ISSN : 0974 - 7435 Volume 10 Issue 6

BioTechnology
An Indian Journal

FULL PAPER

BTAIJ, 10(6), 2014 [1544-1549]

Analytic hierarchy process-based recreational sports events development strategy research

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ABSTRACT

In the past years, Chinese sports recreational events have been slightly developed, its development trend is not optimistic, recreational sports promotion events can effective solve the problem. The paper utilizes analytic hierarchy process, selects mountaineering, climbing and drifting three sports recreational events as research objects, and considers best recreational sports promotion events from consumers' cognitive status, mass values, projects development and outdoor recreational sports events spending four aspects. By calculation and analysis, it gets the conclusion that mountaineering is the best recreational sports promotion event. By comparing three sports recreational events each kind of factors data, it finds that the most proper generalized sports event each kind of data indicator is lower.

KEYWORDS

Recreational sports;
Analytic hierarchy process;
Best event;
Development strategy.

INTRODUCTION

In recent years, recreation sports that integrate fitness and entertainment have gradually come into people's life. Recreational sports include outdoor recreational sports and indoor recreational sports, from which outdoor recreational sports focus on hiking, mountaineering and drifting, indoor recreational sports focus on climbing, yoga. Until now, recreational sports are still not received by most of people. Recreational sports promotion influence factors are various, such as consumers' consumption level, personal values orientation and other factors.

In 2006, Wang Zhi-Guo in the article "Chengdu University students develop outdoor recreational sports investigation research", he selected Chengdu universities seven hundred students in school as research objects, adopted quantitative analysis and qualitative analysis two ways to study on university students' outdoor sports status and influence fact ors, the paper pointed out that students themselves cognition degree on recreational sports were not enough, besides family income was direct factor that affected students participating in recreational sports. In 2010, Xu Hui-Yuan in the article "Investigation research on Hangzhou vocational college students'outdoor recreation sports organization", she made investigation and research from Hangzhou vocational college students' recreational sports cognition status, values orientation, project participation and organization status as well as outdoor recreational sports spending and other aspects, and analyzed research results, analysis showed that university students had serious insufficient cognition on recreational sports, values orientation status was relatively good. In 2009,

Wang Wen-Li and others in the article "University students' recreational sports participation influence factors research", took five universities students as research objects, targeted universities students participation in recreational sports influence factors, they made investigation, research results showed that universities students recreational sports participation status suffered family effects. In 2007, Zhou Dan in the article "Urban professional woman participates in recreational sports influence factors research—take Hangzhou as an example", targeted professional women recreational sports influence factors such problem, she established influence factors system and structural model. Utilize factor analysis and variance analysis to verify established system and model, the paper pointed out that woman's recreational sports cognition status and self values orientation affected her recreational sports participation degree.

By consulting relative documents, the paper based on previous researches', works on researching on proper promoted sports recreational sports events so that improve national recreational sports participation level.

AHP MODEL ESTABLISHMENT

AHP can solve relative tedious and vague problems' decision-making problems. Use the method to construct model, it roughly needs four steps:

Establish hierarchical structure scheme;

(1) Construct every layer that fully used in judgment matrix;
(2) Hierarchical single arrangement and consistency test;
(3) Hierarchical total arrangement and consistency test;
(4) In the following, it respectively states each step detailed process.

Hierarchical structure

AHP solved problems are required to be hierarchic, orderly and logic. Only then it can construct hierarchical scheme. Let tedious problems' elements to form into multiple hierarchies according to its attributes, membership and its relations. Last hierarchical element plays a dominate role in next hierarchical relative elements. In general, these hierarchies can be divided into 3 types:

(1) Top hierarchy: Only one element in this hierarchy, it normally is final target of analytic problems. The layer is also called target hierarchy.
(2) Middle hierarchy: In this hierarchy, it includes intermediate links that get involved to fulfill targets, which can be composed of some hierarchies that include multiple and multilayer criterions that required to consider. It can also be called criterion hierarchy.
(3) The bottom hierarchy: This hierarchy includes optional each method and way to fulfill targets. It can also be called measure hierarchy or scheme hierarchy.

Hierarchy numbers in hierarchical structure have something to do with problem's complicated degree as well as analysis detailed requirements, normally the hierarchy numbers are not limited, each element in every hierarchy governs less than 9 elements. Hierarchical structure is as Figure 1.

In Figure 1, layer 1 is target layer that is the purpose which is required to finally fulfill for researching problems, layer 2 is criterion layer that is the medium process that researching problems go through, layer 3 is scheme layer that is each kind of referencing schemes. In general, layer one is one factor, layer two and layer three have multiple factors and quantity is not fixed.

Judgment matrix construction

Each layer structure can show factors relationships,

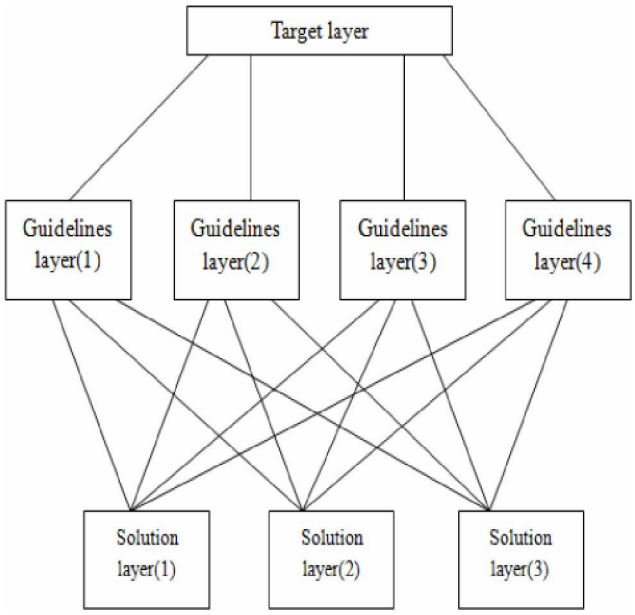

Figure 1 : Hierarchical structure chart

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but in middle layer, each factor occupied proportion in target evaluation basically will not be fully the same, in the heart of evaluators, each factor has certain proportions.

When define each factor proportion that is to compare n pieces of factors $X=\{x_1,\cdots,x_n\}$ to factor Z impacts. *Saaty* and others proposed to carry out paired comparison among factors, and constructed comparison matrix method. That is to say, it selects two factors x_i and x_j every time, uses a_{ij} to express x_i and x_j to Z impacts ratios, all comparison is using matrix $A=(a_{ij})_{n\times n}$ to express, A has become judgment matrix between $Z-X$. From matrix, it is clear that if x_i and x_j to Z impact ratio is a_{ij}, thenandto impact ratio is $a_{ji}=\frac{1}{a_{ij}}$.

According to linear algebra theoretical knowledge, if matrix $A=(a_{ij})_{n\times n}$ meets $a_{ij}>0$ and $a_{ji}=\frac{1}{a_{ij}}(i,j=1,2,\cdots,n)$, then matrix A is positive reciprocal matrix.

a_{ij} Value determination can accord scale table, contents are as following TABLE 1:.

Judgment matrix construction

Matrix A corresponding maximum feature value $\lambda_{\max}$ feature vector W, it is the priority weight of same hierarchy corresponding elements relative importance to last hierarchy some element through normalization, the process is called hierarchical single arrangement. Though the process can reduce other factors interference, it is hard to avoid appearing inconsistency to some extent when integrate all comparison results. If comparison results are consistent, then A factor should also meet:

$$\mathbf{a_{ij}a_{jk}=a_{ik},\forall i,j,k=1,2,\cdots,n} \quad \textbf{(1)}$$

The positive reciprocal matrix that meets above formula is called consistent matrix. To easy define A can be accepted or not, it should test A inconsistency is very serious or not.

If A is consistent matrix, then

(1) A surely is positive reciprocal matrix.

(2) Transposed matrix A^T is consistent matrix.

(3) A matrix any two lines are in proportions, and factors are above 0, therefore $rank(A)=1$, so is the column.

(4) In A, $\lambda_{\max}=n$, n is A matrix order number. Other features roots of A is 0.

(5) $\lambda_{\max}$ corresponding feature vector $W=(w_1,\cdots,w_n)^T$, then $a_{ij}=\frac{w_i}{w_j},\forall i,j=1,2,\cdots,n$, so:

$$\mathbf{A}=\begin{bmatrix} \frac{w_1}{w_1} & \frac{w_1}{w_2} & \cdots & \frac{w_1}{w_n} \\ \frac{w_2}{w_1} & \frac{w_2}{w_2} & \cdots & \frac{w_2}{w_n} \\ \vdots & \vdots & \vdots & \vdots \\ \frac{w_n}{w_1} & \frac{w_n}{w_2} & \cdots & \frac{w_n}{w_n} \end{bmatrix} \quad \textbf{(2)}$$

TABLE 1 : Scale table

Scale	Definition
1	Indicates two factors have equal importance by comparing
3	Indicates the former is slightly more important than the later by comparing two factors
5	Indicates the former is obviously more important than the later by comparing two factors
7	Indicates the former is intensely more important than the later by comparing two factors
9	Indicates the former is extremely more important than the later by comparing two factors
2, 4, 6, 8	Indicates middle level of above judgment
Reciprocal	If importance ratio between i and j is a_{ij}, then importance ratio between j and i is $a_{ji}=\frac{1}{a_{ij}}$.

A is n order positive reciprocal matrix, when it is consistent matrix, when and only when $\lambda_{max} = n$ as well as when A is inconsistent, it surely has $\lambda_{max} > n$. Thereupon, use λ_{max} and n relationship to test whether A is consistent matrix or not.

A consistency test steps

Calculate consistency objective CI,

$$\mathbf{CI} = \frac{\lambda_{max} - n}{n - 1} \quad (3)$$

Consult corresponding average random consistency indicator RI. *Saaty* Researched RI value, RI value could refer to TABLE 2.

RI Value is got in this way that randomly constructs 500 sample matrixes. Random select numbers from 1 to 9 as well as its reciprocals to construct positive reciprocal matrix, and determine average value of maximum feature root λ'_{max}, and define

$$\mathbf{RI} = \frac{\lambda'_{max} - n}{n - 1} \quad (4)$$

Solve consistency ratio CR

$$\mathbf{CR} = \frac{\mathbf{CI}}{\mathbf{RI}} \quad (5)$$

When $CR < 0.10$, it is thought that A consistency is acceptable, otherwise it should make proper correction. In the process, it also includes hierarchical total arrangement and consistency test, due to article lengths are limited, no theoretical statements here, directly apply it in the following.

CONSTRUCT BEST PROMOTION EVENT MODEL

The paper aims to look for the most proper promotion of recreational sports; therefore target layer factor should be best promotion of recreational sports. By referencing lots of relative documents, recreational sports events promotion influence factors roughly divide into four items that are respectively mass cognitive status, mass values, projects development, outdoor recreational spending. Therefore criterion layer should include these four influence factors. Assume that it compares three sports recreational events P_i this time, and then scheme layer includes three schemes. Constructed hierarchical structure chart is as Figure2.

TABLE 2 : RI **value**

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

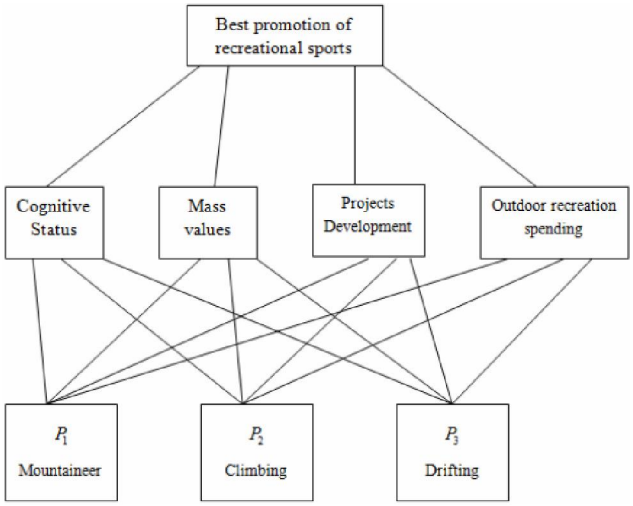

Figure 2 : The hierarchy chart of Best promotion of outdoor recreational sports

Judgment matrix construction

Judgment matrix construction should first define

TABLE 3 : Sports recreational event promotion current main difficulties

	Percentage (%)	Rank
Cognitive status	80	1
Values	36	2
Spending status	23	3
Participation status	6	4

TABLE 4 : Target layer paired comparison matrix

A	B_1	B_2	B_3	B_4
B_1	1	1/3	1/5	1/7
B_2	3	1	1/2	1/4
B_3	5	2	1	1/2
B_4	7	4	2	1

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TABLE 5 : Criterion layer paired matrix one

B_1	P_1	P_2	P_3
P_1	1	2	3
P_2	1/2	1	2
P_3	1/3	1/2	1

TABLE 6 : Criterion layer paired matrix two

B_2	P_1	P_2	P_3
P_1	1	3	5
P_2	1/3	1	2
P_3	1/5	1/2	1

TABLE 7 : Criterion layer paired matrix three

B_3	P_1	P_2	P_3
P_1	1	3	5
P_2	1/3	1	2
P_3	1/5	1/2	1

sports recreational events promotion influential four factors importance. TABLE 3 is sports recreational event promotion currently main difficulties that are from "Investigation research on Hangzhou vocational college students' recreation sports organization". From TABLE 3, it is clear about cognitive status, values, projects development, sports recreational spending impacts degrees on sports recreational events promotion.

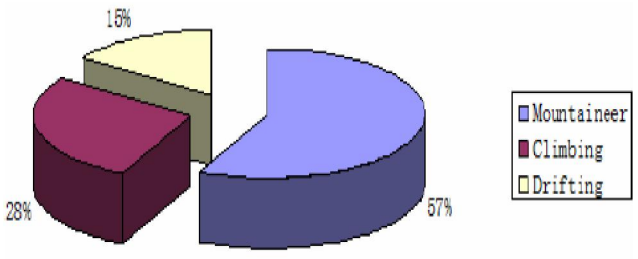

Figure 3 : The figure of evaluation results

According to that, establish target layer paired comparison matrix as TABLE 4 shows.

And then, establish criterion layer paired matrix, contents are as TABLE 5-8.

Computed result

By *Matlab* software program calculating, computed result is as TABLE 7.

From TABLE 7 total arrangement weight, it is clear that scheme one is best scheme. In order to intuitional express computed result, draw pie chart as Figure3.

By Figure3, we can more intuitional see that mountaineering is most proper promoted event. What the model compares are three sports events, in real life, it exists lots of sports recreational events, in order to more rapidly make preliminary judgment on best event in future research, we need to compare three events'

TABLE 8 : Criterion layer paired matrix four

B_4	P_1	P_2	P_3
P_1	1	2	3
P_2	1/2	1	2
P_3	1/3	1/2	1

TABLE 9 : Hierarchical total arrangement

Criterion		Cognitive status	Values	Spending status	Participation status	Total arrangement weight
Criterion layer weight		**0.0079**	**0.0032**	**0.0032**	**0.0079**	
Scheme layer single arrangement	Scheme 1	0.5396	0.6483	0.6483	0.5396	0.012675
	Scheme 2	0.2970	0.2297	0.2297	0.2970	0.006163
	Scheme 3	0.1634	0.1220	0.1220	0.1634	0.003363

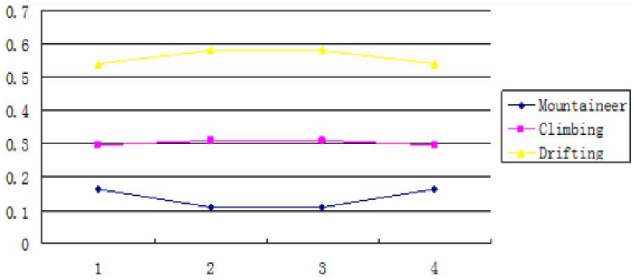

Figure 4 : Internal situation comparison chart

multiple data. Draw three sports events' each factor broken line chart, as Figure4 shows.

In Figure4, "1" represents cognitive status, "2" represents values, "3" represents spending status, "4" represents participation status. From Figure 4, it is easy for us finding that mountaineering event each data is lower than that of other two events. Therefore, we preliminarily affirm that promotion event each indicator data is lower.

CONCLUSION

There are two most important aspects in analytic hierarchy process, one is to abstract practical problems into hierarchical structure with logic relations, and the other is to judge quantitative parameters by qualitative comparing the problems. These problems are up to people's experience to great extent, subjective awareness is possible to affect analysis results.

The paper utilizes analytic hierarchy process into looking for best sports recreational event promotion project problem, makes judgment on mountaineering, climbing and drifting three sports recreational events. Judgment results show that mountaineering is the best recreational sports promotion event. According to the result, analyze three sports recreational events each factor data features, we preliminarily affirm that promotion event each indicator data is lower.

REFERENCES

[1] Wang Kun, Wei Wen-yi; Biomechanical Research on Specific Ability of Takeoff in Long Jump[J]. China Sport Science, **25(1)**, 42-45 **(2005)**.

[2] Li Hong-bo, Liv Hao; Research development of special physical competence theory of aerobics[J]. Journal of Sports Adult Education, **27(2)**, 55-57 **(2011)**.

[3] Yang Fengjuan; Researches on Traumas of Competitive Aerobic Dancing Athletes[J]. Journal of Beijing Sport University, **4**, **(1998)**.

[4] Dai Li-Ping; Biomechanical Analysis on Jumping Typical Difficulty Elements in Sports Aerobics[J]. Fujian Sports Science and Technology, **31(3)**, 27-30 **(2012)**.

[5] Shan Xinhai, Dai Yusheng, Cai Guojun, Jin Jichun; The Comparison of Biomechanical Variables of The Takeoff Performances of Three Atheltes With Different Jumping Abilities[J]. Sports & Science, **18(4)**, 22-26 **(1997)**.

[6] Cheng Wan-xiang et al.; Changing Character of the Ground Reaction Force and Joint Torque of Lower Limbs During Landing from Different Height[J]. Journal of Chengdu Physical Education Institute, **36(3)**, **(2010)**.