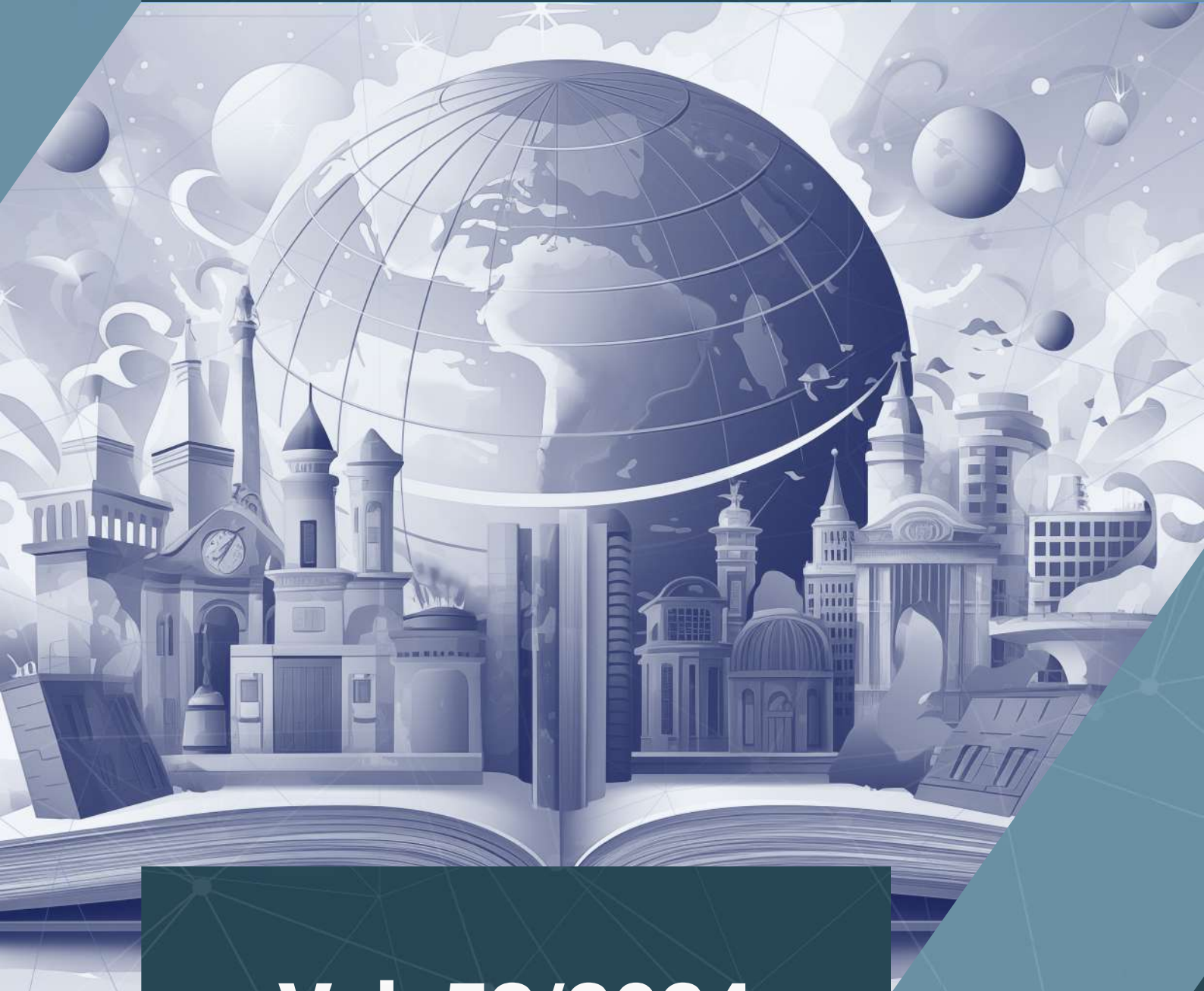




TECHNIUM
SOCIAL SCIENCES JOURNAL



Vol. 53/2024
A New Decade for Social Changes

PLUS
COMMUNICATION P



International
Communication & PR

Indonesia's Potential to Build Nuclear Energy in Geopolitical Perspective

Lilik Muslikhatin¹, Rizal Yusuf², Suhara Golan³, Taufiq Shobri⁴, Wildan Akbar H. R⁵, Yudhi Murfi⁶, I Wayan Midhio⁷, Purnomo Yusgiantoro⁸

Post Graduate Program of Defense Science Doctoral, Republic of Indonesia Defense University.

lilik.muslikhatin@doktoral.idu.ac.id¹, rizal.yusuf@doktoral.idu.ac.id²,
suhara.sidabutar@doktoral.idu.ac.id³, taufiq.shobri@doktoral.idu.ac.id⁴,
wildan.rafsanjani@doktoral.idu.ac.id⁵, yudhi.murfi@doktoral.idu.ac.id⁶,
wayan.midhio@idu.ac.id⁷, purnomoys@gmail.com⁸

Abstract. The use of nuclear weapons in armed conflict has become a major focus in today's geopolitical world. With growing tensions between major powers and ongoing regional conflicts, the debate over the use of nuclear weapons is increasingly heated. In the midst of this global context, Indonesia, as an active member of ASEAN which consistently promotes peace and stability in the region, is faced with major challenges related to the use of nuclear weapons in international conflicts. In this context, the research in this journal aims to examine Indonesia's policies in dealing with the use of weapons. nuclear power in a growing international conflict. This research uses the theories of Situational Leadership and Transformational Leadership to understand Indonesia's potential in developing nuclear weapons. The approach used is qualitative involving in-depth interviews, document analysis, and participant observation. A phenomenological approach is used to understand subjective interpretations from the experts' point of view. The Hierarchical Process Analysis (AHP) data processing method is used to analyze data and support decision making. and it was concluded that Indonesia had no interest or intention to develop or produce nuclear weapons. Political factors, international law, and commitment to world peace provide a strong basis for this country in rejecting the option of developing nuclear weapons.

Keywords. ASEAN, Geopolitics, Indonesia Policy, World Peace, Nuclear Weapons

1. Introduction

The use of nuclear weapons in armed conflict has become a major focus in today's geopolitical world. With growing tensions between major powers and ongoing regional conflicts, the debate on the use of nuclear weapons is heating up. Amidst this global context, Indonesia, as an active member of ASEAN that consistently promotes peace and stability in the region, is faced with major challenges related to the use of nuclear weapons in international conflicts.

Several key events and issues are at the center of this debate, and all have significant implications for Indonesia's foreign policy. These issues include the conflict in Ukraine, tensions in the Middle East between Israel and Hamas, North Korea's efforts to develop a nuclear weapons program, tensions between India and Pakistan, both of which have nuclear weapons, and issues related to Iran's nuclear program. In addition, the AUKUS partnership involving Australia, the United States, and the United Kingdom is also an important issue with a potential major impact on security in the Indo-Pacific region.

As an illustration of the conflict in Ukraine, particularly Russia's involvement in supporting the insurgency in Eastern Ukraine and the annexation of Crimea, has led to speculation about the potential use of nuclear weapons. The views of experts such as Sharikov and Bell provide insight into the implications of this conflict for global stability and diplomacy efforts [1]. Yustiningrum also highlights the importance of understanding the impact of war, especially those involving nuclear weapons [2]. The environmental dimension not only of the Ukrainian state, but of the entire European continent could have been and could be affected by the occupation of the largest Nuclear Power Plant on the territory of Europe, Zaporizhzhia, by the Russian military. At the same time, the environmental dimension not only of the Russian state, but of all the states that are part of the international system could be affected by the nuclear threat rhetoric promoted by the Russian state leaders with the Ukraine war outbreak, with the war evolution and with failures of Russian military actions [3].

In addition, the prolonged conflict between Israel and Hamas has great potential to affect the entire region, including its implications for the nuclear issue. Experts such as Cousens, Kumar, Wermester, and Schreurs provide valuable insights in understanding the dynamics of this conflict. Appleby also adds an important perspective on this issue [4]. Another Middle East Countries is Iran's problem with its nuclear program has also received global attention. Indonesia's decisions related to this issue have an important impact on non-proliferation diplomacy and stability in the Middle East. Perdana, Ramasandi, Setiawan, and Schneider provide expert perspectives in examining the complexity of this issue [6].

Furthermore, North Korea's efforts to build nuclear weapons present its own challenges for several countries. North Korea (North Korea) has been active in efforts to build and improve its nuclear weapons program. These moves by North Korea have caused great concern, especially in terms of the non-proliferation of nuclear weapons in the East Asian region. Colangelo, Hayes, and Perdana, Ramasandi, Setiawan provide an in-depth analysis of this situation, providing different and important views to consider [5]. And in the middle of Asia the ongoing tensions between India and Pakistan, two countries that possess nuclear weapons, are also a source of great concern. These conditions pose a greater risk of conflict escalation, and Indonesia, as a regional country, should consider its role in efforts to prevent this escalation.

In the face of several previous examples, ASEAN has long been committed to the Nuclear-Free Treaty in the ASEAN Zone (SEANWFZ), reflecting its determination to maintain a nuclear-weapon-free region. Indonesia, as a member of ASEAN, has an important role to play in managing nuclear weapons issues and ensuring commitment to the treaty [7]. The House of Representatives (DPR) of the Republic of Indonesia (RI) in Commission I has approved the Draft Law (RUU) related to the Ratification of the Treaty on the Prohibition of nuclear weapons to become a Law (UU). Additionally, the AUKUS partnership involves Australia, the United States, and the United Kingdom, and has major implications for Indo-Pacific security. Australia's plan to build nuclear-powered submarines is an issue that needs to be watched closely, as it could affect Indonesia's foreign policy in the region. Von Der Wense, Mudjiono, Putro and Saragih provide different perspectives on this matter [8].

In recent years, the emergence of variable renewable energy has fundamentally transformed the electricity sector and is expected to have an even greater impact on the future evolution of the energy system [9]. Cost reductions in photovoltaic and solar energy technologies, combined with advances in energy system operational practices, have made variable renewable energies an economically and technically viable alternative to traditional power plants [10,11]. Renewable energy technologies have been identified as one of the most effective de-carbonization technologies for the world's power supply system [12]. Adopting them also provides additional benefits, such as improved energy security and lower air pollution [13,14]. Energy efficiency, renewable energy, energy storage and sector mix all act as moderators in the relationship between economic activity and environmental degradation [15]. One of the renewable energy is nuclear energy [20]. Indonesia has great potential for nuclear resources, particularly uranium and thorium, which can be explored for energy purposes. According to the Head of the National Organization for Nuclear Energy Research (ORTN), Rohadi Awaludin, Indonesia has around 90,000 tons of uranium and 140,000 tons of thorium, which is enough to meet the country's energy needs using nuclear power [16].

In this context, the research in this journal aims to examine Indonesia's policy in dealing with the use of nuclear weapons in emerging international conflicts. In-depth analysis of the steps taken by Indonesia and their impact on regional stability and security is important in facing complex challenges in a changing and adapting world. And it is expected to answer the formulation of the problem of whether Indonesia has the opportunity to make nuclear weapons to prepare for hegemony in geopolitics and the possibility of Indonesia building nuclear energy.

2. Methods

This research utilizes two main theories, namely Situational Leadership and Transformational Leadership. Situational Leadership theory helps in understanding how leadership styles can be adapted to various specific situations and conditions. Another expert opinion makes an important contribution towards understanding the application of Situational Leadership in this context [17].

A quasi-qualitative approach was chosen to gain in-depth insights into Indonesia's potential to develop nuclear weapons and preparations for hegemony in geopolitics. Through in-depth interviews, document analysis, and participatory observation, researchers sought to understand the perspectives, beliefs, and attitudes underlying the potential for nuclear energy development. The expert opinions of Görener, Toker, & Uluçay also cemented the foundation of this qualitative methodology [18].

A phenomenological approach was adopted in this study to understand the subjective meanings and interpretations of experts regarding Indonesia's potential to build nuclear weapons. This expert opinion enriches the viewpoints of individuals involved in this phenomenon, enabling a deeper understanding.

3. Data Processing Techniques

In analyzing the data and support the decision-making process related to the potential development of nuclear weapons in Indonesia, this research relies on the Analytical Hierarchy Process (AHP) Data Processing Method. Expert opinions of Görener et al. and Kurttila et al. [12] became a strong basis for applying this method. The AHP method allows the identification of alternative priorities and generates policy recommendations based on predetermined criteria and sub-criteria, along with an in-depth understanding of the internal and external factors affecting the possibility of nuclear weapons development by Indonesia.

4. Results and Discussions

The results are analyzed using the AHP (Analytical Hierarchy Process) method in the context of whether Indonesia has the opportunity to develop nuclear weapons with the aim of strengthening its position in geopolitics, as well as whether the possibility of building nuclear weapons is an important debate that requires in-depth consideration. The AHP method allows for a structured assessment of relevant criteria and sub-criteria, allowing for a comprehensive evaluation of this kind of decision. The following is a description of the criteria, sub-criteria, and alternatives processed by the researcher:

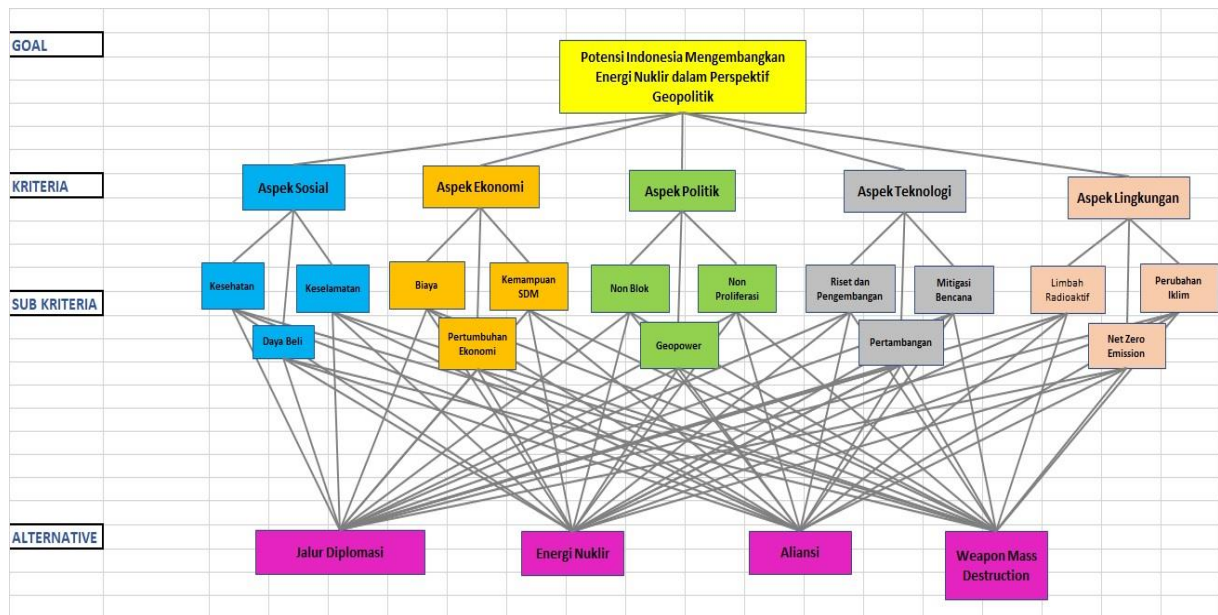


Figure 1. Hierarchy of AHP

From the figure 1, there are 5 criteria can be obtained, namely Social Aspects, Economic Aspects, Political Aspects, Technological Aspects and Environmental Aspects. There are 15 Sub Criteria (Health, Knowledge, Age Structure, Purchasing Power Parity, Cost, Human Resource Capability, Economic Growth, Human Resource Availability, Non-Aligned, Non-Proliferation, Geopower, Disaster Mitigation, Waste Location, Industrial Location, and Mine Location) and 4 Alternatives (Diplomacy Path, Nuclear Energy, Alienation, Weapon of Mass Destruction (WMD)).

Table 1. Priorities according to criteria

Criteria	%
Social Aspect	15.77
Economic Aspect	24.13
Political Aspect	11.55
Technology Aspect	8.60
Environment Aspect	39.95

IC = 0.034 ; RC = 3.01%

Analysis using the Analytical Hierarchy Process (AHP) method provides a more in-depth picture of the factors to consider in deciding whether Indonesia has the opportunity to develop nuclear weapons. The AHP method makes it possible to assess and prioritize different criteria by considering the preferences and weights of the various factors involved.

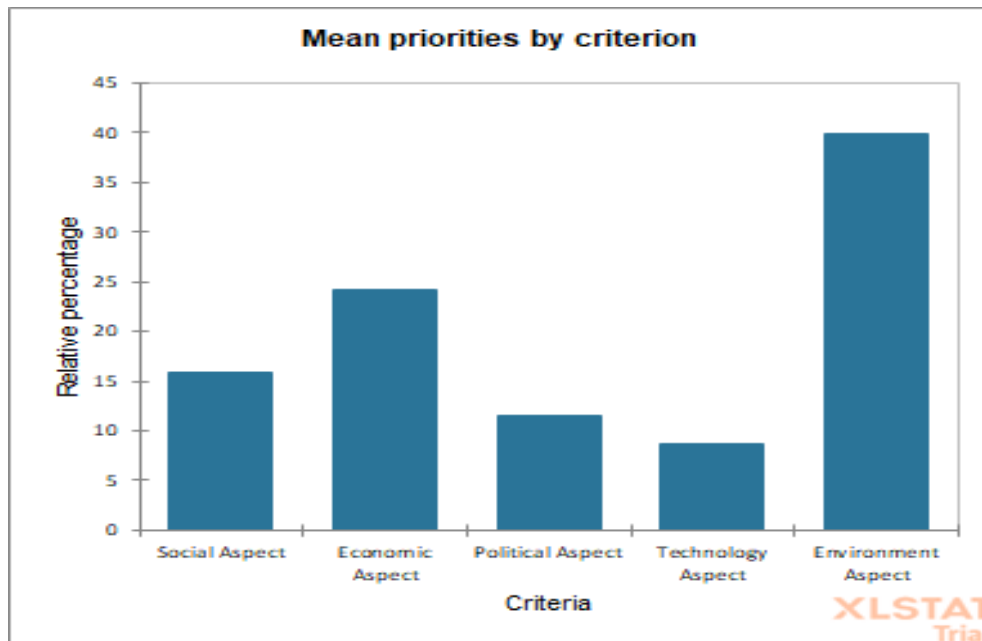


Figure 2. Priorities according to criteria

In designing a journal on Indonesia's potential in developing nuclear energy by considering related geopolitical factors, we can break down the contribution of each aspect indicated in the percentage given. First of all, the social aspect with a contribution of 15.77% highlights the importance of community support and acceptance of nuclear energy development. Public awareness and participation will be key factors to achieve the sustainability of this project, given its impact on daily life.

The economic aspect, with a contribution of 24.13%, shows that the readiness of the Indonesian economy will play an important role in the success of the nuclear energy project. Significant investment is required, and economic stability will be a determining factor in whether the country is able to support the construction of nuclear facilities.

Meanwhile, the political aspect with a contribution of 11.55% reflects the government's role in formulating and implementing nuclear energy-related policies. Political stability and regulatory clarity will provide a strong foundation for the project. In addition, diplomacy and international relations also need to be considered to maintain geopolitical balance.

The Technology aspect, which has the highest contribution of 8.60%, shows that the research of nuclear energy development needs to be the main focus. In addition, disaster mitigation will be crucial elements in considering whether nuclear energy can be applied in Indonesia.

The environmental aspect, which has the highest contribution of 39.95%, shows that the sustainability and environmental impact of nuclear energy development is a major focus.

Nuclear waste management, Climate Change, and Net Zero Emission will be crucial elements in considering whether nuclear energy can be applied sustainably in Indonesia.

By analyzing all the above factors, we can conclude that Indonesia's potential in developing nuclear energy from a geopolitical perspective is closely related to the harmonious integration of social, economic, political, technological and environmental aspects. The success of this project depends not only on technical aspects, but also on the country's ability to harmonize its energy needs with its geopolitical challenges and responsibilities. Correspondingly, whether or not Indonesia has the opportunity to develop nuclear weapons must be carefully considered by taking into account the social, economic, political and environmental impacts inherent to the use of nuclear technology.

In this context, political, legal, technological, and economic aspects were identified as the main criteria that influence decisions regarding the potential development of nuclear weapons. The results of the AHP analysis show that each criterion has a different weight in this decision-making process.

4.1 Environmental aspect

Tabel 2. Priorities according to Environmental Aspect

Environment Aspect	%
Radioactive waste	12.35
Climate Change	23.22
Net Zero Emission	4.38

$IC = 0.002$; $RC = 0.32\%$

For example, environmental aspects and Climate Change have the highest weight in this analysis. This shows that considerations related to legal and security aspects related to nuclear weapons are very important in determining the final decision. The Climate change factor is an important issue where we are also currently focusing on decarbonizing the country. The creation of the Indonesia Carbon Exchange (ICX) shows Indonesia's commitment to reducing the amount of carbon in the country.

In compiling a journal on Indonesia's potential in building nuclear energy with a focus on environmental aspects, we need to consider the data provided, namely the percentage contribution of various environmental aspects.

First of all, the radioactivity of nuclear waste has the highest contribution of 12.35%. This emphasizes the importance of effective nuclear waste management to avoid negative impacts on the environment. Safety in the storage and treatment of radioactive waste should be a top priority in the construction of nuclear facilities.

Climate Change, with a contribution of 23.22%, reflects that Climate change is currently an important issue for all countries including Indonesia. The use of New Renewable Energy (EBT) is one example of Indonesia's commitment in dealing with Climate change. Net Zero Emission, which contributed 4.38%, highlights the need for sustainable and responsible management of natural resources. Mining and Energy Generation must be done with due regard to environmental impacts. Green mining principles and environmentally friendly practices

should be an integral part of the nuclear energy strategy. In addition, the opening of the Indonesian Carbon Exchange (ICX) is Indonesia's commitment to decarbonize the country.

The Complexity Index (IC) of 0.002% and the Achievement Ratio (RC) of 0.32% that the level of AHP processing results is below 0.1% and is valid data. In addition, it reflects that the implementation of nuclear energy in Indonesia must be directed at efforts to increase complexity and positive achievements in environmental aspects. Technological developments and policies that support sustainability and environmental protection should be the main focus in planning and implementing nuclear energy projects.

In the geopolitical context, alignment with international standards and active involvement in cross-border cooperation will be key factors. Indonesia needs to play a proactive role in maintaining global environmental sustainability while building nuclear energy infrastructure. Taking all these aspects into account, Indonesia's potential in building nuclear energy can be measured through the country's commitment and ability to effectively manage environmental impacts. Concrete measures and innovative solutions need to be implemented to ensure that nuclear energy utilization contributes to energy security while minimizing negative impacts on the environment and public health.

4.2 Political Aspect

Table 3. Priorities according to Political Aspect

Political Aspect	%
Non Block	3.14
Non Proliferation	7.02
Geopower	1.38
<i>IC = 0.037 ; RC = 6.39%</i>	

Furthermore, political aspects also have a significant impact in this AHP analysis. Criteria such as non-aligned policy, state commitment, and political territorial sovereignty are important factors that influence the assessment of potential nuclear weapons development. Political decisions and government policies also have major implications on whether Indonesia has the opportunity to develop nuclear weapons.

In the geopolitical context, political aspects have a major impact on Indonesia's potential to build nuclear energy. Let us review the contribution of each political factor presented in percentages. First of all, the non-aligned principle (Non Block) with a contribution of 3.14% reflects Indonesia's foreign policy that is not bound to a particular bloc. In the context of nuclear energy, this can open up opportunities for cooperation and technology exchange with various countries, regardless of specific political alliances. Indonesia's involvement in nuclear projects can be a positive factor in building international relations.

Non-proliferation, with a contribution of 7.02%, highlights Indonesia's commitment to the non-proliferation of nuclear weapons. A clear involvement in the framework of the Nuclear Non-Proliferation Treaty (NPT) can enhance Indonesia's image as a globally responsible country. It can also open the door for international cooperation in the development of peaceful nuclear energy.

The contribution from Geopower of 1.38% emphasizes the importance of geopolitical factors in nuclear energy development. Indonesia's involvement in regional and global

geopolitical arenas can influence support or rejection of the use of nuclear energy. Therefore, diplomacy and navigation of political interests are important factors in determining Indonesia's potential in developing nuclear energy.

The Complexity Index (IC) is 0.067 and the Achievement Ratio (RC) is 7.43% that the level of AHP processing results is below 0.1% and is valid data. In addition, it shows that the implementation of nuclear energy in Indonesia must harmonize political policies with sustainability and national security. The success of this project will largely depend on Indonesia's active engagement in the geopolitical arena, as well as its ability to maintain and enhance its positive image in the eyes of the world.

Overall, Indonesia's potential in building nuclear energy from a political perspective lies in its open foreign policy, commitment to the non-proliferation of nuclear weapons, ability to leverage geopolitical power, and willingness to face disaster risks with effective mitigation. In viewing nuclear energy as an energy option, Indonesia needs to manage its political dynamics in a thoughtful and planned manner to ensure project success and support national and global interests.

4.3 Economic Aspect

Table 4. Priorities according to Economic Aspect

Economic Aspect	%
Cost	6.57
Economic Growth	14.67
Capability Human Capital	2.89

IC = 0.037 ; RC = 6.39%

Meanwhile, economic aspects are also considered as relevant factors in this analysis. Current technology, the effectiveness of nuclear technology, and the environmental impact of using nuclear technology are important criteria in evaluating the potential development of nuclear weapons. On the other hand, economic factors such as human resource availability, cost allocation, and human resource capability also play a role in this analysis.

In detailing Indonesia's potential in developing nuclear energy from an economic perspective, we need to understand the contribution of each economic factor presented in percentage. First of all, cost with a contribution of 6.57% shows that the cost factor is a major consideration in nuclear energy development. Project costs must be controllable and economically justifiable in order to be a viable option. Therefore, financial planning and management determine the potential of this project.

Economic growth contribution of 14.67% reflects the positive impact that nuclear energy can have on the Indonesian economy. The construction of nuclear facilities can be a driver of economic growth through job creation, investment, and increased productivity of the energy sector. In addition, that in the long run the price of electricity produced by nuclear power plants is cheaper than solar power plants (PLTS) and wind power plants (PLTA) the land area per 1 MW generated by solar and wind power plants is larger than nuclear power plants. Solar power plants require 0.0132 km² of land to generate 1 MW of power, while wind power requires 0.0133 km² per 1 MW. The land used for electricity generation with 1 MW of power from nuclear power plants requires an area of 0.00337 km² [19].

The aspect of human resource capability (Capability Human Capital) with a contribution of 2.89% and the availability of human resources (Availability Human Capital) shows the importance of human resource factors in building and operating nuclear facilities. The technical capabilities and proficiency of the workforce must be taken into account in the nuclear energy development plan, and education and training policies must support the formation of a competent workforce.

The Complexity Index (IC) of 0.087 and the Achievement Ratio (RC) of 9.64% emphasize that the level of AHP processing results is below 0.1% and is valid data. In a geopolitical perspective, Indonesia's potential in building nuclear energy from an economic point of view will be an important element in attracting investment interest and international support. By ensuring economic sustainability and competitiveness, Indonesia can improve its position in the international community and play an important role in global energy security.

4.4. Social Aspect

Table 5. Priorities according to Social Aspect

Social Aspect	%
Health	5.05
Safety	8.79
Purchasing Power Parity	1.93

IC = 0.009 ; RC = 1.58%

Indonesia's potential to develop nuclear energy is an interesting thing to explore, especially when looking at the social factors that could affect the success of this project. In reviewing the data above, let's discuss each social aspect listed in percentage. First of all, we have the health aspect with a contribution of 5.05%. The use of Nuclear Energy for Health such as x-rays, CT-Scans, and radiotherapy is already running and is very much needed by the community.

Next, Security, which contributed 8.79%, reflects the direct impact of nuclear facility operations. It is important to ensure that the design, construction, and operation of nuclear plants meet the highest safety standards to protect the surrounding environment. Rigorous monitoring of radiation releases and risk mitigation efforts must be integrated.

Purchasing Power Parity (PPP) with a contribution of 1.93% highlights the importance of economic stability. Nuclear energy projects require large investments, and a solid economic strength can be the basis for the sustainability of such projects. A high PPP reflects society's ability to access and support more advanced energy solutions.

The Complexity Index (IC) of 0.038 and the Achievement Ratio (RC) of 4.19% that the level of AHP processing results is below 0.1% and is valid data. In addition, it indicates the general social complexity and achievements in Indonesia. The success of a nuclear energy project depends not only on technical factors, but also on the ability to harmonize the project with the existing social and regulatory framework.

Overall, Indonesia's potential in developing nuclear energy lies not only in technical aspects, but also involves social aspects. Public awareness, health, economic strength, and

understanding of social structure are key elements that can form a strong foundation for a successful nuclear energy project in Indonesia.

4.5. Technological Aspect

Table 6. Priorities according to Technological Aspect

Technological Aspect	%
Research and Development	2.87
Mining	4.88
Disaster Mitigation	0.84
<i>IC = 0.012 ; RC = 2.13%</i>	

Technological advances are key factors related to nuclear development. Some of the highlights in nuclear technology are R&D, Mining and Disaster Mitigation. First of all, R&D, which contributed 2.87%, is also an important point. Public education about nuclear technology, risks, and benefits will shape a positive attitude. Besides, the use of nuclear energy for education has also occurred in Indonesia today as at Gadjah Mada University (UGM) Yogyakarta and in Bandung where there are nuclear reactors used for education.

Furthermore, Mining, which contributes 4.88%, highlights the need for sustainable and responsible management of natural resources. Mining should be done taking into account the environmental impact as well as local public health. Green mining principles and environmentally friendly practices should be an integral part of the nuclear energy strategy.

Disaster Mitigation, with a contribution of 0.84%, demonstrates awareness of disaster risk and the need for effective mitigation in the development of nuclear facilities. Preparedness to face and cope with possible natural disasters or technical incidents is an important consideration in the political and national security context.

The Complexity Index (IC) is 0.038 and the Access Ratio (RC) is 4.19% that the AHP yield rate is below 0.1% and is valid data. The success of a nuclear energy project depends heavily on technical factors, especially since nuclear itself is a high-level technology that requires large and long-term inventory, not only on the human resource side but also on the technological side.

Indonesia's potential in building nuclear energy must be balanced in terms of research and technological development. Currently, the world's reactors are heading towards a

fourth-generation reactor. The reactors that are currently running in the world are the second and third generation reactors. The Fukushima Daiichi Nuclear Power Plant uses a second-generation reactor, in which some aspects of the second-gen reactor itself have been enhanced on a third-generational reactor such as the level of safety and operational efficiency, as well as reducing the risk of radioactive discharges in emergencies. Examples of third-generation nuclear reactors include the European Pressurized Reactor (EPR), Advanced Boiling Water Reactors (ABWR), and improved Pressurised Water Reactors (PWR).

Here are the results of the AHP processing by experts and experts who agree that Indonesia needs to use nuclear energy as one of the energy sources in Indonesia. Because of our energy needs that require large amounts of energy resources and the urge to manage clean energy for its future, nuclear itself is one of the New Renewable Energy (EBT).

Table 7. Table of Alternatives

Crit./Alt.	Diplomatic	Nuclear energy	Alliances	Weapon Mass Destruction	IC	RC
Social Aspect	3.81	8.50	2.48	0.98	0.00	0.00
Health	1.19	2.81	0.74	0.31	0.02	2.13
Safety	2.15	4.67	1.42	0.55	0.02	2.33
Purchasing Power Parity	0.47	1.03	0.31	0.12	0.02	2.33
Economic Aspect	6.01	12.84	3.75	1.54	0.00	0.00
Cost	1.58	3.57	0.98	0.43	0.03	3.03
Economic Growth	3.58	7.79	2.37	0.92	0.02	2.33
Capability Human Capital	0.85	1.47	0.39	0.18	0.02	2.67
Political Aspect	3.15	6.16	1.52	0.72	0.00	0.00
Non Block	0.82	1.71	0.42	0.19	0.04	4.50
Non Proliferation	2.00	3.69	0.89	0.44	0.03	3.08
Geopower	0.33	0.75	0.21	0.09	0.03	3.03
Technology Aspect	2.00	4.81	1.27	0.51	0.00	0.00
Research and Development	0.66	1.65	0.39	0.18	0.02	2.52
Mining	1.13	2.69	0.78	0.28	0.03	3.84
Disaster Mitigation	0.21	0.48	0.11	0.05	0.04	4.47
Environment Aspect	9.50	21.89	6.11	2.45	0.00	0.00
Radioactive waste	2.83	7.09	1.68	0.76	0.02	2.52
Climate Change	5.48	12.51	3.79	1.45	0.04	4.98
Net Zero Emission	1.19	2.29	0.64	0.25	0.07	7.75

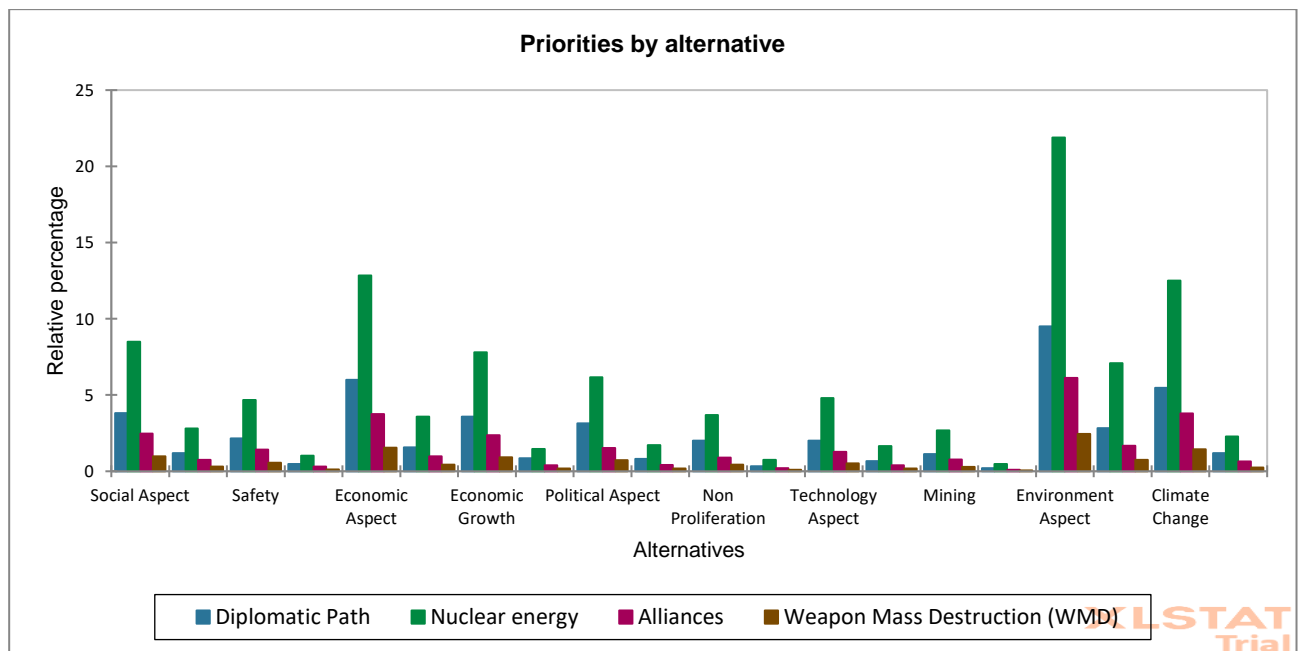


Figure 3. Priorities according to Alternatives

5. Conclusions

Overall, it can be concluded that Indonesia firmly rejects the development of nuclear weapons, supported by political considerations, adherence to international law, and commitment to world peace. This consistency is reflected in the Draft Law related to the Ratification of the Treaty on the Prohibition of nuclear weapons by Indonesia.

In addition, economic and technical aspects are also important factors in the rejection. Not only does Indonesia not yet have the infrastructure and capability to effectively manage a nuclear weapons program, but it also faces large investments and significant security risks. So it is certain that Indonesia needs Nuclear Energy more as an energy source than as a weapon because of the rising national electricity demand. In the long run, investment in nuclear power plants will produce electrical energy that is cheaper than other renewable power plants such as wind and solar panels or even cheaper than coal-fired power plants.

Furthermore, Indonesia views nuclear energy as an alternative energy source needed to meet the country's energy needs. The use of nuclear in various sectors such as health and education has proven its benefits, while the development of nuclear reactor technology towards the third and fourth generation reflects the world's efforts in improving safety and efficiency in the use of nuclear energy. Thus, while Indonesia affirms its rejection of nuclear weapons, the country is positively developing the potential of nuclear energy for civilian purposes, encompassing applications in the health sector, education, and sustainable energy sources.

References

- [1] Sharikov, P. (2018). Artificial intelligence, cyberattack, and nuclear weapons-A dangerous combination. *Bulletin of the Atomic Scientists*, 74(6), 368–373. <https://doi.org/10.1080/00963402.2018.1533185>
- [2] Yustiningrum. (2007). Masalah senjata nuklir dan masa depan perdamaian dunia. *Jurnal Penelitian Politik*, 4(1). DOI: <https://doi.org/10.14203/jpp.v4i1.442>
- [3] Lupu. (2023). Russian Federation-from strength to weakness, from west to east, from a permanent member to a potential outsider. *Technium Social Sciences Journal*, 41, 304-319.
- [4] Appleby, A. (1975). Environmental behavior of radionuclides released in the nuclear industry. *American Potato Journal*, 52, 99–100. <https://doi.org/10.1007/BF02855131>
- [5] Colangelo, A. J., & Hayes, P. (2019). An international tribunal for the use of nuclear weapons. *Journal for Peace and Nuclear Disarmament*, 2(1), 219–252. <https://doi.org/10.1080/25751654.2019.1624248>
- [6] Perdana, D. B., Ramasandi, R. D., & Setiawan, M. E. (2021). Posisi Indonesia terhadap aliansi Amerika, Inggris dan Australia (AUKUS) dalam perspektif neorealisme. 5, 33–44.
- [7] Hurst, S. (2016). The Iranian nuclear negotiations as a two-level game: The importance of domestic politics. *Diplomacy & Statecraft*, 27(3), 545–567. <https://doi.org/10.1080/09592296.2016.1196075>
- [8] Mudjiono, Alimah, S., Susiati, H., Irawan, D., & Bustomi, M. (2018). Penerimaan masyarakat sekitar Puspipstek Serpong terhadap rencana pembangunan reaktor daya eksperimental. *Jurnal Pengembangan Energi Nuklir*, 20(2), 105–110. <https://doi.org/10.17146/jpen.2018.20.2.5044>
- [9] Ahn, K., Chu, Z., & Lee, D. (2021). Effects of renewable energy use in the energy mix on social welfare. *Energy Economics*, 96(2021), 105174.
- [10] Liobikiené, G., & Butkus, M. (2021). Determinants of greenhouse gas emissions: A new multiplicative approach analysing the impact of energy efficiency, renewable energy, and sector mix. *Journal of Cleaner Production*, 309, 127233.

- [11] Ishaya, T. T., Dioha, M. O., & Failler, P. (2020). Renewable energy scenarios for sustainable electricity supply in Nigeria. *Energy and Climate Change*, 1, 100017.
- [12] Alexandru, S., Paraschiv, L. S., & Paraschiv, S. (2020). Assessment of wind energy potential based on Weibull and Rayleigh distribution models. *Energy Reports*, 6(6), 250–267.
- [13] Spiru, P., Nicoleta, B.-M., & Paraschiv, L. S. (2020). Technical and economic analysis of a solar air heating system integration in a residential building wall to increase energy efficiency by solar heat gain and thermal insulation. *Energy Reports*, 6(6), 459–474.
- [14] Divakaran, A. M., Minakshi, M., Bahri, P. A., Paul, S., Kumari, P., & Divakaran, A. M., et al. (2021). Rational design on materials for developing next generation lithium-ion secondary battery. *Progress in Solid State Chemistry*, 62, 100298.
- [15] Eisapour, A. H., Jafarpur, K., & Farjah, E. (2021). Feasibility study of a smart hybrid renewable energy system to supply the electricity and heat demand of Eram Campus, Shiraz University; simulation, optimization, and sensitivity analysis. *Energy Conversion and Management*, 248, 114779.
- [16] BRIN. (2022). Indonesia memiliki potensi bahan galian nuklir yang cukup untuk dieksplorasi. Diambil dari <https://www.brin.go.id/news/111068/brin-indonesia-miliki-potensi-bahan-galian-nuklir-yang-cukup-untuk-dieksplorasi>
- [17] Saragih, S. H. (2016). Penerapan metode analytical hierarchy process (AHP) pada sistem. *Pelita Informatika Darma*, 4(2), 82–88.
- [18] Görener, A., Toker, K., & Uluçay, K. (2012). Application of combined SWOT and AHP: A case study for a manufacturing firm. *Procedia: Social and Behavioral Sciences*, 58, 1525–1534. <https://doi.org/10.1016/J.SBSPRO.2012.09.1139>
- [19] Kurttila, M., Pesonen, M., Kangas, J., & Kajanus, M. (2000). Utilizing the analytical hierarchy process (AHP) in SWOT analysis - A hybrid method and its application to a forest-certification case. *Forest Policy and Economics*, 1(1), 41–52. [https://doi.org/10.1016/S1389-9341\(99\)00004-0](https://doi.org/10.1016/S1389-9341(99)00004-0)
- [20] Paraschiv, S. (2023). Analysis of the variability of low-carbon energy sources, nuclear technology and renewable energy sources, in meeting electricity demand. *Energy Reports*, 9(S11), 276–283. <https://doi.org/10.1016/j.egy.2023.09.008>