Tourism Management and Technology Economy (2024)
Clausius Scientific Press, Canada

DOI: 10.23977/tmte.2024.070305
ISSN 2616-2199 Vol. 7 Num. 3

Data Model of Sports Tourism and Economic Information Based on Intelligent Video Imaging Technology

Yadong Zhang[1,a,*]

[1]*Sports Department, Beijing Second Foreign Studies University, Beijing, China*
[a]*20020046@bisu.edu.cn*
[*]*Corresponding author*

Keywords: Big Data, Mobile Internet, Sports Tourism, Sports Econoour

Abstract: Sports tourism has promoted the development of a series of related industries including catering, accommodation, entertainment, transportation, communications, clothing manufacturing, food processing, construction and even finance and insurance, forming a huge industrial chain system. It effectively meets the needs of sports enthusiasts and travel enthusiasts in sports experience, leisure and entertainment, rehabilitation and health care, and has a broad market space. This article aims to study the construction of sports tourism information data model based on smart big data and the development of sports economy. This paper constructs a simulation system model of sports tourism industry operation. Through the various elements in the causal feedback loop in the operation of the sports tourism industry system, the main variables involved in the sports tourism industry operation system model are analyzed and a mathematical model is constructed. It also constructed a dynamic evolution model for the integration and development of the sports tourism industry, theoretically discussed the existence and stability of the industry integration cycle, and provided indicators for judging the operation stability of the sports tourism industry integration development system, the existence of the integration cycle, and the existence of the integration cycle. The experimental data shows that the highest correlation coefficient obtained by the simulation experiment is 0.992, and the lowest is 0.9026, indicating that the result data of the system simulation simulation is not much different from the actual data, and the data is valid. The dynamic evolution model constructed in this article predicts that not only the number of domestic and international tourists, but also tourism income will increase significantly in the next ten years. It is predicted that sports tourism income will increase by about 320% over the current ten years in the next ten years.

1. Introduction

Intelligent video imaging technology is a technology that the camera can control the imaging components adaptively according to the real-time lighting intensity of the scene to obtain the best or best imaging effect. Intelligent video imaging technology is to ensure that in the outdoor unmonitored conditions, more clear and effective capture video images, to achieve the purpose of video forensics and illegal records. Sports tourism economy is a product of the combination of

sports economy and tourism economy. It is a relatively new economic model. By consulting a large number of literature and field research, we found the problems and deficiencies in the development of traditional national sports tourism resources, and proposed countermeasures to the municipal party committee, government and functional departments, to provide strategic choices and decision-making basis, so as to promote the development of tourism and contribute to the economic, political and cultural development.

Xu W built a big data analysis framework for healthcare organizations. Five big data analysis functions were identified from 26 big data cases. Several strategies for the successful use of big data analysis in the healthcare environment are proposed. Fully understand the potential benefits of big data data analysis [1]. Mann L proposed an intelligent teaching service system, which can integrate data resources for students to use, improve learning ability and decision-making ability [2]. Wang X studied the non-convex optimization of distributed big data in multi-agent networks. He considered the minimization of the sum of smooth non-convex functions, that is, the total utility of the agent, plus the convex non-smooth regularizer. A novel approach to distributed solutions is proposed, in which the agent optimizes in each iteration and then (in an uncoordinated way) only communicates a subset of its decision variables. He established the asymptotic convergence of the stationary solution of the non-convex problem and emphasized the influence of block dimension on communication overhead and actual convergence speed [3]. Al-Ali AR compares the sparse and dense representations of predictive models in macroeconomics, microeconomics, and finance [4]. In order to deal with a large number of possible predictors, a prior that allows variable selection and contraction is specified. The posterior distribution is usually not concentrated on a single sparse or dense model, but on a broad set of models. Only when very low-dimensional models are strongly supported a priori, will clearer sparse patterns appear [5]. Zhang N believes that the current trend of ICT used in education has begun to focus on teaching and learning extensively. Recently, the new concept of big data in the ICT field has expanded the promising research direction of online learning and big data integration. Through the promising content, it can be tailored for each student according to the context of online learning and the Internet behavior of users. He uses big data methods to explore innovative designs for innovative online learning in higher education and uses subject analysis to critically review cited journals and books. Then he puts forward a model reference that can be used in teaching and learning to improve the learning environment and results of students, and improve the development, performance and achievement of students in the learning process of higher education [6]. Wu C believes that due to very diverse service requirements, applications, equipment and network heterogeneity, next-generation wireless networks are evolving into very complex systems. Network operators need to make full use of available resources. Traditional network methods, that is, reactive, centralized management, one-size-fits-all methods, and traditional data analysis tools with limited capabilities are no longer competent, unable to meet and serve future complex network operations and effectively optimize costs [7]. Judging from these studies, they all have a certain degree of influence, but their practicality is not very high, and the depth of influence is not enough.

2. Construction of Sports Tourism Information Data Model Based on Big Data Mobile Information System and the Method of Sports Econoour

2.1. Basic Concepts of Sports Tourism

(1) Sports Tourism

At present, there is no relatively clear and unified definition of the concept of sports tourism in academia, and different majors have given inconsistent definitions. For example, Wan Huaiyu et al. (2004) believe that: "refers to a new way of tourism that promotes the exchange, integration and

development of sports culture by personally experiencing or watching various fitness activities and sports competitions during the travel process. For example, jungle expeditions, mountaineering and rock climbing, etc., but also a series of national sports and cultural projects of tourism"[8]. Yan Zhongbo and Wang Man (2005) put forward another point of view: "Sports tourism is a combination of other social activities that tourists engage in during tourism activities, including sports activities, leisure fitness and other entertainment. Activities belong to the concept between the tourism industry and other social relations"[9]. Lian Guihong and Liu Jiangang (2006) believe that tourism sports, in essence, is to meet the needs of tourists for certain physical exercises during travel, using sports facilities, sports venues, sporting goods, and sports intermediary agencies, etc.[10]. Lian Enyong and Zhang Jianzhong (2006) proposed that sports tourism is a new development trend in the tourism industry, and it belongs to a branch of the tourism industry. Of course, with people now attaching importance to life and health, sports tourism will definitely become the development of the industry in the future. The trend is a kind of tourism favored by human beings, especially young people [11]. Based on the concept of special tourism, sports tourism can be divided into a narrow sense and a broad sense. In a broad sense, sports tourism should include the comprehensive relationship between various leisure, entertainment, fitness, sports, adventure, health care, sports and cultural exchanges and other activities that tourists engage in during the travel process and the society; in a narrow sense, sports tourism is to meet the special needs of tourists. Based on certain sports resources and in the form of certain commodity media, it needs to provide a comprehensive sports service project for tourists who have sports needs during tourism, so that tourists can not only gain the fun of tourism, but also gain a healthy physical state during the process of tourism [12].

We can see that there are still big differences in the above conceptual elaboration, but we can still find two commonalities in the differences. First, it must first meet the definition of tourism; second, this tourism activity must include at least one sports event or sports activity, with the ultimate goal of promoting physical and mental health.

(2) Tourism Resources

In the tourism industry, there is a relatively clear and unified definition of "tourism resources", that is, "refers to the natural and cultural landscapes that can form tourism products through reasonable development and management." There are other different definitions of a concept. The resources that can be developed as a value resource, can generate economic value and improve social benefits, are all defined as tourism resources [13].

Combining the above-mentioned different viewpoints, the definition of "tourism resources" is explained as follows: tourism resources include natural tourism resources such as mountains and rivers in nature, forest vegetation, biological resources, climate environment, etc., and are also included in human society. The ancient and modern architecture, folk culture, opera dance, hunting wrestling, ethnic festivals and different customs and habits formed with the help of human power. As a tourism resource, it must first have a basic function that can arouse tourists' interest in viewing or participating in it. Secondly, tourism resources should have certain commercial value, and after being developed and utilized, they can produce certain economic value and promote local economic development. Finally, tourism resources should also have certain social and cultural values, ecological environmental functions, etc. to promote the overall development of the industry and society [14].

2.2. Development of Sports Tourism Industry and the Development of Sports Econoour

(1) Principles of Complex Systems

The sports tourism industry is a very complex system, which not only shows the characteristics

of order, but also has the characteristics of integrity and complexity. From this, it can be concluded that the development of the sports tourism industry should correctly handle the relationship between the various subsystems within the system to ensure the orderly development of the sports tourism industry system, and at the same time, handle the relationship between the sports tourism industry system and other industries[15]. The development of the sports tourism industry should follow the principles of complex systems, establish a scientific and complete industrial system, form a balanced dissipation structure, ensure the energy source for the orderly development of the sports tourism industry system, and continue to promote the appropriate opening of the sports industry system, and continue to promote reform and innovation of sports tourism industry system [16].

(2)Principle of Openness and Integration

The development of the sports tourism industry should break through the limitations of sports resources and tourism resources, actively seek for the integration of related industries that can promote industrial innovation, realize industrial restructuring, develop new business formats, and realize the further optimization of the structure of the sports tourism industry through the open integration of industries [17]. Multinational sports tourism activities promote the increase of the international flow of personnel, funds, information, etc., and provide a favorable development opportunity for the development of the internationalization of the sports tourism industry. The sports tourism industry adheres to the principle of openness and integration. With its unique industry characteristics and industrial advantages, through important channels such as personnel exchanges and international cooperation, it actively absorbs advanced foreign sports tourism industry development experience, while strengthening the openness of its own industry and attracting more foreign tourists can make important contributions to strengthening international economic exchanges.

(3) Principles of Industrial Synergy

Its formation and development need the joint promotion of sports industry, tourism industry and other related industries. Sports tourism companies should correctly handle the relationship with related companies and form effective collaborations. Through resource sharing, cooperative research and development, structural optimization, and other methods, companies can achieve industry consistency, give full play to the synergy of the sports tourism industry, and promote new industries.

2.3. Big Data Mobile Information

(1) Big Data Concept

The core value of big data lies in data analysis, storage and mining, that is, to quickly obtain valuable information from various types of data. It has the comprehensive cost optimization of "cheap, fast, and optimized". The continuous development of big data technology makes the protection of personal information security very urgent. The big data environment requires strong data storage and analysis technology to be able to give full play to the huge value contained in big data. Cloud computing platform has become the basic platform of big data due to its strong storage and computing capabilities, openness and low cost of use.

(2) Mobile Internet

Through the mobile Internet, people can obtain and process information in any way at any time and place. Mobile Internet greatly improves the efficiency of countries, regions and cities in the process of competition and cooperation, and promotes the rapid development of the global econoour and the improvement of technological innovation capabilities.

(3) Mobile Internet Big Data

1) The core node of data is people, and personal information is more accurate

The existing various mobile Internet applications, especially smart phones, are closely related to personal food, clothing, housing and transportation. Therefore, mobile Internet users are mainly for personal use, the core node is people, and big data is data related to personal work and life. Usually it is a device corresponds to a unique user, so it is more accurate to "personal" than PC Internet big data. Based on this, it can provide personalized services and products more accurately. Mobile Internet big data contains more "personal information".

2) Mobile Internet big data with location services

Through the positioning function of the navigation satellite, combined with the communication characteristics of the mobile network.

3) Mobile Internet application time is more fragmented

Compared with PC Internet, the current mobile Internet is mainly used in work. Therefore, compared with the PC Internet, tablet and other different terminals connected to the Internet, these big data can very completely record and describe a user's activity track and living habits, and various background data are interrelated, which is the embodiment of the value of mobile data.

2.4. Establishment of FC-INM Model

Although INM has achieved good results in subspace segmentation, it cannot theoretically guarantee the block diagonal structure of the affinity matrix when the subspace is independent, that is, the first two that do not meet the EBD condition.

It is known that the function g(Z,X) is defined in (α, β), where α is a set of square matrices, and β is a set of square matrices with non-zero columns.

$$Z = \begin{bmatrix} Z_1 & Z_3 \\ Z_4 & Z_2 \end{bmatrix} \in \alpha, Z \neq 0 \tag{1}$$

Where $Z_1, Z_2 \in \alpha$ is a square matrix, matrix Z_3Z_4 is a compatible dimension, and $X = [X_1, X_2]$, where X1 and X2 correspond to Z_1 and Z_2 respectively.

$$Z^B = \begin{bmatrix} Z_1 & 0 \\ 0 & Z_2 \end{bmatrix} \in \alpha \tag{2}$$

Then the EBD conditions are:

$$g(Z, X) = g(P^T ZP, XP) \tag{3}$$

$$g(Z, X) \geq g(Z^B, X) \tag{4}$$

$$g(Z^B, X) = g(Z_1, X_1) + g(Z_2, X_2) \tag{5}$$

Among them, the formula (3) is the basic requirement of the subspace division of the EBD condition, which ensures that the division result is constant for any arrangement of the columns of the input data matrix X. Formula (4) is that after minimizing the function f, Z becomes the key to the diagonal block under the assumption of a stator space. Formula (5) does not actually require that the solution of the function f is block diagonal, but through this condition, the relationship between the structure of each block and the function used can be understood.

In order to improve the theoretical nature of the INM method, the original model is convexized and a new model is proposed:

$$\min \| Z \|_{\infty,\infty} + \eta \| Z \|_{1,1} \quad s.t. \quad X = XZ \tag{6}$$

The parameter $\eta > 0$ is used to control the balance of low difference and sparsity of the affinity matrix.

If the function is a convex function, then all X, Y belong to R, and have:

$$f(\theta x + (1-\theta y)) \le \theta f(x) + (1-\theta) y \tag{7}$$

Then, define:

$$f(Z) = \| Z \|_{\infty,\infty} + \eta \| Z \|_{1,1} \tag{8}$$

Among them, $Z \in R^{n*n}$, then A, B belongs to R, and $0 \le \theta \le 1$, then there are:

$$f(\theta A + (1-\theta)B) = \| \theta A + (1-\theta)B \|_{\infty,\infty} + \eta \| \theta A + (1-\theta)B \|_{1,1} \tag{9}$$

According to the definition, you can get:

$$\| \theta A + (1-\theta)B \|_{\infty,\infty} \le \| \theta A \|_{\infty,\infty} + \| (1-\theta)B \|_{\infty,\infty} = \theta \| A \|_{\infty,\infty} + (1-\theta) \| B \|_{\infty,\infty} \tag{10}$$

$$\| \theta A + (1-\theta)B \|_{1,1} \le \| \theta A \|_{1,1} + \| (1-\theta)B \|_{1,1} = \theta \| A \|_{1,1} + (1-\theta) \| B \|_{1,1} \tag{11}$$

Therefore:

$$f(\theta A + (1-\theta)B) \le \theta \| A \|_{\infty,\infty} + \eta \| A \|_{1,1} + (1-\theta)(\| B \|_{\infty,\infty} + \eta \| B \|_{1,1}) = \theta f(A) + (1-\theta) f(B) \tag{12}$$

Therefore, it can be concluded that the model is a convex model.

3. Construction of Sports Tourism Information Data Model Based on Big Data Mobile Information System and the Experiment of Sports Econoour

3.1. Purpose of the Experiment

This experiment uses industrial system dynamics, combined with the big data mobile information system, collects Beijing's domestic and international tourism income, the number of domestic and international tourists over the years, and establishes a sports tourism information data model, that is, the sports tourism industry model. The system simulation of this study, by setting different parameters, in order to find the most suitable model for the sustainable development of sports tourism industry, and vigorously develop sports economy.

3.2. Experimental Method

The causality analysis of the system operation of the sports tourism industry is the prerequisite for dynamic simulation of the system and the basis for establishing the system dynamics model. Its main purpose is to clarify the causal relationship between various elements in the system and express it with a feedback loop.

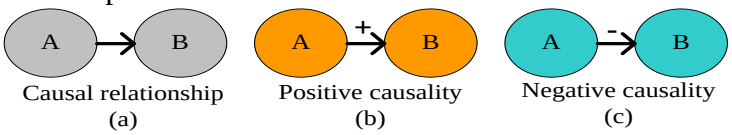

Figure 1: Causal Arrow

As shown in Figure 1, causality can be divided into positive causality and negative causality according to the nature of the effect. Therefore, causal arrows can also be divided into positive causal arrows and negative causal arrows. The positive causal arrow is represented by "+", which means that the direction of change of cause and effect is the same; the negative causal arrow is represented by "-", which means that the direction of change of cause and effect is opposite.

3.3. Experimental Discussion

(1) Variable Selection of Causality in the Sports Tourism Industry System

The environmental auxiliary subsystem of the sports tourism industry system is the environmental elements that the entire system's survival, operation, growth and other system behaviors rely on. These elements are indispensable for the existence and operation of the sports tourism industry system. It has played an auxiliary role in promoting the operation of the entire sports tourism industry system. The institutional environment provides direction guidance and policy guarantees for the development of the sports tourism industry system. Factors such as the level of economic development, capital environment, and industrial structure are the material basis for the development of the sports tourism industry system; information technology continues to deepen the communication between the industry's information and the market connection, and increase opportunities for the integration of related industries; social fashion, consumer culture, infrastructure and competition environment, etc., jointly create a good social atmosphere for the operation of the sports tourism industry system. Under the interrelation and interaction of these environmental elements, it provides auxiliary power for the development of the sports tourism system.

(2) Causal Feedback Related to the Development of Sports Tourism Industry

The polarity of this feedback loop is positive. It reflects the promotion of the development of the sports industry to the city's econoour. The main industry of the sports industry is the sports service industry. The sports service industry includes other related sports services such as sports event services, sports media services, and sports exhibition services. Industrial development and urban economic development play an important role.

4. Construction of Sports Tourism Information Data Model Based on Big Data Mobile Information System and Analysis of Sports Econoour

4.1. Model Checking Analysis

$$R^2 = 1 - \frac{\sum_j (x_j - \hat{x}_j)^2}{\sum_j (x_j - \overline{x_j})^2} \tag{13}$$

Among them, x_j is the actual value in the jth year, $\hat{x}_j$ is the simulated value in the jth year, and $\overline{x_j}$ is the average of the actual values. Since 2006, big data technology will compare the historical data from 2006 to 2017 from the statistical data, and then conduct error analysis according to the formula (13), thus examining the effect of the model operation, that is, the consistency between the reality and the model, and reflect the fit degree of the model operation process and the actual system, so as to determine whether the results of the model simulation will be useful for the analysis and solution of the problem.

As shown in Figure 2, the simulation value of Beijing's GDP from 2006 to 2017 is compared with the actual value. Substituting the value into formula (13), the correlation coefficient is 0.992, which means that the result data of the system simulation and the actual data are not much different. The data is valid within the controllable range. This model has a high correlation to the GDP fitting of the sports tourism industry system in Beijing.

As shown in Figure 3, it is the fitting diagram of the simulation value and the actual value of the number of domestic sports tourism tourists in Beijing from 2006 to 2017. This model has a high correlation with the fitting of the number of domestic tourists in the sports tourism industry system in Beijing, the correlation coefficient. It is 0.9851, and the simulation result data is valid.

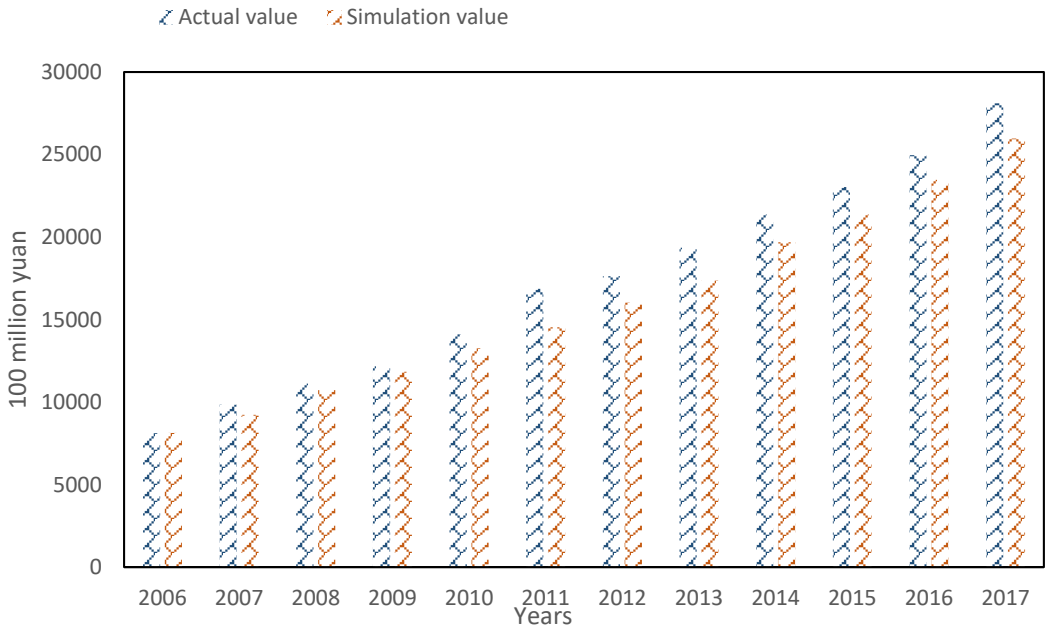

Figure 2: Comparison between the simulated and actual values of Beijing's GDP from 2006 to 2017

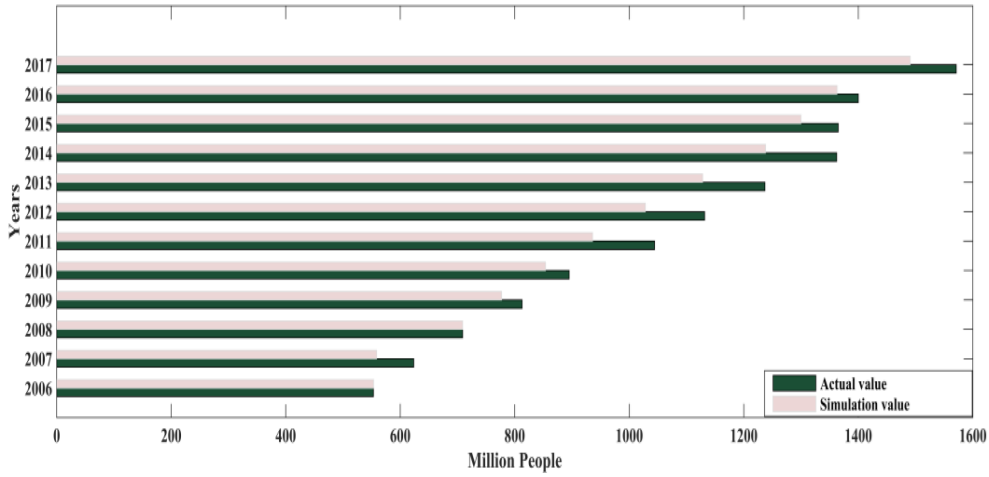

Figure 3: Fitting diagram between the simulated and actual values of the number of domestic sports tourism tourists in Beijing from 2006 to 2017

As shown in Figure 4, it is the fitting diagram of the simulation value and the actual value of the number of Beijing international sports tourism tourists from 2006 to 2017. This model has a high correlation with the fitting of the number of domestic tourists in the Beijing sports tourism industry

system, and the correlation coefficient. It is 0.9026. Although the correlation coefficient is lower than the previous items, the simulation result data is valid as well as reaching the ideal state.

It can be seen from the above analysis that according to the system output and response indicators selected in the previous article, the established sports tourism operation system simulation model was tested. The test results show that the model has a high degree of fit with the actual operation of the Beijing sports tourism industry system. The system simulation results can reach the ideal state, and the data results are valid and credible. This shows that the model has higher reliability and better practicability. After passing the validity test, the SD model can be used to simulate and predict the operation and future development of Beijing's sports tourism industry.

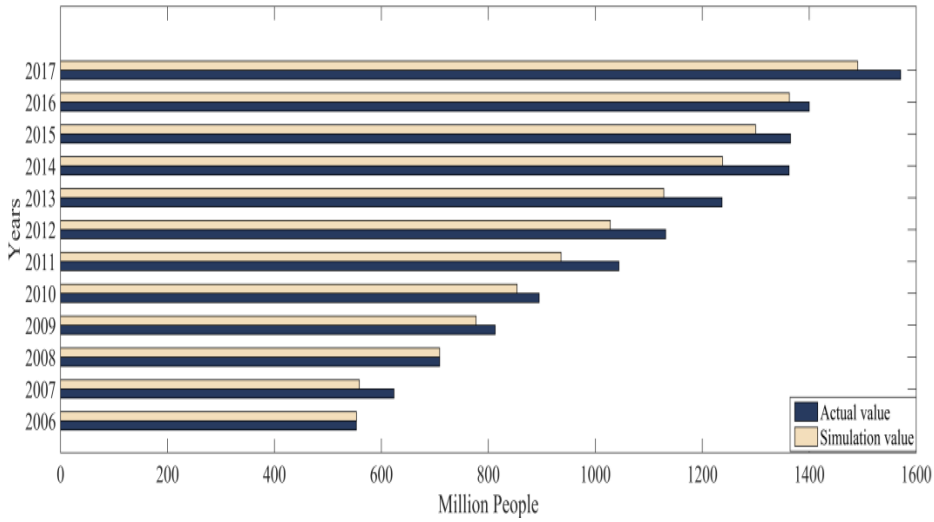

Figure 4: The simulation and actual value fitting diagram of the number of Beijing international sports tourism tourists from 2006 to 2017

4.2. Simulation Prediction Analysis

After passing the validity verification, the sports tourism industry system dynamics model can be used to simulate and predict the future development of the sports tourism industry in Beijing.

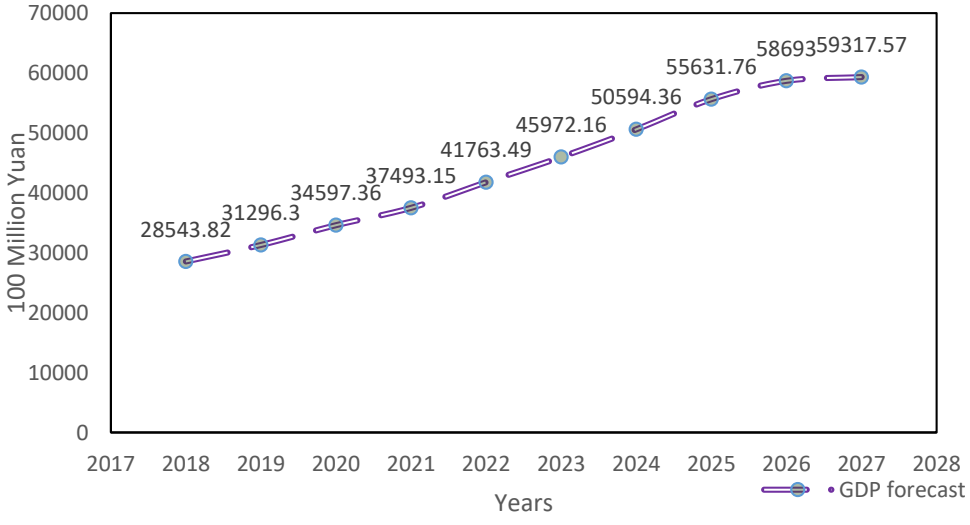

Figure 5: Beijing's GDP forecast from 2018 to 2027

As shown in Figure 5, it is the forecast of Beijing's GDP from 2018 to 2027. The proportion of Beijing's tourism revenue to GDP has been increasing year by year, and the revenue of tourism will affect Beijing's economic development level to a certain extent. With the development of major international sports events in Beijing, the number of sports tourism tourists continues to increase, and the proportion of sports tourism revenue to tourism revenue will also continue to rise, which will have an important impact on the development of tourism. To a certain extent, economic growth is constrained by the development of the sports tourism industry. It is predicted that the income from sports tourism in the next ten years will increase by about 320% over the current ten years.

5. Conclusion

The paper analyzes the nonlinear, multiple feedback and high-latitude complex time-varying problems of the sports tourism industry system through simulation, analyzes the relationship between the system structure and behavior patterns, and constructs the system dynamics equations of the sports tourism industry system model. And take the development of Beijing sports tourism industry as an example to conduct empirical research. The government should fully grasp the development opportunities of the sports tourism industry, implement the five development concepts of "innovation, coordination, green, openness, and sharing", fundamentally improve the development environment of the sports tourism industry, stimulate the development vitality of the sports tourism industry, and enhance sports tourism. The management level of enterprises, the strengthening of domestic and foreign sports tourism market development, and the construction of sports tourism industry clusters have put forward countermeasures and suggestions.

References

[1] Xu W, Zhou H, Cheng N, et al. Internet of Vehicles in Big Data Era. IEEE/CAA Journal of Automatica Sinica, 2018, 5 (1): 19-35.

[2] Mann L. Left to Other Peoples' Devices? A Political Econoour Perspective on the Big Data Revolution in Development. Development and Change, 2018, 49 (1): 3-36.

[3] Wang X, Zhang Y, Leung V, et al. D2D Big Data: Content Deliveries over Wireless Device-to-Device Sharing in Large Scale Mobile Networks. IEEE Wireless Communications, 2018, 25 (1): 32-38.

[4] Al-Ali A R, Zualkernan I A, Rashid M, et al. A smart home energy management system using IoT and big data analytics approach. IEEE Transactions on Consumer Electronics, 2018, 63 (4): 426-434.

[5] Chen Y, Chi Y. Harnessing Structures in Big Data via Guaranteed Low-Rank Matrix Estimation. IEEE Signal Processing Magazine, 2018, 35 (4): 14-31.

[6] Zhang N, Yang P, Ren J, et al. Synergy of Big Data and 5G Wireless Networks: Opportunities, Approaches, and Challenges. IEEE Wireless Communications, 2018, 25 (1): 12-18.

[7] Wu C, Zapevalova E, Chen Y, et al. Time Optimization of Multiple Knowledge Transfers in the Big Data Environment. Computers Materials & Continua, 2018, 54 (3): 269-285.

[8] Meng X L. Statistical paradises and paradoxes in big data (I): Law of large populations, big data paradox, and the 2016 US presidential election. The Annals of Applied Statistics, 2018, 12 (2): 685-726.

[9] Al-Salim A M, El-Gorashi T, Lawey A Q, et al. Greening Big Data Networks: The Impact of Veracity. Iet Optoelectronics, 2018, 12 (3): 126-135.

[10] Vayena E, Blasimme A. Health Research with Big Data: Time for Systemic Oversight. The Journal of Law Medicine & Ethics, 2018, 46 (1): 119-129.

[11] Chang Z, Lei L, Zhou Z, et al. Learn to Cache: Machine Learning for Network Edge Caching in the Big Data Era. IEEE Wireless Communications, 2018, 25 (3): 28-35.

[12] Phinyomark A, Petri G, E Ibáñez-Marcelo, et al. Analysis of Big Data in Gait Biomechanics: Current Trends and Future Directions. Journal of Medical & Biological Engineering, 2018, 38 (2): 244-260.

[13] Chu J F, Wu J, Song M L. An SBM-DEA model with parallel computing design for environmental efficiency evaluation in the big data context: a transportation system application. Annals of Operations Research, 2018, 270 (1): 105-124.

[14] Yu L, Zhao Y, Ling T, et al. Online big data-driven oil consumption forecasting with Google trends. International Journal of Forecasting, 2018, 35 (1): 213-223.

[15] Lamba K, Singh S P. Modeling Big Data Enablers for Operations and Supply Chain Management. The International Journal of Logistics Management, 2018, 29 (2): 629-658.
[16] Muhammad S S, Dey B L, Weerakkody V. Analysis of Factors that Influence Customers' Willingness to Leave Big Data Digital Footprints on Social Media: A Systematic Review of Literature. Information Systems Frontiers, 2018, 20 (3): 559-576.
[17] Lei G, Ning Z, Hou W, et al. Quick Answer for Big Data in Sharing Econoour: Innovative Computer Architecture Design Facilitating Optimal Service-Demand Matching. Automation Science and Engineering, IEEE Transactions on, 2018, 15 (4): 1494-1506.