networks and market potential. Moreover, it worked in partnership with suppliers by providing them with specific requirements for processing byproducts. The products were sold through the Omni channel, which included distributors, retailers, tourist centres, and village service stations, among others.

During its development stage, in establishing a downlink channel and different from other case companies, Minyu did not build its own service stations in villages but set up a downlink platform, C-Shopping Mall, to sell agricultural inputs and serve farmers. At the same time, it promoted C-Shopping Mall to the extant service stations that were established by larger e-commerce platforms, such as Taobao and JD.com.

4.2 Cross-case analysis

We next conducted a cross-case analysis on the four case companies against the predefined data structure based on AST (Figure 1). The findings are discussed below in terms of the digital platform, influencing factors, platform strategy, related services, and intended/unintended outcomes.

Table 3 Capabilities of the four digital platforms

Company	*Digital platform*	*Capabilities and characteristics*
Ganjie	Mobile platform: Ganjie Cunhuo	Integrates sales and distribution functions, spreads among WeChat acquaintances and serves as an efficient and effective platform for enterprises and individuals who are sellers, distributors, and customers
	Web platform: Ganjie Web	Relies on the stationmasters to set up a three-level service station system (county station, town station, and village station) containing various functions and allows farmers access to real products (e.g., agricultural consuming goods), virtual products (e.g., insurance, loans), and services (e.g., online payment, telecommunication, tourism)
All-City	Mobile platform: TMOSS	Committed to the construction of an uplink support system for agricultural products. Sells eight categories of agricultural products and contains a large number of distributors (125,182 registered distributors by May 2018)
	Web Platform: TMOSS web and all-city coupon	TMOSS Web encompasses a complete supply chain management system including a self-building warehouse and unified sorting, packaging, tracing, quality controlling, distributing, and marketing of online products. All-City Coupon provides coupons for goods (63,166 items) sold on TMOSS Web
Wenyuan	Mobile platform: The original taste	Develops a new sales model linking the agricultural products to farmers. Facilitates both the sale of agricultural products and the promotion of the platform. Continues to integrate more resources and stakeholders to build a complete platform-based supply chain
	Web platform	
Minyu	Mobile platform: Qian-xian-nong-hui	Engaged in selling the agricultural products and agricultural byproducts throughout the whole country and linking the distributors all over the country. Solves the seasonal shortage problem of agricultural products for customers
	Web platform: Qian-xian-nong-hui Web and C-shopping mall	Qian-xian-nong-hui web contains additional functions for suppliers, providing services of standard setting, products packaging, brand design, marketing planning, etc. C-Shopping Mall serves as the downlink for agricultural consuming products. The Qian-xian-nong-hui web platform and C-Shopping Mall share data resources and distributors

Note: The slash (/) symbolises the inexistence of corresponding business.

4.2.1 Digital platform

We find that all the case companies open two types of digital platforms, mobile platforms and web platforms, whose characteristics and capabilities are outlined in Table 3. The case companies set up their own mobile platforms on WeChat, such as Ganjie Cun-huo (Ganjie), TMOSS (All-City), The original taste (Wenyuan), and Qian-xian-nong-hui (Minyu). These mobile platforms are characterised by being:

1 user friendly, as customers need only a mobile phone and WeChat to log in and use the platforms very conveniently, anywhere and at any time

2 easy to spread, as WeChat is based on relatively strong social ties linking customers with their acquaintances (e.g., families, friends, colleagues), among which the platforms are easy to share and spread to potential users.

Compared to the mobile platform, the web platform is featured as being fully functional, and thus, a wide group of stakeholders is linked together. For example, the mobile platform contains sales, marketing, and distribution functions that are basically customer and distributor-oriented. However, on the web platform, in addition to the previous functions, more functions, including supply, logistics, and financial services, can also be realised; therefore, more stakeholders, such as suppliers, third-party logistics, banks, etc., are involved.

Table 4 Influencing factors

	Ganjie	*All-City*	*Wenyuan*	*Minyu*
Entrepreneurs experience	Rich e-commerce experience and sensitive to market. The founder has decades of experience in e-commerce consulting industry.	Poor e-commerce experience. The founder has only working experience in government state-owned enterprise and media industry	Rich experience in famous e-commerce company. The founder worked for Alibaba Group for many years	Relevant online selling experience. The founder has been an e-tailer on other platforms selling decorations
Innovation orientation	High-level innovation. Develops a unique e-commerce business mode that spreads across the whole nation	High-level innovation. Incorporates innovation in its long-term business strategy	High-level innovation. Incorporates innovation in its long-term business strategy	Low-level innovation. Lacks long-term strategy and focuses on only the profitable businesses
Coordination	Highly specialised internal functions that cooperate well in various business projects	Strong connection between internal functions and builds several cross-function teams	Flexible organisational structure and builds teams on different projects	Internal functions work independently and rarely collaborate on projects
Political ties	Strong political ties. Its platform serves as the bridge between other e-commerce companies and the local government	Fair political ties. The founder has good government connections	Strong political ties. Builds a good relationship with the government with Alibaba's endorsement	Weak political ties. Through bidding, it becomes the e-commerce service provider in local areas

4.2.2 Influencing factors

We further identified four firm-specific factors influencing the rural e-commerce ecosystem structure. The internal factors are entrepreneurs' experience, innovation orientation, and coordination, and the external factor is political ties. All four factors are illustrated in Table 4. We can see that the entrepreneurs of Ganjie and Wenyuan have more experience than the entrepreneurs of All-City and Minyu. With respect to innovation orientation and coordination, Ganjie, Wenyuan, and All-City all perform better than Minyu. Regarding the external factor, Ganjie has the strongest ties with the local government, and Minyu has the weakest ties, while Wenyuan and All-City maintain medium-level relationships with the government.

4.2.3 Platform strategy

After conducting an in-depth investigation, we found that all the case companies established quality management and revenue structure as their overall platform strategies. Quality management can be further divided into two segments: ex ante/post management and certificate strength. The revenue structure consists of the supply side, demand side and external revenue. The details of quality management and revenue structure are further discussed below.

4.2.3.1 Quality management

In the early days of their platforms, all the case companies preceded quality management by linking the products to the platform, which is considered ex ante (Kim, 2016). With the increasing number of customers on their platforms, Ganjie, All-City and Wenyuan further launched ex post management, i.e., behaviours that are managed after selling the products from the platform (Kim, 2016), such as customer service and after-sales service.

However, the certificate strength varies among the four case companies. Ganjie maintains the strictest quality management, as it is the unique case company with specified selection criteria for products and planting sites, and it also builds a traceability system. Wenyuan also maintains rigid quality management, as it selects products via a deep exploration of high-quality agricultural products in rural areas. In contrast, All-City and Minyu are market-oriented and provide only basic quality management. On the downlink platform, Ganjie, Minyu, and All-City all conduct ex ante, loose quality management, as they would like to invite as many service providers and manufacturers as possible to diversify their platforms to attract rural customers. The comparison of the quality management of the four case companies is shown in Table 5.

4.2.3.2 Revenue structure

Regarding demand-side revenue, all the case companies gain profit mainly from their distributors (i.e., the e-tailers) in three ways. First, on the uplink platform, the companies organise the distributors and market the products through which they can obtain commissions based on sales volume. Second, the companies also provide packaging, branding, and design services for distributors, through which service fees can be collected. Third, the case companies, as platform leaders, have a larger bargaining power than an individual distributor; they can further obtain additional income from intermediate price differences. Regarding supply-side revenue, Ganjie and Minyu earn

profits directly by supplying agricultural consumption products on the platform after buying them from suppliers, which is on the supply side. All-City makes income from the commissions of both its suppliers and distributors, which is, therefore, on both the supply side and the demand side.

Table 5 Quality management

	Ganjie	*All-City*	*Wenyuan*	*Minyu*
Ex Ante/ post management	Both ex ante and ex post regulation	Both ex ante and ex post regulation	Both ex ante and ex post regulation	Only ex ante regulation. Initially, requires government endorsements from e-tailers before entering its platform and later runs general quality control itself
	Ex ante: operates the checking and sorting of products for each e-tailer before entering its platform	Ex ante: applies for public brands (e.g., Zizhong orange), and e-tailers must conform to the quality system of this public brand	Ex ante: village service stations conduct initial checks (e.g., size of agricultural products), and rual service stations run final inspections (e.g., pesticide residues)	
	Ex post: runs highly responsive customer service to track and address quality problems	Ex post: runs after-sales customer service to address quality problems	Ex post: compensates for products with quality problems	
Certificate strength	Hard certificate strength in the uplink platform with highly strict specifications (e.g., degree of sweetness); soft certificate strength in downlink platform as directly sold agricultural product supplies come from other platforms	Soft certificate strength in uplink platform with general specifications; soft certificate strength in downlink platform as directly sold household goods come from other platforms	Hard certificate strength in uplink platform through the customised specifications in the initial and final inspections	Soft certificate strength in uplink platform with general specifications; soft certificate strength in downlink platform as directly sold household goods come from other platforms
	→ Rigid quality management	→ Loose quality management	→ Rigid quality management	→ Loose quality management

Moreover, with respect to external revenue, all the case companies gain additional earnings from external stakeholders by providing training, services for governments, franchise fees, and other services. The training includes internal training and external training. The internal training is mainly aimed at the local farmers and generally free of charge, while the external training is set for personnel from other counties and is therefore not free. Income from services for governments occurs as governments also purchase training services from the four case companies. All four case companies in this study are involved in the projects of e-commerce demonstration counties. Franchise fees are the service fees charged by the case companies when their platform development models are extended to other counties. Another service income is that which comes from services provided for platform users, including online payments, telecommunication, insurance, tourism, etc. The comparison of the revenue structure of the four case companies is summarised in Table 6.

Table 6 Revenue structure

	Ganjie	*All-City*	*Wenyuan*	*Minyu*
Demand side	Distributors on Ganjie Cunhuo by uplink channel	Distributors on TMOSS by uplink channel	Distributors on Original Taste by uplink channel	Distributors on Qian-xian-nong-hu i by uplink channel
Supply Side	Suppliers on Ganjie app by downlink channel	Suppliers and distributors on All-City Coupon by uplink and downlink channels		Suppliers on C-Shopping Mall by downlink channel
External	Provides training, services for governments, franchise fees, and other service income	Provides training, services for governments, and financial service income	Provides training, services for governments, and other service income	Provides training, services for governments

4.2.4 Related services

After gaining insight into utilising platform technology to develop platform strategy, we found that the four case companies are also different in terms of their related services, which can be compared from two aspects, i.e., SCM and marketing services.

4.2.4.1 SCM

SCM can be further broken down into a physical chain process that indicates logistics management and a supporting supply chain process that indicates information or financial flow management.

Table 7 Related services

		Ganjie	*All-City*	*Wenyuan*	*Minyu*
Supply chain management	Logistics management	Supplied by manufacturer; a complete uplink and downlink network; self-warehouse → Strong logistics flow	Supplied by manufacturer; a complete uplink and downlink network; self-warehouse → Strong logistics flow	Supplied by farmer; lack of uplink and downlink network; self-warehouse; no self-built logistics → Weak logistics flow	Supplied by manufacturer; lack of uplink and downlink network; no self-warehouse and self-built logistics → Weak logistics flow
	Information/finance management	Strict traceability system; a complete information system from stocking to after-sales services → Strong information/finance flow	Lack of traceability system; a complete information system from stocking to after-sales services → Strong information/finance flow	Lack of traceability system; an incomplete information system → Weak information/finance flow	Lack of traceability system; lack of information system → Weak information/finance flow
Marketing service	Product	Wide range of products	Wide range of products	Niche products	Niche products
	Price	Double the product premium	A small amount of product premium	Double the product premium	A small amount of product premium
	Promotion	O2O; social commerce; crowdfunding; advance sell; developed marketing department (branding, design, customer service)	O2O; social commerce; crowdfunding; advance sell; underdeveloped marketing department (design, customer service)	O2O; social commerce; crowdfunding; advance sell; underdeveloped marketing department (design, customer service)	O2O; social commerce; crowdfunding; advance sell; lack of marketing department
	Place	Uplink channel and downlink channel; platform: mobile + web → Good marketing service	Uplink channel and downlink channel; platform: mobile + web → Fair marketing service	Uplink channel; platform: mobile → Fair marketing service	Uplink channel and downlink channel; platform: mobile + web → Poor marketing service

Regarding logistics management, Ganjie built an integrated uplink and downlink channel embedded in its online platform and a three-level service station system (three-tier service stations at the county, town, and village levels), which ensures a smooth product supply and emphasises the localisation of products at the same time. Ganjie is the only case company that has self-owned warehouses and operates a self-built and two-way logistics system (uplink and downlink logistics) in rural areas. All-City also built an integrated uplink and downlink channel that relies on its online platform, a three-level service station system, and has self-owned warehouses. However, it did not establish in-house logistics, although it is the most widely penetrating company in rural areas. Compared to the previous two companies, Wenyuan has an uplink platform but lacks a downlink platform; instead, it invites different platform providers into its three-level service station system. In contrast, Minyu establishes its downlink platform by emphasising the localisation of its products but does not establish a service station system to support it.

In terms of information or financial flow management, Ganjie has the most comprehensive supply chain information system to support its rigorous quality management, traceability, and SCM simultaneously. It has strict selection criteria for both products and planting sites, and it installs cameras at each planting site to maintain traceability. In addition, Ganjie offers a service package to its distributors that includes logistics services, packaging, and after-sales services through the utilisation of supply chain information. All-City also owns an information system that governs product standardisation[1] and supply chain information. However, its product standardisation is loose and lacks a traceability system. Relatively, Wenyuan and Minyu are not involved too much in information system building, as they position themselves as agricultural brands, thereby mainly focusing on product standardisation.

4.2.4.2 Marketing services

The marketing services of the four case companies can be compared from four aspects: product, price, promotion, and place. We found that the case companies, as e-commerce service providers, place more emphasis on promotion than the other three aspects through the application of platform technology. When considering the four aspects together, Ganjie performs best in marketing services, followed by All-City and Wenyuan, with Minyu showing the poorest performance.

In terms of product, Ganjie and All-City have a broad range of products, providing a variety of agricultural products, including fresh fruits, rice noodles, tea, and so on. In contrast, Wenyuan and Minyu sell only dried fruits in a niche market. Regarding price, Ganjie and Wenyuan can achieve a product premium, which is often twice its original price, for many of their products. However, All-City and Minyu are not able to obtain such product premiums. The reason for this is that customers are more willing to pay a premium for guaranteed products resulting from strict quality management. With respect to place, all the case companies built uplink channels on their mobile platforms and downlink channels on their web platforms except for Wenyuan, which has an omni channel for its uplink channel but lacks a web platform for its downlink channel.

Regarding promotion, all the case companies are committed to e-commerce innovation initiatives such as the O2O mode, social commerce, crowdfunding, and advanced selling. They offer free tastings in their brick-and-mortar stores, for example, warehouse supermarkets (Ganjie), service stations (All-City), restaurants (Wenyuan), and

souvenir shops (Minyu). Customers can then buy the products either immediately at the store or afterwards on their online platforms. Moreover, the companies also promote products through social commerce, by which distributors share their reviews on products to friends in WeChat to stimulate sales. In particular, Ganjie provides the best promotion services due to its well-developed marketing department that is responsible for branding, design, and customer service. Ganjie gradually formed both a self-brand (Ganjie Cunhuo) and a regional public brand in a local rural area; the professionals in its marketing department are capable of a comprehensive design service that ranges from logos and packaging to copywriting; and its platform also undertakes after-sales services to keep customers satisfied. Whereas All-City and Wenyuan can provide only middle-range services resulting from their underdeveloped marketing departments, Minyu completely lacks such a specialised department. The comparison of case companies in terms of their related services is shown in Table 7.

4.2.5 Intended/unintended outcomes

After implementing the platform strategy and related services, the case companies were found to achieve their intended outcomes, including company outcome and government outcome, and an unintended outcome that is societal in nature since all of them are private e-commerce companies but are funded by the government.

Benefits to e-commerce companies. With an effective platform strategy and comprehensive services, Ganjie has created a virtual circle of business and gains the largest portion of profit among the four case companies. All-City goes just beyond the break-even point and has recently been able to gain profit due to the increase of its business. Similarly, Wenyuan has recently started to gain profits but has a lower break-even point compared to that of All-City because All-City invests more in promotion activities, including coupons and discounts. Minyu, in contrast, has not gained a profit yet due to the limited number of daily active users on its platform. With the profits gained, the four case companies are able to invest more in their businesses. On the one hand, they spend on improving their platforms specifically by enhancing quality management. On the other hand, they focus on expanding their supply chains by increasing the distribution channels.

Benefits to the government. Ganjie is highly recognised by government departments and drafts three national standards for rural e-commerce in China. All-City and Wenyuan are recognised by government departments as well and have become e-commerce service providers in increasingly more counties in China. Minyu is recognised by local governments and has become an e-commerce service provider in increasingly more counties in Fujian Province. With recognition by the government, the four case companies not only receive enormous support from municipal governments but also build cooperation with diverse stakeholders to further improve their platform management and related services, such as Ganjie with telecom services, All-City with banks and financial institutions, and Wenyuan and Minyu with design companies.

Benefits to the local communities. Ganjie enforces social wellbeing for local communities, since, on the one hand, urban residents can now easily obtain access to featured agricultural products sold on its platform, and, on the other hand, it also benefits the farmers of these products with its convenient sales channel. The development of All-City facilitates the upgrading of the local agricultural supply chain, which increases rural household income and helps eliminate poverty. Wenyuan creates a good local

e-commerce entrepreneurship atmosphere and provides e-commerce entrepreneurs with supply chain services and market services. Minyu accelerates the internetisation process of local agricultural business. With the created e-commerce environment in local communities, the four case companies can access more skilled labourers, which can have massive impacts on their business processes.

Table 8 Intended/unintended outcomes

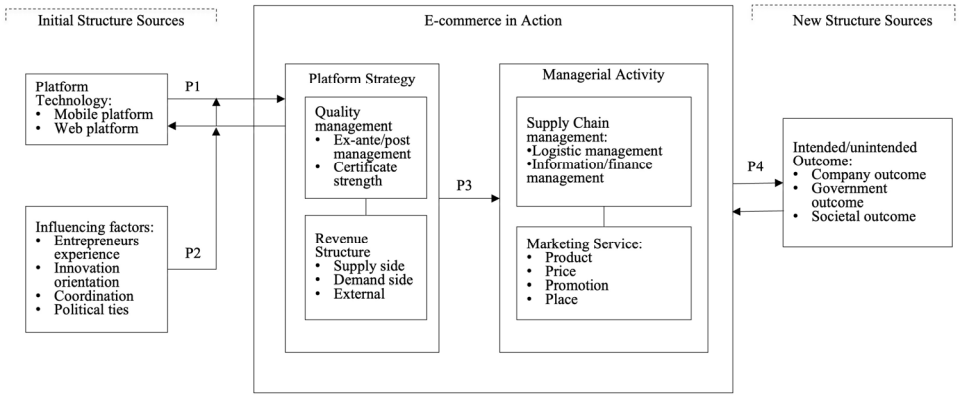
	Ganjie	*All-City*	*Wenyuan*	*Minyu*
Benefits to e-commerce companies	Gains large portion of profit from the demand side due to the high-quality agricultural products	Beyond the break-even point recently due to the large investment in attracting customers (e.g., coupons)	Beyond the break-even point recently and mainly gains profit by providing services for government (e.g., training local farmers' e-commerce awareness)	No profit yet due to the unstable product quality and small user volume
Benefits to government	Highly recognised by government and authorised by the government to draft three national e-commerce business standards	Recognised by government and invited by other counties across the nation to operate e-commerce in their counties	Recognised by government and invited by other counties across the nation to operate e-commerce in their counties	Recognised only by local government, Jianning County, and it ranks first in the Fujian Province Ministry of Commerce's e-commerce
Benefits to local communities	Improves social assessment. Accelerates local wellbeing through training farmers to be e-tailers and serving urban residents with high-quality agricultural products	Increases local income and helps rural households get rid of poverty	Creates local e-commerce entrepreneurship atmosphere	internetisation process through helping farmers sell products online

In sum, the intended/unintended outcomes further serve as sources of a new structure that is represented by new resources such as gained profits, recognition by the government, and the created local e-commerce entrepreneurship environment. These resources provide inputs into the continuous development of the four companies' e-commerce processes. The comparison of case companies in terms of their intended and unintended outcomes is shown in Table 8.

5 Discussion

To deepen the understanding of ICT empowering rural e-commerce, this section further discusses the interrelationships among the domains that emerged in the cross-case analysis through the AST lens. By doing so, an integrated framework associated with four propositions was developed to answer the research question (as shown in Figure 2). The discussion focuses on the interplay between input sources (ICT and influencing factors) and e-commerce in action, the interrelationship between subdimensions of e-commerce in action (i.e., platform strategy and related services), and outcomes derived from e-commerce in action. The details are provided below.

Figure 2 Conceptual framework



5.1 Interplay between input sources and e-commerce in action

We found an interaction relationship between the characteristics of ICT and e-commerce in action. According to DeSanctis and Poole (1994), advanced technology brings about social structures (features and spirit) that either enable or constrain social interaction. The ICT (platform) of the case companies consists of mobile platforms (WeChat) and web platforms. Compared to traditional computer systems that support the accomplishment of business transactions and discrete work tasks, such as billing, inventory management, and financial analysis (DeSanctis and Poole, 1994), the capabilities (features) offered by mobile devices (e.g., WeChat) and internet usage (e.g., web platforms) are far more advanced (Tim et al., 2021; Chaudhuri, 2012). In addition to the above activities, they can further support coordination and interaction among actors who use these platforms and provide procedures for accomplishing information exchanges. The utilisation of these ICTs enables the case companies to develop their overall platform strategy in terms of quality management and revenue structure.

Meanwhile, quality management and revenue structure further create new characteristics for platform technology. For instance, the implementation of quality management implies both ex ante management and ex post management. One method of ex post management is to provide after-sales services through a platform, which indicates the additional real-time online communication function on mobile and web platforms to constantly satisfy customers. This endorses the study of Cui et al. (2019), which reveals

the same capability required for the successful development of e-commerce in rural areas. In contrast with the initial capabilities of ICT, the utilisation of ICT further creates a new preferred set of actions and interpretations (spirit) for mobile platforms and web platforms. This outcome supports the study of DeSanctis and Poole (1994), which suggests that the output of technology adoption emerges as a new source of structure. Combining these two aspects, we propose the following:

P1 The ICT adopted in rural e-commerce (initial structure source) takes the form of a mobile platform and web platform, which enable quality management and new revenue streams in the platform strategy that in turn create new requirements for platform technology.

Furthermore, we identified four moderators that may influence the interplay between platform technology and platform strategy. Based on the internal and external factor analysis, we found that Ganjie performed best in entrepreneurs' experience, innovation orientation, coordination, and political ties. This result influences the utilisation of platform technology in developing quality management and revenue structure. From Sections 4.2.3.1 and 4.2.3.2, we can see that Ganjie establishes the most rigid quality management and highly complex revenue structure. In contrast, Minyu indicates the lowest level in terms of the four factors and is capable of establishing only very loose quality management and a relatively simple revenue structure. Meanwhile, the outputs of the utilisation of platform technology also vary depending on these factors. For example, when the outputs are generated by Ganjie's ex post management, e.g., customer feedback, it requires the coordination among Ganjie internal teams to translate this feedback information into the new characteristics of the mobile and web platforms.

Although our finding does not support the direct relationship between group internal systems and technology appropriation proposed by DeSanctis and Poole (1994), it extends the study of Chatterjee et al. (2002), which indicates the positive influence of top management and coordination on web technology assimilation. Meanwhile, the influence of political ties mirrors the study of Cui et al. (2019), in which successful e-commerce development also depends on ''other factors'' such as interactions with local governments. Therefore, we propose our second propositions as follows:

P2 The coinfluencing effects of platform technology and platform strategy vary depending on four influential factors; that is, the richer the entrepreneur's experience in e-commerce, the higher the level of innovation orientation, the better the coordination among intraorganisational teams, the stronger the political ties with local government, and the greater the coinfluencing effects of platform technology and platform strategy that will be facilitated.

5.2 E-commerce in action

According to Tim et al. (2021) and Chatterjee et al. (2002), the utilisation of platform technology facilitates e-commerce strategy and activities. We found that all case companies, enabled by their mobile platforms and web platforms, established quality management and revenue structure as their overall platform strategies. To implement these strategies, we further identified two categories from companies' related services, i.e., SCM and marketing services (Kim, 2016; Iansiti and Levien, 2004; Johnson and Whang, 2002). Regarding SCM, we found that Ganjie and All-City perform better than

Wenyuan and Minyu in both logistics management and information/finance management. With respect to marketing service, Ganjie performs best, followed by All-City and Wenyuan, while Minyu shows the poorest performance. Accordingly, positive correlations between SCM and marketing services can be inducted.

This outcome also supports a similar argument by DeSanctis and Poole (1994) that indicates that technology appropriation in strategy can be evidenced in group decision-making activities. However, extending this to the e-commerce context, the activities are categorised into related services–SCM and marketing services, with each category further consisting of several subdimensions. By examining each subdimension, the performances of different e-commerce companies and interrelationships between related services can be realised. This further complements the finding of Cui et al. (2019), which highlights the capabilities created through marketing activities but without SCM in the successful development of rural e-commerce. Therefore, we propose our third proposition as follows:

P3 Platform strategy leads to two categories of positively correlated services, including SCM (logistics management and information/financial flow management) and marketing services (product, price, promotion, and place).

5.3 Outcomes of e-commerce in action

We identified three types of outcomes from the case companies, i.e., company outcomes, government outcomes, and societal outcomes, when they implemented their platform strategies associated with related services. Some outcomes are intended and expected, such as gains in profit (company outcome) and being recognised by the government (government outcome), as these companies are private e-commerce providers but also funded by the government. However, some outcomes are unintentionally generated from implementing platform strategies associated with related services, i.e., the benefits for the local community (societal outcome). This adds to the discussion of the social impact of e-commerce in IS studies (Tim et al., 2021; Leong et al., 2016) by confirming benefits such as social wellbeing, poverty alleviation, and local community development brought by e-commerce.

The generation of intended and unintended outcomes also extends the proposition of Rains and Bonito (2017) and DeSanctis and Poole (1994), in which the desired outcomes of the utilisation of technology can occur when ideal appropriation occurs and decision-making activities match the task. Here, we further identify the ideal appropriation in the e-commerce context as the SCM and marketing services. In addition, these outcomes, such as gained profits, additional platform experience, stronger ties with the government, and the created local commerce entrepreneurship environment, serve as sources of a new structure that, in turn, provides resources for the subsequent development of e-commerce processes in terms of both platform strategy and related services. This is in line with the finding of DeSanctis and Poole (1994) that the emergent structure from actions represents the new rules and resources that can be further appropriated in future actions over time. Thus, we propose our fourth proposition as follows:

P4 The implementation of SCM and marketing services embedded in the platform strategy can generate both intended outcomes (benefits to e-commerce companies and government) and unintended outcomes (benefits to local communities in the

form of sustainable rural development), which serve as sources of a new structure that in turn feed back into the following e-commerce process development.

6 Conclusions

This study analysed four Chinese rural e-commerce companies regarding how they utilised ICT to develop their e-commerce business in China's rural areas towards rural development. We grounded our investigation in the AST perspective and proposed a conceptual framework associated with a set of propositions to answer the research question. By answering this question, we make three contributions to the IS literature.

First, this study identified five themes in utilising ICT to develop rural e-commerce at the firm level, i.e., ICT (digital platform), influencing factors, platform strategy, related services, and intended/unintended outcomes. It provides a thorough understanding of how to utilise ICT to shape rural e-commerce, responding to the call of Wu et al. (2020) and Leong et al. (2016). The identified measures (themes) can be generalised in other rural areas in China or even in those from different emerging economies. E-commerce entrepreneurs in these areas or economics can use the proposed measures as benchmarks against which to develop their own strategies and plans for starting an e-commerce business.

Second, through the AST lens, various relationships among the aforementioned themes are further revealed, providing deeper insight into ICT-empowered rural e-commerce (Cui et al., 2019). Facilitated by ICT, a series of platform strategies and related services are implemented by e-commerce platform providers, which subsequently leads to diverse performance outcomes, including both the intended and unintended. These achieved outcomes serve as sources of a new structure, which provides resources to further develop e-commerce processes in the future. In addition, four influencing factors are identified, i.e., entrepreneurs' experience, innovation orientation, coordination, and political ties. This encourages further quantitative tests to verify these interrelationships.

Third, this study may be the first to explore e-commerce processes from an AST perspective. The AST perspective is proven to be a useful lens for analysing the theme and building a theory of e-commerce business. Moreover, by adapting AST to an e-commerce context, we extend AST into a more integrated framework with new themes (i.e., moderators, platform strategy) and propositions (i.e., P2 and P3) that emerged from our research findings. Our integrated framework not only adds new themes to AST but also refines the original findings in the works of DeSanctis and Poole (1994), Chatterjee et al. (2002), and Rains and Bonito (2017).

There are some limitations to this paper. As many rural e-commerce companies are disoriented regarding how to continue their businesses, this study investigates the development pattern of four successful rural e-commerce companies. A large sample survey is required to test this conceptual framework. In this sense, our paper provides a starting point for future empirical studies on this topic.

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Notes

1 Product standardisation includes setting the product specifications and governing quality management.