COMMERCIAL USES OF OUTER SPACE: PROSPECTS, CHALLENGES AND SOLUTIONS

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INTRODUCTION

Historical Perspective

The bi-polar world of the sixties and seventies of the last century was characterised by cold war assertions and a desire for geo-political hegemony and technology one-upmanship. Therefore, technological advances towards conquest of the final frontier were for national prestige and sovereign aggrandisement. USSR won this race with Sputnik in 1957 while the US achieved a first with the Moon-landing in 1969, demonstrating its superior techno-threshold. But along these developments and growing competencies, strategic advantages of outer space as traditional military high-ground had become unmistakably clear and were advantageously harnessed for surveillance and other benefits of missile defence systems.

Then came the era of public services and specialised utilities from the outer space that provided a network of communication applications and a wide footprint of broadcasting and television facilities. The

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advantages of space activities became obvious to the governments and the public alike and their applications multiplied. Internet and satellite mobiles are from this crop. Then followed remote sensing activities which refined with rapidity to attain high definition standards. These activities though initiated by the government space agencies were, subsequently, taken advantage of by commercial enterprise.

Contemporary Scenario

Dawn of the new millennium brought about a new genre of technological advances that ushered in a New Space Age where commercial exploitation of outer space and its resources became possible, feasible and practicable. It was a significant turn in the orientation of space activities where governmental space agencies started concentrating on deep-space exploration and national strategic imperatives and thus weaned themselves off from space activities that bore commercial content, motivation and potential. The dwindling budgetary allocations for NASA as also progressive commercialisation of the US quarters in the ISS by 2024 represent this policy.

Considering this trend of state agencies selectively withdrawing from space activities, except those of strategic importance or deep space exploration, it seems certain that activities with commercial overtones and import such as space travel, space mining and space tourism will not normally be undertaken by governmental space agency nor would public exchequer funds be allocated for this purpose.[1] Perforce, such activity will have to depend upon a business initiative from corporate community,

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[1] It is likely that certain countries like China and India may not involve private enterprise in strategic or commercial space activities for a long time. Yet a small beginning has been made by China in the establishment of a private company in 2015 to undertake space activities. This private company is planning a rocket launch in 2019. Nevertheless, state-owned companies are expected to remain the main players in Chinese space activities for quite some time.

whether for commercial adventurism or entrepreneurial vanity or business aggrandizement.[2]

Given the present standing and competence of private enterprise in advanced countries, it can harness complex space technology, is willing to invest huge funds in space projects and patiently wait during the gestation period with uncertain profit projections. It would, therefore, not be presumptuous to believe that Space-X, Virgin Galactic, Blue Origin, Boeing Aerospace, Lockheed Martin, a start-up company SpinLaunch or a consortium of willing and enterprising 'astro-preneurs' would venture into this nascent yet promising business segment for prestige or profit irrespective of the technological imponderables or attendant financial risks or hazards of hostile space environment. Hope prevails with positivity.

The logic was loud and clear; the state exchequer would not spend public finances on activities that could be legitimately and voluntarily taken over by the industry as commercial enterprise. The bait, indeed, proved tempting. One could, in this connection, cite the example of NASA initiative of COTS (Commercial Orbital Transportation System) on cessation of shuttle operations and de-commissioning of Apollo and Columbia vehicles. This thus became an important milestone in the evolution of Government-Industry partnership that is still flourishing with state impetus through national legislations[3] and positive intuitive visions of the business captains to address newer markets. In fact, commercial transportation of fare-paying passengers has already been started by Russia and regular space carriage by private space operators is likely to commence within a year. Developments are afoot and presage this expectation.

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[2] Gurbachan Singh Sachdeva, "Commercial Mining of Celestial Resources: A Case Study of US Space Laws", *ASTROPOLITICS* (2018), <http://doi.org/10.1080/14777622.2019.15343127>

[3] The US Space Legislation of 2015 and subsequent national laws on the subject.

Futuristic Visions

The next step for space industry, achievable in a decade, will be commercial exploitation of space mineral resources for the benefit of humanity starved of natural resources.[4] Technological progress supports such a vision with genuine hope. And the next foreseeable plunge for the human species appears to be for planetary settlements for which many groups like Church of Scientology, Asgardians[5] and All-for-Moon are literally craving. This would involve commercialisation of planetary real estate whether for planned Woerner's Moon Village or Mars Colony or even for space tourism resorts.

All these commercial venture projections envisaged and planned for the outer space domain, despite promising prospects, are still beset with certain techno-imponderables and legal challenges. However ominous, these can be overcome in different ways and resolved with different options. Acceptability and consensus are the only debateable matters. This article, therefore, is a concept paper that intends to focus on contentious legal issues and explore various viable solutions from treaties[6] perspectives. The explicit legal denials or silent omissions are not insurmountable and the author offers positivist and pragmatic solutions for global consideration so that acceptable option can be worked upon in detail. The task call for concerted action.

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[4] Sachdeva, G. S., *Outer Space: Law, Policy and Governance,* (2014), New Delhi, KW Publishers, p. 155.

[5] Sachdeva, G. S., *Space Commercialisation: Prospects, Challenges and Way Forward,* (2019), pp. 122-3, New Delhi, Pentagon Publishers.

[6] The Outer Space Treaty, 1967 and the Moon Agreement, 1979. Cited in detail in notes infra.

PROSPECTS OF SPACE COMMERCIALISATION

Commercial Space Travel

Commercial space travel of space tourists has already started. Dennis Tito was the first such traveller carried to the outer space by Russia nearly two decades back and he stayed in the Russian quarters of the ISS for a week, ostensibly doing some research. And since then over two dozen persons, including US astronauts on rotation, have travelled as fare-paying passengers in chartered space flights that have docked at the ISS. The Russian experiment is being emulated by the US private enterprise and frantic efforts are being made to operationalise scheduled, regular space travel, at least in the low-earth orbit.

Technology experiments in re-use of rockets to make space travel affordable are in advanced stages of mixed success. Public response in advance bookings is tremendous. Therefore, the dawn of commercial space travel seems imminent and very near. Associated with this will be space tourism which is expected to be innovative and novel to impart life-time memories and out-of-the-world experience that adequately pays back the value of the trip. Some of the ideas being touted are honey-mooning in near-zero-gravity environment or an exhilarating view of the mother earth dotted with artificial lights at night or *lumiere* splendour of the universe. Thus space tourism opens up a wide vista of an imaginative future industry.

Exploitation of Space Mineral Resources

The fact that there lies a limitless bounty of mineral wealth in outer space has been proved by remote sensing and close observation through space probes and analysis of samples of planetary soils. And that these minerals are useful to humanity and can augment the depleting natural resources of Earth is also established beyond doubt. Further, the technology to excavate and, to some extent, process the same *in situ* also

promises feasibility. The end product that would make for a smaller quantum of high utility metals can be used for other activities on the mined planet or transported to Earth in economical capsules.

Possibility can also be envisaged where processed material and procured water can be recycled in some manner for use and manufacturing on the celestial body itself or to replenish probe vehicles on deep-space missions. Thus, the utility of celestial natural resources, including water, to mankind is affirmative but the algorithms of comparative economics of excavation, processing, haulage to earth or use *in situ* are not yet too clear to convince of commercial viability and sustained profits. But prospects appear promising and business sentiment is bullish.

Attention to space resources has been attracted due to depleting natural resources on the earth, the growing scarcity and consequently escalating prices of short-supply minerals. Of late the pinch has been felt rather acutely and that has diverted attention to prospects from other probable sources, the viability of excavation, the quality of the excavated ore, and the cost parameters. One such source has zeroed onto asteroids that were long known for their mineral richness but technological competence for exploitability on commercial scale was lacking. Technology has since progressed to challenge this opportunity and viability knocks at our door. Some countries, through commercial enterprise albeit with governmental policy support, are making frantic efforts to actualize this possibility and reach the goalpost first to bag obvious advantages of the winner.[7]

Commercialisation of Planetary Real-Estate

The third possible commercial activity in outer space, likely to happen in a decade or so, would relate to planetary human settlements whether for tourism, temporary resort or permanent residence. An advertisement in

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[7] For example, the US, Japan, China and the Dutchy of Luxembourg.

this context elicited thousands of applicants who opted for one-way ticket to the Mars and were least interested in returning to the planet Earth with which they seemed highly disenchanted. Such disaffection for the mother Earth should be socially disturbing and disconcerting. Nevertheless, it opens up prospects of planetary real estate assuming commercial status and economic value for estate builders and space settlers alike. The vision appears realistic.

Thus there is a trend metamorphosing rather fast with humans craving to settle down on the planetary bodies with permanent residence. The Moon Village and Mars Colony would be favourite townships to reside and live permanently. The prospective residents believe that they can comfortably sever their nationality affiliation to the global state and can survive as citizens of the Universe or planet of emigration. Though technically the idea is not weird and designs of igloo-like accommodation and provision of utilities and conveniences are on the anvil yet, it appears a distant vision. But dreams do come true and sooner than anticipated.

LEGAL CHALLENGES TO COMMERCIALISATION

Legality of Private Enterprise

The legality of private enterprise undertaking activities relating to peaceful uses and scientific exploration in outer space can be validly derived from Article VI of Outer Space Treaty (OST). This provision permits non-governmental entities for such ventures. There is, however, a rider in the same article of the Treaty that these activities "shall require authorization and continuing supervision by the appropriate State Party to

the Treaty".[8] This defines primal responsibility of the state for space activities. Thus, whatever may be the tenor of conditionality, a basic permission exists for private enterprise to enter this domain on authorisation by the state of nationality and for legitimate and *bonafide* activities within the ambit of the Treaty.

In fact, this is happening already and satellites owned and operated by the private sector are already in outer space for communications, broadcasting and remote sensing. Commercial space travel for select passengers has already started for almost two decades whether for persons like Dennis Tito or for rotation of ISS crew. Further, scheduled space flights for fare-paying passengers by private space-carriers are in the offing. Space mining for *in-situ* utilization of planetary mineral resources, raw or processed, can be justified on the basis of existing Moon Agreement.[9] Hence, the US Commercial Space Launch Competitiveness Act, 2015[10] encouraging private space industry is valid and benign to this extent.

Private Appropriation of Celestial Resources

The problem would arise at 'commercial recovery of space resources'. Perhaps, quantum of recovery and their private appropriation could be relevant and contentious here. Small quantities as samples may be obtained from celestial bodies and recovered for distribution or may be sale to interested parties for scientific investigation as urged under the Treaty. But the clause in the US legislation that authorises US citizens

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[8] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and other Celestial Bodies, 1967. 610 UNTS 205 (1967);18 UST 2410, TIAS No 6347, 6 ILM 386. Often referred to as Outer Space Treaty or the Treaty or OST.

[9] Agreement Governing the Activities of the States on the Moon and other Celestial Bodies, 1979, available at https://treaties.un.org/pages/ViewDetails.aspx?src=TREATY&mtdsg_no= XXIV-2& chapter=24&clang=_en It entered into force on 11 July, 1984. It has received 17 ratifications till end of 2018.

[10] HR 2262. The President of the US signed it into law on 25 November, 2015.

“ engaged in commercial recovery of an asteroid resource or space resource obtained, including to possess, own, transport, use and sell the asteroid resources or space resources obtained in accordance with applicable law, including the international obligations of the United States” is tricky.[11] This provision contains a syllogistic fallacy and lacks legal synchronicity with the Treaty law. Viewed differently, it smacks of defiance that is tantamount to sovereign irresponsibility and political impertinence deserving of correction.

Humanity through UN resolutions on space activities and space governance has avowed itself to compliance of the Outer Space Treaty and the principles and tenets enshrined therein. Therefore, abiding by this, Articles I and II of the OST clearly omit permission for such a crass attempt at commercialization and private appropriation of excavated resources. The US, in an initiative of ‘business populomacy’, has enacted a domestic law to overcome this obstacle but that impinges on the OST as this act guarantees enlarged rights to its citizen than bestowed on the state by the Treaty. In a way, the US enactment has strains of negativity against established legal order and is not as innocuous as is made to appear by a bland reference to its international obligations.

Nevertheless, there is no need to be dismissive of the motivated narrative of the US enactment or other legal challenges incumbent on commercialisation. The matter deserves to be rationally debated to find best amends to the situation within the gamut of space law and explore viable solution in the common interest of humanity. In the ultimate, there appears a need to revisit the embedded concepts and align them with contemporaneous reality for a revised and modern construct of OST because the law, being dynamic, must adapt itself with the demands of evolving human needs, advancing technological developments and newer business initiatives into prospective markets.

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[11]N.2 ante.

The Moon Agreement of 1979[12] is more visionary and flexible in its approach to exploitation of planetary natural resources. It permits excavation but excavated material is treated as Common Heritage of Mankind (CHM) and cannot be individually appropriated by mining companies for exclusive private profit. As per one implication of the concept of CHM, benefits accrued must be shared with all states, but proportion of sharing and modalities for distribution of shares have not been stipulated in the MA. Ironically, the MA is more pliable and easier to amend through in-built provisions but has elicited limited interest with only a few ratifications to bring it in force. Ergo, this Agreement deserves to be mainstreamed to eke out its latent potential and in-built advantages.

Commercial Value of Celestial Real Estate

Space travel and space tourism, which is predicted to be the industry of the 21st century, creates a new characteristic of commercialization in outer space. This activity will induce value-addition to the real estate of planetary bodies for establishing space-ports for travel as well as tourism infra-structure in the form of hotels and resorts that offer thrills and pleasures to the tourists. Once this industry picks up in right earnest, the commercial value of celestial realty will soar tremendously.

Another impetus of value-addition to the spatial real-estate will emanate from inter-planetary human migration and celestial settlements, for temporary stay or permanent residence, necessitating construction of housing and resorts on real estate which cannot be subjected to state sovereignty and, logically, nor privately appropriated and permanently owned by infra-structure magnates. There is a vacuum in law and the dilemma is real. Perhaps a viable solution could lie in lease-holding of real estate under the aegis of the UN, the modalities for which will be discussed in a later section.

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[12] N. 6, ante.

The legal challenge relating to property right on real estate of the habitable planets is slightly complex. The Treaty provisions are prohibitive on claims of national sovereignty as also not explicitly permissive on individual rights on *res nullius*. Further, there are likely to be other stakeholders to planetary real estate. A group of Asgardians, who claim themselves to be a Space Nation, are striving for a place in outer space that they can call as their own. Their competition with commercial usages by global 'astro-preneurs' is possibly going to be tough because global corporates will be governed by the UN regulations while the Asgardians will have no such legal shackles.

Again, adherents of the Church of Scientology profess faith in the belief that they are descendants from a Space Confederacy of King Xenu and have the first right on planetary bodies of the confederacy. Their assertions may be tenuous; logic and rationality may dismiss these claims on whatever reasoning or lack of justification from the other side, yet an endemic conflict resides in the situation. Therefore, this lurking contradiction may adversely affect the business sentiment as well as progress of commercial ventures on celestial bodies. Incidentally, existence of such 'planetary locals' would seem detrimental to the safety of 'the Earthians' and security of global economic interests. The problem that looms is real, though in the future.

VIABLE SOLUTIONS

Through Outer Space Treaty

OST is a symbol of global trust, and humanity through the UN resolutions has avowed itself to honour its precepts and support compliance of principles enshrined in the Treaty. The principles espoused therein are egalitarianism, altruism inclusiveness and equity. Therefore, devious and contorted interpretations or motivated infringement or outright defiance would not only be embarrassing but also near-

blasphemous amounting to political impertinence, sovereign irresponsibility or tantamount to reneging on our solemn pledge. Such a situation must not occur and be avoided at all costs and by all stakeholders. Hence, viable solutions should be found within the ambit of the Treaty and cognate Space Laws. As deemed necessary and expedient, a thorough revision of the Treaty or a *specialis* protocol or an amending resolution in the UN General Assembly may be attempted. This effort, however, can be nuanced for success by offering bait of benefits.

There, however, appears no legal hurdle in commercial transportation of space tourists. The problems, if any, faced would not involve principles of governance but would merely pertain to personal identity of tourists, records of immigration to planetary destinations, maintenance of public order in space and standardisation of space travel contract and attendant liability regime. These are procedural and regulatory measures that can be sorted out with mutual discussion among stakeholders. Tried and tested precedents exist in Air Laws that can be duly mutated to suit space travel and applied as such.

At present, the existing regimen of Outer Space Treaty is silent on the aspect of commercial exploitation of space resources. Frankly, it could not have been anticipated half a century back that man would achieve such spectacular progress on space technology in diverse applications and, that too, so fast. But this development is now on us and we cannot shut off a treasure trove of useful spatial natural resources, so direly needed on earth, for sheer lack of legal permissibility. An unimpeachable provision in this regard has to be found or created or suitably added; and equally fast too so that OST adequately equips itself to the impending challenges of New Space Age. However, experience tells that amendment to treaties is painfully arduous in diplomacy and time-consuming in negotiations. Nevertheless, positive and plausible action in the right direction must commence soonest.

A short-term, *ad interim* legal measure and policy expedient has been proposed for the space-faring nations to take initiative and

purposefully resolve issues on the legal canvas keeping in view the principles of common benefit, inclusiveness and equity. A pragmatic solution could be that a reasonable portion of accruing profits from such commercial activity can be deposited in an escrow account with a UN financial institution to be shared to benefit all states in structured ratio and weightage as and when such modalities are finalised and made effective. This could be called Space Benefits Fund (SBF) on the concept of Corporate Social Responsibility (CSR). Thus a broad agreement may be easier to reach, if not true consensus. This would be supportive of the inclusive spirit of the Treaty as well as mollify non-stakeholder beneficiaries. There is, of course, a view-point doing the rounds relating to unearned profits and unfair enrichment that foils this stand. But OST still constitutes basic law on the subject and stands valid.

Through The Moon Agreement

Another viable solution lies in the Moon Agreement (MA), which is more permissive and liberal in this regard. In Article 8, the Agreement permits excavation on the Moon, on or below the surface, and allows for free movement of equipment and personnel etc. Further, provisions of this Agreement "…shall also apply to other celestial bodies within the solar system…" So near-Earth asteroids get covered in its ambit. But as regards private appropriation of natural resources of outer space, Article 11 (1) of the MA treats these as 'Common Heritage of Mankind (CHM)'.

Under this concept, celestial natural resources are treated as *res communis omnium,* which doctrine defies proprietary individualization in any manner or for any purpose. To overcome this hurdle, it is felt that it may be more prudent to ratify this Agreement and initiate a suitably modified legal regime for equitable exploitation of natural resources under Article 11(5). The agreed and suitable amendment as negotiated by the requisite number of state parties to the Moon Agreement can be adopted by a majority vote because consensus is not relevant here. Even

otherwise also, MA deserves to be popularised and mainstreamed as it is ripe for revision under its own, in-built, Article 18.

Some Allied Recommendations

Not interfering with the governance principles of the OST and cognate laws as Public Space Law for maintaining public order, peace and stability in outer space domain, commercialization of outer space activities by private corporate entities, in contra-distinction, needs a new set of rules under, what can be termed as, Private Space Law. This would cover in its scope regulation of space-lines and tourist facilities vis-à-vis the tourist or determinate leasing for excavation or the regulation of celestial real-estate for infra-structure and dwellings for private habitations involving principles of natural justice, equity and fair play, corporate social responsibility, and sensitivity towards welfare of space workforce. It will thus be seen that the proposed dichotomy is analogous to the one found in International Law (Public and Private). And to encourage commercial exploitation of space resources, Private Space Law should be debated and strengthened.

The discourse is now ripe, and another recommendation can be proffered. It is pleaded that the present set-up of UN Office of Space Affairs (OOSA) is too skeletal for full-sectrum governance and regulation of activities. It may also lack competence to handle specialised affairs of space commercialisation, in terms of regulation of space travel and inter-planetary immigration; grant of leases for mining, checking of compliances, collection of lease rentals, termination of leases, sanctions for defaults and redressal of disputes; management of planetary habitations and law & order problems, to name just a few. Ergo, the stated issues and unsaid problems would need professional management on each aspect and for the purpose it is proposed to establish World Space Organisation (WSO) as a specialised organ of the UN. And within this umbrella organisation, a Celestial Resources Authority (CRA) is recommended to efficiently handle all aspects of the human exploitation

of spatial natural reserves. Surely, such structural changes would appear relevant and necessary. The time to usher in change has come.

Apart from legal and policy solutions, it may be commented that humanity has not covered itself with glory in its business activities on the Earth. No doubt, the primal motivation for any commercial or business activity is profit but generally corporate agenda has been to squeeze unconscionable profit by means, legal, pseudo-legal, or even illegal. This does not behove well and has created inequity, acrimony and discord among the participants for production of wealth. Management-labour disputes have existed for over centuries and sharing of wealth has been disproportionate to the contribution of factors for production. It needs no statistical data in proof because the economic milieu is open to empirical observation and specialist comments by economists. It will, therefore, deem desirable to jettison such baggage of business mind-set and commercial culture and not to induce it into the outer space activities.

It is further emphasized that diversification of space activities and commercial exploitation of space resources brings humanity to a different threshold and ushers in a new space era. No operator in space is fully self-sufficient in all respects to operate independently; and his dependence on other space players is manifest in normal operations as well as in emergencies. Therefore, cooperation and not mere co-existence, becomes the norm. Thus the new space age will be an 'Era of Cooperation and Responsibility' among space players. The law of state responsibility, and consequent state liability, is well established in International Law and only needs to be adapted *mutatis mutandis*. Further, international cooperation between space players has been repeatedly stressed in the OST and more specifically enunciated in the

Declaration on International Cooperation, 1996.[13] It will be in the mutual and reciprocal interests of all space actors to cooperate responsibly and abide by this declaration and respect its exhortation to fully gain advantages of unity and cooperation.

CONCLUSION

In nutshell, it may be concluded that the epochal era of commercialization of outer space and its celestial bodies is right on us with technological capabilities, economic viability, and corporate eagerness to exploit the opportunities lying in wait. The pioneer will be the winner in business terms. At the same time the legality of such activities and total appropriation of accrued profits by the engaging private enterprise is under penumbra of doubt in relation to the OST and allied international instruments that seem braided together for synergy and for public order in space. Business motivations should not undermine or overpower the law. The majesty of OST must be upheld and its legal augmentation as is requisite to sustain its relevance and contemporise the treaty should be introduced, as per procedure, so that law does not appear a handicap in the use of bounties from outer space towards welfare of humanity and betterment of humankind.

I must concede that some of the concepts and possibilities visualized here relating to technical creativity and space applications may appear futuristic but it is no oneiric vision. Science of today is the technology of tomorrow that may become operational ground reality

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[13] Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in the Interest of All States, Taking into Particular Account the Needs of Developing Countries, 1996. Adopted by the UN General Assembly in its Resolution 51/122 of 13 December, 1996

sooner than later. The solemn purpose is that law should not be a laggard and not 'look an ass' when it confronts a new situation or reality. The law scholars also need to be pro-active in identifying impending issues, initiate healthy discussions, and create valid opinions on such issues so that law is not caught napping.

In fact, in the absence of direct and relevant provisions, ingenious constructions and devious interpretations motivated by national policy or devoted to vested interests start doing the rounds. A current example of lacunae in law confronts us is in exploitation of celestial mineral resources by megalomaniac corporations, who are almost ready with wherewithal, for private appropriation. This predicament is least desirable and only debated solutions with congruent opinions should be accepted for the emerging space economic order.

Therefore, let's herald the new space revolution and welcome it with open arms for its expected benefits to humanity but with a caveat. The acceptance of infraction of established space law by these eager activities will come at a cost that will be hard to pay in the future. Ergo, caution beckons us to adapt and adjust the laws in conformity to contemporary challenges rather than disregard the OST and make it redundant. Such haste may land us in legal chaos and a sustained disorder in space. The interests of posterity can also not be sacrificed. Therefore, treaty-member-states owe a duty *erga omnes* to usher the development process and simultaneously initiate desired upgrade of Treaty law and other adaptive legal changes to maintain equity and inclusiveness as well as peace and stability in the public order of outer space.