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Operation mechanism and strategy research on government purchasing sports public services from social organizations

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ABSTRACT

The paper firstly solves optimal result of strategies about government purchasing sports public services from social organizations is that social organization agree to government purchasing, and government also selective properly purchase through game analysis and evolution game analysis. And then it establishes analytic hierarchy process model, considers required working ability, resource superiority, social organization of cognition and social stability as well as other influence factors when government purchases sports public services from social organizations, and gets occupied proportion of government purchasing ways of sports public services from social organizations respectively as independent competitive purchase is 0.340, the specified purchase is 0.257, and the formal purchase is 0.403. It gets the best way that government purchases sports public services from social organizations.

KEYWORDS

Game theory; Evolution game theory; AHP.

INTRODUCTION

With constantly development after China's opening-up and reforming, public service has become important contents in China's government reformation ideas; government reformation on public services should involve multiple aspects of society. Therefore, public services have many contents; expressed forms are various, from which it can be divided into lowest fundamental public services, economic aspect services, social welfare services and public security and safety as well as others. Among them, sports public services are import parts in government public service system, one country sports public services levels high or low represents the society's people health degrees high or low, and also is presentation of the nation vital force. With party's the 17^{th} CPC national congress holding, nation highlights government functions transformation, and it should perfect government public services functions, construct service-oriented government, and conform to requirements of building socialism harmonious society. The paper studies government to sports social organizations' public services best purchase way.

MODEL ESTABLISHMENTS

Chinese public service status and government purchase necessity analysis

Since opening-up and reforming, China's economy has rapidly developed; it leads to Chinese people life demands to increase. With living standards improvements, in order to strengthen national comprehensive physical quality, China's public service s are also rapidly developing, from which it contains government supply, enterprise supply and social organizations provision. Though sports public services sources are quite a lot, in some utilities, social organizations and enterprises provisions are not ideal, which let to sports public services supplying efficiency to be decreased, Table 1 is each department efficiency in each aspect.

TABLE 1 : Each department efficiency indication

E = **Valid** I = **Invalid** D = **Uncertain**			
	Public department	**Private department**	**Social organizations**
Policy management	*E*	*I*	*D*
Management implementation	*E*	*I*	*D*
Implementation fairness	*E*	*I*	*E*
Prevent discrimination	*E*		*D*
Prevent exploitation	*E*	*I*	*E*
Promote social cohesion	*E*	*I*	*E*
Economic task	*I*	*E*	*D*
Profit	*I*	*E*	*I*
Investment	*I*	*E*	*D*
Improve self-sufficient ability	*I*	*E*	*D*
Social task	*D*	*I*	*E*
Voluntary labor task	*D*	*I*	*E*
Generate meager profit	*D*	*I*	*E*
Promotion of individual sense of responsibility	*I*	*D*	*E*
Community strengthens tasks	*D*	*I*	*E*
Promotion of sense of responsibility to others	*D*	*I*	*E*

By above table,it is clear that in the aspects of government management, management implementation, implementation fairness, prevent discrimination, prevent exploitation and promote social cohesion as well as others, public department plays best roles; enterprise is most effective in profit making aspect; social organizations dominant in voluntary labor task, promotion of individual sense of responsibility and sense of responsibility to others, and in order to build socialism harmonious society, these aspects are main parts that government should purchase.

Sports public service purchase's game analysis

By above analytic hierarchy process, it is clear that in the supplying of sports public services non-profit aspect, government and social organizations take the main parts, in order to build socialism harmonious society, government should selective purchase social organizations' sports public services. Therefore, under game theoretical system analysis, government has purchase and don't purchase two cases, and social organizations have agree and disagree two kinds. Here set in case that government purchases and enterprise disagree, government earnings is Y_1, social organizations earnings is 0; on the contrary, when social organizations agree and government don't purchase, enterprise earnings is $Y_1^{'}$, government earnings is Y_2, causes are though government don't purchase services,social organizations supply services while also carries out government system, it supports government policies and is beneficial to build socialism harmonious society. When both government and social organizations come to terms, government earnings is Y, social organizations earnings is $Y^{'}$; If both government and social organizations disagree, then both earnings are 0. Table 2 is government and social organizations supplying earnings matrix.

TABLE 2 : Government and social organizations public cultural services supplying earnings matrix

		Social organizations	
		Agree	**Disagree**
Government	Purchase	$Y, Y^{'}$	$Y_1, 0$
	Don't purchase	$Y_2, Y_1^{'}$	$0,0$

Among them, $Y > Y_1 > Y_2$,but size of $Y^{'}, Y_1^{'}$ cannot define, therefore the paper will adopt evolution game analysis to analyze government and social organizations practical status, and make respectively strategies adjustment.

Sports public services purchase's evolution game analysis

The paper thinks that government strategy selection on government and social organizations agree and disagree with sports public service purchasing is independent and random, and can carry on repeated games. Therefore, set government purchase probability as P, probability that don't purchase as $1-P$; social organizations agree probability is Q, probability that don't agree is $1-Q$. According to Malthusian theorem, it is clear that government strategies supplying times selection growth rate $\dot{P}/P$ should be differences between fitness $E_w W\{f, 1-Q\}^T$ and average fitness $\{P, 1-P\} W \{Q, 1-Q\}^T$. $E_w = [1,0]$, when government supplying probability is 1 , its earnings matrix is

$$W = \begin{bmatrix} Y & Y_1 \\ Y_2 & 0 \end{bmatrix}$$

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

$\dot{P} = P(1-P)\left[(Y-Y_1-Y_2)Q+Y_1\right]$ Similarly, social organizations strategy supplying times growth rate $\dot{Q}/Q$ should be differences between fitness $E_J H\{P,1-P\}^T$ and average fitness $\{Q,1-Q\}\, H\{P,1-P\}^T . E_J = [0,1]$, when social organization supplying probability is 1 , its earnings matrix is

$$H = \begin{bmatrix} Y^{'} & 0 \\ Y_1^{'} & 0 \end{bmatrix}$$

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

$$\dot{Q} = Q(1-Q)\left[Y_1^{'} + (Y^{'} - Y_1^{'})P\right]$$

Therefore when $\dot{P} = 0, \dot{Q} = 0$, $(0,0)$, $(0,1)$, $(1,0)$, $(1,1)$ are balance points of public cultural services purchasing. According to matrix stability, analyze these balance points partial stability, solve partial derivatives of $\dot{P}$ to P , and partial derivatives of $\dot{Q}$ to Q , matrix is

$$R = \begin{bmatrix} \partial\dot{P}/\partial P & \partial\dot{P}/\partial Q \\ \partial\dot{Q}/\partial P & \partial\dot{Q}/\partial Q \end{bmatrix} = \begin{bmatrix} (1-2P)\left[(Y-Y_1-Y_2)Q+Y_1\right] & P(1-P)(Y-Y_1-Y_2) \\ Q(1-Q)(Y^{'}-Y_1^{'}) & (1-2Q)P \end{bmatrix}$$

Among them

$$\det R = (1-2P)(1-2Q)\left[(Y-Y_1-Y_2)Q+Y_1\right]\left[Y_1^{'} + (Y^{'}-Y_1^{'})P\right] - PQ(1-P)(1-Q)(Y-Y_1-Y_2)(Y^{'}-Y_1^{'})$$

$$trR = (1-2P)\left[(Y-Y_1-Y_2)Q+Y_1\right] + (1-2Q)\left[Y_1^{'} + (Y^{'}-Y_1^{'})P\right]$$

Table 3 is balance point partial stability

TABLE 3: Balance point partial stability

Balance point (P,Q)	$\det R$		trR		**Stability**
$(0,0)$	$Y_1 \bullet Y_1^{'}$	+	$Y_1 + Y_1^{'}$	+	unstable point
$(0,1)$	$-(Y-Y_2)\bullet Y_1^{'}$	-	$Y - Y_2 - Y_1^{'}$	Unknown	Saddle point
$(1,0)$	$-Y_1 \bullet Y^{'}$	-	$Y^{'} - Y_1$	Unknown	Saddle point
$(1,1)$	$(Y-Y_2)\bullet Y^{'}$	+	$-(Y-Y_2+Y^{'})$	-	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 1 is strategy evolution graph.

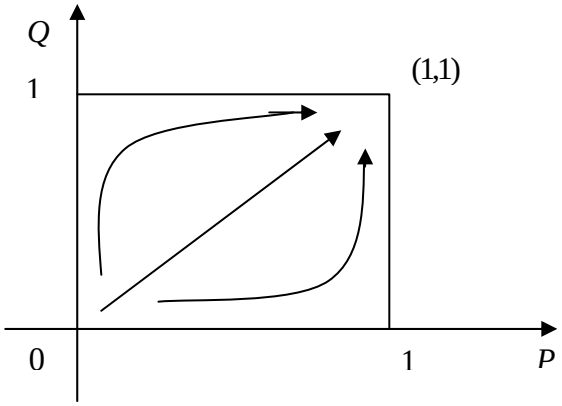

Figure 1 : Strategy evolution graph

Therefore, it is clear that government and social organizations' sports public service purchasing strategy system evolves from initial unstable point $(0,0)$ gradually to stable point $(1,1)$,therefore optimal result is social organizations should agree with government purchasing and government should also selective proper purchase.

Establish analytic hierarchy process structure

In order to solve government sports public services purchasing best way, firstly, it needs to find out government all purchasing ways that are independent competitive purchase, the specified purchase and the formal purchase. Therefore, the paper firstly based on analytic hierarchy process, it makes quantization on sports public services purchasing.

Establish target layer, criterion layer and scheme layer relations.

Target layer : The emption of sports public services.

Criterion layer : Scheme influence factors, f_1 is working ability, f_2 is resource superiority , f_3 is the social organization of cognition, f_4 is social stability.

Scheme layer : C_1 is independent competitive purchase, C_2 is the specified purchase, C_3 is the formal purchase, and it gets hierarchical structure as Figure 2 shows.

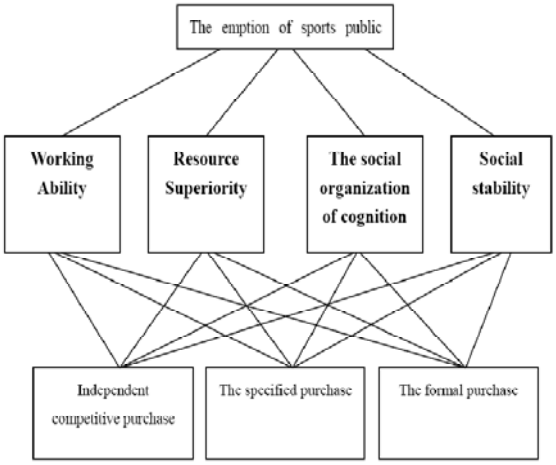

Figure2 : Hierarchical structure

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 4-8.

Table 4 : Comparison matrix

G	f_1	f_2	f_3	f_4
f_1	1	1/3	3	3
f_2	31/8	1	5	5
f_3	1/3	1/5	1	1
f_4	1/3	1/5	1	1

Table 5 : Comparison matrix

f_1	C_1	C_2	C_3
C_1	1	1	1/3
C_2	1	1	1/3
C_3	3	3	1

Table 6 : Comparison matrix

f_2	C_1	C_2	C_3
C_1	1	5	5
C_2	1/5	1	5
C_3	1/5	1/5	1

Table 7 : Comparison matrix

f_3	C_1	C_2	C_3
C_1	1	5	8
C_2	1/5	1	5
C_3	1/8	1/5	1

Table 8 : Comparison matrix

f_4	C_1	C_2	C_3
C_1	1	5	8
C_2	1/5	1	5
C_3	1/8	1/5	1

Table 9 : 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

Hierarchical total arrangement and its consistency test

Use consistency indicator 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 gets closer to consistency and CI value will be smaller.

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

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

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

$$\xrightarrow{\text{Normalization}} \begin{Bmatrix} 0.2515 \\ 0.555 \\ 0.0965 \\ 0.0965 \end{Bmatrix} = U^{(0)}$$

$$CU^{(0)} = \begin{Bmatrix} 1 & 1/3 & 3 & 3 \\ 3 & 1 & 5 & 5 \\ 1/3 & 1/5 & 1 & 1 \\ 1/3 & 1/5 & 1 & 1 \end{Bmatrix} \begin{Bmatrix} 0.2514 \\ 0.555 \\ 0.0965 \\ 0.0965 \end{Bmatrix} = \begin{Bmatrix} 0.328 \\ 1.385 \\ 1.376 \\ 0.376 \end{Bmatrix}$$

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

$$u^{(0)} = \begin{pmatrix} 0.100 \\ 0.385 \\ 0.365 \\ 0.150 \end{pmatrix}$$

Judgment matrix is

$$D_1 = \begin{Bmatrix} 1 & 1 & 1/3 \\ 1 & 1 & 1/3 \\ 3 & 3 & 1 \end{Bmatrix}, D_2 = \begin{Bmatrix} 1 & 5 & 5 \\ 1/5 & 1 & 5 \\ 1/5 & 1/5 & 1 \end{Bmatrix}, D_3 = \begin{Bmatrix} 1 & 5 & 8 \\ 1/5 & 1 & 5 \\ 1/8 & 1/5 & 1 \end{Bmatrix}, D_4 = \begin{Bmatrix} 1 & 5 & 8 \\ 1/5 & 1 & 5 \\ 1/8 & 1/5 & 1 \end{Bmatrix}$$

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

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

$$\lambda^{(2)}{}_{\max} = 3.31, u^{(1)}{}_2 = \begin{Bmatrix} 0.657 \\ 0.251 \\ 0.092 \end{Bmatrix}$$

$$\lambda^{(3)}{}_{\max} = 3.29, u^{(1)}{}_3 = \begin{Bmatrix} 0.648 \\ 0.204 \\ 0.148 \end{Bmatrix} \lambda^{(4)}{}_{\max} = 3.33, u^{(1)}{}_4 = \begin{Bmatrix} 0.648 \\ 0.204 \\ 0.148 \end{Bmatrix}$$

According to $CI = \dfrac{\lambda_{\max} - n}{n-1}$,it gets RI value that can refer to Table 9.

For judgment matrix A, $\lambda^{(0)}{}_{\max} = 4.063, RI = 0.9$

$$RI = \frac{4.063 - 4}{4 - 1} = 0.023$$

$$CR = \frac{CI}{RI} = \frac{0.023}{0.90} = 0.024 < 0.1$$

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

Similarly, to judgment matrix D_1, D_2, D_3, D_4 utilize above principle, all pass consistency test. Therefore target layer to scheme layer computational result can refer to Figure 3.

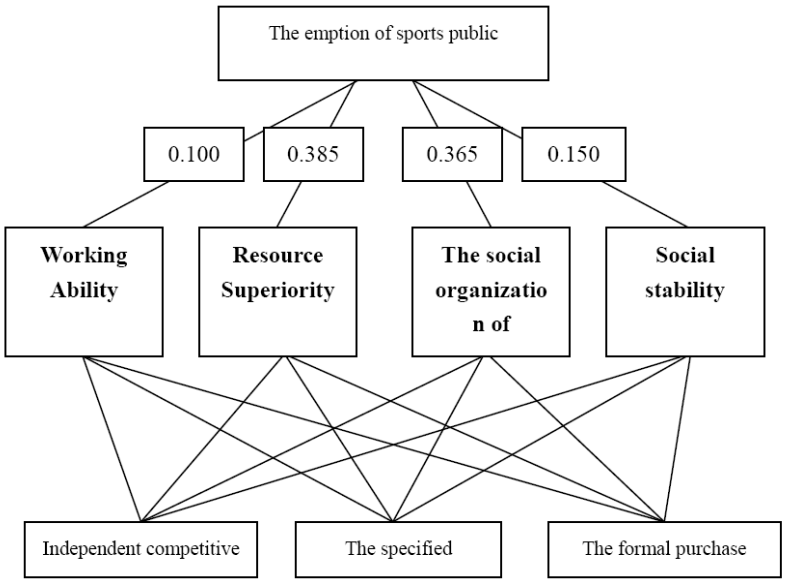

Figure 3 : Target layer to Scheme layer calculation result

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

Calculation structure is as following :

$$u^{(1)} = (u_1^{(1)}, u_2^{(1)}, u_3^{(1)}, u_3^{(1)})$$

$$= \begin{Bmatrix} 0.624 & 0.185 & 0.252 & 0.575 \\ 0.234 & 0.240 & 0.089 & 0.286 \\ 0.136 & 0.575 & 0.66 & 0.139 \end{Bmatrix}$$

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

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

$$= \begin{Bmatrix} 0.340 \\ 0.257 \\ 0.403 \end{Bmatrix}$$

By above analysis,it is clear that consider required working ability, resource superiority, social organization of cognition and social stability as well as other influence factors when government purchases sports public services from social organizations, it gets occupied proportion of government purchasing ways of sports public services from social organizations respectively as independent competitive purchase is 0.340 ,the specified purchase is 0.257 , and the formal purchase is 0.403.

CONCLUSION

The paper firstly solves optimal result of strategies about government purchasing sports public services from social organizations is that social organization agree to government purchasing, and government also selective properly purchase through game analysis and evolution game analysis. And then it establishes analytic hierarchy process model, considers required working ability, resource superiority, social organization of cognition and social stability as well as other influence factors when government purchases sports public services from social organizations, and gets occupied proportion of government purchasing ways of sports public services from social organizations respectively as independent competitive purchase is 0.340 ,the specified purchase is 0.257 , and the formal purchase is 0.403. It gets the best way that government purchases sports public services from social organizations.

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