Problem Chosen	2020 MCM/ICM Summary Sheet	Team Control Number
F		2000865

Abstract:

In recent years, due to the sea-level rise caused by global warming, Maldives, Tuvalu, Kiribati, and other island countries are facing the risk of no place to settle and lose their culture. It is of great significance to determine the number of environmentally displaced persons (EDP) and provide them with countries and routes for migration through analysis.

In the first question, we first collected the number of environmentally displaced persons (EDP) in 2008-2018, established a grey prediction model, and brought in the data. It is predicted that in 2020, the number of environmentally displaced persons (EDP) will reach 1.61 billion. Then, we collected the sea-level rise rate for 18 consecutive years, established the grey prediction model and brought in the data, and predicted that the sea-level rise rate will reach 4.69mm/year in 2050. Secondly, we collected the data of the top ten countries of global greenhouse gas emissions and per capita emissions and the rate of their forest coverage reduction. We used the principal component analysis method to calculate the weighted scores of each country. Finally, we got the top three countries that have a greater impact on the greenhouse effect: China, the United States, Iran.

In the second question, according to the prediction results of the grey prediction model, we put forward the proposed policies from the aspects of religion, culture, public education and so on, and revised them in the subsequent evaluation process.

In the third question, to evaluate the policy, we choose to make a comparison between the proposed policy and the current international multiculturalism / ethnic minority migration model policy, as well as the situation of no policy intervention. We use three important indicators of politics, economy, and culture to measure the living conditions of the environmental displaced persons (EDP) after moving to the destination country and use the analytic hierarchy process to build the hierarchical structure The entropy method is used to calculate the index weight of each policy scheme, and then the proposed policy is modified and the optimal scheme is obtained.

In the fourth question, we collected the population of Maldives, Tuvalu, Kiribati and Marshall Islands, established the Markov chain, analyzed the probability of the residents of these island countries going to these 10 countries, and thus formulated the best migration route for them. The drawback of the model is that in the solution of the probability of the destination country, the "traffic distance" is the indicator of lack of proof. It should be considered from the feasible route, mode and cost of transportation.

In the fifth question, according to the prediction of the grey prediction model, we analyzed the change trend of the number of environmentally displaced persons (EDP) with or without policy intervention and showed the importance of policy implementation through comparison.

Key words : Principal component analysis AHP, entropy method, grey prediction model, consistency detection model, Markov chain

Contents

I. Introduction

1.1 Background situation

In recent years, due to sea-level rise caused by global warming, island countries such as Maldives, Tuvalu, and Kiribati are in danger of disappearing completely. When the land of the island nation disappears, these environmentally displaced persons not only need to be resettled but also face the risk of losing their unique culture, language, and lifestyle. In the face of the threat of sea-level rise, each coastal country has its special problems to be solved, which not only depends on the physical and biological characteristics of its coast but also takes into account resources, politics and culture. The impact of sea-level rise on biodiversity, fisheries, and tourism is very different in highly developed coastal areas than in remote, less developed coastal areas. From a macro perspective, the impact of sea-level rise on coastal countries is mainly as follows:

- loss of agricultural and non-agricultural land;
- frequent floods;
- There are many storm surge disasters;
- accelerated erosion of coastlines and artificial beaches;
- accelerate salinity of soil and groundwater;
- Increase of tidal river flood lines;
- (Marsh / Mangrove / Coral Reef) loss of biodiversity;
- Damage to aquaculture, fishing, and dock infrastructure;
- Reduced beaches, threats to resorts and a decline in tourism.

Land loss is generally considered the smallest problem caused by sea-level rise. Of course, this view does not take into account the quiet situation of Tuvalu and other atoll countries, because rising sea levels may cause these countries to be completely submerged. The more serious ones are those that seem less direct but cause economic and social harm to a country. Huge impact situations, such as the receding coastline that poses a hidden danger to waterfront buildings; damage to tourism infrastructure; damage to coastal fruit infrastructure such as sea walls, pier, roads; Groundwater salinization; damage to sewage and drainage systems that cause health problems Destruction of coastal biological systems and food sources, etc .[i]

1.2 Problem restatement

In recent years, due to the rising sea level caused by global warming, some island countries, such as Tuvalu and Kiribati, are in danger of completely disappearing, which also brings a series of problems such as the resettlement of these environmental displaced persons (EDPS) and the protection of their unique culture. This paper studies the policies of some countries and institutions on human rights and cultural protection uses the methods of grey prediction, principal component analysis, analytic hierarchy process, and entropy, applies the consistency detection model and Markov chain to establish several models that can simulate the situation of problems, hoping to provide solutions for the resettlement of environmental displaced persons (EDPS) and the protection of their culture Theoretical basis.

The issues we need to study are: finding suitable models to analyze the number of people at risk and the risk of cultural loss; proposing proposed policies to deal with

EDP in the cultural protection of human rights; establishing models to measure the potential impact of proposed policies; Design and improve methods; analyze and explain the importance of the policy.

II. The Description of the Problem

2.1 How many people are currently at risk of becoming EDPs?

2.1.1Who are EDPs?

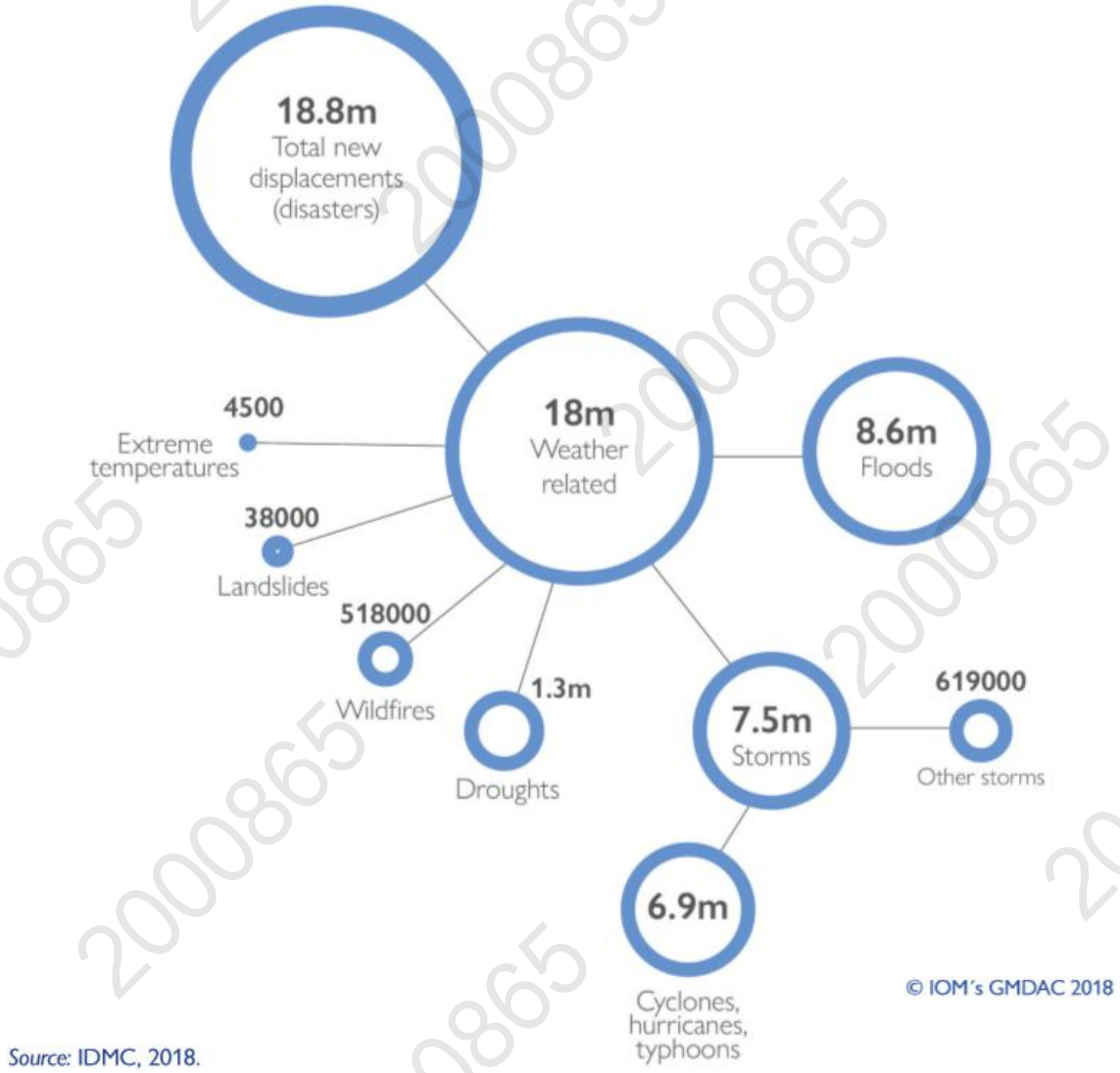


Figure 1

2.1.2 Data collection

First, we defined two variables, time and the number of environmentally displaced persons (EDP). We found the total number of global environmentally displaced persons (EDP) on the Internet at different times, as shown in the 2008 to 2018 EDP population table 1.

time (year)	number of EDP (million)
2008	22.5
2009	15.3
2010	38.3
2011	13.9
2012	31.7
2013	20.3
2014	17.4
2015	14.7
2016	23.5
2017	18.0
2018	16.1

(Table 1. 2008 to 2018 EDP population table)

2.1.3 Grey forecasting model

With raw data columns $x^{(0)} = (x^{(0)}(1), x^{(0)}(2), \cdots, x^{(0)}(n))$, n is the number of data.If $GM(1,1)$ is established based on the $x^{(0)}$ data column, the prediction function is realized. The basic steps are as follows:

- The original data is accumulated to weaken the volatility and randomness of the random sequence and obtain a new data sequence:

$$x^{(1)} = (x^{(1)}(1), x^{(1)}(2), \cdots, x^{(1)}(n),)$$

The data in $x^{(1)}(t)$ represents the accumulation of the corresponding previous items of data:

$$x^{(1)}(t) = \sum_{1}^{t} x^{(0)}(k), t = 1,2, \cdots, n$$

- Establish $x^{(1)}(t)$ first-order linear differential equations for $x^{(1)}(t)$:

$$\frac{dx^{(1)}}{dt}+ax^{(1)}=u$$

Can be determined by programming results, where $a=0.0393, u=26.1935$, a and u are called development coefficient and gray effect.Remember that a and u form a matrix $\hat{a}=\begin{pmatrix}a\\u\end{pmatrix}$.From the values of parameters a and u, $x^{(1)}(t)$ can be obtained, and then the future predicted value of $x^{(0)}$ can be obtained.Substituting the gray parameter $\hat{a}$ into $\frac{dx^{(1)}}{dt}+ax^{(1)}=u$ and solving $\frac{dx^{(1)}}{dt}+ax^{(1)}=u$, we get:

$$\hat{x}^{(1)}(t+1)=(x^{(0)}(1)-\frac{u}{a})e^{-\hat{a}t}+\frac{u}{a}$$

- Discretize the function expressions $\hat{x}^{(0)}(t+1)$ and $\hat{x}^{(0)}(t)$, and make a difference between them to restore the original sequence of $x^{(0)}$. The approximate data sequence $\hat{x}^{(0)}(t+1)$ is as follows:

$$\hat{x}^{(0)}(t+1)=\hat{x}^{(1)}(t+1)-\hat{x}^{(1)}(t)$$

- Finally, a prediction model is obtained and used for prediction:

e

$$\hat{x}^{(0)}=[\hat{x}^{(0)}(1),\hat{x}^{(0)}(2),\cdots,\hat{x}^{(0)}(n),\hat{x}^{(0)}(n+1),\cdots\hat{x}^{(0)}(n+m)]$$
$$=[22.5,15.3,38.3,13.9,31.7,20.3,17.4,14.7,23.5,18,16.1,22.5,24.8179,23.8612,22.9413,$$
$$22.0569,21.2066,20.3891,19.6030,18.8473,18.1207,17.4222,16.7505,16.1048]$$
$$=16.1048$$

The forecast value for 2020 is 1610.48 million

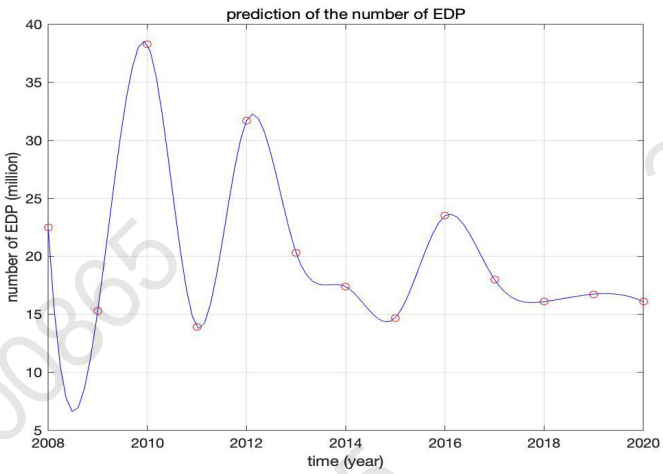


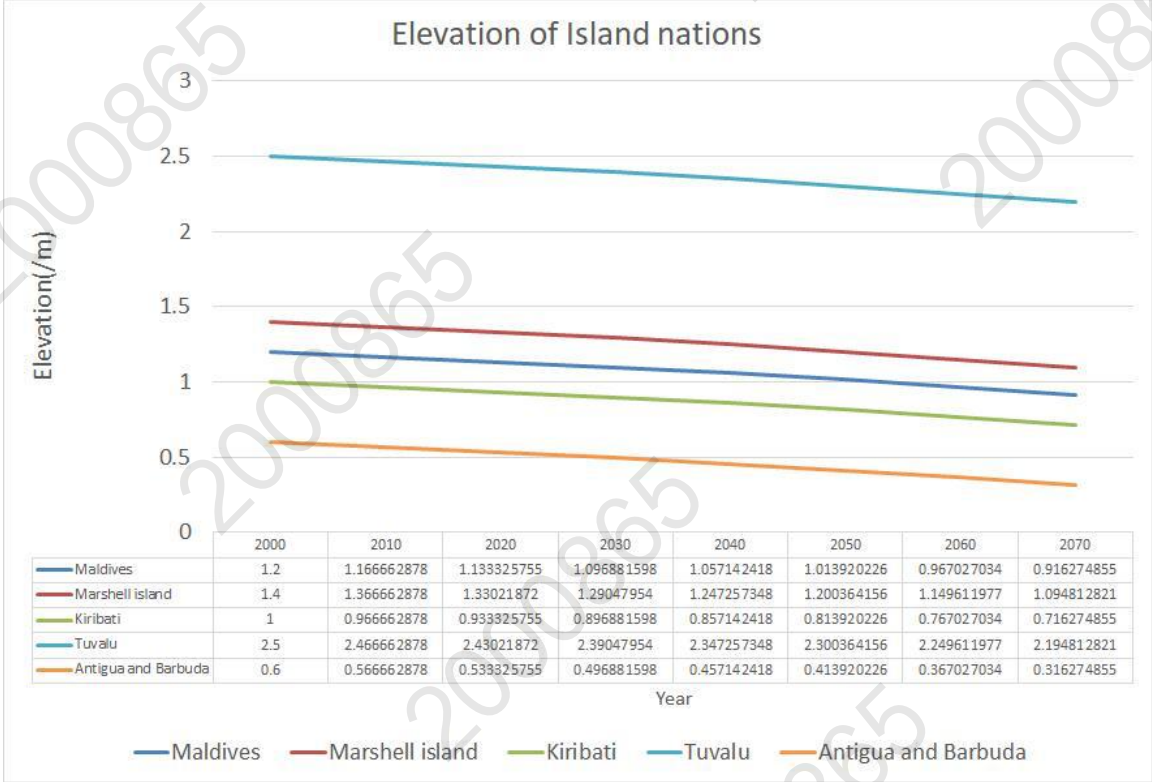
Figure 2

2.2 Prediction of sea level rise rate

According to the sea-level rise rate measured before 2016, the sea-level rise rate in 2030 and 2050 is obtained by using the grey prediction algorithm, as shown in the figure below:

Figure 3

With the rapid rise of sea level, some island countries surrounded by oceans are in danger. Using the grey prediction model, it is predicted that the land elevation of some island countries will decline, and their nationals will become EDP in this century.



	2000	2010	2020	2030	2040	2050	2060	2070
Maldives	1.2	1.166662878	1.133325755	1.096881598	1.057142418	1.013920226	0.967027034	0.916274855
Marshell island	1.4	1.366662878	1.33021872	1.29047954	1.247257348	1.200364156	1.149611977	1.094812821
Kiribati	1	0.966662878	0.933325755	0.896881598	0.857142418	0.813920226	0.767027034	0.716274855
Tuvalu	2.5	2.466662878	2.43021872	2.39047954	2.347257348	2.300364156	2.249611977	2.194812821
Antigua and Barbuda	0.6	0.566662878	0.533325755	0.496881598	0.457142418	0.413920226	0.367027034	0.316274855

Figure 4

2.3 What countries will take EDP?

2.3.1 Principal Component Analysis

From the perspective of countries' contribution to greenhouse gas, that is, the cause of sea-level rise, we have found a reasonable function that weighs both total emissions and per capita considerations. Let the two indices weigh differently Considering the analysis, four factors that have a lot to do with the greenhouse effect can be summarized:They are defined as per capita emissions, total CO2 emissions, non-forest cover ratios (referring to the ratio of the area of each country minus the forest cover area to the country's land area), and the rate of forest decrease, which is represented by $x_1\ x_2\ x_3\ x_4$, $c_1\ c_2\ c_3\ c_4$ represents the weight of each factor, then the weighted sum is:

$$s = c_1x_1 + c_2x_2 + c_3x_3 + c_4x_4 \cdots\cdots (1)$$

Of course, the above formula must be added with some restrictions, otherwise, the weight can be chosen to be infinite and meaningless. We stipulate:

$$c_1^{\ 2} + c_2^{\ 2} + c_3^{\ 2} + c_4^{\ 2} = 1$$

Under this constraint, find the optimal solution of the above formula. Since this solution is a unit vector in 4-dimensional space, it represents a "direction", which is often the main component direction.
Here are the solution steps:

- For data sets to be standardized, the principal component analysis is greatly affected by the dimensions, so the dimensions need to be removed through standardization. Here are representative countries: China, the United States, India, the United Kingdom, Iran, Japan, South Korea, Russia, Germany, Canada. Use i (1 ~ 10) to represent them, j to represent 4 greenhouse effect factors, and $x_{ij}^{'}$ to represent the standardized values of different countries under different greenhouse effect factors.

$$x_{ij}^{'} = \frac{x_{ij} - \bar{x}_j}{s_j} (i = 1,2,\cdots,10;\ j = 1,2,3,4)$$

Where,

$$\bar{x}_j = \frac{1}{10}\sum_{i=1}^{10} x_{ij}, s_j = \left[\frac{1}{10}\sum_{i=1}^{10}(x_{ij} - \bar{x}_j)^2\right]^{1/2} (j = 1,2,3,4)$$

By data[ii]:

(Table 2. Data related to greenhouse gas emissions by country)

Evaluation index / Country	Total emissions of GHG(100 million tons)	Per capita emissions of GHG(tons per person)	Forest Coverage in 2016(%)	Decline rate of forest cover(%)
America	59	18.033	33.93	-0.000885347
Canada	6.1	16.46	33.162	0.000261711
Russia	17	11.766	49.759	4.82294E-05
Germany	8.6	10.37	32.691	0
Korea	5.14	9.954	63.355	0.001514192
Japan	12.47	1.265	68.456	6.49173E-05
Iran	4.71	5.758	6.564	0
England	5.86	8.813	13.006	-0.010831663
China	60	4.300	22.354	-0.007440761
India	12.9	0.954	23.833	-0.002527061

- To calculate the negative impact of each country's forest area on the greenhouse effect, the non-forest coverage rate of each country here is $s = 1 - s^{'}$. From the previous formula (1), the weighted score of the influence degree of each country on the greenhouse effect is:

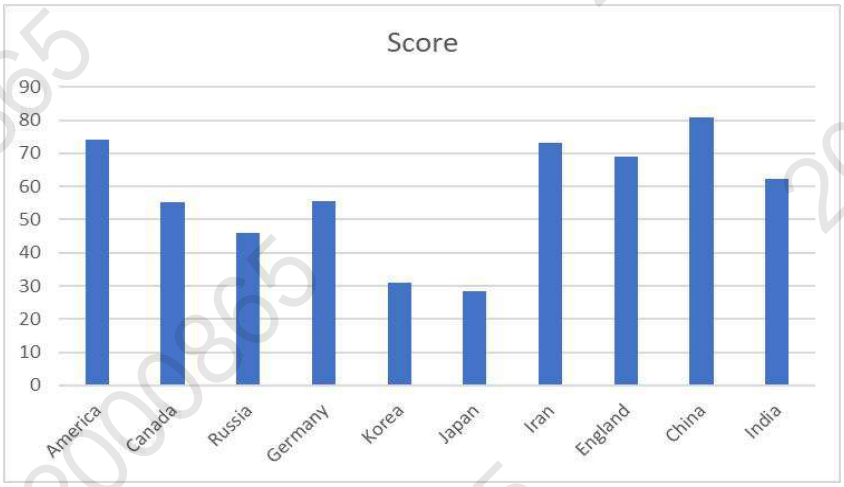


Figure 5

According to the score, the top three countries that have a greater impact on the greenhouse effect are China, the United States, and Iran. These countries all exceeded 70 points in our calculation of the weighted scores of the impact on the greenhouse effect of each country. Therefore, these countries contribute a lot to the greenhouse effect. Should assume corresponding responsibilities.

- Calculate covariance matrix.
- Calculate the eigenvalues and eigenvectors of the covariance matrix, and unitize the eigenvectors to get the unit vector:

$$\sum = \begin{bmatrix} 0.3643 & 0 & 0 & 0 \\ 0 & 0.8004 & 0 & 0 \\ 0 & 0 & 1.1637 & 0 \\ 0 & 0 & 0 & 1.6716 \end{bmatrix}$$

Find its weight as:

$$c = [0.7535, 0.5245, 0.3608, 0.1642]$$

- Select the principal components: The covariance matrix eigenvalue is the projection variance. Calculate the contribution rate of the projection variance of each eigenvector to the total variance. Generally, the contribution rate of the principal component is between 70% and 80%. We select 3 principal components, which are ranked according to $f(r)$: forest reduction rate, non-forest coverage rate, and per capita emissions. The evaluation index we use is the ratio of the projection variance in the direction of the main component to the total variance of the original data.

$$f(r) = \frac{\lambda_1 + \lambda_2 + \lambda_3}{\lambda_1 + \lambda_2 + \lambda_3 + \lambda_4} = \frac{\sum_{i=1}^{3} \lambda_i}{\sum_{i=1}^{4} \lambda_i} = \frac{\sum_{i=1}^{3} \lambda_i}{\mathrm{var}(D)}$$

We determine the threshold of the projection variance ratio $\alpha = 0.85$, first, calculate the first principal component, and then add them one by one, when $r = 3$ satisfies $f(3) > \alpha$.

- The original data is projected in the principal component direction to obtain new data after dimensionality reduction.

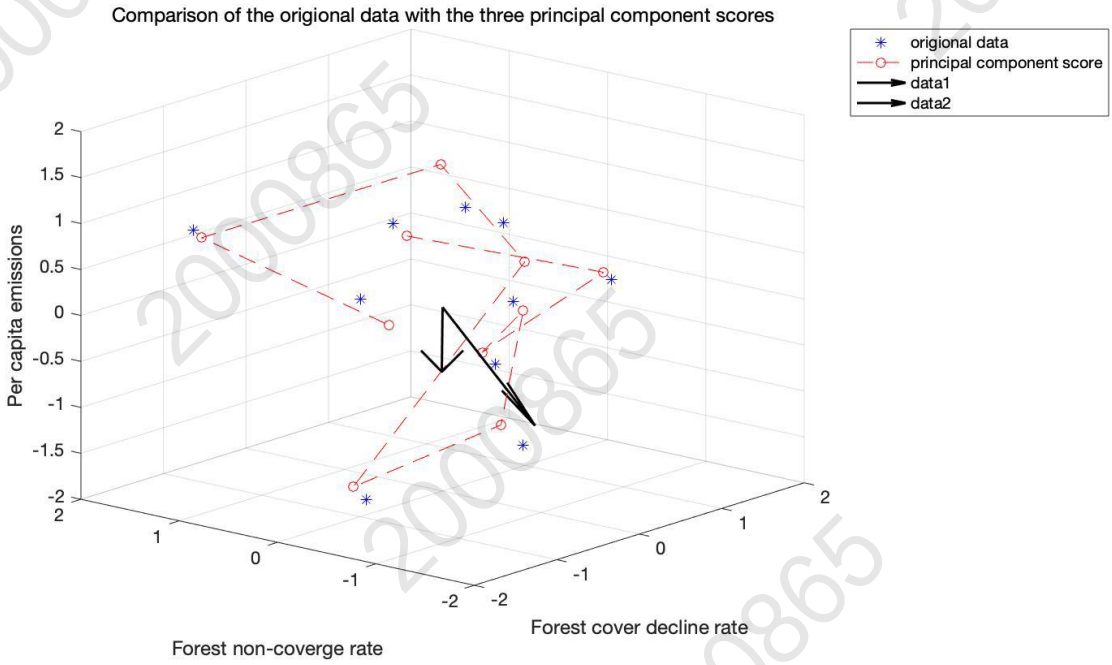


Figure 6

III. Proposed policy

3.1 Proposed policy

To ensure that the EDP can resettle in its new home and participate fully in life, as well as being adequately protected in terms of culture, state parties and EDP should strive to achieve the following:

1.Obligations

All refugees have a responsibility to their country, and this responsibility specifically requires them to comply with the laws and regulations of that country and measures are taken to maintain public order.

2.Religion

The Contracting States shall accord to refugees in their territories at least the treatment afforded to their nationals concerning the freedom to conduct religious ceremonies and the freedom to teach their children a religious education.

3.Exemption of mutual conditions:

(1)In addition to the more favorable provisions contained in this policy, the State party shall grant refugees the same treatment as ordinary foreigners.

(2)After the expiration of three years, all refugees shall enjoy the exemption of mutual legislative conditions in the territories of the contracting countries.

(3)Contracting States shall continue to grant refugees the rights and benefits they do not need to be entitled to under mutual conditions on the date this policy enters into force for that country.

4.Right to attend court:
(1)Refugees have the right to freely attend courts in the territories of all contracting States.
(2)Refugees shall enjoy the same treatment as their nationals in matters concerning their attendance at the court, including assistance in litigation and waiver of guarantees of litigation, in the States parties to which they are resident.
5. Right of association

Concerning non-political and non-profit societies and trade associations, each State Party shall grant the most-favored-nation treatment enjoyed by a foreign national under the same circumstances to refugees who legally reside in its territory.
6.Public education:

The contracting States shall grant refugees the same treatment as their nationals enjoy in respect of primary education.

Contracting countries shall treat refugees as preferentially as possible concerning education other than primary education, especially in terms of access to academic research, recognition of certificates, diplomas, and degrees from foreign schools, tuition waivers, and scholarships. In any case, this treatment must not be lower than that enjoyed by ordinary foreigners in the same situation.
7. Public relief

The Contracting States shall accord to refugees legally resident in their territories the same treatment as their nationals in respect to public relief and assistance.
8. Freedom of movement

Contracting States shall grant to refugees legally in their territory the right to choose their place of residence and to move freely within their territory, subject to the regulations applicable to ordinary foreigners in the same circumstances.
9.Identity documents

States Parties shall issue identity documents to any refugee who does not have a valid travel document in their territory.
10.Culture

Contracting States shall promote the establishment or strengthening of institutions for the management of intangible cultural heritage and the promotion of the inheritance of such heritage by providing places and spaces for activities and performances of such heritage. Ensuring the enjoyment of intangible cultural heritage, while respecting customary practices for the enjoyment of special aspects of this heritage.
(2) States parties are obliged to set up schools in their countries to teach their traditional culture to the descendants of refugees.
(3) The contracting states shall amend relevant laws to protect the customs and traditional festivals originally owned by refugees.
(4) States Parties shall encourage scientific, technical and artistic research and methodological research to effectively protect intangible cultural heritage, especially endangered intangible cultural heritage.
11.Self-employed

Contracting States shall grant as far as possible preferential treatment to refugees legally in their territory in respect of their operations in agriculture, industry, handicrafts, commerce, and the establishment of industrial and commercial companies. In any case, this treatment shall not be lower than that of ordinary foreigners in Treatment under the

same circumstances. In particular, it is suggested that the Middle East countries represented by Iran should give more preferential working conditions to refugees and reduce the employment rate to a greater extent; the North American countries represented by Canada should implement corresponding measures to control their unemployment rate below 5%.

Ⅳ.Evaluation of the proposed policy

In order to evaluate the policy, we chose to compare the proposed policy with the multiculturalism, ethnic immigration model policies, and no-policy interventions currently adopted internationally. The plan is measured by three main indices-economic, political, and cultural. Measure the living conditions after migration destination country (among three clusters of data, the first one comes from CEIC to be Non-intervention mode's condition):

Country	Market economy			Legal politics			Cultural			
	Labour force participation rate(%)	Unemployment rate(%)	GDP (USD)	Changes in restrictiveness (%)	Refugees (% of host country)	Refugees (% of origin country)	Tourism revenue (%)	Admission rate (%)	Per capita expenditure of college students as a percentage of GDP per capita(%)	
America	68	3.865	59,484.000	33.8	0.1	0.4	-0.5	88	38.7	Non-intervention mode
Canada	69	6.5	45,447.208	57.5	0.3	0.5	-7.7	69	31.6	
Russia	70	4.678	11,510.425	45.5	1.2	0.4	24.6	53	10.9	
Germany	66	3.529	46,284.684	68.5	1.3	0.1	-3.1	70	33.6	
Korea	73	3.8	31,754.000	75.0	2.1	2.1	-2	75	14.7	
Japan	70	2.433	40,313.168	61.3	2.1	2.1	22.4	75	12.9	
Iran	70	20.563	5,494.060	61.9	1.2	2.1	18.3	20	33.2	
England	68	4.2	43,058.389	68.5	1.3	0.1	38	60	37.9	
China	75	3.8	10,263.741	59.5	2.1	2.1	4.6	51	89.1	
India	79	2.55	2,044.590	56.3	2.1	2.1	-11.2	28	59.6	
America	68.68	3.4785	65,432.400	33.8	0.103	0.36	-0.475	88	38.7	Proposed policy
Canada	69.69	5	49,991.929	57.5	0.309	0.45	-7.315	69	31.6	
Russia	70.7	4.2102	12,661.468	45.5	1.236	0.36	25.83	53	10.9	
Germany	66.66	3.1761	50,913.152	68.5	1.339	0.09	-2.945	70	33.6	
Korea	73.73	3.42	34,929.400	75.0	2.163	1.89	-1.9	75	14.7	
Japan	70.7	2.1897	44,344.485	61.3	2.163	1.89	23.52	75	12.9	
Iran	70.7	14.3941	6,043.466	61.9	1.236	1.89	19.215	20	33.2	
England	68.68	3.78	47,364.228	68.5	1.339	0.09	39.9	60	37.9	
China	75.75	3.42	11,290.115	59.5	2.163	1.89	4.83	51	89.1	
India	79.79	2.295	2,249.049	56.3	2.163	1.89	-10.64	28	59.6	
America	68	3.865	59,484.000	33.8	0.1	0.4	-0.45125	89.76	37.539	Multicultural model
Canada	69	6.5	45,447.208	57.5	0.3	0.5	-6.94925	70.38	30.652	
Russia	70	4.678	11,510.425	45.5	1.2	0.4	27.1215	54.06	10.573	
Germany	66	3.529	46,284.684	68.5	1.3	0.1	-2.79775	71.4	32.592	
Korea	73	3.8	31,754.000	75.0	2.1	2.1	-1.805	76.5	14.259	
Japan	70	2.433	40,313.168	61.3	2.1	2.1	24.696	76.5	12.513	
Iran	70	20.563	5,494.060	61.9	1.2	2.1	20.17575	20.4	32.204	
England	68	4.2	43,058.389	68.5	1.3	0.1	41.895	61.2	36.763	
China	75	3.8	10,263.741	59.5	2.1	2.1	5.0715	52.02	86.427	
India	79	2.55	2,044.590	56.3	2.1	2.1	-10.108	28.56	57.812	

Table 3.

The data of the proposed government indicates that if these policies are adopted, we assume that such effects will be obtained:

The labor force participation rate increased by 1%; the overall unemployment rate fell by 10%. It is particularly recommended that Iran, as a representative of the Middle East, give more favorable working conditions to immigrants and reduce the unemployment rate to a greater extent; North American countries take Canada as an example to control the unemployment rate Below 5%; education has improved, GDP has risen accordingly; the number of refugees of host has increased; the number of refugees of origin has decreased, and tourism income has increased.

4.1 Analytic hierarchy process

All indices are compared in pairs to construct a judgment matrix. The feature vector corresponding to the maximum eigenvalue of the judgment matrix is the weight of different indices.

Construct the judgment matrix:

If the ratio of the weight of factor i and factor j is a_{ij}, then the ratio of the weight of factor j and factor i is $a_{ji} = 1/a_{ij}$. To avoid the subjective influence of the analytic hierarchy process on the scale of the judgment matrix, we use the ratio of factor weights to represent the ratio of the importance of factor i to factor j, and can pass the consistency of the new judgment matrix:

To check by:

$$CI = \frac{\lambda - n}{n - 1}$$

The larger the CI is, the greater the degree of inconsistency is. When CI is 0, it indicates complete agreement.

Table 4. Stochastic Consistency Index RI

n	1	2	3	4	5	6	7	8	9	11	12
RI	0	0	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49	1.51

Define the consistency ratio:

$$CR = \frac{CI}{RI}$$

When CR is less than 0.1, it can be considered that the consistency of the judgment matrix is good, and the test is passed.

V. Model

5.1 Building a structural model

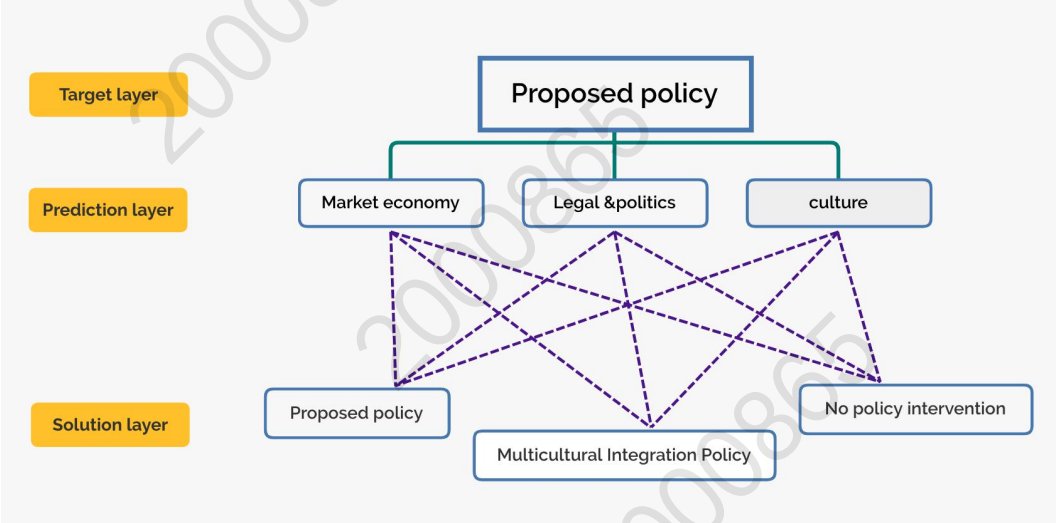
We chose to compare the proposed policy with the multiculturalism, ethnic immigration model policies and non-policy interventions currently adopted

internationally, that is, three options. The plan is measured by three main indices (economic, political, and cultural) as a measure of the living conditions after the country of destination.Among them, three indices are measured by principal component analysis, each of which is measured by three main factors (collecting data representing the country to reflect the situation of international migration) (data from CEIC)

5.2 Algorithm application

Build the hierarchy:

(Figure 7. Hierarchical chart)



5.2.1 Entropy method to find index weights under each policy scheme

For example, weight each factor (labor population participation rate, unemployment rate, and GDP) under the index "market economy" to obtain $\lambda = [\lambda_1, \lambda_2, \lambda_3]$, and use the entropy method to find its weight $\omega = [\omega_1, \omega_2, \omega_3]$.

Data pre-processing: $p_{ij} = \dfrac{x_{ij}}{\sum_i x_{ij}}$ (i, country; j, index of factor in country)

Calculate the information entropy of each factor:

$$e_j = -k\sum_{i=1}^{n} p_{ij}\ln(p_{ij}),\ k = 1/\ln(n)\ (n = 3, \text{this index has 3 factors})$$

Maximize entropy and introduce information entropy redundancy: $d_j = \dfrac{\max(e) - e_j}{\max(e) - \min(e)} = 1 - e_j$

Calculate the weight of each index: $\omega_j = \frac{d_j}{\sum d_j}$, find the weight $\omega = [\omega_1, \omega_2, \omega_3]$.So the score for each index: $Score_{index} = \sum_{j=1}^{n} \lambda_j \omega_j$ (Every index has n = 3 factors)

The scores of the three indices corresponding to each policy situation are calculated by calculation: $Score_{case} = [Score_{index1}, Score_{index2}, Score_{index3}]$

5.2.2 Objective judgment matrix based on analytic hierarchy process

Each element of the objective judgment matrix represents the ratio of the weights of the two indicators. This avoids the impact of the subjective selection scale in the traditional analytic hierarchy process, so our policy evaluation model is more objective.

c_{ij} is called an objective scale, which indicates how important element i is to element j:

$c_{ij} = \frac{Score_{indexi}}{Score_{indexj}} (i = 1,2,3; j = 1,2,3)$ (i, j are scores of index in a same case)

So the objective judgment matrix is: $i \times j \ C = (c_{ij})$

Finally, the consistency check of each objective judgment matrix constructed passed.

5.2.3 Finding the optimal solution

Get the weight of each scheme through the above algorithm:

$Weight_{case} = [Weight_{case1}, Weight_{case2}, Weight_{case3}] = [0.3342, 0.3291, 0.3338]$

It can be seen that our proposed policy W_case1 accounts for the largest proportion, so our policy is optimal compared to the other two policy situations.

5.2.4 Resettlement and movement of EDP

The political planning evaluation model reflects the country's ability to guarantee people's livelihood. The data in Table 3. is still used to calculate the number of people who have migrated from 4 representative island countries to 10 representative countries.

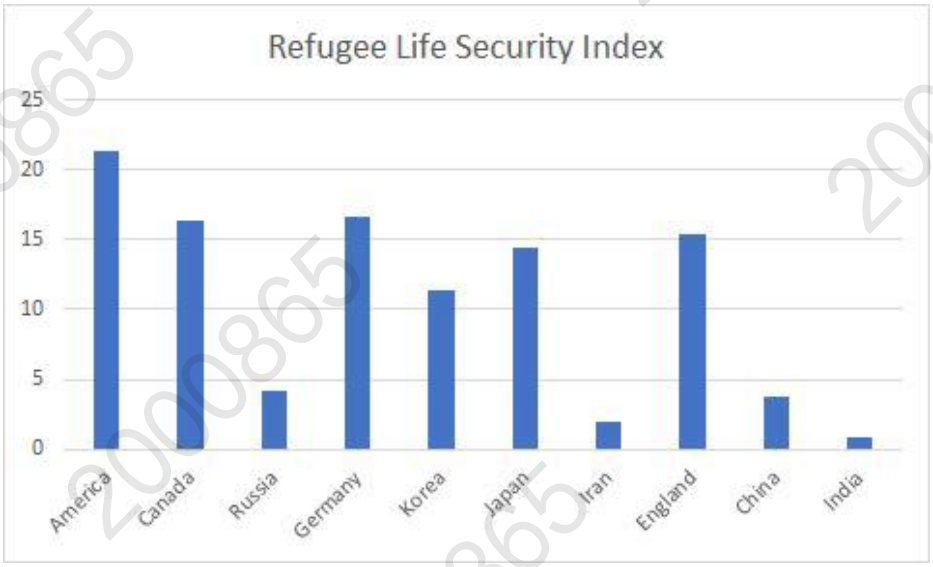


Figure 8.

Because the index comprehensively considers the country's enrollment rate, tourism industry income, unemployment rate, labor force participation rate, GDP and other factors, it is sufficient to reflect the country's human rights and legal protection, market economy development, and cultural and pluralistic adaptability. And other indicators as to whether refugees are livable. From this perspective, the countries that EDP mainly considers are America, Germany, Canada.

Ⅵ.Where their migration?

6.1 Markov chain Model

6.1.1 Introducing the model

To restore the migration situation of the victims' islanders to North America, Asia, Europe and other ideal areas under this model, and to solve the shortcomings of the limited evaluation index of EDP resettlement and flow model mentioned in heading 5.2.4, the Markov chain model is used to improve the original model. The matrix multiplication characteristic of this model is more suitable for predicting the migration situation of islanders.

The four island countries and 10 ideal migration countries mentioned above are still used as the description objects.

6.2 Model Application——EDP population migration

6.2.1 Data preparation

From the data (from World Bank) update to 2015, the population of these island countries is:

Country	Maldives	Tuvalu	Kiribati	Marshall Islands
Population	454915	162	112423	57439

Table 5.

Composition sequence $p_j = [454915, 162, 112423, 57439]$

Next, solve the probability r_{ij} of the island country j migrating to the destination country i within the scope of our model:

To this end, here is a synthesis of the above-mentioned countries' contribution to greenhouse gas and the adaptability of refugees to the effect of the proposed government. We also add the transportation distance as one of the reference data for solving the probability r_{ij}. The island country and migration are measured by map software. Distance L data of the destination country:

Distance between countries(km)	America	Canada	Russia	Germany	Korea	Japan	Iran	England	China	India
Maldives	15540	13553	7137	7995	6720	7628	3971	9007	4932	2152
Tuvalu	10121	9783	9874	15037	7175	6432	128899.8	14685	9121	11306
Kiribati	5832.9	6746.1	8931.8	14461.6	8526	7607	15542.7	13581.2	9532.5	13396
Marshall Islands	7836.2	7505.7	5579.2	13708.2	5562	4613.1	11724.6	12880.4	5742.6	10375.9

Table 6.

It is stipulated here that the distance L is inversely proportional to the degree of willingness of the EDPs to select the destination country, then the transportation choice relationship between each island country and the destination country is expressed as a matrix $i \times j$ $T(t_{ij})$, and t_{ij} represents the degree of transportation choice of the island country j to the country i.

From the previous data, Figure 3 and Table 5, the proportion of countries' contribution to greenhouse gas and the role of the proposed policy are obtained:

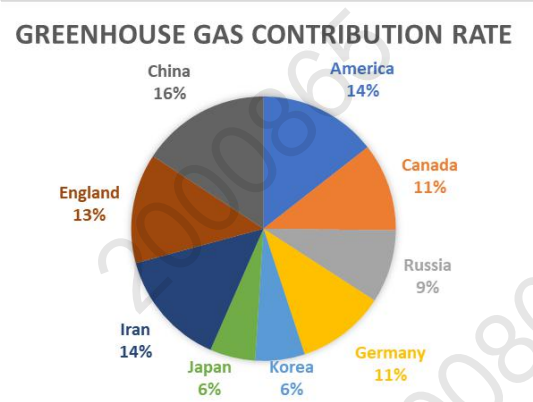


Figure 9

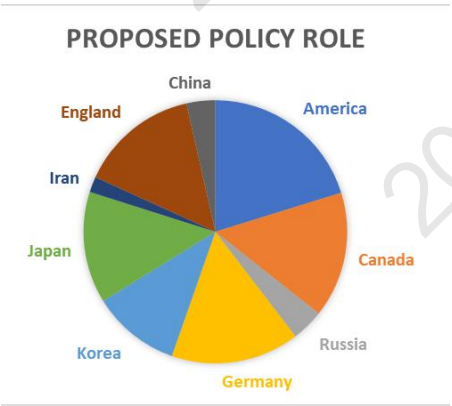


Figure 10

The probability matrix of these island countries going to the destination country is: r_{ij} represents the probability of the island country j going to the destination country i:

0.128306	0.028451	0.016743	0.042365
0.086057	0.015459	0.019071	0.021986
0.036253	0.056195	0.073186	0.096983
0.03884	0.04038	0.065511	0.075652
0.028205	0.055952	0.045774	0.054718
0.064495	0.075815	0.080025	0.087239
0.162879	0.393783	0.227806	0.192467
0.038335	0.028377	0.044488	0.05677
0.096436	0.094578	0.129435	0.115464
0.320194	0.211011	0.29796	0.256356

switches as a probability matrix:

$$Ratio = \begin{bmatrix} 0.1283 & \cdots & 0.0424 \\ \vdots & \ddots & \vdots \\ 0.3202 & \cdots & 0.2564 \end{bmatrix}$$

6.2.2 Model operations

After processing the data by principal component analysis to obtain the eigenvector λ of $Ratio$, the entropy method is used to process the data to obtain the weight vector W_{ij}.Calculate the number of people from four island countries to 10 representative countries. Use the element x_{ij} to represent the number of migrants from island country j to destination country i, and w_{ij} to represent the weight of residents of island country j who choose destination country i. Then island country j goes to 10. The number of destination countries is expressed as:

$$X_j = p_j \cdot W_j = p_j \cdot \begin{bmatrix} w_{1j} \\ \vdots \\ w_{ij} \end{bmatrix}$$

The results show that, taking the Maldives as an analysis, it is geographically similar to southern India, that is, almost in the tropics. Maldivian refugees will give priority to migrating transportation distance and choose India.The result is a figure:

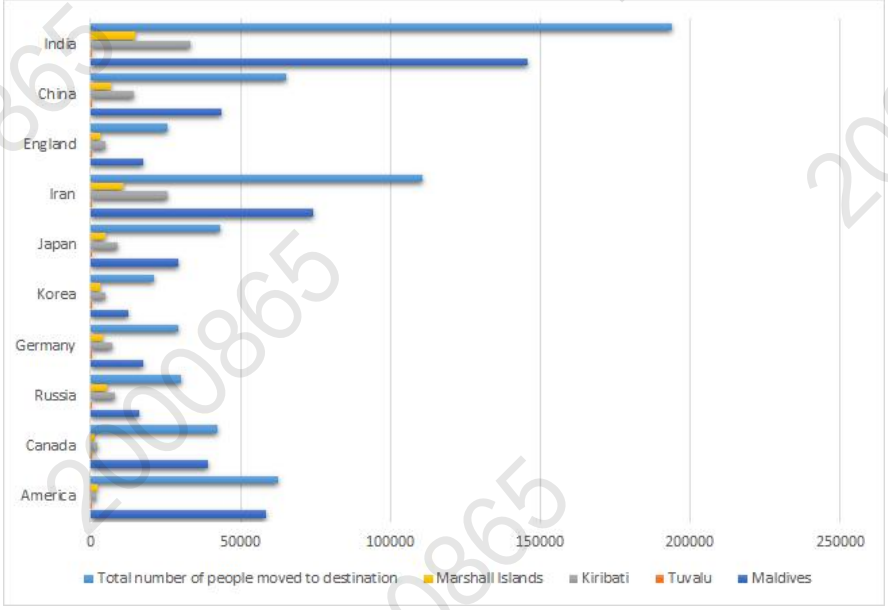


Figure 11

6.3 Model disadvantages

1. "Transportation distance" is added to the solution of the probability of the destination country of migration, which lacks the strength of proof. The model does not fully consider the feasible path, mode and cost of transportation to measure the selection degree of transportation route and mode when refugees migrate.

2. The model describes the relationship between representative island countries and representative migration destination countries

3. The model does not make full use of the nonlinear regression method to describe the more complex route migration based on the Dynamic dynamic model.

Ⅶ. Importance analysis of simulation policy

After the previous forecast and analysis, the following points are explained about the importance of implementing this policy.

Language, religion, festivals, and customs, as important spiritual and cultural heritage of the Environmentally Displaced Person (EDP), may encounter the following situations during processing:

I. Environmentally displaced persons (EDPs) have not been properly resettled and their culture has perished.

II. During the resettlement of the environmentally displaced persons (EDP), the culture was not properly handled, and conflicts such as religious beliefs and languages appeared, causing losses to both the “absorbing country” and the “relocating country”.

III. In the process of resettlement of environmentally displaced persons (EDP), the culture was properly resettled and willing to obey naturalization. The original culture gradually merged to form a new culture.

IIII. During the resettlement process of the environmentally displaced persons (EDP), the culture was properly resettled, but they were unwilling to obey naturalization. The original culture remained in the “absorbing country” and became a “resident” characteristic population.

The implementation of our proposed policies can minimize the cultural conflicts between the “originating country” and the “absorbing country” and maximize the preservation of the spiritual and cultural heritage of the environmentally displaced (EDP).

According to our policy, in terms of education, placing environmentally displaced persons (EDPs) in "absorbing countries" with the same or similar language family can not only shorten the time for migrants to learn a new language but also It can reduce the extra-economic consumption required during the running-in period. In terms of medical treatment, the climate of the migrating place is similar to the original site, which can greatly reduce the situation of environmentally displaced persons (EDP), and also reduce the new disease infection brought by migrants to a certain extent. The risk of people in the “absorbed country”, thus alleviating the pressure on health resource protection during the running-in period; in terms of housing, the environmentally displaced persons (EDP) are absorbed in an appropriate amount according to the cost of the country ’s housing and the original housing pressure. Similar geographical locations and climate can maximize Avoid new construction of houses to achieve the most reasonable use of the housing resources of people in the "absorbing countries".

According to our policy, in agriculture, the loss of the original arable land of the Environmentally Displaced Persons (EDPs) is unavoidable, but for the “absorbing countries”, the influx of sufficient labor has increased their agricultural production to a certain extent. In terms of manufacturing and tourism, the original production and living of environmentally displaced persons (EDPs) have been preserved to the greatest extent, and traditional production tools may have a longer development in the “absorbing countries”.

Following our policies, we have chosen to place environmentally displaced persons (EDPs) in some countries with long-standing territorial disputes into relatively neutral "absorbing countries", which can alleviate global regional or territorial disputes to a certain extent and resolve them to the greatest extent possible. The political and military conflicts that have long existed in the "Original Country". Also, political integration and mutual influence can effectively alleviate political pressure on both sides and promote world peace.

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