ISSN : 0974 - 7435 Volume 10 Issue 8

2014

BioTechnology

An Indian Journal

FULL PAPER

BTAIJ, 10(8), 2014 [2668-2675]

Chinese rural sports public service innovation supply way game theory analysis and research under new pattern urbanization background

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ABSTRACT

With new policies releasing of city leading countryside, industry leading agriculture, reciprocity between industry and agriculture, urban and rural integration, rural new pattern urbanization is heating up, its sports public service construction is also constantly innovating. Firstly by establishing analytic hierarchy process model, considering policy support, yield returns, the brand effect and authority and social cohesion and other influence factors when supply sports public service, the paper solved rural new pattern sports public service supply way's government, enterprise and third department respectively occupied proportions are respectively 0.423, 0.385 and 0.192. It gets that government and enterprise supply in rural sports public service new pattern supply way are the main parts. Then according to game analysis and evolution game analysis, it solves government and enterprise supplying public cultural service strategies should be government collaborating with enterprise to supply sports public service, so rural sports public service new pattern supply way should be government and enterprise collaborative supply on it, and government should properly carry out selective acquisition on the third department public service, adopt strategies of stimulating foreign companies by competition to promote new rural area sports public service construction.

KEYWORDS

AHP; Game theory; Sports public service; Urbanization.

INTRODUCTION

Since new China has been founded, China's comprehensive strength has started to promoting, after opening-up and reformation, Chinese economy has been rapidly developed, national demands increase, therefore public service has become Chinese government reform concept important contents, government reformation on public service should involve in multiple aspects of society. Therefore, public services have many contents, represented forms are various, from which it can divide into lowest basic public service, economic aspect service, social welfare service and public security and safety so on. And sports public service is an important reflection of national physical quality; it reflects a country and a society people health extent, which is also reflection of the country vital force. And China is gradually going ahead with socialist harmonious society construction, puts emphasis on driving rural development that is new pattern urbanization. Therefore, supply that confronts to new situation rural sports public services should also make reformation, the paper makes research and analysis on new pattern urbanized China's rural sports public services, and finds out the supply way that is more suitable to China's rural status.

MODEL ESTABLISHMENT

Establish hierarchical structure

In order to find out more suitable supply way for China's rural status, firstly it should find out supply's most influential unit, with new rural policies releasing, no matter society, enterprises or nation, all focus on rural construction. Therefore, the paper firstly based on analytic hierarchy process to make quantization on rural sports public service. Establish target layer, criterion layer and scheme layer relations.

Target layer: The supply of rural sports public service.

Criterion layer:scheme influence factors, E_1 is policy support, E_2 is yield returns, E_3 is the brand effect and authority, E_4 is social cohesion.

Scheme layer: A_1 is government supply, A_2 is enterprise supply, A_3 is third department supply, it gets hierarchical structure as Figure 1 shows.

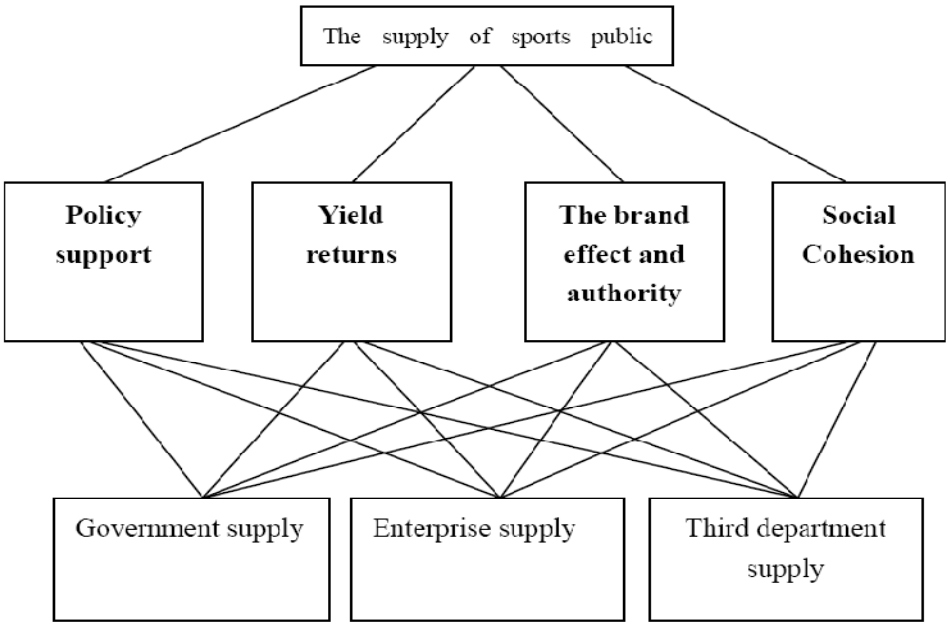

Figure 1 : Hierarchical structure

Construct judgment matrix

According to lots of experts experiences and referencing lots of documents as well as 1~9 scale setting, it gets paired comparison matrix that is judgment matrix as TABLE 1-5.

TABLE 1 : Comparison matrix

G	E_1	E_2	E_3	E_4
E_1	1	1/3	3	3
E_2	31/8	1	5	5
E_3	1/3	1/5	1	1
E_4	1/3	1/5	1	1

TABLE 2 : Comparison matrix

E_1	A_1	A_2	A_3
A_1	1	1	1/3
A_2	1	1	1/3
A_3	3	3	1

TABLE 3 : Comparison matrix

E_2	A_1	A_2	A_3
A_1	1	5	5
A_2	1/5	1	5
A_3	1/5	1/5	1

TABLE 4 : Comparison matrix

E_3	A_1	A_2	A_3
A_1	1	5	8
A_2	1/5	1	5
A_3	1/8	1/5	1

TABLE 5 : Comparison matrix

E_4	A_1	A_2	A_3
A_1	1	5	8
A_2	1/5	1	5
A_3	1/8	1/5	1

Consistency test

Use consistency test formula as : $CI = \frac{\lambda_{\max} - n}{n-1}$. Among them, $\lambda_{\max}$ is maximum feature root value of comparison matrix, n is comparison matrix order. It is clear that judgment matrix and CI value are in inverse proportion.

$$C=\begin{Bmatrix}1 & 1/3 & 3 & 3\\ 3 & 1 & 5 & 5\\ 1/3 & 1/5 & 1 & 1\\ 1/3 & 1/5 & 1 & 1\end{Bmatrix}$$

$$\xrightarrow{\text{Column vector normalization}}\begin{Bmatrix}0.214 & 0.192 & 0.3 & 0.3\\ 0.075 & 0.577 & 0.5 & 0.5\\ 0.121 & 0.115 & 0.1 & 0.1\\ 0.201 & 0.115 & 0.1 & 0.1\end{Bmatrix}$$

$$\xrightarrow{\text{Solve sum by line}}\begin{Bmatrix}1.066\\ 2.22\\ 0.386\\ 0.386\end{Bmatrix}$$

$$\xrightarrow{\text{Normalization}}\begin{Bmatrix}0.2510\\ 0.5545\\ 0.0970\\ 0.0970\end{Bmatrix}=\mathrm{Y}^{(0)}$$

$$CU^{(0)}=\begin{Bmatrix}1 & 1/3 & 3 & 3\\ 3 & 1 & 5 & 5\\ 1/3 & 1/5 & 1 & 1\\ 1/3 & 1/5 & 1 & 1\end{Bmatrix}\begin{Bmatrix}0.2514\\ 0.555\\ 0.0965\\ 0.0965\end{Bmatrix}=\begin{Bmatrix}2.156\\ 1.274\\ 0.388\\ 0.388\end{Bmatrix}$$

$$\lambda_{\max}^{(0)}=\frac{1}{4}\left(\frac{1.023}{0.251}+\frac{2.286}{0.555}+\frac{0.376}{0.0965}+\frac{0.376}{0.0965}\right)=3.98$$

$$u^{(0)}=\begin{pmatrix}0.513\\ 0.303\\ 0.092\\ 0.092\end{pmatrix}$$

Judgment matrix is

$$C_1=\begin{Bmatrix}1 & 1 & 1/3\\ 1 & 1 & 1/3\\ 3 & 3 & 1\end{Bmatrix},C_2=\begin{Bmatrix}1 & 5 & 5\\ 1/5 & 1 & 5\\ 1/5 & 1/5 & 1\end{Bmatrix},C_3=\begin{Bmatrix}1 & 5 & 8\\ 1/5 & 1 & 5\\ 1/8 & 1/5 & 1\end{Bmatrix},C_4=\begin{Bmatrix}1 & 5 & 8\\ 1/5 & 1 & 5\\ 1/8 & 1/5 & 1\end{Bmatrix}$$

Corresponding maximum feature value and feature vector are in order as:

$$\lambda^{(1)}{}_{\max}=3.62,y^{(1)}{}_1=\begin{Bmatrix}0.244\\ 0.244\\ 0.512\end{Bmatrix}$$

$$\lambda^{(2)}{}_{\max}=3.29,y^{(1)}{}_2=\begin{Bmatrix}0.656\\ 0.255\\ 0.087\end{Bmatrix}$$

$$\lambda^{(3)}{}_{\max}=3.31,y^{(1)}{}_3=\begin{Bmatrix}0.650\\ 0.212\\ 0.137\end{Bmatrix}\ \lambda^{(4)}{}_{\max}=3.12,y^{(1)}{}_4=\begin{Bmatrix}0.604\\ 0.248\\ 0.148\end{Bmatrix}$$

According to $CI = \frac{\lambda_{\max} - n}{n-1}$,it gets RI value that can refer to TABLE 6.

TABLE 6 : RI value

n	1	2	3	4	5	6	7	8	9	10	11
RI	0	0	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49	1.51

For judgment matrix C, $\lambda^{(0)}_{\max} = 5.063, RI = 1.12$

$$RI = \frac{5.063 - 4}{4 - 1} = 0.039$$

$$CR = \frac{CI}{RI} = \frac{0.039}{1.12} = 0.035 < 0.1$$

It represents C inconsistency extent is within permissible range, now it can use C feature vector to replace weight vector.

Similarly, to judgment matrix C_1, C_2, C_3, C_4, utilize above principle, all pass consistency test. Therefore target layer to scheme layer computational result can refer to Figure 2.

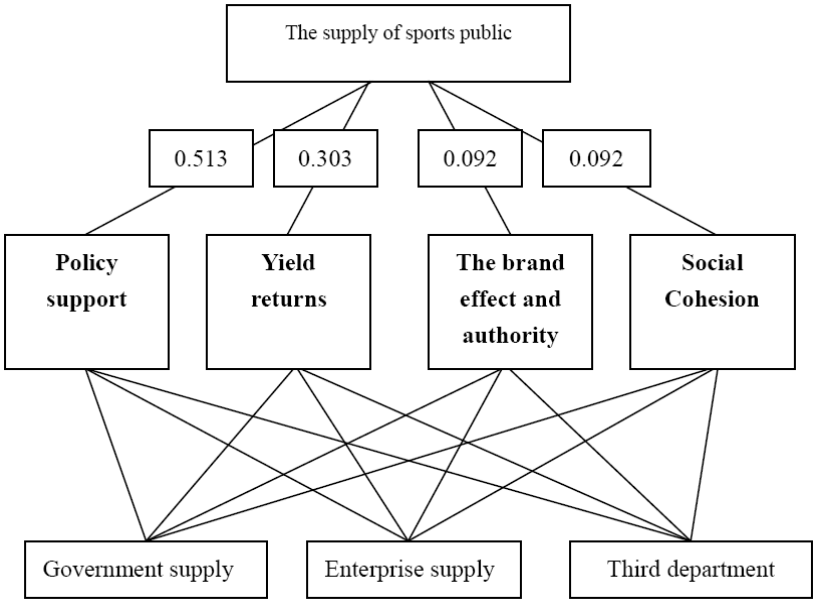

Figure 2 : Target layer to Scheme layer calculation result

$$\begin{Bmatrix} 0.252 \\ 0.089 \\ 0.66 \end{Bmatrix}, \begin{Bmatrix} 0.575 \\ 0.286 \\ 0.139 \end{Bmatrix}, \begin{Bmatrix} 0.624 \\ 0.240 \\ 0.136 \end{Bmatrix}, \begin{Bmatrix} 0.185 \\ 0.240 \\ 0.575 \end{Bmatrix}$$

Calculation structure is as following:

$$y^{(1)} = (y_1^{(1)}, y_2^{(1)}, y_3^{(1)}, y_3^{(1)})$$
$$= \begin{Bmatrix} 0.624 & 0.185 & 0.252 & 0.575 \\ 0.234 & 0.240 & 0.089 & 0.286 \\ 0.136 & 0.575 & 0.66 & 0.139 \end{Bmatrix}$$

$$y = y^{(1)}y^{(0)}$$

$$= \begin{Bmatrix} 0.252 & 0.575 & 0.624 & 0.185 \\ 0.089 & 0.286 & 0.240 & 0.240 \\ 0.66 & 0.139 & 0.136 & 0.575 \end{Bmatrix} \begin{Bmatrix} 0.577 \\ 0.066 \\ 0.124 \\ 0.253 \end{Bmatrix}$$

$$= \begin{Bmatrix} 0.423 \\ 0.385 \\ 0.192 \end{Bmatrix}$$

New rural sports public service supply way game analysis

By above analytic hierarchy process, it is clear that in new rural sports public service aspect, leading component is changing from previous government and the third department to enterprises that rapidly develops into rural sports public service supply main party. According to game analysis, it can roughly regard government and enterprise as main parts, their implemented strategies are both two kinds that are supply and don't supply. Set in case government supplies sports public service and enterprise doesn't supply, government payoff is P_1, enterprise payoff is 0;on the contrary in case enterprise supplies while government doesn't supply,enterprise payoff $P_1^{'}$,government payoff is p_2,cause is though government doesn't supply, enterprise supplies and meanwhile adheres to government system,is beneficial to socialist harmonious society construction. When both government and enterprise simultaneously supply sports public service, government payoff is P,enterprise payoff is $P^{'}$;If both government and enterprise don't supply, then both two payoff is 0. TABLE 7 is government and enterprise payoff matrix.

TABLE 7 : Government and enterprise cultural service supply payoff matrix

		Enterprise	
		Supply	**Don't supply**
Government	Supply	$P, P^{'}$	$P_1, 0$
	Don't supply	$P_2, P_1^{'}$	$0,0$

Among them, $P > P_1 > P_2$,but size of $P^{'}, P_1^{'}$ cannot define, therefore the paper will adopt evolution game analysis to analyze government and enterprise sports public service supply practices, and make respectively strategies adjustment.

New rural sports public service supply evolution game analysis

Due to government and enterprise strategies selection in sports public service supply and don't supply independent and random and can carry on repeated games. Therefore, set government supply probability to be U, probability that don't supply is $1-U$; enterprise supply probability is R ,probability that don't supply is $1-R$. According to Malthusian theorem, it is clear that government strategies support times selection growth rate $\dot{U}/U$ should be differences between fitness $E_w T\{f, 1-R\}^T$ and average fitness $\{U, 1-U\} T \{R, 1-R\}^T . E_w = [1,0]$,when government supply probability is 1, its payoff matrix is

$$T = \begin{bmatrix} P & P_1 \\ P_2 & 0 \end{bmatrix}$$

Simplify $\dot{U} = U(1-U)\{1,-1\} Q \{R, 1-R\}^T$ and get

$$\dot{U} = U(1-U)\left[(P - P_1 - P_2)R + P_1\right]$$

Similarly, enterprises strategies supply times growth rate should be differences between $\dot{R}/R$ fitness $E_J H\{R,1-R\}^T$ and average fitness $\{R,1-R\} H \{U,1-U\}^T$. $E_J = [0,1]$, When enterprise probability is 1, its payoff matrix is

$$H = \begin{bmatrix} P^{'} & 0 \\ P_1^{'} & 0 \end{bmatrix}$$

Simplify $\dot{R} = R(1-R)\{-1,1\} H \{t,1-R\}^T$ and get

$$\dot{R} = R(1-R)\left[P_1^{'} + (P^{'} - P_1^{'})U\right]$$

Therefore when $\dot{U} = 0, \dot{R} = 0, (0,0), (0,1), (1,0), (1,1)$ are public cultural service supply balance points. According to matrix stability, analyze these balance points partial stability, solve partial derivatives of $\dot{U}$ to U ,and partial derivatives of $\dot{R}$ to R ,matrix is

$$W = \begin{bmatrix} \partial\dot{U}/\partial U & \partial\dot{U}/\partial R \\ \partial\dot{R}/\partial U & \partial\dot{R}/\partial R \end{bmatrix} = \begin{bmatrix} (1-2U)\left[(P - P_1 - P_2)R + P_1\right] & U(1-U)(P - P_1 - P_2) \\ R(1-R)(P^{'} - P_1^{'}) & (1-2R)U \end{bmatrix}$$

Among them

$$\det W = (1-2U)(1-2R)\left[(P - P_1 - P_2)R + P_1\right]\left[P_1^{'} + (P^{'} - P_1^{'})U\right] - UR(1-U)(1-R)(P - P_1 - P_2)(P^{'} - P_1^{'})$$

$$trW = (1-2U)\left[(P - P_1 - P_2)R + P_1\right] + (1-2R)\left[P_1^{'} + (P^{'} - P_1^{'})U\right]$$

TABLE 8 is balance point partial stability

TABLE 8 : Balance point partial stability

Balance point (U, R)	$\det W$		trW		**Stability**
$(0,0)$	$P_1 \bullet P_1^{'}$	+	$P_1 + P_1^{'}$	+	unstable point
$(0,1)$	$-(P - P_2) \bullet P_1^{'}$	-	$P - P_2 - P_1^{'}$	Unknown	Saddle point
$(1,0)$	$-P_1 \bullet P^{'}$	-	$P^{'} - P_1$	Unknown	Saddle point
$(1,1)$	$(P - P_2) \bullet P^{'}$	+	$-(P - P_2 + P^{'})$	-	Stable point

By above table, it is clear $(0,0)$ point is unstable point, $(0,1)$ and $(1,0)$ are saddle points, evolution stable point is $(1,1)$. Figure 3 is strategy evolution graph.

Therefore, it is clear that government and enterprise optimal supply strategy to sports public service should be government collaborating with enterprise to supply sports public services.

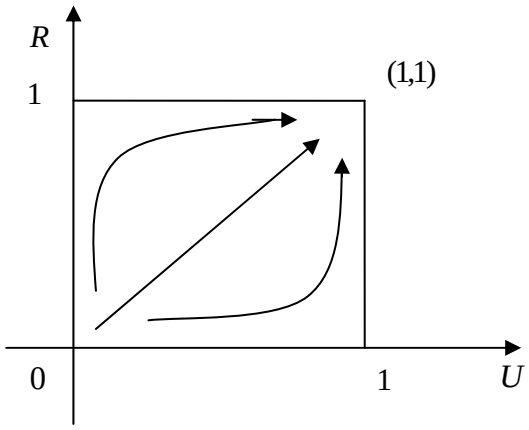

Figure 3 : Strategy evolution graph

CONCLUSION

Firstly by establishing analytic hierarchy process model, considering policy support, yield returns, the brand effect and authority and social cohesion and other influence factors when supply sports public service, the paper solved rural new pattern sports public service supply way's government, enterprise and third department respectively occupied proportions are respectively 0.423, 0.385 and 0.192. It gets that government and enterprise supply in rural sports public service new pattern supply way are the main parts. Then according to game analysis and evolution game analysis, it solves government and enterprise supplying public cultural service strategies should be government collaborating with enterprise to supply sports public service, so rural sports public service new pattern supply way should be government and enterprise collaborative supply on it, and government should properly carry out selective acquisition on the third department public service, adopt strategies of stimulating foreign companies by competition to promote new rural area sports public service construction.

ACKNOWLEDGMENT

Fund Project: Project supported by the research foundation of philosophy and Social Science in Colleges and universities in Jiangsu, approved: 2014SJB456; Youth Study of Jiangsu University of Technology, approved: 13510.

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