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A Framework of New Rural E-Government and the Related Information Resources Integration

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Abstract

Nowadays, with the rapid development of China's economics, like many foreign governments, Chinese government regards improving farmers' living standard as the basic state policy, which has introduced many policies and poured a large sum of money to develop and promote New Countryside Construction, and planning and building rural E-Government and E-commerce is key content of New Countryside Construction in china. This paper begins with exploratory research for designing New Rural E-Government and integrating the related information resources, which can provides a powerful technical support for further narrowing the gap between urban and rural areas to build a harmonious China society. This paper divides into 4 sections: the first to summarize the development of rural e-government in developed countries; the second to puts forward a framework model of rural e-government based on modern e-government and e-commerce management theories and combined with the characteristics of the development of rural area in China; the third to design an integration model of information resources in rural e-government, and gives the methods and goals of integration; At last, based on integration model of information resources and game theory, this paper analyses the strategy choices of sharing information resources in the new rural e-government, and proposes the corresponding suggestions for developing and constructing e-government in rural areas. At present, few research fruits has been applied to plan New Rural E-Government in China. So, the research in this paper is an innovation.

Key words: *rural e-government; information integration; game theory; framework*

1. Introduction

1.1. Current Research Situation at Abroad

With the arrival of the age of the Internet economy, the governments in all the country have the consciousness of constructing rural e-government to improve the level of public service. Facing the global international competition and the challenge of knowledge economy, many governments take the affairs of electronic government as a priority development strategy.

The United States, who developed e-government early, also has the most developed electronic government. The members of EU also have made great progress in constructing e-government. There are many foreign scholars to study the electronic government. P. L. Peter (2013) proposed an integrated model of e-business strategy, getting inspiration from the case of Haier [1]. T. S. Kumar (2011) put forward an agent based service middleware for e-governance and insists that a hybrid approach can be considered as an effective approach for the development of predictive modeling in complex E-governance

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systems[2]. R. M. Hussein etc. (2011) studied the e-government in the application of the tax system, and had an integration model in their paper [3].

The development of e-government in Japan and Singapore is also very fast. The Japanese government had started an engineering of e-government in 2003. The main content of this e-government engineering included any formalities of applications, declaration and examination thought network system. The purchasing plan of government is also completed in this ways. There are more than 3000 business which are taxes declaration online and submitting securities reports and so on. At present, the most applications of government are completed by e-government system which means that Japan has been fully into the office of the paperless and electronic era.

Like USA and Canada, Australia has become the world's most advanced nations in the development of e-government. According to Global e-government survey report which announced by the economic and social department of the United Nations in December 2005, the E-government readiness index of Australia ranked in the top ten. Nowadays, Australia which began to develop the electronic government in 1980s has become one of the most advanced nations in the development of e-government. Many scholars in Australia are looking for deep insights into the development of e-government and have obtained some success. K. A. Karunasena and H. P. Deng (2009) proposed a conceptual framework for evaluating the public value of e-government from the perspective of citizens [4]. They insisted that four dimensions of public value creation through e-government should include delivery of public service, achievement of outcomes, development of trust, and effectiveness of public organizations. A. K. Chatfield,S. F. Wamba and H. Z. Tatano (2010) researched into the Role of RFID Technology in Building Safe and Secure Local Communities, and considered that the RFID technology can promote the development of e-government [5]. All those works make the development of e-government in Australia in first class level of the world.

There are many scholars in India devoted theirs energy into the construction of rural electronic government, and achieved some good result. Prof. T. P. Rama (2008) considered that the appropriate public private partnership model could prompt the electronic government to develop rapidly, and the cost of e-government could be effectively solved [6]. R. Basettihalli (2010) analyzed the structure of rural electronic government in India, and considered that e-government was an important method to improve the efficiency of governance [7]. Taking examples from the development of rural e-government in India, D. Bhatia,S. C. Bhatnagar and J. Tominaga (2009) analyzed and compared how e-government services and manual ones had done [8].

Social affairs of the Secretariat of the United Nations publishes the E-government readiness index of every country in the word every year. In the United Nations e-government survey report published in 2010, the top 10 countries of E-government readiness index are as the following Table 1. According to the Table 1, the countries with high ranking in the E-government readiness index have rapid development of the economy and the economy is relatively strong. Through a series of measurement methods, many researchers devote most of their time to discover the relationship between the development of electronic government and the development of economic. At last, they found that the development of e-government can improve the development of local economic. Wan Jianxiang consider that the improve policy of electronic environment means the development of the economy [9]. Y. Q. Rao, K. Zhang, and L. Lin also believe that there is a close relationship between the development of e-ecommerce and the improvement of GDP [10]. Maung K. Sein also believes that the improvement of the construction of rural e-government can improve the progress of society, and ensure the service level of government [11]. Therefore, China, as a country with rapid economy, should intensify the construction of rural e-government to improve farmer’s living standards, to enhance the relationship between government and farmers, to promote the development of economy in rural areas.

Table 1. The Ranking of e-government Readiness Index

Rank	Country	Index
1	Republic Of Korea	0.8785
2	United States of America	0.8510
3	Canada	0.8448
4	United Kingdom	0.8147
5	Netherlands	0.8097
6	Norway	0.8020
7	Denmark	0.7872
8	Australia	0.7863
9	Spain	0.7516
10	France	0.7510

This paper is dedicated to study the structure and function new rural electronic business, and its information resources integration model. The next part of this paper will put forward related models to provide the theory of the construction of rural electronic government.

1.2. Current Research Status

As China's economy growing and the rural policy unveiling, more and more scholars in China gradually realize the importance of rural e-government. Suqun Cao has a web-service-based design for rural industry by the local e-government, and gives an example to support the development of rural e-government [12]. X. K. Yang and X. N. Zhang have an exploratory research to find out the construction model of new rural electronic government, and analysis the difference between the developments of e-government in rural areas and in cities [13]. J. Y. Huang puts forward the measures to construct new rural electronic agriculture in the new socialist countryside from the point of view of constructing new rural e-government, and explains the relationship between e-agriculture and rural e-government in China [14]. Although the development of rural e-government has been made great progress by the hard work from those scholars in China, there are still many problems in the development of rural e-government. According to the e-government evaluated standards of international society, the construction of rural e-government in China is still at beginning stage, and need to enhance the power of constructing. At present, there are four main problems in China's rural e-government.

The development of e-government in China is not balanced. Not only the development of rural e-government, but also the construction of government portal website has the seriously unbalanced development between east and west in China. The development of e-government in the east cities and coastal areas is much faster than the cities in the central and western regions. The speed of constructing e-government in the provincial and higher level government is fast, and the website is perfect. However, the speed in the department with low management level is slow. The situation in some rural areas is quite terrible.

The popularity rate of rural e-government is very low. According to the Chinese e-government research report from Times wealth technology companies, the achieve ratio of e-government in China is 22.6%, which means that there is a long distance to achieve the public's expect in the e-government's practice, integrity and material functions. The shortage directly reflected in the government's portal website.

The construction of rural government's portal website is lack of effective organization and planning. This problem is not only reflected in the irregularity domain name of some government's portal website, but also in the content of those websites. The websites,

without the most basic specification, bring the gap between the homepage of government and public image of government.

The applications of e-government are lack of effective management. According to an evaluation from an organization, More than one third of government portal websites cannot be opened and don't have much application value in 2500 government websites. Many government portal websites without any integration of business functions are just for distributing information. The way of communication between public and government is quit single.

The fundamental purpose of the rural e-government is still to establish public service. The literacy and receptiveness of public is different. People in a city with a better education environment can accept new things more quickly than people in rural areas which can accept the service of e-government easily. However, the whole economic culture in rural areas is still weak, and the information literacy of farmers is still low. Therefore, the gap between countryside and city makes the construction of e-government in rural areas is different from in cities.

To sum up, the priority of constructing rural e-government is that building a complete and convenient website base on improving the farmer's overall quality, which is an important window to develop any other functions of e-government. At the same time, considering to the low popularity rate and limited knowledge of farmers, the next part of this paper will introduce a new rural e-government framework based on agent, and research its information integration.

2. The Framework of New Rural e-government

2.1. The Stages of Constructing Rural e-government

Considering the characteristic of the development and the strength of economy in rural, the construction of rural e-government in China is based on the power from social and dominated by government. The engineering of rural e-government is a complicated system, which dominated by government who can coordinate the social power. The stage of contracting an e-government system with completed functions can be divided into three ones.

The first stage is the construction and management of government's portal website. The success of this stage is information announces and the direction of information flow is single.

The second stage is to complete the translation of date and information. The characteristic of this stage is that government department can assess the database with permission. For example, Industry and Commerce Department can translate its information with Tax authorities to provide data to the user with permission. The key factor of the improvement of functions is the system security.

The third stage is the high integration of applications and business process. The characteristic of this stage is that all government office businesses can be competed online, and completely realize the paperless office to improve the development of rural economy.

At the same time with the construction of rural e-government, how to popularize the rural e-government is another hot topic that many scholars are researching. A method named "first commerce then government" is proposed to promote the development of rural e-government, and the method insists that farmers can receive necessary and accurate market information by e-commerce to improve their income. Then, other applications of rural e-government can be easily accepted.

According to the request of rural e-government development in China, this paper puts forward a structure model which faces to rural basic government based on the agent technology, and the structure model is as shown in Figure 1.

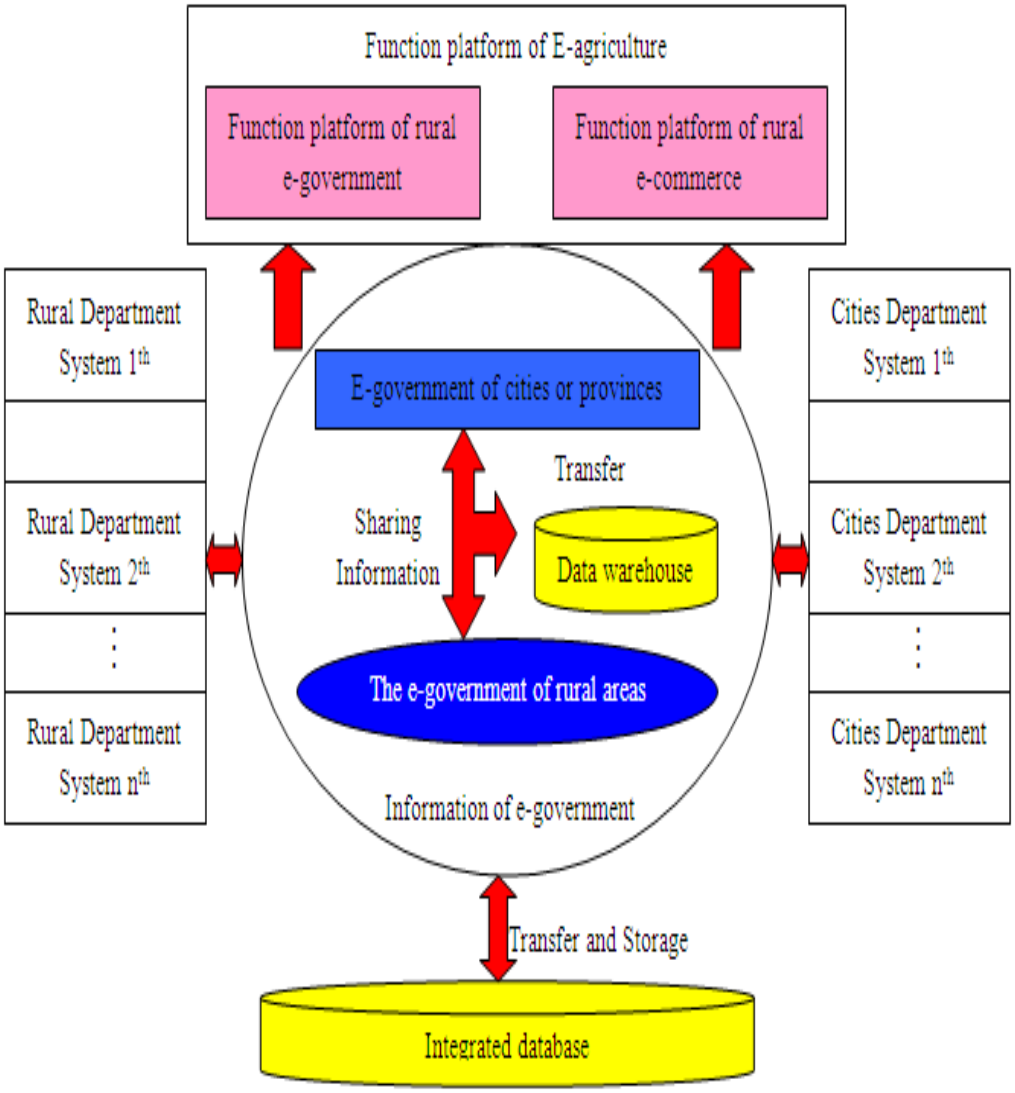

Figure 1. Topological Structure of New Rural e-government

From the above model, we can see that the e-government in cities is the necessary of new rural e-government. The information resource in countryside is limited. The sharing information from cities and rural areas is an important method to construct rural e-government. Government can make two-way market planning based on the sharing information from cities and rural areas. Through the two-way market planning, the tools of agriculture (the necessary of rural areas) and the agriculture food (the necessary of cities) can be integrated to save the cost of logistics. In this way, government can promote the coordinated development of economy in rural and urban.

2.2. Functional Structure

According to the above structure model of the construction of e-government, we can get the main content of electronic government. The idea of constructing the rural e-government in this paper is that farmers can receive necessary and accurate market information by e-commerce to improve their income. By the method above, farmers can improve their skills of operating e-commerce. Then, other applications of rural e-government can be easily accepted. This paper insist that the rural e-government system can be divided into three models from the view of the applications of public and

enterprise and the view of the applications of rural government and the view of applications of two-way. Based on this structure model, the government can gradually construct the system, and the function of this system can be as shown in Figure 2.

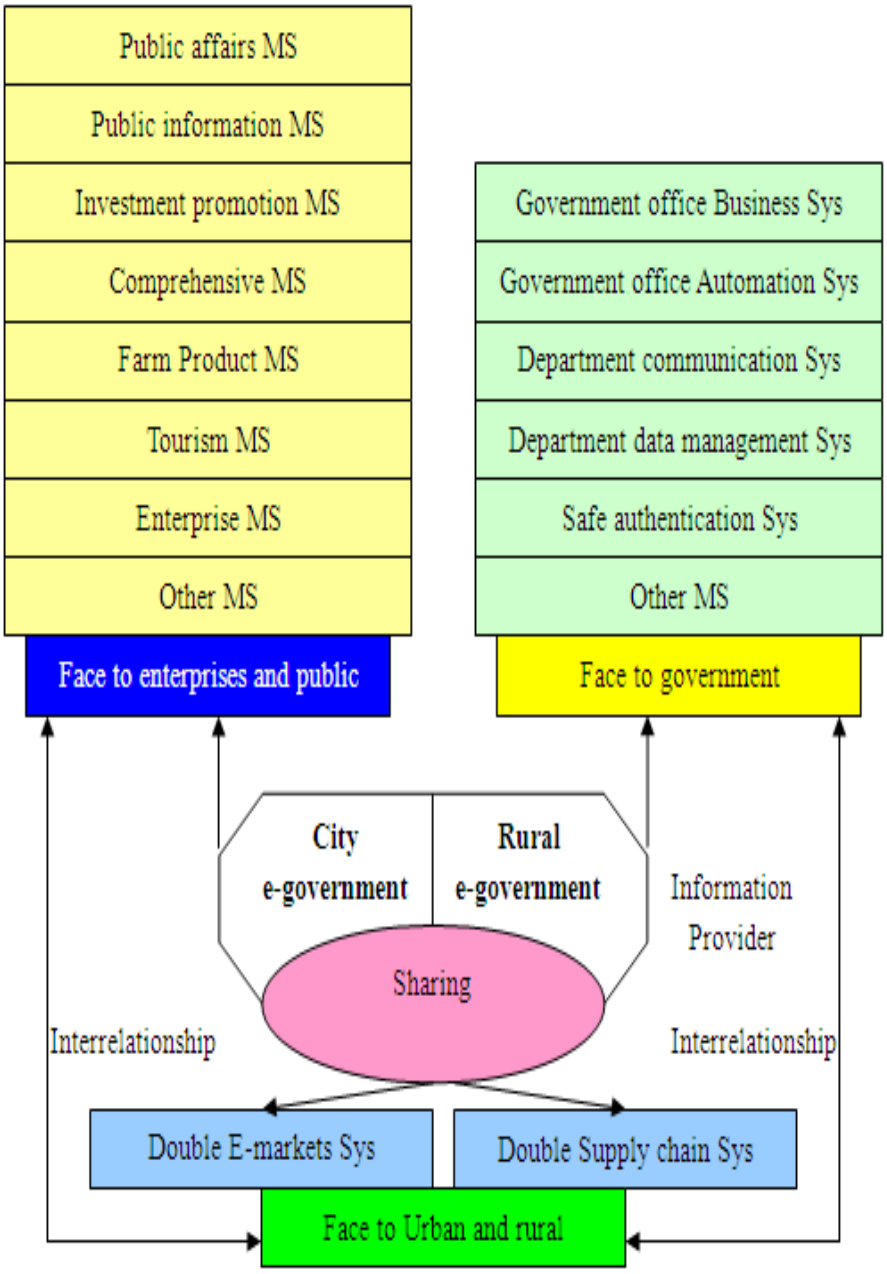

Figure 2. Function Model of Rural e-government

(1) The applications based on public and enterprise.

This paper insists that the rural e-government system should combine the application of e-commerce and e-government. The main content of this system includes Public affairs Management system, Public information Management system, Investment promotion Management system, Comprehensive Management system, Farm Product Management system, Tourism Management system, Enterprise Management system and so on.

- Public affairs Management system: The function of this system is to announce the news, laws, regulation, notice, responsibilities and any other information to public.
- Public information Management system: The content of this system includes tourism resources, consumer guide, and agricultural information guide, business guide, and online library, online map, and any other service facilities.
- Investment promotion Management system: The content of this system includes planning information, business development, investment policies, and economic trends.
- Comprehensive Management system: The function of this system is to introduce geographical scenery, folk past, history, Population resources, and Strategic planning in countryside.
- Farm product Management system: The function of this system is to announce farm products information to farmers and make sure the products can be translated speedily.
- Tourism Management system: Combined with the characteristics of local tourism project, using Internet e-commerce technology to enhance the management of rural tourism resource.
- Enterprise Management system: Integrated the business information of the enterprise, so that government can have a correct guidance.

(2) The applications based on government.

The main content of this system includes Government office Business system, Government office Automation system, Department communication system, Department data management system, and Safe authentication system.

- Government office Business system can ensure that any business processes can be done by internet, such as applications, payment, inquiry and so on.
- Government office Automation system can make sure that the translation of information between different departments. The common technologies include IP telephone, video conference and email.
- Department communication system can backup, update and share the date in time. The information (statistical index, files, and policy) from different department can be exchanged and shared in time.
- Safe authentication system can ensure the security of the rural e-government. There are some information that cannot be opened in every department. Therefore, the countryside electronic government system must have a corresponding security authentication system, such as Electronic official seal, RFID, User identity signature, *etc*.

(3) The model faces to the urban and rural. Based on the research before, the two-way rural e-commerce system and the two-way logistics integration system can be brought into the new rural e-government system.

Combined with the characteristics of agricultural products market in China, constructing the two-way e-commerce system can bring an online market operation platform. The platform not only can make sure farmers' goods can be easily sold without going out, but also the orders of two big market can be integrated with two-way logistics integration system. Therefore, rural products of the countryside can enter into international market which can improve the income of farmers, and drive the prosperity and development of the rural economy.

Considering the characteristic of rural logistics in China, the rural e-government puts forward a two-way agricultural logistics integrated concepts and methods. The two-way agricultural logistics integration system not only can form scale, but also can effectively reduce the empty loading rate and the cost of rural logistics, and drive the development of China's rural domestic demand.

3. Information Resources Integration

At present, the government has set up their own government websites, but these systems are inconsistency and isomerism in the security platform, application environment, data storage and exchange standard, and this cause difficulty for the electronic government in application integration and data exchange of the systems. How to integrate different government departments and enterprise data resources, integrate existing application, ensure data integrity, accuracy, real-time and accessibility, and eventually build a decision support system becomes the current core question in domestic e-government research. Through statistical analysis the paper about Chinese recent year's e-government information resources integration research, it's not difficult to find that our country's e-government information resource integration research has made a series of achievements. But we should also realize soberly, our country's e-government information resources integration is still in the initial stage, and compared with developed nations, it has gap and many problems, and the e-government information resources integration and sharing should reduce the government cost and improve the efficiency; it's helpful for administrative supervision and promoting the government informationization. E-government flows are the foundation of realizing e-government information resources integration and sharing. Therefore, we should learn the successful practice and experience of foreign e-government information resources integration to speed up the development of the construction of e-government in China.

3.1. The Framework

The benefits of new rural e-government information resources integration are obvious, and it must integrate the new rural e-government information resources. First of all, Chinese rural electronic commerce environment cannot compare with the developed country; most of rural e-government construction would lack resources such as capital and information. Therefore, the new rural e-government through integrate the rural and urban resources to speed up the new rural construction. In the information integration process, it still can integrate the rural market information and urban market information; guide the rural agricultural products market correctly; and solve the problem of rural product market. Through the resources integration, it set up two-way electronic market between rural and urban. Based on the promotion of this electronic commerce, it will further strengthen other business construction of the new rural e-government. This paper will analyze the domestic and foreign e-government resources integration model research. With Chinese rural economic development condition, we put forward the new rural e-government resources integration framework (seen in Figure 3).

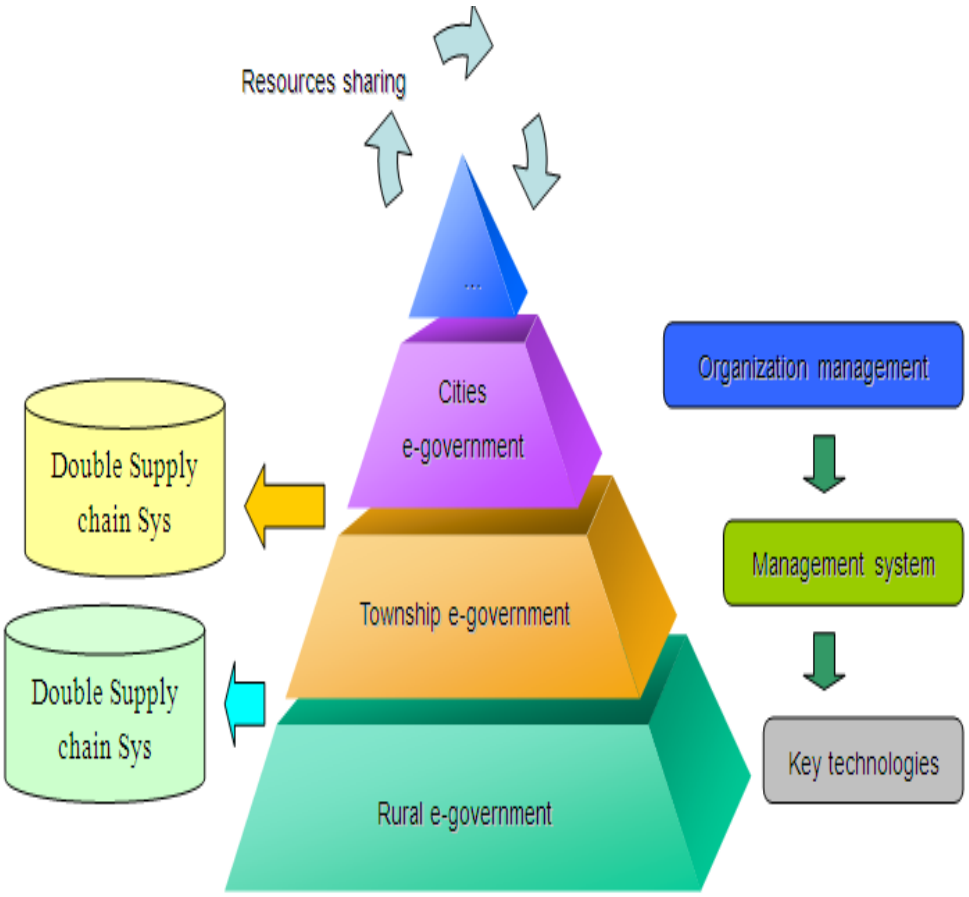

Figure 3. New Rural e-government Resources Integration Model

From the model ,we can find that the rural e-government system resources is limited, we can get more useful information through the integration between the rural and urban, such as the new rural two-way electronic market model, the new rural two-way logistics model and two-way business integration model. We integrate data of all levels of government system through the data warehouse, and it's convenient for government to make decisions. Farmers and citizens can get the latest agriculture information and market policy information through login the government website or intelligent agent, and it's convenient for them to adjustment the operation. The whole new rural e-government resources integration has corresponding support system, how to construct the new rural e-government more effective is the domestic scholars' research topic. Wang Yan *et al.*, think that the new rural e-government resources integration need module includes: the government reform and management system innovation, infrastructure construction, information standardization system, legal laws and regulations, *etc*.

3.2. Data Integration

The key factor of rural e-government information resources integration framework is the realization of each information resource module, and it is dependent on the data integration and data exchange among the modules. In order to simplify the data exchange among distributed operating system and set up the connection among distributed data, it uses relevant methods to integrate data of different application system as a whole. It's called data integration.

According to the definition, we can understand the data integration to achieve the objectives are:

- Data filtering transparent: Through provide uniform data access interface for user to make sure the data of internal and external database system transfer and receiving effectively.
- Heterogeneous transparent: The users can use the same way to access other e-government database.
- Control management: About data sharing, data online exchange, *etc*.
- Database expansion: It can expand the original e-government database and add new database.

At present, the data integration methods mainly include:

- Integrate the data in the middleware layer, and release the integrated data as standard interface through the standard interface of middleware layer.
- Process the data in the date source layer, and release the integrated data as standard interface to middleware layer, the middleware layer is responsible for data access.
- Integrate the dispersed data of database to ODS or data warehouse, and then release the integrated data as standard interface to middleware layer.
- Use data grid method to integrate data of data layer to middleware layer, and then forming data grid. The middleware layer is responsible for data processing, integrating and releasing as standard interface.

3.3. Information Sharing

Through the above study, we can know that the new rural e-government system construction is dependent on the support of other levels of e-government, so it must be the security problem with the data sharing among different database. A lot of scholars have focused on studying the safety of e-commerce and e-government. We will evaluate the security problem of information sharing in online virtual enterprise by game theory and tests the electronic commerce agreement to ensure the security of electronic commerce. Because of the database system of different town enterprise and governments, there is a shared limit problem with data sharing. Many enterprises and governments are not willing to let their own data to be shared by others but wish to get more information from others, so there is a corresponding equilibrium among the enterprises and government data sharing. Therefore, we use game theory to research the safety problem of the new rural e-government data sharing, to analyze the strategy choice when the enterprises share data.

A successful rural e-government relies on efficient data acquisition, integration degree and information sharing degree. The governments can rely on the policy to share the information compulsory with each other, but the enterprises cannot. Therefore, not all enterprises are willing to share their own information resources in building a new rural e-government system. Rural e-government system can be as a public platform, and the enterprise information is private resources, it can use the private resources supply model of public goods. We assume that new rural e-government construction is constituted by n enterprises, each enterprise willing to share the amount of data as s_i, so the total amount of calculating e-government information resources sharing can be made as formula (1):

$$S = \sum_{i=1}^{n} s_i \qquad (1)$$

There is a function U seen in formula (2), where each enterprise i shares the information on the e-government platform, x_i is the consumption of enterprise i information sharing.

$$U = u_i(x_i, S) \qquad (2)$$

From anglicizing the influences of the degree of share information to platform, we can know that $\partial u_i / \partial x_i > 0$, $\partial u_i / \partial S > 0$ .The meaning of the above two formulas are that the more enterprise i share information, the better utility by rural e-government; the higher amount of information sharing, the better utility by rural e-government; C_x is the unit cost of the enterprise private information; C_S is the unit cost of the total amount of information sharing; L_i is the information revenue of enterprise i . So formula (3) is the objectives function when the enterprise i use the optimal strategy (x_i, s_i), λ is the Lagrange parameter:

$$M_i = u_i(x_i, S) + \lambda(L_i - C_x x_i - C_S s_i) \quad (3)$$

Formula (4) and formula (5) are the objective function optimization conditions:

$$\partial u_i / \partial S - \lambda C_S = 0 \quad (4)$$

$$\partial u_i / \partial x_i - \lambda C_x = 0 \quad (5)$$

Combine formula (4) and formula (5) ,we can get the equilibrium condition of the enterprise information sharing formula (6) :

$$\frac{\partial u_i / \partial S}{\partial u_i / \partial x_i} = \frac{C_S}{C_x}, \qquad i = 1,2,\ldots,n \quad (6)$$

Then we analyze the optimal strategy of the enterprise resources information sharing, we assume that the total utility function of rural e-government platform is formula (7) , and the total cost function is formula (8):

$$W = \theta_1 u_1 + \ldots + \theta_n u_n, \qquad \theta_i \geq 0 \quad (7)$$

$$\sum_{i=1}^{n} C_i = C_x \sum_{i=1}^{n} x_i + C_S S \quad (8)$$

Through countdown the first derivative of function, we can get the corresponding equilibrium conditions. Assume that the utility function of the enterprise information sharing is $u_i = x_i^{\alpha} S^{\beta}$ $(0 < \alpha < 1, 0 < \beta < 1, \alpha + \beta \leq 1)$ which put forward by C.W.Cobb and Paul H. Douglas.

Therefore, if each enterprise with the amount of information are equal, we can get the corresponding equilibrium strategy formula (9) :

$$s_i^* = \frac{\beta}{\alpha n + \beta} \frac{M}{p_S}, \qquad i = 1,2,\ldots,n \quad (9)$$

Based on the analysis above, we can draw the conclusion that with the number of enterprise rising, the number of information resources that enterprise can share will drop accordingly. When the size of the enterprises are uneven, the large enterprise will share their information resources as much as possible, but small businesses will share a small amount or not share their information resources. Therefore, to some extent, the implementation of rural e-government is impeded. Obviously, the purpose of government is that the enterprise can share information resources as possible so that the government can accurately grasp the market, and monitor the enterprises more reasonably. However, the model above also has something unreasonable. Because information resource is different from other resources, each enterprise information resources may be repeated. Therefore, the function of sharing costs and benefits is too simple. Although this model is simplified, to some extent, it can still show the strategy of enterprises.

Therefore, through policy or other means, the government must ensure the enterprise who shares their information can get more profits to improve enterprise's enthusiasm of

taking part in the constructing the rural e-government., so as to improve the level of the whole rural economy. Governments also have to promote enterprise technology innovation by the policies. Only when the technology of enterprise is frequently innovated, can the enterprise reduce the cost of sharing information. Through the methods above, promoting the construction of rural e-government system and improving the sharing level of data integration can help public to grasp the accurate market information and speed up the development of rural economic.

4. Conclusion

This paper summarizes the development of the foreign rural e-government, and found that the development of e-government will bring to the corresponding economic development of government. The rural e-government development level is closely linked with the economic development level. After taking examples from foreign e-government development and combining the domestic rural e-government development, we put forward the suitable e-government frame model for the most of China's rural development. Based on the model, we put forward the main function modules for the new rural e-government system, and provide relevant direction for our country's rural e-government research. With the hot spot of the current domestic e-government research, we put forward the new rural e-government resources integration model and analyze the data integration goals and methods of the rural e-government. Through the method of game theory, we analyze the information sharing strategy between enterprises at the new rural e-government system platform, and found that, with a growing number of new rural e-government enterprise, the willing of enterprise to share information resources will corresponding drop. When the size of the enterprise uneven, the larger enterprise will share their information resources as much as possible, and the small businesses will share less information resources or not. To a certain extent, it impedes constructing implementation of rural e-government. Based on the above analysis, we give the government's opinions about the new rural e-government construction finally. We strongly believe that the research fruits in this paper will help to improve farmers' living standard, further narrow the gap between urban and rural areas, and build a harmonious society in China.

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