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Protecting the Intellectual Property Rights of Private Entities in Outer Space

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Abstract

Activities in outer space had grown exponentially in the last few years, due to increased participation of private entities in outer space activities. At the centre of renewed interests and investments in space was the issue of intellectual property (IP) rights for the private sector. Companies required the stability presented by defined intellectual property laws in order to attract investors, but it appears that the international laws on space expressly excludes IP rights. This study examined the dynamics of juxtaposing intellectual property rights which was individualistic and nationalistic, with rights in outer space that was communal in nature that led some jurists to conclude that there was no protection for IP rights in outer space. The study employed doctrinal method of research with emphasis on international laws on I.P. The study found out that while the space treaties were made at the time that IP rights were not envisaged, some of the provisions of the law have direct implications for protecting private rights in outer space including patents protections, trade secrets and innovations. The study discovered that international instruments failed to define patentable subject matter, but national laws were being employed by private entities to fill the lacunae. The study recommended that private agreements between parties to space exploitation may be drawn up in ensuring that IP rights are settled and well detailed in the memorandum of understanding between the parties. The study concluded that a stable legal framework for outer space is needed that will be able to accommodate all the conflicting interests in outer space.

Keywords: Intellectual property, outer space, patents, trade secrets, international law

1. Introduction

Space law is a relatively new field but has its core values enshrined in established principles of international law, including aviation law, law of the sea, nuclear and security laws.[1] Space law has major significance for societies because many activities on the earth are controlled by space-based applications; these include telecommunication systems, remote sensing and navigation systems.[2] However, in the beginning, outer space was controlled and dominated by the two world powers with a focus on domination. As more countries began joining the space sector, the benefits of space technologies became apparent because investments in space are huge and costly, which had discouraged countries that do not have such financial capacity from engaging in space activities.[3]

The availability and affordability of space technology in subsequent years made outer space more accessible to more states, though its exploration remains fraught with high risks and huge costs. Technology facilitated the incursion of private companies beginning from the 1980s, and pushed the growth of the industry into a multimillion-dollar worth of investments today. Technologies are still being deployed that will further enlarge space exploration, both for the public as well as the private sectors. However, private entities still have to work alongside the government because space expertise and scientific competencies have transformed. The foundations of space law remain the same. The test confronting the space sector now is the practicality of the laws enacted years ago being used to regulate new challenges the sector is having with the new space actors.[4] The successful launch of Sputnik in 1957 drew the attention of the world to the need for new laws that would tackle the relatively new field of international relations. The United Nations responded by creating two subcommittees under the Committee on the Peaceful Uses of Outer Space (COPUOS), whose efforts led to many international resolutions[5] that subsequently incorporated into the Space Agreements beginning with the Outer Space Treaty of 1967.

Hertzfeld observed that while the OST dealt with events in outer space, it did not address the outer space itself. The core purpose of the OST was "exploration and use of outer space", and the treaty failed to define some of the terms used within the treaty itself, leading to the problem of interpretation. A few of the terms and phrases that lacked definitions include "celestial bodies", "use", "peaceful purposes", "internationally responsible" and "objects". These definitional deficiencies caused uncertainties in the interpretation of space law. A further problem was that the space treaties were originally written in six languages with each claiming to be the

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[1] Henry R. Hertzfeld, 'Developing Issues in the law of Outer Space' (2015) 3 Penn Undergraduate L.J.

[2] Ibid

[3] Ibid

[4] Ibid at 2.

[5] UN General Assembly Resolution 1721 of December 1961 and Declaration of Legal Principles Governing the Activities of States in the Exploration and use of Outer Space, Resolution 1963.

"official one".[6] Some words might have changed or lost their intended meanings as a result of the various interpretations into the six languages.
The deployment of space technologies was mainly centred on national security,[7] scientific research and technological prowess at the beginning, with only the United States (US) and the Soviet Union (USSR) at the forefront of the space race, since the two world powers possessed the financial and technological assets to pursue their goals.[8] As a result of the stiff competition between the two space-faring nations, certain precautionary measures had to be put in place from the very beginning, which formed the legal focus of the time. This includes being mindful of the safety of the public when launching any object into space and taking responsibility for compensating any victim of such damage. Secondly, ensuring that outer space is not colonised exclusively by any state to the exclusion of others and preventing an arms race in outer space by encouraging the peaceful uses of outer space.

The above measures were later incorporated into the space treaties, binding all space-faring nations. However, space assets later became readily accessible and space technology became cheaper, thus increasing states' and private sectors' involvement, particularly in the area of telecommunications and remote sensing.[9] As a result of technological accessibility, direct television broadcasting (DTB) became the biggest revenue-generating space service.[10] Telecommunication services include fixed and mobile services.[11] The telecommunications sector has been under the control of private companies in the US, though subject to government regulations.[12] In the 1980s, private companies started competing with international companies like Intelsat, culminating in improvements to the service delivery. The launch vehicle services were government-controlled and regulated in many states, but similarly became open to participation of the private sector, leading to unprecedented growth in the market; a market now majorly controlled by the public and private sectors.[13] The Global Positioning System (GPS) proved to be a revenue generator for governments all around the world, especially for the space-faring states. However, the dual-use features of the Earth observation system limit the revenue that can be generated from it. Space became essential for most of these services because it creates a good setting from which to obtain signals from ground posts on earth and then to transmit and re-distribute those signals and re-broadcast them from space effortlessly and economically to patrons wherever on earth. Very

[6] NPEC, 'The Outer Space Treaty and Prohibited Military Space Activities (Occasional Paper 2304) (May 2, 2023) <https://npolicy.org/the-outer-space-treaty-and-prohibited-military-space-activities-occasional-paper-2304/> accessed 04/10/2023.
[7] T. Harrison and M. Strohmeyer, 'Commercial Space Remote Sensing and Its Role in National Security' (CSIS, February 2, 2022) <https://www.csis.org/analysis/commercial-space-remote-sensing-and-its-role-national-security> accessed 04/10/2023.
[8] A. Mann and C. Mckelvie, 'What Was the Space Race' (Space.Com May 14, 2023) <http://www.space.com/space-race.html> accessed 04/10/2023.
[9] Ibid.
[10] A. M. Z. Acha, Financial Analysis of Broadcast TV Programming (2012) Master's Thesis, Drexel University
[11] Kim Yongkyu *et al*, 'An Empirical Analysis of the Demand for Fixed and Mobile Telecommunications Services' (2013) SSRN <https://ssrn.com/abstract=2195068> accessed 04/10/2023
[12] Ibid
[13] Hertzfeld, supra n 1 at 7.

little reutilizing or 'manufacturing' actually takes place in space except for the manoeuvres that ensure the satellite stays in a precise location.[14]
The space sector today has changed; advances in technology have made it possible for the private sector's involvement and brought the issue of intellectual property to the forefront. This will be discussed below.

2. Method

This research employs a doctrinal method to study the legal aspects surrounding the protection of intellectual property rights of private actors in outer space. The doctrinal method is appropriate for this investigation as it concentrates on analysing existing legal rules, principles, and frameworks that underpin intellectual property and space law, at both state and international levels. The study considers primary sources of law, including core international treaties, such as the Outer Space Treaty (1967), the Moon Agreement (1979), and the Agreement on the International Space Station (1998), together with national legislation from jurisdictions with an established space industry, including the US, UK and Japan. The study also critiques secondary sources of law, including scholarly articles, legal commentary, policy papers, and reports published by international organisations, including the WIPO and UNCOPUOS, to read, interpret, and evaluate the existing legal regimes. The information collected in the due diligence is organised thematically into ownership, jurisdiction, patent enforcement and technology transfer in outer space. The doctrinal research then compares and interprets the different forms of regulations to identify and analyse the gaps, ambiguity and overlap in existing regimes, and their impact on the protection of property rights for private actors in outer space activity.

3. Analysis or Discussion

3.1. Intellectual Property Rights in Outer Space

Intellectual property (IP) rights are individualistic in principle, while outer space rights are based on communal leanings.[15] Nations involved in outer space activities cannot appropriate the outer space environment nor its resources. Property rights, including intellectual property rights, appeared prohibited by the space treaties; taking a contrary position creates challenges in the application of IP laws to space activities. Yet, such problems may seem hypothetical because space activities usually start from the Earth, as space objects are manufactured on Earth.[16] Discussions around intellectual property rights will centre mostly on regulations applicable to inventions originating from outer space, because IP laws are limited by national boundaries. Rights to IP can be obtained in the domicile's state by any inventor. Such rights are limited to the state, and whatever rights or privileges obtained cannot be extended to another state. The inventor is protected only within

[14] Ibid
[15] Z. Chen and Y. Zhao, 'Intellectual Property in Outer Space: Conflict in Theory and Application in Practice' (2022) <https://www.sciencedirect.com/science/article/abs/pii/S02596462000108> accessed 04/10/2023.
[16] Ruwantissa Abeyratne, 'The Application of Intellectual Property Rights to Outer Space Activities' (2003) 29 J Space L 1

the state of registration,[17] subject to the laws of that state. However, there are protections for IP rights at the international level in addition to what is available at the national level. An invention that took place in a state can be patented in another state entirely.[18]

The Outer Treaty barred claims of sovereignty in outer space, but states are to maintain control over any object launched to space by continuous supervision and authorisation of space activities.[19] The Intergovernmental Agreement (IGA) of 1998 was created to regulate activities on the International Space Station (ISS)[20] and became important because of the significance of IP to the activities on the ISS. The IGA has specific provisions relating to intellectual property rights arising from the ISS. Under the IGA, territorial laws of the states that own the module where the research leading to the invention was conducted are to be applied to the IP rights.[21]

IP laws give an inventor the freedom to decide whether to make the invention known to the public or keep the details secret. While disclosure remains vital to patenting[22] an invention, secrecy[23] is recognised in trade secrets. These two IP rights have divergent legal approaches and benefits attached to them, and the choice of one precludes the other, so an inventor must weigh the pros and cons of each before making their choice in protecting their IP. Industries and policymakers tend to stick to one of the methods of protection after considering their options. Granting patent rights is believed to encourage innovations by giving owners of the patent some kind of monopoly over the market. Patent monopoly hinders competition and allows the grantee to enjoy the market for several years, though the two rights have similar features, as observed by some commentators.[24] Few jurists had argued that trade secrets do not encourage innovation; others held strongly that it does offer some measure of protection.[25]

Patents entail rewarding an inventor for revealing his invention(s) or work, in the form of a monopoly granted by the state for a certain period. A patent is granted to

[17] Ibid at 2
[18] Ibid
[19] Ibid at 3, see also Article VI of the OST 1967. The authorization by the states extend to private organization involved in space activities.
[20] The ISS is a station orbiting space orbit, a result of an international cooperation between five partner states including the United States, Canada, Russia; Robin Mckie, 'It Only Makes the News When the Toilets Stop Working: Has the 25-Year-Old International Space Station Been a Waste of Space?' (the Guardian, 29 October 2023) <https://www.theguardian.com/science/2023/oct/29/international-space-station-25-years> accessed 30/10/23
[21] Ibid, see Article 21(2) of the Intergovernmental Agreement of 1998.
[22] WIPO, 'Intellectual Property and Space Activities' (April 2004) <https://www.wipo.int/export/sites/www/patent-law/en/developments/pdf/ip_space.pdf> accessed 09/10/2023
[23] Ibid.
[24] Mark A. Lemley, 'The Surprising Virtues of Treating Trade Secrets as IP Rights' (2008) 61 STAN. L. REV. 311, 313.
[25] J.J Anderson, 'Secret Inventions' (2011) 26 BERKELEY TECH.L.J. 921

encourage the disclosure of innovative works. The inventor, having invested time, energy and finances in his work, should be assured of being compensated for his efforts. Patent rights are limited in scope and may not apply in all circumstances, thus restricting the types of works that they can be used to protect. In addition, the duration of its protection is restricted, and the inventor has to recoup their investments within the years of the protection.[26] The right of patent is restricted to the boundary of the state, conceding the right, which means that a right holder can only enforce the right against infringement within the boundaries of the state.[27] The difficulties and costs of obtaining a patent make its restrictions unattractive. On the importance of patent protection for the space sector, Doldirina noted as follows:

Patents constitute an alternative form of IP protection that is used to keep technologically related or otherwise functional discoveries. Due to the specificities of space activities, in particular their advanced and inventive aspects, as well as the cost and charges for the hardware used in conducting them, adequate patent defence is germane for the expansion of this field of commercial activity. A patent system is based on more formalised and rigorous principles for protection than those essential for a copyright system. In addition, a distinct process for conceding or processing patents, are to be performed by chosen establishments.[28]

Patent grants come with a time limitation; a grantee can only operate within a certain time limit, such as twenty or twenty-five years, depending on the IP laws of the state. The purpose of the time frame is to create a balance so as not to give an absolute monopoly to a grantee. A patent allows the patentee to operate for some years without competition in order to make a profit, because where profit is not certain, there would be no incentive to invest in research that will produce innovation.[29] The right of exclusion is enshrined in the patent law, which increases the likelihood of making a profit and leading to more innovations. Patents encourage public disclosure; the society can take advantage of the discovery after the patent monopoly had expired. Monopoly serves as an encouragement, as the inventor has the right of secrecy in the first instance, in which case no one but himself would benefit from the invention, and waiving the right would result in completion after the expiration of the patent protection, which would result in expansion of the market.[30] During the subsistence of the monopoly, others can vary the inventions to

[26] WIPO, supra n 22.
[27] T. Leepuengtham, *The Protection of IP Rights in Outer Space Activities* (2017) Edward Elgar Publishing Limited, 56.
[28] Catherine Doldirina, Intellectual Property Rights in the Context of Space Activities, in Frans von der Dunk (Ed.) Handbook of Space Law (Routledge 2015) 972.
[29] Bilski v. Kappos 561 U.S. 593, 650 (2010)
[30] J. L. Silvernail, 'Calibrating Intellectual Property and Innovation in New Space' (2020) 6 Tex. A & M J. Prop. L. 113 at 118.

the advantage of the general public, or the invention can encourage other works in a new way entirely.[31]

There are schools of thought that argue that patents destroy creativity as they give the inventor too much power, which can lead to "intellectual monopoly".[32] Some jurists believe that innovations that are not patented can lead to increased profits, as a monopoly is believed to create negative effects on the economy by creating scarcity, since a monopoly discourages competition by excluding others from the market.[33] While there is no evidence to support the argument that patents encourage innovation, experience has shown that competition fosters innovation.[34] Patenting thicket[35] had become problematic to the patent system also, but in the real sense, the use of patents as a protection in the space industry is minimal.

3.2. Specific IP Rights Relating to Outer Space Activities

IP rights became a topic under discussion for space activities during the 51st session of the United Nations General Assembly.[36] The United Nations Committee on the Peaceful Use of Outer Space (UNCOPOUS) had recommended that the usage of outer space should be predicated on fairness and reasonability, taking cognisance of the rights and benefits of all parties, especially in the field of intellectual property.[37] Intellectual property rights can be enforced by states that have objects registered in their state registry. The US is an example of a country with many laws applicable to IP rights in space, such as Executive Order 10096, which confers on the government rights over IP work that came during the employment of government employees.[38] Other states have laws and instruments that can be employed by the governments to protect IPR, such as the Canadian Public Servants Inventions Act[39] which likewise confers on the Canadian government rights over inventions and discoveries made by public servants in the course of their work.

IPRs are protected internationally. The Patent Cooperation Treaty (PCT) of 1970 makes it likely to register patents in several states. The PCT does not have public

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[31] Boldrin and Levine, *Does Intellectual Monopoly Increase Innovation?* (Chapter 8) <http://www.dklevine.com/papers/anew08.pdf> accessed 09/10/2023

[32] Silvernail, supra n 30 at 118, see also J.C Fromer, 'Patents Disclosure' (2009) 94 IOWA L. REV. 539, 548.

[33] Ibid at 119.

[34] See generally T. Canare and J. P. Francisco, 'Does Competition Enhance or Hinder Innovation' (2021) Journal of Southeast Asian Economics Vol. 38, No. 1, 24-50.

[35] Stefan Wagner, 'Are 'Patents Thicket' Smothering Innovation?' (Yale Insights, April 22, 2015) <https://insights.som.yale.edu/insights/are-patent-thickets-smothering-innovation> accessed 09/10/2023

[36] R. Abeyratne, 'The Application of Intellectual Property Rights to Outer Space Activities' (2004) Journal of Space Law, Umiss, Vol.29, No. 1& 2.

[37] Ibid at 17

[38] Daisy Jain, 'Outer Space Patenting: Is the World Ready' (IPleaders, 25 September 2021) <https://blog.ipleaders/outer-space-patenting-world-ready/#Countries_that_have_IPR_laws_compatible_with_space_law> accessed 09/10/2023.

[39] Public Servants Inventions Act, 1985.

benefit criteria[40] for a patent to be registered, and natural phenomena newly discovered are not patentable. When it relates to IP rights in space, emphasis should be put on inventions and technology improvement, as space expertise is one of the most advanced technologies and a patent process that would enable invention, rather than one which acts merely as a rubber stamp. Also important is the need to encourage further inventions while protecting the ones available.[41]

As more space activities become privatized and commercialized, and the involvement of state actors lessens, intellectual property issues will expand. By virtue of the fact that patent laws are nationalistic in nature, whereas space activities are under international law, patentees only have control over their inventions in the state where the invention was registered. Uncertainties remain in juxtaposing the territorial laws of IP and the international laws of outer space.[42] Lots of inventions relating to outer space took place on Earth, such as memory foam, scratch-resistant eyeglass lenses[43] and the solar panel being used on the ISS.[44] The doctrine of temporary presence (freedom of transport) established in Article 5 of the Paris Convention becomes relevant here.[45] The laws relating to patent protection must be established and clarified to provide incentives to investors. It also gives credence and certainty to the legal regimes.

3.3. International Laws on Space-Related Patents

The Paris Convention of Industrial Property[46] created guidelines for the protection of patents globally. It contains principles such as national treatment, filing, contract and enforcement mechanism. The Paris Convention covers many of the patent's subjects, such as models, trademarks, designs, but leaves patentability to be addressed at the state level of the agreeing parties.[47] Consequently, criteria for patentability will differ from jurisdiction to jurisdiction since there is no universal rule of patentability.[48] thereby limiting patent protection. In relation to outer space activities, patent protection comes by way of national laws or by special agreements

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[40] WIPO, 'Patent Cooperation Treaty (PCT) 1970 (Modified on 3 October 2001) <http://admin.theiguides.org/Media/Documents/WIPO%20PCT.pdf> accessed 09/10/2023.
[41] Ibid
[42] Abdel Ghany, 'Inventions Used or Made in Outer Space' (2020) 7 Ct Uncourt 18
[43] P. J. Kiger and M. Spoon, 'Top 10 NASA Inventions' (Howstuffworks, 10 May 2021) <https://science.howstuffworks.com/innovation/inventions/top-5-nasa-inventions.htm> accessed 09/10/2023.
[44] Abdel Ghany, supra n 44; Giorgia Lombardo, '15 Inventions and Designs Originally Made for Space That Entered Our Daily Lives' (August 24,2021) <https://medium.com/demagsign/15-inventions-and-designs-originally-made-for-space-that-entered-our-daily-lives-52dfb028bd22> accessed 09/10/2023
[45] See generally Article 5 of the Paris Convention; Rikard Mikalsen, 'The Scope of the Paris Convention's Exception from Patent Infringement for Visiting Foreign Vessels' (2016) Journal of Intellectual Property Law & Practice, Vol. 11, Iss. 8, 612.
[46] G.H.C. Bodenhausen, *Guide to the Application of the Paris Convention for the Protection of Industrial Property* (BIRPI 1968) Geneva Switzerland
[47] Doldirina, supra n 28 at 973.
[48] Ibid.

between the parties; regulations would apply to specific tasks with special attention to cooperative undertakings.[49] The National Treatment Principle documented in Article 2 of the Paris Convention for the Protection of Industrial Property 1883 grants foreign inventors enjoyments of same privileges as creators who are citizens of the state that has ratified the Paris Convention. It dispenses with the necessity of registering the patent in the domicile state. The territorial nature of patent protection was noted in the treaty, vis-à-vis the same invention granted protection in different jurisdictions, which suggests that a patent holder in one jurisdiction cannot enforce their rights over an invention registered in another jurisdiction.[50] The treaty bestows the privilege of registering the patent in other states within 12 months,[51] as long as those states are parties to the Paris Convention.

Article 5ter of the Paris Convention became relevant under the flag of convenience doctrine, which exempts certain vessels (air and land) from being subjected to the rules of the state it is passing through because of carrying patents that may infringe the laws of the state.[52]These vehicles will be able to pass freely without being subjected to prosecution for patent infringement.[53] However, this freedom will not be extended to the issue of patentability. The PCT is a practical agreement that was made to address the requirement for filing established by the Paris Convention and its execution.[54] The WIPO is in charge of the international filing process and making rules for the filing process. It creates a system that ensures protection in more than one jurisdiction with a single filing of an application. An application for patent protection can be made in any party state for international status.[55] Since the PCT is a treaty on the procedures for filing, it failed to tackle the subject of patentability. The failings of major international treaties to address the issue of patentability led to the development of regional patent laws to address the lacunae.[56] In essence, when it comes to patentability, recourse will have to be made to national and regional laws. Note that the criteria for patentability in most states are similar, but a few differences can be found in filing discrepancies.[57]

[49] Ibid.
[50] Ibid, see Article 4 of the Paris Convention 1883.
[51] See Article 4A (1) of the Paris Convention 1883.
[52] See Adrian Taghdiri, 'Flags of Convenience and the Commercial Space Flight Industry: The Inadequacy of Current International Law to Address the Opportune Registration of Space Vehicles in Flag States' (2013) B. U. J. SCI & TECH. L., Vol. 19
[53] Ibid.
[54] Patent Cooperation Treaty, Washington which entered into force on 24 January 1978; see generally, K. Lapenne, 'Patent Cooperation Treaty' (2010) 92 Journal of patent & Trademark Office Society 92, cited by Doldirina.
[55] Doldirina, at 975.
[56] Ibid; Examples of regional patent regimes include the European Patent Convention of 1977, the Eurasian Patent Convention of 1995.
[57] Ibid.

The issue of patentability of any invention(s) originating from outer space is germane, as both domestic and international laws do not prohibit such.[58] Under TRIPS provisions, as long as a discovery meets the criteria, irrespective of the origin (even in outer space), it would be patented. In addition, national laws have been put in place by some states to allow inventions coming from outer space to be patented under domestic legislation.[59] The most important thing is for the invention to meet basic requirements for patents; the location of the invention makes no difference.[60] International instruments failed to define patentable subject matter, but national laws can be used to fill the lacunae. It was reasoned that any creation of the human mind and/or discovery may qualify for patent protection. In *Diamond vs. Chakrabarty*, decided that "anything under the sun that is made by a man" may qualify as patentable.[61] It has been observed that while some states, like the US, stated specifics of what qualifies as patentable, some states, like the United Kingdom, did not provide specifics.[62] Nevertheless, most states expressly stated what would not qualify as patentable under their laws.[63] For an invention to become patentable, it must meet the basic requirements and must not have been excluded by any law.

An invention from outer space has to be patentable, but its patentability must not breach any known law and must have been given the force of law under Article 27(1) of the TRIPS.[64] Inventions that meet the legal criteria would be granted protection since the TRIPS did not exclude such protection from being extended to outer space inventions.[65] An invention once created becomes eligible for protection if it meets the requirements of the national laws.[66] Location is of little importance. Patentable subject matter is not defined under international laws, but some sections of TRIPS provide guidelines on what will not qualify as patentable under national laws, for any human effort work or finding may qualify for patent protection.[67] This was depicted in the U.S. laws that qualify any form of human creation as a potential

[58] Leepuentham, supra n 27 at 57; Article 27(1) of the TRIPS noted that "patents shall be available for any inventions, whether products or processes, in all fields of technology, provided that they are new, involve an inventive step and are capable of industrial application".
[59] Ibid .
[60] Leepuengtham, supra n 27 at 58.
[61] Ibid, Diamond v. Chakrabarty 447 U.S. 303, 309 (1980)
[62] See generally, the US Patent Act, 35 U.S.C. 101 and the UK Patent Act of 1977, and Articles 52(1) and (2) of the European Patent Convention (EPC) 2000.
[63] WIPO, 'Certain Aspects of National/Regional Patent Laws' (June,2023) <https://www.wipo.int/scp/en/national_laws/exclusion.pdf> accessed 09/10/2023.
[64] T. Leepuenengtham, The Protection of IP Rights in Outer Space Activities (2017) Edward Elgar Publishers; Article 27(1) is to the effect that "patents shall be available for any inventions, whether products or processes, in all fields of technology, provided that they are new, involve an inventive step and are capable of industrial application".
[65] Ibid.
[66] Ibid
[67] Ibid at 58; see Article 27 of TRIPS.

patent creation.[68] Four classes of invention would qualify for a patent in the US, thus: methods, devices employed, techniques of production and a configuration of substance.[69] The situation is different in the UK; there is no classification of patentable invention or definition of invention.[70] In the UK, inventions are classified as "products or processes".[71] Specific subject matter that can qualify for a patent under space activities will be considered below

The choice of orbital spot for satellites determines the effectiveness of satellite communication, with technology playing a key role in measuring "velocity and orientation".[72] While orbit is a natural resource that is not patentable, it can form part of the technological processes for locating a satellite for effectiveness. It is unclear if the requirements for patentability would still be met with the use of an orbit that is not patentable.[73] States like the US have granted a patent for the process involving orbits, as it is recognized that "an orbit is part of the process of achieving a telecommunication service".[74] A satellite orbiting by itself is not classified as work of nature as it involves human effort and intellectual input, which qualifies it as patentable works, such as the procedures employed in stowing extra satellites in orbits, as well as cable cellular receivers and information communications systems in which satellites are compelled to keep and shift spots between specific orbits.[75] Under UK laws, orbits are classified as natural resources and therefore, a process involving orbits may not be patentable; thus, an analogy may have to be made to other inventions to apply for the grant of patent protection under the UK law.[76]

Helium-3 is used to generate nuclear power more effectively on the moon than on earth; this is possible because of its abundance on the moon. The process of generating nuclear power will encompass the intellectual property of humans,[77] but the level of protection available for the process of "generating nuclear power" is unclear. It can be argued that since a technological process is involved in creating nuclear power in outer space, it should be qualified for protection. The thrust of the argument is that the technological process would entail human intellect usage.[78] However, the process of generating nuclear power may not be patentable on other

[68] Ibid; see Diamond v. Chakrabarty (1980) 447 U.S. 303,309.
[69] Ibid.
[70] See Section 1(1) of the UK Patent Act.
[71] R. Miller et al, *Terrell on the Law of Patents* (17th ed., Sweet and Maxwell, 2011) 35
[72] Leepuengtham, supra n 27 at 60.
[73] Ibid; see also A. Rush, 'Patenting Orbits?' It's All Part of the Process', IP is Space (12 September 2012) <http:ipinspace.com/2012/09/12/patenting-orbits-its-all-part-of-the-process/>.
[74]Ibid; see J.M. Mueller, Patent Law (3rd ed., Aspen Publishers 2009) in Leepuentham, supra n 27 at 28.
[75] Ibid, see Hughes Aircraft v. the United States, TRW v. ICO Global Communications, Case No.96-3381KMW (MCX) US District of California).
[76] See Section 1(2) of the UK Patent Law and Genentech [1989] R.P.C. 147 (CA).
[77] Ibid.
[78] Ibid

grounds, such as lack of novelty.[79] Nuclear power itself is not patentable as it is regarded as energy, but the process or technology involved may be patentable.

The outer space environment is very conducive to producing pharmaceuticals and electrical products because of the zero gravity in outer space. While the process and end product may qualify for a patent, if other requirements for patents are not met, they may not be patented, an example is where the invention lacks novelty. It is not clear if the location of the invention, such as the zero-gravity environment, will make the invention patentable.[80] The environment of space can generate research results that may not occur on Earth, Leepuengtham observed as follows:

It is doubtful whether such resources would be classified as taking place ordinarily; consequently, unentitled to protection. In such instances, the method of producing novel objects in outer space atmosphere would seem to be possibly patentable, since it would produce goods for human intelligent interference.[81]

3.4. Requirements for Patent Application

Any invention that meets the requirements for patentability will qualify for a patent, irrespective of whether it is a product or a process, as long as it is not excluded by any other law. This is because patent laws expressly exclude works such as laws of nature, abstract ideas, things that happen naturally and formulas for mathematics from being patentable.[82] An invention that would qualify for a patent must have features that set it out as an invention by meeting the criteria of being novel,[83] non-obvious[84] and useful.[85] Under UK Patent Act, the criteria for a patent are that inventions must be original, involving a process of invention that is capable of commercial application and must not have been excluded by any law.[86]

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[79] W. N. Price II, 'The Problem with Novelty' (Draft Copy) <https://www.law.msu.edu/ipic/workshop/2018/papers/problem-with-novelty.pdf> accessed 09/10/2023

[80] Ibid.

[81] Leepuentham, supra n 27 at 64; C.H. Walker, 'Potential Patent Problem on the ISS' (1999) Proceedings of the 42nd Colloquium on the Law of Outer Space, Amsterdam, October 1999, 64 in Leepuengtham.

[82] Leepuengtham at 59; Doldirina at 975; see also S.W. Harpern *et al*., *Fundamentals of United States Intellectual Property Law: Copyright, Patent and Trademark* (4th ed., Wolters Kluwer Law International 2012) at 154.

[83] Novelty signifies that the work is new and was not part of works done before, if the work can be proven to exist before anywhere in the world, it will lose its novelty under the Canadian and EU Laws; see Article 54 of the European Patent Convention, Article 3 of the German Patent Law.

[84] Non-obviousness means that the work would require additional skill to be understood by a skilled person even in the field, it is a person that is skilled that can make assessment of non-obviousness. See Article 56 of the European Patent Law and Article 4 of the German Patent Law and Section 103 of the US Patent Law.

[85] Usefulness implies the practicality of the work, but meanings differ in jurisdictions, the Canadian Law interpreted it as "actual and ultimate utility", while in the US, it means "specific, substantial and credible utility" and in the EU, it means "industrial applicability". See Doldirina at 976-977; Article 57, European Patent Convention, Article 5, German Patent Law, Bedford v. Hunt 3 F. Cas. 37 (C.C. Mass. 1817); Newmann v. Quigg, 877 F.2d 1575 (Fed. Cir. 1989); X v. Canada (Commissioner of Patents) (1981) 59 CPR (2d) 7 [1981] FCJ No 1013.

[86] Section 1(1) of the UK Patent Act.

Following the appropriate filing procedure by the inventor is important to enforcing patent rights.[87] Filing procedure can be based on the "first-to-file" and "first-to-invent" systems.[88] Time and location are of the essence to the first-to-invent system, but the first-to-file is the more popular amongst states.[89] An inventor has to institute the filing procedure once the invention is made, which will include applying to the patent office, examination of the patent by appropriate authorities, institution of opposition where appropriate, and finally, issuing of the patent.[90] In terms of documentation for patent applications, the rules must be complied with strictly. Where a patent is sought in another jurisdiction, details must include a description of where disclosure had been made and the kind of protection sought. This will indicate limitations of the patent protection and the type of protection being offered.[91]

The limitations of patent protection can be garnered from the provisions of national and regional patent laws. Doldirina noted that the right of the patent owner is a negative right to use and dispose of property for others, as established in the national laws.[92] In the EU, the scope of rights under the EU laws is taken as if it were given by each of the member states.[93] Patent protection is restricted by the years during which the protection will last, mostly 20 years.[94] In addition, there are other limitations to patent rights, such as government right of use,[95] compulsory licensing conditions,[96] non-commercial experimentations and research.[97] All these exceptions have different interpretations under different jurisdictions, with their attendant consequences.[98] Patent rights can be infringed literally[99] or non-literally,[100] significantly or minutely. Action can be instituted against infringers

[87] Doldirina, supra n 28 at 977.
[88] See WIPO, The Importance of Intellectual Property Rights for the Protection of Inventions in Relation to Outer Space Activities, in *Intellectual Property Rights in Outer Space*, ESCL Workshop 19-20 in Doldirina.
[89] Doldirina, supra n 28 at 977.
[90] Ibid.
[91] Ibid at 978; Article 6 of Patent Cooperation Treaty.
[92] Ibid; Section 42 of the Canadian Patent Act; section 154 of the US Patent Act, Articles 9-10 of the German Patent Act and Section 30 of the UK Patents Act.
[93] Ibid.
[94] Ibid.
[95] Exy Intellectual Property, 'Exceptions and Limitations to Patent Rights' (4 May 2021) <https://www.exyip.com/2021/05/04/exceptions-and-limitations-to-patent-rights> accessed 09/10/2023.
[96] Economie, 'Limitations and Exceptions to the Rights of the Patent Holder and the Holder of the Supplementary Protection Certificate' (21 February 2023) <https://economie.fgov.be/en/themes/intellectual-property/intellectual-property-rights/patents/limitations-and-exceptions> accessed 09/10/2023.
[97] Ibid
[98] Doldirina observed that "differences in the drafting and interpretation of the research exception may lead to the 'migration' of companies to states that recognize this exception in a broader way from those states where this is not the case".
[99] Geeta, 'India: Patents Infringements and Their Types' (Mondaq, 09 June, 2020) <https://www.mondaq.com/india/patent-infringements-and-their-types> accessed 09/10/2023
[100] Ibid.

before the authorities that issued the patent.[101] In relation to how the requirements apply to outer space products, this will be addressed below.

3.4.1. Novelty

Novelty is the first criterion an invention has to meet to be given protection. A new invention must not have been part of an existing work or "state of the art".[102] A discovery may not be considered novel where the knowledge is already in the public domain and/or where a previous patent application had been made. The US further stated that where the invention is in the market, or in a printed publication, it would not qualify for a patent.[103] States have different methods for measuring novelty; the priority date is used in assessing in the UK, but a different regime operates in the US.[104] Novelty is assessed based on the day the information is first made public or the priority date.

Priority date is the term used to describe the right given to an applicant within twelve months of filing the initial application to file a similar application in other party states to the Paris Convention. The subsequent application is accorded similar protection as the first application and given priority over subsequent third-party applicants. The right of priority affords protection to the holder of the patent before he files for protection in other states. Novelty is adjudged by the lack of public disclosure before the priority date, but in most states, it is taken as complete novelty without any recourse to the grace period. Disclosure to the public is not limited by geographical limitations; the invention must not have been disclosed anywhere in the world.[105] It had been held that it is the public disclosure that matters, even if no one knew about its availability.[106] Public accessibility is at the heart of the patent claim.[107] In relation to outer space activities, the public disclosure doctrine will become problematic when an astronaut makes an invention that is already divulged to other astronauts in space; the invention may not be considered novel if it is filed for patent on Earth, except where it is caught by exception rules.[108] Where there is an absence of exception, the grace period under the US rules may be taken advantage of. Another critical problem concerns states that do not have the grace period provided for in the US laws, and if an inventor's work is being livestreamed to the earth, how the novelty of the invention would be preserved remains unclear. It

[101] Doldirina, supra n 28 at 979.
[102] Section 2(2) of the UK Patent Act states that "The State of art in the case of an invention shall be taken to comprise all matter (whether a product, a process, information about either, or anything else) which has at any time before the priority date of that invention been made available to the public (whether in the United Kingdom or elsewhere) by written or oral description, by use or in any other way".
[103] U.S. Patent Act, 35 U.S.C. 102.
[104] Maitli Jha, 'Novelty as Criteria of Patentability –Study of U.K., U.S. and INDIAN Position' (Corpbiz, 25 July, 2023) <https://corpbiz.io/learning/novelty-as-a-criteria-for-patentability/> accessed 09/10/2023.
[105] See section 2(2) of the UK Patent Act; *Synthon BV v SmithKline Beecham* [2006] RPC 10
[106] Leepuengtham, supra n 27 at 69.
[107] Gayler v. Wilder 51 U.S. (10 How.) 477, (1850)
[108] Leepuengtham, supra n 27 at 70.

appears that no special provision is made for space-related activities, especially in states that do not have a grace period.

A suggested way out may be by having terms on confidentiality inserted into the agreements between the parties not to disclose important data before the work has been protected.[109] Leepuengtham argued that since novelty is critical to the patent application, any disclosure on the ISS should not be regarded as public disclosure since the work is carried out on a module that can be compared to a laboratory on earth, where an invention may be known to a group of people who are expected to keep the information private.[110] In addition, partners on the ISS are bound by strict confidentiality contracts.[111] However, the Code of Conduct Agreement would not third parties unless another agreement is reached with the third party. Without such an agreement, a third party can breach the confidentiality of the invention, though a breach by a third party can be disputed in court.[112]

3..4.2. Inventive Step

A patent application must meet the inventive step criteria; it must not be so obvious to an expert in the field. The obviousness of the invention would disqualify the invention[113] from being patented. Obviousness is based on the assessment of a person with the required skills and expertise in the area and on other important relevant knowledge, each case being assessed independently.[114] The importance of this prerequisite is to ensure that only an invention that has contributed to the state of the art is awarded a patent.[115] The invention must not only be new, but it must be of the nature that it is not easily produced or replicable; if it can be produced by a third party within a reasonable time, it might not pass the non-obvious test. As noted by Leepuengtham, the inventive step conditions necessitate not only that any invention at stake is original, but it has to be novel enough in its exact field that it would not have been projected by a person trained in the art.[116] Concerning space activities, it remains uncertain whether the same standards required on Earth would apply to the space sector. It had been suggested that since space activities involve technology, the same criteria should be adopted.[117] However, the advanced technologies of space activities may require expert evidence in determining non-obviousness.

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[109] ibid
[110] ibid
[111] The Intergovernmental Agreement and the Code of Conduct for the International Space Station Crew.
[112] Article 55 of the EPC and Section 2 of the UK Patent Act.
[113] See Section 3 of the UK Patent Act, Article 56 of the EPC 2000 and 35 U.S.C. 103; Section 3 of the U. K. Patent Act states that "an invention shall be taken to involve inventive step if it is not obvious to a person skilled in the art, having regard to any matter which forms part of the state of art".
[114] Leepuentham, supra n 27 at 74.
[115] Ibid; Pozzoli SPA v BDMD SA & Anor [2007] FSR (CA)
[116] Ibid at 76.
[117] ibid

3.4.3. Industrial Application

The invention must have industrial capability before it can be patented. In essence, it should have a futuristic practical application, an invention that is still based on theory, which has not been proven, may not be patentable.[118] The requirement for this step is not much, as long as it is capable of being used in any industry.[119] An applicant is not required to prove actual usage but only to establish the potential of the invention. The requirements for the industrial capability are easily determined in the technical and mechanical fields than in the biological sciences.[120] For space-based inventions, it is to be noted as follows:

> A patent holder is generally required to demonstrate that their space-related invention has industrial applicability under the same standards used for inventions developed on Earth. Determining whether a specific invention fulfils the utility requirement is a factual issue that must be evaluated individually. Therefore, a space invention meets the utility criterion if it can serve a practical purpose and functions effectively within its intended industry.[121]

On the question of whether an invention whose utility only exists in zero gravity should be patentable on Earth, the answer should be yes. This is because what is important is the utility of the invention to the industry, irrespective of where it is being used. In this instance, it does not matter whether the invention would be utilised on Earth or in space. A case that had demonstrated this argument is the patent that the USPTO granted for a cup developed by scientists for use in space.[122] Where space inventions met all the necessary patent requirements, they may still not be patentable because of some exclusions in the national laws.[123]

3.5. Applying Patent Laws to Outer Space Activities

Identifying activities in space that would require patent protection may not be clear-cut. There are arguments that problems with patents may not arise where only a few companies are involved in space exploration, but challenges will arise where more actors can access space, and the issue of patentability of space inventions would have to be tackled sooner or later.[124] Inventions such as computer hardware and space objects will be subjected to the principles of the state in which they are made, or the location where the application for a patent was made. Concerning inventions made in outer space, different challenges exist. The scenario is different when the

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[118] Leepuengtham, supra n 27 at 77.
[119] Section 4(1) of the UK Patent Act and Article 57 of the EPC 2000.
[120] Ibid.
[121] ibid
[122] Ibid.
[123] Section 4A of the UK Patent Act, Article 53 (c) of the EPC 2000 and 35 U.S.C 101.
[124] Ibid; G. Ghidini, 'Inventions in Outer Space: Licencing Related Problems, in *Intellectual Property Rights in Outer Space*, ECSL Workshop 53.

use and infringement of a patent occurs in outer space, which raises the question of which jurisdiction will apply. The first challenge is how the patentability requirements discussed above would apply to inventions made in outer space, knowing that micro-gravity contributes to the discovery. The lingering question would centre on its usefulness on earth, which may entail not granting a patent to such inventions, especially where their non-obviousness and novelty cannot be established.[125]

In addition, establishing where a patent is to be registered will create an issue where the invention took place in outer space. Especially where the research that led to the invention was conducted jointly by partners from different states, having different filing systems. Agreements on this issue would have to be determined in order to avoid conflicts.[126] Doldirina pointed out the risks of early exposure that may arise before the invention is patented, which can render the invention non-patentable. The risk might also affect compliance with national laws on patents, but it will have greater implications for activities on ISS. Particulars of an invention made available to the society can render the invention non-patentable, which makes it important to guide against disclosure of important details until the patent is filed.[127] The enforcement of patent rights would be challenging because of the territorial nature of patent rights and the extra-territorial nature of outer space. Enforcing rights against infringements that happen in outer space is not straightforward; parties have to determine where to institute action and obtain remedies. Agreements made by independent space actors in relation to space can contain details about which state is to have jurisdiction over infringements.[128] The implication is that it can lead to 'forum shopping'.[129] Lack of precision as to whether space activities will come under the exceptions in Article 5*ter* of the Paris Convention is also an issue. The wording of the convention did indicate that space activities were included.

3.5.1. Ownership, Transfer and Infringement of Patent

Ownership of an invention can be transferred by a title holder with or without the consent of the original inventor. It is the title-holder of the patent that has legal right over the patent and not real inventor, though certain rights accrue to the real inventor.[130] For space activities, ownership is as it is obtained in relation to earth-based inventions. Ownership of an invention resides in the inventor except in an employment relationship, where ownership will vest in the employer.[131]

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[125] Doldirina, supra n 28 at 980.
[126] Ibid.
[127] Doldiraina, supra n 28 at 981.
[128] Ibid.
[129] Ibid; J.C. Ginsburg, 'Copyright without Borders? Choice of Forum and Choice of Law for Copyright Infringement in Cyberspace' (1997) 15 Cardozo Arts & Entertainment Law Journal 153 in Doldirina 981.
[130] Leepuengtham, supra n 27 at 80
[131] ibid

Employment contracts will contain all the details. In the USA, the government own any invention(s) emerging out of any research work conducted by NASA irrespective of the working arrangements.[132] This may not augur well for private investors.[133] The Space Act Agreement further gave NASA legal autonomy over inventions from its partners, and even when the right vests in investing parties, NASA can still use the invention by way of licensing.[134] In other words, ownership will vest in the actual inventor or the employer in a working arrangements, except where the parties have contrary agreements.[135] For joint inventions in outer space, the arrangement as obtained on earth will bind the parties.[136]

3.5.2. Telecommunication by Orbital Orbit

Satellite constellations in orbit make communication accessible through the use of velocity and orientation. In considering the technological work going on in space that may lead to patentable inventions, it is to be noted that orbits are natural objects that do not qualify as inventions.[137]

3.5.3. Trade Secrets

Trade secrets have their fortification in the privacy of the trade, and it is one protection that inventors tend to adopt since its scope of protection is bigger than patentability. In relation to space activities, what is not clear is the role orbit plays in satellite technology in outer space. Particularly, trade secret issues will crop up in relation to asteroid mining,[138] because data collected from an asteroid will have to be protected, though the issue of trade marks in outer space had been left untouched and unregulated for many years.[139] Trade secrets do not require registration, nor demand the novelty or invention criteria like other IP rights. It is considered an easy protection for space activities. The most important feature is that the data is not available to the public sphere and has unlimited years of protection. The features noted above make trade secrets attractive to the space industry, especially as they come into existence without the need for disclosure and necessary filing fees.[140]

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[132] Section 305(a) 1-2 of the National Aeronautics and Space Act.
[133] Maeve Dineen, 'For the Betterment of All Mankind Claiming the Benefits of Outer Space Through Intellectual Property Rights' (2020) Vol. 12, No.1.
[134] Leepuengtham, supra n 27 at 81.
[135] Ibid.
[136] Ibid; Section 36(1) of the UK Patent Act.
[137] Ibid.
[138] K. Muzyka, 'A Quick Look at Trade Secrets in Outer Space' (The Space Review, 6 May 2015) <https://www.thespacereview.com/article/2758/1> accessed 13/10/2023
[139] C. W. Lackert, 'Trademarks in Outer Space: Supporting the Off-World Economy' (The WIPO Magazine, December 2021) <https://www.wipo.int/wipo_magazine/en/2021/04/article_0005.html> accessed 13/10/2023
[140] ANGELS, 'Intellectual Property Law' <https://spacelaws.com/articles/intellectual-property-law/> accessed 13/10/2023.

Trade secrets are not without their downsides, one of which is the danger of reverse engineering. A competitor can use reverse engineering to get around the secrets and then patent the work. It should be noted that the protection offered by trade secrets are not as comprehensive as patents, and a leaked secret is no longer protected, especially since a third party can consequently patent the work.[141] Despite the drawbacks, trade secrets are important for the space industry because an invention that failed to meet the criteria for patentability can simply be protected under laws for trade secrets.[142] The most important factor is keeping the trade secrets confidential.

3.5.4. Copyright

Copyright is said to be an ancient protection that can be obtained from IP laws together at the global stage as well as the national stage.[143] The most comprehensive international law on IP is the Berne Convention for the Protection of Literary and Artistic Works.[144] The protection offered by copyright covers creative works as enshrined in Article 2 of the Berne Convention.[145] Copyright does not extend to ideas but only to the mode of expressing the ideas. Most importantly, there is the omission of certain works created by a medium, such as digital works.[146] The Berne Convention gave member states the liberty to expand the scope of protection under copyright, making the concept of copyright vary between states.[147] Copyright protection does not require registration of any kind, and it is created as soon as the work is formed. Copyright gives an author or creator the right to exclude others from using the work, whilst the author enjoys the exclusive right to own, use, reproduce, and dispose of the work.[148] There is also a moral right to be recognised as an author of a work under copyright protection. Protection is always granted for a number of

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[141] Ibid; Jonathan Stempel, 'Boeing Accused in Lawsuit of Stealing Trade Secrets for NASA Rocket' (Reuters, June 7, 2023) <https://www.reuters.com/legal/boeing-accused-lawsuit-stealing-trade-secrets-nasa-rocket-2023-06-07/> accessed 13/10/2023.

[142] ESA, 'Trade Secrets and Other IPRs' <https://www.esa.int/About_US/Law_at_ESA/Intellectual_Property_Rights/Trade_secrets_and_other_IPRs> accessed 13/10/2023.

[143] Catherine Doldirina, Intellectual Property Rights in the Context of Space Activities, in Frans von der Dunk and Fabio Tronchetti (Eds.) Handbook of Space Law (Routledge 2015) 949.

[144] The Berne Convention on the Protection of Literary and Artistic Works (hereafter Berne Convention) 9 September 1886, which entered into force on 5 December 1887; other instruments include the Universal Copyright Convention of 1952; the Agreements on Trade-Related Aspects of Intellectual Property Rights (TRIPS Agreements) and the WIPO Copyright Treaty

[145] Catherine Doldirina, supra n 144, at 953; the protection offered by Article 2 will not extend to works that are not creative, that requires time and effort, labour or financial input but lacks creativity which translate to the fact that remote sensing will not qualify to be protected by the Copyright laws because of the methods of collecting and processing of the data.

[146] Ibid.

[147] Leepuengtham, supra n 27 at 102; see Section 2 of the UK Copyright, Designs and Patent Act 1988 (CDPA 88); Section 102 of the US Copyright Act

[148] Ibid; see also Articles 8, 9, 11 and 12 of the Berne Convention.

years,[149] mostly 50 years, but in some jurisdictions, it can extend to 75 years,[150] after which the work will enter the public domain.[151]

Copyright laws have exceptions that have proven important to the protection granted under the legal regime. These exceptions allow creative work to be used freely without the need for permission or prior authorisation. For example, databases are protected under the copyright legal regime if they meet certain criteria.[152] Originality is not a requirement for the protection of datasets under copyright laws, as the contents are of little importance once the content meets the "creativity criterion".[153] Doldrina noted that "protection granted to the author of a database does not cover any parts of its contents, as an interpretation that allows such a scenario would exceed the traditional scope of copyright protection".[154] Different states have different regimes for the protection of catalogues, such as the European Union Database Directive of 1996.[155] The Berne Convention also affords protection for the protection of "foreign works" in a partner state; such works are given the national treatment status. This implies that such works are given the same protection as if they had originated from the same state.[156] The law of the state where protection was sought would be applicable, but most importantly, the Berne Convention took care of the level of rights and duration of rights. Copyright protections are only enjoyed within a legal framework, and their protection will only extend to the level recognised by the law.

4. Conclusion

In 2015, the US enacted a national law known as the Spurring Private Aerospace Competitiveness and Entrepreneurship (SPACE) Act, that changed the space landscape, by giving US citizens the right to claim property rights to space resources by stating thus:

> Under this provision, any U.S. citizen involved in the commercial extraction of asteroid or space resources is granted ownership rights over the materials they recover. This includes the legal authority to possess, utilize, transport, and sell those resources, provided such activities comply with relevant laws and align with the international obligations of the United States.[157]

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[149] Stephen Carlisle, 'Copyrights Last Too Long! (Say the Pirates): They Don't and Why It's Not Changing Anytime Soon' (NSU, 15 July 2014) <http://copyright.nova.edu/copyright-duration/> accessed 09/10/2023.

[150] Inioluwa Olamiposi, 'An Introduction to Copyright Protection in Nigeria' (Law Global Hub) <https://www.lawglobalhub.com/copyright-protection-in-nigeria/> accessed 09/10/2023.

[151] Rights can also be transferred or waived during the time the protection is still on.

[152] Ibid; see Article 2(5) of the Berne Convention.

[153] Ibid,

[154] Catherine Doldirina, supra n 144 at 955.

[155] Directive of the European Parliament and of the Council on the Legal Protection of the Databases (hereafter Database Directive) 96/9/EC of March 1996; OJ L 77/20 (1996).

[156] Ibid; Article 5 (3) of the Berne Convention.

[157] See the SPACE Act 2015.

Other states have made similar laws[158] and it appears that states are employing national regulations to bridge perceived lacunae in international law with some outrightly bestowing the rights on private entities, which led Pershing to note that

> The official commentary on the legislation clarifies that its purpose is to give companies legal assurance concerning their ownership of space-derived materials. The commentators maintain that this objective is consistent with the Outer Space Treaty and does not violate the non-appropriation principle.[159]

There has been a complete shift from the earlier interpretations of the space treaties, and newer issues, including IP rights, are now being taken care of by states in their laws. Addressing intellectual property rights became apposite because it appears that space law opposes recognition of IP rights, probably because IP rights are individual rights limited to terrestrial, while space treaties appear to expressly ban sovereignty and individual claims to outer space and its resources.[160] The issue of property rights in outer space is polarizing, it depends on the jurist and their leanings. While most commentators from the developed states would argue that outer space permits property rights, in line with the goals of their private sectors, the commentators from the soviet states would argue that property rights are not allowed under the treaties. The commercialisation and privatization of outer space activities is responsible for the renewed interest in the protection of intellectual property rights, and according to Leepuengtham,

> This is because safeguarding intellectual property rights is acknowledged as an effective legal tool for protecting the interests of private entities involved in space ventures, while also fostering a fair and competitive atmosphere within the sector.[161]

Reconciling the two positions had proven difficult and unresolved. The reason is that outer space laws defend public interests while intellectual property laws focus on individual rights.[162] Private entities and investors in space should be given intellectual property rights in order to ensure the sustainable development of the sector. That will act as an incentive for more research and development, leading to more inventions that would benefit society. Without legal and institutional incentives, it would be difficult to encourage further exploration of outer space. There should be a procedure for protecting IP in outer space; the international community, such as the United Nations, can take up the role of regulating IP rights in outer space. Private Agreements between parties to space exploitation may be drawn up to ensure that IP rights are settled and well-detailed in the memorandum of understanding between the parties. Space activities are moving from the exclusive preserve of state governments to the private sector; agreements will have

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[158] Luxembourg enacted a law called 'On the Exploration and Utilization of Space Resources in 2017.
[159] A. D. Pershing, 'Interpreting the Outer Space Treaty's Non-Appropriation Principle: Customary International Law from 1967 to Today' (2019) 44 YALE J. INT'L L.
[160] Z. Chen and Y. Zhao, 'Intellectual Property in Outer Space: Conflict in Theory and Application in Practice' (2022) Space Policy https://www.sciencedirect.com/getaccess/pii/S0265964622000108/purchase accessed 10/11/23.
[161] Leepuengtham, supra n 27, at 208.
[162] Ibid.

to be made by the parties in the light of private arrangements and/or public and private initiatives. These contracts possibly will comprise communications, remote sensing and direct television broadcasting. Parties must have in place arrangements covering these matters. This can be in the form of licence contracts and/or R&D agreements.