

Quantitative Assessment of the Influence of the Shanghai World Expo

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Abstract - In order to evaluate the influence of the Shanghai World Expo, collecting data through the Internet, considering the input-output ratio, day traffic, the number of participating countries, GDP effect, employment opportunities, between man and nature in harmony degree influence indicators established two assessment models: the analytic hierarchy process model, the factor analysis model. From different angles and aspects, quantitative assessment of the influence of the Shanghai World Expo. The two models can be a good influence of the Shanghai World Expo is obtained, without exception, to come to the same conclusion: the influence of the Shanghai World Expo

Keywords- Analytic Hierarchy Process Model; Factor Analysis Model ;Degree of harmony of man and nature

1. Introduction

Since the first session of the true sense of the World Expo held in London in 1851, the World Expo has gone through 150 years of history. The Expo has made a huge contribution to progress of human civilization and social development. However, an objective evaluation is absolutely necessary for the role of the World Expo. The Shanghai World Expo of China attracting world's attention is focused again, and people are increasingly concerned about the influence of the World Expo.

We collect information of some of the World Expo by the Internet, due to the data collected from the Internet, the data may exist error, our model is created on this basis, the model may not fully reflect the influence of the World Expo. However, it can to some extent reflect the Expo on the economy, science and technology and the environment. So we have selected a few typical World

Expo of countries which compare with the Shanghai World Expo , and assuming from input and output ratio, the daily flow, effect of GDP, employment opportunities, degree of harmony of man and nature and other indicators of the influence of the World Expo conducted a analysis, because the input-output ratio may reflect the level of profit and loss, the daily flow GDP effect, employment opportunities reflects the Expo's influence on the economy, the most important is the degree harmony of man and nature which can reflect the economy of the country of the World Expo , the comprehensive influence of human, natural, scientific and technological development, the above data can be used as assessment of the indicators of the World Expo.

After finishing after discovery, and to determine the influence of the World Expo indicators mainly related to: the amounts of money spent, exhibition period, visitors, the number of participating countries, GDP effect, Employment opportunities, profits and losses, and

many other aspects. On the analysis of the data base , we believe that we can assess influence of the Expo from the input-output ratio, the daily flow, the participating countries, GDP effect, employment opportunities, degree of harmony of man and nature, the input-output ratio is defined as (invested amount + amount of gain or loss) / input amount,daily flow is defined as "visitors / exhibition period", " People in harmony with nature is defined as "the session Expo will launch a new role in promoting science and technology on society, as well

as the destructive power of the environment that the degree of harmony of economic development and social development and the maximum value of the degree of harmony of man and nature specified is 1, the data refer to Appendix 2 get. Integrated all the data, we selected different periods which are more representative of the 6th World Expo Shanghai World Expo comparative analysis, quantitative assessment of the influence of the Shanghai World Expo.

Table 1. The Expo influence data table

Years	Nation	Region	Input and output ratio	Daily flow (million)	Participating countries	GDP effect (%)	Employment opportunities (million)	Degree of harmony of man and nature
1970	Japan	Osaka	38.1702	34.97	75	2.10	40	0.09
1986	Canada	Vancouver	0.0032	9.09	54	0.15	6.3	0.13
1993	Korea	Daejeon	1.1513	15.05	141	0.72	20	0.25
1998	Portugal	Lisbon	0.3092	7.58	146	1.20	2.9	0.35
2000	Germany	Hannover	-4.8823	12.09	155	0.26	10	0.55
2005	Japan	Aichi	0.9474	11.89	121	1.4	0.55	0.60
2010	China	Shanghai	1.0333	38.04	240	5	25(Forecast)	0.75

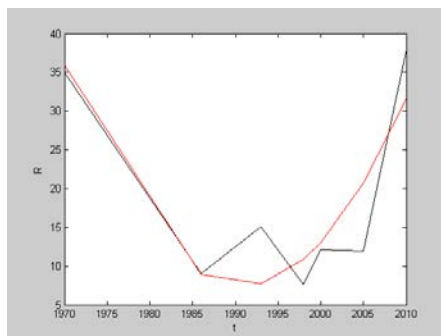


Figure1. Day traffic analysis

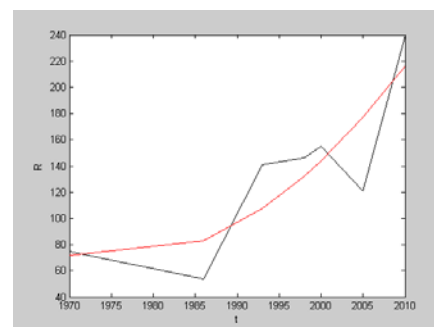


Figure2. Number of participating countries analysis

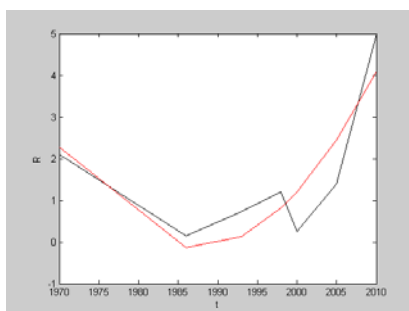


Figure 3. GDP effects analysis

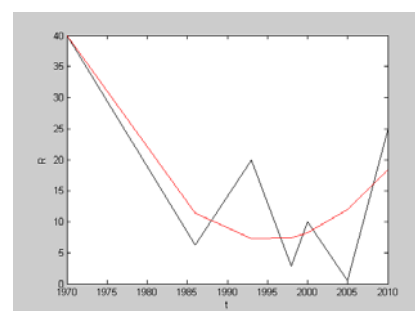


Figure4.Employment Opportunity Analysis

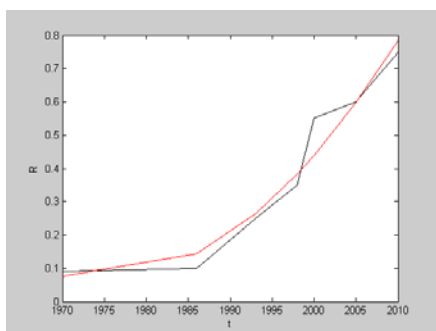


Figure 5. Analysis of degree of harmony of man and nature

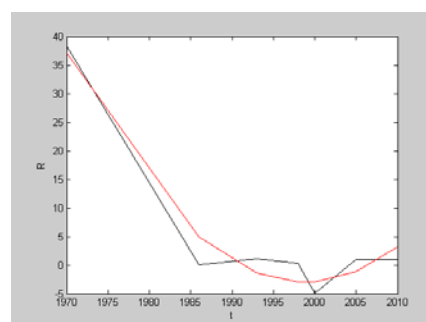


Figure 6. Input and output ratio

Graphical analysis:

From analysis of the above six figures analysis known, in daily flow area Japan was successive Supreme in 1970, Portugal in 1998, the daily flow of bottom Expos; in GDP effect China has Supreme growth, Canada grew the least; in employment opportunities area Japan was Supreme in 1970 years, but in 2005 years minimum; Shanghai in degree of harmony of man and nature area created successive Supreme; in input-output ratio area Japan in 1970 created Supreme, Germany minimum. Therefore, we cannot derive from one or two indicators to analyze the influence of World Expo, we integrated multiple indicators to analyze the influence of World Expo.

By selecting the corresponding indicators, establish respectively the analytical hierarchy model, the factor analysis model to evaluate the influence of the World

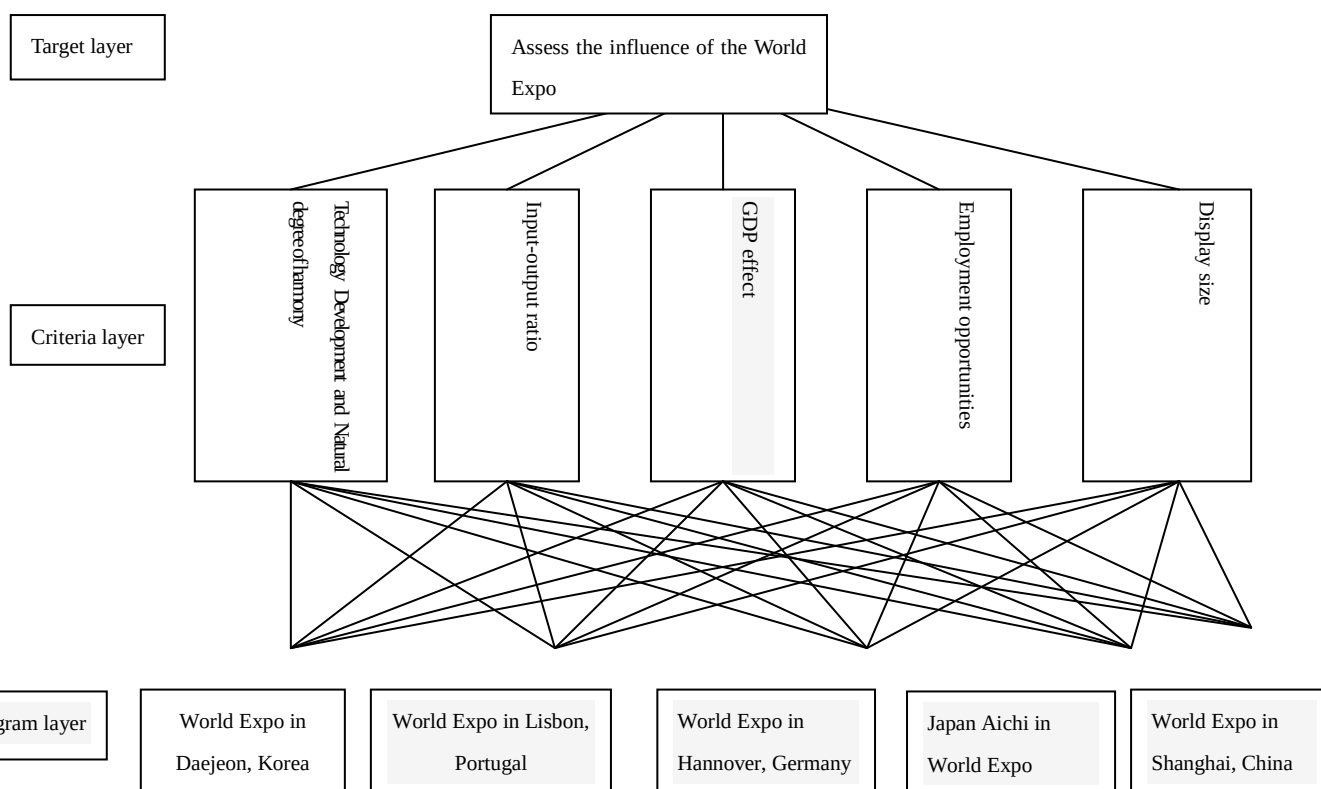
Expo.

Analysis for each model individually described below.

2. Model 1--Analytic Hierarchy Process Model

The principle of analytic hierarchy model, see Reference [1] page 224-231, not repeat them here.

2.1 Establish of model



2.2 Structure Pairwise comparison matrix

The index system is as follows:

Degree of technological development and natural harmony: world Expo will launch science and technology, and pay closely attention to the degree of harmony between human beings and the environment.

Input-output ratio: the initial investment in the Expo,

as well as the latter part income of the World Expo.

GDP effect: World Expo GDP effect;.

Employment opportunities: Expo will provide jobs.

Display size: daily flow of World Expo visitors, the number of participating countries.

Selected by the above figures little difference between the sessions of the World Expo as the goal of the assessment as follows:

Table 2. Impact indicators of World Expo

Years	Nation	Region	Input and output ratio	Display size		GDP effect (%)	Employment opportunities (million)	Degree of harmony of man and nature
				Daily flow (million)	Participating countries			
1993	Korea	Daejeon	1.1513	15.05	141	0.72	20	0.25
1998	Portugal	Lisbon	0.3092	7.58	146	1.20	2.9	0.35
2000	Germany	Hannover	-4.8823	12.09	155	0.26	10	0.55
2005	Japan	Aichi	0.9474	11.89	121	1.4	0.55	0.60
2010	China	Shanghai	1.0333	38.04	240	5	25 (Forecast)	0.75

Generate a contrast matrix $A = (a_{ij})_{n \times n}$, $a_{ij} > 0$,

$$a_{ij} = 1/a_{ji}$$

With $C_1, \dots, C_5$ followed by the five criteria of the development of science and technology and degree of harmony of human and natural, the input-output ratio of the Expo, the Expo GDP effect, the jobs created by the Expo, the Expo exhibition scale pairwise comparison matrix of pairwise comparison method

$$A = \begin{bmatrix} 1 & 1/6 & 1/8 & 1/4 & 1/3 \\ 6 & 1 & 1/2 & 2 & 3 \\ 8 & 2 & 1 & 2 & 3 \\ 4 & 1/2 & 1/2 & 1 & 2 \\ 3 & 1/3 & 1/3 & 1/2 & 1 \end{bmatrix}$$

Where in $a_{12}=1/6$ indicates that the importance of the C_1 and C_2 Expo influence ratio of 1:6. Use the same method to construct 3rd layer (Program layer) on the 2nd

floor (Criteria layer) paired comparison matrix for each guideline, set them as follows:

$$B_1 = \begin{bmatrix} 1 & 1/3 & 1/5 & 1/6 & 1/7 \\ 3 & 1 & 1/3 & 1/5 & 1/7 \\ 5 & 3 & 1 & 1/2 & 1/4 \\ 6 & 5 & 2 & 1 & 1/2 \\ 7 & 7 & 4 & 2 & 1 \end{bmatrix},$$

$$B_2 = \begin{bmatrix} 1 & 4 & 7 & 3 & 2 \\ 1/4 & 1 & 4 & 1/4 & 1/7 \\ 1/7 & 1/4 & 1 & 1/3 & 1/5 \\ 1/3 & 4 & 3 & 1 & 1/2 \\ 1/2 & 7 & 5 & 2 & 1 \end{bmatrix},$$

$$B_3 = \begin{bmatrix} 1 & 1/3 & 1/2 & 1/4 & 1/7 \\ 3 & 1 & 6 & 1/2 & 1/5 \\ 2 & 1/6 & 1 & 1/4 & 1/7 \\ 4 & 2 & 4 & 1 & 1/5 \\ 7 & 5 & 7 & 5 & 1 \end{bmatrix},$$

$$B_4 = \begin{bmatrix} 1 & 6 & 4 & 7 & 1/2 \\ 1/6 & 1 & 1/5 & 3 & 1/7 \\ 1/4 & 5 & 1 & 6 & 1/3 \\ 1/7 & 1/3 & 1/6 & 1 & 1/7 \\ 2 & 7 & 3 & 7 & 1 \end{bmatrix},$$

$$B_5 = \begin{bmatrix} 1 & 3 & 1 & 2 & 1/5 \\ 1/3 & 1 & 1 & 1/3 & 1/7 \\ 1 & 1 & 1 & 2 & 1/4 \\ 1/2 & 3 & 1/2 & 1 & 1/4 \\ 5 & 7 & 4 & 4 & 1 \end{bmatrix}$$

Here matrix B_k ($k=1, \dots, 5$) in the program

b $\begin{matrix} (k) \\ ij \end{matrix}$ (the city hosting the World

Expo) superiority comparison criteria C_k scale.

2.3 Calculate the weight vector and Consistency test

Feature vector of A is $(0.044, 0.278, 0.389, 0.179, 0.109)^T$, Largest eigenvalue = 5.069, CI = 0.017, RI = 1.120, CR = 0.015, CR = 0.015, The consistency inspection $CR < 0.1$, consistency checking through.

By the comparison of the third layer paired matrix out the weight vector is calculated, the largest eigenvalue and the consistency index, the results table is as follows.

Table 3. Largest eigenvalue and consistency index

k	1	2	3	4	5
$\omega_k^{(5)}$	0.038	0.411	0.048	0.327	0.157
	0.068	0.076	0.150	0.058	0.066
	0.158	0.044	0.055	0.162	0.132
	0.275	0.169	0.193	0.035	0.108
	0.460	0.300	0.553	0.420	0.537
λ_k	5.183	5.395	5.397	5.374	5.306
CI (Consistency index)	0.046	0.099	0.099	0.094	0.076
RI (Random consistency Indicators)	1.120	1.120	1.120	1.120	1.120
CR (Consistency ratio)	0.041	0.088	0.088	0.084	0.068

Through consistency test .

2.4 hierarchy Sort results

Weight vector $\omega = (0.210, 0.100, 0.084, 0.153, 0.453)^T$

Analysis of the model results:

China Shanghai World Expo will be accounted for the weight for 0.453 in the assessment of the influence of the World Expo, the weight is much larger than the Daejeon Korea, Lisbon Portugal World Expo, Hannover, Germany World Expo, Aichi Japan World Expo in the assessment of the World Expo influence weightings, so the influence of the 2010 Shanghai World

Expo will be the largest.

Commentary:

This method, the problem of the influence of the World Expo broke down into the various elements of systematic. In turn these factors dominate relations grouped to form a hierarchical structure. By pairwise comparison to determine the relative importance of the various factors, and comprehensive judgment of policy makers to determine the total ranking of the relative importance of the decision-making program, very practical, and at the same time simple and basic steps, the results clearly easy decision-making and analysis.

3. Model 2--Factor Analysis Model

According to multivariate statistical methods,

statistical data factor analysis of each country World Expo^[2], using statistical software SPSS to evaluate impact of world Expo, quantitative assessment of the effect of the Shanghai World Expo.

Table 4. the original data table of World Expo influence

years	nation	Session (Days)	Visitors (Million)	Daily flow (Million)	Participating countries	GDP effec t (%)	Employe nt opportu nities (mill ion)	Degree of harmony of man and nature
1970	Japan (Osaka)	183	6400	34.97	75	2.1	40	0.09
1986	Canada(Vancouver)	165	1500	9.09	54	0.15	6.3	0.1
1993	Korea (Daejeon)	93	1400	15.05	141	0.72	20	0.25
1998	Portugal (Lisbon)	132	1000	7.58	146	1.2	2.9	0.35
2000	Germany (Hannover)	153	1850	12.09	155	0.26	10	0.55
2005	Japan (Osaka)	185	2200	11.89	121	1.4	0.55	0.6
2010	China (Shanghai)	184	1700	38.08	240	5	25	0.75

Factor analysis has the following characteristics:

(1) The factor of the number of variables is much smaller than the original indicator variables. Factor analysis can reduce the workload in the calculation in the analysis of the variables.

(2) Factor variable is not the trade-offs of the original variables, but according to the information of the original variables re-group structure, Factor analysis, the number of factors need to be appointed by analyst (SPSS set automatically under certain conditions, as long as they are eigenvalues greater than 1 factor into the analysis), with a certain degree of subjectivity, and the number of factors specified have different results, it can only reflect most of the information of the original data, the disadvantage can not completely reflect the raw data information.

(3) There is no linear relationship between the factor variables relatively simple analysis of the variables.

(4) The factor variable has named explanatory that

the variable is integrated and reflect on some of the original variable information.

(5) Principal component analysis and factor analysis using SPSS when factor rotation start different, principal component analysis without rotation factor, they do not calculate the factor score, factor analysis need to be rotated by the factor, The common factor has a large load, the significance of the factor is more explicit.

Symbol Description:

x_1 :Session(Days); x_2 :Visitors(Million); x_3 :Daily flow(Million); x_4 :Participating countries; x_5 :GDP effect (%); x_6 :Employment opportunities (million); x_7 :Degree of harmony of man and nature; F_1 :score of the public factor 1; F_2 :score of the public factor 2

In accordance with the principle of the characteristic roots which is greater than 1, Elected to the two common factor, characteristic roots and accumulated contribution rate the following table

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %

1	3.280	46.863	46.863	3.280	46.863	46.863
2	2.453	35.046	81.908	2.453	35.046	81.908
3	.980	13.997	95.905			
4	.219	3.124	99.030			
5	.053	.755	99.784			
6	.015	.216	100.000			
7	-4.386E-17	-6.265E-16	100.000			

Extraction Method: Principal Component Analysis.

Rotated Component Matrix(a)

	Component	
	1	2
Daily flow(Million)	.943	.285
Employment opportunities(million)	.895	-.136
Visitors(Million)	.823	-.472
Session(Days)	.561	.166
Participating countries	.062	.947
Degree of harmony of man and nature	-.055	.937
GDP effect (%)	.665	.690

Table 5. Common factor score and Composite score

years	nation	F ₁	F ₂	Composi te score	Analysis of the results of the composite score
1970	Japan (Osaka)	1.81574	-1.19938	0.53	Japan composite scores second about Expo in Japan in the 1970 's better economic development
1986	Canada (Vancouver)	-0.54818	-0.98664	-0.74	Canada ranked last, the comprehensive development of its World Expo is poor
1993	Korea (Daejeon)	-0.50231	-0.28973	-0.41	Korea ranked fifth , World Expo held in their development is not so ideal
1998	Portugal (Lisbon)	-0.86160	0.11118	-0.45	Portugal ranked sixth illustrates Expo held in its development of the relatively poor
2000	Germany (Hannover)	-0.52219	0.22418	-0.20	Germany ranked fourth, good description of the comprehensive development of the World Expo in Germany
2005	Japan (Osaka)	-0.37773	0.31163	-0.08	World Expo on Japan's economic development in 2005 is a better
2010	China (Shanghai)	0.99627	1.82876	1.35	China composite score first Expo will China's overall development is very good

4. Conclusion

Rotated factor loading matrix can be seen, the common factor F_1 on the load x_1 (session), x_2 (visitors), x_3 (daily flow), x_6 (jobs) are very big, which reflect various countries' state economy short-term economic effect, x_6 reflects the size of the jobs created and thus F_1 reflects the country's Expo will be the short-term economic effect and re-employment level. By x_4 (Participating countries), x_5 (GDP effect), x_7 (Degree of harmony of man and nature) known, F_2 reflects the level of economic and social coordination and its long-term economic effects. The countries with the highest score in F_1 are Japan and China, which Japan score 1.181574, followed by China is 0.99627, much higher than the other countries that the Expo will be a short-term economic effects in Japan and China and the impact of re-employment level, while Portugal and Germany isn't favorably affected by the aspect, China, Japan, Germany, in the F_2 score higher, while Canada and South Korea are relatively small, China, Japan, and Germany pay more attention to the coordination of economic and social development.

Each country sub-weight composite score on two factors, you get a composite score. According to the composite score on the comprehensive evaluation of each country's level of development, their scores rank from the highest score to the lowest score for China, Japan, Germany, Korea, Portugal, Canada, and Japan. From the factor score shows that the Expo will be held on the impact of the short-term economic effects of various countries and their economic and social development are different, at least in some aspects. From this we know that the comprehensive development level of China's has greatly improved with

influence the Expo, whether countries visited daily flow or the harmony of man and nature, the factor scores are high, so assessment of World Expo is to have a positive effect on China.

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