Sport industry strength influence factor weights research based on factor analysis

Hailong Zhang

Department of Physical Education, Xinxiang University, Xinxiang, Henan, China
_____

ABSTRACT

Sport industry as a vigorous sunrise industry; explore sport industry influence factors are of great significance in increasing sport industry comprehensive strength. Through analyzing sport industry development influence factors, take Chinese eastern 11 provinces and cities in 2012 as sample points, carry out factor analysis of each sample influence factors, it gets main economic development factor, people's life factor as well as industrial development factor, calculate factor scores; according to factor scores , calculate eastern 11 areas comprehensive scores as well as rankings, it gets each area development advantages and constraints, and put forward correlation suggestions.

Key words: factor analysis, sport industry, influence factor, comprehensive evaluation
_____

INTRODUCTION

With development of global economy, leisure has already become an important part of people's lives. With people's life constant improving, people will have more energy and money that can be used on leisure. Sport industry in western countries has already been the important economic growth point and support. In America, Italy, Britain and other countries, sports gross national product can account for 1% to 3% of gross national product. Other developed countries as Japan, Australia and so on, their sports gross national product also cover quite a large proportion of gross national product [1-3].

In China, recently years' sport industry has been developing at an amazing speed. Every year growth rate is very big, but comparing with other developed countries, it still has a long way to go [4-6]. Therefore research on sport industry competitiveness development problems is of great significance for Chinese present sport industry. While industry is a great concept, there are many factors affect industrial development. Influence factors directly or indirectly have an effect on industrial development [7]. Sport industry in China is still in its immature stage, it has many aspects that urgently need of improvement. Compared to other areas, eastern coastal provinces and cities have developed well; utilize factor analysis carrying out analysis and evaluation on eastern area sport industry strength, it puts forward guidance in methods and thinking for other provinces and cities, and provides references for them. It can quicken each province and city sport industry development pace.

CONSTRUCT EVALUATION INDICATOR SYSTEM BLOCK DIAGRAM
Based on sport industry influence factors evaluation indicators selection systematicness, operable, effectiveness, comparability and other principles, by relative researches learning, the paper establishes a set of sport industry evaluation indicator system. Select Chinese 11 provinces and cities data in 2012, establish sport industry influence factors factor analysis model. Finally, make investigation on model results, by comparing 11 samples' sport industry influence factors, it provides strengthen sport industrial development corresponding counter measurements and suggestions. The constructed evaluation indicator system block diagram is as following Figure 1.
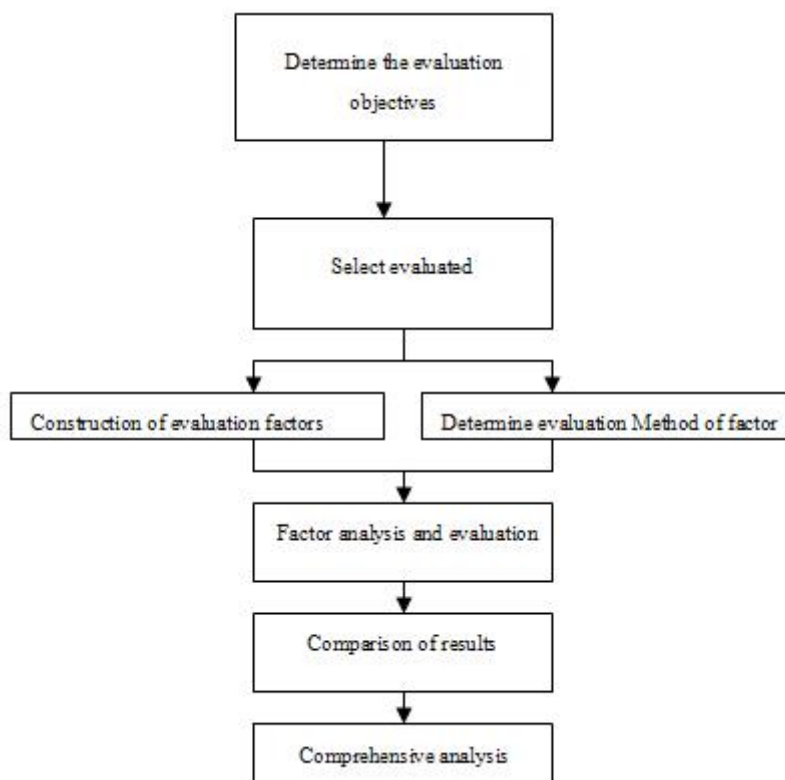
Figure 1: Evaluation indicator system block diagram

EVALUATION INDICATOR SYSTEM CONTENT

There are many indicators that can reflect sports industry influence factors, by analyzing sports industry generated backgrounds and features, and combine with indicator selection principle and system block diagram, reference relative documents. Construct indicator system from economic development, people's life and sports industry factor as well as others these three aspects.

Economic development factor indicator

Regional economic development is sports industry basis and premise guarantee. Develop sports industry; in the meanwhile, it can also drive regional economic development. Economic development factor selects GDP gross x_1, local financial revenue x_2, total social fixed asset investment x_3, sex ratio x_4, natural population growth rate x_5, year-end population x_6, total social retail sales x_7. These seven indicators data all can be consulted through China statistical yearbook.

People's life factor

People is main body of productivity, is the condition that social activity implementation. People's life quality also has great connections with sports industry development. After people's life gets basic guarantee, having enough to eat and having shelter, they will consider carrying out people's spiritual living factor indicator selection per capita GDP x_8, per capita regional financial revenue x_9, household find consumption expenditure x_{10}, average wages of staff and workers x_{11}, per capita floor space x_{12}, per capita reserve balance x_{13}, expectation of life x_{14}.

Sports industry factor

Sports industry development can't do without each material resources and manpower supporting. Sports industry factor selection sports lottery sales x_{15}, finance assistance to culture and sports and media x_{16}, numbers of sports coaches x_{17}, numbers of grade athletes x_{18}, farm population weight on local population x_{19}, student's proportion of whole province x_{20}, numbers of university graduates x_{21}. Sports lottery sales can be got from China lottery network.

_____

Sort out these indicators; get one sports industry influence factors evaluation system composed of 21 concrete indicators, as following Table 1 shows.

Table 1: Sports industry influence factors evaluation system

Evaluation objectives	Main influence factors	Influence factors evaluation indicators
sports industry strength	economic development	GDP gross x_1
		local financial revenue x_2
		total social fixed asset investment x_3
		sex ratio x_4
		natural population growth rate x_5
		year-end population x_6
		total social retail sales x_7
	People's life factors	Per capita GDP x_8
		per capita regional financial revenue x_9
		household find consumption expenditure x_{10}
		average wages of staff and workers x_{11}
		per capita floor space x_{12}
		per capita reserve balance x_{13}
		expectation of life x_{14}
	Sports industry factors	sports lottery sales x_{15}
		finance assistance to culture and sports and media x_{16}
		numbers of sports coaches x_{17}
		numbers of grade athletes x_{18}
		farm population weight on local population x_{19}
		students proportion of whole province x_{20}
		numbers of university graduates x_{21}

According to selected evaluation indicators, apply factor analysis; carry out practical research on selected 11 provinces and cities' sports industry strength levels. At first select 11 samples data in 2012, and carry out filtering and integration on data, get required data, and then make analysis and handling with received data. This chapter finally makes comprehensive evaluation on factor analysis results, gets Hubei province sports industry strength advantages and disadvantages of 11 provinces and cities.

Due to data units are different, it is impossible to make directly comparison, therefore make use of SPSS19.0 data to implement standardization, so that can ignore unit affects data definitions, let data more reliable. So get following Table 2.

Table 2: Each region each indicator after standardization

	Beijing	Tianjin	Hebei	Liaoning	Shanghai	Jiangsu	Zhejiang	Fujian	Shandong	Guangdong	Hainan
GDP gross	-0.64	-0.92	-0.15	-0.24	-0.51	1.40	0.31	-0.53	1.18	1.57	-1.48
local financial revenue	0.04	-0.86	-0.67	-0.08	0.28	1.49	0.11	-0.85	0.46	1.70	-1.63
total social fixed asset investment	-0.97	-0.79	0.39	0.61	-1.07	1.51	0.19	-0.34	1.55	0.30	-1.37
sex ratio	0.11	-1.19	0.00	-0.81	0.83	-1.16	0.00	-0.54	-0.49	1.46	1.79
natural population growth rate	-0.01	-0.83	0.63	-2.01	-0.22	-0.90	-0.06	0.88	0.07	0.85	1.59
year-end population	-0.89	-1.08	0.65	-0.20	-0.80	0.84	0.12	-0.39	1.36	1.63	-1.24
total social retail sales	-0.47	-1.02	-0.24	-0.23	-0.51	1.08	0.39	-0.53	1.28	1.72	-1.47
Per capita GDP	1.27	1.56	-1.27	-0.27	1.17	0.32	0.07	-0.46	-0.51	-0.39	-1.48
per capita regional financial revenue	1.74	0.97	-1.09	-0.18	1.68	-0.11	-0.36	-0.69	-0.81	-0.44	-0.71
household find consumption expenditure	1.16	0.20	-1.59	-0.62	1.69	-0.09	0.56	-0.14	-0.81	0.77	-1.13
average wages of staff and workers	2.32	0.86	-1.10	-0.87	-0.38	0.22	0.24	0.05	-0.32	0.21	-1.24
per capita floor space	-0.23	-0.84	-0.47	-0.92	1.50	0.75	1.63	0.75	-0.21	-0.73	-1.23
per capita reserve balance	0.00	-1.06	-0.04	-0.19	-0.07	0.67	0.35	-0.89	0.40	2.28	-1.45
expectation of life	1.64	0.91	-1.31	-0.51	1.69	-0.37	0.26	-0.86	-0.46	-0.45	-0.55
sports lottery sales	-0.55	-0.54	-0.66	-0.11	-0.79	2.33	-0.03	-0.19	0.89	0.85	-1.17
finance assistance to culture and sports and media	1.22	-1.13	-0.60	-0.16	-0.31	1.43	0.17	-0.90	0.62	1.14	-1.48
numbers of sports coaches	-0.60	-0.77	-0.52	0.70	-1.27	0.62	0.03	1.37	0.03	1.67	-1.27
numbers of grade athletes	-0.36	-0.42	0.56	-0.22	-0.18	0.68	0.91	-0.76	1.52	0.49	-2.21
farm population weight on local population	-1.42	-1.09	1.36	0.03	-1.64	0.22	0.20	0.46	0.96	-0.09	1.02
students proportion of whole province	1.49	2.21	-0.85	0.05	0.05	0.05	-0.67	-0.31	-0.67	-1.03	-0.31
numbers of university graduates	-0.66	-0.94	0.43	-0.11	-0.78	1.48	-0.03	-0.50	1.51	1.03	-1.44

TEST AT RESULTS

Before factor analysis, it should define whether data meets factor analysis adaptation conditions that KMO value is above 0.5 and Bartlett's sphericity degree test null hypothesis probability value is less than 0.005. Besides, the more KMO value close to 1, it will more fit for factor analysis. Make use of SPSS19.0 directly can get these two values. When KMO value is less than 0.5, data will not meet factor analysis conditions. Sort out SPSS19.0 analyzed KMO value and sphericity degree test probability value, it gets Table 3.

Table 3: KMO value and Bartlett's sphericity degree test

	Economic development factor	People's life factor	Sports industry factor
Sample enough degree Kaiser-Meyer-Olkin measurement	0.630	0.724	0.632
Bartlett sphericity degree test Sig.	0.000	0.000	0.003

From above Table 3, it is clear that these three factors KMO value all above 0.6, indicates they are relative suitable to factor analysis.

FACTOR EXTRACTING

Adopt principal component analysis, utilize correlation coefficient matrix extracting common factors. Define common factors numbers by common factor variance contribution rate in total variance. To ensure data reflection more authentic, comprehensive and objective, generally it should guarantee factor variables possessing above 70% variance contribution rate. Respectively carry out factor analysis of economic development indicator, people's life factor, sports industry factor and other sub factors. Sort out results, it can get Table 4.

Table 4: Explanatory total variance

Element	Economic development factor		People's life factor		Sports industry factor	
	Variance%	Accumulation%	Variance%	Accumulation%	Variance%	Accumulation%
1	64.159	64.159	61.406	61.406	54.921	54.921
2	24.923	89.083	17.508	78.914	23.433	78.354

The three elements' factor variables' variance contribution rates all beyond 70%. Indicate extracted common factors can reflect each factor status. Economic development factor accumulation variance contribution rate gets close to 90%, which indicates that extracted two elements can relative correct , objective evaluate economic factors and arrive at dimensional reduction purpose.

CALCULATE FACTOR SCORES

After factor analysis model establishment, it can make use of least square method to calculate factor scores, get one group of elements' scores.

$$F_m = A'X_i$$

(1)

_____

Among them, F_m represents element score, A' represents element score coefficient matrix, X_i represents original variable matrix.

$$F_i = B'F_m$$

(2)

Among them, F_i represents sample point factor scores, B' represents factor variance contribution rate coefficient matrix, F_m and represents element scores. Then formula (1) can solve principal component score, utilize formula (2), and work out each sample point factor scores. From scores, it can reflect the sample regional sports industry strength level as Table 5, Table 6.

Table 5: Component matrix after each region each factor indicator rotating

\	Indicator	Factor scores 1	2
Economic development factor	GDP gross x_1	0.233	0.031
	local financial revenue x_2	0.204	0.015
	total social fixed asset investment x_3	0.165	-0.172
	sex ratio x_4	0.058	0.511
	natural population growth rate x_5	0.055	0.498
	year-end population x_6	0.235	0.1
	total social retail sales x_7	0.238	0.067
People's life factor	Per capita GDP x_8	0.238	-0.048
	per capita regional financial revenue x_9	0.263	-0.157
	household find consumption expenditure x_{10}	0.151	0.273
	average wages of staff and workers x_{11}	0.176	0.052
	per capita floor space x_{12}	-0.001	0.412
	per capita reserve balance x_{13}	-0.153	0.705
	expectation of life x_{14}	0.253	-0.105
Sports industry factor	sports lottery sales x_{15}	0.264	-0.035
	finance assistance to culture and sports and media x_{16}	0.305	-0.226
	numbers of sports coaches x_{17}	0.144	0.124
	numbers of grade athletes x_{18}	0.241	-0.032
	farm population weight on local population x_{19}	-0.116	0.522
	students proportion of whole province x_{20}	0.037	-0.456
	numbers of university graduates x_{21}	0.235	0.093

_____

Table 6: Each region each influence factor scores

Region	Factor					
	F1(Economic development factor)	F2(Economic development factor)	F1(People's life factor)	F2(People's life factor)	F1(Sports industry factor)	F2(Sports industry factor)
Beijing	-0.61541	0.08116	1.76023	-0.16683	0.11887	-1.80094
Tianjin	-1.1312	-1.1062	1.20252	-1.32065	-0.71077	-1.47411
Hebei	0.02414	0.2806	-1.34591	-0.34467	-0.38764	1.21598
Liaoning	-0.2344	-1.56207	-0.45591	-0.63077	-0.05864	0.1172
Shanghai	-0.50969	0.37389	1.34468	0.51002	-0.52317	-1.00401
Jiangsu	1.219	-1.07518	-0.12501	0.81384	1.62893	-0.12226
Zhejiang	0.2421	-0.01612	0.06012	1.11091	0.21197	0.34562
Fujian	-0.55494	0.11936	-0.38622	-0.13079	-0.49197	0.73785
Shandong	1.22338	-0.2141	-0.68989	0.15565	1.01041	0.73275
Guangdong	1.68843	1.4731	-0.52012	1.66199	1.14592	0.42119
Hainan	-1.35142	1.65108	-0.84449	-1.65869	-1.94392	0.83071

CONCLUSION

According to factor scores, it can make ranking; from ranking, it can make comparison of 11 regions strength levels. It can also know each region sports industry development constraints, make correlated suggestions, and get following Table 7. Total score is the sum of economic factor, people's life factor and sports industry factor comprehensive scores. Each element score is got by factor analysis, so it possesses commonality and comparability, it can directly add and get total scores.

Table 7: China 11 provinces and cities sports industry development influence factor comprehensive score and ranking table

Region	Economic element comprehensive score	Ranking	People's life comprehensive score	Ranking	Sports industry comprehensive score	Ranking	Total score	Ranking
Beijing	-0.375	8	1.05	1	-0.36	8	0.315	5
Tianjin	-1.001	11	0.51	3	-0.74	10	-1.231	10
Hebei	0.085	5	-0.89	11	0.07	5	-0.735	8
Liaoning	-0.54	10	-0.39	8	0	6	-0.93	9
Shanghai	-0.234	6	0.92	2	-0.52	9	0.166	6
Jiangsu	0.514	3	0.07	5	0.87	1	1.454	2
Zhejiang	0.151	4	0.23	4	0.2	4	0.581	4
Fujian	-0.328	7	-0.26	7	-0.1	7	-0.688	7
Shandong	0.732	2	-0.4	9	0.73	2	1.062	3
Guangdong	1.45	1	-0.03	6	0.73	2	2.15	1
Hainan	-0.456	9	-0.81	10	-0.87	11	-2.136	11

From above Table 7, it is clear that negative number represents it lower than average level. Take following provinces and cities as examples; Guangdong economic development factor, people's life factor and sports industry factor ranking all are in top three. It is clear that Guangdong sports industry strength is stronger and total score is also No.1 in 2012. Compared with Guangdong, Hebei province total score and ranking lies in the middle of the lowest, Hubei province economic factor ranks the fifth, indicates that it ranks in the middle in eastern regions in that year. People's life ranks the 11th, lower than eastern region average level, indicates Hebei province people's life is inferior to that of Guangdong people in 2012. In 2012, Hebei province sports industry factor score ranks the fifth, indicates sports industry ranks in the middle. With regard to people's life, economic factor and sports industry factor ranks are forward, so to Hebei province, its sports strength development constraints is people's life factor, improving people's life level is key to improve sports industry strength rank, meanwhile it should also make great efforts to economic development and strengthen sports competitiveness.

By comprehensive analysis, it gets selected 11 sample points regional sports industry development advantageous main regions are Guangdong, Shandong, Jiangsu, Zhejiang as well as Beijing in 2012. In each influence factor ranking, it can analyze and get each region development advantages.

Beijing: Constraints are economic development factor and sports industry factor, it has advantages in people's life factor, which are relative dominant in people's life levels, people's life factor ranks No.1. Tianjin: It is the same as Beijing. Hebei: Economic factor and sports industry factor ranks are forward, so to Hubei province, its sports strength development constraint is people's life factor, improving people's life levels is the key to improve sports industry strength ranking. Liaoning: All three ranking have no advantages, total ranking also lies in the middle of the lowest. Shanghai: It has same constraints and advantages as Tianjin, Hebei. Jiangsu: Sports industry factor ranks the No.1, indicates sports industry factor is its advantage, other two items lies above the middle. Zhejiang: All three

factors rank the fourth. Development is relative balanced. Fujian: All three factors rank the seventh, indicates overall is required to be improved. Shandong: Economic development factor and sports industry factor rank the second that are its advantages, its constraint is people's life, indicates that it should improve people's life level to improve sports industry strength. Guangdong: Constraint is people's life level, the same as Shandong, but Guangdong is stronger than Shandong in overall strength. Hainan: Ranks backward, entirety is need to be improved, so sports industry strength is relative weaker.

Industry policy as a big system, its content involved each aspect of industry. According to analysis methods in this paper, except it should continue play advantageous factor development, it should also weaken comprehensive strength influence constraints. That is to learn from each other, and increase government supports and monitoring sports industry.

REFERENCES

[1] LU Jin-kui; NI Gang; Xiong Jian-ping. *China Sport Science*, **2009**, 29(6), 28-38.
[2] Zhang Bing. *Hubei social science*, **2013**, 9, 75-78
[3] Wang XiaoLin; Hu AnYi. *Journal of Wuhan Institute of Physical Education*, **2013**, 47(1), 49-57.
[4] Li Weiming; Liu Cheng; Wang Hao. *Forum on Science and Technology in China*, **2013**, (4).
[5] Pan Xiong-feng; Liu Feng-chao; YANG Ling. *Studies in Science of Science*, **2009**, 27(1), 52-58.
[6] Zhou Liang-jun; Li Fan. *Journal of Chengdu Physical Education Institute*, **2011**, 37(4).
[7] Zhang B.; Zhang S.; Lu G.. *Journal of Chemical and Pharmaceutical Research*, **2013**, 5(9), 256-262.