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Presentation date: Juny, 2024
Date of acceptance: October, 2024
Publication date: December, 2024

ANALYSIS AND ASSESSMENT OF THE NATIONAL POWER OF THE REPUBLIC OF AZERBAIJAN

ANÁLISIS Y VALORACIÓN DEL PODER NACIONAL DE LA REPÚBLICA DE AZERBAIYÁN

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Suggested citation (APA, seventh ed.)

Alasgarli, E., Rustamov, A., Mammadzada, V., Gasimov, S., & Islamov, I. (2024). Analysis and assessment of the national power of the republic of Azerbaijan. ***Universidad y Sociedad, 16***(S2), 322-330.

ABSTRACT

The national power assessment is very important in the development of state policy and international relations because it influences directly the strategic decisions and global positioning of the country. Although there are some models for calculating national power, comprehensive frameworks considering both traditional components and modern factors like scientific progress are still lacking, at least for emerging nations. In this paper, an improved formula of the calculation of national power is developed and applied to the Republic of Azerbaijan. Structural components such as population, territory, economy, military power, scientific and technical progress, political will, and geopolitical factors are analyzed in the paper. The research introduces a new measurement mechanism that combines fuzzy number scaling based on expert opinions. Our work demonstrates that the use of fuzzy assessment techniques in national power calculation is viable and therefore offers a more accurate assessment methodology. The model proposed quantify both the tangible and intangible aspects of national power and hence provide an integral assessment tool.

Keywords: National power, Geopolitics, Scientific and technical progress, Fuzzy assessment.

RESUMEN

La evaluación del poder nacional es muy importante para el desarrollo de la política estatal y las relaciones internacionales porque influye directamente en las decisiones estratégicas y el posicionamiento global del país. Aunque existen algunos modelos para calcular el poder nacional, aún faltan marcos integrales que consideren tanto los componentes tradicionales como los factores modernos como el progreso científico, al menos para las naciones emergentes. En este artículo, se desarrolla y aplica una fórmula mejorada para el cálculo del poder nacional en la República de Azerbaiyán. En el artículo se analizan componentes estructurales como la población, el territorio, la economía, el poder

militar, el progreso científico y técnico, la voluntad política y los factores geopolíticos. La investigación introduce un nuevo mecanismo de medición que combina una escala de números difusos basada en opiniones de expertos. El trabajo demuestra que el uso de técnicas de evaluación difusa en el cálculo del poder nacional es viable y, por lo tanto, ofrece una metodología de evaluación más precisa. El modelo propuesto cuantifica tanto los aspectos tangibles como los intangibles del poder nacional y, por lo tanto, proporciona una herramienta de evaluación integral.

Palabras clave: Poder nacional, Geopolítica, Progreso científico y técnico, Evaluación difusa.

INTRODUCTION

The modern world is experiencing fundamental and dynamic changes that deeply 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. 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), as their development is a long historical process. The process of forming national interests is based on economic, social, ethno-psychological, and other factors (Mammadzada & Imamverdiyev, 2023) and is directly related to the state's national power. The national interests of larger, richer, and more powerful states are broader and more comprehensive than those of small and weak states.

A country's ability to coexist with others while developing independently and protecting its national identity is determined by its national strength. From this perspective, the assessment of national power has great theoretical and practical value. Since ancient times, strategists have maintained that the outcome of war depends on calculating the enemy's strengths and weaknesses and correctly assessing forces. As with other political and economic indicators, a specific measurement system should be applied to evaluate national power. Based on the role played by the country under consideration in the world arena and possible threats to national security, the assessment of national power can be local and relative in nature. In other words, evaluating the national power of states that claim world hegemony can be done by comparing their resources and potential with global indicators (such as the share of a country's military expenses in the total expenses of countries worldwide).

In this study, by taking all these factors into account, Equation 1 is proposed for calculating national power, 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 play leading roles among the main factors influencing the formation of national power. The coefficient STP characterizes the level of scientific and technical progress and indicates that when its value is high, economic and military power factors can significantly increase national power.

$$NP = Pop + Terr + STP \times (Econ + MP) + PW + GF$$

The assessment of a state's national power depends primarily on the characteristics of the historical period. For example, in the Middle Ages, factors such as the size of the state's territory and its population were considered fundamental, whereas in the modern era, factors such as scientific and technical progress and economic power are given greater emphasis. Equation (1) has a philosophical character, similar to the national power formulas proposed by Cline (1977), Davutoglu (2010), Gasimov (2017), Prohozheva (2005), and other scientists. It should be noted that the numerical evaluation of the components included in this formula can enable the calculation of a country's national strength and its comparison with other countries. Thus, this article proposes a national power evaluation mechanism based on various factors determined through expert opinion, using a fuzzy evaluation method (scale) for calculating and comparing national power. Since the numerical evaluation of traditional indicators in the humanitarian sciences is not always applicable, elements of fuzzy set theory can be used to calculate national power (Emami et al., 1999; Klir & Yuan, 1995).

The evaluation system is based on a system of scales or priorities and the mechanism for determining them according to the research object. Fuzzy research primarily aims to construct a logical calculation scale based on socio-political considerations. This type of scale can be set either universally or according to specific research requirements. Depending on the nature of the research object, this scale can be designed as either a rating or level scale. Each factor included in Equation (1) is evaluated using five linguistic levels: "high," "moderate," "sufficient," "low," and "very low."

DEVELOPMENT

Analysis of structural components of national power

Population factor

The influence of demographic factors on national power is determined based on indicators such as the number of young people in the labor force, population growth rate, and marriage and divorce rates. In 2023, the population of the Republic of Azerbaijan increased to 10,127,100 people. Despite an increase in both the number of young people in the labor force and overall population (natural increase), a decrease in the growth rate has been recorded. Within the Republic of Azerbaijan, significant changes have been observed in marriage and divorce patterns. During January-November of the current year, the Ministry of Justice (city) registration departments recorded 49,549 marriages and 19,761 divorces. Compared to 2022, the number of marriages per 1,000 people decreased from 6.3 to 5.3, while the number of divorces increased to 2.1 (Agayev, 2024).

During the first nine months of 2023, 1,536,378 people entered the country, and 1,533,047 people left. During this period, 283,021 people registered their place of residence. According to available information, the entry-exit and registration indicators for the country in 2023 decreased compared to the corresponding period of 2022 (Nakhchivan News, 2023). Based on these factors, the population component affecting the formation of the Republic of Azerbaijan's national power can be characterized as having a "moderate" linguistic value.

Territorial factor

The influence of territorial factors on national power is determined by indicators such as the state's geostrategic position, transport and communication networks, natural resources (both underground and surface), geopolitical value, territorial connectivity with the mainland, and the presence of neighboring states' relations. The Republic of Azerbaijan's geostrategic position is characterized by its 86,600 square kilometers of land area and 80,000 square kilometers of national waters in the Caspian Sea. The country connects Europe and Asia through road, rail, and water transport networks with Russia, Turkey, Iran, Georgia, Armenia, Central Asian countries, and the Black Sea region. It possesses diverse natural landscapes, favorable climatic conditions, and abundant natural resources (Hasanov, 2016). Recent global developments (such as the Russia-Ukraine war) have enhanced the Republic of Azerbaijan's geopolitical value, particularly due to its position along the Middle Corridor. The country's role in uniting the global Azerbaijani population, despite historical separation from South Azerbaijan, is considered a significant factor.

However, the Republic of Azerbaijan faces several geographical challenges. It is situated in a complex, unstable region that is susceptible to external influences and lacks direct access to the world's oceans. The country has limited geographical depth due to its relatively small area. Additionally, the Nakhichevan Autonomous Republic (5,502.75 square kilometers with 461,500 people) lacks direct territorial connection with Azerbaijan's mainland. The presence of potentially challenging relationships with neighboring states such as Russia, Iran, and Armenia represent strategic vulnerabilities that impact the country's power factor. Based on these geographical considerations, the territorial factor influencing the Republic of Azerbaijan's national power can be characterized as having a "sufficient" linguistic value in terms of geographical power.

Economic factor

The impact of economic factors on national power is determined by indicators including gross domestic product (GDP), banking sector performance, strategic currency reserves, total investment in the country, and salary and pension levels. While the International Monetary Fund (IMF) projects GDP growth for the Republic of Azerbaijan at 2.4% in 2023 and 2.3% annually from 2024-2028 (IMF, 2023), the country's GDP in 2023 increased by 1.1% compared to the previous year, reaching 123,005.5 million manats. The oil sector's production volume decreased by 1.7% compared to 2022, amounting to 45,343.7 million manats. The non-oil sector's production volume increased by 3.7% compared to 2022, reaching 77,661.8 million manats, following a GDP growth rate of 9.1% in the non-oil sector in 2022 (Cabbarov, 2024).

The international rating agency "Fitch Ratings" has noted continuous improvement in Azerbaijan's banking sector indicators (Hasanov, 2023). The sector's net profit increased from 914.5 million manats in 2022 to 1,084.2 million manats in 2023, representing an 18.5% increase. By the end of 2023, the Republic of Azerbaijan's strategic currency reserves reached 68.5 billion US dollars, representing a 17% increase from 2022. The Central Bank of the Republic of Azerbaijan's strategic currency reserves increased by 29.1%, reaching 11.6 billion US dollars (Report News Agency, 2024). Since independence, total investments in the country have exceeded 300 billion dollars, with approximately 200 billion dollars invested in the non-oil sector (AZERTAC, 2023b).

In the social sphere, over the past five years, the minimum wage has increased 2.7 times from 130 manats to

345 manats, while the minimum pension has increased 2.5 times from 110 manats to 280 manats. However, with the current need criterion set at 270 AZN, these increases remain modest relative to overall economic indicators. Notable challenges include the country's continued high dependence on the hydrocarbon sector, significant dollarization of the banking system, and inadequate economic policy forecasting capabilities (Babayev, 2023). Based on these factors, the economic component affecting the Republic of Azerbaijan's national power can be characterized as having a "sufficient" linguistic value.

Military power factor

The influence of military factors on national power is determined by indicators such as military personnel numbers, security and defense expenditures, military branch rankings, material and technical capabilities, operational flexibility, technological development in the arms industry, and domestic military supply production. The Azerbaijan Army comprises Land Forces, Navy, and Air Forces, with 126,000 active personnel and 300,000 reservists (Ismayilova, 2021). The Republic of Azerbaijan consistently increases its security and defense spending annually. According to the Stockholm International Peace Research Institute (SIPRI), in 2021, Azerbaijan ranked fifth among countries with the highest share of military expenditures relative to GDP, with military spending accounting for 5.3% of GDP (Lopes da Silva et al., 2022). SIPRI's military expenditure data, derived from NATO, includes all current and capital expenditures for armed forces, including peacekeeping forces.

According to the United States "Global Firepower" website, which evaluates international military power using multiple criteria, in 2023 the Azerbaijan Navy ranked 67th (əliyeva, 2023) and the Land Forces ranked 57th (Omar, 2023). Overall, the Armed Forces of the Republic of Azerbaijan ranked 59th among 145 countries in 2023 (GFP, 2024). The Global Firepower ranking considers factors such as technological development in the arms industry, financial capabilities, logistics, and operational flexibility. Key factors in assessing military power include the proportion of armed forces to total population, officer composition, modern tank and armored vehicle inventory, troop morale, and technological advancement in command systems and weaponry.

The 2024 state budget allocates 3.0 billion manats for modernizing military equipment and enhancing military potential to strengthen national defense capabilities and security (AZERTAC, 2023a), representing a 6% increase from 2023. The Ministry of Defense Industry of the Republic of Azerbaijan produces over 1,000 types of military products. This domestic production capability significantly supported the Azerbaijani Army during the Second Karabakh War. The successful deployment of domestically produced modern weapons and military equipment during the 44-day conflict, combined with the army's combat experience, has positively impacted overall military strength.

Considering all factors—including military expenditures, peacekeeping forces, technological development, financial resources, material and technical capabilities, and operational flexibility—the military strength of the Azerbaijan Army can be assessed as "moderate." Therefore, the military power factor influencing Azerbaijan's national power can be characterized as having a "moderate" linguistic value.

Geopolitical factors

The influence of geopolitical factors on national power is determined by several elements: the changing configuration of the South Caucasus, the Turkey-Russia dynamic in the region, the Russia-Ukraine conflict, Western pressures on Russia and Iran, increasing European demand for Azerbaijan's hydrocarbon resources, the state's key geopolitical assets, and diaspora and lobbying activities. The transformation of the South Caucasus region's configuration over the past 30 years and the Turkey-Russia partnership were crucial foreign policy factors in the Republic of Azerbaijan's victory in the Second Karabakh War. Should the Russian Federation withdraw from this partnership, the resulting collapse would lead to a new geopolitical configuration in the region (Elgun, 2021).

The Russia-Ukraine war and Western sanctions against Russia and Iran have strengthened Azerbaijan's geopolitical position. The EU's sanctions and embargo policy on Russian and Iranian oil and gas sectors, coupled with Europe's increasing need for Azerbaijan's hydrocarbon resources, has enhanced Baku's geopolitical standing. Azerbaijan's active membership in the Organization of Islamic Cooperation (OIC), the Organization of Turkish States (OTS), and the Non-Aligned Movement (NAM), along with its strategic alliances with Turkey, Pakistan, and Israel, constitute the state's primary geopolitical resources.

However, certain factors negatively affect the state's national power, including the limited effectiveness of Azerbaijan's diaspora in foreign countries and its geographical position surrounded by Russia, Iran, and Armenia. Based on these considerations, the role of geopolitical factors in shaping the Republic of Azerbaijan's national power can be characterized as having a "moderate" linguistic value.

Political will

The influence of political will on national power is determined by indicators such as resistance to foreign political pressure, ability to conduct independent policy, rejection of occupation, elimination of long-standing separatism, and restoration of state borders and territorial integrity. Political will represents a manifestation of political consciousness and behavior—specifically, a subject's ability to consistently implement consciously set goals while overcoming internal and external obstacles. The absence of political will among state leaders often results in unresolved political issues. A state's foreign policy reflects an extension of its domestic policy. Currently, the Republic of Azerbaijan's foreign policy is characterized by unity and independence, primarily due to strong political will (Aliyev, 2014). The Republic maintains a multidimensional and independent political position, remaining distinct from power centers in the world's geopolitical conflicts.

President Ilham Aliyev's political will has been instrumental in establishing Azerbaijan as one of Eurasia's most successful countries. According to Igor Korotchenko, CEO of the Caspian Institute for Strategic Studies (Russia):

Azerbaijan faced unprecedented political pressure, but Western attempts proved unsuccessful. Despite strong internal positions aimed at maintaining separatist pressure and manipulating Baku, the Republic of Azerbaijan achieved a complete military victory. The local anti-terror measures conducted on September 19-20, 2023, which achieved military success in less than 24 hours, eliminated Western pressure leverage in this regard (Korotchenko, 2023).

While 20% of Azerbaijan's territories were under occupation, President Aliyev rejected proposals to accept the occupation (Agaveh, 2020). He withstood all pressures, maintained state national interests, demonstrated unwavering resolve, and resolved the thirty-year Armenian-Azerbaijani conflict in a brief period, ending long-standing separatism in the country (Report News Agency, 2023). His actions restored Azerbaijan's state borders and territorial integrity, transforming regional geopolitical realities in Azerbaijan's favor. Consequently, the role of political will in shaping the Republic of Azerbaijan's national power can be characterized as having a "high" linguistic value.

Scientific and Technical Progress

The influence of scientific and technical progress on national power is determined by several indicators: invention and patent dynamics, state budget allocation to education, the number of professors and teachers, population education levels, and citation metrics of Azerbaijani scientists in international indexed journals. Scientific and technical progress represents the application of latest technological achievements across various fields to enhance production efficiency, improve process quality, and better meet societal needs through scientific advancement.

Following the USSR's collapse (particularly in the 1990s), Azerbaijan experienced significant challenges: scientists and highly qualified specialists shifted to more profitable sectors, brain drain to foreign countries increased, and science-intensive production enterprises either closed completely or partially suspended operations, negatively impacting the country's scientific development. However, by 2000, Azerbaijan's brain drain indicator decreased to 1.8, leading World Bank economists to include Azerbaijan among countries with the lowest brain drain levels (Gurbanov, 2018).

Currently, the primary limitation on high-level scientific and technical progress in the country is an outdated stimulation system. Optimal increases in state budget allocations for scientific development could enhance the field's popularity, improve research quality and quantity, and transform young specialists' attitudes toward science. The dynamics of invention-related indicators in Azerbaijan (2010-2019) show decline. Valid invention patents decreased from 496 in 2010 to 236 in 2019, indicating low inventor interest in maintaining protection documents and weak patent demand (Intellectual Property Agency of the Republic of Azerbaijan, 2020). The 2024 state budget allocates 4,549.9 million manats for implementing 10 programs encompassing 102 educational measures, representing a 3.2% increase from 2023 (Huseynli, 2023).

According to the State Statistics Committee, the country had 14,393 professors and teachers during the 2021-2022 academic year (Abdullayeva, 2023). In 2023, Azerbaijani scientists achieved the following citation metrics: "Scopus h-index 166, Web of Science h-index 145, Google Scholar h-index 186" (NHR, 2024). The fact that 974 out of every 1,000 people aged 15 and over in Azerbaijan have completed full or secondary education (State Statistical Committee of the Republic of Azerbaijan, 2023) represents a positive indicator. Based on these factors, the coefficient of scientific and technical progress achievement in the Republic of Azerbaijan can be characterized as having a "low" linguistic value.

Fuzzy estimation of national power

In order to give mathematical meaning to the proposed Equation (1) for estimating national power, it is first necessary to construct fuzzy numbers corresponding to linguistic variables. This step is called fuzzification. In essence, all considered factors (population, territory, economy,

military power, political will, and geopolitical factors), as well as the coefficient of scientific and technical progress utilization, can be determined by fuzzy numbers given in the same interval..

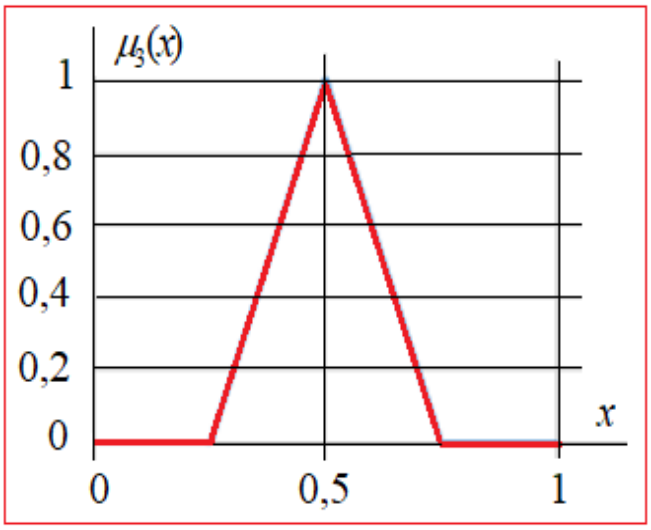
The linguistic values “high”, “medium”, “sufficient”, “weak”, and “very weak” used for evaluating the indicated factors can be considered equivalent to the linguistic values “great”, “good”, “satisfactory”, “small”, and “very few” used in evaluating the coefficient of scientific and technical progress utilization. The membership functions of fuzzy numbers corresponding to these linguistic descriptors can be constructed. For simplicity, these membership functions are represented as piecewise linear functions. The membership functions corresponding to the linguistic grades “high” (“great”), “medium” (“good”), “sufficient” (“satisfactory”), “weak” (“small”), and “very weak” (“very few”) are numbered as j=5,4,3,2,1. The membership function for each number j is defined in this form of Equation 2:

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

For example, Figure 1 shows the graph of the membership function for a fuzzy number corresponding to the value “sufficient”. Based on the expert-assigned values explained above for the components of Equation (1), the membership function (Equation 3) for the fuzzy expression of national power can be written as follows:

$$\mu(x) = \mu_4(x) + \mu_3(x) + \mu_2(x) \times [\mu_3(x) + \mu_4(x)] + \mu_4(x) + \mu_5(x) \quad (3)$$

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



Source: own elaboration.

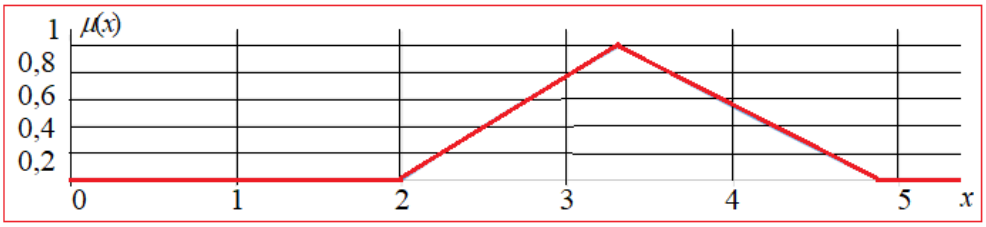
The expression of the function $\mu(x)$ calculated according to the arithmetic operations rule on fuzzy numbers is written in the following way shown in Equation 4 (Prohozheva, 2005):

$$\mu(x) = \begin{cases} 0, & x \le 2, \\ \sqrt{6.5625 + 8x} - 4.75, & 2 < x \le 3.3125, \\ -\sqrt{6.5625 + 8x} + 6.75, & 3.3125 < x \le 4.875, \\ 0, & 4.875 < x. \end{cases} \quad (4)$$

For clarity, its graph is given in Figure 2, and here it can be seen that the support of $\mu(x)$ functions is set in the interval $[-0.25, +6.25]$. The rating scale covering this interval is included as follows (Equation 5):

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

Fig 2. Description of the membership function of the fuzzy number calculated by the Equation (3).

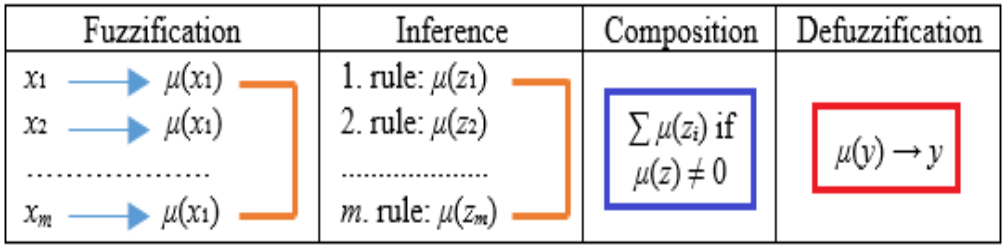


Source: own elaboration.

Next, defuzzification should be performed in order to express the result with linguistic values on the scale (5). For this purpose, if defuzzification is applied considering the center of the interval limited by the membership function, $\mu_o \approx 3.375$ is obtained according to the number calculated according to (3). According to the scale, the evaluated power is characterized as “satisfactory” power.

Thus, the proposed Equation (1) for national power evaluation becomes an evaluation Equation. A decision-making algorithm based on fuzzy logic performs the following process. This process uses several rules simultaneously. The characteristics of the above rules show that the solution can be different or opposite at the same time with classical logic. In practice, this inconsistency can be solved by fuzzy logic. This process is a combination of 4 sub-processes: fuzzification, inference, composition and defuzzification (Mammadova & Suleymanova, 2020). The application diagram of fuzzy logic is described in Figure 3.

Fig 3. Fuzzy logic application diagram.



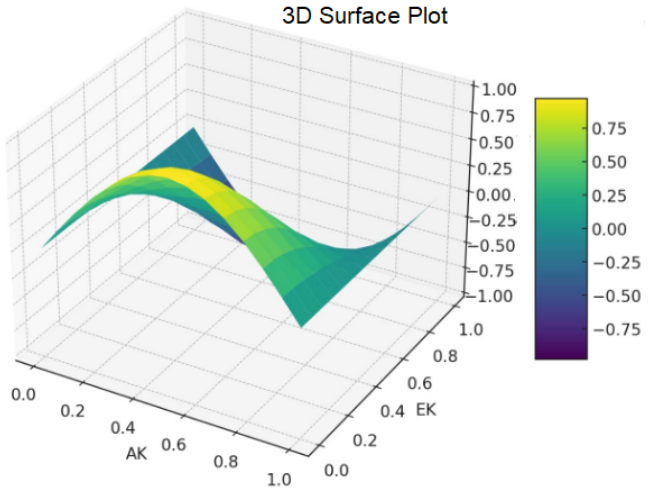
Source: own elaboration.

The Weighted Mean of Maximum method is one of the most widely used methods (Mammadova & Suleymanova, 2020). This method calculates the average of the degree of accuracy with the true values of all applied membership functions reaching their maximum degree. The trapezoidal membership function is considered to be the center of the maximum range. Formally, the weighted average of the maximum result Z (Equation 6), were, n - the number of output results; x_i - degree of severity of the i-th membership function; μ_i - degree of accuracy of the i-th membership function.

$$Z = \frac{\sum_{i=1}^{n} \mu_i x_i}{\sum_{i=1}^{n} \mu_i} \tag{6}$$

The result is visualized in 3D format in Figure 4.

Fig 4. Visualization of results in 3D.



Source: own elaboration.

CONCLUSIONS

This article proposes an advanced equation for calculating national power based on analyzing the structural components of state power: population, territory, economy, military power, scientific and technical progress, political will, and geopolitical factors. Using a fuzzy assessment method, the state's power is characterized as satisfactory in the case of the Republic of Azerbaijan. Each state determines its resources and potential by assessing its national power, prioritizes its national interests and potential threats to its national security system, and can improve its domestic and foreign policies while implementing its political course on a more realistic basis. Furthermore, the parallel and balanced development of all components that form the foundation of state power ensures internal stability, strengthens the country's international reputation, transforms it into a regional power center, and increases its global influence. Therefore, regardless of a country's size, state policy that is not based on realistic national power assessment cannot be sustained and will lead to decline rather than development.

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