

SUSTAINABLE SPACE EXPLORATION AND USE: SPACE MINING IN PRESENT AND FUTURE PERSPECTIVES

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The article aims to discuss the legal challenges that the nascent industry of space mining has to overcome. This article firstly deals with relevant concepts of existing international space law which promote exploitation activities in outer space. The principle of ‘national appropriation’ is discussed which forbids public and private property rights in outer space. However, it is opined by jurists that it does not impede the ownership of ‘natural resources’, but only ‘areas’. The Moon Agreement holds more significance with mining endeavors. The principle of Common Heritage of Mankind would be discussed with a dynamic industry-oriented interpretation. Then, the article discusses the lessons that can be learnt from other regimes for sustainable mining activities in outer space. Lastly, the article discusses the international regime divorced from the Moon Agreement keeping in view that investments demand returns and safeguards to be taken to make mining in outer space a profitable prospect.

1. INTRODUCTION

During the launch of Sputnik I in 1957, the law on outer space was rather a speculative matter. The activities in outer space, since has been far-reaching, so has the laws on outer space. The outer space is *Res communis omnium*. This basic principle is enshrined in the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (hereinafter referred as ‘OST’) which clearly indicates that the extraterrestrial realm is open for access to all states on the basis of equality. Under *res communis*, the property is owned by the community and every member can use the property without exclusive ownership rights.

Space, the final frontier for mankind has vast opportunities regarding the exploitation of extraterrestrial resources which can be tapped. One of them is ‘Mining’ in outer space, which, if carried on sustainably can benefit mankind in innumerable ways. The relevance of this article is increased by recent international events. Recently, Planetary Resources Inc. and Deep Space Industries have announced plans to mine asteroids for water and rare earth metals.¹ In furtherance of the same, the US introduced the Space Act 2015 to promote mining activities in outer space, which has passed the House and is in consideration by the Committee on science, space and technology in the Senate.² In 2013, China landed their spacecraft *Chang’e* on Moon to assess mineral resources using the rover *Yutu*.³ India (*Chandrayan* and *Mangalyan*) and Japan has also done similar assessments from orbit.⁴

Humankind's thirst for consumption of resources will invariably land them on celestial bodies, which follows the exploitation of extraterrestrial resources. For example, it is speculated that there are one million metric tons of Helium-3 in the lunar regolith that has been deposited over time due to solar winds.⁵ It would be in strategic interest of any nation to mine Helium-3 from the lunar regolith and return them to Earth. The present article will analyze the various legal challenges that mining activities in outer space might encounter and envisage future perspectives for creation of a robust legal regime for mining activities in outer space. Presently, the lack of an acceptable legal framework for space mining impedes commercial mining activities. Therefore, this paper proposes a balanced and workable framework for the regulation of such mining activities with due regard to the interests of various stakeholders.

2. ANALYSIS OF LEGAL CHALLENGES TO MINING IN OUTER SPACE

2.1. National Appropriation principle

The national appropriation principle is unique to Space Treaties. Although similar terminologies have been used with reference to the same in the Antarctica Treaty and the UNCLOS 1982, the exact phrase has not been mentioned in any other law in force.⁶ It is clear from the literal interpretation of Art. II of OST that any property title over outer space, including moon and other celestial objects by use or occupation or any other means is prohibited.⁷ Such interpretation is also supported by the *travaux* of the OST⁸ and state practice as evidenced in U.S.⁹ and China¹⁰. A statement issued by the Board of Directors of IISL also reaffirms the principle of non-appropriation *strictu sensu* by stating that there can be no private property rights in outer space, including the moon and other celestial bodies.¹¹

The fact that a State retains jurisdiction and control over its installations and facilities till they exist in outer space does not mean that it gains ownership over the said "area". It is because under international law, things which are owned by the public, like the seashore or the global commons, cannot be the property of one State based on prescription or adverse possession.¹² The right to use an area exists till the state abandons its installation or it is demolished, subsequent to which another State can establish its installations on that area. The former state cannot argue henceforth that it had acquired a prescriptive right by being in that area by continuous possession of the same. This is the freedom of access and use in the commons regime.

2.2. Exploration and use

The OST principally emphasises the importance of free access to outer space by all states on the basis of equality for exploration and use.¹³ Article I is a general clause which affirms the right to freedom of exploration and use for all states. It is to be noted that by reference to all states, the freedom of exploration and use is not only restricted to states, but extends to international organizations, nongovernmental organizations and individuals.¹⁴ However, states will have to bear responsibility for national activities of their nongovernmental organizations and individuals.¹⁵

'Exploration' is a scientific endeavour while 'use' may be scientific or commercial. It is of common understanding that commercial use of outer space is allowed by the OST.¹⁶ The term 'use' is of more importance with respect to mineral resource mining in outer space. Scientific 'use' of space resources is largely free; however the pivotal question is whether commercial 'use' of outer space resources is envisaged under OST. Or to put it simply, is "exploration and exploitation" of outer space resources envisaged by the OST?

'Use' in legal sense refers to enjoyment of property which is often result of exercise of such property and includes an element of profit or

benefit.¹⁷ The term ‘province of all mankind’¹⁸ is not defined in the space treaties. ‘Province’ according to Blacklaw’s Dictionary means sphere of an activity related to profession.¹⁹ A co-joint reading of ‘use’ and the ‘province of all mankind’ would mean *a sphere of activity*²⁰ which involves an element of profit or benefit by enjoyment of property. As the OST prohibits any establishment of ownership rights, a State may still accrue benefit out of use of certain area of outer space, including moon and other celestial bodies, owing to the right of usufruct, discussed later in this article. A right of usufruct arises upon de facto possession of a property owned by another.

The United Nations General Assembly Resolution (UNGA) 1348 (XIII) of 1958 establishing the Ad Hoc Committee on the Peaceful Uses of Outer Space (COPUOS) includes the word ‘exploration and exploitation’²¹ which was later changed to ‘exploration and use’ in UNGA Resolution 1721 (XVI) of 1961, preceding the OST.²² This indicates that term ‘use’ was originally intended to encompass ‘exploitation’. State practice also suggests that term ‘use’ includes exploitation of space resources.²³

The question whether extraction of mineral resources from the moon and other celestial bodies can be considered as ‘exploitation’ is answered by referring to the Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (hereinafter referred as ‘Moon Agreement’) which envisages the exploitation of natural resources of the moon and other celestial bodies in Article 11(5). If the Moon Agreement includes the exploitation of natural resources, *a fortiori* the OST should also allow the exploitation of resources. Moreover, the *res communis* regime involves the idea of exploration, exploitation and use of the community area and its resources.²⁴

2.3. Property Rights in Outer Space vis-à-vis appropriation of mineral resources

For promoting mining in outer space, the distinction between appropriation of an area or part thereof by claim of sovereignty must be

distinguished from appropriation of particular resources existing in that area.²⁵

The national appropriation principle discussed prohibits any public or private property rights in outer space. Now, any interpretation of a treaty has to be done by reference to its context and object and purpose.²⁶ Article I literal 1 of OST read with Article I literal 2 OST forwards a view that as the exploration and use of outer space should be carried out for benefit and in interests of all countries, any claim of sovereignty in outer space would run contrary to Article I literal 1.²⁷ Hence, the purpose of Article II is to prevent exclusive claims to outer space due to its *res communis* nature.²⁸

The resources present in a commons regime can be exploited by all. For example, fisheries wherein the area is a common pool and the resource i.e. the fishes can be utilized by everyone.²⁹ Just as the mineral resources in the High Seas are open to all, subject to international regulations, outer space mineral resources are open to all.³⁰ Freedom of exploration and use is the fundamental principle of space law and has no express prohibition on exploitation of mineral resources. As a corollary to the freedom of exploration and use in the OST, the residuary rule of presumptive freedom of action as a principle of international law, permits what is not prohibited.³¹

Jurists like Professors Gorove³² and Jenks³³ opine that the non-appropriation principle applies only to landed areas of the moon and other celestial bodies and does not extend to mineral resources. Keeping in view the aforementioned contentions, it can be said that the national appropriation principle only prohibits appropriation of ‘areas’ in outer space including the Moon and other celestial bodies, however does not prohibit the appropriation of mineral resources in outer space.

The Space Benefits Declaration³⁴ can be considered as an interpretation of Article 1 of the OST.³⁵ While the Declaration expands the OST with regard to apportionment of benefits, it does not prohibit the appropriation of resources. In

presence of express prohibition of public and private property rights in Article II of OST, if the appropriation of natural resources was also to be prohibited, then such stipulation should have been included. Hence, it can be concluded that appropriation of natural resources are not prohibited under the OST, while the amount of international cooperation in benefit sharing that a state is willing to do is at its own discretion in accordance with the Space Benefits Declaration.³⁶

2.4. The Usufructuary's rights of Enjoyment

The concept of usufruct is a civil law concept derived from Roman jurisprudence.

In Roman law, "*usufructus is...the right of using and enjoying property belonging to another provided the substance of the property remained unimpaired... A usufruct may be in land or building, a slave or beast of burden, and in fact, in anything except things which were destroyed by use*"³⁷

The holder of such right is called the usufructuary. Usufruct consists of two elements: the right to use a thing (*jus utendi*) and the right to draw its fruits (*jus fruendi*).³⁸ The usufructuary does not have ownership rights, only the right to use and draw benefits from the subject matter of usufruct. The principle of usufruct is a national law principle and its extension to outer space can be termed as instant customary law. Extension of national laws to the regime of outer space is not uncommon as evidenced by State Practice. For example, United States Patents Act extends to a spacecraft in outer space.³⁹ This recent state practice although limited is evidence of *opinio juris*.⁴⁰ Hence, by analogy, we can term the rule of usufruct to be instant customary law. The principle of usufruct can also be termed as a general principle of law recognized by civilized nations.⁴¹ The principle of usufruct can be imported to extraterrestrial law as outer space law is an extension of international law. Space law is *lex specialis* and international law is *lex generalis*.

Now, as the OST prohibits ownership rights of areas in outer space, but allows the appropriation of resources, the exploiter can be

termed as a usufructuary. The principle of usufruct is vital as it embodies the tenets of space law. A usufructuary acquires the ownership of resources upon separation.⁴² Mines on earth may be subject to usufruct provided such a right to mine is granted by the State.⁴³ Similarly, States may be granted Mining Rights by the international community as outer space is *res communis*. The State does not gain any title in the area to be mined, but only the protection of law regarding usufruct.⁴⁴ This allows orderly development of minerals prospecting and extraction. As the term 'mankind' is a vague terminology, there is an urgent requirement to create an international regime which represents 'all' countries for granting of mining rights to space faring nations.

2.5. The dynamism of CHM Principle: Promoting Space Commercialisation

The Moon Agreement is said to be the most poorly drafted of the five United Nations Treaties on space law⁴⁵ and has practical problems of application. The specific reference to present and future legal processes in the Moon Agreement is designed in such a way that it offers optimum utilization and exploitation of the Moon and its natural resources.⁴⁶ The precise stipulation in Article 4 of the Moon Agreement states that 'exploration and use of the Moon' shall be in benefit of all mankind and that due regard to economic and social progress should be given. Therefore, it can be suggested that Moon Agreement promotes the idea of economic exploitation of resources. Article 11 (1) declares that the Moon and other celestial bodies to be the Common Heritage of Mankind (CHM).

The CHM principle has also been applied to the deep seabed and to some extent to the Antarctic Regime.⁴⁷ However, the CHM principle in Moon Treaty is qualified by the phrase, 'which finds its expression in the provisions of this treaty', and such qualification sets it apart from the CHM provision in UNCLOS 1982.

The CHM principle which involves the non-appropriation principle and the socialist

principle of equitable benefit sharing has been the obstacle for the treaty.⁴⁸ There is no consensus on the basic premise of the principle and that is the primary reason for the reluctance of States who were involved in the negotiating process actively, to ratify the Moon Agreement.⁴⁹

The CHM is a dynamic concept⁵⁰ and keeping in view the internal inconsistencies in the Moon Agreement and the practical difficulties of implementation of non-appropriation principle in accordance with the treaty, it is desirable to divorce the concept of non-appropriation from the CHM for better workability of the treaty provisions. Henceforth, it is desirable to interpret the CHM as a 'functional concept', rather than a 'territorial concept' divorced from the independent international law principle of non-appropriation.⁵¹

The International Law Association Resolution No. 1/2002 at New Delhi, India which is a major breakthrough in interpretation of space law declared that the CHM has evolved for allowing commercial uses of outer space for the benefit of mankind.⁵² The inapplicability of the non-appropriation element of CHM is more evident in cases where the object of this principle is a resource rather than spatial.⁵³ Exploitation of natural resources in outer space is general practice among states and private entities. The consideration of the Geo-stationary orbit is required for a moment. The orbital spectrum resource (OSR) in the GEO is an exhaustible natural resource involving a set of frequencies, coverage areas and orbital positions needed for the operation of any satellite communication system.⁵⁴ The International Telecommunication Union (ITU) constitution refers to these OSR as natural resources and access to the orbits shall be made available on an equitable basis. The purpose of the ITU is to allocate bands of radio frequencies and orbital positions in the GEO to countries⁵⁵ and to promote extension of the benefits of telecommunications to all the world inhabitants.⁵⁶ The allocations of so called slots are basically allocation of natural resources in space for its sustainable exploitation. The state practice and *opinio juris* (in form of ITU Constitution and

Regulations) suggest the existence of an international custom in furtherance of the legality of exploitation of natural resources in outer space.

Hence, international practice suggests that states now intend to interpret the CHM principle in a manner which promotes commercialization of outer space, rather than restricting commercialization. This change in interpretation of this principle with respect to the Moon Agreement is grounded on Article 31(3) (b) of the Vienna Convention on Law of Treaties, 1969 which articulates that subsequent state practice may change the interpretation of a treaty.⁵⁷

2.6. Equitable Sharing of Benefits: Responsible Space Exploration and Use

The other challenge that commercial mining faces in the Moon Agreement is the equitable sharing of benefits clause and the express wording in Article 11(7) (d) of the Moon Agreement. The CHM concept philosophically supports the idea of common trusteeship of resources in contrast to common ownership concept of *Res communis*. Trusteeship does not negate existence of propriety appropriation.⁵⁸ This means that the benefits derived should be used for betterment of humanity by removing inequalities in wealth distribution among nations.⁵⁹

The term used in Article 11 (7d) is 'equity' and not 'equality' which means that a balance of interests between the developing countries and the developed countries is intended by the treaty. However, there is no specific mention about the methods of equitable sharing. The best way would be to negotiate an agreeable specific manner in which benefits will be shared as it will remove the discrepancy and mistrust of developed countries which fear that equitable distribution may be construed as free lunch by developing countries and other non-space faring nations.

The Moon Agreement does not specify what types of benefits are to be shared under Article 11(7d). The term 'benefits derived from resources' indicate that indirect benefits may also be provided. Such benefits for example, may

include the grant of right to developing countries to participate in exploration of outer space through bilateral agreements etc.⁶⁰. Non-discrimination and reasonable profit is the key element for effective and balanced implementation of the equity clause. Hence, exploiters must be allowed to maximise their profits, but at the same time levies or quotas can be imposed upon economic benefits derived by market access. Collection from levies may be then utilized for fulfilling the obligations under the treaty creating a rational and orderly development of space resources. A good example is the United States Deep Seabed Hard Minerals Resources Act which established a Trust fund; wherein levies were to be collected from the benefits derived from deep seabed exploitation and deposited at the Trust Fund.⁶¹

The provisions of the Moon Agreement deal extensively with exploitation of natural resources contra-distinct to the OST. The OST does not contain any mention of exploitation which is open to interpretation differently by different States. In light of the same, some states who believe that developed nations may act unilaterally under the expansive scope of OST and might interpret it narrowly to create chaos to the well established law of space. In light of the same, Moon Agreement seems more favourable to the states intending to exploit the natural resources of the Moon and other celestial bodies, subject to certain reasonable restrictions.

2.7. Is there a Moratorium to start the exploitation of mineral resources in the Moon Agreement?

The answer is in negative as evident from drafting history of the Moon Agreement. A clarification was issued by the United Nations General Assembly regarding the Moon Agreement that it was not intended to result in prohibiting the exploitation of natural resources which may be found on celestial bodies other than the Earth.⁶²

2.8. Ownership of natural resources: 'In-situ' and 'extracted'

In Article 11(3) of the Moon Agreement, it is stated that neither the surface nor the subsurface of the Moon or other celestial bodies or

natural resources 'in place' shall become property of any State, international organization or NGO or natural person.⁶³

Article 6 of the Moon Agreement refers to in-situ scientific utilization of resources and is subject to the *re communis* regime while commercial exploitation of resources under the Moon Agreement will be subject to the CHM principle. This is the dichotomy in the Moon Agreement.⁶⁴

It is to be noticed that the natural resources are qualified by the term 'in place'. The provision read as whole suggests that Article 11 (3) intends to prevent creation of ownership rights over natural resources *in-situ* by establishment of installations, or structures, etc.⁶⁵ Rather than acting as an obstacle to the right to appropriate mineral resources, it promotes the same by implication that ownership of resources which have been displaced or removed from the Moon and other celestial bodies may be subject to territorial law of the state which has caused the collection of the mineral resources.⁶⁶

So, exploiters cannot have ownership rights over the surface or subsurface over the Moon and other celestial bodies, but they can have property rights over the mineral resources that have been extracted.⁶⁷ The *travaux* also supports the view that the whole purpose of inserting the term 'in place' was to create ownership rights over the resources once they have been removed from their original location.⁶⁸ The Soviet draft⁶⁹, the U.S. draft⁷⁰, the Austrian draft of 1978 all reiterated the same interpretation. The Argentine proposal of 'all substances originating in'⁷¹ was rejected and the term 'in place' was used. The term 'in place' neutralizes the CHM qualification for recovery and retaining of resources. The lack of moratorium is also evidence of the fact the Moon Agreement does not prohibit appropriation of minerals in outer space.⁷²

3. LESSONS FROM OTHER GLOBAL COMMONS

3.1. Convention on the Regulation of Antarctic Mineral Resource Activities, 1988 (CRAMRA)

The Antarctic Treaty System (ATS) is a complex collection of legal instruments one which has flourished as a result of international cooperation and effective demilitarization. The Antarctic Treaty consists of the elite club called the Antarctic Treaty Consultative Parties (ATCPs)⁷³ which practically 'run the show'. ATCPs have special interests in the region and have allocated responsibilities in furtherance of the same.

The CRAMRA⁷⁴ is an Antarctic Treaty System Convention which dealt with prospective mineral exploitation regime in Antarctica. The CRAMRA was also a compromise between States, like the Moon Agreement, which failed to receive the requisite number of signatories to come into force.⁷⁵ Nevertheless, investigating the working of the CRAMRA will inexorably provide insight into a mineral extraction regime that might be helpful for establishing the international regime for exploitation of natural resources as mandated in the Moon Agreement

The CRAMRA is a *sui generis* compromise agreement which balances the competing claims of sovereignty and those states which do not accept those claims in Antarctica. The Agreement is a neutral document which neither promotes nor prohibits mineral development in Antarctica. The Convention is not a mining code; rather it is a guiding framework stating specific positive and negative obligations of States regarding mineral resource development and contains provisions for authorizing and administration of the mineral resources regime. CRAMRA has strong environment protection provisions which demand high standards to be fulfilled.⁷⁶ CRAMRA regulates minerals prospecting, exploration and development activities, although mining can be done only after proper authorization to the project. The authorization will be granted only if significant

adverse impact is not caused to the atmospheric, terrestrial and marine environments.⁷⁷

Regarding liability, Operators are 'strictly liable' for all environmental damage arising from mineral resource activities, including clean-up and restoration costs.⁷⁸ At the outset, CRAMRA seems like an interesting model for the international regime in outer space. Although, the ATS is a *sui generis* system, it might be an inspiring tale for the regime in outer space because the success of the ATS is based on international cooperation and the maturity of States in understanding the importance of protecting the environment of Antarctica.

3.2. The Inter-Agency Consultative Group (IACG)

The search for international cooperation might be answered by an umbrella organization in line with the likes of IACG. Multilateral organizations fail due to bureaucratic obstacles and the ensuing fear among nations that they might lose control over their own projects.⁷⁹ The IADG is a multinational group which overcame these obstacles. The IACG was formed for building, launching and tracking of the GIOTTO spacecraft prior to the passage of Halley's Comet in 1986 to coordinate national efforts to observe the comet.⁸⁰ The organizational structure of IACG was simple and it acted as an advisory body to the member agencies.

The international effort of the ICAG was a success example of international cooperation. The success of the IACG was attributed to its simple management interfaces.⁸¹ Moreover, the IACG did not require exchange of funds and involved minimal technology transfer. International cooperation is necessary to provide synergy to a space project.⁸² Unfortunately, after the demise of the Roger Bonnet, who was instrumental in promoting the IACG, the organization also disappeared. Its last meeting was at Moscow, Russia in 2002.⁸³

Unlike the IACG, an umbrella organization for commercial mining of space resources requires fulfilling the condition of equitable benefit sharing⁸⁴ It can be formalized

through an inter-governmental agreement or terms of reference for compliance with international law and an operating agreement for regulating the relationship between public and private entities. The Agreement may be formed by a 'club' of developed States and some developing states which can provide major contribution to prospecting, exploration and development of resources.

3.3. Deep seabed regime

States are unwilling to replicate the Law of Seas mechanism for outer space due to its specificity. More specifically, due to the provisions related to transfer of technology, an economic model against the tenets of free market economy, due to the Authority's control over level of production and prices and equal voting rights irrespective of States' technological capabilities or contributions to development of seabed resources.⁸⁵ Hence, it is opined by the author that the Deep seabed regime mechanism cannot be replicated in outer space in the future.

4. PROPOSED INTERNATIONAL FRAMEWORK

Sustainable utilization of Minerals contribute to progress and development to ensure high living standards, create a competitive market for resources at the national and international level and most importantly are of strategic value to any nation. Keeping in view the benefits of space mining and its importance to mankind as a whole, it is important to create an international regime which facilitates market access to benefits of outer space and protects the interest of investors at the same time.

Here it is noteworthy that an international regime *need* not be created exclusively under the Moon Agreement i.e. an international regime can also be created by States without being party to the Moon Agreement. Considering the poor performance of the Moon Agreement, it would be futile to expect an international regime under its mandate of Article 11(5). However, an

international regime to govern exploitation of mineral resources is indispensable for sustainable exploitation of space resources. The process in which the regime harmonises the basic tenets of space law with a beneficial economic model for investors is of vital consideration. The failure of the UNCLOS to cater to investor's interests under the deep seabed regime is required to be kept in mind while establishing an international regime for outer space.

4.1. 'Hard law' regime for mining activities in outer space

A Convention on Mining Activities on the Moon and other Celestial Bodies (Mining Convention) is required to be negotiated by like-minded states. The reference to like-minded states is important because agreement reached by states which are directly affected by space mining can provide a general foundation on which further integration could be done.⁸⁶ The Convention may be in furtherance of the Moon Agreement designed on the lines of CRAMRA, however with prominence to the principle of non-appropriation. The CRAMRA evades the question of sovereign claims by States which undermines its effectiveness; the Mining Convention should give prominence to the national appropriation principle and the non-weaponization principle. No property rights would be recognized by the State Parties, instead mining slots are to be provided to applicant States, similar to the ITU mechanism of providing orbital slots in GEO to States. This will ensure freedom of access of Article I of OST. However, the mining slots do not confer ownership rights; rather it confers the right to usufruct. The right to usufruct will give proper safeguards to the entities engaged in mining activities from interference by other States in their activities. The mining slots can be renewed periodically. Mining Rights may be granted to private entities provided authorization and continuing supervision is done by the appropriate State Party. Conformity to the OST and general international law is a prerequisite for Mining Activities in Outer space. States will bear international responsibility for the conduct of their

non-governmental entities pursuant to Article VI of OST.

The Mining Convention should establish four organs which will carry out the objectives and functions of the Convention.

1. The Commission: The Highest Decision making body, consisting of all State Parties and engaged in formulation of a 'Mining Code'. The Mining Code should promote investor returns keeping in mind protection of outer space environment. The voting procedure in the Commission will be based on 'one State, one vote'. Veto powers should be provided to the States which have special interests in mining.
2. The Regulatory Committee (RC): The RC will be the implementing body which means that it will award mining slots and mining contracts on prospected areas. Prospecting should be largely free pursuant to Article I of OST; however exploration and developmental activities will require the approval of the RC. Pursuant to RC approval, Mining contracts shall be awarded to the applicants.
3. The Scientific Advisory Committee and Secretariat shall have well defined roles as decided by the State Parties to the Convention.
4. Establishment of Trust Fund for equitable sharing of benefits.

The ownership of 'extracted' minerals shall belong to the entity which has the Mining Contract with the RC, as the appropriation of resources is allowed by the OST and also by the Moon Agreement. Apportionment of resources in case of joint usufruct rights over mining slots can be done through Partnership Agreements between the entities themselves. The Mining Convention should be without prejudice to any such agreement between Parties.

The States shall compulsorily have to adhere to the other agreements and conventions applicable in outer space. The definition of 'launching state' has to be revamped keeping in view the participation of non-governmental entities. The Mining Contracts should be for a limited period of time to prevent any assertion of ownership claims which can be periodically renewed and non-renewal will amount to termination of the contract. Termination of the Contract can also be possible in case of any violation of the Mining Code.

Pollution is a corollary of mining activities. Hence, to mitigate the same, Mining Pollution Control (MPC) guidelines shall have to be formulated along with the Mining Code by the Commission. 'Safety zones' have to be designated for areas which are sensitive for the scientific research; such areas cannot be used for commercial mining purposes. The RC shall impose levies on any entity which does not adhere to the MPC guidelines. Mining Credits similar to Carbon Credits should be awarded to entities which control their pollution levels. Carbon credits are tradable commodities; similarly mining credits can also be traded between the entities.

Now, the most controversial of all is the principle of equitable sharing of benefits. Any convention on Mining will have to include the issue as the concerns of the developing nations and non-space faring nations have to be given special consideration in accordance with Article I of OST and the Space Benefits Declaration (also the Moon Agreement). A Trust Fund will have to be established for furtherance of equitable sharing of benefits accrued from exploitation of resources in outer space. Mining entities (Contributors) will have to contribute a percentage of their profits to the Fund. The Fund will use those profits to provide space-based applications, knowledge sharing and exposure to space-based benefits like remote sensing and satellite communications to the developing nations.

The percentage share of the contributors will be based on the proposal of a new principle of '*Equitable Responsibility for Global Commons*' in

space law which means that every entity involved in mining activity has a common responsibility towards the mankind as a whole; however the responsibility will be equitably shouldered in accordance with differing financial and technological capabilities. This idea is similar to the principle of Common But Differentiated Responsibility (CBDR) recognized under International environmental law.⁸⁷ Each entity involved in Mining activities should shoulder differential burden based on their investment levels. This will lead to equitable sharing of benefits in its truest sense, wherein benefits as well as the burden shared is based on the notions of equity.

The Post mining activities like transfer, sale criteria, etc. of space mineral resources should be based on the market principle of *laissez faire* i.e. minimum government interference is expected in such areas for ensuring maximum returns for investors. There should be less regulation over post mining stage because once the principle of equitable sharing of benefits is adhered by the parties, further regulation over the mining regime would be detrimental to investment concerns. The prime purpose of the Mining Convention should be to promote sustainable exploitation of resources on the moon and other celestial bodies rather than regulation of profit incentives for investors. Effective commercialisation of the space resources would be only possible if investors are allowed autonomy over the 'extracted minerals' as if vesting them with property rights over the 'extracted minerals'. Vesting of property rights over 'extracted' mineral resource is not prohibited by the national appropriation principle in OST or the CHM principle of Moon Agreement. In order to resolve the disputes between the states parties under the Mining Convention, the Commission should also establish a dispute settlement body where Arbitration could be resorted to for effective resolution of disputes.

4.2. 'Soft law' alternatives

The question of space mining is a contentious and sensitive issue for states, and

political considerations may act as a clog for the formation of new treaties. There may be the possibility of a treaty falling dead during the negotiation process due to political reasons or may be rendered ineffective due to lack of participation. This calls for analyzing alternative approaches of developing a regulatory regime for space mining. Long-term sustainable space exploration and use requires broad stakeholder support through consultations.⁸⁸ These consultations can be done in a transparent, non-binding and trustworthy ambience through establishment of norms of behavior. Norms of behavior are soft law instruments which constitute recommendatory guidelines for standard practices established through shared understandings of responsible behavior within the international community.⁸⁹

With the influx of time, as hard law has become unpopular, development of international norms of behavior supported by national legislation for regulation of mining activities would lead to sustainable space exploration and use. Such standard-setting endeavors may include the development of TCBMs which have been considered by the international community as a pragmatic approach to initiate international dialogue on sensitive issues.⁹⁰ TCBMs are voluntary, non-legal measures which involve multiple levels of dialogue and interaction for broader understanding of shared commitments by reducing misperceptions, political wariness and miscalculations.⁹¹

Norms of behavior provide the much required political flexibility.⁹² They should encourage international cooperation, consultative mechanisms, outreach and coordination among relevant actors involved in mining activities.⁹³ Basic principles of OST like national appropriation and peaceful use of outer space, information sharing and peaceful settlement of disputes should be reiterated by the standard practices established by the international community.⁹⁴ Once, a consensus on the shared understanding of responsible behavior has been reached among states, national legislation can be effected to implement such standards according to

the commitments of the states. This would lead to implementation of common standards at a global level, thus gradually creating a common ground for developing the much required international regulatory regime for space mining.

5. CONCLUDING REMARKS

With the outstanding technological advancement, space mining has become a reality now for space faring nations and private entities. However, there is no clarity on the international legal regime dealing with exploitation of the resources in outer space. Since commercial mining venture will involve huge financial investments, it cannot be performed in an environment of legal uncertainty and therefore, creates the need for having an international legal framework covering the same. During the drafting of the OST, the commercialisation of the outer space and its resources was not anticipated. However, under the Moon Agreement, the principle of Common Heritage of Mankind developed, thus allowing the commercial use of outer space and its resources. The application of the Moon Agreement is not only to Moon itself, but to other celestial bodies, thus potentially covering the planets and asteroids where the mining potential is considered to be infinite.

With the analysis of principles like national appropriation, the usufructuary rights of enjoyment and CHM, it can be concluded that it is possible to have property rights over the mineral resources that have been extracted. As suggested, a Convention between the like-minded states to govern mining activities in outer space will help to clear the unsettled position of the legal mechanism and will provide a regulatory mechanism as well. In the alternative, norms of behaviour will also hold strong influence in setting up international rules along with national legislations for regulation of mining activities.

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