



Искусственные общества. 2013-2026

ISSN 2077-5180

URL - <http://artsoc.jes.su>

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Выпуск 3 Том 16. 2021

Национальная безопасность стран мира

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Аннотация

Статья продолжает исследование «Моделирование и оценка национальной силы разных стран мира», посвященное расчету показателя национальной мощи. В настоящее время это наиболее информативный и популярный показатель в мире, который интегрально характеризует совокупный потенциал конкретной страны и в то же время позволяет сравнивать уровень ее мощи и социально-экономического развития с другими странами. Результаты исследования опубликованы в статье «Моделирование и оценка национальной силы разных стран мира».

Если национальная мощь государства, по сути, определяет его потенциальные возможности и для расчета в основном используются валовые показатели, то показатели национальной безопасности рассчитываются на основе нормированных значений (как правило, на душу населения) и указывают на уровень развития, той или иной составляющей социально-эколого-экономической системы страны, а также эффективности использования имеющегося потенциала.

В данной статье мы рассчитаем показатели национальной безопасности государств-членов ООН с помощью методов многомерного статистического анализа. Кроме того, мы оценим пороговые значения для всех рассматриваемых здесь факторов национальной безопасности. Последняя часть статьи будет содержать прогноз национальной безопасности на среднесрочную перспективу.

Ключевые слова: национальная безопасность, географические характеристики, природные ресурсы, население и рабочая сила, экологические показатели, вооруженные силы, наука и инновации, факторный анализ, интегрированный индекс, многомерный статистический анализ

Дата публикации: 16.09.2021

Источник финансирования:

Работа поддержана грантом РФФИ № 20-010-00335 «Разработка программно-аналитического комплекса для оценки, мониторинга и прогнозирования интегрального показателя национальной мощи».

Ссылка для цитирования:

Макаров В. Л., Ву Ц. , Бахтизин А. Р., Ву З. , Сушко Е. Д., Хабриев Б. Р. Национальная безопасность стран мира // Искусственные общества. 2021. Т. 16. Выпуск 3. URL: <https://artsoc.jes.su/s207751800016011-1-1/> DOI: 10.18254/S207751800016011-1

Introduction

Having come into wide use, the term "national security" was initially interpreted as the ability of the state to defend itself in the event of a military attack and also included an assessment of the military potential of the nation. For example, in accordance with the National Security Act of 1947 adopted by the US President H. Truman on July 26, 1947, the National Security Council was established. It is an advisory body on national security issues under the President of the United States. But the most important thing is that the country's armed forces were reformed to work in post-war conditions [8].

² The concept of national security expanded as time passed. The corresponding doctrines of various countries began to include other components: countering terrorism, economic, environmental, energy, food and other types of security (see, for example, documents for the United States of America [10] and Great Britain [9]).

³ Nevertheless, despite the large number of documents developed all over the world, there is still no clear definition of national security. Apparently, this is a consequence of the high fluctuation and nonstationarity of processes taking place in many spheres of life, as well as the subjectivity of views of representatives of different countries. The USA pays the main attention to issues of its hegemony in relation to all other countries and the role of a dependent partner or state that poses risk to the USA is assigned to others, but in other countries national security strategies to a large extent are dedicated to peaceful interaction with neighbors and joint resolution of general issues in the field of economy, security, etc. (for example, [11, 14]).

⁴ Below we will give a brief overview of foreign experience in assessing the level of national security. The assessment is carried out using a set of various indicators.

⁵ UN experts define national security as the ability of the state to ensure the safety of life of its citizens, the country's defense and consider it through indicators related to the following seven blocks: 1) economy (indicators that determine the labor market and the level of poverty are considered); 2) food (for example, the level of provision of the population with food); 3) health (incidence rate, availability of medical care, etc.); 4) ecology (environmental pollution, frequency of natural disasters, etc.); 5) quality of life (crime rate, domestic violence, etc.); 6) social interaction (level of tolerance, religious identity, etc.); 7) political sphere (violation of human rights, etc.).

⁶ At the same time, it is especially emphasized that it is important to ensure national security of each country, since its violation poses a threat to global security. In this regard, the UNO calls on the world community for closer interaction and cooperation to further strengthen both intercountry relations and the level of national security of each state [1]. A structural unit of the RAND corporation², the *National Security Research Department*, conducts a comprehensive assessment of national security of many countries of the world³. RAND experts also note the need for an expanded interpretation of national security, including mandatory consideration of indicators related to human capital, and justify the need to consider national security from the perspective of potentially vulnerable spheres of society and main risks associated with the ownership structure of critical facilities, information protection, availability of natural resources, degree of important technologies development, level of corruption, socio-economic inequality and food supplies. To assess the level of national security of various countries, it is proposed to create a list of critical economy sectors and infrastructure facilities, as well as to use a changeable set of variables related to the following blocks:

- armed forces;
- resources and territory;
- investments;
- production;
- human capital;
- employment;
- finance;
- technologies;
- trade;
- ecology;
- transport (see, for example, [13]).

⁷ There is a lot of work on assessing national security, and in order to draw a line under the review of research in this area, we would like to refer to the results of scientists from the University of Science and Technology of China obtained on the basis of a bibliometric analysis of 5,837 works in the field of national security published in 817 journals over the past 17 years. The texts of these publications were assessed according to a number of criteria: the number of citations, the distribution of authors by country, research center, etc., but most importantly, by the frequency of use of keywords identified by the authors [7].

⁸ So, the researchers identified the following components of national security: military, social, economic, environmental, food, and health-related issues. At the same time, the following words and phrases were most often used: politics, income, food security, market, climate change, USA, China, productivity, consumption, hunger, health, employment.

Principles

Consideration of numerous methods of quantitative assessment of national security in a number of countries allows us to draw the following conclusions:

1. When obtaining appropriate assessments, qualitative indicators are often used. It is difficult to reduce them to quantitative ones and thus to calculate the integral level.
2. In the overwhelming majority of cases national security is assessed for each country separately, but taking into account the close relationship of almost all countries, it seems expedient and highly relevant to assess it simultaneously for all interacting states. This circumstance is also emphasized by RAND experts.
3. In almost all methods factor weights were estimated by interviewing experts, which imposes a fair amount of subjectivity on the final result.

¹⁰ Considering the above, we will formulate the *principles* that we will adhere to when constructing the integral indicator of national security (as well as in the work by [3]).

1. To measure the level of national security, we will calculate not only its individual components, but also integral indices, which make it possible to carry out cross-country comparisons across the entire set of factors at the same time.

2. When calculating integral indices, we will use the methods of multivariate statistical analysis. This will help remove the problem of bias in assessing the contribution of factors to the integral indicator inherent in expert methods.

¹¹ 3. Integral indicators of national security will be calculated for all UN member states, and the need for this procedure is due to the following circumstances:

- The use of a large array of data makes it possible to statistically justify the calculation of weights of individual components of national security that affect the integral indicator;
- A database for a number of states will allow carrying out the clustering of countries and calculate threshold values for the cluster of world leaders.

¹² 4. When forming the components of the integral indicator of national security, the list of factors most often used in the most cited studies will be taken as a basis, which will improve the quality of assessing the level of national security and make a more correct comparison with other countries.

5. Integral indicators for UN member states are supposed to be calculated for the period from 2010, which will allow considering the direction of the corresponding trends, as well as predicting the level of national security of the states under consideration.

¹³

Data

To construct integral indices, data from the sources given in Table 1 were used.

¹⁴ Table 1. Sources of data used to calculate national security indices of countries across the world

Name	Internet resource
World Bank Open Data	data.worldbank.org
Global Energy Statistical Yearbooks	yearbook.enerdata.net
Publications of the World Steel Association	www.worldsteel.org
The Military Balance Annual Reports	www.iiss.org/publications/the-military-balance
World Gold Council Database	https://www.gold.org
The U.S. Energy Information Administration	www.eia.gov

¹⁵ It should be noted that due to the discrepancy in the work of the state statistics bodies of different countries of the world, the information necessary for the calculations is received with a significant lag. So, at the moment the most recent data related to many indicators is limited to 2019. However, in our opinion, this does not interfere with the solution of the main task - to obtain the weight of the selected components of national security for a number of recent years in the process of calculation and forecast integral indicators of the world countries for the medium term. In addition, using the simulator developed by us, we will calculate national security indicators for 2020 and give their forecast until 2025 depending on the most likely scenario of world dynamics from our point of view. The simulator of the social economic dynamics (SED model) for more than 100 countries of the world was developed by IT company Guangzhou Milestone Software Co., Ltd with the support of the National Supercomputer Center of China and the Chinese Academy of Social Sciences and is described in a number of publications [4, 5].

¹⁶ We will list the proposed indicators (28 in total) grouped by 6 thematic blocks:

¹⁷ **1. Resources** (a group of indicators that determine the level of resource availability)

1. Gold reserves (tons per million people);
2. Natural gas reserves (million cubic feet per person);
3. Oil reserves (thousand barrels per person).

¹⁸ **2. Economy and production** (a group of indicators that determine the level of development of the country's economy, the scale of industrial production, the release of strategically important products, and the share of the working population)

1. GDP per capita, purchasing power parity (current international \$);
2. Industry (including construction), value added (% of GDP);
3. Steel production (tons per person);
4. Cereal production (tons per person);
5. Food imports (% of merchandise imports);
6. Population ages 15-64 (% of total population).

¹⁹ **3. The standard of living of the population** (a group of indicators that determine the level of employment, income, health, mortality, crime, and environmental conditions)

1. Unemployment, total (% of total labor force);
2. The ratio of incomes of 10% of the most and 10% of the poorest population;
3. Life expectancy at birth, total (years);
4. Mortality rate, infant (per 1,000 live births);
5. Mortality rate, adult, male (per 1,000 male adults);
6. Mortality rate, adult, female (per 1,000 female adults);
7. Mortality from CVD, cancer, diabetes or CRD between exact ages 30 and 70 (%);
8. Mortality caused by road traffic injury (per 100,000 people);
9. Intentional homicides (per 100,000 people);
10. CO2 emissions (kg per purchasing power parity \$ of GDP).

20 **4. Financial indicators** (a group of indicators that determine the level of development of the financial system)

1. Domestic credit to private sector (% of GDP);
2. Market capitalization of listed domestic companies (% of GDP);
3. Broad money (% of GDP);
4. Inflation, consumer prices (annual %).

21 **5. Armed forces** (a group of indicators that determine the level of defense)

1. Military expenditure (current USD);
2. Armed forces personnel, total.

22 **6. Science and innovation** (a group of indicators that determine the potential of the scientific sphere)

1. Researchers in R&D (per million people);
2. Technicians in R&D (per million people);
3. Research and development expenditure (% of GDP).

23

Calculations

We would like to note that methods for the assessment of national power and national security are almost identical. To calculate the integral indicators of the latter, a well-proven method of statistical information multivariate processing - factor analysis with the method of principal components - was also used. The original array was processed as follows:

1. Standardization of variables by means of z-scoring;
2. Calculation of integral indices for each group of indicators by the convolution of the selected variables;
3. Calculation of integral indices of national security for all countries by means of the convolution of group indices.

24 Please note that despite the similarity of calculations, integral indicators of national security are fundamentally different from integral indicators of national power. It has already been said above that the components of national security are normalized values, and if, for example, the gross indicators of the most valuable natural resources in Russia are much higher than in other countries, then their values correlated to the number of inhabitants significantly reduce its rating.

25 All the above-mentioned indices were calculated for 193 UN member states, however, to save space in the resulting tables, we will consider only the first fifteen leading countries. All calculations were performed for each year in the interval from 2010 to 2020.

26 Integral indices for the first group of indicators are shown in Table 2. Numerical values are dimensionless values of the main component calculated in the process of factor analysis and further normalized in relation to the worldwide average level. Tables 4, 6, 8, 10, 11, 13 were created in a similar way. So, we see how the integral index of the corresponding group of indicators for a particular country correlates to the average values of all states. In other words, the value of the index for Qatar in 2020 should be understood as the excess of natural resources per capita by 52.67 times relative to the world average.

27 Table 2. Integral indices of the first group of indicators ("Resources") for 15 leading countries

Countries	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
1. Qatar	61,89	59,57	58,96	57,45	56,65	55,79	55,30	54,71	53,99	53,61	52,67
2. Kuwait	30,00	28,63	28,08	26,78	26,36	25,94	25,35	24,93	24,68	24,48	24,42
3. UAE	11,65	11,53	11,65	11,72	12,10	12,37	12,39	12,36	12,32	12,47	12,39
4. Venezuela	3,90	6,98	7,17	9,50	9,70	9,85	9,94	10,20	10,50	10,74	10,71
5. Saudi Arabia	9,06	8,95	9,04	8,87	8,91	8,90	8,85	8,78	8,70	8,64	8,68
6. Libya	7,44	7,72	7,86	8,01	8,25	8,32	8,34	8,33	8,28	8,22	8,18
7. Turkmenistan	5,56	5,85	6,21	6,36	6,53	6,69	6,79	6,84	6,84	6,82	6,81
8. Brunei	5,96	6,16	6,47	6,57	6,75	6,90	6,03	5,44	5,46	5,46	5,40
9. Switzerland	5,10	5,06	4,75	4,63	4,49	4,45	4,82	5,06	4,91	4,79	4,76
10. Canada	4,26	4,25	4,33	4,31	4,40	4,46	4,39	4,37	4,35	4,26	4,25
11. Iraq	3,45	3,39	4,13	3,97	3,98	4,03	3,93	3,85	4,04	3,94	3,87
12. Iran	2,96	3,03	3,52	3,63	3,77	3,86	3,88	3,87	3,87	3,84	3,80
13. Norway	2,83	2,54	2,59	2,69	2,87	2,85	2,71	2,92	3,05	3,06	2,95
14. Kazakhstan	2,16	2,18	2,31	2,36	2,47	2,58	2,68	2,79	2,87	2,97	2,95
15. Russia	1,76	1,88	2,01	2,20	2,31	2,43	2,57	2,70	2,79	2,89	2,84

28 We should note that when calculating the integral group index for the indicators used to calculate the components of national power [7]– "Natural resources" – but not normalized per capita, the results were very different and the first two places were taken by the USA and Russia, respectively.

29 The countries listed in Table 2 are exporters of oil and gas (including Brunei), and due to their small population they are among the richest and wealthiest countries in the world. Turkmenistan possesses the super-giant gas field Galkynysh, and when normalized to the number of inhabitants, it also raises the country's rating according to the index under consideration, and Switzerland's entry into this list is explained by large reserves of gold. As for Russia, it is in 15th place, although the level of its provision with natural resources is gradually increasing. On the one hand, this is due to an increase in gold reserves, and on the other one - due to a decrease in the population. So, Russia, being one of the richest countries in the world in terms of the gross aggregate of resources (here you can also include diamonds and rare earth elements), is no longer such in terms of per capita indicators, although it exceeds the world average level by 2.84 times.

30 Below we will present data on weight coefficients for the first group of indicators, based on which we can conclude that the influence of the indicator "gold reserves" is gradually increasing, while values of the component "proven oil reserves" are decreasing. This component, nevertheless, currently makes the greatest contribution when calculating group indices (Table 3).

31 Table 3. Weight coefficients of the first group of indicators

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Gold reserves	0,152	0,152	0,143	0,142	0,138	0,139	0,152	0,161	0,158	0,162	0,161
Natural gas reserves	0,414	0,414	0,419	0,419	0,421	0,422	0,417	0,413	0,414	0,413	0,414
Oil reserves	0,435	0,435	0,438	0,439	0,44	0,44	0,432	0,427	0,427	0,425	0,425

32 Integral indices of the second group of indicators are shown in Table 4.

33 Japan's first place in this group is due to its leadership in steel production, as well as due to its high place in terms of "GDP per capita by PPP". Moreover, the annual volume of steel production in China is almost 10 times higher than in Japan, but when this indicator is normalized per capita, the situation changes in the opposite direction. Luxembourg, Singapore, the USA, Qatar, the Netherlands and Sweden are among the leading countries in terms of "GDP per capita by PPP", which largely provides high places in terms of the group index.

34 Despite the fact that Russia is noticeably inferior to the leading countries in terms of almost all components of this group (for example, in terms of GDP per capita calculated by purchasing power parity it takes 51st place, in terms of value added created in industrial production it is 47th, in food security - 71st, and 46th in terms of the share of the economically active population), but due to the production of steel and grain Russia's positions are quite high.

35 Table 4. Integral indices of the second group of indicators ("Economy and production") for 15 leading countries

Countries	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
1. Japan	2,76	2,69	2,87	3,12	3,09	3,03	3,15	3,08	2,97	2,97	2,95
2. The Republic of Korea	2,26	2,42	2,58	2,65	2,74	2,74	2,81	2,81	2,75	2,83	2,82
3. Luxembourg	2,93	2,82	2,74	2,78	2,77	2,73	2,81	2,72	2,66	2,76	2,78
4. China	1,95	2,02	2,18	2,43	2,41	2,42	2,51	2,57	2,59	2,72	2,74
5. Canada	2,61	2,48	2,59	2,70	2,50	2,61	2,62	2,58	2,52	2,56	2,55
6. Germany	2,44	2,43	2,51	2,61	2,61	2,59	2,64	2,63	2,49	2,52	2,52
7. USA	2,43	2,30	2,30	2,40	2,39	2,31	2,40	2,38	2,36	2,45	2,45
8. Russia	2,03	2,12	2,17	2,28	2,32	2,32	2,43	2,43	2,32	2,40	2,38
9. Sweden	2,39	2,36	2,33	2,40	2,43	2,46	2,56	2,54	2,30	2,38	2,38
10. Czech Republic	2,31	2,37	2,28	2,40	2,48	2,47	2,58	2,32	2,33	2,32	2,33
11. Qatar	2,61	2,93	2,95	2,93	3,00	2,83	2,76	2,72	2,68	2,26	2,29
12. Australia	2,60	2,48	2,39	2,21	2,21	2,20	2,23	2,41	2,15	2,19	2,19
13. Netherlands	2,00	2,01	2,08	2,12	2,13	2,14	2,19	2,13	2,07	2,13	2,15
14. Finland	2,14	2,13	2,11	2,12	2,15	2,16	2,25	2,19	2,12	2,06	2,06
15. Singapore	1,91	1,94	1,96	1,90	1,96	1,94	1,97	2,01	2,01	2,05	2,05

36 Now let's consider weight coefficients for the second group of indicators calculated in the process of factor analysis (Table 5). As you can see, the indicator "GDP per capita" has the maximum weight, but at the same time the influence of the indicator "steel production" increases.

37 Table 5. Weight coefficients of the second group of indicators

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
GDP per capita, purchasing power parity	0,223	0,221	0,227	0,232	0,231	0,227	0,229	0,228	0,224	0,224	0,224
Industry (including construction), value added (% of GDP)	0,105	0,119	0,125	0,116	0,121	0,134	0,113	0,114	0,135	0,117	0,118
Steel production (tons per person)	0,146	0,149	0,158	0,166	0,167	0,164	0,166	0,167	0,160	0,170	0,171
Cereal production (tons per person)	0,128	0,110	0,099	0,100	0,100	0,098	0,100	0,099	0,093	0,099	0,098
Food imports (% of merchandise imports)	0,189	0,188	0,179	0,174	0,171	0,171	0,184	0,188	0,186	0,188	0,188
Population ages 15-64 (% of total population)	0,210	0,214	0,212	0,212	0,210	0,205	0,208	0,204	0,202	0,202	0,201

38 Table 6 shows integral indices of the third group, which includes a large set of indicators that comprehensively consider the standard of living of the population. The first fifteen places were taken by countries with high values of life expectancy and low rates of unemployment, various types of mortality, homicide, harmful emissions, as well as with a minimal income gap between the rich and the poor. As you can see, according to the final values, the countries are located very tightly.

39 Table 6. Integral indices of the third group of indicators ("Living standards of the population") for 15 leading countries

Countries	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
1. Norway	1,273	1,266	1,267	1,264	1,262	1,255	1,254	1,251	1,248	1,249	1,250
2. Switzerland	1,277	1,272	1,270	1,268	1,265	1,256	1,257	1,253	1,248	1,249	1,250
3. Sweden	1,277	1,271	1,269	1,267	1,264	1,255	1,253	1,249	1,245	1,245	1,246
4. Iceland	1,281	1,275	1,275	1,271	1,266	1,256	1,251	1,247	1,244	1,244	1,245
5. Netherlands	1,268	1,262	1,260	1,259	1,255	1,247	1,244	1,240	1,236	1,237	1,238
6. Ireland	1,262	1,254	1,254	1,253	1,251	1,243	1,241	1,238	1,233	1,235	1,236
7. Finland	1,256	1,252	1,253	1,253	1,251	1,245	1,242	1,238	1,234	1,235	1,236
8. Malta	1,267	1,258	1,254	1,256	1,252	1,243	1,240	1,237	1,232	1,233	1,235
9. Luxembourg	1,258	1,255	1,251	1,252	1,251	1,242	1,243	1,240	1,234	1,235	1,235
10. The Republic of Korea	1,249	1,243	1,242	1,242	1,240	1,235	1,238	1,237	1,232	1,233	1,234
11. Austria	1,260	1,254	1,253	1,252	1,249	1,240	1,239	1,236	1,232	1,233	1,234
12. Israel	1,260	1,254	1,252	1,251	1,249	1,241	1,239	1,236	1,232	1,233	1,234
13. Italy	1,266	1,259	1,257	1,257	1,254	1,242	1,241	1,236	1,231	1,232	1,234
14. Spain	1,262	1,256	1,257	1,258	1,252	1,242	1,239	1,235	1,231	1,232	1,233
15. Denmark	1,255	1,252	1,251	1,250	1,247	1,241	1,238	1,235	1,230	1,231	1,233

40 Weight coefficients for the third group are shown in Table 7. To the maximum extent the final places of countries are determined by such factors as "life expectancy at birth", "mortality rates of adult population aged 15-60 per 1000 adult men and women", "infant mortality rate".

41 Table 7. Weight coefficients of the third group of indicators

2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
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1. Unemployment, total (% of total labor force)	0,027	0,020	0,009	0,004	0,008	0,013	0,025	0,034	0,042	0,045	0,046
2. The ratio of incomes of 10% of the most and 10% of the poorest population	0,086	0,085	0,087	0,089	0,090	0,087	0,087	0,088	0,088	0,088	0,090
3. Life expectancy at birth, total (years)	0,148	0,150	0,150	0,150	0,149	0,149	0,145	0,141	0,140	0,139	0,138
4. Mortality rate, infant (per 1,000 live births)	0,129	0,131	0,132	0,132	0,131	0,132	0,129	0,126	0,124	0,123	0,123
5. Mortality rate, adult, male (per 1,000 male adults)	0,143	0,144	0,145	0,145	0,145	0,145	0,141	0,138	0,137	0,136	0,135
6. Mortality rate, adult, female (per 1,000 female adults)	0,144	0,145	0,146	0,145	0,144	0,145	0,142	0,138	0,137	0,137	0,137
7. Mortality from CVD, cancer, diabetes or CRD between exact ages 30 and 70 (%)	0,098	0,099	0,099	0,099	0,098	0,106	0,105	0,102	0,101	0,100	0,099
8. Mortality caused by road traffic injury (per 100,000 people)	0,119	0,121	0,121	0,120	0,119	0,119	0,119	0,116	0,115	0,114	0,114
9. Intentional homicides (per 100,000 people)	0,074	0,070	0,074	0,078	0,074	0,067	0,073	0,082	0,081	0,082	0,084
10. CO2 emissions (kg per purchasing power parity \$ of GDP)	0,031	0,034	0,037	0,037	0,042	0,038	0,034	0,035	0,035	0,036	0,035

42 Next, we will consider integral indices of financial indicators related to the fourth group (Table 8). As expected, the leaders are Switzerland, Japan, the USA and China. Their high places are determined by the high level of lending to the private sector from domestic sources, market capitalization of domestic companies and money supply (as a percentage of GDP).

43 Table 8. Integral indices of the fourth group of indicators (“Economic indicators”) for 15 leading countries

Countries	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
1. Switzerland	3,82	3,96	4,23	4,59	4,49	4,60	4,25	4,49	4,48	4,49	4,43
2. Japan	3,46	3,63	3,64	3,97	3,89	3,98	3,76	3,99	4,02	4,09	4,02
3. USA	3,06	3,16	3,21	3,55	3,57	3,42	3,33	3,54	3,52	3,29	3,24
4. China	2,88	2,85	2,91	3,02	3,14	3,38	3,25	3,25	3,15	3,23	3,23
5. Singapore	3,51	3,74	3,93	3,93	3,94	3,66	3,40	3,54	3,50	3,15	3,11
6. The Republic of Korea	2,85	2,97	3,02	3,01	2,97	3,00	2,90	3,08	3,10	2,94	2,90
7. Australia	2,72	2,64	2,60	2,65	2,68	2,75	2,82	2,85	2,78	2,76	2,73
8. New Zealand	2,06	2,13	2,19	2,27	2,32	2,42	2,45	2,46	2,54	2,51	2,48
9. Norway	2,09	2,02	2,01	2,05	2,03	2,10	2,23	2,31	2,30	2,31	2,29
10. Great Britain	2,87	2,71	2,64	2,55	2,27	2,15	2,16	2,21	2,24	2,22	2,19
11. Qatar	1,46	1,51	1,45	1,50	1,70	2,04	2,11	1,97	2,03	2,16	2,14
12. Denmark	2,27	2,21	2,22	2,14	2,09	2,03	1,95	1,95	1,94	1,90	1,88
13. UAE	1,60	1,39	1,35	1,57	1,65	1,87	1,93	1,88	1,84	1,77	1,76
14. Sweden	1,64	1,68	1,77	1,80	1,74	1,66	1,69	1,75	1,75	1,76	1,75
15. Brazil	1,58	1,60	1,64	1,58	1,55	1,51	1,57	1,57	1,69	1,73	1,72

44 In turn, weight coefficients for the fourth group are given in Table 9, among which the indicator “lending to the private sector from domestic sources” has the greatest weight. The factor "money supply (as a percentage of GDP)" also has a significant impact.

45 Table 9. Weight coefficients of the fourth group of indicators

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Domestic credit to private sector (% of GDP)	0,288	0,293	0,303	0,319	0,299	0,294	0,294	0,302	0,295	0,296	0,297
Market capitalization of listed domestic companies (% of GDP)	0,238	0,247	0,240	0,257	0,249	0,264	0,233	0,254	0,255	0,249	0,244
Broad money (% of GDP)	0,250	0,264	0,258	0,276	0,264	0,265	0,257	0,247	0,244	0,269	0,275
Inflation, consumer prices (annual %)	0,224	0,196	0,198	0,149	0,187	0,177	0,216	0,196	0,206	0,186	0,185

46 Table 10 includes values of integral indices of the fifth group, according to which the global superiority of the USA is obvious, however, it noticeably decreased over the period under review. A twofold increase in China's power also calls attention to itself. It has already been said above that the armed forces of UN member states were considered only through the prism of military expenditures and the number of personnel of the armed forces, and such an important component as nuclear weapon was not taken into account due to the impossibility of obtaining correct results of factor analysis. In addition, the use of this type of weapon is seen as a last resort neutralizing other components of national security.

47 Table 10. Integral indices of the fifth group of indicators (“Armed forces”) for 15 leading countries

Countries	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
1. USA	82,73	79,27	76,32	71,22	67,87	69,31	70,20	68,23	69,55	69,56	68,30
2. China	13,71	15,37	17,54	20,03	22,34	24,89	25,27	25,66	26,80	27,60	27,80
3. India	5,46	5,53	5,26	5,28	5,67	5,96	6,63	7,27	7,13	7,25	7,22
4. Russia	6,96	7,83	9,08	9,84	9,42	7,72	8,10	7,49	6,58	6,63	6,61
5. Saudi Arabia	5,36	5,41	6,30	7,46	8,99	10,14	7,45	7,93	7,24	6,30	6,29
6. France	7,32	7,20	6,69	6,95	7,08	6,44	6,71	6,80	6,84	6,11	6,07
7. Germany	5,48	5,36	5,18	5,11	5,13	4,63	4,86	5,11	5,30	5,22	5,02
8. Great Britain	6,88	6,72	6,52	6,33	6,59	6,26	5,63	5,23	5,36	5,32	5,27
9. Japan	6,48	6,77	6,69	5,46	5,22	4,90	5,44	5,11	5,00	4,95	4,85
10. The Republic of Korea	3,34	3,45	3,56	3,82	4,18	4,25	4,31	4,41	4,62	4,47	4,27
11. Brazil	4,03	4,12	3,79	3,66	3,63	2,86	2,83	3,30	2,98	2,75	2,48
12. Italy	3,79	3,77	3,32	3,34	3,08	2,58	2,93	2,98	2,98	2,73	2,53
13. Australia	2,75	2,96	2,92	2,76	2,87	2,80	3,09	3,12	2,86	2,64	2,51
14. Canada	2,29	2,38	2,28	2,06	1,99	2,09	2,08	2,40	2,32	2,26	2,25
15. Turkey	2,13	1,93	2,00	2,08	1,98	1,85	2,09	2,01	2,03	2,08	2,09

48 Integral indices of the sixth group of indicators are shown in Table 11. When calculating the national power component, the leaders are China and Germany, however, the use of normalized indicators significantly corrects the results. So, the Republic of Korea, Switzerland and Austria are in the first positions of the current list due to high values by all three considered components of this group of factors.

49 Table 11. Integral indices of the sixth group of indicators (“Science and innovation”) for 15 leading countries

Countries	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
1. The Republic of Korea	7,09	6,81	7,90	7,78	8,36	7,55	7,75	8,07	8,10	8,01	8,01
2. Switzerland	0,00	0,00	8,62	1,77	1,78	8,36	8,41	8,26	8,09	7,71	7,69
3. Austria	4,44	6,73	4,52	7,74	4,70	7,57	7,77	7,63	7,49	7,41	7,46
4. Israel	3,47	7,95	8,58	6,84	7,00	6,53	6,83	6,88	7,03	6,66	6,64

5. Germany	6,53	6,20	6,90	6,57	7,06	6,52	6,70	6,73	6,65	6,49	6,55
6. Luxembourg	9,11	7,51	7,25	7,04	7,58	6,88	6,76	6,60	6,37	6,21	6,19
7. Iceland	0,00	7,24	2,86	6,06	4,02	6,63	6,88	6,87	6,77	6,03	6,01
8. France	6,73	5,77	6,42	6,16	6,39	5,71	5,74	5,65	5,55	5,37	5,39
9. Czech Republic	4,90	4,50	5,44	5,43	5,88	5,20	5,00	5,23	5,11	5,28	5,26
10. Denmark	9,35	7,96	5,60	5,40	5,49	5,32	5,66	5,58	5,70	5,20	5,25
11. Sweden	5,30	7,35	5,06	5,54	5,52	5,20	5,46	5,62	5,75	5,16	5,14
12. Japan	6,09	5,51	5,69	5,65	5,93	5,22	5,22	5,25	5,31	4,95	4,94
13. Great Britain	4,87	4,43	4,64	4,75	5,04	4,71	4,72	4,63	4,58	4,56	4,57
14. Finland	6,90	6,07	6,13	5,73	5,60	4,92	4,80	4,84	4,94	4,36	4,33
15. Singapore	5,47	5,02	5,13	5,05	5,27	1,76	1,80	1,75	1,79	4,25	4,23

50 As for weight coefficients for the sixth group, they are approximately equal (Table 12).

Table 12. Weight coefficients of the sixth group of indicators

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Researchers in R&D (per million people)	0,346	0,344	0,346	0,342	0,348	0,342	0,343	0,344	0,345	0,344	0,343
Technicians in R&D (per million people)	0,316	0,317	0,306	0,319	0,310	0,322	0,321	0,320	0,320	0,318	0,318
Research and development expenditure (% of GDP)	0,337	0,339	0,348	0,339	0,342	0,336	0,336	0,335	0,335	0,338	0,339

51 And, finally, let us present the final results of calculating integral indicators of national security obtained by the convolution of the above group indices (Table 13). As you can see, there are two clear leaders in the world - the United States of America and China, but at the same time values of the integral indicators of the USA are gradually decreasing, while China strengthened by approximately 1.86 times over the period under review. It should also be noted that two countries - India and Russia, which are ranked third and fourth in terms of national power, respectively, look completely different from the standpoint of national security. So, Russia is in 12th place, and India is in 31st (not among the leaders). Russia in 2018 was in the 12th place, although in 2013-2014 it was the tenth. This decline is largely due to the fall in the indicators of the groups "living standards of the population" and "science and innovations".

52 In general, almost all countries - world leaders in terms of the integral value of the national security index - are balanced across almost the entire set of indicators under consideration, so their presence in the top 15 during a number of years is quite stable.

53 Table 13. Integral indicators of national security for 15 leading countries

Countries	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
1. USA	11,44	10,97	10,70	10,76	10,57	10,25	10,49	10,40	10,58	10,60	10,59
2. China	3,21	3,39	3,73	4,24	4,59	4,78	4,89	5,00	5,13	5,91	5,96
3. The Republic of Korea	3,27	3,27	3,58	3,60	3,79	3,61	3,67	3,80	3,81	3,82	3,77
4. Switzerland	3,65	3,67	3,72	3,78	3,78	3,71	3,68	3,70	3,64	3,49	3,47
5. Japan	3,66	3,56	3,66	3,66	3,67	3,46	3,53	3,54	3,51	3,28	3,28
6. Germany	3,19	3,08	3,26	3,22	3,33	3,13	3,22	3,28	3,24	3,14	3,05
7. France	3,36	3,10	3,22	3,23	3,30	3,06	3,09	3,15	3,11	2,95	2,88
8. Great Britain	3,00	2,82	2,85	2,92	2,94	2,76	2,80	2,86	2,62	2,61	2,60
9. Luxembourg	3,39	2,94	2,88	2,82	2,89	2,72	2,74	2,70	2,61	2,60	2,55
10. Austria	2,46	2,46	2,50	2,66	2,68	2,59	2,66	2,64	2,57	2,50	2,51
11. Canada	2,94	2,74	2,75	2,72	2,71	2,67	2,61	2,61	2,56	2,44	2,44
12. Russia	2,77	2,81	2,81	2,73	2,88	2,62	2,62	2,63	2,55	2,43	2,43
13. Sweden	2,44	2,84	2,38	2,49	2,49	2,39	2,49	2,53	2,51	2,41	2,41
14. Israel	2,69	2,71	2,87	2,51	2,56	2,46	2,46	2,47	2,48	2,39	2,39
15. UAE	1,80	1,92	1,85	1,96	2,13	2,47	2,52	2,46	2,45	2,36	2,34

54 To make the picture complete, we will also present values of weight coefficients for group indices. As you can see, the indicators of the second group – "economy and production", which remain approximately at the same level, have the greatest impact. The second most important component is the group index "science and innovation", which also remains stable. The weight of the group "standard of living" noticeably decreased due to the increase in the group "armed forces" (Table 14).

55 Table 14. Weight coefficients for six groups of indicators

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Group 1 "Resources"	0,054	0,059	0,060	0,058	0,060	0,066	0,065	0,063	0,063	0,061	0,060
Group 2 "Economy and production"	0,233	0,229	0,227	0,229	0,230	0,228	0,228	0,229	0,228	0,232	0,232
Group 3 "Living standard of the population"	0,202	0,205	0,200	0,198	0,195	0,193	0,193	0,191	0,191	0,193	0,194
Group 4 "Financial indicators"	0,197	0,196	0,197	0,194	0,192	0,196	0,196	0,197	0,198	0,197	0,197
Group 5 "Armed forces"	0,107	0,107	0,107	0,115	0,117	0,112	0,113	0,115	0,115	0,112	0,112
Group 6 "Science and innovation"	0,207	0,204	0,209	0,205	0,207	0,205	0,205	0,206	0,205	0,205	0,205

56 Next, we will consider threshold values for all factors of national security considered in the paper. If the value of a specific indicator is not included in the range determined by the minimum and maximum values among the group of 15 leading countries, then, on the one hand, this means going beyond the threshold allowed within the selected cluster of countries, and on the other one, a clear threat to national security (Table 15).

57 Table 15. Threshold values of the indicators used in the study

Indicator	Minimum and maximum among 15 leading countries
Group 1 – "Resources"	
Gold reserves (tons per million people)	min: 0,0 max: 121,3 (Switzerland)
Natural gas reserves (million cubic feet per person)	min: 0,0 max: 22,0 (UAE)
Oil reserves (thousand barrels per person)	min: 0,0 max: 10,0 (UAE)
Group 2 – "Economy and production"	
GDP per capita, purchasing power parity (current international \$)	min: 17 287,1 (China) max: 113 990,1 (Luxembourg)
Industry (including construction), value added (% of GDP)	min: 11,3 (Luxembourg) max: 46,2 (UAE)
Steel production (tons per person)	min: 33,1 (Israel) max: 786,3 (Japan)
Cereal production (tons per person)	min: 0,001 (UAE) max: 1,568 (Canada)
Food imports (% of merchandise imports)	min: 4,32 (Switzerland) max: 12,1 (Luxembourg)

Population ages 15-64 (% of total population)	min: 59,4 (Japan) max: 84,1 (UAE)
Group 3 – “Living standard of the population”	
Unemployment, total (% of total labor force)	min: 2,97 (Japan) max: 9,48 (Canada)
The ratio of incomes of 10% of the most and 10% of the poorest population	min: 7,6 (Sweden) max: 18,0 (USA)
Life expectancy at birth, total (years)	min: 72,7 (Russia) max: 84,2 (Japan)
Mortality rate, infant (per 1,000 live births)	min: 1,8 (Japan) max: 8,8 (China)
Mortality rate, adult, male (per 1,000 male adults)	min: 58,2 (Switzerland) max: 138,3 (USA)
Mortality rate, adult, female (per 1,000 female adults)	min: 32,3 (The Republic of Korea) max: 81,9 (USA)
Mortality from CVD, cancer, diabetes or CRD between exact ages 30 and 70 (%)	min: 7,8 (The Republic of Korea) max: 17,0 (China)
Mortality caused by road traffic injury (per 100,000 people)	min: 2,7 (Switzerland) max: 18,2 (China)
Intentional homicides (per 100,000 people)	min: 0,2 (Japan) max: 5,3 (USA)
CO2 emissions (kg per purchasing power parity \$ of GDP)	min: 0,075 (Switzerland) max: 0,593 (China)
Group 4 – “Financial indicators”	
Domestic credit to private sector (% of GDP)	min: 65,4 (Israel) max: 187 (USA)
Market capitalization of listed domestic companies (% of GDP)	min: 29,9 (Austria) max: 260,9 (Switzerland)
Broad money (% of GDP)	min: 59,1 (Russia) max: 252 (Japan)
Inflation, consumer prices (annual %)	min: 0,363 (Switzerland) max: 4,47 (Russia)
Group 5 – “Armed forces”	
Military expenditure (current USD)	min: 0,429 (Luxembourg) max: 731,7 (USA)
Armed forces personnel, total	min: 2,000 (Luxembourg) max: 2 875,6 (China)
Group 6 – “Science and innovation”	
Researchers in R&D (per million people)	min: 1379,6 (China) max: 8250,4 (Israel)
Technicians in R&D (per million people)	min: 519,5 (Japan) max: 3166,0 (Luxembourg)
Research and development expenditure (% of GDP)	min: 0,990 (Russia) max: 4,95 (Israel)

⁵⁸ In our previous work we noted that, firstly, the modern world is becoming more and more multipolar (on the one hand, the countries of the "collective West" headed by the leader - the USA, on the other hand - China trying to expand its orbit involving its neighbors in global projects like "one belt, one road"), and secondly, the fundamental issue is the effective use of their national power from the standpoint of strengthening sovereignty and national security [7].

⁵⁹ In this regard, it seems appropriate to compare the indicators of national power and national security. Table 16 shows the corresponding correlation coefficients between the integral indices of the mentioned aggregates.

⁶⁰ Table 16. Coefficients of correlation between the integral indicators of national power and national security of 193 UN member states

2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
0,780	0,764	0,760	0,771	0,779	0,766	0,773	0,770	0,775	0,756	0,757

⁶¹ It is noteworthy that the USA and China are leading in both ratings, while Russia, being the fourth most powerful country (until recently it was the third), is no longer among the top ten countries in terms of national security. So, the existing potential does not always mean the effectiveness of its management, as evidenced by the obtained coefficients, which demonstrate an average dependence.

⁶² **Forecasting**

Now let us turn to the final part of the work - forecasting national security for the medium term. Please note that the main purpose of the article was to describe the methodology for assessing integral indicators of national security and their calculation for the entire period for which official statistics is available. However, the study would be incomplete without a forecast for the future using the calculated weights for the factors we selected.

⁶³ To predict variables of the economic and financial blocks, we will use a simulator of social economic dynamics for more than 100 countries of the world (SED model) developed by IT company Guangzhou Milestone Software Co., Ltd with the support of the National Supercomputer Center of China and the Chinese Academy of Social Sciences into a single software and analytical complex [4, 5]. As for the indicators related to science and innovation, armed forces, and mortality, we extrapolate the ten-year trends we track.

⁶⁴ So, we will calculate national security indicators of 193 countries of the world until 2025 depending on the most likely scenario of world dynamics from our point of view.

⁶⁵ The scenario was described in detail in the article [7]. It is based on the assumption that in the medium term the regionalization of global production chains, as well as the redistribution of trade flows between key trading partners and the escalation of multipolarity will continue to increase. The scenario envisages a gradual transfer of production capacities from China partly to the USA and EU countries, but also in order to minimize costs to developing countries (India, Brazil, Mexico, etc.). Specifically, in the model we will consider the following events until 2025: (1) gradual reduction in the trade imbalance between the United States of America and China by 5% per year; (2) increased trade between the USA and EU countries on the one hand and India, Vietnam, Mexico and Brazil on the other hand. Trade is expected to grow with an average growth rate of 5% per year; (3) increase in domestic demand in China by 6% per year; (4) increase in the share of APR countries in the total volume of oil and oil products exports in Russia up to 40% by 2025.

⁶⁶ There are a lot of output parameters in the simulator, but as the results we will present the calculated values of national security indices for 15 leading countries (Table 17). Such indicators as GDP, CPI, etc. are more susceptible to market changes, therefore, from our point of view, complex indicators that simultaneously cover many aspects of socio-ecological and economic systems are of greater interest.

⁶⁷ As we can see, the national security indicators for the USA and a number of European countries (Switzerland, Austria, France, Luxembourg), Russia, Canada and Japan decreased slightly, which is associated not only with changes in global trade chains, but also with processes associated with depopulation and aging of the population. In turn, China is significantly reducing the gap with the USA.

⁶⁸ Table 17. Integral indicators of national security for 15 leading countries for 2020 and 2025

Countries	2020	2025
1. USA	10,59	10,31

2. China	5,96	6,65
3. The Republic of Korea	3,77	3,84
4. Switzerland	3,47	3,25
5. Japan	3,28	3,13
6. Germany	3,05	3,06
7. France	2,88	2,87
8. Great Britain	2,60	2,65
9. Luxembourg	2,55	2,46
10. Austria	2,51	2,45
11. Canada	2,44	2,42
12. Russia	2,43	2,34
13. Sweden	2,41	2,46
14. Israel	2,39	2,35
15. UAE	2,34	2,40

⁶⁹ Table 18 shows the final ranking of 15 leading countries (the values indicate the rank of the country in terms of the integral indicator as compared to other states).

⁷⁰ Table 18. Ranking by the value of the integral index of national security for 15 states - world leaders

	2020	2025
USA	1	1
China	2	2
The Republic of Korea	3	3
Switzerland	4	4
Japan	5	5
Germany	6	6
France	7	7
Great Britain	8	8
Luxembourg	9	9
Austria	10	11
Canada	11	12
Russia	12	15
Sweden	13	10
Israel	14	14
UAE	15	13

⁷¹ Six states have changed their position in the ranking - Austria, Canada, Russia, Sweden, the United Arab Emirates, and Russia is much behind all of them. This is a consequence of downward trends in mortality, quality of life, and regression in science and innovation. The UAE and Sweden noticeably improved their positions. In general, the list of 15 leading countries in terms of national security remained unchanged.

⁷² We would like to note that in the future much will depend on the dynamics of force majeure factors (pandemic, international conflicts, etc.), as well as emerging trends related to reducing the carbon footprint under the Paris Agreement [12].

⁷³

General conclusions

1) The use of methods of multivariate statistical analysis made it possible to assess the weights of national security factors for all UN member states and eliminate the problem of subjectivity that inevitably arises in the course of expert assessment.

⁷⁴

2) The conducted research can complement national security strategies of world countries in terms of:

- The clarification of the set of used indicators;
- The methods for calculating the integral indicator, which allows comparing the level of national security of different states;
- Determination of ranges of permissible values for the indicators, violation of which entails increased risks not only in the relevant areas, but also at the level of the entire socio-ecological and economic sphere of a particular country.

⁷⁵ 3) Comparison of national power and national security indicators showed that the management of the available potential in all countries is not always effective. 4) The weights calculated for the indicators used in the methodology made it possible to forecast integral national security indices for 193 UN member states for the medium term.

⁷⁶

5) The current geopolitical configuration and the existing system of economic ties in the medium term will continue to strengthen China and weaken the USA. In general, we would like to note that there is a high probability that there will be no drastic changes in the global geopolitical situation.

Примечания:

2. Center for Strategic and International Studies that works on orders of the US government

3. >>>>

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National security of countries all over the world

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Abstract

The article continues the study “Modeling and Assessment of National Power of Different Countries all over the World” dedicated to the calculation of *national* power indicator. It is currently the most informative and popular indicator in the world that integrally characterizes the aggregate potential of a particular country and at the same time allows comparing the level of its power and socio-economic development with other countries. The research results were published in the article “Modeling and Assessment of National Power of Different Countries all over the World”.

If national power of the state, in fact, determines its potential capabilities and gross indicators are mainly used for the calculation, then national security indicators are calculated on the basis of normalized values (as a rule, per capita) and indicate the level of development of one or another component of the social-ecological-economic system of the country, as well as the efficiency of using the existing potential.

In this article we will calculate national security indicators of UN member states using the methods of multivariate statistical analysis. Moreover, we will estimate threshold values for all national security factors considered herein. The last part of the paper will contain a forecast of national security for the medium term.

Keywords: national security, geographical characteristics, natural resources, population and labour, environmental indicators, armed forces, science and innovation, factor analysis, integrated index, multivariate statistical analysis

Date of publication: 16.09.2021

Citation link:

Makarov V., Wu J., Bakhtizin A., Wu Z., Sushko E., Khabriev B. National security of countries all over the world // Artificial societies. 2021. Vol. 16. Issue 3. URL: <https://artsoc.jes.su/s207751800016011-1-1/> DOI: 10.18254/S207751800016011-1