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Interactive development of agri-tourism bi-chain under the background of informatization

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ABSTRACT: With the continuous development of informatization, the development of agriculture also opens a rapid development model under the background of informatization. Especially, the development of agricultural tourism industry in the growing tourism industry is subject to the concerns of the majority of agricultural workers. Under the background of informatization, the agricultural tourism encounters a new development opportunity. Compared with the development of the traditional agricultural industry chain, it has a tremendous change in the promotion of the agricultural tourism industry. This paper analyzes the interactive development status of agricultural tourism industry chain under the background of informatization and forecasts its development based on the time series model. This paper first establishes a forecasting model for the interactive development of agricultural tourism industry chain under the background of informatization based on the time series model, and considers the situation of excluding mutants in the specific condition under the background of informationization. The forecasting model obtained can be used to forecast the future interactive development trend of agricultural tourism industry chain under the background of informatization, thus providing a scientific reference for the rapid and healthy development of agricultural tourism industry chain under the background of informatization. Finally, according to the forecasting model and the interactive development status of agricultural tourism industry chain under the background of informatization, this paper proposes the relevant suggestions to provide powerful guidance for the harmonious development and rational allocation of the agricultural tourism industry chain under the background of informatization.

Keywords: agri-tourism bi-chain; informatization; time series model; status analysis; interactive development

1 INTRODUCTION

The emphasis of the foreign exploratory development of the agricultural tourism interaction in the early period is the interrelations between the concept, agricultural tourism interaction and sustainable rural development. The Western scholar and Spanish scholar, Gilbert and Tung point out that, the agricultural tourism means that the farmers are responsible for the basic accommodation of the tourists and allowing the tourists to experience and enjoy a variety of entertainment in the classic rural areas. Since 1880, the agricultural tourism interaction has had a rapid development. At home, Lu Yunting, Long Xiaohua, Yan Yan, Wang Bing, et al. conduct in-depth analysis of some concepts of agricultural tourism interaction, and distinguish the distinction between the nouns in the article; Liu Sifu, Liang Mingzhu, Liu Junping, et al. analyze and discuss the factors formed by the agricultural tourism interaction from multiple aspects, and point out the key factors that make an unprecedented development of the agricultural tourism interaction; Long Xiaohua, Qin Jianxin, et al. research the development situation of the agricultural tourism interaction at home and abroad; Wang Bing, Ma Yong, et al. discuss the domestic territory form and experiencing stages of the agricultural tourism interaction; Lu Yuting, Wang Renqiang, et al. divide the agricultural tourism into different categories; some scholars not only carries out detailed discussion of the agricultural tourism interaction, but also verifies it by the use of actual examples; in recent years, Ran Shanshan introduces that, by relying on the background of the development of the urban and rural areas as a whole, the agriculture supplies raw materials to the tourism industry, the agriculture provides resources to the tourism companies, and the agricultural tourism industry is complementary and crossover; Si Wei researches

the coupling status and corresponding countermeasures of the agricultural tourism industry and profoundly analyzes the problems in the process of research of coupling of agricultural tourism and its influencing influential elements; Zhang Zhele elaborates a selection mechanism based on the coupling theory through selection of the key products in the agricultural tourism coupling eco-industrial chain, creates a selection principle of its key products, and constructs a selection index system of the key products. The invisible tourism services require the tangible products as the choice. He also elaborates the agricultural tourism coupling eco-industrial chain and its internal mechanism, and evaluates and analyzes the key products through qualitative and quantitative comprehensive analysis. A top priority of the agricultural tourism mode is to create an agri-tourism bi-chain to make interactive development of the agriculture and tourism.

Today, with the rapid development of informatization, the continuous application for the background of informatization in the agricultural field is of extensive concern. Informatization plays a significant role in driving and promoting the agri-tourism bi-chain. Meanwhile, under the current situation, the development of agri-tourism bi-chain also has some problems. Informatization is an ideal platform for agricultural tourism products and industry development, publicity, management and sharing. Therefore, the research on the interactive development of the agri-tourism bi-chain under the background of informatization is widely concerned by the majority of agricultural workers. It is necessary to carry out scientific research on the interactive development of the agri-tourism bi-chain under the background of informatization, in order to better guide the rational development of the agri-tourism bi-chain under the background of informatization and constantly strengthen and expand the structural system of the interactive development of the agri-tourism bi-chain under the background of informatization. However, currently, the research on the interactive development of the agri-tourism bi-chain under the background of informatization is still the interview investigation and documentary methods, and the research is not involved in the quantitative analysis and forecasting of the interactive development of the agri-tourism bi-chain under the background of informatization. Based on the gap of the research on the interactive development of the agri-tourism bi-chain under the background of informatization, this paper uses the time series model to research the interactive development of the agri-tourism bi-chain under the background of informatization and fill the research gaps in this regard [2], and provide a scientific research method for the interactive development and research of the agri-tourism bi-chain under the background of informatization.

2 MODELING

2.1 *Introduction of time series model*

The time series model is a kind of model used to research the forecasting of problems based on the time and reveal the internal relations of the problems.

(1) *ARMA* model

For the time series formula $\{x_t\}$ as a zero mean sequence and stationary series, through the establishment of the fitting difference for $\{x_t\}$, the equation obtained is:

$$x_t - \varphi_1 x_{t-1} - \varphi_2 x_{t-2} - \cdots - \varphi_n x_{t-n} = \varepsilon_t - \theta_1 \varphi_{t-1} - \cdots \theta_m \varepsilon_{t-m}$$

Simplified as:

$$x_t - \sum_{i=1}^{n} \varphi_i x_{t-i} = \varepsilon_t - \sum_{j-1}^{m} \theta_j \varepsilon_{t-j}$$

Where:

$\{\varepsilon_t\}$ - white noise sequence;

φ_i - autoregressive parameter;

θ_j - moving average parameter;

n, m - order in the corresponding part.

When the order m=0 in *ARMA* model, the model is called as *AR* model; when the order n=0 in the model, the model is called as *MA* model, expressed as [3]:

$$\sum_{i=1}^{n} \phi_i x_{t-i} = \varepsilon_t \; ; \quad x_t = \sum_{j=1}^{m} \theta_j \varepsilon_{i-j}$$

In the above formula, after adding the backward shift operator *B*:

$$(1 - \varphi_1 B - \varphi_2 B^2 - \cdots \varphi_n B^n) x_t = (1 - \theta_1 B - \theta_2 B^2 - \cdots \theta_n B^m) \varepsilon_t$$

If $\phi(B) = (1 - \sum_{i=1}^{n} \phi_i B^i), \theta(B) = (1 - \sum_{j=i}^{m} \theta_j B^j)$,

then: $x_t = \dfrac{\theta(B)}{\phi(B)} \varepsilon_t$.

Where:

ε_t - input;

x_t - output;

$\dfrac{\theta(B)}{\phi(B)}$ - transfer function;

$\varphi(B)$ - inherent characteristics of the system;

$\theta(B)$ - relations between the system and outside.

(2) *ARIMA* model

For non-stationary time series $\{x_t\}$ existing in some problems, the difference method can be used to obtain the corresponding increment sequence:

$$\vee x_t = x_t - x_{t-1} (t = 2,3,\cdots,N)$$

The difference method can make the correlation between increment sequences reduced and make the

whole sequence tend to be stable. If the increment sequence $\{\vee x_t\}$ is a stationary increment sequence, in this case, *ARMA* time series model can be obtained for $\{\vee x_t\}$; if the increment sequence $\{\vee x_t\}$ is a non-stationary increment sequence, in this case, the second order increment sequence can be solved for $\{x_t\}$. There is a need to repeat the operation until the increment sequence $\{\vee^d x_t\}$ becomes a stationary sequence.

Through the relation between the backward shift operator and the difference operator, then:

$$\vee = 1 - B, \cdots, \vee^d = (1-B)^d$$

In this way, the general form of *ARIMA* model is:

$$\varphi(B)(1-B)^d x_t = \theta(B)\varepsilon_t$$

Where:

n, *m* - autoregressive and moving average order;

d - difference operation order.

If $(1\text{-}B)^d x_t$ in the formula $(1-\phi_1 B-\phi_2 B^2-\cdots\phi_n B^n)x_t = (1-\theta_1 B-\theta_2 B^2-\cdots\theta_n B^m)\varepsilon_t$ is expressed as y_t, then: $(1-\varphi_1 B-\varphi_2 B^2-\cdots\varphi_n B^n)x_t = (1-\theta_1 B-\theta_2 B^2-\cdots\theta_n B^m)\varepsilon_t$ is called as *ARMA* model[4].

(3) *CAR* model

ARIMA model solves the problem of time series when there is only one variable, but multiple time series and multidimensional time series problems may exist in solving the practical problems. *CAR* model can be used to solve such multidimensional time series problems.

Usually, the first order of the time series problems is expressed as:

$$\overline{X_t} = \theta_1 X_{t-i} + \cdots \theta_n X_{t-n} + \varepsilon_t$$

Autoregressive *ARMA* model based on *n* order is expressed as:

$$\overline{X_t} - \alpha_1 X_{i-1} - \cdots \alpha_n \overline{X_{i-n}} = \varepsilon_t - \beta_i \varepsilon_{t-1} - \cdots \beta_n \varepsilon_{t-n}$$

3 TIME SERIES ANALYSIS

3.1 *Stationary time series analysis*

The time series problem is usually composed of stationary time series and non-stationary time series. General stationary time series analysis process is mainly to generate the time series for the data collection through the time characteristics of the research object. The correlation model of the time series can be obtained through establishment of autoregressive analysis and moving average analysis and autoregressive moving analysis of the data [5]. The main analysis process is shown in Figure 1:

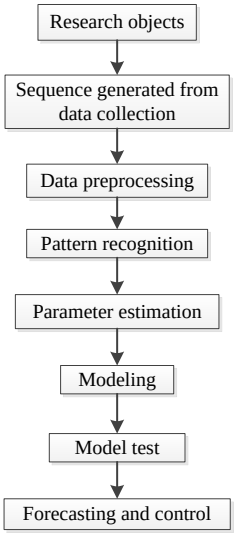

Figure 1. Flow chart of analysis

(1) Autoregressive model *AR*(*p*)

If the correlation time series X_t (t=1,2,…) is a stationary sequence, and there is a corresponding relation between the data, if there is a correlation between X_t and X_{t-1} , X_{t-2},…, X_{t-p}, and X_t is not related to the white noise of the time series model input at a relatively previous time, if there is *P*-order memory relationship, the *P*-order autoregressive forecasting model that represents the correlation is [6]:

$$X_t = \varphi_1 X_{t-1} + \varphi_2 X_{t-2} + \cdots + \varphi_p X_{t-p} + a_t$$

Where:

a_t - white noise.

If the backward shift operator *B* is added in $X_t = \phi_1 X_{t-1} + \phi_2 X_{t-2} + \cdots + \phi_p X_{t-p} + a_t$, then: $(1 - B\varphi_1 - B^2\varphi_2 - \cdots - B^P\varphi_P)X_t = a_t$.

(2) Moving average model *MA*(*q*)

If the relevant time series X_t (t=1,2,…) is a stationary sequence, and there is a corresponding relation between the data, if there is a correlation between X_t and X_{t-1} , X_{t-2},…, X_{t-p}, and X_t is related to the white noise of the time series model input at a relatively previous time, if there is *P*-order memory relationship, the *q*-order moving average forecasting model that represents the correlation is:

$$X_t = a_t - \theta_1 a_{t-1} - \cdots - \theta_q a_{t-q}$$

If the backward shift operator *B* is added, then:

$$X_t = (1 - \theta_1 B - \theta_2 B^2 - \cdots - \theta_q B^q)a_t$$

(3) Autoregressive moving average model *ARMA*(*p*,*q*)

If the relevant time series X_t (t=1,2,…) is a stationary sequence, and there is a corresponding relation be-

tween the data, if there is a correlation between X_t and X_{t-1} , X_{t-2},…, X_{t-p}, and X_t is related to the white noise of the time series model input at a relatively previous time[7], then this system is called as the autoregressive moving average system, and the forecasting model is:

$$X_t - \varphi_1 X_{t-1} - \cdots - \varphi_p X_{t-p} = a_t - \theta_1 a_{t-1} - \cdots - \theta_q a_{t-q}$$

Namely:

$$(1 - B\varphi_1 - \cdots - B^P \varphi_P) X_t = (1 - B\theta_1 - \cdots - B^q \theta_q) a_t$$

3.2 *Non-stationary time series*

The time series in the practical problems has a certain regularity, so we could not simply consider that is a process of stationary time series problems. In solving these problems, there is a need to consider the development trend of the problem, and express the integrated functions, then the model is:

$$X_t = U_t + Y_t$$

Where:

U_t - the mean value of X_t with respect to time variation.

There are two methods of calculation:

(1) The data rule existing in X_t is first eliminated through the correlation processing of data, and then Y_t is viewed as a stationary process to research by using the relevant processing method. The calculation method of inverse operation can be used to solve X_t forecasting result.

(2) U_t function can be first obtained by fitting, and then analyzed through the residual sequence $\{X_t - \hat{U}_t\}$ of $\hat{U}_t$ obtained, which is considered as stationary in the analysis process, and finally $\hat{Y}_t$ is solved. The correlation function equation is:

$$\hat{X}_t = \hat{U}_t + \hat{Y}_t .$$

3.3 *Non-stationary time series demonstration*

U_t function can be first obtained by fitting, and then through the residual sequence of $\hat{U}_t$ obtained:

$$Y_t = \{X_t - \hat{U}_t\}$$

3.4 *AIC test of the model*

The specific order of the time series model can be obtained by *AIC* order determination criterion:

$$ACI(p,q) = \ln(\hat{\sigma}_a) + \frac{2(p+q)}{N}$$

The trend forecasting of English training institutions can be obtained through the time series model of statistical data importing for the number and development status of English training institutions[8].

Autocorrelation and partial autocorrelation show that, the autocorrelation shows that sine wave has a certain tailing phenomenon. When the autocorrelation function K=3, the others are in the random region. Taking:

$$M = \lfloor \sqrt{N} \rfloor$$

$$\frac{2}{\sqrt{N}} = 0.3802$$

After the third step, when M value is between (-0.3790, 0.3917), in this case, the residual sequence of the time series model is *AR*. And then *Y* calculated through the statistical software *Eviews*, obtaining the model:

$$\hat{Y}_t = 1.6847 Y_{t-1} - 1.0365 Y_{t-2}$$

Therefore, the forecasting of interactive development of agri-tourism bi-chain under the background of informatization is:

$$X_t = 11.989 \times 1.205^t + 1.522 Y_{t-1} - 1.0037 Y_{t-2}$$

4 RESULT ANALYSIS

(1) Analysis of current development status of the agri-tourism bi-chain

The infrastructure construction of the agricultural tourism industry is imperfect. Under the background of informatization, the current development of the agri-tourism bi-chain is still imperfect and needs constant development. The development of agricultural tourism and agricultural tourism products presents a single and isolated nature, without active integration of all-round development of resources. The network application still has a very low utilization rate, part of which still relies on the reputation among customers, and word of mouth. This model greatly limits the current interactive development of the agricultural tourism and agricultural tourism products. Moreover, the characteristics of many websites are not strong; the quality of website varies greatly; the brand effect is not established; the information network between the agricultural tourism is imperfect, leading to difficulty in the information exchange between different agricultural tourism spots, industries and products and slow development; the industrial chain network is not formed, so that the validity and timeliness of information are subject to restrictions. A unified database is not established for sharing of information between the enterprises with agricultural tourism products, so it is difficult to achieve sharing of data between all regions, whole enterprises, various attractions and products.

(2) Interactive development and suggestions of the agri-tourism bi-chain under the background of in-

formatization

The forecasting results of the time series model show that, in the next few years of development, the agri-tourism bi-chain under the background of informatization will have a sustainable growth, but with a slow growth. Therefore, in the face of such development trend, we should greatly standardize the market, explore a more reasonable mode of development, and constantly enhance the strength in the interactive development, and rapid and healthy development of the agricultural tourism chain under the background of informatization.

Firstly, there is a need to speed up the infrastructure construction under the background of informatization, especially in the agricultural tourism industry. The main core of the agricultural tourism industry is the experience of agricultural tourism, thus driving the development of agricultural tourism products. Under the background of informatization, large amounts of data are required for processing and integration of the products promotion, marketing, market analysis and after-sales management, and timely analysis and sharing. Therefore, it is very important to establish the network between each link of the agricultural tourism industry.

Secondly, under the background of informatization, offline and online marketing between the websites of the agricultural tourism products is also the most important. The appropriate information publicity and characteristics propaganda is the basis for the brand establishment for the agricultural tourism products market, and provides strong support for the vast number of consumers to timely access to agricultural tourism information. By the use of existing e-commerce platform, e-commerce of the agricultural tourism products is established in the existing e-commerce platform.

Thirdly, there is a need to strengthen the informatization business sense of the agricultural tourism managers and practitioners, improve the development of agricultural tourism products under the background of informatization to a certain height, so as to reach informatization utilization and development of the current agricultural tourism products, and build a good environmental foundation for the interaction between the entire agricultural tourism products.

Fourthly, for the training and development of agricultural tourism talents, the talent training is a dynamic source for the continuous development of the agricultural tourism industry. Timely training, lessons and lectures and other forms are general forms to the talents, and there is also a need to strengthen the application practice of information technology, and continuously expand the scale and profession of the talents.

In summary, the forecasting model obtained can be used to forecast the future interactive development trend of agri-tourism bi-chain under the background of informatization, thus providing a scientific reference for the rapid and healthy development of agri-tourism bi-chain under the background of informatization. Finally, according to the forecasting model and the interactive development status of agri-tourism bi-chain under the background of informatization, this paper proposes the relevant suggestions and more broad prospects of harmonious development and rational allocation of the agri-tourism bi-chain under the background of informatization.

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