Sustainable Development of Leisure Tourism Agriculture in Guangzhou Based on Data Hierarchical Modeling

Ning Wang¹, Jinyu Zhou¹* and Liming Liu²

¹Guangdong Mechanical and Electrical College, School of Foreign Languages & International Business, Guangzhou, 510515, China
²School of Information & Technology, Guangzhou City Polytechnic, Guangzhou, 510405, China

*Corresponding author e-mail: wangning@gdmec.edu.cn

Abstract. Hierarchical modeling breaks down the problem of multiple input and multiple output modeling into a series of single input multiple output data modeling problems. This method can improve the efficiency and accuracy of multi-input multi-output system modeling. The model is suitable for describing a system with a complex structure and can contain more input variables, which is conducive to making full use of the existing system information. The problem of data modeling is to get this kind of mapping relationship. Usually a set of basic functions is selected for linear combination, an expression of F with a parameter is given, and then the coefficient of the parameter is determined by least square method or other methods. Urban agriculture was proposed in the process of industrialization and urbanization, with the rapid development of the urban economy, the increasingly severe environmental problems, and the deepening of the idea of sustainable development. Urban agriculture tourism is developed based on urban agriculture by developing various functions of urban agriculture. It makes the development of urban tourism more plentiful and novel, and further expands the space for agricultural development. Therefore, to find the efficient way, this paper proposes the pattern of the sustainable development of leisure tourism agriculture in Guangzhou based on data hierarchical modeling. Numerical analysis and the sample overview are provided to test the performance of the proposed methodology.

Keywords: Hierarchical Data Modeling, Hierarchical Model, Guangzhou, Leisure Industry, Sightseeing Agriculture, Sustainable Development

1. Introduction

The rapid development of the global social economy and the accelerating process of urbanization have led to a series of the negative effects such as population congestion, traffic congestion, resource depletion, environmental pollution, and ecological destruction. In order to experience "high quality of life," urban residents are seeking to return to nature and relax physically and mentally[1]. Enjoyment has generated demand for urban agriculture tourism[2]. Urban agritourism came into being, showing its close relationship with the city's geographical space, modern urban agriculture as the basis, and promoting the integration of urban and rural cultures. Urban agritourism contributes significantly to agricultural development and has a positive effect on improving the ecological environment[3]. It also has an impact on the peasant family's life style and values. The harmonious relationship between rural community residents and tourists further promotes the integration of urban and rural cultures. Urban agriculture tourism in developed countries such as the United States, France, Germany, Japan, Singapore and Australia started early and
developed rapidly\cite{4}. In 2007, France had about 292 million person trips to rural leisure tourism in the surrounding cities, which accounted for 1/3 of the total number of tourists in the country. Urban agricultural tourism revenue is about 24.46 billion euros, equivalent to 1/5 of national tourism revenue. China has abundant agricultural production resources, a vast agricultural ecological space and a long history of farming culture. In the recent years, urban agricultural tourism has been widely promoted in the suburbs of major cities such as Shanghai, Beijing, Chongqing, and Guangzhou. In 2011, 211 agricultural tourist attractions of various types have been built in the Shanghai suburbs, with a total of 16.4 million tourists. The total agricultural tourism income was 1.09 billion yuan, driving the sales income of agricultural products and by-products to 540 million yuan, solving 24,170 peasant jobs, and realizing rural residents' per capita disposable income was 15,644 yuan, an increase of 13.8% over the previous year, an increase of 10 years. Judging from the development experience, urban agricultural tourism has achieved remarkable results in narrowing the gap between urban and rural areas, increasing the income of farmers, promoting the upgrading of urban agricultural industrial structure, and improving the urban and rural ecological environment.

Therefore, vigorously developing urban agriculture tourism is a good policy for the benefit of the country and the people\cite{5}.

China's tourism agriculture has achieved good results in the development process, and different tourism agricultural tourism resources have gradually emerged in the development process, namely the formation of different types of tourism agriculture. First of all, from my tour of the composition of the agricultural resources for the classification, we can be divided into sightseeing agriculture farming, tourism and sightseeing ecological agriculture forestry and other types. Then, if we from my tour of some agricultural resource implications for the classification, we can be divided into the resource features" and the "culture". Featured resource-based tourism agriculture is mainly based on the local agricultural resources and the pristine development, so as to let people feel the pristine agricultural and tourist sights.

![Figure 1. The Leisure Tourism Agriculture Pattern](image)

The culture and the tourism agriculture, leading to some of our unique farming culture as the theme of this culture, sightseeing agriculture, to let more people enjoy the ancient and long history of farming civilization of the mystery\cite{6}.

Urban agriculture tourism is an agricultural tourism model combining urban agricultural production with modern tourism. It transforms urban agricultural resources into tourism products, and uses urban agricultural production and management models, agricultural ecological environment, and agricultural production activities to attract new types of tourism. In recent years, urban agricultural tourism has developed rapidly in major cities such as Shanghai, Beijing, Chengdu, and Guangzhou. However, in practice there are still problems of lack of integration of resources, inadequate cultural protection, serious environmental damage, and low comprehensive benefits. The reason is mainly due to the lack of overall planning and system development. It fails to take into account the balanced economic, social, and environmental benefits. Therefore, urban agriculture tourism must take the path of sustainable development. The sustainable development of urban agriculture tourism is a complex system of “economy-resources-society”. On the one hand, the sustainable development of urban agricultural tourism optimizes the structure of rural industries, shifts surplus rural labor, and promotes farmers to increase their income. On the other hand, the sustainable development of urban agriculture tourism is conducive to protecting rural ecological resources, beautifying the urban environment and alleviating the pressure on urban tourist attractions. In addition, the sustainable development of urban agriculture
tourism promotes the mutual penetration of urban and rural economy, society, and culture, thereby stimulating the construction of rural infrastructure, improving the living environment of farmers, and improving the cultural quality of farmers. Sustainable development of urban agriculture tourism must fully integrate various resources and formulate a general strategic plan to promote the coordinated development of industrial economy, resource environment, and social culture.

Table 1. The Development Trend of the Leisure Tourism Agriculture in Guangzhou: The Overview

| Development Trend of the Leisure Tourism Agriculture in Guangzhou | Overview |
|---------------------------------------------------------------|----------|
| Highlight themes and features                                  | Characteristic is the life of sightseeing agriculture. Without characteristics, tourists cannot be attracted. The characteristic is the obvious difference between the local characteristics of sightseeing agriculture and the theme of the project, and highlight the functional orientation and the characteristic theme, seek new, seek for different, not seek perfection, and also avoid duplication of construction. |
| Strengthen environmental protection and maintain the ecological environment in the same area | The park was developed and opened to tourists. Will bring a series of environmental problems. In particular, tourism parks with strong seasonality do not pay attention to environmental protection. Visitors from all over the world will inevitably cause damage to the park's environment. Sightseeing agricultural tourism is actually a form of eco-environmental tourism. Environmental protection in the park must be equal to tourism, and effective measures should be taken to create a good ecological environment and ensure the sustainable development of the modern park. |
| Strengthening infrastructure construction                     | Only when the infrastructure is improved, it is possible to increase the duration of tourists' stay, thus obtaining greater benefits. Improvement and infrastructure development, the standardization of the sightseeing agriculture development in China is of profound significance, therefore, the developers also should strengthen the construction of the modern sightseeing agriculture infrastructure. |

2. Research on Sustainable Development of Leisure Tourism Agriculture in Guangzhou Based on Data Hierarchical Modeling

2.1. Hierarchical Modeling of Data
For the data modeling problem, if the input and output variables are multidimensional, searching and generating the optimal model of the problem directly in the multidimensional model set will increase the difficulty of the problem and reduce the computational efficiency. The modeling problem can be simplified from two aspects to reduce the complexity of the problem:

(1) Introduce the prior knowledge model of the problem, expand the spatial domain of the feasible model, and increase the search probability of the problem feasible solution set.

(2) Decompose the multi-input multi-output modeling problem into a series of single-input multi-output, even single-input, single-output data modeling problems, reducing the dimensionality of the model set each time modeling, repeatedly in the single-input model focusing on searching and combining functional formulas significantly reduces the space for model search and improves search efficiency[10].
Figure 2. The Layered Data Information System

From a large number of engineering data or diagrams, it can be seen that a large amount of data can be obtained under different working conditions. The shape of the curves is relatively close. These data can be represented by a set of identical function models, except that the parameters of the model are different and constitute a function. Therefore, the organization from the systematic layer can be considered as follows.

1) MapReduce, a distributed processing framework, can be used not only to deal with large-scale data, but also to hide a lot of the tedious details, such as automatic parallelization, load balancing, and disaster management, which will greatly simplify the development of the programmers. The scalability of MapReduce is very good, that is to say, each additional server is added to the cluster, and most of the distributed processing frameworks of the past are far from the MapReduce in scalability[8]. Because single X86 host performance in general, in the process of operational support fully introduction of new technology, based on the basis of resource pool in the establishment of PaaS layer cloud management platform, introducing the Docker technology, flexible released will be applied to any host, implement virtualization, the underlying through the influence of shielding basic resources for the application of cluster management.

2) The service bus provides the capability to service the management of resources, the services provided by the bus out on the capacities are derived from the resource base, the service bus with protocol conversion, routing and forwarding service access and Service Management Service is responsible for the management and control. The business center is a service management of the target object and service management is responsible for the management of the centers, the provision of the service registry, service life cycle management, relationship management and service status control.

The advantages of hierarchical modeling methods are:

(1) The system can be divided into several parts directly based on the data and divided into two levels. If the conditions permit, a more hierarchical system model can also be established using this method. Obviously, such a model is generally closer to the actual system. Such models are useful for qualitative and quantitative analysis of large systems that lack prior knowledge.

(2) Since the two parameters are divided into two levels, the difficulty of system identification is dispersed, and it is easier to identify models with more complex structures. The sub-models (first level) of different structures can be promoted to the same level. Among the models, this greatly expands the scope of the identifiable model[9-10].
Figure 3. The Structure of the Proposed Data Structure

(3) The layered modeling approach overcomes the difficulties commonly encountered in a large class of systems, including multi-collinearity, which is considered a modeling obstacle. The variables contained in the model contain many more variables than the models built by other methods. Therefore, the model is more universal, and it is better for predicting and analyzing the overall system.

(4) Hierarchical modeling can make full use of the existing statistical data, and it is particularly applicable to the case where the data length is general, but the cross-section data is abundant, because making full use of cross-section data makes up for the lack of historical data. This has a greater impact on the identification of large systems and the estimation of parameters$^{[11]}$.

\[
\theta = H(x_1, \ldots, x_{k-1}, x_k, \ldots, x_n) \\
S(i)^{i-1} = \text{Rank}(M_i) \\
F_2(x_i) = \text{Modeling}(S(i)^{i-1})
\]

### 2.2. Analysis of Urban Agrarian Tourism Development in Guangzhou

Excellent natural conditions. Located on both sides of the Tropic of Cancer, it has a hot and humid climate, four seasons of evergreen, diverse landforms, superior natural conditions, a long history of agricultural production, advanced agricultural technology, and agricultural product productivity$^{[12]}$. It is very conducive to the development of various types of urban agro-tourism products, and can easily form a complementary tourism network in the region.

(1) Strong economic foundation. Since 1992, its overall strength has ranked first in the top 10 cities in the country. The per capita GDP ranks first among the top 10 cities in the country, with a population of approximately 1,200 people.

(2) Outstanding regional advantages. Adjacent to Hong Kong and Macau, it is the southern gateway to China, the central city and transportation hub in South China, and it enjoys an advantageous location. Inland expressways, railways and the Pearl River are the arteries, connected with the vast urban and rural areas of the Pearl River Delta and the Pearl River Basin, and have a vast hinterland. The center is Baiyun Airport, one of the three largest airports in China, and the South China Sea is a corridor, with more than 170 countries in the world. It is connected to more than 600 ports in the region, and the international market is vast.

(3) The development of urban agriculture tourism in Guangzhou has developed rapidly with the advancement of urbanization, the rapid development of tourism, and the constant adjustment and optimization of agricultural structure. Starting in the early 1980s, the South China Botanical Garden, one of China's three largest botanical gardens, began to be open to tourists in 1980. In 1986, Liuxihe National Forest Park, one of the ten national forest parks in China, was developed and constructed on the basis of the Liuxihe Forest Farm. Entering the 1990s, Guangzhou's urban agricultural tourism developed rapidly and flourished. According to incomplete statistics from the Guangzhou Tourism Bureau, the Forestry Bureau, and the Bureau of Agriculture, there are currently 59 scenic spots. During the development of tourism agriculture in China, the change of ideology is also important. First of all, we must set up innovative consciousness, and applies the innovative ideology in the process of sightseeing agriculture development in our country, in the form of development and operation mode constantly innovate, to run out alone the development of their own characteristics. Only in this way can we better base ourselves on the fierce tourism market from the following aspects.
(4) Ecological agriculture is an efficient and low consumption modern agriculture based on the ecological principle and economic principle, which is based on the original agricultural development, and is the main purpose of creating economic, social and ecological benefits[13]. Ecological agriculture require the first industry and the organic combination of the second and third industry, it is the artificial design system, by planning, planning to form a fabulous, artistry, participated the types of agricultural implement the unity of the economic, social and ecological benefits.

(5) As China's economy continues to grow steadily in the tourism and leisure needs of urban and rural residents will greatly increase, and a wide range of the convergence, therefore, gradually formed a set of agricultural science and technology, research and development testing, agricultural production and technology show the green tourism, agriculture and cultural theme park resort casual, all-in-one regional economic complex.

(6) The establishment of ecological sightseeing agriculture demonstration zone to ecology theory as the guiding ideology, the principle of the ecology, environmental technology, biotechnology and modern management mechanism, make the whole park form a virtuous cycle of agriculture ecosystem[14]. Through the demonstration area of scientific planning, the ecological benefit is realized mainly by the design of ecological agriculture. To realize the social benefits of the agricultural tourism planning and to realize its economic benefits by means of tourism or other income, the economic, ecological and social benefits should be unified to establish a sustainable eco-tourism agricultural park.

(7) The development of urban agriculture tourism in Guangzhou not only has the characteristics of early start, fast speed, good momentum and large scale. The spatial distribution has also initially exhibited certain characteristics: The urban area is dominated by flowers and horticultural tourism attractions, such as Lanpu and Guangzhou Flower Expo Park; the suburbs are all kinds of orchards, vegetable gardens, forest gardens, and farms. Mainly, the scale is not very large. It attracts tourists for leisure at weekends. Among them, the tourists are mainly family and close friends and associates, such as Yangtao Park, Tree Park, Yingzhou Ecological Park, South China Botanical Garden, and Kissing Farm. The suburbs have sufficient space for development, superior agricultural resources, large-scale scenic spots, and large differences from the urban environment.

2.3. Construction of Resource and Environment Subsystem
The sustainable development of urban agriculture tourism needs to emphasize the rational use of resources and environmental protection. On the one hand, the resource and environment subsystem provides resources for the industrial economic subsystems. The growth of the agricultural tourism industry will inevitably consume agricultural tourism resources, which will reduce the number of resources. On the other hand, the resource and environment subsystems will continue to receive waste from tourism activities. Contaminants and harmful substances have reduced the level of environmental quality in the agricultural tourist areas. If they are not properly controlled, they will adversely affect the sustainable development of the industrial economy. Based on this, the five major causal feedback relationships of the resource and environment subsystem are derived, among which the first four are the strengthened causal relationships between urban agriculture and agricultural tourism industry development on agricultural tourism attractions, and the last one is the development of urban agriculture tourism industry and resources Regulatory causality of environmental degradation.

The economic growth of the urban agro-tourism industry has stimulated the employment of peasants and increased their income. It has also raised the cultural quality of community residents. The social benefits of urban agricultural tourism have further promoted the economic growth of the urban agro-tourism industry. From this, two main causal feedback relationships in the social subsystem are obtained. The first is the enhancement of the education and cultural level in rural areas to the development of the urban agricultural tourism industry. The second is the enhanced loop between the development of the urban agro-tourism industry and per capita net income of farmers.

The urban agricultural tourism sustainable development system covers many factors and the structure is complex. There are many variables used to describe system behaviors and trends, making modeling and simulation more difficult. Therefore, based on grasping the key causal feedback variables, this paper reduces the number of indicators and ensures the operability of the system model.

3. Conclusion
In the industrial economic subsystem, urban agrarian tourism income and total agricultural output value are selected as the main state variables, which respectively reflect the economic benefits of tourism and agricultural economic efficiency, and jointly determine the main operating status of the industrial economic subsystem. The rate variable is
the urban agricultural tourism income increment and agricultural output value increment corresponding to the horizontal variable. Auxiliary variables include number of agricultural tourist reception, per capita agricultural tourism consumption, value-added of primary industry, value-added of tertiary industry, intermediate input of primary industry, gross domestic product, investment in fixed assets of entire society.

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