A Comprehensive FAHP evaluation model on domestic sports economy development mode

Tao Shi[1], Zhijie Xing[2*]

[1]*Handan College, Handan city, Hebei province, China*

[2]*Hanshan District Experimental Primary School, Handan city, Hebei province, China*

Received 19 July 2014, www.tsi.lv

Abstract

Sports economy refers to rational allocation of various resources to develop sports related functions and economy. This study identified the bottleneck factors constraining the development of sports economy. A fuzzy hierarchical evaluation model was developed using FAHP. The results indicated internal competitiveness, development of market-oriented economy and social development played important role to sports economy. Thus, policy recommendations on sustainable and sound sports economic development were proposed. The future prospect and development mode were analysed.

Keywords: sports economy, fuzzy analytic hierarchy process, evaluation model

1 Introduction

Sports economy has made great contributions to the development of domestic economy. With the development of domestic economy, its contributions have become increasingly prominent. Sports economy evaluation often requires integrated qualitative and quantitative analysis on a variety factors. Currently, the development of domestic sports economy has encountered certain bottleneck. Detailed study on various factors restricting the development of domestic sports economy will be helpful to give a clear and objective understanding on development of domestic sports economy. This study attempted to develop a hierarchy fuzzy evaluation model to analyse various constraints. Based on the results, recommendations on sustainable, rapid and robust development of domestic sports economy and its prospects in the future were proposed.

2 The meaning and positioning of domestic sports economy

Sports economy refers to rational allocation of various resources to develop sports related functions and economy. More simply, sports economy is a special industry integrated public sports and relevant economic behaviour [1]. The sports related industries are collectively known as sports service industry. The sports industry is mainly targeted to three pillar industries referring to development process in developed countries and actual conditions in China: competition performance, fitness and entertainment, and intangible assets. However, the sizes and scale of these three industries are limited, e specially the intangible assets. Although China is a strong country regarding sports, a few kinds of mass sports are popular, such as table tennis and badminton. In addition, the operation of such main industry is not standardized. Thus, the following goals are proposed based on the needs of sports economy development and actual situation:

2.1 TO IMPROVE ECONOMIC BENEFITS OF SPORTS INDUSTRY

Currently, the output of sports economy is not high and also the profits are low. Therefore, improvement of economic benefits is identified as primary goal. Sports economy can be promoted from three ways:

1) direct economic benefits, i.e. the sports venues, sports facilities and broadcast/TV right.

2) indirect economic benefits, i.e. the benefits from organization of large events and games, etc., as well as investments in associated infrastructures. Such as the Beijing Olympic Games hold in 2008, the investments in venues and related infrastructure were as high as 134 billion CNY. The total investment reached 280 billion CNY. Such investments have brought more than 600 billion CNY direct benefits.

3) Derivative economic benefits, such as advertising, lottery and football lottery. The benefits will be doubled during big events. For example, football lottery sales are about eight times than usual during 2014 World Cup. Sports itself is an industry integrated watching, information and economy. The growth of industry economy will be enhanced by promoting its social and economic benefits.

[*] ***Corresponding author*** e-mail: 1051153583@qq.com

2.2 TO ACCELERATE URBAN CONSTRUNCITON AND CREATE JOB OPPORTUNITIES

According to the statistics, large events such as Olympic Games and World Cup would allow the host city to improve the infrastructures to 20-50 years in advance. In addition, the construction of venues and related facilities will create employment opportunities for thousands labor force, which will bring great significance for social benefits. According to statistics, Shanghai has more than 6000 fitness centres that providing a large number of jobs. There are nearly 200 sports industry relevant enterprises in Shenzhen. These enterprises not only create economic output but also provide a large number of jobs and contribute to social stability. Some world champions founded companies in his/her own name, such as Li Ning and Deng Yaping. These companies have promoted the brand name and also created a lot of jobs. At presents, China is in a critical period of developing a moderately prosperous society. It will have great significance to promote social harmony and stability if vigorously develop sports economy, accelerate urbanization and create a large number of job opportunities.

2.3 TO OPTIMIZA INDUSTRIAL STRUCTURE AND PROMOTE RAPIDE DEVELOPMENT OF TERTIARY INDUSTRY

The sports industry has experienced rapid growth with the development of domestic economy, especially the promotion of Beijing 2008 Olympic Games. The major part of sports industrial chain concentrates in the tertiary industry. Therefore, its robust and orderly development is important to optimize industrial structure and promote the tertiary industry. In addition, with the expansion of the tertiary industry, the related industries in the secondary and tertiary industry will also be promoted. The increasing awareness of sports and pursuit of health have greatly promoted the development of sports apparel and sports equipment producers. In addition to contributing to the domestic economic output, the development of sports economy would promote industrial structure and provide foundation for sustained economic growth.

3 Constraints to sports economy

In recent years, the domestic economy has been growing rapidly. The reasons can be summed up to two aspects. On the one hand, the sports consumption affordability improved constantly. With the sustained economic development and construction of the well-off society, residents' living has been improved continuously. Once physiological, security and other basic demands are satisfied, people start to pursue social interaction, self-realization, respects and other high-level demands. Meanwhile, with rising incomes, residents have more spare money that can be used for sports. According to relevant statistics, money spent on sports and sports services have been increasing in recent years. On the other hand, the sports market in China consisting of competition performance, sports tourism, fitness and entertainment has gradually expanded to certain scale. However, there are various inevitable constraints and bottleneck during the development of sports economy. It is necessary to identify the factors restricting development of sports economy to find an appropriate model for future development.

3.1 INSTITUTIONAL CONSTRAINTS

In the past, sports events were entirely arranged by the National Sports Commission without any market-oriented mechanism. With the process of reform and opening – up, the constraints from conventional institution have been recognized [2]. The government attempted to transform from government behaviour to corporate behaviour gradually. However, it still not completely got rid of the long-term impact of planned economy. In addition, with the promotion of market-oriented economy, China has opened up a way to organize sports event jointly by corporation and sports institutions. However, the sports institutions were often in dominant position. Enterprises were hard to get adequate autonomy so that they were not very willing to be involved. Generally, enterprises only obtained few profit after the events. Usually enterprises participated in sports events for two purposes:

1) to enhance visibility and social benefits;

2) economic benefits. However, due to long term institutional constraints, enterprises were not very positive to invest in sports.

3.2 LEGISLATION CONSTRAINTS AND LACK OF POLICY SUPPORT

Currently, there is few legislation regarding sports market and lack of authorization legislation. The management authority, role and responsibility are not clearly defined. It is found that in Britain, the United States and other developed countries the governments often give proper policy supports to develop sports economy, such as certain tax relief for the revenue from sports event and operation of stadium, preferential policies for land acquisition and low-interest loans for stadiums etc. Such supports in China are far from enough. The sports industry has suffered "cold reception" in the preferential policies, which also caused enterprises reluctant to enter into sports industry.

3.3 SPORTS MARKETS STILL IN THE INITIAL STAGE

The response speed of sports market and ability to create demand are highly related with the needs of the market. Currently, people's consumption concept on sports has not been completely converted, which mainly presented in limited consumption capacity and irrational consumption structure. In addition, there is lack of high-quality sports management talent. The irrational knowledge structure

and incomprehensive capability of the sports management staff have severely restricted the development sports market so that the sports market in China is still at initial stage.

4 FAHP model for sports economy development mode

The FAHP model has been introduced to sports economics due to its strong applicability. For the evaluation of socio-economic system, integrated qualitative and quantitative FAHP is required in the case of many subjective qualitative indicators. For sports economics, single indicator evaluation can be used to identify strengths and weaknesses and support decision-making. AHP and FAHP can be used for overall comprehensive evaluation. The qualitative factors are described by quantitative means and then transformed back to qualitative factors through fuzzy comprehensive evaluation so that qualitative factors and quantitative factors are fully integrated and the subjective factors are excluded during this process.

4.1 AHP MODEL

4.1.1 Features of analytic hierarchy process

The Analytic Hierarchy Process (AHP) is a structured technique developed in 1970s by T.L. Saaty, an American operational researcher. This technique has the capability to integrate qualitative analysis and quantitative analysis effectively. The procedure for using the AHP can be summarized as five steps. Step 1: propose problem; step 2: establish hierarchy analysis model; step 3: develop judgment matrix; step 4: establish priorities among the elements of the hierarchy; step 5: yield a set of overall priorities for the hierarchy. The comprehensive evaluation value can be generated through calculating the weight of each element of each hierarchy to the overall goal thereby providing basis for alternative selection.

AHP is useful to make effective, reliable and rational decision and it is applicable to wide field, such as resources allocation, alternative selection and evaluation.

4.1.2 Establish hierocracy model and judgment matrix

A multi-stage hybrid hierarchy structure is usually adopted for sports economy evaluation. It is necessary to note that the elements selected should be independent. The complex problem is decomposed into several sub-problems comprised of different elements which can be further broken down so that the hierarchy is built.

The judgment matrix is the basic information of AHP, which is also an important basis for calculation of weight. In this step, the experts and researchers invited need to repeatedly answer the question: which one is more important to achieve the goal b_i or b_j? How important is it (using 1-9 to measure the importance)? Then, a pairwise comparisons matrix containing n elements for hierarchy B is established.

4.1.3 Determine the weight of each element and the maximum eigenvector of judgment matrix

1) Determine relative weight using uniform criteria:

$$W_i = \frac{\left(\prod_{j=1}^{n} b_{ij}\right)^{\frac{1}{n}}}{\sum_{k=1}^{n}\left(\prod_{j=1}^{n} b_{kj}\right)^{\frac{1}{n}}}, (i = 1,2,3,\ldots,n);$$

eigenvector $W = [W_1, W_2, W_3,...,W_n]^T$;

2) Calculate the maximum eigenvector of the judgment matrix:

$$\lambda_{\max} = \frac{1}{n}\sum_{j=1}^{n}\frac{\sum_{j=1}^{n} b_{ij}W_j}{W_i}$$

4.1.4 Test consistency of judgment matrix

The consistency index *CI* is used to test the judgment matrix:

$$CI = \frac{\lambda_{\max} - n}{n-1}, CR = \frac{CI}{RI}$$

When $CI = 0$, the judgment matrix is fully consistent; when $CI < 0.1$, the consistence is at acceptable level; when $CI \geq 0.1$, (*RI* is the average random consistency index of which the values are given in Table 1), it needs to adjust the judgment matrix until satisfactory.

TABLE 1 *RI* matrix from 1to 9 order

order	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
RI	0.00	0.00	0.58	0.90	1.12	1.24	1.32	1.41	1.45

4.2 FAHP MODEL

The AHP is straightforward that the judgment matrix does not consider fuzziness. However, fuzzy judgment is always used unconsciously when solve complex decision problem. Therefore, Fuzzy Analytic Hierarchy Process (FAHP) has been developed to apply AHP in fuzzy conditions.

When comparing two elements, quantitative importance is give to both elements, i.e. represented by membership function *A*. The fuzzy judgment matrix $A = (a_{ij})_{n\times n}$ has the following two properties:

$a_{ii} = 0.5, \forall i \in N$,

$a_{ij} + a_{ji} = 1, ai_j \geq 0, \forall i, j \in N(i \neq j)$.

Such judgment matrix is called fuzzy complementary judgment matrix. For the fuzzy complementary judgment matrix, the weight is determined by:

$$W_i = \frac{\sum_{j=1}^{n} a_{ij} + \frac{n}{2} - 1}{n(n-1)}, i \in N.$$

Similarly, it needs to test the consistency of the weight values determined. The compatibility of the fuzzy judgment matrix is used to test the consistency. The procedures are as follows:

4.2.1 Determine characteristic matrix for fuzzy judgment matrix A

The weight vector of fuzzy judgment matrix A is $W = [W_1, W_2, W_3, ..., W_n]^T$ and $\sum_{i=1}^{n} W_i = 1, W \geq 0 (i \in N)$. The element of characteristic matrix is:

$$W_{ij} = \frac{W_i}{W_i + W_j}, \forall i, j \in n.$$

Then the characteristic matrix of judgment matrix A can be presented as $W = (W_{ij})_{n \times x}$.

4.2.2 Test consistency of fuzzy complementary judgment matrix and characteristic matrix

The attitude of decision-maker is denoted by α. When

$$I(A, W) = \frac{1}{n^2} \sum_{i=1}^{n} \sum_{j=1}^{n} |a_{ij} + W_{ji} - 1| \leq \alpha.$$

The consistency of judgment matrix is regarded as satisfactory. The smaller α indicates the decision maker has high requirement on consistency of fuzzy judgment matrix. Usually α is taken as 0.1.

Establish a Multi-dimensional Sports Economy Development Model.

Based on the identification of bottleneck restricting development of domestic sports economy and results of FAHP evaluation, a multi-dimensional model is established (Figure 1).

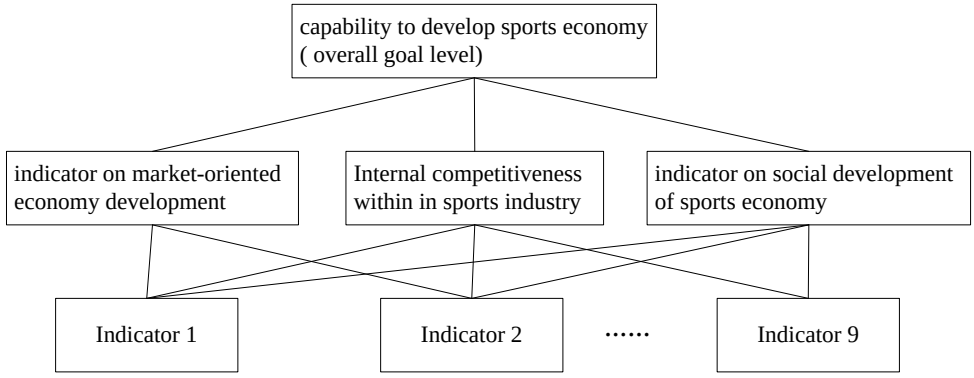

FIGURE 1 Multi-dimensional model on development of sports economy

For the middle hierarchy (criteria level), these three indicators are pairwise compared for preference by experts to construct judgment matrix for the evaluation system of sports economy development:

$$U = \begin{bmatrix} 1 & \frac{1}{5} & 3 \\ 5 & 1 & 7 \\ \frac{1}{3} & \frac{1}{7} & 1 \end{bmatrix}.$$

The corresponding weights of each element are: [0.1884, 0.7307, 0.0808]. The consistency of weights is tested: $\lambda_{max} = 3.0649$; $CI = 0.03245$; $CR = 0.056 < 0.1$, indicating the consistency is satisfactory.

Using FAHP the fuzzy judgment matrix is determined as:

$$U = \begin{bmatrix} 0.5 & 0.3 & 0.6 \\ 0.7 & 0.5 & 0.8 \\ 0.4 & 0.2 & 0.5 \end{bmatrix}.$$

The corresponding weights of each element are: [0.3167, 0.4167, 0.2666]. The consistency index $I = 0.0842 < 0.1$, concluding the consistency is satisfactory.

It is shown that internal competitiveness is the most critical factor to sports economy development, followed by market-oriented economy and social development. The results from FAHP are satisfactory and comply with actual situation.

5 Recommendations on policy and development model for domestic sports economy

It is concluded from the FAHP evaluation that internal competiveness is the most important factor to development of sports economy. Therefore, it is critical to establish regulated market. In view of this, recommendations on policy and model selections are proposed.

5.1 RECOMMENDATIONS ON POLICY FOR DEVELOPMENT OF DOMESTIC SPORTS ECONOMY

5.1.1 Establish and improve socialistic market system

China, a big country with 1.3 billion populations, has huge demands on sports and also is a huge market. With the development of reform and opening-up, living conditions and incomes have been greatly improved. The consumption habits were also changed. There is increasing demands for fitness, leisure, sports and entertainment [4]. People are willing to spend more time and money in physical exercise to pursuit for health. National wide fitness programs have reached a climax and brought more business opportunities. Together with more commercialized competition sports, these will promote the prosperity of sports goods market [3].

The sports market in China like a huge "cake" that many other counties covet. Since joining WTO, some international brands have entered into Chinese market. To establish and improve socialistic market system, as well as strengthen domestic brands will not only further motivate sports market but also promote the prosperity of domestic sports goods market.

5.1.2 Strengthen marketization of sports industry

At present, China's sports economy has broken the limits of original planned economy. However, the marketization is not completed. Thus, it is essential to accelerate the pace of sports innovation and strengthen market-oriented sports industry. The sports institutions at each level should strengthen cooperation with enterprises to maximize the effectiveness of diverse sports. Most sports institutions are public institutions. With the promotion of public institution reform program in 2014, the sports institutions are encouraged to transfer to enterprise if possible and accelerate the pace of industrialization. However, this is a long term and systematic project that has to be phased. First stage: from full funding to balance allocation. Second stage: from balance allocation to self-supported [5]. Third stage: from self-supported to enterprise. Through the staged reform the sports institutions could find multi funding source and don't need to rely on government allocations. The sports could cooperate with strong enterprises to jointly promote sports industry and market-oriented process so that the sports institutions and enterprises are complementary with each other.

5.1.3 Enhance policy support

Sports industry is a kind of quasi-public goods, i.e. the public and private properties coexist in sports industry. The government cannot ignore the public welfare when vigorously promoting development of sports economy, while private enterprises often only purse for profits. Sports industry usually benefits "externalities" so that private enterprises are not interested in. Therefore, the government is required to afford the input in sports infrastructures and perform management responsibilities. At present, the sports market system in China is mainly for the purpose of cultivating various sports markets. On the one hand, sports goods, talent and capital are three basic elements for sports economy. These three elements interact with each other and have become three pillars. On the other hand, sports technology, property and equipment ensure material and services supplies for these three pillar industries. Therefore, it is critical to provide appropriate basic supporting industries timely. In addition, reasonable and orderly development of sports market can promote consumption and also create a large number of job opportunities thereby making great contributions to social benefits. Therefore, the government needs to actively provide guidance and supports to the development of sports industry and establish sound regulation to promote diverse development especially. In particular, the industry reform is still at initial stage. Many enterprises are still waiting to see the further prospect. The relevant governments should give certain supports, such as tax incentives, to attract more substantial enterprises and promote sustainable development jointly.

5.2 FUTURE DEVELOPMENT MODEL FOR DOMESTIC SPORTS ECONOMYY

Phelan Gary, the general secretary of World Tourism Organization predicted that China would become the largest tourist destination in 2015. The authority considered tourism would become a pillar industry and new growth point. Currently, sports tourism has become a hot industry. Sports tourism integrates tourism and sports industry that sports resources and tourism resources complementary and mutually beneficial with each other [6]. Tourism and sports industry enjoy similar social and cultural background and have similar product features. Sports tourism contains various functions, including leisure, fitness, entertainment, sightseeing and participation.

Sports economy, making using of both sports resources and tourism resources, will become new economic growth point. It can improve living, promote inheritance and propagation of modern civilization and also drive other related industries and create more employment opportunities, thereby improve regional economy.

Reference

[1] He G 2012 Research on the evaluation of the coordinated development between china regional mass sports and economy *Journal of Beijing Sport University* **35**(6) 23-7 (*in Chinese*)
[2] Lei X, Li S, Luan F, et al 2012 Application of improved AHP in evaluation on sustainable sports industry *Journal of Shandong Institute of Physical Education and Sports* **4** 12-3 (*in Chinese*)
[3] Yu C, Liu Z, Ding H, et al 2001 Research on evaluation indexes of sustainable development and human resources *Journal of Xi'an Institute of Physical Education* **18** 24-5 (*in Chinese*)
[4] Li J, Guo L 2012 Research on sports industry model China *Sport Science and Technology* **3** 47-8 (*in Chinese*)
[5] Hu X 2013 The breakthrough of Chinese sport reform: changing the institutional bottleneck of the transformation of the mode of sports development *Journal of Sports and Science* **01** 26-7 (*in Chinese*)
[6] Yu L 2013 Public Service supply mode transformation and realistic choice since 30 years of reform and opening-up in China *China Sports Science* **33**(2)11-21 (*in Chinese*)

Authors

Tao Shi, born on December 25, 1978, Handan city, Hebei province, China

Current position, grades: lecturer of Institute of Physical Education, Handan College, Handan, China.
Scientific interest: physical education and sports coaching.
Publications: more than 3 papers.
Experience: teaching experience of 8 years, 3 scientific research projects.

Zhijie Xing, born on April 20, 1980, Handan city, Hebei province, China

Current position, grades: senior teacher of Hanshan District Experimental Primary School, Handan, China.
Scientific interest: physical education and sports coaching.
Publications: more than 1 paper.
Experience: teaching experience of 7 years, 2 scientific research projects.