

Original Article

Enacting Space Law in Malaysia to Transfer Knowledge About Outer Space Engineering and Technology

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Abstract - In line with the technological advancement in today's modern world, many nations embark upon steps to attain the highest achievement in development. Developed countries such as the United States of America (USA), Russia, Canada, Japan and China have shown their own capabilities in the field of space exploration through the creation and launch of satellites and other objects beyond the earth's atmosphere. Even though such objects are out of the earth's atmosphere, there should be, however, laws to control such activities. This study's objective is to review affairs pertaining to the enactment of space law and its role in outer space activities. This review study used a qualitative method through the instruments of document analysis and observations. The results of this study found that it is indeed necessary and important to enact space laws to regulate and oversee all outer space activities. This matter is crucial in order to avoid any activities, such as in outer space, being carried out without any monitoring and control, which could eventually lead to catastrophes and negative impacts on earth ecosystems.

Keywords - Space law, Space engineering, Space technology, Space activities, Astronomy.

1. Introduction

Laws are created to manage and govern our lives. In addition to raising the developmental achievement of a nation, laws are also seen as a process to control and resolve disputes and encourage public order to safeguard the peace and well-being of the people. There are a multitude of laws passed all over the world covering various aims and jurisdictions, including space law [1]. In line with current technological advancements, many activities nowadays no longer employ manual labour. Machines have become an interface medium replacing manual labour, whereby their use can have a substantial impact compared to the use of the human workforce. Numerous new technologies are innovated to facilitate all affairs running smoothly and efficiently. This can be observed not only in technological advancements on earth but also outside the earth's atmosphere [2].

Since 1957, man has been carrying out space exploration involving various activities. Outer space exploration activities are carried out by deploying various objects created to function outside of the earth's atmosphere. Such activities, which have been spanning over 60 years, can bring about negative effects on the earth's ecosystems if not controlled from the aspects of environment, legal, security, and others [3]. Therefore, establishing space law is a noble effort to control and oversee the activities of space exploration. The enactment of space law in Malaysia presents several research

gaps that require comprehensive exploration. Firstly, there is a notable lack of detailed studies examining the current legislative framework's adequacy in addressing the unique challenges posed by space activities. Existing research often highlights broad policy objectives without delving into specific legal provisions and their effectiveness in regulating space operations.

Secondly, comparative studies between Malaysia's nascent space laws and those of established spacefaring nations are scarce. Such comparative analyses are crucial for identifying best practices and potential areas for improvement within Malaysia's legal framework. Furthermore, there is a need for research on the integration of international space treaties and agreements into Malaysia's domestic legislation. Understanding how global legal standards can be effectively localized is essential for ensuring Malaysia's compliance with international obligations while catering to national interests.

Another significant gap lies in the exploration of public and private sector roles in space law development. The dynamic interplay between governmental regulatory bodies and private enterprises engaged in space activities needs thorough investigation to create a balanced and effective legal environment. Lastly, the socio-economic impacts of space law on Malaysia's development, including its influence on technological innovation, economic growth, and international



collaboration, are under-researched. Addressing these gaps will provide a holistic understanding of the implications and necessities of enacting comprehensive space law in Malaysia, guiding policymakers and stakeholders in crafting a robust legal framework.

2. Literature Review

The discourse on the development of space law in Malaysia is both extensive and profound, encompassing a wide array of critical issues. Central to these discussions is the national space policy, which serves as a pivotal framework aimed at propelling the advancement of space science and technology within the country. This policy outlines strategic goals and initiatives designed to enhance Malaysia's capabilities and competitiveness in the global space sector [4]. In addition to policy development, there are significant insights into Malaysia's legislative efforts and policy frameworks specifically crafted to support the burgeoning space industry. These legislative measures are crucial for establishing a robust legal infrastructure that can effectively govern space activities, ensuring compliance with international standards and fostering a conducive environment for innovation and growth [5].

Moreover, Malaysia's application of space technology extends beyond traditional aerospace activities, showcasing its versatility and impact on various sectors, including fisheries. The integration of space technology in fisheries management exemplifies how satellite data and remote sensing can enhance resource monitoring, boost efficiency, and promote sustainable practices [6]. Malaysia's ambitions are further highlighted by its emergence as a new space launch site on the world map. This development positions Malaysia as a key player in the global space launch market, offering strategic geographical advantages and contributing to the diversification of global launch site options [7]. Furthermore, the exploration of future legal issues and challenges associated with international space laws is a critical component of this discourse. As space activities continue to expand and evolve, Malaysia must navigate complex legal landscapes, address potential conflicts, and adapt to emerging international norms and treaties. This forward-looking approach underscores the importance of proactive legal and policy planning in sustaining Malaysia's long-term growth and leadership in the global space arena [8]. These studies provide a comprehensive overview of the current state and future prospects of space law and the space sector in Malaysia.

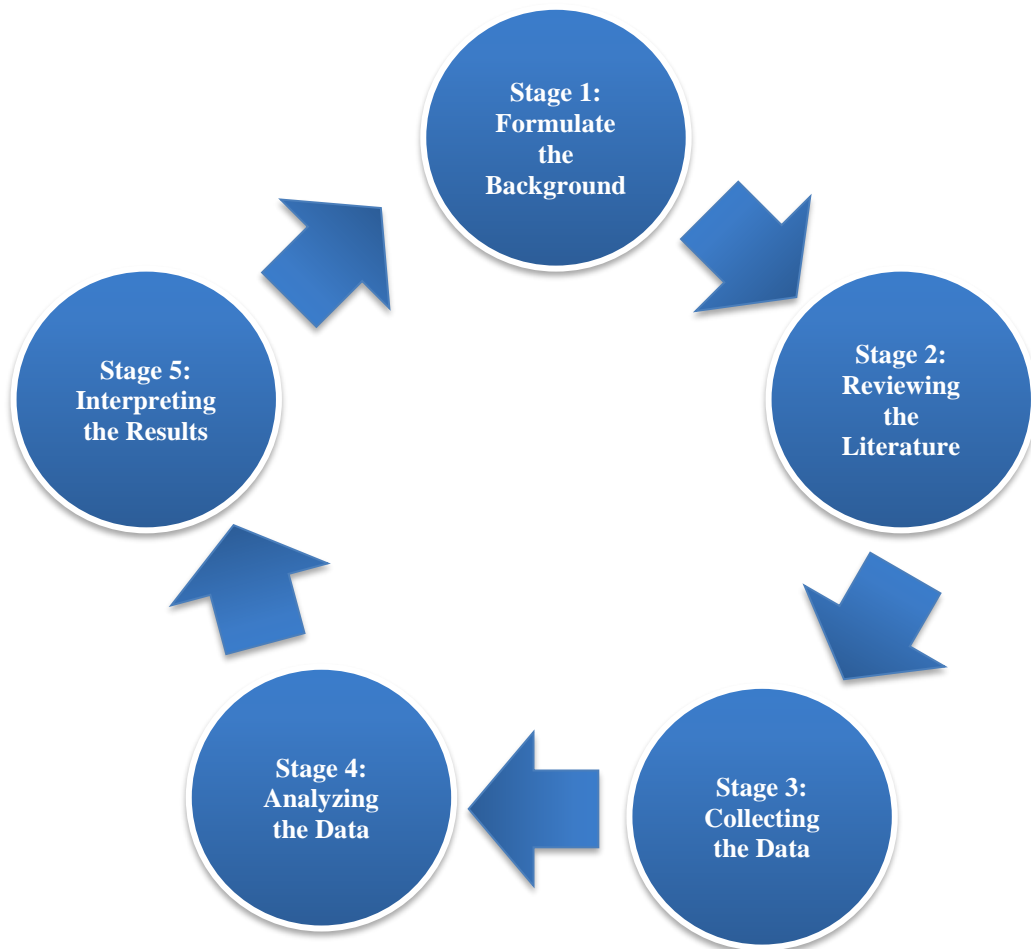


Fig. 1 Research flow

3. Materials and Methods

This article employs a qualitative research approach initiated through reviews of previous works on Islamic astronomy in Malaysia. The study was conducted in Malaysia and selected based on specific research criteria. To fulfil the objectives of this study, data collection methods included document analysis, interviews, and observations. These methods were employed to assess the feasibility of the research area. Document analysis was performed to gather information accessible only through official channels, encompassing documents such as project proposals, progress records, manuscripts, and private correspondence. Additionally, interviews were conducted with representatives from the Ministry of Science, Technology and Innovation Malaysia (MOSTI), the Malaysian Space Agency (MYSA), the National Planetarium, and several observatories. The flow of this research is in Figure 1.

All interviews were conducted individually using a standardized set of questions to gather insights into the importance of enacting space law in Malaysia. Furthermore, specific observations were made to obtain precise and accurate data relevant to the study. Fieldwork visits were undertaken to verify the conditions of the sites, ensuring the validity of the collected data. To enhance data reliability, focus group discussions were held to deliberate on the research problems, thereby illuminating the research area. These discussions also facilitated the preparation of conference presentations and the publication of findings in various academic outlets.

4. Results and Discussion

4.1. The Enacting of Space Law

Space law can be illustrated as a form of regulation which governs rules in relation to space activities. In general, space law is similar to any international law comprising various treaties, conventions, and United Nations General Assembly resolutions, as well as regulations of international organisations. The term Space Law is often linked with the rules and legal principles of international law, which encompass five international treaties and five principles concerning outer space. All of these were developed under the auspices of The United Nations Organisation [9, 10]. The Law of Space was formed after Ernile Laude, a lawyer in Belgium, in a piece which deliberated on the history of aerial law. His article was published in 1910 in France, which was 47 years before the launch of Sputnik-1. In concluding the discussion on the matter, Laude [11] enticed readers with his commentary as follows: It is anticipated that the term aerial law will be adopted; however, it will not apply to the breathable layer of air where aviation issues arise. The legal solutions to questions concerning the unbreathable gas layers and the ether enveloping our planet remain to be seen. Ownership and usage rights of Hertzian waves will inevitably become pertinent issues, necessitating a new body of law distinct from aerial law. Predicting its exact nature is challenging, as the term

‘ether’ obscures our current understanding, and ‘ethereal law’ seems premature. Nonetheless, this new legal domain will undoubtedly pertain to space law. Thus, space law will serve as a comprehensive term analogous to how private law encompasses civil and commercial law. Beginning in 1957, many nations started to discuss the question of the need for a system to ensure the security of mankind consequent to outer space exploration activities. Discussion, which mainly involved the USA and the Union of Soviet Socialist Republics (USSR), was eventually heard by the United Nations (UN). In 1958, this matter was raised as an issue to be presented and debated by the UN. The idea was well-received by the UN leading to the formation of the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS) in 1959. Five treaties, known as United Nations Treaties, were presented and debated in COPUOS, namely [12]:

- The 1967 Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, or presently known as The Outer Space Treaty. This treaty was in effect from the 10th of October 1967 and had 17 articles. Among the essences of the treaty is that outer space must be ensured to be in peace and free of any military activities for the nations involved.
- The 1968 Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space or currently known as the Rescue Agreement. This treaty was in force since the 3rd of December 1968 and has 17 articles concerning rescue missions and returns of astronauts and objects launched into outer space by the nations involved.
- The 1972 Convention on International Liability for Damage Caused by Space Objects or now known as the Liability Convention. This convention has been in force since the 1st of September 1972 and has 17 articles giving descriptions of the liabilities of the nations involved towards any damage caused by any object launched by them.
- The 1975 Convention on Registration of Objects Launched into Outer Space or the Registration Convention as it is currently known. This convention has been in effect since the 15th of September 1976 and has 17 articles on the registration of launched objects covering the name of the country, design and registration number of the object, date and site of launch, as well as functions the object is capable of.
- The 1979 Agreement Governing the Activities of States on the Moon and Other Celestial Bodies or presently known as the Moon Treaty. This treaty has been in force beginning from the 19th of July 1984, having 17 articles which prohibit any military activity on the moon, including building an army camp and carrying out any weapon test on it. In addition to that, the moon's vicinity is also protected, and any mining exploration is also forbidden.

Table 1. Countries involved in the United Nations treaties

Agreement	Ratification (R)	Signatory (S)	Declaration (D)
Outer Space Treaty	104	25	0
Rescue Agreement	94	24	2
Liability Convention	92	21	3
Registration Convention	62	4	3
Moon Treaty	16	4	0

Source: Committee on the Peaceful Uses of Outer Space Legal Subcommittee 2016

The five agreements were formulated to address key issues in outer space governance, including the arbitrary allocation of space territories to nations, arms control, freedom of exploration, liability for damage caused by launched objects, and the safety and security of space vessels and astronauts. They also cover the prevention of harmful interference with space activities and the environment, the notification and authorization of space activities, scientific research, the exploitation of natural resources, and conflict resolution.

Each agreement emphasizes that outer space, the activities conducted within it, and the benefits derived must contribute to the well-being of all nations and humanity. This goal is pursued by fostering international cooperation, ensuring that space activities enhance global welfare and promote collaborative efforts among nations. These agreements collectively ensure that outer space remains a domain dedicated to peaceful and cooperative use, benefiting all of humanity through shared advancements and knowledge. Table 1 shows the status and the number of countries involved in the United Nations Treaties as follows [13]:



Fig. 2 Measat satellite

Source: MEASAT (2023)

4.2. Outer Space Engineering and Technology

Activities of outer space exploration have indeed given much benefit to the advancement of science and technology. Such progress can be seen in a number of technologies devised to facilitate research activities in outer space, such as:

4.2.1. Satellite

A satellite is an object which orbits the earth within a specific direction and period as a result of its launch from earth for a specific purpose. The first satellite ever built was Sputnik 1, launched into space by the Soviet Union on the 4th of October 1957. The invention of the satellite became a pinnacle to the advancement of science and technology of the Soviet Union at that moment, prompting the USA to embark upon actions to compete [14]. Since then, the USA and Russia have been competing in developing new outer space technology, beside the involvement of other countries which do not want to lose the opportunity to advance their technology from time to time. To date, there are approximately 3000 satellites currently orbiting the Earth, including Malaysian satellites, MeaSAT I and II, RazakSAT and TiungSAT, which have their own functions, including RazakSAT-2, which was estimated to be completed at the end of 2017 [15].

4.2.2. International Space Station

The International Space Station (ISS) is a premier research facility in low Earth orbit, established through an unprecedented collaboration among several space agencies: the National Aeronautics and Space Administration (NASA) of the United States, the Russian Federal Space Agency (RFSA), the China National Space Administration (CNSA), the Japan Aerospace Exploration Agency (JAXA), the Canadian Space Agency (CSA), and the European Space Agency (ESA).



Fig. 3 International space station

Source: NASA (2023)

This collective endeavour, exemplifying international cooperation, culminated in the launch of the ISS on November 20, 1998. Positioned approximately 360 kilometres above the earth's surface, the ISS serves as a unique microgravity and space environment research laboratory where scientific investigations across various disciplines, including biology, physics, astronomy, and meteorology, are conducted. The ISS completes 16 orbits around the earth each day, facilitating continuous observation and experimentation. This continuous orbit allows researchers to conduct long-duration studies that are not possible on earth, offering invaluable insights into the effects of microgravity on biological organisms, material properties, and fundamental physical processes [16].

One notable mission associated with the ISS was Malaysia's Angkasawan program, which aimed to advance the country's scientific and technological capabilities. Sheikh Muszaphar Shukor, an orthopaedic surgeon, became the first Malaysian astronaut through this program. He was selected after rigorous training at the Gagarin Cosmonaut Training Center in Star City, Russia. In 2007, Shukor embarked on a mission to the ISS, where he conducted various experiments, including studies on the effects of microgravity on cells and microbes, which contributed to the global pool of scientific knowledge. His journey symbolized Malaysia's commitment to space exploration and highlighted the ISS's role as a hub for international scientific collaboration, fostering advancements that benefit all of humanity [17, 18].

4.2.3. Space Telescope

Space telescopes, launched beyond earth's atmosphere to function in outer space, have revolutionized astronomy by producing clear and high-resolution images of both our solar system and distant galaxies. The most renowned of these telescopes is the Hubble Space Telescope, named in honor of the eminent astronomer Edwin P. Hubble. Launched in 1990 to an altitude of 575 kilometers above the earth's surface, the Hubble Space Telescope has significantly advanced our understanding of the cosmos [19].

One of its primary missions is to measure the distances to stars with unprecedented accuracy, a task vital for refining the parameters used to calculate the universe's rate of expansion. The precise data gathered by the Hubble has been instrumental in deepening our knowledge of the universe's structure and evolution [20]. The newest is The James Webb Space Telescope (JWST), which is known as the scientific successor to the Hubble Space Telescope. In contrast to the Hubble Space Telescope (HST), the JWST is designed as an infrared-optimized telescope to observe the redshifted visible and ultraviolet radiation from the first galaxies and supernovae of the first stars [21].

4.2.4. Rocket

A rocket is a cylindrical apparatus characterized by a pointed tip and launched through ignition, designed to achieve

high power and velocity for transportation purposes, both within and beyond the earth's atmosphere. The primary function of a rocket is to serve as a delivery mechanism for objects such as satellites, facilitating their journey into outer space. This propulsion system is integral to the operation of spacecraft, enabling the transport of astronauts into orbit around the earth and on missions to more distant celestial destinations.

The underlying principles of rocket technology extend beyond space exploration; they are also pivotal in military applications, including guided missiles, aircraft engines, and various weaponry systems. Rockets generate thrust through the expulsion of exhaust gases, adhering to Newton's third law of motion, which states that for every action, there is an equal and opposite reaction. This principle is harnessed to achieve the substantial velocities necessary for space travel and the precision required in military operations. Thus, the evolution of rocket technology has been instrumental not only in advancing human space exploration but also in enhancing national defense capabilities, underscoring its multifaceted significance in contemporary science and technology [22].

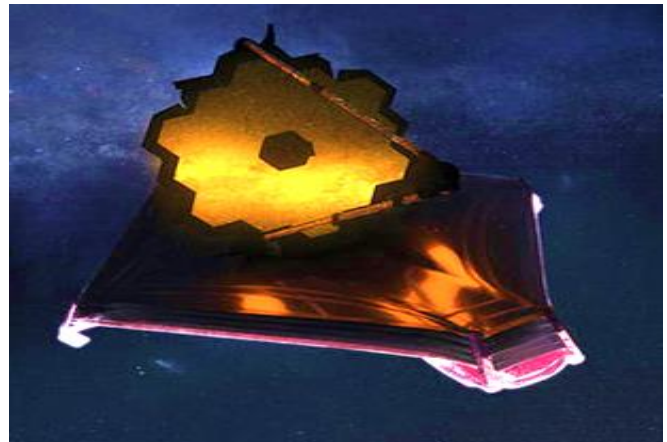


Fig. 4 James webb space telescope

Source: NASA (2023)



Fig. 5 Falcon 9 rocket

Source: SpaceX (2023)

4.3. Space Law and Current Issues

In addition, exploration and use of outer space have to be monitored and carried out systematically to control the effects and consequences they have on any country. This inevitably leads to certain legal questions, raising the need for the enactment of specific laws to tackle the related issues. Establishing such a law is seen as pivotal in a number of aspects, such as the following [23]:

4.3.1. Education

Education on space law is of paramount importance for raising awareness about its significance among various societal strata, from academics to the general public. Such education fosters an understanding of the rights and peaceful uses of outer space, contributing to a well-informed populace.

Space law, which governs the activities of nations and private entities in outer space, is relatively novel in many countries. For instance, Malaysia has yet to legislate comprehensive space law, and efforts are still underway to develop a robust legal framework in this domain. The creation of educational modules on space law is crucial to ensure the continuity and advancement of this field. These modules can be developed through international cooperation, leveraging the expertise of countries with established space law regimes. By doing so, the complexities of space law can be elucidated in a systematic and accessible manner, promoting gradual understanding among the masses.

This educational initiative can also help cultivate a new generation of legal experts specializing in outer space, addressing the growing demand for proficient professionals in this area [24]. Moreover, integrating space law into educational curricula can bridge knowledge gaps and inspire

interest in space-related legal issues. It can highlight the importance of international treaties, such as the Outer Space Treaty of 1967, which outlines principles for the peaceful exploration and use of outer space, and the Moon Agreement of 1984, which governs the activities of states on the moon and other celestial bodies. Understanding these treaties and their implications is essential for ensuring that space exploration and utilization are conducted responsibly and ethically. In conclusion, the establishment of space law education is vital for disseminating knowledge about the legal dimensions of outer space activities. It promotes awareness, fosters international cooperation, and develops legal expertise, ensuring that the exploration and use of outer space are carried out in a peaceful, sustainable, and legally sound manner [25].

4.3.2. Economy

The provision of space law education is an excellent opportunity for any nation seeking to enhance its economic growth and developmental initiatives. By investing in space law education, countries can organize a variety of fund-generating activities such as international conferences, seminars, courses, workshops and astro tourism. These events not only facilitate the exchange of knowledge but also attract global attention, fostering international collaboration and investment. Through the acquisition of space law knowledge, society becomes more ‘space-aware’ leading to increased interest and exploration in the field. This heightened awareness can stimulate innovation and development within the country as individuals and enterprises seek to create and advance technologies and instruments related to outer space. As a result, the nation stands to gain significant economic advantages. For instance, the development of new space-related technologies can create a robust domestic industry, generating employment and contributing to the economy [26].

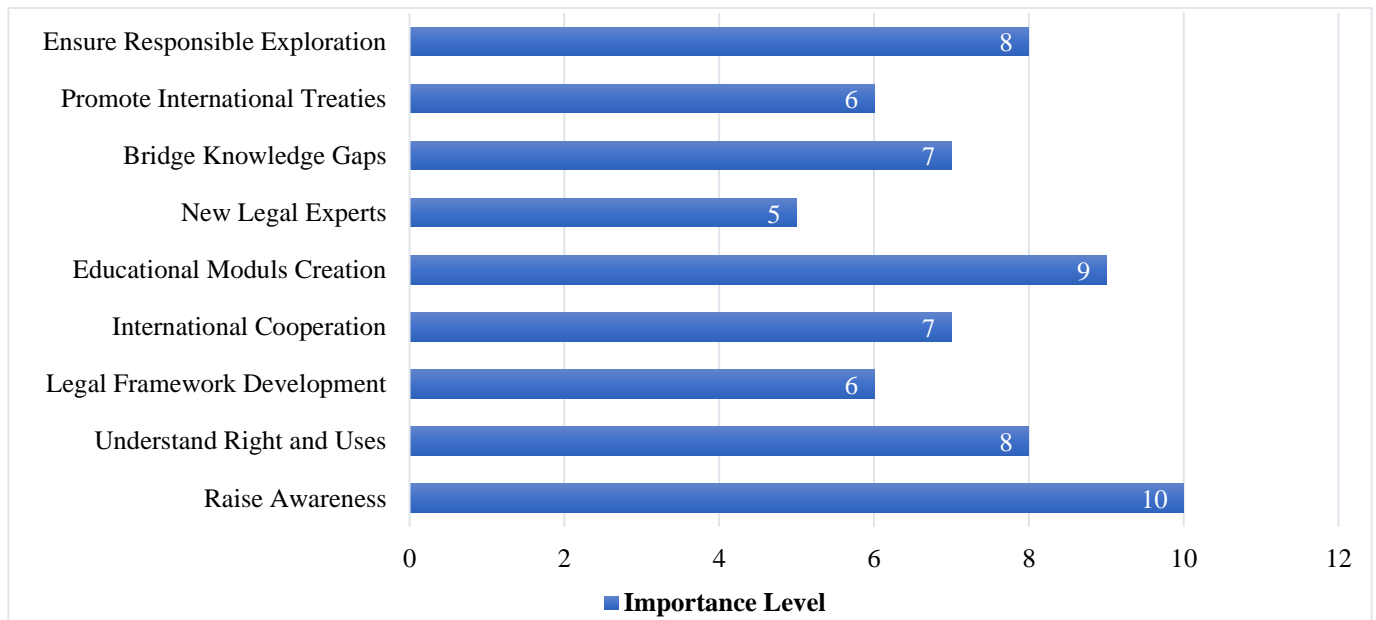


Fig. 6 Importance level of space law in education

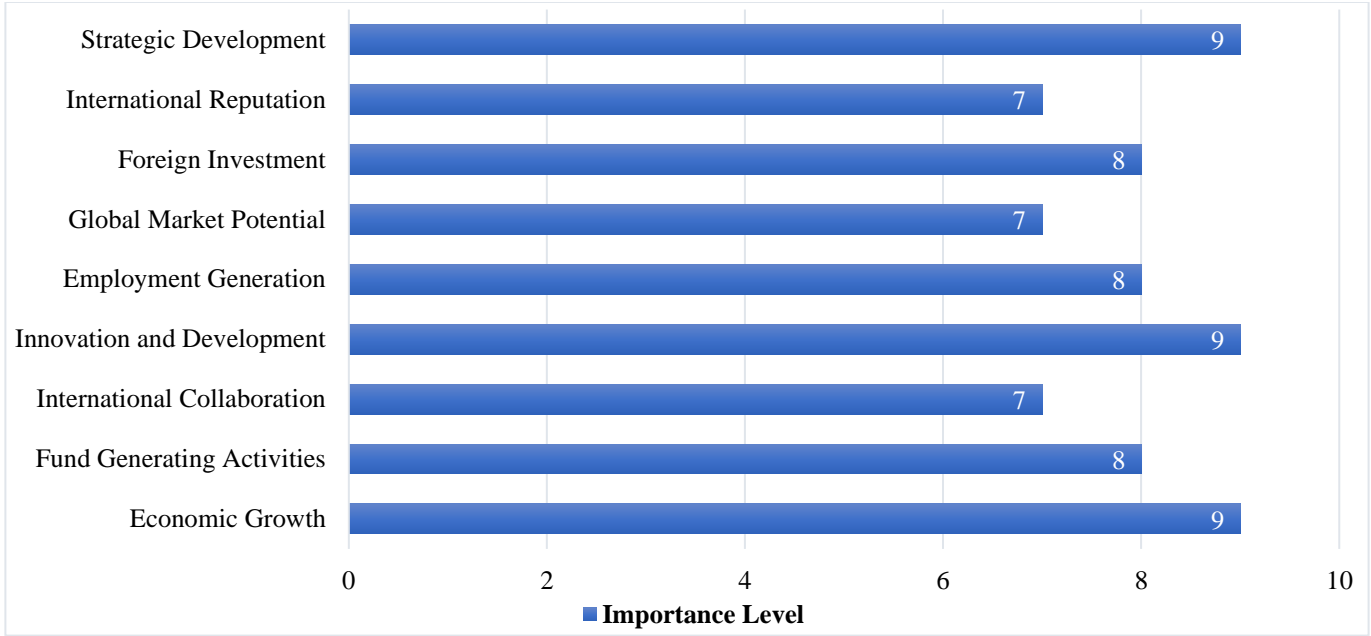


Fig. 7 Importance level of space law in the economy

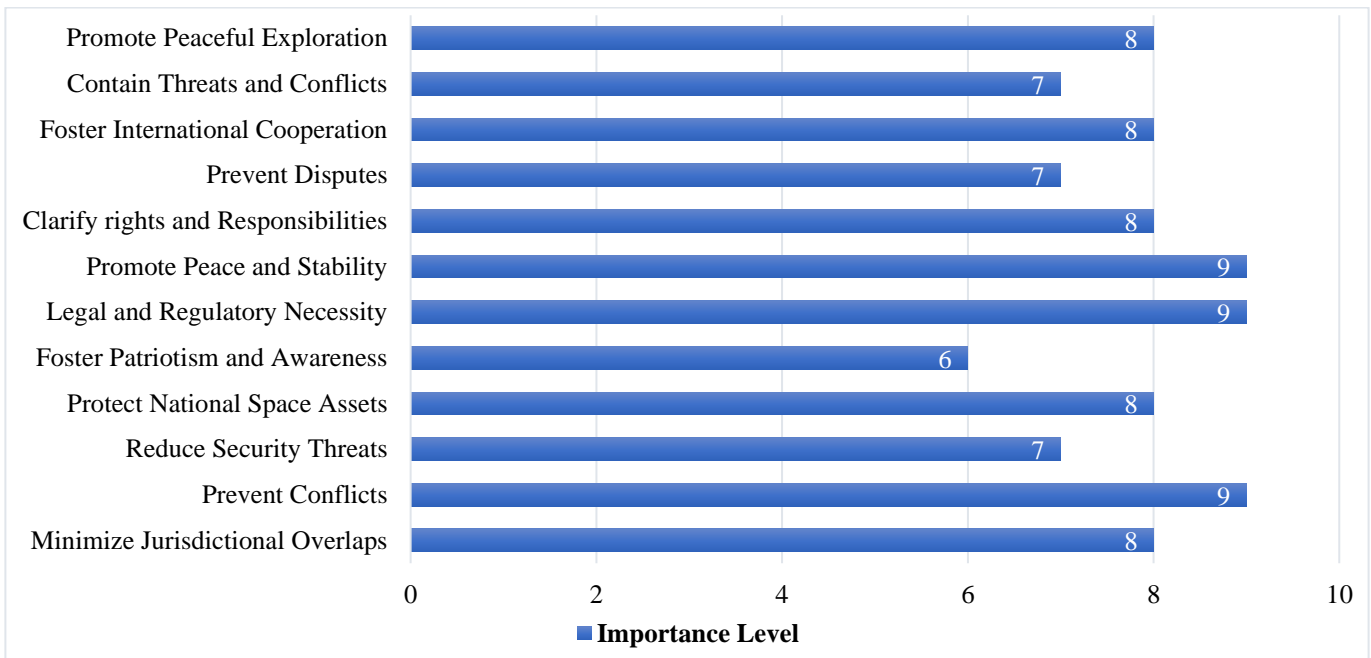


Fig. 8 Importance level of space law in security

Moreover, the innovations emerging from a space-aware society have the potential to be marketed globally. The technologies developed can be sold abroad, establishing the nation as a leader in space technology and fostering a new source of revenue. This international trade not only boosts the nation's economy but also enhances its reputation on the global stage. Furthermore, the strategic development of space law education and the subsequent growth in space-related industries can attract foreign investment, further propelling economic growth.

Countries with advanced space law education and robust space industries become attractive partners for international collaborations, leading to additional economic and developmental benefits. Offering space law education is a strategic move for any nation aiming to advance its economic growth and development. By fostering a space-aware society and encouraging innovation in space-related technologies, nations can generate substantial economic benefits and establish themselves as key players in the global space industry [27].

4.3.3. Security

The question of security encompasses both the people and the nation. Establishing space law is a crucial measure to assure national security, as it helps minimize jurisdictional overlaps and potential conflicts among nations. The absence of regulatory frameworks in the vast expanse of outer space can lead to significant negative impacts, such as invasions and security threats arising from man-made or natural space debris. Without proper regulations, the risk of harmful interference with national space assets increases, potentially jeopardizing a nation’s security and strategic interests.

Educating the populace on the importance of space law can foster a heightened sense of patriotism and awareness regarding national security. When people understand the critical role that space law plays in safeguarding their country’s interests in outer space, they are more likely to support and advocate for these legal frameworks. The establishment of space law should thus be seen not only as a legal and regulatory necessity but also as a fundamental component of national security that becomes ingrained in the public’s ideology [28].

Effective space law can serve as a deterrent against international conflicts, promoting a stable and secure outer space environment. By clearly delineating the rights and responsibilities of nations, space law helps prevent disputes over space resources and orbital territories. This legal clarity is essential for maintaining peace and fostering international cooperation in space exploration and utilization. Moreover, the implementation of space law contributes to the broader objectives of peace and freedom, reinforcing a nation’s

commitment to these values. It helps contain potential threats and conflicts, ensuring that outer space remains a domain of peaceful exploration and development. In conclusion, the establishment of space law is integral to national security, fostering a sense of patriotism and ensuring that outer space activities are conducted in a manner that promotes peace and prevents conflicts [29].

4.3.4. Research

Another significant dimension of space exploration is research. Advancements in technology now enable sophisticated research to be conducted in outer space, which is often necessary due to the unique conditions that cannot be replicated within earth's atmosphere. The microgravity environment of space, for instance, allows scientists to conduct experiments that are impossible or impractical on earth, leading to breakthroughs in various fields such as medicine, materials science, and fundamental physics.

Space law plays a crucial role in regulating these activities to prevent harm to celestial bodies. It establishes a framework that ensures research activities are conducted responsibly without causing damage or instability to the solar system. This regulatory oversight is particularly evident in research activities involving the moon.

The Outer Space Treaty of 1967, a cornerstone of space law, explicitly prohibits any national appropriation of the moon and other celestial bodies by any means, including use, occupation, or any other means. This prohibition extends to activities that could lead to exploitation, such as mining, even if undertaken for research purposes [30].

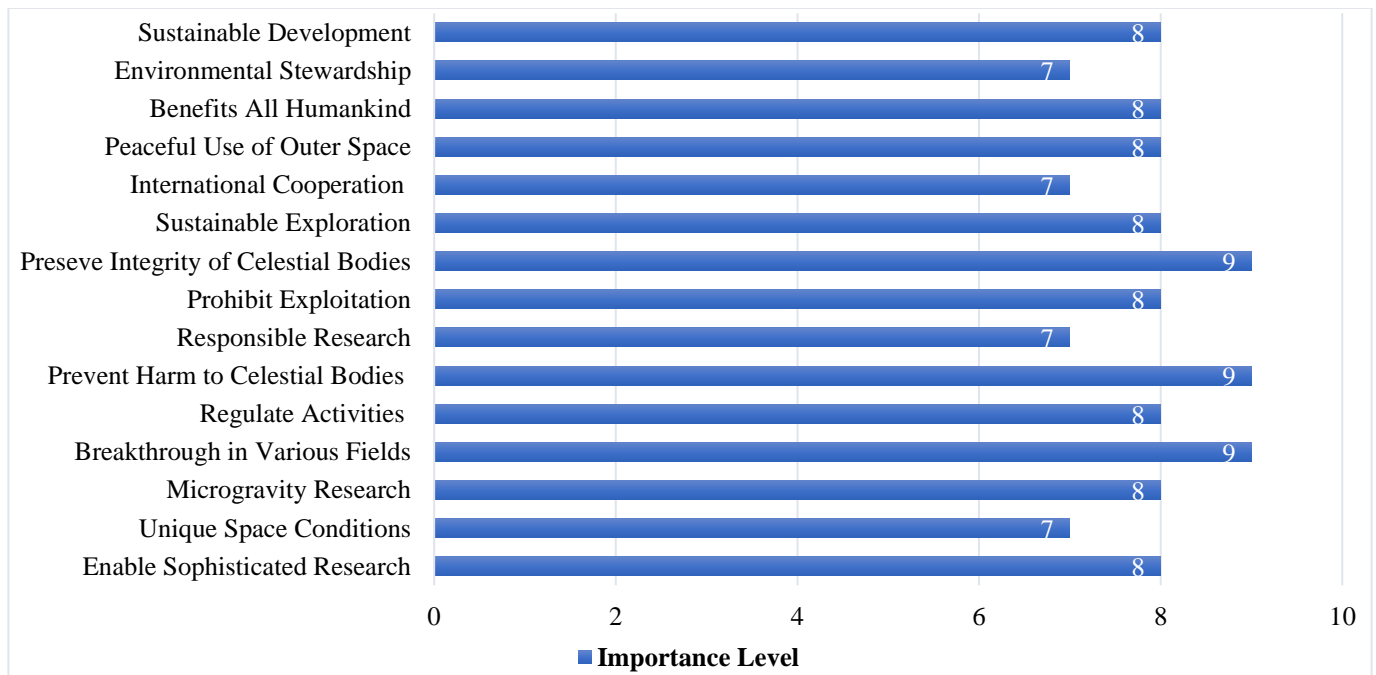


Fig. 9 Importance level of space law in research

By limiting such potentially harmful activities, space law helps preserve the integrity of celestial bodies, ensuring they remain unspoiled for future generations of researchers and explorers. This legal framework underscores the importance of conducting space exploration and research in a manner that is sustainable and respectful of the extraterrestrial environment. Moreover, the regulation of space activities fosters international cooperation and promotes the peaceful use of outer space. It ensures that research conducted in space benefits all humankind rather than serving the interests of a few. This approach not only protects the solar system from damage but also aligns with broader principles of environmental stewardship and sustainable development. In summary, space law is essential for regulating space research activities, safeguarding celestial bodies from harm, and ensuring that technological progress in space exploration is conducted responsibly and sustainably [31].

5. Conclusion

Enacting space law is a crucial undertaking due to the numerous incidents that have had adverse impacts on the space environment. The increasing level of space debris is a particularly pressing concern. By establishing comprehensive space laws, nations can be bound by regulations designed to control outer space exploration activities more effectively, thereby reducing the number of harmful incidents. Such laws would ensure that all spacefaring nations adhere to a standardized set of rules, promoting safer and more sustainable practices in space. In Malaysia, current legislation related to space activities is limited. For instance, the Akta Multimedia 1998 regulates the licensing of communication satellites within the country. However, there is no specific law

addressing the broader spectrum of outer space matters. Recognizing this gap, the Malaysian Space Agency (Agensi Angkasa Malaysia, MYSA) has collaborated with the Attorney-General's Chambers to draft the Rang Undang-undang Angkasa Lepas Malaysia, a proposed law intended to specifically regulate and oversee outer space activities.

This initiative gained momentum following Malaysia's 2007 program that sent its first astronaut into space. The government, concerned with the rights of astronauts and national security, recognized the necessity of a dedicated space law. The drafting of this legislation is a proactive step by the government to secure the future peace and security of the country. By engaging in negotiations with various stakeholders, Malaysia aims to develop a comprehensive legal framework that addresses the complexities of outer space activities. This ongoing effort reflects a commendable initiative by the Malaysian government. Establishing such a legal framework is essential not only for protecting the country's interests in outer space but also for contributing to the global effort to ensure the sustainable and peaceful use of outer space. As space exploration and activities continue to expand, the implementation of robust space laws will be crucial in mitigating risks and fostering international cooperation.

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