The Analytic Hierarchy Process Evaluation and Linear Regression Model of the Global Equity

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Abstract: This thesis establishes a model based on analytic hierarchy process (AHP) to measure global equity. First of all, there are a large number of countries in the world, and in order to simplify the calculation, several representative countries have been selected. By comparing the overall situation of each continent, such as GDP, with the countries within the continent, the countries that can represent the continent are selected and adjusted according to the specific circumstances such as the total number of countries. For example, China, India and Japan are selected in Asia, the United States, Brazil and Argentina are selected in the Americas, Australia is selected in Australia, and South Africa and Egypt are selected in Europe and The United Kingdom and Germany are selected. The inputs and needs of these countries are then identified and the situation in each country is sorted using analytic hierarchy and tools such as MATLAB, SAS, LINGO, etc. Finally, the order of inputs and requirements is fitted and analyzed. It is then concluded that the global equity level is 60%. We qualitatively address every step of asteroid mining and finally identify its possible impact on global equity. Through analytic hierarchy, the global equity for asteroid mining is infrastructure, science and technology research and development, beneficiary funding, and high-end technologies. Based on the above modeling data analysis results, the main parameters and mechanisms of asteroid impact global equilibrium are determined. Targeted policy recommendations are then made based on key impact parameters so that asteroid mining can truly benefit all and promote global equity.

1 INTRODUCTION

Since 1967, when Outer Space Treaty (Si, 2018) was signed by the vast majority of the world's nations, it has guided and restricted the exploration and development (Jiang, 2021) of outer space resources for the sake of global equity (Qu, 2022). But is this international commitment to fairness sustainable? In other words, we need to develop a model for measuring global fairness. In that case, our biggest difficulty is to define global fairness, select appropriate analysis methods to analyze and rate 224 countries around the world, and finally draw conclusions through complex programming. Because we only select the asteroid mining case for analysis among many outer space resources, we need to combine the actual asteroid mining cases in various countries around the world with the global equity measurement model we created for specific analysis, and then conclude the specific factors that asteroid mining affects global equity. The biggest difficulty during this period is the difficulty of collecting a large amount of data and programming, which requires us to make concerted efforts to overcome. In addition, we need to take into account global development patterns (Wu, 2021) to develop policies that encourage the asteroid mining sector to move towards global equity. These are all the difficulties we may meet before the study, and we need to work together to solve them.

Fairness is an eternal topic in human society, and the understanding of fairness (Wang, 2016; Li, 1995; Cheng, 2014) has given us a preliminary understanding of the definition of fairness through the research of Wang Dongtong, Wang Yiduo, Li Riqin and others. For the topic of global equity, there have been many articles that have carried out in-depth research, such as in global education, Li Hanying, David Echolaina, Dai Weifen, Chen Jiawen (Li, 2012; David, 2018; Dai, 2018; Chen, 2017) and others elaborated that the current global education level is in a relatively unfair stage, but through the implementation of a number of policies has achieved good development. In terms of global response to

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climate issues, Sun yaohua, Chen Hua (Fairness and Justice in the Global Governance System, 2014; Sun, 2013; Chen, 2012; Wang, 2011; Liu, 2012; He, 2009) and others have discussed the issue of global equity in environmental governance. And the issue of global equity in economic globalization has also been studied in depth by Liu Qijun, Udo Kreickemeier, Douglas Nelson and others. (Liu, 2002; Liu, 2002; Udo Kreickemeier, 2010; Udo Kreickemeier) With the increasing progress of science and technology and the development of the mining industry, human beings have begun to study how to carry out mining operations on asteroids in order to extract better, more efficient and clean resources. (Zhang, 2020) For the development of the industry and the technology of mining, Jiang Kai, Chen Xiaolong (Jiang, 2022; Li, 2022; Chen, 2022; Qiang, 2022; Li, 2022) and others have made plans and predictions for the technical development and safety intelligence of mining pages. Through the application of a variety of technologies, humans have found various resources on multiple asteroids. (Flying to an asteroid in search of treasure in space, 2013; Chen, 2013; Zhu, 2012; Sun, 2013) Due to the gap between countries in economy and technology, the asteroid mining industry will inevitably affect global equity issues. (Qu, 2022; Zhang, 2015; Oriental Star, 2017; Asteroid Exploration, 2017; Lv, 2021) In general, the development of the asteroid mining industry has been rewarded and developed accordingly through the different inputs and efforts of each country, thus further affecting the fair status quo of various countries around the world.

In this paper, global fairness will first be defined, then a hierarchical matrix of global countries be built through the construction of Markov model, and then GDP and other indicators for cluster analysis of 224 countries be selected in the world. Then, ratings will be calculated based on multi-objective decision making (MODM) with fuzzy evaluation. The modeling analysis and collected data will be calculated and analyzed by MATLAB, SAS, LINGO and other programming software, and the preliminary results will be obtained. After that, the development of the asteroid mining industry will be simulated and a reasonable development plan be come up. Based on the previous model analysis, analytic hierarchy Process (AHP) will be used to assign weights to qualitatively analyze and ultimately be found out what impact asteroid mining will have on global equity. Based on the above results of modeling data analysis, the main parameters and mechanisms of asteroid impact global parity will be determined. We will propose targeted policy recommendations based on key impact parameters and make asteroid mining truly beneficial to all and promote equitable development globally. Finally, the strengths and weaknesses of the model will be objectively evaluated, and the exact direction for model improvement and horizontal and vertical extension of the model be provided.

2 MODEL CONSTRUCTION

In order to identify some highly representative countries on a global scale (which can cover all national levels around the world), we select indicators such as GDP, population, population density and so on the basis of each continent, compare and fit the countries within each continent with the overall situation of the continent, select representative countries within each continent according to the results of the analysis, and draw preliminary conclusions. We take the different realities that exist on the six continents into account, such as the total population, the total number of countries, etc., to adjust the representative countries. In the end, 11 countries are selected. They are the United States in North America, Brazil and Argentina in South America, Australia in Australia, India, China and Japan in Asia, South Africa and Egypt in Africa, and the United Kingdom and Germany in Europe. (Due to the length of this article, we will not repeat it here and explain it graphically).

Figure 1: Map of the selected country.

2.1 The AHP Model of Global Equity

2.1.1 Model of Inputs by Countries

We selected per capita investment in the five aspects of "infrastructure construction, education, environmental protection, social equality and poverty reduction" to form the second tier of the analytic hierarchy method. We compared the five indicators in the second tier to obtain the following pairwise comparison matrix.

$$A=\begin{bmatrix} 1 & 2 & 3 & 2 & 4 \\ 1/2 & 1 & 2 & 1 & 3 \\ 1/3 & 1/2 & 1 & 1 & 1/2 \\ 1/2 & 1 & 1 & 1 & 2 \\ 1/4 & 1/3 & 2 & 1/2 & 1 \end{bmatrix} \quad (1)$$

After solving for the maximum eigenvalue of A, program solutions using MATLAB software, and then we get the solution yields the maximum eigenvalue λ_{max}=5.2145 and normalized weight vectors as following.

$$\omega_1=(0.5197,0.2163,.0.0173,0.2292,0.0175)^T$$

The weight of each criterion in the second tier is determined in the same way by all countries of the third tier. Set P_i to the decision-making tier's pairwise comparison matrixes in turn are W_1, W_2, W_3, W_4, W_5.

$$W_1=\begin{bmatrix} 1 & 1/3 & 3 & 3 & 3 & 3 & 1/4 & 3 & 3 & 3 & 1 \\ 3 & 1 & 4 & 4 & 4 & 4 & 1/2 & 4 & 4 & 4 & 2 \\ 1/3 & 1/4 & 1 & 1 & 1 & 1 & 1/6 & 1 & 1 & 1 & 1/3 \\ 1/3 & 1/4 & 1 & 1 & 1 & 1 & 1/7 & 1 & 1 & 1 & 1/4 \\ 1/3 & 1/4 & 1 & 1 & 1 & 1 & 1/6 & 1 & 1 & 1 & 1/3 \\ 1/3 & 1/4 & 1 & 1 & 1 & 1 & 1/7 & 1/7 & 1 & 1 & 1/4 \\ 4 & 2 & 6 & 7 & 6 & 7 & 1 & 5 & 5 & 5 & 3 \\ 1/3 & 1/4 & 1 & 1 & 1 & 7 & 1/5 & 1 & 1 & 1 & 1/3 \\ 1/3 & 1/4 & 1 & 1 & 1 & 1 & 1/5 & 1 & 1 & 1 & 1/3 \\ 1/3 & 1/4 & 1 & 1 & 1 & 1 & 1/5 & 1 & 1 & 1 & 1/3 \\ 1 & 1/2 & 3 & 4 & 3 & 4 & 1/3 & 3 & 3 & 3 & 3 \end{bmatrix} \quad (2)$$

Solve for the maximum eigenvalue of A, program solutions using MATLAB software, and then we get the solution yields the maximum eigenvalue λ_{max}=11.6600 and normalized weight vectors as following.

$$\omega=(0.0766,0.2439,0.0199,0.0155,0.0199,0.0255,0.4263,0.0566,0.0193,0.0193.0.1904)^T$$

Later, the largest feature root and normalized weight vector of W_2, W_3, W_4 and W_5 pairwise comparison matrix were found by the same method, the consistency test was accepted, and all paired comparison matrices passed the consistency test. Furthermore, five normalized feature vectors Wi can be used as a weighting of the third tier (national P_i) to the second tier of each data.

Table 1: Calculation Results of The Third Tier to The Second Tier.

	j					Φ_1
	1	2	3	4	5	
	0.0038	0.0256	0.1068	0.2790	0.6540	
	0.2781	0.0645	0.1272	0.1048	0.1546	
	0.2275	0.0467	0.1088	0.1142	0.8400	
	0.0135	0.1624	-0.0079	0.1306	0.1200	0.5197
	0.0128	0.1723	-0.0394	0.0014	0.9874	0.2163
ω_j	0.0033	0.0538	0.0524	0.0815	-0.3331	0.0173
	0.1337	0.4291	0.3065	0.0972	0.1547	0.2292
	0.0049	0.0327	0.0025	0.0247	0.9436	0.0175
	0.0036	-0.0478	0.0051	0.0245	0.2110	
	0.1581	0.0110	0.0744	0.0633	0.6720	
	0.1606	0.0496	0.2635	0.0788	0.3640	
λ_j	11.2539	12.9060	11.3717	11.5112	12.9820	

In summary, the above operation is equivalent to multiplying a matrix composed of ω_j by the weight vector Φ_1, thus obtaining the comprehensive weight of the third tier to the first tier ω. It can be calculated by calculation as following.

ω=(0.0848,0.1874,0.1711,0.0740,0.0608,0.0271, 0.1926,0.0318,0.0009,0.1121,0.1232)^T

This represents the proportion of inputs in each country in the selected data. From this, we order the countries' inputs down from P_7(Japan) to P_2(the United States) to P_3(Australia) to P_{11}(Germany) to P_{10}(the United Kingdom) to P_1(China) to P_4(Brazil) to P_5(Argentina) to P_6(India) to P_8(South Africa) to P_9(Egypt). X_i and Y_i correspond to the countries in this sequence. And the X_i value is incremented from 1 to 11.

2.1.2 Model of Requites by Countries

Among the data from countries, we collected and used five data, including "GDP, forest cover, safety index, poverty rate, and number of PhDs per million people", to estimate the international requites countries received. By comparing the five items of data in the second tier, we can get the pairwise comparison matrix B.

$$B=\begin{bmatrix} 1 & 6 & 3 & 3 & 2 \\ 1/6 & 1 & 1/3 & 1/2 & 1/2 \\ 1/3 & 3 & 1 & 1/2 & 1/2 \\ 1/3 & 2 & 2 & 1 & 1/2 \\ 1/2 & 2 & 2 & 2 & 1 \end{bmatrix} \quad (3)$$

Solve for the maximum eigenvalue of A, program solutions using MATLAB software, and then we get the solution yields the maximum eigenvalue λ_{max}=5.1787 and normalized weight vectors as following.

ω=(0.5682,0.0128,0.0558,0.0600,0.30321)^T

Using the same method, we can determine the weight of each criterion in the second tier by all countries in the third tier, then Q_1, Q_2, Q_3, Q_4, Q_5 can be obtained as shown in Table 2.

Table 2: Calculation Results of The Third Tier to The Second Tier.

	j					Φ_2
	1	2	3	4	5	
	0.0766	0.0927	0.0156	0.0940	0.0779	
	0.2439	0.2069	0.0112	0.1324	0.2432	
	0.0199	0.2669	0.3164	0.3483	0.1400	
	0.0155	0.0535	0.0112	-0.0131	0.1430	
	0.0199	0.0074	0.0163	0.0178	0.0500	
ξ_j	0.0255	-0.0336	0.0089	0.0010	0.1360	0.5682 0.0128 0.0558 0.0600 0.3032
	0.4263	0.1170	0.0019	0.1155	0.0846	
	-0.0566	0.0181	0.0039	0.0088	0.1522	
	0.0193	0.0272	0.0879	0.0564	0.1113	
	0.0193	0.1220	0.0508	0.0576	0.0987	
	0.1904	0.1220	0.4759	0.1812	0.0354	
λ_j	11.6600	12.0307	11.7355	11.2727	11.6988	

In summary, the above operation is equivalent to multiplying a matrix composed of ω_j by the weight vector Φ_1, thus obtaining the comprehensive weight of the third tier to the first tier ξ_2. It can be calculated by calculation as following.

ξ_2=(0.0748,0.2235,0.0957,0.0527,0.0285,0.0559, 0.2764,0.0150,0.0533,0.0487,0.1579)^T

This represents the proportion of requites in each country in the selected data. From this, we order the countries' inputs down from P_7(Japan) to P_2(the United States) to P_{11}(Germany) to P_3(Australia) to P_1(China) to P_6(India) to P_9(Egypt) to P_4(Brazil) to P_{10}(the United Kingdom) to P_5 (Argentina) to P_8(South Africa). At this point, it can be concluded that the value of Y_i is the ranking value of the corresponding country in terms of requites.

2.1.3 Comparative Models of Inputs and Requites to Countries

Through the above summary, we solve the values of X_i and Y_i, and the conclusions are as follows:

Table 3: Comparative Data on Inputs and Requites.

X_i	1	2	3	4	5	6	7	8	9	10	11
Y_i	1	2	4	3	9	5	8	10	6	11	7

By comparing the input with the requite, a conclusion can be drawn as to whether fairness is achieved. We established a Cartesian coordinate system for input X and requite Y, and mark the (X_i, Y_i) values in the figure. Then, the linear regression (Qi, 2019) (LR) equation between the input X and requite Y can be expressed as:

$$\hat{y} = \hat{a}x + b \tag{4}$$

Where the $\hat{a}$ and $\hat{b}$ are the coefficients of slope and intercept, respectively. The coefficients of slope $\hat{a}$ can be obtained based on the least square method as following.

$$\hat{a} = \frac{\sum_{i=1}^{n}(x_i-\bar{x})(y_i-\bar{y})}{\sum_{i=1}^{n}(x_i-\bar{x})^2} \tag{5}$$

In addition, the intercept $\hat{b}$ in the linear regression (LR) equation can also be obtained based on the average point $(\bar{x}, \bar{y})$ as following.

$$b = \bar{y} - \hat{a}\bar{x} \tag{6}$$

After programming using the MATLAB software, the line between the input X and requite Y from the linear regression (LR) can be plotted as shown in Figure 2.

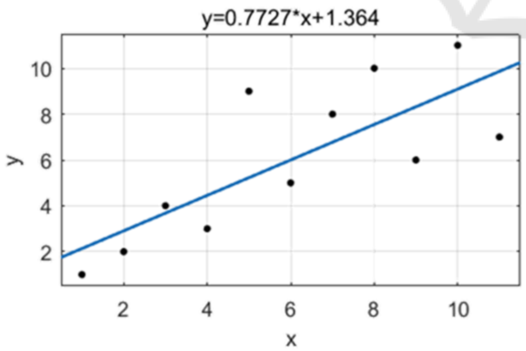

Fig 2. The line of linear regression equation.

From the comparison of input and requite, it can be seen that if the X and Y fitted correlation index is 1, then it is in an absolutely fair state, and if the fitted correlation index is 0, then it is in an absolutely unfair state. The degree of fit can be calculated from the formula (7):

$$r = \frac{\sum_{i=1}^{n} x_i y_i - n\bar{x}\bar{y}}{\sqrt{\left(\sum_{i=1}^{n} x_i^2 - n\bar{x}^2\right)\left(\sum_{i=1}^{n} y_i^2 - n\bar{y}^2\right)}} \tag{7}$$

Then we can calculate "r" equals 0.5971. It can be seen that the correlation coefficient of this regression line fitting is at a moderate level. At this point, we can measure that global equity is 60% fair.

2.2 A Model of the Impact of Asteroid Mining on Global Equity

2.2.1 Impact on Inputs

In order to clarify the impact of each project on the input, we take the infrastructure, scientific and technological research and development, and personnel training as the third tier of the analytic hierarchy method, and take the specific data on the input of various countries as the second tier. Compare the items in the third tier in pairs to form a pairwise comparison matrix C_i.

$$C_1=\begin{bmatrix}1 & 3 & 5\\ 1/3 & 1 & 2\\ 1/5 & 1/2 & 1\end{bmatrix} C_2=\begin{bmatrix}1 & 1/5 & 1/2\\ 5 & 1 & 2\\ 2 & 1/2 & 1\end{bmatrix}$$
$$C_3=\begin{bmatrix}1 & 1/3 & 1/4\\ 3 & 1 & 1\\ 4 & 1 & 1\end{bmatrix} C_4=\begin{bmatrix}1 & 3 & 5\\ 1/3 & 1 & 2\\ 1/5 & 1/2 & 1\end{bmatrix}$$
$$C_5=\begin{bmatrix}1 & 3 & 2\\ 1/3 & 1 & 1/2\\ 1/2 & 2 & 1\end{bmatrix} \tag{8}$$

We can calculate the weight vector as following.
$(0.4512,0.3527,0.1920)^T$

It is concluded that the impact of infrastructure construction, scientific and technological research and development, and personnel training on input are ranked as infrastructure construction, scientific and technological research and development, and personnel training respectively. At this point, the impact on the "Input" aspect is derived.

2.2.2 Impact on Requites

The benefit funds, harvest resources, and high-end technology are taken as the third tier of the analytic hierarchy method, and the specific data on the requites of each country is taken as the second tier. Compare the items in the third tier in pairs to form a pair comparison matrix D_i.

$$D_1 = \begin{bmatrix} 1 & 3 & 6 \\ 1/3 & 1 & 2 \\ 1/6 & 1/2 & 1 \end{bmatrix} D_2 = \begin{bmatrix} 1 & 1/4 & 1/2 \\ 4 & 1 & 2 \\ 2 & 1/2 & 1 \end{bmatrix}$$

$$D_3 = \begin{bmatrix} 1 & 2 & 1/2 \\ 1/2 & 1 & 1/4 \\ 2 & 4 & 1 \end{bmatrix} D_4 = \begin{bmatrix} 1 & 3 & 5 \\ 1/3 & 1 & 1/2 \\ 1/5 & 2 & 1 \end{bmatrix}$$

$$D_5 = \begin{bmatrix} 1 & 6 & 1/3 \\ 1/3 & 1 & 1/6 \\ 3 & 3 & 1 \end{bmatrix} \tag{9}$$

We can get the weight vector $(0.4122,0.2135,0.3742)^T$. So the ranking of the impact on "Requite" is derived as benefit funds, high-end technology, and harvest resources.

3 RESULTS AND DISCUSSIONS

3.1 The Results of Evaluation

According to the world's existing large-scale mineral mining programs (Liu, 2020), large private enterprises or state-owned enterprises are responsible for mining, and under the supervision and management of the government, resources are rationally allocated and benefited from. However, due to the particularity of asteroid mining, the huge demand for funds, and the high requirements for scientific research capabilities, management levels, distribution schemes, etc., it is impossible for countries or enterprises to mine alone.

Based on the above analysis, we have summarized the following solutions: Cooperation among governments to facilitate the participation of private enterprises and international institutions, with technical support provided by enterprises with strong scientific research capabilities, and jointly funded by private enterprises, national governments and international cooperation agencies, in order to facilitate the development of the asteroid mining industry. In addition, after satisfying both a reasonable and equitable distribution, the various benefits of the minerals themselves and the minerals on the asteroid should also be provided by providers of funds and technologies in the asteroid mining industry, so as to comply with the basic concept of global equity.

So far, we have simulated the basic scenario of asteroid mining. Based on previously established the model to measure global equity, the following conclusions can be drawn: Asteroid mining will affect the investment of countries, such as increased investment in infrastructure construction, increased investment in education, etc., and it will also affect the requites of countries, such as GDP growth, the increase in the number of doctoral students per million people. These changes will affect global equity to some extent.

In summary, many countries are in a situation of high investment and low return. Asteroid mining is a high-input industry, and its benefits flow more to higher-level countries, that is, it will affect the fitting correlation coefficient of X_i and Y_i. Based on the established model, countries' "Input" rankings will remain, while "Requite" rankings will be disrupted, that is, the global inequities will be added.

3.2 Suggestions and Recommendations

We've got the factors that affect global equity in asteroid mining. The asteroid mining industry affects the input situation of countries by influencing global infrastructure construction and scientific and technological research and development, and affects the requite of countries by influencing global benefit funds and high-end technology. In turn, it also influences the state of global fairness. Based on the above analysis, this paper gives the following analysis suggestions:

- Policy Recommendation I: Countries around the world should consciously abide by the laws and regulations on the allocation of space resources. At the same time, countries should monitor each other and firmly oppose any violation of the concept of "global equity".
- Policy Recommendation II: The United Nations organization should judge the contribution of each country to all humanity in the world, and distribute the various benefits of space resources, including minerals themselves, to each country fairly (Li, 2013). At the same time, the United Nations should uphold the concept of "Input" and "Requite" synchronization to better maintain global equity.
- Policy Recommendation III: For those countries that have made outstanding contributions to

the cause of space resource exploration, the United Nations Organization should give them additional rewards and use this to inspire people to move higher and thus creating more wealth for mankind (Zhang, 2022).

- Policy Recommendation IV: In terms of inputs, because capital inputs in infrastructure, scientific and technological research and development and other fields are more likely to affect global equity, countries should join hands, cooperate with the division of labor, and try to balance the capital inputs in each field.
- Policy Recommendation V: In terms of requites, because the benefits of benefit funds, high-end science and technology and other fields are more likely to affect global equity, all countries should strictly abide by the distribution of benefits of the United Nations organization and resolutely oppose hegemonism (Cao, 2019).
- Policy Recommendation VI: The premise for the benefit of all mankind is not to endanger the planet on which humanity depends and to maintain respect and equal treatment for everyone in the world, so that the rich mineral resources obtained by asteroids must not produce weapons of great mass destruction or products with extremely high-risk factors without the permission of the United Nations. On the contrary, these mineral resources should be rationally utilized to maximize the progress of human society and promote scientific development.
- Policy Recommendation VII: The abundant scarce mineral resources of the earth on the asteroid should be rationally exploited and distributed. We must not exploit the scarce and expensive resources on the earth on a large scale on the asteroid, such as diamonds, gold, etc., thus causing a financial crisis (Lian, 2021) on the earth and undermining the peace of the earth.

3.3 Error Analysis

In the model of global equity, for the factors affecting the input and requite of countries around the world, we just selected five evaluation indicators for analysis by hierarchical analysis, so increasing the number of evaluation indicators will make the calculation results of our model more accurate. In addition, we just collect relevant data for one year, but due to the different rates of development across countries around the world, the data is changing rapidly, and if more data can be collected and analyzed, the accuracy of the model will be improved. In the model of the impact of asteroid mining on global equity, the influencing factors of the asteroid mining industry on global equity are just selected in six aspects, and if the data can be specific, the influencing factors can be more accurately reflected.

Since the model for measuring global fairness constructed by this team is a measure of "global fairness", so all the data have been determined and the sensitivity cannot be directly obtained. The value of a single indicator can only be changed under the condition that the data of other indicators is unchanged, so as to obtain the rate of change of the model results. Or we can use the values of previous years, compare them with this result, and evaluate the sensitivity in the light of the global fairness of the actual situation.

3.4 Model Evaluation

3.4.1 Advantages

a.This model has reasonable conjectures and assumptions about the evaluation and prediction of the problem.

b. This model adopts a scientific and reasonable method in the selection of representative countries, which greatly improves the reliability of data and results.

c. We use analytic hierarchy in the model solution many times, which greatly improved the effectiveness, reliability and feasibility of decision-making.

d. This model uses the method of linear regression to innovatively solve the problem of comparison and analysis between two sets of data.

e. We use a variety of mathematical and drawing software such as MATLAB, SPSS and EXCEL to create models and write articles to make the results obtained by the model.

3.4.2 Disadvantages

a.Due to the particularity of the analytic hierarchy method, from the establishment of the hierarchical model to the giving of the pairwise comparison matrix, it is easy to be affected by the subjective feelings of the operator, resulting in different people having different results, so the results obtained by this method cannot be accepted by all readers.

b. When measuring global equity, the model built by our team uses ranking to measure the selected metrics, not in terms of more specific weights, and has reduced in accuracy.

3.5 Model Extension

The model for measuring global equity is extensive, and if specific data can be collected, it can be used to obtain the state of global fairness at any time. And through this model, we can understand the many factors affecting global equity and their proportions, and adjust various factors to achieve a more equitable state. For example, the development of the asteroid mining industry can be adjusted through this model to achieve better results. This model is popular, through simple data analysis, using simple analytic hierarchy to convert data into rankings, simplifying the difficulty of data operation, making the model easy to understand and disseminate. This model can not only be used for the judgment and measurement of fairness, but also can be used for other practical problems that need to be compared, which has strong practical significance.

3.6 Model Improvements

We should expand the model it has built to cover a wider range of areas. For example, we rely on only a few aspects of the data to represent the whole, easy to lead to the error of partial generalization. Therefore, the model should be more careful in selecting the influencing factors of "Input" and "Requite", and choose more convincing indicators that can make the model more accurate and understandable. In addition, this model should also be how much improvement in data collection and processing, because the model in the process of data collection, by many aspects of the inhibition, resulting in the model used data is not enough to summarize all aspects.

Another limitation of this model is that multiple sets of data that can be calculated and draw conclusions need to come from the same year, so it is not easy and convenient to process data from multiple years. Therefore, the model needs to be further refined in this area to enable it to calculate whether two, three or more years at the same time meet the global fairness standard.

4 CONCLUSION

In conclusion, we construct the Markov model, establish the hierarchical matrix method of global countries, select GDP and other indicators for cluster analysis of 224 countries in the world, then use multi-objective decisions based on fuzzy evaluation (MODM) to calculate the score, and finally use MATLAB, SAS, LINGO and other programming tools to analyze the data. To conclude that only 60% of global equity is fair. In the case of asteroid mining, which is a high-input industry, the benefits flow more to the top countries. Based on the established model, the "Input" ranking of countries will remain the same, while the "Return" ranking of countries will be disrupted, that is, global inequality will increase. Then, we plan how the development of asteroid mining will correspond to the change of input and return of each country, then use the analytic hierarchy process to express and rank the factors of weight change, and get the specific factors that affect the global rights and interests of asteroid mining. The analytic hierarchy process is used to represent the weight of changing factors, and the specific factors that affect the global equity of asteroid mining are infrastructure, scientific research and development, beneficiary funds and high-end technology. Based on the above modeling data analysis results, the main parameters and mechanism of asteroid impact on global equality are determined. We make targeted policy recommendations based on key impact parameters to make asteroid mining truly beneficial to all and promote global equity.

We can extend the model we will build in the future to cover a wider range of domains. We should be more cautious in choosing the influencing factors of "Input" and "Return", and choose more convincing indicators to make the model more accurate and understandable. In addition, the model should also be improved in data collection and processing, so it needs to be further refined in this area to be able to calculate whether two, three or more years at the same time meet global equity standards.

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