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Remote Sensing Data and International IP Laws

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Abstract: ***Remote sensing technologies use electromagnetic waves which are reflected and diffracted from earth to space to create sophisticated data which is largely useful for natural resource management and land uses. Initially, only a few countries had had access to remote sensing data however, withthe development of outer space technology and research, more states are acquiring the capacity to explore the use of remote sensing data. Likewise, the availability of private remote sensing data for commercial purposes has increased. At this juncture, countries are increasingly turning to the Intellectual Property ("IP") Rights, particularly copyright, to protect and monopolise remote sensing data. The existing IP laws on remote sensing data vary greatly in the domestic and international law arena. The international laws on outer space do not adequately address the problems that afflict the copyright protection of remote sensing data. The paper sets out the dilemmas and debates surrounding the protection regime of remote sensing data, and finally, advances a possible solution to tackle the concerns.The conventions and journal articles are served to develop the arguments for the paper.***

Keywords: Outer Space, Remote Sensing, Copyright, Data, International Law, Intellectual Property Rights.

1. INTRODUCTION

Remote Sensing Data and the International Regime of Intellectual Property Laws – Analysis, Debates and Dilemmas

Remote sensing is the science of gathering information of objects or areas from a distance, usually from outer space. It is a tool frequently used to sense a particular area or object from outer space with the aid of data gathered by detecting and analysing electromagnetic waves emitted, reflected or diffracted by the sensed object(UNITED NATIONS Office for Outer Space Affairs, n.d., p. Principle I). Remote sensing is used for studies of the earth that require regular observation, namely in agriculture, mineralogy, geology, hydrography and land use.Furthermore, remote sensing can be used to detect cleared areas, delineate wetlands, determine water quality, disaster alerts, GPS services, measure soil moisture, surveillance,

urban planning, meteorology, traffic control and various other multitude of applications(MAPASYST, 2019).It is highly valuable as it can safely provide information about locations that are too difficult to be accessed by humans(UNITED NATIONS Office for Outer Space Affairs, n.d.). Interestingly, remote sensing imagery is also used as evidence in disputes under the International Court of Justice(Peter, 2004). The application of each remote sensor depends on its specific design and elements, including the wavelengths it can measure, the accuracy with which it can detect the smallest object on earth, and the frequency with which it can make measurements(MAPASYST, 2019). Therefore, remote sensing data is a highly coveted tool for states and non-state actors around the world.

The paper examines whether the existing international laws governing remote sensing and Intellectual Property ("IP") rightseffectively address the problems and dilemmas that surround the intersection of IP protection and remote sensing data. The first section explores the current state of international law of remote sensing. The second section analyses the need for an extensive international law instrument for addressing the intersection of IP law and remote sensing data. Third section of the paper examines the international IP protection afforded to remote sensing data – raw and processed, also referred as enhanced. Later the paper considers the dilemmas, debates and legal lacunae that are present in the current legal system governing the IP protection provided to remote sensing data. The dilemmas and lacunae assist in appreciating the shortcomings of the current regime and also, help develop a potential solution. The discussion also gains significance because of the active involvement of private entities in the remote sensing activities worldwide.Finally, the paper outlines a set of solutions that can potentially help resolve the issues raised in the paper.

Not just States but also private entities around the world are increasingly participating in developing remote sensing technology and in launching satellites for remote sensing due to its various beneficial applications mentioned above. Private entities and States participating in remote sensing activities for monetarybenefit is known as commercialisation(Cambridge Dictionary, n.d.). Rapid commercialisation of space activities has allowed an increasing number of countries to take benefit of space technology including satellite communications, remote sensing and other purposes for national, economic and social growth. Nonetheless, commercialisation and granting of IP protection for remote sensingdata has become detrimental to developing nations in accessing information gathered by remote sensing satellites. As they lack resources, investment for the development of expertise and training in the usage of remote sensing satellites, the developing nations are farther away to realise and take advantage of the resources and immense knowledge that remote sensing offers(Nirmal, 2012). As already discussed, the knowledge from remote sensing is used for weather, climate, hazard response, agriculture, transportation and infrastructure planning(Doescher, Ristyb, &Sunne).This deliberation of benefits of commercialisation vis-à-vis developing nation interests will be discussed later in the paper. It is against this backdrop that this paper aims to discuss remote sensing and the protection that the international Intellectual Property Rights regime affords it.

International Principles Governing Remote Sensing

The international legal principles that specially govern the remote sensing satellites and access to remote sensing imagery or data were discussed for about fifteen years in the Legal Subcommittee of the Committee on Peaceful Use of Outer Space ("COPOUS"). There were two opposing views that were forwarded by the States. One was presented by States, such as U. S. and other developed nations, that advocated for the unrestricted use of satellite for remote sensing and unequivocal freedom of distribution of remote sensing data(Jakhu, Legal

issues relating to the global public interest in outer space, 2006, p. 76). On the other hand, developing nations, socialist and some developed countries, argued that the acquisition and distribution of remote sensing data must be governed by the internationally accepted principle of State sovereignty(Magdelenat, 1981, p. 114)(Jakhu, Legal issues relating to the global public interest in outer space, 2006, p. 76). In principle, they advocated prior consent of the sensed State for the gathering and distribution of remote sensing data concerned with its respective territory.

A compromise was reached in 1986 when the UN General Assembly adopted unanimously a Resolution containing the Principles Relation to Remote Sensing of the Earth from Outer Space ("UN Principles")(UNITED NATIONS Office for Outer Space Affairs, 1986). Under this compromise, the countries gave up on the prior consent in exchange for the recognition of the right of sensed State to have access, "on a non-discriminatory basis and reasonable cost terms"(UNITED NATIONS Office for Outer Space Affairs, 1986, p. Principle XII), to the primary data and the processed data concerning its territory. The sensed State also the has the right to access to analysed data (UNITED NATIONS Office for Outer Space Affairs, 1986, p. Principle I)concerning its territory. The various types of remote sensing data will be discussed in the upcoming sections of the paper. Thus, the UN Principles seek to establish a balance of interests of all States. The paper will later show how the balance sought by the UN Principles is disturbed because of IP.

The UN Principles are a method to strengthen international cooperation in the field of remote sensing(von der Dunk, United Nations Principles on Remote Sensing and the User, 2002). The UN Principlesoffer a set of non-binding butagreed and politically relevant 15principles to guide the remote sensing activities of the United Nations member states.The UN Principles are based on the assumption that States have a right to engage in remote sensing of earth and its environment.The UN Principles outline the definition of remote sensing and its associated data, attempt to provide a legal regime on dissemination and collection of the remote sensing data, and also, restate the general principles of international law.

Principle I of the UN Principles define remote sensing as the sensing of Earth's surface from outer-space by utilising the sensors and the electromagnetic waves which are emitted, reflected or diffracted by the sensed object on Earthfor the purpose of improving natural resources consumption, land use and for environment protection(UNITED NATIONS Office for Outer Space Affairs, 1986, p. Principle I). These principles promote the principle that remote sensing activities are to be carried out for the benefit of all countries, with respect for the sovereignty of all States and their natural resources, and for the rights and interests of the other States(von der Dunk, United Nations Principles on Remote Sensing and the User, 2002)(Matignon, 2019). Especially, in the absence of an alternative international instrument governing remote sensing activities, United Nations Resolution can have great moral and political weight(Matignon, 2019).

However, a downfall of the principles is that they are non-binding and cannot be enforced. Ensuring compliance with the Resolution is, consequently, not likely even upon those States which have voted and consented to the principles (Williams, 2005). Moreover, owing to the want of jurisprudence on the matter, application of the General principles is not clear-cut. Therefore, only those principles which coincide with the existing customary international rules might be effectively binding on the states. One such principle is the usage of remote

sensing data for the betterment of all States which conforms to the already established rule that outer space is to be used in a manner favourable to humankind.

The UN Principles is not an exhaustive legal instrument on remote sensing and does not address the questions on IP rights, contract between States and private entities, liability concerns of remote sensing activities, thus, supplementary rules and regulations are essential. The heightened amount of commercialisation and privatisation and deregulation of space activities around the world require an updated set of principles on remote sensing. Nevertheless, the UN principles are an agreed politically significant tool for modelling the remote sensing activities of the States and for developing further laws on the topic.

The UN Principles on the Issue of Remote Sensing and IP Rights

The UN Principles on Remote Sensing as previously saidare non-binding and fail to clearly clarify the issues on liability, privacy, contract between a State and private entities, contract between two States arising out of remote sensing activities. One such area lacking anyspecific international legal covenants is the intersection of intellectual property rights and remote sensing.

The UN Principles on Remote Sensing affords no IP protection to the remote sensing data(UNITED NATIONS Office for Outer Space Affairs, 1986, p. XII). Principle II of the UN Principle states that remote sensing activities "shall be carried out *for the benefit and in the interest of all countries*, irrespective of their degree of economic, social or scientific and technological development, and taking into particular consideration the needs of the developing countries." Additionally, Principle II states that such activities "shall be conducted *in accordance with* international law, including the Charter of the United Nations, the 1967 Outer Space Treaty and relevant instruments of the International Telecommunications Union." None of these international instruments expressly permit States to grant IP protection over remote sensing data.

However, as it will be observed later in the paper States are increasingly turning to IP protection of remote sensing data in order to protect their national interests and also, to boost the commercialisation of outer space. It is important to ascertain a nexus between intellectual property rights and remote sensing with the help of existing specific international conventions on intellectual property rights and the UN Principles Relating to Remote Sensing. To analyse the intellectual property rights protection that is provided by States to remote sensing data, it is fundamental to appreciate the nature and the kinds of remotely sensed data.

Existing International Intellectual Property Law Regime on Remote Sensing Data

An understanding of the application of intellectual property rights to remote sensing data requires an understanding of the difference between primaryor unenhanced data and processed data or enhanced data. According to Principle I of the Principles Relating to Remote Sensing of the Earth from outer space, unenhanced data or raw data directly obtained from the remote sensors borne by the satellite and are delivered to earth by telemetry in the form of electromagnetic signals, by "photographic film, magnetic tape or any other means" (UNITED NATIONS Office for Outer Space Affairs, 1986). Raw data may contain numeroussystematic distortions and errors produced by the curved shape of the Earth, atmosphere, daily and seasonal differences in the extent of solar radiation received at the surface and faults in the scanning devices; thus, it is not utilisable to accurately gauge the Earth's features(Dibiase, n.d.). On the other hand, enhanced data is produced from the

processing of the raw data by humans or through electronic analysis(UNITED NATIONS Office for Outer Space Affairs, 1986)(West, 1990, p. 406)(Myers, 2006). Enhanced data is usually free of the errors produced in the raw data and is comparatively more precise in estimating the sensed object.

International copyright conventions are extremelypertinent to the intellectual property rights issues that arise within remote sensing activities. Copyright is largely governed under the Berne Convention for Protection of Literary and Artistic Works (1886) and the WIPO Copyright Treaty (1996). The Berne Convention on Copyrightsis applicable for the remote sensing data as copyright is certain to maps(Berne Convention for the Protection of Literary and Artistic Works, 1982, art. 2), databases and computer programs(World Intellectual Property Organization, n.d.). The other important convention of intellectual property laws is the WIPO Copyright Treaty. Article 5 of the WIPO Treatyexcludes data from the scope of protection and hence, has no applicability to remote sensing data (WIPO Copyright Treaty, 1996, art. 5).

Raw Data

The Berne Convention defines copyright as "literary and artistic works shall include every production in the literary, scientific and artistic domain, whatever may be the mode or form of its expression…" (art. 2).Copyrights for creative works is granted automatically without any need for registration (Berne Convention for the Protection of Literary and Artistic Works, 1982). Moreover, the convention protects expression not ideas, therefore, the idea has to be fixed as a material form. With remote sensing, the interpreter applies an idea to the raw material and through this process expresses a protectable, unique creation. Remote sensing raw data is produced by a machine in outer-space which is then sent to the interpreter. There is no element of creativity involved in the production of raw data as it has merely represented the object or the area of the earth as it already exists and therefore, Berne Convention does not provide it with any protection under copyright(West, 1990)(Ayalp, 2016, p. 103). Contrarily, Patrick A. Salin argues that for copyright protection under WIPO, the work should be unique and original and should not be a copy of some other work which remote sensing raw data is(Salin, 1993, p. 198). He also contends that remote sensing which comprises of the authorship of an observation machine as the Berne Convention provides for co-authorship. Therefore, remote sensing raw data could be a result of collective authors, namely, human and machine. Creativity which presupposes a human interference, Partrick A. Salin takes the example of the sensors of SPOT satellites which are programmed to sense according to client requests which are mostly carried out by a human present on Earth(Salin, 1993, p. 198). Therefore, he believes that raw data should be copyright protected.

However, national laws which should abide with international copyright conventions do not consider raw data as being original and of a creative nature(Salin, 1993, p. 198)(Sterling, 2007, p. 377)(Lockridge, 2006, p. 336). Nonetheless, as Professor Adrian Sterling, anestablished international expert in copyright,argues if a remote sensing device was being used to gather the data then the prerequisite originality for copyright eligibility does not exist under any domestic law or the Berne Convention, since there is no human authorship (Sterling, 2007)(Ayalp, 2016). The Berne Convention on copyright makes no explicit reference that only humans can create a work to be granted copyright(Meifa-Kaiser, 2006, p. 300). However, at the 1948 Brussels Conference(General Committee, 1948, p. 257) it was stated that it is unnecessary to mention that the works are "personal intellectual creations", because it was implied that such condition was necessary.

Since, almost all the countries around the world do not consider raw data as copyrightable, this could gain the status of customary international law practice. Another important aspect is that if raw data is given copyright protection the international conventions would essentially be copyrighting facts, i.e., Earth's naturally existing features –which are to be publically available for everyone to use as they desire.

Following the trend of not copyrighting raw data, for instance,the general rule pertaining to unenhanced data under the US's Land Remote Sensing Policy Act of 1992 under section 5632is that "unenhanced land remote sensing data gathered an owned by the United States Government … shall be made available to users in a timely fashion"(Office of the General Counsel, n.d.). Another example, is that of the European Space Agency whose remote sensing data policy states that "free access to the data on an open and non-discriminatory basis"(von der Dunk, Non-discriminatory Data Dissemination in Practice, 2002, p. 43).

While a copyright protection under the Berne convention is not possible, there are other self-help protections of raw data available. Trade secret law could be used to protect raw data. Entities which are self-sufficient and do not require any third-party aide could protect their remote sensing data with the help of trade secret protection(Singh, 2018). Steps could be taken to maintain secrecy, protect the information and to keep it from becoming public.EOSAT (Earth Observation Satellite) uses trade secret protection for certain aspects of its Landsat operation(West, 1990, p. 403). With trade secret protection, the problem arises as to how the said secrecy can be maintained and others could be allowed use the information while maintaining confidentiality. Another method is that the raw data can be protected with the help of contract law, licensing and confidentiality agreements. These are enforceable in a court of law. Another method could be technological measures wherein, the raw data can be secured online and otherwise, the raw data could be encrypted to prevent people from gaining access to it(Myers, 2006, p. 388). However, encryption does not work against insider threat to the data. The downside of these types of self-help protection is that another enterprise could easily remotely sense and gain the same raw data and freely use that information without any liability(Myers, 2006, p. 388).

Processed Data

As noted in the above section, the Berne Convention affords copyright protection to any work which has a creative element attached to it. Raw data transmitted to the ground stations of the earth is processed, enhanced and analysed by humans or interpreters therefore, processed data or enhanced data seems to be protected by the copyright regime under the Berne Convention.Processed data, in contrast to raw data, is a product of a value-added industry(Zhao, 2006). It is a human enhancement to raw data. States consider enhanced data to be the property of the interpreter as it is a product of the interpreter's work and application of mind. Although one might question the validity of such copyright protection, considering that the UN Principles on Remote Sensing require that the enhanced data be available on non-discriminatory access, it is settled law that if there is no legislation to the contrary, data which has been enhanced through human creativity qualifies automatically for copyright qualification (Berne Convention for the Protection of Literary and Artistic Works, 1982).

Even if there is a confusion with regards to the copyright granted to processed data, processed data contains information and is an immaterial good which copyright protects. Moreover, copyright is granted to all geographic information products which are a creation(Doldirina, A Rightly Balance Intellectual Property Rights Regime as a Mechanism to Enhance Commercial Earth Observation Activities, 2010, p. 1).Interpretation of the raw

data to processed data is not a fully automated process as a human is responsible for producing data with the desired results. The definition of copyright in the Berne Convention also confirms that processed data is copyrightable as it includes maps and other images (Berne Convention for the Protection of Literary and Artistic Works, 1982, art. 2).

Analysed Data

Analysed information is used to indicate the facts and figures, which result "from the interpretation of processed data, inputs of data and knowledge from other sources" (UNITED NATIONS Office for Outer Space Affairs, 1986, p. Principle I). The degree of accuracy and completeness of the information processed depend on the interpreter's skill and knowledge of the objects being analysed and their surroundings. This is collected from the information in literature, such as maps, books, articles or reports. The analysed data has to be also be accessible on a non-discriminatory basis as under the UN Principles.

As it can be seen the Berne Convention affords copyright protection to the processed data and analysed data because of the application of human mind. However, raw data is freely available for dissemination without the protection of IP.Now that we have understood the nature of the data and type of protection granted to them it is significant to explore the contradictions and dilemmas that a vague legal regime poses to remote sensing data.

Dilemmas and Contradictions in the Current Regime

The current section addresses the issues caused by the unstable and underdeveloped international regime on IP rights protection of remote sensing activities. The sections, also, assists us in appreciating the pressing need for an exhaustive international regime for remote sensing.

Disparities in Domestic Legislations Concerning Data Categorisation and IP Rights Protection of Remote Sensing Data

Due to the emergence of new legal issues concerning remote sensing, several countries have fashioned their individual country specific laws on remote sensing. Mostly the laws are governing commercial and private activities of remote sensing. The United States and Canada follow an approach similar to the UN Principles. Under the US Land Remote Sensing Policy, 1992, remote sensing is defined as collection of data which can be processed into imagery of surface features of Earth from a classified or unclassified satellite (Land Remote Sensing Policy Act, 1992). Read together with the definition of the raw remote sensing data – "land remote sensing signals or imagery product that are unprocessed or subject only to data pre-processing" (Land Remote Sensing Policy Act, 1992) – it is clear that the US law makes a clear distinction between data and information depending on the processing applied. Canadian law similarly makes a distinction between raw data and remote sensing product, based on processing (Remote Sensing Space Systems Act, 2005, Section 2). Laws in Europe do not generally follow the raw data and processed data distinction as within the UN Principles, the US and Canada. For example, the German Satellite Data Security Law (Satellite Data Security Law, 2007) explicitly negates the importance of distinction between raw and processed data (Doldirina, Open data and earth observations: The case of opening up access to and use of earth observation data through the global earth observation system of systems, 2015, p. 75). While the European Space Agency Data Policy refers to the UN Principles it categorises data based on its availability and accessibility – free dataset and restrained dataset, instead of basing it on processing (ESA Data Policy for ERS, Envisat and Earth Explorer Missions, 2012, p. 2).

The legislated laws of the States regulate remote sensing data generation and enhancement by private entities. The laws are wholly diverse amongst different States as for example US's remote sensing policy particularly focuses on remote sensing satellite technology, and makes a distinction between private and public while France and EU's focus appears to be on remote sensing data driven, and there is no difference between public and private (Gabrynowicz, 2010, pp. 9, 13). The differences in approaches to defining and differentiating remote sensing data may have very specific implications on the availability and the type of protection available to them.

Before discussing the State-specific laws relating to IP, it is crucial to understand the position on the matter in the international outer space conventions. Article III of the Outer Space Treaty, states that no nation can claim sovereignty over any celestial body by means of use or occupation (Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and other Celestial Bodies, 1967). Therefore, no State has the right to claim jurisdiction in outer-space except on a space object registered under it. This principle of the Outer Space Treaty creates an additional issue in the existing regime of intellectual property laws and remote sensing which is an outer space activity. The setback is that the outer-space activities are extra-territorial in nature and no State has jurisdiction over outer-space. While on the other hand, intellectual property laws are State-specific and hence, it would not be probable to devise a uniform regulation of intellectual property laws if there exists a disparity in States' ideas on protecting the remote sensing data. One example of the difference in laws is of the US and the European Model. In the US data has been protected under a pure copyright regime while the European Model grants a *sui generis* protection for specific databases (Doldirina, A Rightly Balance Intellectual Property Rights Regime as a Mechanism to Enhance Commercial Earth Observation Activities, 2010)(European Space Agency, n.d.).

The Court of Justice of the European Union, following the 2015 decision in Ryanair v PR Aviation, confirmed that only those databases which fulfilled the criteria set out at article 1(2) and 7(1) of the Directive 96/9/EC on the Legal Protection of Databases would be granted the protection of the sui generis right(Ryanair Ltd v PR Aviation BV, 2015). To put it simply, to merit protection under sui generis, 'a collection of independent works, data, or other materials"; 'arranged in a systematic or methodical way'; and the creator of the database must furthermore establish that there is a substantial investment in obtaining, verifying or presenting the contents of the database (The Legal Protection of Databases, Directive 96/9/EC, article 1.2, 7.1) (Alexander & Jankowska, 2018, p. 990). The European Model widens the ambit of intellectual property rights protection granted to data by including unenhanced raw data. Therefore, unlike the US legislators, the European legislators do not differentiate between raw data and enhanced data (Doldirina, A Rightly Balance Intellectual Property Rights Regime as a Mechanism to Enhance Commercial Earth Observation Activities, 2010). Another difference between both the domestic legislations are that the term for which the protection is granted in Europe is only 15 years while in the US the term is life plus 70 years. These stark differences in ideas between both countries would only increase the conflict in efforts to categorise remote sensing data internationally.

Principle of Non-Discriminatory Access Inconsistent with Copyright Afforded to Enhanced Data by States

Now we discuss in detail the ambiguities as a result of copyright protection granted to data. The UN Principles on Remote Sensing allow the countries with remote sensing capabilities to sense any country without the country's approval(UNITED NATIONS Office

for Outer Space Affairs, 1986).The principles also state that the remote sensing activities are to be conducted per article I of the Outer-Space Treaty which provides that outer space exploration and use has to be carried out for the benefit and interest of all countries (Treaty on principles governing the activities of States in the exploration and use of outer space, including the moon and other celestial bodies, 1967, art. I). The UN's Remote Sensing Principles, based on the above principle, states that enhanced and unenhanced data would be available to all countries on non-discriminatory access. The non-discriminatory access principle could be understood as a means to balance the advantages of both the sensing and the sensed State. The non-discriminatory access principledoes not alignwith the State practicewhich seems to afford protection to processed remotely senseddata. While restrictions are imposed to protect national interests, it hampers foreign access to the data and also, restrict domestic access to use the data(See, 2017, p. 156). Interestingly, the argument that commercialisation through the grant of IP protection would heighten technological development would not sustain. As the IP protection restricts domestic access to remote sensing data, it in turn stands as an obstacle to any development of new products and services(Jakhu, Doldirina, & Nyampong, 2012, p. 410).

Any unilateral imposition of restriction on the collection and distribution of remote sensing data solely on the ground of national interest is contrary to UN Principles. States such as USA, France, Canada, India and Germany manifestly deviate from the free flow of data and information rules envisaged in the UN Principles. Their national remote sensing or outer space laws aim at establishing government control, and subject remote sensing to various licensing and supervisory procedures (Hofmann, 2011)such as intellectual property rights. For instance, the US's The Land Remote Sensing Policy Act of 1992, requires raw data to be available to the users on a non-discriminatory basis, conversely, processed remote sensing data is subject to copyright(Office of the General Counsel, n.d.).Similarly, the ESA copyrights data which has been processed(European Space Agency, n.d.). Nevertheless, it has to be borne in mind that the UN General Assembly principles on remote sensing cannot be enforced as they are soft law.Since soft laws are not strictly enforceable one cannotstrongly argue that enhanced data has to be accessible on non-discriminatory basis.

Commercialisation versus Non-discriminatory access by Developing Nations

This copyright protection offered to enhanced data brings us back to the debate between commercialisation and non-discriminatory access to data of developing nations highlighted in the introduction of the paper. Commenters on remote sensing believe that strong intellectual property rights protection is crucial to promote commercial remote sensing activities(West, 1990). Proponents for IP rights for remote sensing data argue that some form of protection of the data is of utmost importance as a minor distortion of the data could have catastrophic effects (West, 1990, p. 411). Protection in the form of moral rights, which are the rights of an author to object to any "distortion, mutilation or other modification of, or other derogatory action in relation to"(World Intellectual Property Organisation, 2016) a work could prevent the catastrophic events (Sullivan, 2020). For instance, a data enhancement firm may sell processed data, which amongst other information, indicates the presence of ground water in a region where a government wishes to situate a nuclear waste dumping site. A company which buys this data at first, for profits, may modify the data to conceal the presence of ground water and resell the data to the government. If the government uses the modified data to build the nuclear waste dumping site, the essential ground water could be contaminated with hazardous chemicals as a result.

Data generators, generally States or private companies, would attempt to seek protection to ensure remuneration or profitsthrough copyright for their remote sensing data, which is the result of significant financial investment, and their technical expertise(Ito, 2011, p. 213)(Cromer, 2006). The State or the private companies could make profit from royalties or from the licensing fees from the users of the copyrighted remote sensing data. International copyright protection for data is necessary to induce firms to enter the data enhancement industry(West, 1990, p. 421). This method of receiving financial gain out of copyrighted data through royalties and license fees is termed as commercialisation(Cambridge Dictionary, n.d.). Only with sufficient protection for remote sensing data in place will private entities be willing to participate (Zhao, Intellectual Property Protection in Outer Space: Reconciling Territoriality of Intellectual Property with Non-Territoriality in Outer Space, 2017, p. 151)(Shoemaker, 1999, pp. 396, 397)in outer space activities and in turn, further commercialisation.

Conversely, the commercialisation of remote sensing datacould deprive the developing countries,which might not have remote sensing data gathering and analysing capabilities, of taking advantage of the benefits that outer-space offers to humankind.Commercialisation of remote sensing data presents a fundamental tussle with principles of equal access to raw and enhanced data and dissemination based on non-discrimination that the UN Principles attempt to guarantee(UNITED NATIONS Office for Outer Space Affairs, 1986, p. Principle XII).Laws which afford copyright protection to encourage commercialisation are based on principles of “freedom of competition” and “freedom of enterprise” (Feder, 1991, p. 634)which at their ideological essence are at variance with the principles of equality and non-discrimination, and access to data present in the UN Principles.

Private companies asserting copyright claims to the remote sensed data poses a danger to the non-discrimination provisions. Furthermore, since raw data contains no copyright protection, if the sensed country has played no role in enhancing the raw data, it may have no IP protection in the remotely sensed data to counterbalance the copyright claim of a private company which enhanced the raw data.A copyright protection would, therefore, enable the private companies to economically exploit an already deprived State lacking analysing capabilities. Another facet of this argument is that IP protection facilitates the private entities to commercially exploit the data concerning the territory of the sensed State (Nwodo, Nwodo, & Udochukwu, 2018, p. 2)(Ambrosetti, 1984, p. 16)Therefore, national security rather than data costs is increasingly becoming the primary concern of the sensed States, particularly now with the growth of the Internet (Freeland & Zhao, 2020, p. 423). A similar argument was put forth by Christopher C. Joyner and Douglas R. Miller in the context of commercialisation of LANDSAT data by the then Reagan administration(Joyner & Miller, 1985, p. 77 & 100). The exclusivity IP offers would seriously impair the non-discriminatory access. While this may help firms, the policy alienates the developing countries, which fear economic exploitation by multinational corporations with exclusive information about their sovereignty.

Also, under the UN Remote Sensing Principles,a sensing State can sense another State without the permission of the sensed State(von der Dunk, United Nations Principles on Remote Sensing and the User, 2002)(Matignon, 2019).The rationale behind the principle is that outer space is free for exploration and use by all states (Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and other Celestial Bodies, 1967)and cannot be prohibited or prevented by any state even if its sovereignty is threatened.No veto exists for the sensed State to prevent it from being sensed,

nor an exclusive, free or preferential right of access to data. Rather, for the purpose of the certain set of remote sensing data the sensed State is no different from any other State interested in such data.This threatens the sovereignty of the sensed State as it can be surveyed without its consent or as Maureen Williams terms it a "surrender of sovereignty" (Williams, 2005). A State which usually has permanent sovereignty(Jakhu, International law governing the acquisition and dissemination of satellite imagery, 2003, p. 78) over its resources and territorial information about such resources, as under the customary international law, is then left defenceless.

While copyright, as emphasised previously, might protect data from distortion and piracy, granting strict copyright protection would narrow down the ways in which remote sensing data can be used, and hinder the development of value enhancing services which produce the useful and distributable information. Moreover, it also poses a danger to the non-discriminatory access provisions contained in the UN Principles.

The above-discussed dilemmas and debates in existing law present a very grave image of the current legal regime on remote sensing, and the challenges a new regime has to address. The next section offers suggestions and solutions to address the issue and possibly to rectify it to an extent.

Possible Solution to the Existing Debates and Dilemmas

From the previous sections of the paper it is evident that a protection of remote sensing data is essential to avoid data distortion and privacy. While it is settled that copyright is not the best mechanism for protecting raw remote sensing data, it is suitable for processed and analysed remote sensing data. Protection of the remote sensing data also ensures the safeguarding of the rights of stakeholders involved in processing and analysing the raw remote sensing data. However, it has to be emphasised that a strict copyright regime would lock up valuable information and is principally against the non-discriminatory access to remote sensing data granted to the developing nations under the UN Principles. Thus, in order to facilitate the development of commercial remote sensing satellite systems, as well as of data enhancing firms, a proper balance of interests of the stakeholders has to be found.

Prevailingstrict copyright licenses around the world include clauses called "permitted uses" which include a list of actions a licensee is allowed to perform with the remote sensing data(Doldirina, A Rightly Balance Intellectual Property Rights Regime as a Mechanism to Enhance Commercial Earth Observation Activities, 2010). Licenses also forbid or restrict the distribution of derivative work made by licensees. Some practices also include the expansion of the copyright by retaining copyright in physical copies of the protected work (Doldirina, A Rightly Balance Intellectual Property Rights Regime as a Mechanism to Enhance Commercial Earth Observation Activities, 2010). Such regulatory and licensing practices restrict the ways in which the remote sensing data can be used and consequently, impede its development and diminish its value. Therefore, it is important that the rights of the parties involved is balanced by the insertion of a clause which authorises the production and distribution of the derivative works produced by processing or analysing the licensed data. It would reinforce the current copyright laws on derivative work which identify a separate copyright in the original and a derivative.An example of a balanced data policy is of the China-Brazil Earth Resources Satellites (CBERS). CBERS allows the data generated by it to be used and distributed without any restrictions under a recommendation that the user would adhere to the free distribution policy(Sharing Earth Observation Resources, n.d.).

Another vital issue that requires to be addressed is the non-discriminatory access to the remote sensing data by sensed States. As the sensed states territory can be sensed without prior consent, these states should have timely and unhindered access to remote sensing data on a priority basis at nominal costs. At the UNISPACE 82 Conference in Vienna a declaration on similar grounds was proposed, only to be refused**(United Nations, 1982)**. The main purpose of remote sensing, being an outer space activity, is to maximise the public benefit of outer space. The priority basis of distribution of data at low costs would not only conform to the non-discriminatory access principle but would also, further develop the remote sensing data and information market due to the easy availability of data.

The drawback of priority access is that even if the right to prior access is recognised it would be of little use to a country with neither the facilities to receive the data nor the capability or the technology to process the data to make it useful.

International cooperation can further enable developing nations to develop their own remote sensing capabilities, more specifically, be able to receive and process the remote sensing data. The solution is not only a matter of access to remote sensing technology. An effective use of remote sensing technology involves, access to knowledge, sharing of data and the training of local staff at all levels and considerable human and financial resources. These requirements cannot be met without the assistance from developed and outer space faring countries.

2. CONCLUSION

Remote sensing data and information has become indispensable for carrying out a lot of activities. Various sectors around the world demand for remote sensing data. States do not have the full capacity to develop remote sensing technology. Therefore, private entities entering remote sensing market allows for the development of more robust technology.Though there is currently no existing international convention on the intersection of remote sensing data and IP rights - individual conventions on IP rights like the Berne Conventionoffer us with an understanding on the matter. International IP rights conventions and treaties regarding outer space like the Outer Space Treaty, UN Principles on Remote Sensing, read together, help us comprehend the prevailing law. The existing regime while not remedying the problems plaguing the regime, additionally, adds onto the issues.Since the Berne Convention is not envisioned or legislated specifically for outer space activities like remote sensing, contradictions creep in. The contradictions mostly arise out of the differences in International and National laws. National legislations on remote sensing of various States adds to the contradictions and issues revolving IP rights of remote sensing data.

Another aspect of this discussion to uphold the international principle of non-discriminatory access to data guaranteed by the UN Principles. The protection of the non-discriminatory access principle,which balances the rights of the sensed and sensing states, is at risk as the enforceability of UN Principles is vague and the state practice points towards the contrary.The contradictions and dilemmas plaguing the current international regime have to be eliminated. Granting a strict IP copyrights protection without flexibility to data could impede the developing nations' access to remote sensing data on non-discriminatory basis guaranteed by the UN Principles and lock up valuable data. Balancing the interests of all the parties involved in remote sensing activities, while safeguarding the interests of all the stakeholders, should be given weightage when envisioning an international regime of IP rights and remote sensing. As outer space is a "common province of humankind", a common

and uniform protection method which focuses on access to data could be devised to govern the remote sensing activities of the all the states to expel the vagueness and contradictions that have set in which do not allow for the fullest realisation of the outer space utilization.

It is reckless to expect that resolution of legal problems of remote sensing will be quick. Legal problems are intrinsically linked with political, economic, military, economic, financial and technical factors. The way forward would be to focus on international cooperation in outer space for the benefit of the humankind and to use outer space in a sustainable manner.

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