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# A Framework of Rural E-commerce in Context of Big Data in China

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**Abstract:** E-commerce has been developing rapidly in rural areas, and has a big influence on people's life especially in villages and towns in recent years. The popularization of Taobao Villages is the best example. In this paper, we conduct a literature review on rural e-commerce (REC) in China from three aspects: the research status, research contents, and research tendency firstly. We then taking farmers' special situation into consideration, propose a framework of rural e-commerce in context of big data. We hope this paper will trigger broader discussion on big data analysis in REC, which will make contributions to decision-making to change farmers' income determined by climate change situation.

**Keywords:** rural e-commerce, e-commerce, framework, big data analysis

## 1. INTRODUCTION

With exponentially growth of Internet over the past decades, more and more people go shopping online, including rural residents. According to CNNIC report of 29th August, 2016, rural e-commerce (REC) maintains rapid growth, and the amount of Internet user is about 1.95 billion till December, 2015, increased 1694 million compared with 2014<sup>[1]</sup>. The emerging of Taobao Villages in 2015 shows that developing REC is becoming a tendency and irreversible, which suits agricultural policy in the thirteenth Five-Year Plan. However, the relevant high quality and deep research is lack, especially in China, while there has a lot in other countries. There is a big gap between practice and theory about REC in China, too. Practice is in front of theory. Additionally, although the Internet has diffused nationally, the diffusion of e-commerce among cities and rural areas is not uniform, at the same time the development in cities is much better than that in rural areas. There are many problems existing in rural areas, such as lack of awareness, lack of infrastructure, lack of workforce skills, lack of government initiatives etc. Despite it has been widely acknowledged that in developing countries the adoption of EC by businesses is a significant economic growing indicator, numerous companies in the developing countries like China, South Africa and India still haven't been aware of the potential benefits of EC<sup>[2]</sup>.

Therefore, it is necessary to retrospect the previous literature to know the research status, and research contents, and existing problems. In part 2, research status in Chinese is shown; research agenda for the future is put forward in part 3. In part 4, we put forth a framework of REC in context of big data. Finally, it is implications and limitations in part 5.

## 2. THE RESEARCH STATUS IN CHINESE

We use “电子商务&农村”, “农村电子商务” or “农电商” or “农村电商” as keywords to search relevant literature that has been published from 2007 to 2016 on CNKI and Wanfang academic periodical full-text database. Finding out 1630 articles in total, removing some meaningless and repeatable articles, we got 1618 articles finally. REC has been becoming a hot theme since 2007 (Table 1). It is the first year that the published articles in journal beyond a hundred in 2014, and it has accelerating tendency from 2014. During 2016, there were more than seven hundred published academic. In Table 1, more and more related researches have been supported by National Natural Science Foundation as well as National Social Science Foundation from 2013. Though an increasing amount of published papers has focus on REC in this domain, but the extant literature is not enough. More high-quality and deep-research is needed seriously in China.

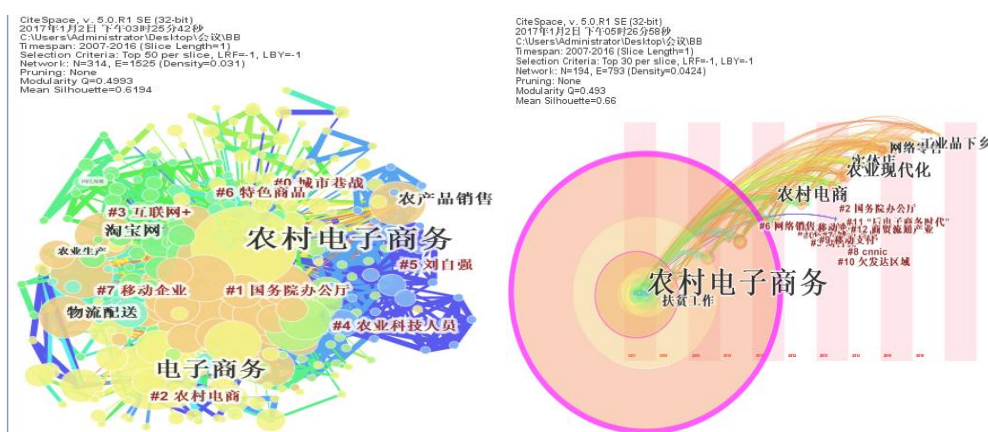
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**Table 1 The distribution of published articles year by year**

Year	Supported by National Natural Science Foundation	Supported by National Social Science Foundation	Quantity
2007	0	0	15
2008	0	0	16
2009	0	0	12
2010	0	0	28
2011	2	0	52
2012	0	0	43
2013	1	0	67
2014	2	1	101
2015	7	2	533
2016	15	12	750

CiteSpace is a useful academic tool to analyze previous literature, which can be used to know the research hotspots, the research evolution and research tendency. We used CiteSpace to analyze keywords (Figure1 and Figure2). Figure1is a simple keywords distributed figure, which shows the main keywords with very high frequency, especiallylike ” rural e-commerce (农村电子商务)” that regarded as keyword with more than 900 times. “#X” means the researchmain themes, such as General Office of the State Council (国务院办公厅),“Internet + (互联网+)”, rural e-business (农村电商), specialty products (特色商品), mobileenterprises (移动企业) and so on.These themes reflect the backgrounds and reasons of studying it. In Figure2, horizontal axis represents time from 2007 to 2016, which shows the research tendency as time flowing. As shown onFigure2, we know that modernization of agriculture (农业现代化), online retailing agriculture products (网络零售农产品), rural e-business (农村电商), Taobao (淘宝), logistics and delivery (物流配送) etc. are beingresearched by academics now. It gives us a hint about the future study.



**Figure 1. Keywords from existing literature Figure 2. Timezone of keywords from existing literature**

E-commerce via Internet has changed the way of how to sell agriculture products fundamentally, which is good for buyers and sellers to decrease asymmetric of information<sup>[3]</sup>. But, the developing situation is different among 34 provinces and municipalities<sup>[4]</sup>. Next, we will extend the part from three aspects as following.

**2.1 Related factors with REC**

As we know what factors have a significant influence on REC, we will easily take actions to improve operating procedures. These related factors will get more attention in the whole REC chains to create business value. Reference [5] uses structural equation model to study related factors, which sets 15 REC demonstration

counties in Heilongjiang province as examples. This study shows that infrastructure in rural areas, e-commerce platform, e-businessmen's abilities have a significant influence on REC. Reference [6] establishes a Probit model in view of farmers' participation to study on the influence factors of REC development, finding that age, education, income-level, commercial bank covering rate, distance, government incentives etc. are significant factors. Reference [7] also has some meaningful results: farmers' education, infrastructure level in rural areas, logistic and investment size are the main factors. These meaningful results will be helpful for both practitioners and scholars. But how these factors influence REC is still a black box. How much these factors create business value is also opaque.

## 2.2 REC business model

Agriculture products and rural residents are the main parts in REC. How to sell agriculture products easily therefore is an extremely important problem for rural residents. Based on the application there are three categories about e-commerce types: B2B (inter-organizational), intra-organizational, B2C (business to customers)<sup>[2]</sup>. However, reference [4] proposed four e-commerce business models: M2M, Mediator Pattern, Strategic Alliance and affiliate mode. There is a paucity of research taking its specialty into consideration, in his opinion, B2B2C business model is the best commercial model for REC instead of B2C or B2B<sup>[8]</sup>. With supply and marketing cooperatives appearing, there're four business models: B2B, B2C, C2C, and O2O. According to the most successful REC in different places that have satisfied incomes and big influences, more than ten business models exist. From ecosystems aspects, reference [9] uses case study to research Chinese REC and thinks it has three stages: birth, expansion, and self-renewal. Its conclusions are based on two real cases in China, so it can give Chinese REC some instructions.

Although there are plenty of different business models, they can be summarized into two types: one is from up to bottom; another is from bottom to up. No matter how many advantages this business model has; only the business model that suits your own characters is the best. There is no standard business model for Chinese REC.

## 2.3 Appraisal indicator system for REC

REC is dedicated to the development of villages and plays a greatly important role in realizing an overall well-off society. Reference [10] constructs an appraisal indicator system for REC, which includes six aspects with sixty indicators. But it is complex to use these entire indicators to appraise REC. Reference [11] estimates REC level in China from five aspects with twenty-five indicators, using PCA and clustering method. It shows: REC developing situation classified into five levels has a big difference around the country; eastern areas have developed rapidly, then the central part and western part. As REC having germinated since 2014, the feasible and easy-operate appraisal indicator system having not been completely formed, still needs deep study on it.

## 2.4 How to develop REC better

In fact, in a long time, income of peasants is determined by climate and weather change. Agricultural product is the sole source of their income. In addition, there are still many farmers who only live their life by their own hands rather than technology, planting grains and selling agriculture products in a traditional way. REC which has changed the way of transaction of agriculture products is a good way to overcome this constrains. However, REC develops not so rapidly because there are many problems existing in rural areas, such as lack of awareness, lack of complete infrastructure, lack of basic workforce skills, lack of government initiatives etc. A part of papers research about how to develop REC better. Some papers illustrate that there are some directions to deal with it: improving rural infrastructure including transportation, computer, telecommunication, having expertise training to related people, motivating college students participating in REC, enhancing logistic system ability, concentrating on agriculture products' security. Human capital is the most important one among them, which is the core competitive of an organization.

The proper development strategies of REC are still on the way in China, particularly using big data analysis.

### 3. RRSEARCH AGENDA FOR THE FUTURE

Internet and e-commerce can do a favor in reducing poverty by improving access to online education, fund collecting, government and other services. The government in China has published some incentive policy to attract more human capital, technology, investment to focus on agriculture and rural areas developing. As seen in Table 2, Asia has the largest population of Internet users in the world, with lower penetration rate of Internet user than average rate of Internet users. From 2000 to 2016, it has increased 1515.2% Internet users. And, China (not including

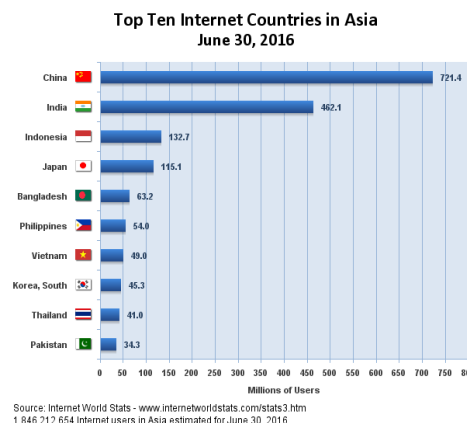


Figure 3. Top ten Internet countries in Asia  
 Hong Kong, Macau, Taiwan) has the largest population of Internet users in Asia (Figure 3), which means REC in China needs more related study.

In this section, the paper puts forward three research agendas in the future, triggering broader discussions on them.

**Table 2 World Internet usage and population statistics JUNE 30, 2016 –update**

World Regions	Population (2016 Est.)	Population % of World	Internet Users 30 June 2016	Penetration Rate (% Pop.)	Growth 2000-2016	Table % Users
Asia	4,052,652,889	55.2 %	1,846,212,654	45.6 %	1,515.2%	50.2 %
Europe	832,073,224	11.3 %	614,979,903	73.9 %	485.2%	16.7 %
Latin American/Caribbean	626,119,788	8.5 %	384,751,302	61.5 %	2,029.4%	10.5 %
Africa	1,185,529,578	16.2 %	340,783,342	28.7 %	7,448.8%	9.3 %
North America	359,492,293	4.9 %	320,067,193	89.0 %	196.1%	8.7 %
Middle East	246,700,900	3.4 %	141,489,765	57.4 %	4,207.4%	3.8 %
Oceania/Australia	37,590,820	0.5 %	27,540,654	73.3 %	261.4%	0.8 %
World total	7,340,159,492	100.0 %	3,675,824,813	50.1 %	918.3%	100.0 %

According to research status on REC and present situation of Internet usage in China, these problems like customers’ behaviors research in REC, REC research in context of big data and how to overcome difficulties in new situation etc. are challenging but meaningful.

#### 3.1 Customers’ behaviors research in REC

Although research on customers’ behaviors in REC is poor at present, customers are the main stakeholders in REC ecosystem. As REC has a great potential to enhance farmers’ income and reduce poverty, a greater number of rural residents will take part in REC. It is essential to study on customers’ behaviors, analyzing the influenced factors on them, finding out customers’ habits and preference, and mining value information about how to direct these businessmen to go on REC well. Reference [12] uses empirical study to verify some factors having different influences between urban and REC. With more farmers’ adoption of mobiles, there has been an increasing emphasis on mobile usage. M-commerce that is different from traditional e-commerce has been emerging in the countryside<sup>[13]</sup>. In the future, scholars can study differences of customers’ behaviors between urban and rural residents in China and its mechanism. Research on customers’ behaviors in REC is vital to know what influences their decision-making.

#### 3.2 REC research in context of big data

With the big data era coming, many e-commerce firms have injected big data analytics into their value chain. Due to the huge influence in e-commerce, especially in generating business value, big data has been becoming the focus of academic and industry. And some researches show that big data analytics can make contributions to the growth of firms<sup>[14]</sup>. However, in Chinese, only handful of REC studies exists in context of big data. “5V”

characters of big data are volume, velocity, variety, veracity and value. Big data analysis can help e-businessmen to achieve a range of benefits, like affording customization products, generating wonderful ideas for value-added services, new products and features, having better sales promotion schemes, sharing delivery information with customers in time, and launching target advertisements and so on. What's more, big data analysis will minimize the impact of climate and weather change; improve the efficiency of market transaction cost, time cost and managerial cost. Overall, big data analysis will assist stakeholders to make relevant decisions. Although big data has great potential to enhance business value, there are some challenges for decision maker to deal with to reap transactional, informational and strategic benefits<sup>[15]</sup>. Therefore, it is extremely needed to research REC in big data context. But using customers' data to find value business information and protecting customers' private information is like the two sides of coins, how to keep its balance and being ethical are obviously important.

### 3.3 How to overcome difficulties in new situation

In all, in order to expand the scope of rural e-commerce research as well as benefit from it, a great many opportunities exist for scholars in this field. Reference [9] emphasizes that some e-tailors have no choice but to shift their non-farming operation to the town or nearby cities in order to expand their e-business, because of lacking effect workforce, finance and space. This situation may trigger population outflow, and then dash the expectations of rural residents. Owing to intensive REC developing in rural areas, it also can cause environmental degradation and intense social relationship. In this case, profit-driven business may lead to environment pollution problems which have caused hundreds and thousands new problems in rural areas; sacrificing environment for the sake of business is stupid. Therefore, it is imperative to study on how to deal with these unintended problems.

## 4. A FRAMEWORK OF REC RESEARCH IN CONTEXT OF BIG DATA

### 4.1 A framework of REC in context of big data

Big data analysis and cloud computing like a smart brain can help people to discovery knowledge to do decision-making. In order to make better decision and form smart agriculture, a framework of REC in context of big data is proposed (Figure 3), which consists with big data, cloud computing, decision-making and Internet of things (IoF) of REC.

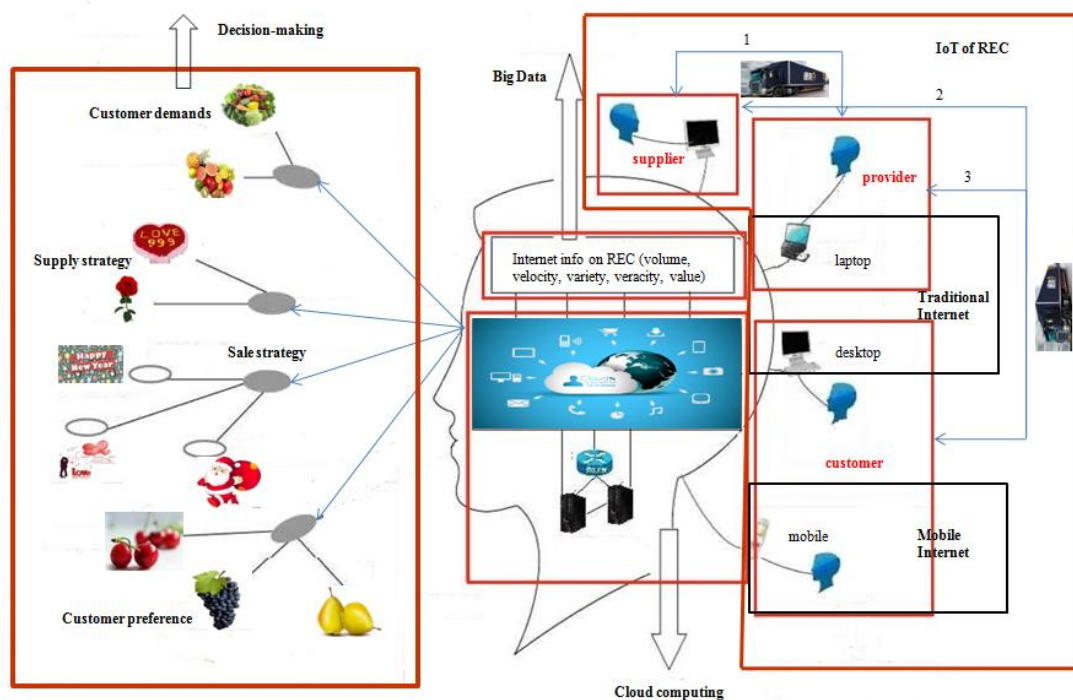


Figure 3 A framework of REC research in context of big data

In this figure, there are three main kinds of people on REC included: supplier, provider, and customer. 1 means transaction and communication between supplier and provider, while 2 and 3 mean that between customer and provider, customer and provider respectively. Provider represents farmers who afford initial products with abundant natural resources, poor hard resources and soft resources. According to CNNIC report of 29th August, 2016, only 6% of rural Internet user is with college education and above <sup>[1]</sup>, which means farmers with high education background are few. As a result of farmers' low education or illiteracy and decentralized villages, if providers are good at REC, they will trade with customers on REC directly. Otherwise, they are only occupied in planting agricultural products: such as grains, fruits and cotton and so on, affording products to suppliers instead of selling products on REC platform in person. Suppliers are goods collectors that are good at REC, interested in REC and occupied in REC. They buy goods from analphabetic or low-educated farmers and make deals with customers at the same time. Among different transactions, IoF links data receiver and products, providing logistics information in real-time. IoF is used on REC, particularly for tracking on fresh agricultural products, decreasing logistics cost and loss.

Only if data are produced on REC, can we go on big data analysis. As mobile is popular in rural areas, REC can happen in between traditional Internet including laptop and desktop, and mobile Internet. Internet information on REC among supplier, customer and provider, and other data they produced on REC are big data sources. Big data contains structured data, semi-structured data and unstructured data that refer to the huge quantities of click-stream, transaction, video, and voice data <sup>[16]</sup>. In addition, during big data analysis, these data can be handled with cloud computing. Cloud computing is a computing style, which provides dynamically scalable and usually virtualized resources over the Internet. Therefore, it's convenient to access these resources.

During big data mining process, there are 6 steps to finish: acquiring data, data storage, data importing, data preprocessing, data mining and visual analysis and rendering. Data mining aims to discover knowledge and marketing rules about REC. Analysis results is the output of data mining, which can service for customer demands, customer preference, sales strategy, and supply strategy decision-making. In another word, an equation as shown in equation (1) can express the framework clearly:

$$DM = F(S_{ij}, C_{ij}, P_{ij}) \quad (1)$$

In this equation, DM means discovery knowledge, which is the result of data mining.  $S_{ij}$ ,  $C_{ij}$ , and  $P_{ij}$  mean the  $i^{th}$  suppliers' or customer's or provider's data in  $j^{th}$  indicator in REC ecosystem. These data are structured data, semi-structured data and unstructured data, such as transaction data, sharing times, ranking, comments, texting messages, commodity attributes and so on.

In context of big data, data mining and cloud computing are necessary to research on REC. When making decision, we suggest providers and suppliers think about four main problems, such as customer demands, customer preferences, supply strategy and sales strategy etc. and these questions as following:

- Is the order placed on PC or mobile?
- Is logistics service good?
- Do customers satisfy it from big data analysis?
- Do customers share with friends via REC?
- What kind of agriculture goods is the most popular?
- Where is it popular?
- How about customer service and logistics?
- Do I need to afford customization product project?
- How can I improve my products?
- Do I need a sales promotion?

#### 4.2 Process of customer purchasing goods on REC

As a framework of REC in big data context is proposed in Figure3, data mining is dedicated to decision-making to satisfy customers' demands. During this process, customers will produce numerous data, which is a part of data sources to data mining. Therefore, customers' buying decision process must be known clearly. In this part, we discuss process of customer purchasing goods on REC. First of all, we divide customer's buying decision-making process into different stages (Figure 4). If a rational customer wants to purchase something on REC, he will go through these stages: need recognition, information search, alternative evaluation, actual purchase, post-purchase evaluation. We suppose that if a customer has need recognition, he will find goods by searching it on Internet or clicking some links directly. Then he intends to finish information search and alternative evaluation stages, he will ask advice or scan it to know goods. When he thinks that it's worth to buy, he will have actual purchase: purchasing it via placing an order and then waiting it with checking logistic information. In the post-purchase evaluation stage, he will use it including making comments in spare time and maybe share it with his friends, like recommending to others. As all his demands are satisfied, he will purchase it again. All this stages are customers' behaviors tracks with plenty data.

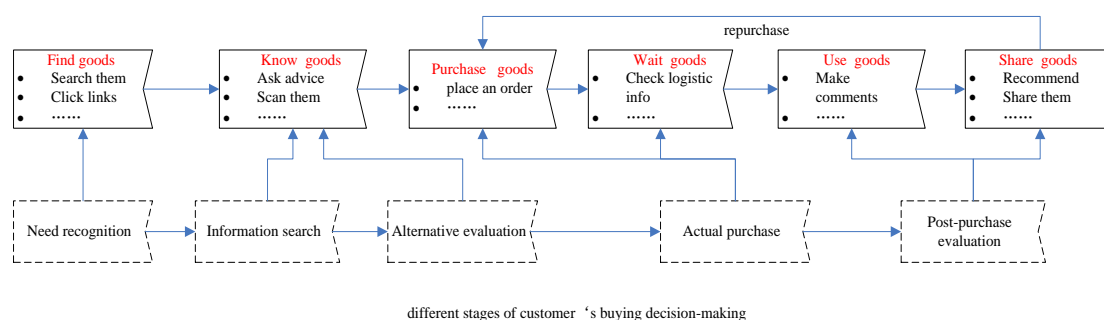


Figure 4 Process of customer purchasing goods on REC

#### 5. IMPLICATIONS AND LIMITATIONS

It is acknowledged that REC has many advantages and has positive impact on rural residents' life. With Alibaba, JD.com, Suning having plans on REC, practice goes in front of theory. Scholars should pay more attention on REC study. The fact that the penetration rate of Internet in urban firms is much higher than that in rural firms of China and better firms' performances in urban, demonstrate Internet access has positive and strong relationship with firms' performances<sup>[17]</sup>. REC in China with a stage of self-renewal, the government in China should promote and motivate Internet usage among rural firms as well as affording some expertise services to help farmers how to handle problems. Though income of peasants is determined by climate change in the history, it can be altered by new technology and REC. Owing to information technology which brings lower coordination cost but without increasing the associated transactions risk<sup>[18]</sup>, studying and developing REC is a good way to solve hard-to-sell problem and then reduce poverty, construct a well-off sociality on a large scale. The paper only has a review on previous literature in Chinese. We will study customers' behaviors on REC with data mining method in the future and use case study to research REC business model.

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