
Leveraging Slovenian National Space Law for Sustainable Development and Human Rights Protection including SWOT Analysis

*Aida Gajić**

ABSTRACT

This article offers a comprehensive analysis of Slovenia's emerging role in the space sector, underscored by the enactment of the 2022 Space Activities Act. As a new participant in the international space community, Slovenia has demonstrated a strategic intent to harness space for national development, innovation, and international cooperation. Central to this analysis is the scientific question of how space technologies, regulated by national space law, can be utilized to protect and enhance human rights. An inductive research approach is employed to present a case study of a Slovenian private actor developing and launching nanosatellites, aimed at supporting the theory that small satellites can contribute to meeting the Sustainable Development Goals (SDGs). The research also examines the regulation of space within the framework of new global governance, with a particular emphasis on the role of the private sector, and seeks to deepen understanding of the importance of space in safeguarding basic human rights on Earth. However, significant challenges, such as technological and financial barriers, as well as intense global competition, pose threats to Slovenia's space sector. To assess the development of this sector, the article applies a SWOT¹ analysis. Space Activities Act from 2022 serves as the foundational legal framework for regulating all space-related activities within and beyond Slovenia's borders. Aligned with international treaties and standards, the Space Activities Act emphasizes sustainable practices and space debris mitigation, reflecting Slovenia's commitment to responsible space exploration. Key provisions of the

*Aida Gajić is a PhD student at European Faculty of Law.

¹ SWOT analysis stands for strengths, weaknesses, opportunities and threats.

law include comprehensive licensing procedures, stringent safety and environmental regulations, and measures to encourage public and private sector involvement in space activities. The article concludes with strategic recommendations to leverage Slovenia's institutional frameworks and partnerships to enhance its position in the global space sector. It advocates for adaptive strategies to navigate the evolving landscape of international space law. Through this SWOT analysis, the article provides insights into how Slovenia can maximize the potential of its space sector to contribute to economic growth, technological advancement, and the protection of human rights through regulated space technologies.

Keywords: Space Activities Act, Slovenia's Space Sector, SDGs, Human Rights protection, SWOT analysis

Slovenska vesoljska zakonodaja za trajnostni razvoj in varstvo človekovih pravic s SWOT analizo slovenskega vesoljskega sektorja

POVZETEK

Članek ponuja celovito analizo vloge Slovenije v vesoljskem sektorju, ki je podprta s sprejetjem Zakona o vesoljskih dejavnostih iz leta 2022. Slovenija je kot nova udeleženka v mednarodni vesoljski skupnosti pokazala strateško namero izkoristiti vesoljski sektor za nacionalni razvoj, inovacije in mednarodno sodelovanje. V središču analize je raziskovalno vprašanje, na kakšen način uporabiti vesoljske tehnologije, ki jih ureja nacionalna vesoljska zakonodaja, za zaščito in krepitev človekovih pravic. Z induktivnim raziskovalnim pristopom je predstavljena študija primera slovenskega privatnega sektorja, ki razvija nanosatelite in deluje na področji visoke vesoljske tehnologije. Namen analize je podpreti tezo, da majhni sateliti in vesoljska tehnologija prispevajo k uresničevanju ciljev trajnostnega razvoja (SDG). Raziskava obravnava tudi ureditev vesolja v okviru novega globalnega upravljanja s posebnim poudarkom na vlogi zasebnega sektorja in poskuša poglobiti razumevanje pomena vesolja pri varovanju temeljnih človekovih pravic na Zemlji.

Obenem slovenski vesoljski sektor ogrožajo pomembni izzivi, kot so tehnološke in finančne ovire ter močna svetovna konkurenca. Za oceno razvoja tega sektorja je v članku uporabljena SWOT analiza. Zakon o vesoljskih dejavnostih iz leta 2022 služi kot temeljni pravni okvir za urejanje vseh z vesoljem povezanih dejavnosti znotraj in zunaj meja Slovenije. Omenjeni ZVDej je usklajen z mednarodnimi pogodbami in standardi, poudarja trajnostne prakse in zmanjševanje količine vesoljskih odpadkov, kar odraža zavezanost Slovenije k odgovornemu raziskovanju vesolja. Ključne določbe zakona vključujejo celovite postopke izdaje dovoljenj, stroge varnostne in okoljske predpise ter ukrepe za spodbujanje vključevanja javnega in zasebnega sektorja v vesoljske dejavnosti. V zaključku so poudarjena strateška priporočila za uporabo institucionalnih okvirov in partnerstev Slovenije v namen krepitve njenega položaja v vesoljskem sektorju na mednarodni ravni. Zavzema se za prilagodljive strategije, ki so nujno potrebne na področju mednarodnega vesoljskega prava. S SWOT analizo članek ponuja vpogled v to, kako lahko Slovenija z regulacijo vesoljskih dejavnosti čim bolj izkoristi potencial svojega vesoljskega sektorja ter tako prispeva h gospodarski rasti na nacionalnem nivoju ter tehnološkemu napredku in varstvu človekovih pravic v globalnem smislu.

Ključne besede: Zakon o vesoljskih dejavnosti, slovenski vesoljski sektor, cilji trajnostnega razvoja, varstvo človekovih pravic, SWOT analiza

1. Introduction

In recent years, Slovenia has demonstrated its ambitions in the field of space exploration through an increasingly active engagement with the international community and prominent players in the space sector. One of the more visible developments in space sector is the establishment of the Slovenian Space Office within the Ministry of the Economy, Tourism and Sport, which works closely with other relevant ministries and institutions to promote and raise awareness of space activities. The activities of the Slovenian government include collaboration with the European Space Agency, the recent signing of the Artemis Accords with the US government, and the growing visibility of

the private space sector. Despite Slovenia's relatively small size, these developments have placed the country in the spotlight of potential major powers in the field of space activities. Slovenian space activities are under the authority of the Ministry of the Economy, Tourism and Sport, which closely cooperates with other relevant ministries and institutions to promote and raise awareness of space activities. Slovenia's efforts to become a full member of the European Space Agency in 2024, reinforced by the recent signing² of the understanding regarding its membership and the adoption of the Space Activities Act, provide a robust legal framework for both governmental and private entities to operate in this field, despite some shortcomings. The exploration and utilisation of space have transcended geopolitical boundaries, offering boundless opportunities for scientific discovery, technological advancement, and economic growth. In this context, Slovenia, situated in the heart of Europe, has demonstrated a keen interest in leveraging space as a strategic domain for innovation and development. This article proceeds to examine the evolving role of Slovenia in the space arena. It considers the legislative framework, strategic partnerships, educational initiatives, and commercial ventures that underpin this journey through SWOT analysis.

2. Slovenian's Commitment to International Space Law

Slovenia is a signatory to four international treaties; OST, ARRA, LIAB and REG³, but did not accept the MOON Agreement.⁴ Membership of multilateral international treaties is of paramount importance for Slovenia, as it confirmed its status as a successor

² The Accession Agreement between the Government of the Republic of Slovenia and ESA to the Convention for the Establishment of a European Space Agency and the related conditions was signed following the mandate given by the Government at its 105th regular session on 30 May 2024.

³ Agreement on the rescue of astronauts, the return of astronauts and the return of objects launched into outer space with Succession entered into force in 1992, Liability Convention with succession from former SFRJ entered into force in 1992. Outer Space Treaty and Registration Convention were ratified in 2019.

⁴ The practice of succession of the Republic of Slovenia is based on the internal legal acts of the Resolution on the Proposal for the Agreed Reunification of the SFRY and the Constitutional Law for the Implementation of the Fundamental Constitutional Charter on the Independence and Independence of the Republic of Slovenia. The legal basis at international level is governed by the 1978 Vienna Convention on Succession of States in respect of Treaties and the 1983 Vienna Convention on Succession of States in respect of State Property, Archives and Debts.

state (Grašek, 2013) and enabled it to act as a sovereign state in the international community.

State succession in international law occurs when one state replaces another in terms of sovereignty over a territory. This process raises questions about the validity of treaties, membership of international organisations, state property, debts, archives, the rights of populations and nationality. State succession ensures stability in international relations by regulating the transition of the »old state« to the »new state« (Polak Petrič, Pajnikihar, 2024). Article 8(2) of the Constitution of the Republic of Slovenia stipulates that ratified international treaties are directly applicable⁵, thereby obviating the need for their provisions to be transposed into the laws of the Republic of Slovenia (Petrič, 2019).

2.1. Space Law and Its Connection to General International Law

While state sovereignty shapes the character of international law, space law operates as a *lex specialis*, meaning it consists of specialized legal principles governing activities in outer space, distinct from general international law (Von der Dunk, 2020). However, it is essential to ensure that space law remains connected to general international law to prevent it from becoming isolated, stagnant, and ineffective. Overemphasizing space law as a *lex specialis* could indicate a lack of understanding of general international law, which must be avoided (Lyall & Larsen, 2018). Law should be consistent across all domains, including space, where "we seek the rule of law, not rule by law," (Lyall & Larsen, 2018, p. 944) where rules are followed only when convenient for the powerful and changed at their request.

This leads to Evolving Perspectives on Customary International Law where a growing body of contemporary literature (Roberts, 2001; Roozbeh, 2010; Petersen & Lepard, 2010) has emerged that questions the traditional understanding of what constitutes a rule for the creation of customary international law. As an example, the essence of Lepard's theory is the reduction of the two constitutive elements of customary law to one - *opinio iuris*: »a norm of

⁵The Constitution of the Republic of Slovenia, Article 8: "Laws and other regulations must comply with generally accepted principles of international law and with treaties that are binding on Slovenia. Ratified and published treaties shall be applied directly."

customary international law arises when States generally believe that it is desirable, now or in the foreseeable future, to have an authoritative legal principle or rule prescribing, permitting, or prohibiting a particular course of conduct” (Petersen & Lepard, 2010, p. 795). The practice of states is not perceived as a compulsory requirement, but rather as evidence of this belief. With this emphasis on *opinion juris*, Lepard follows a popular trend among international law scholars.

This approach downplays the importance of state practice, reflecting a trend towards emphasizing norms with moral effects, such as human rights law. Despite the discrepancies between official declarations and actual practice, treaties and customary international law remain fundamental to regulating the exploration and use of outer space. “As we often observe discrepancies between official declarations of states and actual practice in this field” (Petersen & Lepard, 2010, p. 795), it can be generally concluded that these sources, in particular treaties and customary international law, play a very important and fundamental role in the international legal regulation of the exploration and use of outer space. They provide the framework under which activities in outer space are carried out. Regarding international conventions, five major United Nations treaties on outer space have been finalised under the auspices of the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS).

2.2. Interaction between national and international Space Law

The sources of law can be defined as the systems or processes that give rise to international law. If a rule or norm is endorsed by one of the recognised sources, it can be accepted as part of a system of law. Conversely, if it cannot be confirmed by one of these sources, it is a mere assertion and cannot be binding on any international actor. Another unique aspect of international law is that the “mere violation of the law may lead to the creation of a new law” (Higgins, 2018, p. 19). Understanding the doctrine of sources in public international law is therefore essential to clarify what is binding in space law and what is mere interpretation or assertion. While describing interaction between national and international Space Law, it should be stressed that the presence or absence of a particular provision in the domestic

legal structure of a State, including its constitution, if any, cannot be used to avoid an international obligation. Otherwise, the basic purpose of the operation of international law would be defeated, leading to a great deal of uncertainty as to the relationship between the domestic and international legal frameworks (Shaw, 2008).

It is important to understand the relationship between national space law and the sources of international space law. In general, space law consists of two levels of laws and regulations (Ma, 2014). The first level is international law, which governs the rights and obligations of States and intergovernmental organisations operating in outer space. The second level is the national level, or the adoption of the formal domestic legal frameworks that enable a State to operate in space. The fact is that the formal and legal resources of international space law are not sufficient for today's activities and the rapid technological advances in this field, and therefore the international community seeks to address this problem, which arises within the activities of States as well as other international entities, through the channels of soft international law, or so-called *soft-law instruments*, which are non-binding documents or *non-legally binding documents*, and through the adoption of national laws (Marchisio, 2022; Sancin, Grünfeld & Ramus Cvetkovic, 2021). The international community is also undergoing drastic changes in which economic, cultural, political and social relations have become much more interconnected, particularly in the space sector (Jakhu, Freeland & Chan, 2021). The concrete example of licensing and authorisation of space activities at the level of national law is a more straightforward process, as national space laws are applied within the framework of a country. For example, the Republic of Slovenia, more specifically the Ministry that is in charge for technology, issues a licence to carry out space activities on its territory on the basis of the Space Activities Act.⁶

On the other hand, it is an irrefutable fact that a significant proportion of space activities has been privatised, which has led

⁶ Space Activities Act, Article 4, Licence: "(1) Space activities shall be conducted on the basis of a licence issued by the ministry responsible for technology (hereinafter: the ministry) following an application by the operator. (2) The ministry shall issue the licence within four months of the date of receipt of a complete application for the issuing of the licence. (3) The Government of the Republic of Slovenia shall determine, by way of a decree, the contents of the application referred to in paragraph one of this Article."

to the involvement of the commercial sector (Jacobson, 2020). Consequently, the response of national law to space activities is becoming increasingly important. Furthermore, we are currently in a period of transition, a period during which formal international law is being complemented by informal forms of new global governance involving civil society as well as the private sector. This allows the international community to act more flexibly and to react more quickly to technological developments in the space sector. While the space sector acknowledges the value of some regulations, it is essential to strike the right balance. Improving these procedures would benefit both the commercial and the civil sector, as a loosening of restrictions and a more flexible legal regulatory environment has proven to be more economically beneficial for the countries themselves (Jacobson, 2020). To operate and meet the challenges of current developments in the space sector, an ideal mix of international treaties, guidance, standards, national laws, and private sector best practice is needed. The formula for the optimal relationships between the various actors in this field is not straightforward to determine. However, the skeleton that would most appropriately enforce both *hard* and *soft international law* must satisfy the first and foremost principle of international space law, which is the welfare of all mankind and the preservation of the space environment for future generations through the prism of justice *infra legem*, *praeter legem* and *contra legem* (Higgins, 2018). Consequently, the equal sharing of the benefits of outer space must be ensured.

2.3. Big steps forward to sustainable use of Space with signing the Artemis Accords

On 19 April 2024, Slovenia officially signed the Artemis Accords⁷, a framework for sustainable space exploration. This makes Slovenia the 39th country to join the accords and the third European country to do so within a span of five days, following Switzerland and Sweden (Foust, 2024). The Artemis Accords, initiated in 2020, is built upon the Outer Space Treaty of 1967 and em-

⁷The Artemis Accords. Principles for Cooperation in the Civil Exploration and Use of the Moon, Mars, Comets, and Asteroids for the Peaceful Purposes. United States of America, NASA, introduced on 13.10.2020.

phasise principles such as transparency, interoperability, and the preservation of space heritage. This move aligns with Slovenia's commitment to the peaceful use of space. Slovenia, which has been an associate member of the European Space Agency since 2016, views this as a strategic step to enhance its role in global space exploration and to develop its space sector.

The Artemis Accords is the basic basis for international cooperation with other space agencies and has the pre-legislative character of a bilateral agreement (Von der Dunk, 2022). Also classified as a Memorandum of Understanding (Von der Dunk, 2022) this document has more significance than a geneticist's agreement but is still less binding than a treaty would be.

The document is divided into thirteen sections, each representing one of the principles of the implementation of space activities and the functioning of inter-parties in the space sector. The Artemis Accords aim to establish best practices of conduct and, over time, to become part of customary international space law by adhering to basic legal principles, which are also the source of international law. The importance of respecting the principles set out in existing international agreements is stressed »with a view to implementing the provisions of the Outer Space Treaty and other relevant international instruments, thereby establishing a political consensus on mutually beneficial practices for the future exploration and use of outer space, with a focus on activities carried out in support of the Artemis programme« (The Artemis Accords, 2020, p.1).

It is notable that the Artemis Accords act as an alternative to the failed Moon Treaty but in a non-legally binding manner. Of particular significance is the section dealing with resource exploitation and the redistributive regime relating to benefits derived from space resources.⁸ The document states that the

⁸The Artemis Accords, section 10: "1. The Signatories note that the utilization of space resources can benefit humankind by providing critical support for safe and sustainable operations. 2. The Signatories emphasize that the extraction and utilization of space resources, including any recovery from the surface or subsurface of the Moon, Mars, comets, or asteroids, should be executed in a manner that complies with the Outer Space Treaty and in support of safe and sustainable space activities. The Signatories affirm that the extraction of space resources does not inherently constitute national appropriation under Article II of the Outer Space Treaty, and that contracts and other legal instruments relating to space resources should be consistent with that Treaty. 3. The Signatories commit to informing the Secretary-General of the United Nations as well as the public and the international scientific community of their space resource extraction activities in accordance with the Outer Space Treaty. 4. The Signatories intend to use their experience under the Accords to contribute to multilateral efforts to further develop international practices and rules applicable to the extraction and utilization of space resources, including through ongoing efforts at the COPUOS."

exploitation of space resources does not in itself constitute national appropriation under Article II of the Outer Space Treaty. It will be of interest to observe how Slovenia will decide to utilise space resources in the future. As a signatory to the Artemis Accord, it is likely that Slovenia will be in favour of the use and exploitation of resources, but it must be borne in mind that the resources of space are for the benefit of humanity as a whole. Furthermore, it asserts that the safety zones defined in Section 11, are necessary for the transparency of information and coordination, and thus for the prevention of harmful interference and the fulfilment of the obligations of due diligence. While the Artemis Accords promote the extraction and exploitation of resources, they do not provide for an international regime, as provided for in the Moon Treaty in Article 11. Time and the practice of States and *opinio juris* will determine whether the AA document is a solution in the right direction and whether it offers consistent rules of conduct for all actors. It is true that the solutions offered in the AA are innovative and represent a certain progress, but to what extent they do so remains to be seen and determined by the practice of all the subjects of international law. If one understands international law as a process, the Accords may be seen as a good way of bringing together the public and private sectors at international level.

3. Going further with Slovenia's Space Activities Act

The most obvious way to make international space law work coherently is to introduce national laws governing space activities. Much practical space law is being developed in the various legal systems of the world, particularly in the legal systems of space-active States. The development of space law is thus taking place in three directions (Steer, 2017). Firstly, the domestic legal order is responding with new national laws dedicated to space activities, i.e., the establishment of new structures and procedures to deal with space activities. Secondly, by applying the existing rules of the national legal system to space activities or, in the third case, by applying the international law theory of »self-executing treaties« and achieving a direct transposition of international agreements into the national normative system.

The peculiarity of space law is that “in addition to sovereign states, non-state structures such as private entities, international organisations, and even individuals” (Steer, 2017, p. 4) have been increasingly involved in recent decades and play a key role in the development of this sector. Given the rapid progress and interdisciplinary nature of the space sector, this branch of international law needs flexible rules, including in the form of non-binding legal instruments, which will support its long-term objectives and allow it to grow in different directions. The regulatory environment for space law is rudimentary and in need of updating, if not revision since it was conceived thirty to forty years ago. It was envisaged that we would have about ten commercial launches a year, launching about twelve to fifteen satellites, but we are now doing ten times more in all areas (Jacobson, 2020). Thus, today, the term transnational law is also in use, and includes relations and relationships between states. Non-state actors are involved in shaping the processes of international law (Steer, 2017). The relationship between transnational and national law is leading to new forms of global governance which, to be more flexible and to respond more quickly to a rapidly changing global world, uses soft law approaches and can become a binding legal norm through national legislation.

National legislation guided by international space treaties should be tailored to align with the specific interests, socio-economic development, legal traditions, and current and planned space activities of each country. One of the key motivations for adopting national legislation is to create a competitive regulatory framework that will enhance the opportunities for private entities to engage in space activities within the country’s territory. Historical evidence suggests that many countries have established national space legislation as the most effective means of implementing international obligations under space treaties (Tapio & Soucek, 2022).

Slovenia has opted for the first path, adopting the Space Activities Act in April 2022 with the intention of facilitating more effective participation in space activities. The Act allows for a more precise, transparent, and authentic engagement within the international community. The primary motivation for the enactment of the national legislation was the aspiration to facilitate

the full operationalisation of the European Space Agency within the internal space sector, as well as the operation of research and educational institutions engaged in space activities.⁹ In light of the obligations imposed by international treaties, such as the State's liability for damages to third countries, the legislation introduced oversight of space activities and established a national register of space objects. In the case of Slovenia, the national law fulfils the commutative subjective condition, that is, the legal consciousness of the State, which shapes customary international law. The practice of the Slovenian State, the objective condition, is in the making and will certainly be better formulated with the creation of the Space Activities Act.

Slovenian Space Activities Act is primarily concerned with personal and territorial jurisdiction. Through the Act, the State implements certain international legal obligations arising from ratified treaties. Through the law, the State implements certain international legal obligations arising from ratified treaties. For example, Art. VI of OST; "international responsibility for national activities in outer space, including the moon and other celestial bodies, whether such activities are carried on by governmental agencies or by non-governmental entities... shall require authorization and continuing supervision".¹⁰ Article 2 of Space Activities Act defines the scope of application and, in line with the OST, establishes control also over space activities outside the territory of Slovenia carried out by Slovenian citizens and legal entities established in Slovenia. Thus, it can be noted that the Act, in establishing a real connection with legal persons, is based on the seat theory and thus deviates from the internationally established theory of incorporation, which is used to determine the nationality of legal persons in the light of the provision of diplomatic protection (Sancin, 2021).

An example of the implementation of guidelines for the long-term sustainability of space activities is Article 5 of the Space Activities Act, which fully supports the preservation of the space environment for future generations. Even if it is not explicitly stated that »environment« also refers to the space environment, this can be inferred from the individual points of the article. Point (b) calls

⁹ Predlog zakona o nadzoru vesoljskih dejavnosti – Proposition of Space Activities Act, 2018-2130-0005, p. 1.

¹⁰ OST, art. VI.

for compliance with international standards; »space activities are conducted in accordance with the international standards and guidelines of internationally recognised standardisation organisations on the safety and technology of space activities;«. Similarly, point (c)¹¹ mentions the need to protect the environment. The most illustrative reference to the space environment is Article 5(e), which lists the limitation of the generation of space debris as one of the conditions for licensing.¹² It thus also fulfils one of the guidelines¹³ of UNGA Resolution 68/74 on Recommendations on National Legislation Relevant to the Peaceful Exploration and Use of Outer Space. Article 5(e) also provides mitigation of space debris as one of the conditions for licensing “with the applicable UN Space Debris Mitigation Guidelines and for limiting adverse environmental effects on Earth or in outer space or adverse changes in the atmosphere”.¹⁴

Slovenia thus follows and promotes the sustainable development of outer space and implements the LTS guidelines as a non-legally binding document. However, the definition of space debris in Article 3 of the Space Activities Act, is inadequate and lacks precision. It describes space debris as »space objects remaining in space after the cessation of space activities or as a consequence of space activities, or space objects that return to Earth uncontrolled«. ¹⁵ It does not mention that space debris also includes particles of these space objects that are separated from the main source, whether controlled or uncontrolled. There is also no mention of the non-functionality of the facility being in space. The linguistic interpretation of the word »termination« does not cover the intention of termination and the consequence that follows. Termination can be intentional or unintentional. In the practice of States, waste is defined as those objects that are no longer able to perform their function. They are not necessarily valueless to the State exercising jurisdiction over them. It

¹¹ Space Activities Act, article 5(c): “space activities do not pose a threat to national defence, public order, the safety of people or their property, national intelligence and security operations, and protection against natural or other disasters and do not negatively affect public health, the environment or aviation.”

¹² Space Activities Act, article 5(e): “space activities envisage measures for limiting the generation of space debris in accordance with the applicable UN Space Debris Mitigation Guidelines and for limiting adverse environmental effects on Earth or in outer space or adverse changes in the atmosphere.”

¹³ Recommendations on national legislation relevant to the peaceful exploration and use of outer space, UN General Assembly, A/RES/68/74, 16.12.2013.

¹⁴ Space Activities Act, 5(e).

¹⁵ Space Activities Act, article 3.

has been suggested that it is the same State, and only that State, which can determine whether its facility is functional. Although a space object might be perceived by others as completely useless, it may in fact still have some value. For example, an inactive space object may be held in reserve for future activities, may carry valuable classified information, or may otherwise be of interest to other States (Viikari, 2007). Therefore, the criterion of »functionality«, at least if understood in a purely technical sense, may not be the most useful linguistic interpretation as set out in the Slovenian law, namely »cessation of activities«. To distinguish space debris from other space objects, it should be noted that even apparently non-functional - inactive space objects can be valuable assets.

The Government of the Republic of Slovenia shall determine, by way of a decree, the educational, technical, financial, safety and environmental criteria to establish the meeting of criteria referred to in paragraph one of Article 5, which is highly progressive for small countries like Slovenia. To these criteria, Article 6 of the Space Activities Act adds insurance of the minimum amount of EUR 60,000,000 per loss event for the duration of space activities.

Space Activities Act provides the basis for access to the premises and installations of licence holders and for inspection of documentation.¹⁶ The operator is also obliged to report events or facts that may affect the validity of the licence and the existence of an accident or hazard.¹⁷ However, this does not include reporting irregularities that could cause danger or damage. It also includes the revocation of the licence¹⁸ and the imposition of a fine¹⁹ in the event of an offence, which is relatively low, but does not include the suspension of the licence or the modification of the duration of the licence. However, there is an option for the Ministry responsible for technology to set a deadline for the operator to remedy the irregularities before revoking the licence, which shall not exceed one year.²⁰

Article 13 of the Space Activities Act provides that the operation of a space facility, for which a licence has been issued may

¹⁶ Space Activities Act, article 17.

¹⁷ Space Activities Act, article 15.

¹⁸ Space Activities Act, article 12.

¹⁹ Space Activities Act, article 18.

²⁰ Space Activities Act, article 12(3).

be transferred to another operator who is a citizen of the Republic of Slovenia or a legal entity established in the Republic of Slovenia only with the authorisation of the Ministry responsible for technology,²¹ provided that the new operator meets certain legal conditions issuing a licence and has insurance in place. If the management of a space facility is transferred to an operator of another country, the Ministry shall give its consent to the transfer only if the RS has concluded an international agreement with that country on the regulation of liability for damages.²² Such a regime thus provides the possibility of concluding international treaties establishing responsibility for a particular space object. This has implications for the regulation of the increasingly common on-orbit transfers in practice, whereby there is a transfer of ownership, but not necessarily an explicit transfer of responsibility by the launching State. There are differences of opinion in theory regarding this issue (Sancin, 2021).

Under the Registration Convention, when a launching state launches a space object into space, the launching state must record the launch in its national register and provide information about the object to the Secretary-General of the United Nations for inclusion in the international register. This State of Registry then has »jurisdiction and control« over the object in accordance with Article VIII of the Outer Space Treaty. One interpretation of Article VIII is that “the State of registry has exclusive jurisdiction to regulate the space object, its personnel, and any related disputes” (Sundahl, 2017, p. 43). Starting from Article I of the Convention on Registration of Objects Launched into Outer Space, such a State may be the State that launches or commissions the launch of a space object, the State from whose territory or platform the space object is launched²³. As stated, there are four possibilities for naming and identifying a State Party as a launching State, namely it can be the State that launches the space object, the State that commissions the launch of the space object, the State

²¹ Space Activities Act, article 13(1).

²² Space Activities Act, article 13(2).

²³ The Convention on the Registration of Objects Launched into Outer Space, Article I, defines the launching or launching State as follows: »For the purposes of this Convention, the term ‘launching State’ means [...]» (i) The State which launches or commissions the launch of a space object; (ii) The State from whose territory or facility the space object is launched; (b) The term ‘space object’ includes the components of a space object and its launch vehicle and its components; (c) The term »State of Registry« means the State of launch in whose registry the space object is held in accordance with Article II.

that launches the space object from its territory or the State that launches the space object from its platform. It is precisely because of the different possibilities of determining the launcher's auction that it is necessary to keep a register at international level, where it is clearly stated who owns the space object and who thus also assumes responsibility for the damage caused and the other consequences that may follow.

For this reason, the maintenance of a national register, as provided for in Article 14 of the Space Activities Act, is of paramount importance. Article 14 of the Space Activities Act outlines provisions for the establishment and maintenance of a register by the Ministry for the purpose of collecting data on space objects launched into outer space. This register is intended to be public and maintained as an electronic database. The Republic of Slovenia is designated as the state of registration for space objects entered into its register. Objects eligible for entry include those for which the ministry has issued a license for space activities or those covered by international agreements regarding liability for damage. Operators are required to provide necessary data for entry within 30 days of launch or transfer to another operator. Data to be entered in the register include details such as license number, object name, launch information, orbital parameters, purpose, operator and owner information, and status of the object. Operators must notify the ministry of any changes to the registered data within eight days. Personal data collected in the register is used to identity verification and is kept permanently. The ministry is responsible for notifying the United Nations Secretary-General of entries, changes, and amendments to the register in accordance with international conventions. The government is tasked with issuing detailed regulations for maintaining the register.

Article 16 establishes a clear framework for assigning liability and ensuring compensation for damages caused by space objects, while also outlining conditions under which the state can seek reimbursement from operators. This article has certain limitations on reimbursement: which is limited by the total sum insured, except in specific circumstances which refers to intentional damage, damage caused due to gross negligence or if the damage results from non-compliance with licensing conditions or contravention of the Act.

In general, the biggest shortcoming of the Space Activities Act is the lack of clearly defined terms such as space object, space debris, space activities manager, and environment, which is mentioned in Article 5. Clearly defined authorisation and licensing implementing the LTS guidelines are of utmost importance for the sustainable development of space activities both in Slovenia and internationally. Relatively low sums of sanctions could lead to abuses, where foreign entities would lease Slovenia's low penalties and carry out illegal space activities here that would not be possible abroad due to the higher penalties. This could even lead to a kind of *space shopping* (Sancin, 2021).

4. Slovenian Space Strategy: a step towards STEM education and collaboration with ESA

The strategy presented by Slovenia was developed after the law was adopted. It is based on five pillars, which highlight the importance of promoting and developing space activities, broadening participation in space exploration, promoting the development and use of space applications, securing the next generation of scientists, and promoting entrepreneurship.²⁴ During the public hearing on the strategy²⁵, the several proposals were presented.²⁶ These included the integration of the LTS guidelines into national best practices and legislative frameworks, with an emphasis on enhancing awareness of their importance for stakeholders in the space sector. Additionally, the establishment of a space sustainability rating for private entities was proposed to promote more sustainable practices across the global space industry. In this way, Slovenia could serve as a model, following the lead of other similar countries like Austria.

Central to Slovenia's space aspirations is its strategic partnership with the European Space Agency, a collaboration that opens doors to a wealth of resources, expertise and opportunities in space exploration and technology development. Through its membership in ESA, Slovenia gains access to cutting-edge projects and initiatives ranging from Earth observation and sat-

²⁴ Further reading in the Slovenian Space Strategy from year 2023.

²⁵ Public hearing took place in April, 2023.

²⁶ The proposals outlined were put forward by the author during the public hearing on the strategy.

ellite navigation to human spaceflight and exploration missions. Slovenia's commitment to space education is also reflected in the establishment of ESERO Slovenia, a dedicated platform aimed at promoting STEM (Science, Technology, Engineering and Mathematics) education and fostering a culture of space literacy among students and educators alike. Through its collaboration with ESA and ESERO Slovenia, Slovenia aims to create a new generation of space enthusiasts and professionals with the skills and knowledge to drive future advances in space science and technology. ESERO supports the European formal primary and secondary education community. From 2023/2024, it started a gradual expansion into different forms of non-formal education, involving pre-school children and families.²⁷ By encouraging young people to pursue technological and scientific studies, ESERO will help in the long term not only the development of the space sector, but of all high-tech industries, which are already suffering from a lack of adequate human resources. Although the project is well designed for the younger generations and provides a basic introduction to the space sector, it lacks specificity and focus on the education of young people who are about to make decisions on higher education. There is a perceived lack of projects aimed at students in social or natural sciences in higher education that are feasible in Slovenia by Slovenian staff. This is assumed to be due to the lack of professional staff in the space sector. Nevertheless, Slovenia provides assistance in establishing connections with European and global organisations and in integrating with them. As an example of collaboration, we would also like to mention the multidisciplinary student research group SpaceDent, which operates in the Open Laboratory of the Faculty of Mechanical Engineering in Ljubljana and participates in the ESA Academy PETRI. It involves students of mechanical engineering, dental medicine and electrical engineering who are preparing dentistry for long-term missions to the Moon and Mars.²⁸

²⁷ Further reading about the project in O projektu ESERO, ESERO, e-source.

²⁸ Further informations available in "Priložnosti za institucije, podjetja in študente na področju vesoljskih tehnologij" which was published online by The Ministry of the Economy, Tourism and Sport, e-source.

5. Slovenian space sector in achieving SDGs – case studies

In addition to the five pillars that the office already has in the proposed strategy, this article is stressing the importance of implementing policies that would promote the sustainable development of the space sector and that would take care of the use of space applications for the achievement of the Sustainable Development Goals set by the United Nations (Space4SDGs). In the study provided by United Nations Office for Outer Space Affairs it is clearly presented the positive impact of GNSS and EO, with special focus on European GNSS and Copernicus, in achieving sustainable development and specific SDGs (UNOOSA, 2018) and they “could be used to support the achievement of the SDGs not only in Europe but worldwide” (UNOOSA, 2018, p. 1). The best results will be achieved when telecommunications, global navigation satellite systems (GNSS) and Earth observation (EO) satellites and services collaborate to achieve common goals and meet clear user requirements (UNOOSA, 2018). Two European flagship projects; European GNSS and Copernicus in synergy can lead to great support for achieving SDGs for the benefit of all humankind (Gajić, 2023). “These services are supporting a continuously increasing number of users in many different market application domains: from transport related services (for example aviation, road, maritime and rail) and consumer solutions to professional applications; for example, agriculture, construction and infrastructure monitoring” (UNOOSA, 2018, p.1.). Therefore, the use of space applications and the expertise of Slovenian companies is crucial for the achievement of the SDGs (Gajić, 2023). A well-defined strategy that leverages space technologies and knowledge to address the Earth’s most pressing problems is crucial, as it highlights the direct connection between each Sustainable Development Goal (SDG) and space applications (Gajić, 2023).

Slovenian companies like Sinergise and Space.si exemplify this approach by contributing to the fight against poverty through the use of satellite imagery and advanced data processing techniques. The case study of Sinergise, with its extensive earth observation data archive, demonstrates how such resources can significantly advance the achievement of SDGs on a glob-

al scale, reinforcing the role of space technology in sustainable development.

Sinergise can use machine learning to find patterns in the data, further enhancing its use. Recorded satellite imagery provide further important information about the processed zones for their customers coming from the field of agriculture, real-estate, GIS-tools, remote sensing, and machine learning. Organization Sinergise and their service Sentinel-hub is supporting Sustainable Development Goal 2 with their space technologies that can help increasing productivity of agricultural cultivation through informed management processes, improving the efficiency of the utilization of existing assets, (including land, seeds, fertilizers, plant protection agents and water). Decisions are supported by software services based on data generated by space systems, GNSS and EO, as well as by terrestrial technologies. Sinergise has developed several integrated applications for administration and control, such as: farm Registry, Land Parcel Identification System, On-the-spot controls, Animal controls. Components of the applications can handle, for example, land consolidation, meliorations, disease outbreak, forestry, and others. Services can be used within the institution, government, or general public.

Referring to this case study it is obvious that the use of space technologies is working in positive correlation to ending hunger more accurately, is in intersection with SDG 2 which is Zero Hunger to end hunger, achieve food security, improved nutrition, and promote sustainable agriculture. Human Rights that are related to this exact SDG are Right to adequate food [UDHR art. 25; ICESCR art. 11; CRC art. 24(2)(c)] and international cooperation, including ensuring equitable distribution of world food supplies [UDHR art. 28; ICESCR arts. 2(1), 11(2)].

Another example led by a company Space-SI, Slovenian Centre of Excellence for Space Sciences and Technologies, has developed several successful technology demonstration cases utilising the Nemo-HD microsatellite for the Soča, Sava, Drina and Danube rivers in the Alpine, Ionian-Adriatic and Danube EU macro-regions. The new technologies are now being transferred and tested in India in collaboration with the cGanga Centre for Ganga River Basin Management and Studies and the Indian Institute of Technology Kanpur as part of the Ganga and Sava River Twinning

initiative. The space industry is no longer the exclusive domain of major countries and industrial conglomerates. It has become democratised both geopolitically and financially, with the costs of developing, launching, and deploying micro and nanosatellites being significantly reduced.²⁹

The Space-SI Centre of Excellence was established with the objective of uniting the academic, scientific, and technological potential within Slovenia. This initiative offers Slovenian scientists and engineers the opportunity to participate competitively in space research and missions. Furthermore, it seeks to connect the Slovenian public with these processes, which are of great importance to society as a whole and are often invisible. The objective is to enable more sustainable management of water resources (SDG 6). This is achieved by implementing satellite data and digital twin models into integrated water resources and river basin management at all levels, including through trans-boundary cooperation. Furthermore, international cooperation and capacity-building support will be expanded through River Twinning approaches.

SDG 6 aims to ensure the availability and sustainable management of water and sanitation for all, with specific targets including universal and equitable access to safe and affordable drinking water, sanitation, and hygiene for everyone. It also focuses on reducing pollution, increasing water-use efficiency, and promoting participatory management of water and sanitation services. This goal aligns with the right to safe drinking water and sanitation as recognized in ICESCR Article 11, and the right to health as outlined in UDHR Article 25 and ICESCR Article 12. Additionally, it emphasizes equal access to water and sanitation for rural women, as stated in CEDAW Article 14(2)(h).

The second objective of this private actor is to improve actions to combat climate change and its impacts (SDG 13). This is achieved by strengthening resilience and adaptive capacity to climate change. Integration of satellite data and digital twin models to optimise climate change measures into national policies, strategies, and planning. Improved education, awareness-raising and human and institutional capacity for adaptation to climate change as well as impact reduction and early warning. SDG 13

²⁹ Satellite Data and Digital Twin Models to Support River Basin Management, United Nations, Department of Economic and Social Affairs Sustainable Development, e-source.

calls for urgent action to combat climate change and its impacts, with specific targets that include strengthening resilience and adaptation to climate change and natural disasters, particularly in marginalized communities, as well as the implementation of the Green Climate Fund. This goal is closely linked to the right to health, which includes the right to a safe, clean, healthy, and sustainable environment, as recognized in various international human rights instruments such as UDHR Article 25(1), ICESCR Article 12, CRC Article 24, CEDAW Article 12, and CMW Article 28. Additionally, SDG 13 supports the right to adequate food and safe drinking water, as outlined in UDHR Article 25(1) and ICESCR Article 11. Furthermore, it upholds the right of all peoples to freely dispose of their natural wealth and resources, as stated in ICCPR and ICESCR Article 1(2).

Another goal is SDG 15 which is to enable sustainable use of terrestrial ecosystems, combat desertification as well as halt land degradation and biodiversity loss.³⁰ SDG 15 focuses on protecting, restoring, and promoting the sustainable use of terrestrial ecosystems, including the sustainable management of forests, combating desertification, halting, and reversing land degradation, and stopping biodiversity loss. The specific targets include the sustainable management of freshwater, mountain ecosystems, and forests, combating desertification, halting biodiversity loss, and fighting against poaching and trafficking of protected species. This goal supports the right to health, which encompasses the right to a safe, clean, healthy, and sustainable environment, as recognized in UDHR Article 25(1), ICESCR Article 12, CRC Article 24, CEDAW Article 12, and CMW Article 28. It also aligns with the right to adequate food and safe drinking water, as stated in UDHR Article 25(1) and ICESCR Article 11. Furthermore, SDG 15 upholds the right of all peoples to freely dispose of their natural wealth and resources, as articulated in ICCPR and ICESCR Article 1(2).

There are many similar practical examples³¹ all leading directly or indirectly to the achievement of the Sustainable Development Goals (SDGs) set by the international community.

³⁰ Satellite Data and Digital Twin Models to Support River Basin Management, United Nations, Department of Economic and Social Affairs Sustainable Development, e-source.

³¹ For a more detailed information and more case studies see the appendix in European Global Navigation Satellite System and Copernicus titled Supporting the Sustainable Development Goals; Building Blocks towards the 2030 Agenda presented by UNOOSA in 2018.

Moreover, “GlobalNavigation Satellite Systems and satellite communications can be of use in the context of an 8 billion world” (UNOOSA, 2023, p. X). At the same time, the SDGs directly fulfil and protect the human rights enshrined in binding international treaties and agreements. As the population reaches 8 billion, tackling the global challenges facing humanity as a whole is all the more important. Under current scenarios, the population will continue to grow in the coming years, peaking at between 9 and 11 billion between 2050 and the end of the century. This population increase creates challenges and opportunities that need to be addressed through appropriate policies to ensure development while addressing the sustainability of humanity’s activities. Space data and services can help to address the challenges of the »8 billion world« and the successful implementation of global agendas.³² In fact, the space sector, activities and space technologies can make a significant contribution to solving some of the key problems of the international community.

It is necessary to acknowledge that all SDGs are interrelated and that all together bring to common goods in the benefit of all humankind, where the main subject is an individual and his/her dignity in correlation to basic principles of Human Rights and their protection. Satellite imagery and space application are indispensable tool of today and future for governmental organizations, non-governmental organizations, and society for protection of Human Rights (Gajić, 2023). Constitutional democracy and the rule of law have been under stress in Slovenia and when speaking about Human Rights there is a lack of holistic, balanced, and pluralistic approach to Human Rights protection (Avbelj & Letnar Čerňič, 2020). It is believed that companies and other private entities, operating independently of governmental financial support, could serve as an effective support system for achieving a comprehensive path toward Human Rights protection. Although a positive approach is maintained regarding the intersections between Space Law and International Humanitarian Law, many more questions remain to be addressed. The central challenge here is to make sure that space is used in a safe, secure, and sustainable manner by an

³² Further information about the EU Space in support of a world of 8 billion people available in the »Space2030« agenda published by UN in year 2023.

ever-increasing number of actors. Complicating this is the fact that almost all space technology can be used for military as well as civilian purposes. Although it is a novel area of global governance, this strategic importance of space means that its regulation is still mainly done through traditional instruments and institutions of global governance that are dominated by States (Introduction to Global Governance, 2023). The protection of human rights is, therefore, an important objective for global governance. A variety of actors, institutions, and instruments work towards the protection of human rights around the globe. In other words, they contribute to the global governance of human rights - sometimes called the global human rights regime.

6. SWOT (strengths, weaknesses, opportunities, and threats) Analysis

The Slovenian space sector is analyzed through a SWOT framework to identify the strengths, weaknesses, opportunities, and threats associated with its development. This analysis provides insights into the current state of the sector and offers strategic directions for its future growth and sustainability.

One of the key strengths of the Slovenian space sector is its highly proactive regulatory framework, established by the Space Activities Act of 2022. This legislation provides a solid foundation for regulating space activities, ensuring compliance with international standards, and facilitating the smooth operation of space-related initiatives within the country. The Act mandates the registration of space objects and ensures that space activities are safe and environmentally sustainable, positioning Slovenia as a leader in environmental stewardship within the space industry. Additionally, Slovenia's strategic partnerships with organizations such as the European Space Agency and its participation in international agreements like the Artemis Accords enhance its credibility and capabilities on the global stage. These partnerships, coupled with initiatives to promote STEM education and collaboration with research institutions, further strengthen the sector's innovation potential.

Despite its strengths, the Slovenian space sector faces significant challenges. The industry is relatively small, and Slovenia's

limited domestic market size and investment capabilities may hinder its expansion. A major weakness is the shortage of high-profile professionals in space law, making the country heavily dependent on international collaboration. This reliance on external partnerships could pose risks if geopolitical relations or strategic priorities shift. Additionally, while the Space Activities Act is comprehensive, there are regulatory gaps that need to be addressed, particularly in defining critical terms such as »space object« and »space debris,« to keep pace with the rapid evolution of space technologies and activities. Also, one may ask whether the stringent requirements and high standards presented in Slovenian Space Activities Act are not the result of the small number of Slovenian satellites.

The Slovenian space sector has substantial opportunities, particularly in emerging technologies. Participation in next-generation space projects, such as satellite technology, space exploration, and sustainable space practices, presents significant growth potential. The expansion of educational programs in space studies could position Slovenia as a regional hub for space education, further enhancing its innovation capacity. Moreover, the increasing privatization of space activities offers opportunities for Slovenian start-ups and businesses to innovate and enter new market segments, thereby contributing to the growth of a circular space economy.

The potential threats to the Slovenian space sector's success are rooted in technological and financial barriers. The high costs and complexity of space ventures pose significant challenges for a smaller nation with limited resources. Furthermore, while international regulatory changes may not be imminent, any future alterations to space law and policy could impact Slovenia's activities and partnerships. The global space sector is marked by intense competition, with major players investing heavily in technology and market expansion, which could overshadow the efforts of smaller countries like Slovenia. To remain competitive, it is crucial for Slovenia to maintain flexibility in its national legislation, allowing space for all actors in the space sector and ensuring the development of a highly educated workforce to support future generations.

Picture 1: SWOT Analysis of Slovenian Space Sector

<u>Threats</u> <ul style="list-style-type: none"> - Technological barriers - High costs of space ventures - Alternations in international law - Competitive global landscape 	<u>Strengths</u> <ul style="list-style-type: none"> - Proactive regulatory framework - Supervision and state registry - Sustainability - Environmental leadership - International partnership - Education and research focus
<u>Opportunities</u> <ul style="list-style-type: none"> - Emerging technologies - Expansion of educational programmes - Supporting start-ups and circular space economy 	<u>Weaknesses</u> <ul style="list-style-type: none"> - Small industry - Depending on international cooperation - Regulatory gaps - Lack of high-profile professionals; etc: space law

Source: the author's own work.

7. Conclusion: searching for an answer in pursuing a holistic approach

The development of international space law is moving from traditional governance to a new global governance of the international community that considers actors other than states. The sustainable development of space and activities on Earth using space applications leads to the achievement of the SDGs, which are the foundation for the establishment of inter-national relations based on justice, trust, and solidarity. At the same time, such conduct promotes the protection of human rights and the preservation of the space environment for future generations. The application of soft law forms of international law in the space domain is of paramount importance and allows global challenges to be met more quickly, both on Earth and in outer space. Where there are challenges, there are also opportunities. But opportunities usually require acting with a certain degree of responsibility. And it is the responsibility of international law actors to preserve the environment of outer space and to use its resources responsibly that constitutes one of the missing components of the legal and normative regulation of outer space. This statement opens another important question which needs to be answered. The

legal regulation of outer space must be seen from a broader perspective, one that is much more adapted to today's developments, both technological and in terms of raising collective consciousness. Given the technical complexity of space law and its scientific research development, there is a need to shift towards New Global Governance, where standards, declarations, and guidelines are integrated into domestic law, directly influencing actors such as the private sector and society. The central challenge lies in ensuring that space is used in a safe, secure, and sustainable manner by an ever-increasing number of actors.

SWOT analysis reveals that while Slovenia has established a promising foundation in the space sector through robust legislation, strategic partnerships, and educational initiatives, it must navigate challenges related to its size, dependency on international cooperation, and dynamic global competition. To maintain and enhance its space sector, Slovenia must capitalise on its strengths, address its weaknesses, seize emerging opportunities, and mitigate potential threats. Since international space law requires a holistic approach, the importance of a defined national law on space activities is even more important. Given the developed private sector in Slovenia, it is crucial to follow the state's transparent and precise operational guidelines from the state is critical, if not essential.

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