

A "Colour Revolution" in Iran? Attack it with a Social Stability Model based on TOPSIS!

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Abstract. A "color revolution" achieves regime change by attacking the weakest link in society, but once the ratio of each link in society is out of balance, it will cause social deformation and thus affect social stability. To study the factors affecting social stability and avoid "color revolutions", it is necessary to establish an effective social stability index system, and on this basis, to build a social stability coefficient model. To establish a complete social stability index system, this paper selects population, defense science and technology, environment, education, economy, and agriculture after dimensionality reduction. The six indicators were then downscaled to obtain population, national defense, science and technology, environment, education, economy, and agriculture, and the social stability coefficient was classified into five levels from 0 to 1 using the TOPSIS evaluation algorithm, with the higher the level the worse the social stability. Using Spearman and Akaike Causality to test the indicator system, it was found that there was a significant correlation and causality between the stability coefficient and each indicator, and the indicator system was well established. For regions that failed to launch "color revolutions", this paper takes Iran as an example, and after bringing its 44 indicators into the social stability coefficient model in 2018, it comes out that the social stability coefficient of Iran is 0.637, and the social stability level is in the second level of stability to the third level of stability, which is a more stable state at this time. There may be some precursors of social unrest. At the same time, Iran's population development and education level are at a high level, and the general education and knowledge of the Iranian people are high, so the number of people who participate in internal conflicts and revolutions is reduced, which leads to the failure of color revolutions.

Keywords: Social Stability Indicator System; AHP-EWM; Stability Warning.

1. Introduction

Peace and stability are the prerequisites for development, and concern for social risk and stability is an eternal topic in human society. After this new crown pneumonia that has swept the world, we see that the world will continue to experience risk factors that affect social stability, and it can be devastating to world stability, the global economy, and other developments. Since modern risks are structural, global, multiple, and complex, the construction of a scientific, comprehensive, and practical social risk early warning system is a major theoretical and practical problem facing society today.

2. Data Processing and Analysis

2.1. Data Collection

There is no data given in the problem, so we need to collect our data for modeling. To further study the problem, we need to collect data on population, defense science, technology, environment, education, economy, and agriculture from various countries or regions around the world. After the data collection is completed, it is further processed and analyzed to prepare for model building.

Data for each indicator for each country can be found in the table below.

Table 1. Data source

Database Names	Database Websites
Europe and the U.S. Indicators Database	http://genderstats.worldbank.org/dataonline/
Database of Iranian indicators	http://genderstats.worldbank.org/dataonline/
Database of indicators in Ukraine	http://genderstats.worldbank.org/dataonline/

Finally, the following 44 sub-indicators were screened in each of the six areas of population, defense science and technology, environment, education, economy, and agriculture, as shown in the table below.

Table 2. Indicator Selection

Indicator Name	Sub-index selection
Population (4)	Urban population (% of the total population), urban population growth rate (annual growth rate), population in urban agglomerations with more than 1 million inhabitants (% of total population), population in the largest cities (% of urban population)
Defense Science and Technology (9)	Military expenditures (% of GDP), Fixed telephone subscriptions (per 100 people), Air transport & passenger traffic, Electricity consumption (kWh per capita), Transmission and distribution losses (% of electricity production), Information and communication technology (ICT) services exports (% of services exports, BoP), Intellectual property royalties, received (BoP, current US\$), Intellectual property royalties, paid (BoP, current US\$), Armed forces personnel, total
Environment (7)	Total natural resource rents (% of GDP), oil rents (% of GDP), gas rents (% of GDP), mineral rents (% of GDP), forest rents (% of GDP), coal rents (% of GDP), renewable inland freshwater resources per capita (m3)
Education (4)	Educated (% of total population), population aged 0-14 (% of total population), school attendance, pre-school (% of total), school attendance, secondary (% of total)
Economy (6)	Net foreign income (current dollars), gross national income (GNI) (current dollars), gross domestic savings (current dollars), GDP per capita (constant 2015 dollars), grants and other income (% of income), industrial value added (current dollars)
Agriculture (14)	Agriculture, value added (current dollars), trade (% of gross national product (GDP)), imports of goods and services (current dollars), gross national expenditure (current dollars), final consumption expenditure (current dollars), residential final consumption expenditure (current dollars), agricultural raw material exports (% of merchandise exports), agricultural raw material imports (% of merchandise imports), rural population (% of total population), food production index (2014-2016 = 100), crop production index (2014-2016 = 100), cereal production (metric tons), arable land (% of land area), agricultural land (% of land area)

2.2. The Establishment of a TOPSIS-based Social Stability Index Assessment System

TOPSIS, as a basic evaluation method, can make full use of the original data and the results can reflect the gap between each program, and its basic evaluation processes are as follows:

- 1) Original matrix orthogonalization
- 2) Standardization of positive indicators
- 3) Calculate and normalize scores

Since the indicators have been normalized during data processing, the next steps are as follows:

Step 1: Suppose we need to have n evaluated objects and m evaluation indicators, which constitute the forwarding matrix as shown below.

$$X = \begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1n} \\ x_{21} & x_{22} & \cdots & x_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ x_{n1} & x_{n2} & \cdots & x_{nm} \end{bmatrix} \quad (1)$$

Then the matrix for which the maximum and minimum values are normalized is denoted Z , and each element of Z :

$$z_{ij} = \frac{x_{ij} - \min}{\max - \min} \quad (2)$$

Step2: To calculate the score, let us have n objects to be evaluated and m standardized matrices of the evaluated indicators:

$$Z = \begin{bmatrix} z_{11} & z_{12} & \cdots & z_{1m} \\ z_{21} & z_{22} & \cdots & z_{2m} \\ \vdots & \vdots & \ddots & \vdots \\ z_{n1} & z_{n2} & \cdots & z_{nm} \end{bmatrix} \quad (3)$$

The final record z_{ij} is the data after forwarding and normalizing the j -th sampling point of the i -th index.

Define maximum value:

$$\begin{aligned} Z^+ &= (Z_1^+, Z_2^+, \dots, Z_m^+) \\ &= (\max\{z_{11}, z_{21}, \dots, z_{n1}\}, \max\{z_{12}, z_{22}, \dots, z_{n2}\}, \dots, \max\{z_{1m}, z_{2m}, \dots, z_{nm}\}) \end{aligned} \quad (4)$$

Define minimum value:

$$\begin{aligned} Z^- &= (Z_1^-, Z_2^-, \dots, Z_m^-) \\ &= (\min\{z_{11}, z_{21}, \dots, z_{n1}\}, \min\{z_{12}, z_{22}, \dots, z_{n2}\}, \dots, \min\{z_{1m}, z_{2m}, \dots, z_{nm}\}) \end{aligned} \quad (5)$$

The distance between the i -th ($i = 1, 2, \dots, n$) evaluation object and the maximum value:

$$D_i^+ = \sqrt{\sum_{j=1}^m (Z_j^+ - z_{ij})^2} \quad (6)$$

The distance between the i -th ($i = 1, 2, \dots, n$) evaluation object and the minimum value:

$$D_i^- = \sqrt{\sum_{j=1}^m (Z_j^- - z_{ij})^2} \quad (7)$$

The final score can be calculated as $y_i = \frac{D_i^-}{D_i^+ + D_i^-}$, among $0 \leq y_i \leq 1$

The generalized data on the six indicators of population, defense science and technology, environment, education, economy, and agriculture were used as model inputs, and the final result TOPSIS model yielded social stability coefficient values [13].

The final results of the social stability index system are presented in the following table:

Table 3. Social stability indicator system (first 20 groups)

Serial number	Population	Defense Technology	Environment	Education	Economy	Agriculture	Social stability coefficient
1	0.319303	0.091097	0.038628	0.325771	0.003538	0.000545	0.017454
2	0.314382	0.087656	0.042227	0.325891	0.00655	0.000776	0.035893
3	0.309689	0.086744	0.082749	0.333096	0.009026	0.003462	0.030363
4	0.305303	0.087757	0.14783	0.345044	0.010957	0.007012	0.154541
5	0.301305	0.09009	0.225111	0.359395	0.012332	0.010923	0.309863
6	0.297776	0.093137	0.30223	0.373807	0.013143	0.014694	0.469555
7	0.294796	0.096295	0.366826	0.385938	0.013378	0.017823	0.606841
8	0.292444	0.098958	0.406538	0.393448	0.013029	0.019809	0.694945
9	0.290721	0.100647	0.413015	0.395106	0.012174	0.020342	0.715487
10	0.2893	0.101388	0.39395	0.394126	0.011238	0.019884	0.683664
11	0.287777	0.101333	0.361047	0.394831	0.010735	0.01909	0.623069
12	0.285744	0.100632	0.326008	0.401546	0.01118	0.018614	0.557293
13	0.282934	0.099486	0.298612	0.416995	0.01292	0.018946	0.50607
14	0.279636	0.098291	0.280934	0.437504	0.015646	0.019916	0.473694
15	0.27628	0.09749	0.273125	0.457799	0.018879	0.021192	0.460599
16	0.273293	0.097529	0.275333	0.472605	0.022145	0.02244	0.467219
17	0.270983	0.098681	0.286349	0.478184	0.025067	0.0234	0.491246
18	0.269183	0.10054	0.299514	0.476945	0.02767	0.024118	0.519394
19	0.267603	0.10253	0.30681	0.472831	0.030079	0.02471	0.535637
20	0.265954	0.104076	0.30022	0.469786	0.032419	0.025297	0.523945

2.3. Spearman Correlation Analysis

It is calculated based on the difference in the number of each pair of equivalents in two columns of paired ranks, and for the two variable objects studied, if they have identical correlation coefficients, their Spearman correlation coefficients can be +1 or -1, which means that the closer the absolute value of the correlation coefficient is to 1, the stronger the correlation between the two variables [3]. Its calculation formula is as follows:

$$\rho_{X,Y} = \frac{\frac{1}{n} \sum_{i=1}^n \left((R(X_i) - \overline{R(X)}) \cdot (R(Y_i) - \overline{R(Y)}) \right)}{\sqrt{\left(\frac{1}{n} \sum_{i=1}^n (R(X_i) - \overline{R(X)})^2 \right) \cdot \left(\frac{1}{n} \sum_{i=1}^n (R(Y_i) - \overline{R(Y)})^2 \right)}} \quad (8)$$

Where $R(X)$ and $R(Y)$ are the bits of X and Y, respectively.

The absolute values of the results calculated from the spearman correlation coefficients range from 0.8 to 1.0, indicating a very strong correlation between the two, 0.6 to 0.8 indicating a strong correlation, 0.4 to 0.6 indicating a moderate correlation, 0.2 to 0.4 indicating a weak correlation, and 0.0 to 0.2 indicating only a very weak correlation or even no correlation between the two.

Spearman correlation coefficient analysis was done for each indicator and social stability coefficient, and the following results were obtained:

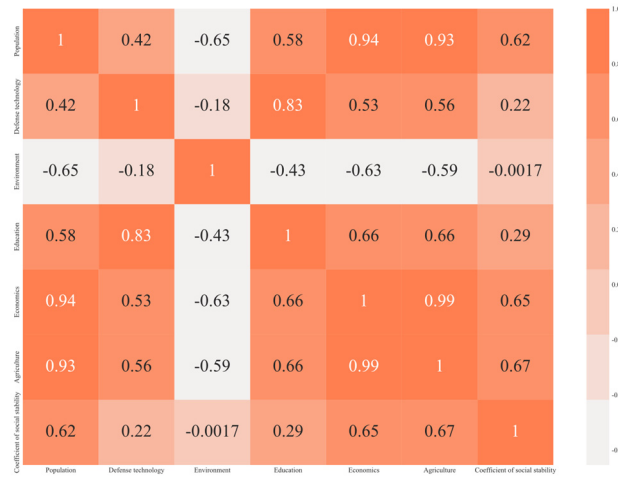


Fig 1. Spearman Correlation coefficient matrix

The above graph shows that the correlation between population and economy and agriculture is very significant at 0.94 and 0.93. The correlation between defense science and technology and education is very significant at 0.83. Education is strongly correlated with defense science and technology, economy, and agriculture with coefficient values of 0.83, 0.66, and 0.66. The economy is very significantly correlated with population and agriculture with coefficient values of 0.94 and 0.99. Agriculture is very significantly correlated with population and economy with coefficient values of 0.93 and 0.99. Social stability coefficients are strongly correlated with population, economy, and agriculture, and weakly correlated with education and defense science and technology.

3. Iranian Social Risk Study

In 2018, Iranian society is in turmoil, with economic sanctions imposed by the West on Iran due to its growing influence in countries such as Syria and Iraq, causing Iran's economic development to suffer, intensifying internal conflicts between conservatives and reformists, causing social unrest and launching a color revolution. To this end, this paper investigates the social stability coefficient in Iran at this time by investigating the social influences in Iran around 2018.

The social stability coefficient of Iran from 1972-2021 was obtained by collecting six social indicators: population, defense, science and technology, environment, education, economy, and agriculture, and performing hierarchical analysis, entropy weighting, and topsis scoring, and then bringing the obtained data into the XGBoost-LSTM model to predict the social risk coefficient of Iran to obtain the exact social stability coefficient at this time, as shown in the following figure 2:

As can be seen from the graph, the social stability coefficient of Iran was in the fifth rank around 1980, when the society was in a state of turmoil and collapse, and in reality, the Iranian state was in a state of war and all social stability factors were affected thus leading to social unrest. The social stability coefficient of Iran in the period 2015-2020 is at the level of secondary stability leaning toward the level of tertiary stability, when the society is in a more stable state and there may be some precursors of social unrest, corresponding to the reality of the color revolution in Iran, when the society was affected but did not experience great unrest.

Over time, after 2018, the indicators of social factors such as Iran's economy and agriculture changed and their weights increased, thus it can be seen that in the coming period, without considering the influence of external factors, Iran's social stability coefficient will keep rising and gradually stabilize after converging to the first rank. The specific changes are shown in the following figure 3:

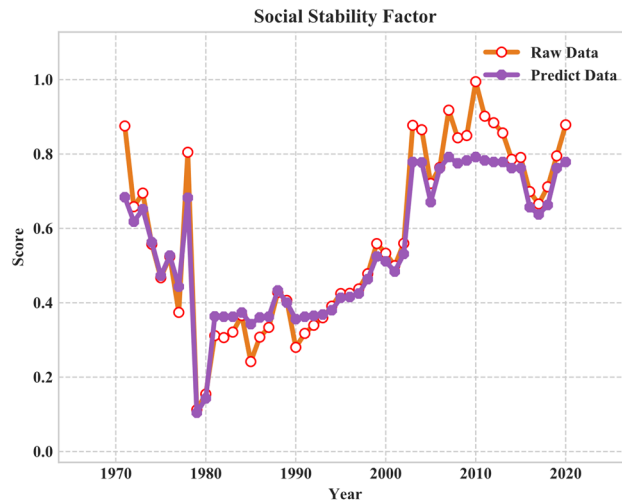


Fig 2. Iran's social stability coefficient by years

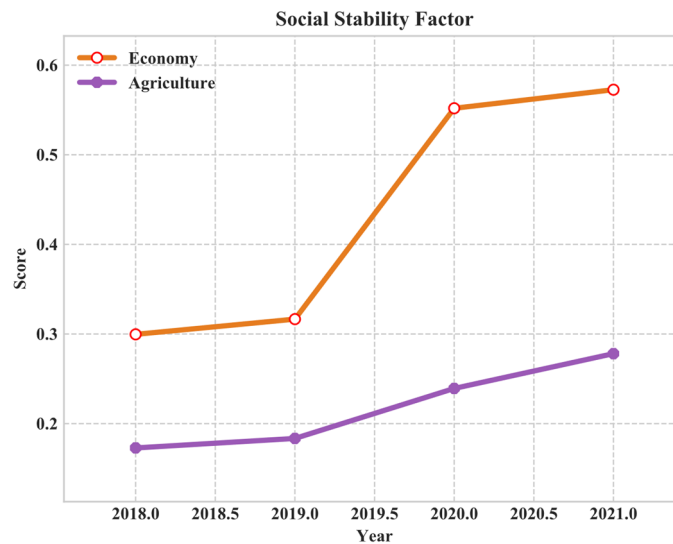


Fig 3. Economic and agricultural trends in Iran beyond 2018

3.1. Failure Factors of the "Iranian Spring"

Iran's color revolution was not successful and the social stability coefficient in Iran after the failure of the color revolution is increasing and gradually approaching the first level social stability coefficient, this paper summarizes the weight of each social factor and the social stability coefficient when the color revolution occurred in Iran in 2018 as shown in the following figure:

First of all, according to question one, it can be seen that the environment is negatively related to social influences and population, while defense science and technology, education, economy, and agriculture are positively related. We believe that the main reasons for the failure of Iran's national color revolution are as follows:

1. As can be seen from the graph, in 2018, Iran's population development and education levels were at a high level, which greatly increased the general education and intellectual and cultural sophistication of the Iranian people, resulting in a decrease in the number of people involved in internal radicalization for revolution.
2. The lower social-environmental weight makes the exploitation of Iran's natural resources by other countries less, which can further alleviate the exploitation of Iran's national mineral resources and protect Iran's natural environment.

3. The Iranian state had a war in 1980, which displaced many people and left them in dire straits, so it was natural that the color revolution would be opposed by the people, setting up its failure.

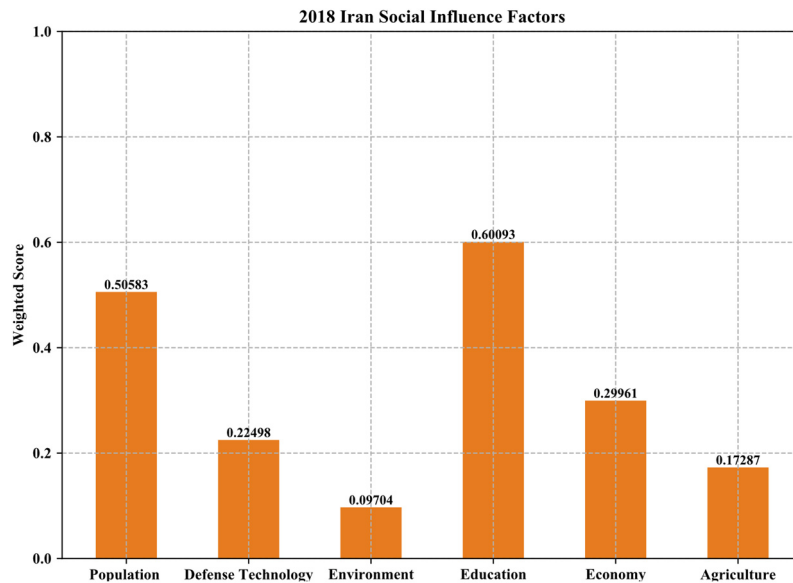


Fig 4. Iranian social indicators in 2018

4. Conclusion

In summary, the social stability system is related to a variety of factors. In this paper, six indicators of population, defense science and technology, environment, education, economy, and agriculture are selected to construct the social stability indicator system using TOPSIS, and the system contains very comprehensive qualitative and quantitative indicators, so the final completed social stability indicator system is also very complete. Finally, this paper draws the following conclusions:

1. Using TOPSIS to construct a social stability index system can reduce the subjectivity of the AHP method of assigning weights, and reduce the fluctuation of weights caused by data changes, making the system more interpretable.
2. Using the model developed in this paper to conduct separate early warning studies on social stability in Iran and Ukraine, it can be found that the main factors leading to the failure of the Iranian Spring were education and environment.

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