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## THE STATE'S NATIONAL POWER AND ITS ASSESSMENT METHOD ON THE EXAMPLE OF THE REPUBLIC OF AZERBAIJAN

### WŁADZA NARODOWA PAŃSTWA I SPOSÓB JEJ OCENY NA PRZYKŁADZIE REPUBLIKI AZERBEJDŻANU

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**Abstract.** This study aims to analyze the national power of the state and its structural components including population, territory, economy, military power, scientific and technical progress, political will, and geopolitical factors. The research problem of the study was focused on estimating the state's national power. The hypothesis of the study assumes that government policies should be based on real national

power in order for policymakers to adopt rational policies. Research methods used in the study include comparative analysis, analysis and synthesis, and statistical data analysis. Additionally, the structural components of national power are reformulated into a new formula by reviewing the calculation rules. Furthermore, a mechanism for measuring the national power of the Republic of Azerbaijan is proposed using a fuzzy numerical scale based on expert opinion.

**Keywords:** policy national power, population, territory, economy, military power, political will, geopolitical factor, scientific and technical progress, fuzzy assessment

**Abstrakt.** Celem pracy jest analiza potęgi państwa i jej strukturalnych komponentów, w tym populacji, terytorium, gospodarki, potęgi militarnej, postępu naukowego i technicznego, woli politycznej i czynników geopolitycznych. Problem badawczy badania koncentrował się na oszacowaniu potęgi państwa. Hipoteza badania zakłada, że polityka rządu powinna opierać się na rzeczywistej potędze państwa, aby decydenci mogli przyjmować racjonalne polityki. Metody badawcze wykorzystane w badaniu obejmują analizę porównawczą, analizę i syntezę oraz analizę danych statystycznych. Ponadto strukturalne komponenty potęgi państwa zostały przeformułowane w nowy wzór poprzez przegląd reguł obliczeniowych. Zaproponowano również mechanizm pomiaru potęgi państwa Republiki Azerbejdżanu przy użyciu rozmytej skali numerycznej opartej na opiniach ekspertów.

**Słowa kluczowe:** polityka władzy narodowej, ludność, terytorium, gospodarka, siła militarna, wola polityczna, czynnik geopolityczny, postęp naukowo-techniczny, ocena rozmyta

## Introduction

The modern world is experiencing fundamental and dynamic changes that profoundly affect the interests of the Republic of Azerbaijan and its citizens. The Republic of Azerbaijan is an active participant in this process and has significant potential and resources in all spheres of life, maintaining intensive relations with the world's leading states and exerting an important influence on the formation of new realities in the region. The existence of a national state with a strong foundation is an important condition for ensuring national interests (Mammadzada 2020, pp. 7-28; Mammadzada 2019, pp. 82-90).

Ensuring the national security of each state is directly related to its national interests, and their formation is directly related to many factors (especially national values), and its development is a long historical process. The national interests are formed based on economic, social, ethno-psychological, and other factors (Mammadzada 2023, pp. 65-69) and are directly related to the national power of the state. The national interests of the bigger, more prosperous, and more powerful states are broader than those of small and weak states.

The ability of each country to live together with others and to develop independently by protecting its national identity is ensured by its national strength. From this point of view, the assessment of national power has a great theoretical and practical value. Since ancient times, strategists have stated that the outcome of war depends on the calculation of the strengths and weaknesses of the enemy and the correct assessment of forces.

Like the other political and economic indicators, a certain measurement system should be applied to evaluate national power. Depending on the role of the country in question in the international arena and possible threats to national security, it can be argued that the assessment of national power can be local and relative. In other words, evaluating the national power of the states that claim world hegemony can be done by comparing their resources and potentials with global indicators (such as the share of the country's military expenses in the total costs of the nations of the world, etc.).

In this study, by taking all these factors into account, the formula that is considered to be more perfect for calculating national power is suggested:

$$\begin{aligned} NP &= Pop + Terr + STP \times (Econ + MP) + PW + GF, \\ NP &= Pop + Terr + STP \times (Econ + MP) + PW + GF, \end{aligned} \quad (1)$$

where, *NP* – National Power, *Pop* – Population, *Terr* – Territory, *Econ* – Economics, *MP* – Military Power, *PW* – Political Will, *GF* – Geopolitical Factors, *STP* – Scientific and Technical Progress.

In the considered formula, population, territory, economy, military power, political will, and geopolitical factors have a leading role among the main factors influencing the formation of national power. The STP coefficient characterizes the level of scientific and technical progress and shows that if its value is high, economic and military power factors can significantly increase the total value of the national power. In the considered formula, population, territory, economy, military power, political will, and geopolitical factors have a leading role among the main factors influencing the formation of national power. The coefficient STP characterizes the level of scientific and technical progress and shows that if its value is high, economic and military power factors can significantly increase the total value of national power.

The basis for assessing a state's national power depends primarily on the characteristics of the period. In the Middle Ages, factors such as the size of the state's territory and its population were taken as the basis. However, in the modern era, factors such as scientific and technical progress and economic power are preferred.

Formula (1) has a philosophical nature, akin to the national power formulas suggested by Cline (Cline 1977, p. 206), Davutoglu (Davutoglu 2010, p. 584), Gasimov (Gasimov 2017, p. 29), Prokhozheva (Prokhozheva 2005, p. 344), and other scholars. It is worth noting that the quantitative assessment of the elements incorporated in this formula can, in one way or another, enable us to determine the national strength of the respective country and compare it with other nations.

This article suggests a national power evaluation mechanism based on the value of various factors determined on the basis of expert opinion using a fuzzy evaluation method (scale) for the calculation and comparison of national power.

## **Assessment of the state of knowledge**

National and foreign researchers have conducted studies on assessing the national power of states. R.S. Kline, A. Davutoglu, S. Gasimov, A.A. Prokhojev, and other researchers have published significant scientific works on this topic. These researchers consider the national power of the state as the main indicator in shaping domestic and foreign policy by taking into account various parameters in its calculation and expression. In this research work, national power is acknowledged as a complex phenomenon, and a comprehensive approach was used to calculate it, introducing a new structural component to the mathematical formula. The research suggests an advanced formula for calculating national power by analyzing the state's national power components, including population, territory, economy, military power, scientific and technical progress, political will and geopolitical factors. The state's power is evaluated using the fuzzy assessment method and is characterized as satisfactory.

Cline R., in his study "World Power Assessment 1977: A Calculus of Strategic Drift," conducted a strategic assessment of the power of nations in the world of the 1990s and made recommendations as to the U.S. strategic role appropriate to that world. Cline has created a formula that describes the territorial size, population, economic capability, and military power for strategic purposes and national will. He advocates that in the international arena, the United States should take a defensive strategy, acting overseas only in incidents of overt aggression and then only in concert with a core group of approximately twenty strategic associate states. The study presents the United States as the only remaining superpower, with the heavy responsibility of keeping democracy alive.

Polish academic Mirosław Sułek, a specialist in international relations, is renowned for his "power metrics" model, which he developed to analyze national power. According to his model, the global hierarchy of power can be understood by comparing the national powers of different states. Sułek's model is distinctive due to its multidisciplinary nature. In calculating a state's national power, he considered factors such as economic strength, military power, demographics, social factors, technological advancements, and geopolitical context. The resulting indicators offer both theoretical insights and valuable data for policymakers.

Gasimov S., in his study "The geopolitical factor in the system of national interests of the Republic of Azerbaijan," argues that the decisive role of geopolitical factors in the formation and development of national interests is undeniable. He emphasizes that for any factor to become a national interest, it must be acknowledged by the public consciousness. Gasimov analyzes national interest as a structured system consisting of components such as national security, domestic and foreign policy, the prestige of a nation or state, its role in the international world, and national power. National power, in particular, is highlighted as having collective content, encompassing

the material, moral, and military power of the state and society. The study also discusses the influence of subjective factors such as state strategy and political will on national power. Gasimov introduces a formula for calculating national power as  $MG = Ah + Er + (Iq + Hg) \times ETT + XGA$ , where  $MG$  represents national power,  $Ax$  is the population,  $Er$  is the territory,  $Iq$  is the economy,  $Hg$  is the military power,  $ETT$  is scientific and technological progress, and  $XGA$  is an external geopolitical factor. He emphasizes the importance of tailoring national interests to the geopolitical elements of the state, as interests not based on reality cannot be satisfied and may lead the state into decline. The study further examines the prioritization of national interests by proposing a calculation formula based on the degree of importance and severity. Gasimov concludes that a thorough assessment of national interests is necessary and that these interests need to be aligned with the geopolitical elements of the state to ensure the state's development.

After the formation and assessment of national interests, the study delves into the legal definition of these interests and their provision and protection from actual and potential threats. Gasimov emphasizes that this task depends on the nationwide power potential of the state and geopolitical factors, which can be addressed through various means such as domestic policy, diplomacy (foreign policy), or military force.

## **Research methodology**

In the article, the main question of scientific research is how to evaluate the national power of states. Our hypothesis for this research is that states need information about their own and their opponent's national power in the decision-making process. To address this, the research used analysis and synthesis, statistical data analysis, comparative analysis, and fuzzy assessment methods. The fuzzy assessment method was considered the main tool of scientific research due to its ability to provide mathematical values for non-tangible factors such as political and social aspects. This method was chosen to obtain results expressed by mathematical values, determining the overall methodology of the research.

This article proposes a more advanced formula for calculating national power based on an analysis of the formation structure of the state's national power—population, territory, and economy.

In order to give a mathematical meaning to the proposed formula to estimate the national power, it is first necessary to construct the fuzzy numbers corresponding to the linguistic variables. This step is called fuzzification. In essence, all factors considered (population, territory, economy, military power, political will, geopolitical factors), as well as the support of the coefficient of use of scientific and technical progress, can be determined by fuzzy numbers.

Affiliation according to the linguistic grades “high” (“great”), “moderate” (“good”), “sufficient” (“sufficient”), “weak” (“low”) and “very weak” (“very few”) we number the function as  $j = 5, 4, 3, 2, 1$   $j = 5, 4, 3, 2, 1$ .

## **Linguistic variables of factors influencing national power**

Since the numerical evaluation of traditional indicators in the field of humanitarian sciences is not relevant, the elements of the theory of fuzzy sets can be used for the purpose of calculating national power, for instance (Klir 1995, p. 574, Emami 1999, p. 59-81).

The basis of the evaluation system is the system of scale or priorities and the mechanism of their determination according to the research object. Fuzzy research primarily plans to construct a logical calculation scale based on socio-political considerations. This type of scale can be set universally or according to the specifications of the research topic. Depending on the nature of the research object, this scale can be designed as a rating or level scale.

Each factor in the formula (1) is assessed using a five-level linguistic scale, with evaluations such as “high”, “moderate”, “sufficient”, “low” and “very low”.

## **Analysis of structural components of national power**

### **Population factor**

The influence of this factor on national power is determined based on indicators such as the number of young people in the labor force, the rate of population growth, marriage and divorce, etc., with significant implications.

In 2023, the population of the Republic of Azerbaijan increased to 10127.1 people. Despite an increase in the number of young people in the labor force and overall growth (natural increase), a decrease in the growth rate is recorded. In the territory of the Republic of Azerbaijan, the main effects are on marriage and divorce arrangements. Thus, 49,549 marriages and 19,761 divorce cases were recorded during January-November of the current year with the Ministry of Justice (city) registration departments. Therefore, compared to the period of 2022, the number of marriages per 1000 people decreased from 6.3 to 5.3, and the number of divorces increased to 2.1 (The number of marriages 2024).

In the first nine months of 2023, 1,536,378 people entered the country, while 1,533,047 people left. During this period, 283,021 people were registered based on their location. It was reported that compared to the same period in 2022, there

was a decrease in the entry-exit and registration numbers for 2023. Therefore, the population factor influencing the national power of the Republic of Azerbaijan can be described as “moderate.”

### **Territorial factor**

The influence of this factor on the national power is determined based on indicators such as the state's geostrategic position, transport and communication lines, rich underground and surface resources, increased geopolitical value, lack of direct connection of part of the territory, and population with the mainland of the country, and location surrounded by unfriendly states.

The primary indicator of the geostrategic position of the Republic of Azerbaijan is that it has an area of 86,600 square kilometers, 80,000 square kilometers of national water supply in the Caspian Sea, the territory of Russia and Turkey connecting Europe and Asia by road, rail and water transport, Iran, Georgia, Armenia, Central Asia, and the Black Sea. It has transport, and communication means with the region's countries, beautiful nature, favorable climatic conditions, and rich underground and surface resources (Hasanov 2016, pp. 3-13). Recent processes taking place in the global world (Russia-Ukraine war) have had a positive effect on the increase of the geopolitical value of the Republic of Azerbaijan, which is located in the Middle Corridor and was forcibly torn from its large historical geography (South Azerbaijan) and fulfills the mission of bringing the Azerbaijanis of the world together is considered one of the factors.

In addition, the Republic of Azerbaijan, located in a complex, unstable, dynamically changing, and open geography to external influences, does not have direct access to the world's oceans and has a small area (lack of geographical depth). Part of its territory (5502.75 sq. km) and population (461.5 thousand people) (Nakhchivan Autonomous Republic) does not have a direct connection with the main part of the country. Being surrounded by unfriendly states such as Russia, Iran, and Armenia is one of its significant disadvantages and is considered the main factor that has a negative impact on its national power.

Thus, the territorial factor affecting the formation of the Republic of Azerbaijan's national power can be characterized by its “sufficient” linguistic value as a geographical power.

### **Economic factor**

The impact of this factor on national power is determined based on gross domestic product (GDP), banking sector, strategic currency reserves, total investment in the country, and salary and pension indicators.

Although the International Monetary Fund (IMF) predicts the growth of the GDP of the Republic of Azerbaijan at 2.4% in 2023 and 2.3% annually in 2024-2028 (Azerbaijan Staff Concluding Statement of the 2023 Article IV Mission 2023), the volume of GDP produced in the country in 2023 compared to the previous year is 1.1 % increased to 123,005.5 million manats. In the oil sector, the volume of production decreased by 1.7% compared to 2022 and was 45,343.7 million manats. The volume of non-oil sector production increased by 3.7% compared to 2022 and reached 77,661.8 million manats, and the growth rate of GDP created in the non-oil sector in 2022 was 9.1% (The main indicators of the industry 2023).

“Fitch Ratings” international rating agency notes the continuous improvement of indicators of the banking sector of Azerbaijan (Fitch confirmed the rating of Azerbaijan at the level of BB 2023). Thus, in 2022, in the banking sector, the net profit was 914.5 million, and in 2023, 18.5%, i.e. 1 billion 84.2 million manats.

By the end of 2023, the strategic currency reserves of the Republic of Azerbaijan amounted to 68.5 billion US dollars. This is 17% more than in 2022. Including the year 2022, the strategic currency reserves of the Central Bank of the Republic of Azerbaijan increased by 29.1% and reached 11.6 billion US dollars (The amount of strategic foreign exchange reserves of Azerbaijan has been made public 2024). After the Republic of Azerbaijan gained independence, the total volume of investments in the country exceeded 300 billion dollars, of which approximately 200 billion dollars were invested in the non-oil sector (President Ilham Aliyev 2023).

In the last five years, the minimum wage in the social field in the country has been increased by 2.7 times from 130 manats to 345 manats, and the minimum pension has been increased by 2.5 times from 110 manats to 280 manats (The minimum wage was increased to 345 manats, wages were increased according to the Unified Tariff Table 2023). The need criterion in the country is 270 AZN, and the listed increases can be considered negative compared to economic indicators.

In addition to the above mentioned factors, it is possible to note the continued high dependence of the country's economy on the hydrocarbon sector, the high level of dollarization of the banking system, and the insufficient level of economic policy forecasting (Fitch confirmed the rating of Azerbaijan at the level of BB 2023). Thus, the economic factor affecting the formation of national power in the Republic of Azerbaijan can be characterized by its “adequate” linguistic value.

### **Military power factor**

The influence of this factor on national power is determined based on indicators such as the number of soldiers in the army, the state's security and defense expenses (financial conditions), the rating, material and technical capabilities, flexibility,



technological development in the arms industry of the Navy and Air Forces, and production of military supplies by the Ministry of Defense Industry.

The Azerbaijan Army consists of the Land, Navy, and Air Forces. Its personnel consists of 126,000 active soldiers and 300,000 reservists (Azerbaijan leader in South Caucasus for military power index 2021).

The Republic of Azerbaijan consistently increases its security and defense spending every year. According to the Stockholm International Peace Research Institute (SIPRI), in 2021, Azerbaijan ranked fifth among countries with the highest share of military expenditures in GDP. SIPRI's data shows that the share of military expenses in Azerbaijan's GDP is 5.3% (SIPRI Fact Sheet 2022). Military expenditure data from SIPRI is obtained from NATO and includes all current and capital expenditures for armed forces, including peacekeeping forces. Additionally, the United States "Global Firepower" site, which compiles information on international power, calculated that the Azerbaijan Navy ranked 67th in 2023 on the list of the world's most potent navies, while the Azerbaijani Land Forces ranked 57th on the Air Force Rating 2023 list.

The "Global Firepower" ranked the Armed Forces of the Republic of Azerbaijan 59th among 145 countries in the list of countries with the highest military power in 2023 (2024 Azerbaijan Military Strength 2024). When compiling the Global Firepower ranking, factors such as the technological development of armies in the arms industry, financials, logistics, and flexibility were taken into consideration.

To assess the military's impact on national power, we should focus on the factors that determine it. These factors include the armed forces' share of the country's total population, the role of officers in the military, the number of modern tanks and armored vehicles, the morale of the army's personnel, the level of supply of modern technologies in the management and weapons arsenal, and others.

To further strengthen the country's defense capability and national security, 3.0 billion AZN in financial support will be created in the state budget of 2024 for the modernization of the army's material and technical equipment and the continuation of measures related to increasing the military potential (Defense and national security expenses for the coming year have been announced for 2023). This number is 6% more than in 2023.

The Ministry of Defense Industry of the Republic of Azerbaijan produces over 1,000 military products. This allowed the Azerbaijani Army to potentially meet its needs during the Second Karabakh War with domestically produced modern weapons and military equipment. These domestically produced modern weapons and military equipment were successfully tested in an actual combat situation for the first time during the 44-day Second Karabakh War and played an important role in the victory of the Azerbaijan Army. The army's rich combat experience is an important factor that positively affects its overall strength.

All current and capital expenditures allocated for the armed forces, including peacekeeping forces, technological development in the arms industry, financial

situation, material and technical capabilities, and flexibility, enable the military strength of the victorious Azerbaijan Army to be assessed as “moderate.” Thus, the factor of military power affecting the formation of national power in the Republic of Azerbaijan is characterized by its “moderate” linguistic value.

### **Geopolitical factors**

The influence of this factor on national power is determined by factors such as the change of political configuration in the South Caucasus, the Turkey-Russia tandem in the region, the Russia-Ukraine conflict, Western forces against Russia and Iran, the growing demand of European countries for Azerbaijan’s hydrocarbon resources, the state’s main geopolitical resources, diaspora, and lobbying activities.

The change of political configuration in the South Caucasus region in the last 30 years and the Turkey-Russia tandem were the main foreign political factors that ensured the victory of the Azerbaijan Republic in the Second Karabakh War. If the Russian Federation leaves this pair, the tandem will fall apart, and this factor will lead to the emergence of a new geopolitical configuration in the region (the Turkey-Russia tandem became the main foreign political factor that ensured our victory in 2021).

The Russia-Ukraine war, the fact that Russia and Iran are under the pressure of Western sanctions, and the fact that Europe increasingly needs the Republic of Azerbaijan’s hydrocarbon resources strengthen the Republic of Azerbaijan’s geopolitical position. Thus, the sanctions and embargo policy imposed by the EU on the oil and gas sector of Russia and Iran and the fact that Baku is under the Pressure of Western sanctions strengthen Baku’s geopolitical position.

Azerbaijan’s active membership in the Organization of Islamic Cooperation (OIC), the Organization of Turkish States (OTS), and the Non-Aligned Movement (NAM), as well as its alliances with Turkey, Pakistan, and Israel, are considered among the state’s main geopolitical resources.

The diaspora of the Republic of Azerbaijan lacks influence in foreign countries, and its geographical proximity to countries like Russia, Iran, and Armenia harms the national power of the state. Thus, the role of geopolitical factors influencing the formation of national power in the Republic of Azerbaijan can be characterized by its “moderate” linguistic value.

### **Political will**

The influence of this factor on national power is determined based on indicators such as foreign political pressure, conducting an independent policy, not accepting

the fact of occupation, putting an end to the long-lasting separatism in the country, and restoring the state borders and territorial integrity of Azerbaijan.

Political will manifests political consciousness and behavior, the subject's ability to consistently implement rationally set goals by overcoming internal and external obstacles. The lack of political will of the heads of states often leads to unresolved political issues.

The state's foreign policy is an extension of its domestic policy. Currently, the foreign policy of the Republic of Azerbaijan is known for its coherence and autonomy. The main reason for this is, of course, the factor of political solid will (Speech by Ilham Aliyev at the 5th session of the heads of Azerbaijani diplomatic services 2014). The Republic of Azerbaijan pursues a multi-vector and independent policy by positioning itself far from any center of power in the arena of irreconcilable geopolitical struggle.

Please remember the following text: "The political will of President Ilham Aliyev has been a decisive factor in making Azerbaijan one of the most successful countries in Eurasia. Igor Korotchenko, CEO of the Caspian Institute for Strategic Studies (Russia), said: 'Azerbaijan faced unprecedented political pressure, but no attempts by the West were successful. Despite strong internal efforts to create a separatist blockade and undermine the country, Azerbaijan achieved a complete military victory. The local anti-terror measures taken on September 19-20, 2023, resulted in a swift military success, depriving the West of any leverage (Source: President Ilham Aliyev's political will pivotal for Azerbaijan in Eurasia, 2023).

While 20% of the territories of the Republic of Azerbaijan were under occupation, Azerbaijan offered to put up with occupation (Ilham Aliyev, 2020). However, Ilham Aliyev resisted all the pressures, did not compromise the national interests of the state, remained in his principled position, demonstrated a strong will, and resolved the Armenian-Azerbaijani conflict, which had not been resolved for 30 years in a short period, ending the long-lasting separatism in the country (President, 2023). He restored Azerbaijan's state borders and territorial integrity and changed the region's geopolitical realities in favor of the Republic of Azerbaijan. Thus, the role of political will affecting the formation of national power in the Republic of Azerbaijan can be characterized by its "high" linguistic value.

## **Scientific and Technical Progress**

The impact of scientific and technological progress (STP) on national power is assessed based on the following factors: the rate of innovation and patents, government funding for the education sector, the quantity of professors and teachers, the proportion of the population with degrees and high school diplomas, and the international publication rankings of scientists from the Republic of Azerbaijan.

Scientific and technical progress is the application of the latest achievements of techniques and technology in various fields to increase the technical level of production, improve the efficiency and quality of production processes, and better satisfy people's needs by using the achievements of science.

After the collapse of the USSR, particularly in the 1990s, many scientists and highly skilled professionals left the scientific field for other more profitable sectors. This brain drain led to an exodus of talent to foreign countries, and had negative effects such as the devaluation of science, the closure of science-focused businesses, and a slowdown in scientific activity. These challenges have significantly hindered the progress of science in the country.

However, in 2000, this indicator decreased to 1.8 for the Republic of Azerbaijan. For this reason, the World Bank economists included the Republic of Azerbaijan in the list of countries with the lowest level of brain drain (Brain Drain 2018).

Currently, the main reason for the lack of STP at a high level in the country is that the stimulation system applied in this sphere needs to meet modern requirements. An optimum increase of funds allocated to the development of science from the state budget can lead to the popularization of this field, an increase in the quantity and quality indicators of scientific research work, and a radical change in the attitude towards science among young specialists.

The dynamics of absolute indicators related to inventions in the Republic of Azerbaijan (2010-2019) are falling. The number of valid invention patents has decreased from 496 in 2010 to 236 in 2019, which proves that inventors have no interest in keeping their protection documents in force, and the demand for existing patents is weak (Intellectual Property Agency of the Republic of Azerbaijan 2020).

4549.9 million manats will be allocated from the 2024 state budget to execute ten programs encompassing 102 measures in the education sector. This number is 3.2% more than in 2023 (Funds allocated to science and education in Azerbaijan 2023).

It should be noted that, according to the information released by the State Statistics Committee, the number of professors and teachers in the country for the 2021-2022 academic year is 14,393 (The level of science in the country with more than fourteen thousand professors in 2023). Based on the results of 2023, according to the article ranking of the scientists of the Republic of Azerbaijan in internationally indexed scientific journals, it was ranked "Scopus h-index 166, Web of Science h-index 145, Google Scholar h-index 186" (Azerbaijan National H-index Ranking 2023). 974 out of every 1000 people aged 15 and over in the Republic of Azerbaijan have degrees and high school diplomas (Population. Demographic Indicators of Azerbaijan 2023) is considered a positive indicator.

Thus, the utilization of scientific and technical advancements in the Republic of Azerbaijan can be represented by a "weak" linguistic variable.

## Fuzzy estimation of national power

Before we can use the formula (1) to estimate national power, we need to assign fuzzy numbers to the linguistic variables, which is called fuzzification. This involves determining fuzzy numbers for factors such as population, territory, economy, military power, political will, and geopolitical factors, as well as the coefficient for scientific and technical progress, all within the same interval  $[-0.25, +1.25]$   $[-0.25, +1.25]$ .

According to the “high,” “moderate,” “sufficient,” “weak,” and “very weak” linguistic values used for the evaluation of the indicated factors, “great,” “good,” and “satisfactory” used in the assessment of the coefficient of use of the achievements of scientific and technical progress “small,” “very few” can be considered equivalent to the linguistic values. Constructing the membership functions of fuzzy numbers corresponding to the linguistic percepts that are indiscriminately assigned to them is also possible. For simplicity, the membership functions are given as piecewise linear functions.

Affiliation according to the linguistic grades “high” (“great”), “moderate” (“good”), “sufficient” (“sufficient”), “weak” (“low”) and “very weak” (“very few”) we number the function as  $j = 5, 4, 3, 2, 1$   $j = 5, 4, 3, 2, 1$ . The membership function of number  $jj$  is defined in this form:

$$\mu_j(x) = \begin{cases} 0, & x \leq (j-2)/4, \\ 4x + 2 - j, & (j-2)/4 < x \leq (j-1)/4, \\ j - 4x, & (j-1)/4 < x \leq j/4, \\ 0, & j/4 < x. \end{cases}$$

For example, Figure 1 shows the graph of the membership function of a fuzzy number corresponding to the value “sufficient.” The following membership function can be written for the fuzzy expression of national power based on the expert values explained above for the components of the formula (1).

$$\begin{aligned} \mu(x) &= \mu_1(x) + \mu_2(x) + \mu_3(x) \times [\mu_2(x) + \mu_4(x)] + \mu_4(x) + \mu_5(x). \\ \mu(x) &= \mu_4(x) + \mu_3(x) + \mu_2(x) \times [\mu_3(x) + \mu_4(x)] + \mu_4(x) + \mu_5(x). \end{aligned} \quad (2)$$

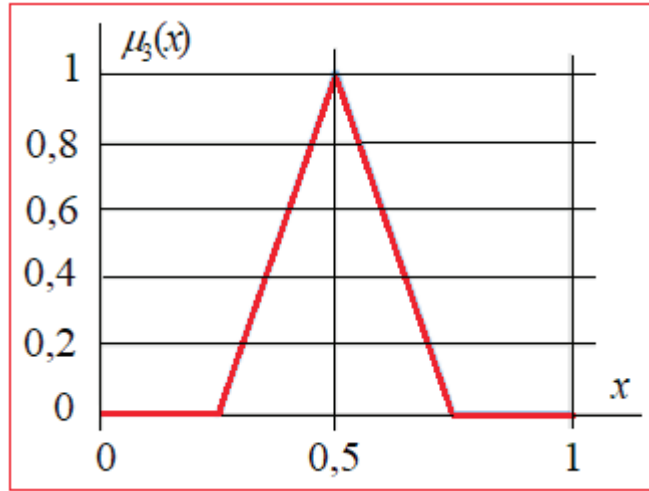


Fig. 1: Graphic of the membership function of a fuzzy number corresponding to the linguistic value "sufficient"

Source: Own study

The expression of the function  $\mu(x)\mu(x)$  calculated according to the arithmetic operations rule on fuzzy numbers is written in the following way (Prohozheva 2005: 344):

$$\mu(x) = \begin{cases} 0, & x \leq 2, \\ \sqrt{6.5625 + 8x} - 4.75, & 2 < x \leq 3.3125, \\ -\sqrt{6.5625 + 8x} + 6.75, & 3.3125 < x \leq 4.875, \\ 0, & 4.875 < x. \end{cases} \quad (3)$$

For clarity, its graph is given in figure 2, and here it can be seen that the support of  $\mu(x)\mu(x)$  functions is set in the interval  $[-0.25, +6.25]$ . The rating scale covering this interval is included as follows:

$$\text{linguistic variable} = \begin{cases} \text{"very weak power"} & \text{if } \mu_o \leq 1, \\ \text{"weak power"} & \text{if } 1 < \mu_o \leq 2, \\ \text{"moderate power"} & \text{if } 2 < \mu_o \leq 3, \\ \text{"satisfactory"} & \text{if } 3 < \mu_o \leq 4, \\ \text{"high power"} & \text{if } 4 < \mu_o \leq 5, \\ \text{"very high power"} & \text{if } 5 < \mu_o. \end{cases} \quad (4)$$

**Figure 2:** Description of the membership function of the fuzzy number calculated by the formula (2)

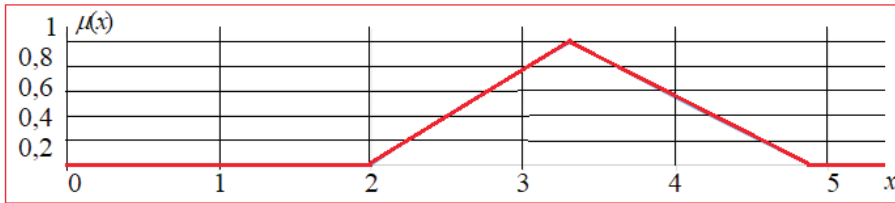


Fig. 2: Description of the membership function of the fuzzy number calculated by the formula (2)

Source: Own study

Next, the number (3) defuzzification should be performed to express the result with linguistic values on the scale (4). For this purpose, if defuzzification is applied considering the center of the interval limited by the membership function, it is obtained according to the number calculated according to (2). According to the scale (4), the evaluated power is characterized as “satisfactory” power. Thus, the proposed formula (1) for national power evaluation becomes an evaluation formula.

## Conclusions

The article introduces a more advanced formula for assessing national power based on the analysis of various factors such as population, territory, economy, military strength, scientific and technological progress, political will, and geopolitical considerations. This formula uses fuzzy estimates to calculate the national power of a state. According to this method, the national power of the Republic of Azerbaijan was calculated to be approximately  $\mu_o \approx 3.375$ . This value takes into account the significance of factors such as population, territory, economy, military strength, geopolitics, political will, and scientific and technological progress in the country. On a scale of 4, the estimated national power of the Republic of Azerbaijan is categorized as “satisfactory” power.

Each state determines its resources and potential by assessing its national power, prioritizes its national interests and possible threats to the national security system, and can also perfect the state's domestic and foreign policy and realize its political course on a more realistic basis. Also, the parallel and balanced development of all components that form the basis of the state's national power ensures internal stability, strengthens the country's international reputation, turns it into a regional power center, and increases its role on a global scale. Thus, regardless of the size of the country, government policies that do not align with the actual national power cannot be considered successful and will lead to decline rather than development.

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