TRADING OF SPACE TECHNOLOGY AND THE ROLE OF INTERNATIONAL COOPERATION: ACHIEVING SUSTAINABLE DEVELOPMENT GOALS THROUGH THE GLOBAL SPACE AGENCY

UJWALA RAGHAVAN IYENGAR

Institute of Air and Space Law, Faculty of Law

McGill University

Montreal Canada

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"Even when it's not pretty or perfect.

Even when it's more real than you want it to be.

Your story is what you have, what you will always have.

It is something to own."

-Michelle Obama

DEDICATION

To,

মা, அப்பா, & Varun,

My whole Universe

ABSTRACT

Climate catastrophe, natural disasters, public health epidemic and financial crisis have altered human perception of essential resources and technology. In the realm of space law, this discourse leads us to the utilization of space resources procured from celestial bodies through space technologies in order to address modern challenges through futuristic solutions. Space technologies remain the fundamental block of outer space exploration determining which participant shall have the functional access to outer space vis-a-visa its benefits. However, the predicament is that space technologies have the tendency of being monopolized as they are capital intensive, requiring substantial investment to support their research & development, leaving technologically advanced space faring nations with little to no incentive to share their technologies.

In space law, the Outer Space Treaty (OST) is one of the core legal instruments amongst the five United Nations Space Treaties, which bases it bases itself on the principle of cooperation with respect to the use and exploration of outer space. While the OST ensures freedom of exploration, it does not guarantee equality in the functional access to outer space. This ambiguity in law raises uncertainty amongst States that desire access to space through the sharing of space technologies. Additionally, the other United Nations Space Treaties have failed to provide States with substantive prohibitions against political, economic or strategic discrimination, in particular with regards to functional access to outer space and space technologies.

This thesis explores the socio-economic impacts of limiting access to space technology innovation to a small number of privileged users, and highlights the potential of achieving immense well-being by making space technology widely available through a pluralistic and inclusive platform. The research also proposes to understand the historical and socio-political elements that condition the currently limited access to space technology innovation and then, seeks to evaluate and suggest methods that can be adopted to enhance accessibility of these specific space technologies by

adopting affirmative policies, ultimately, contributing to the achievement of Sustainable Development Goals (SDGs). Lastly, this thesis adopts an intersectional approach and necessitates the denunciation of the Westphalian model of international law that currently dominates the governance of outer space, highlighting the need for a cosmopolitan and inclusive approach that builds upon the concept of 'collective humanity'.

The 'essence' of this thesis is – evolution and survivability. To not just show there exists a "common good" in the research but to show tangible and quantifiable results that can help achieve SDGs. Discussion regarding this issue is of the utmost importance because it is critical to the facilitation of human survival and offers immense opportunities for well-being.

RESUMÉ

Le changement climatique, les catastrophes naturelles, la pandémie et la crise financière ont changé la façon dont les êtres humains envisagent les ressources essentielles et la technologie. Dans le contexte du droit de l'espace, ce discours amène à l'utilisation des ressources spatiales procurées par des corps célestes à travers les technologies spatiales avancées dans le but de résoudre les problématiques contemporaines par des solutions du futur. Ainsi, les technologies spatiales demeurent le pilier de l'exploration du cosmos, en ce qu'elles déterminent quelle entité aura un accès fonctionnel à l'espace extra-atmosphérique vis-à-vis des bénéfices. Toutefois, l'un des plus importants problèmes qui se présente alors est que les technologies spatiales ont une tendance naturelle à devenir des monopoles, en raison de l'investissement considérable qu'elles requièrent en recherche et développement. C'est pourquoi les nations qui disposent de capacités d'exploration spatiale n'ont que peu d'intérêt à partager leur technologie avancée.

Dans le droit de l'espace, il est possible de contextualiser la dimension juridique de ce problème grâce au Traité de l'espace, un des cinq principaux instruments juridiques des Traités de l'espace des Nations Unies, qui est basé sur un principe de coopération avec respect concernant l'usage et l'exploration de l'espace extra-atmosphérique. Alors que le Traité de l'espace garantit la liberté d'exploration, il ne garantit pas l'égalité des États en ce qui concerne l'accès fonctionnel à l'espace. Ainsi, cette problématique de droit lève une incertitude parmi les États qui souhaitent avoir accès à l'espace par le partage des technologies spatiales. De plus, les traités internationaux n'ont pas réussi à mettre en place l'interdiction aux États de discriminer pour des raisons politiques, économiques ou stratégiques, en particulier concernant l'accès fonctionnel à l'espace extra-atmosphérique et les technologies civiles spatiales.

Ainsi, l'objet de ma thèse est de comprendre l'impact socio-économique de limiter l'accès aux innovations technologiques spatiales à un petit nombre d'utilisateurs privilégiés, ainsi que de mettre

l'accent sur le potentiel d'atteindre un bien-être immense découlant d'une technologie spatiale accessible via une plate-forme pluraliste et inclusive. Cette recherche s'intéressera également aux éléments historiques et socio-politiques qui conditionnent l'accès actuellement limité à l'innovation technologique spatiale, et cherchera à évaluer et à suggérer des méthodes qui pourraient être adoptées afin d'améliorer l'accessibilité de ces technologies spatiales spécifiques via l'adoption de politiques de discrimination positive qui contribueraient à la réalisation des Objectifs de développement durable.

Enfin, cette thèse adopte une approche intersectorielle et nécessite une dénonciation du modèle westphalien du droit international qui domine actuellement la gouvernance de l'espace extra-atmosphérique, accentuant le besoin d'une approche cosmopolite et inclusive bâtie sur le concept d'« humanité collective ».

Par conséquent, l'« essence » de la thèse que je propose est – l'évolution et la capacité à survivre. Il ne s'agit pas seulement de démontrer qu'il existe un « bien commun » dans ma recherche, mais il s'agit également d'apporter des résultats tangibles et quantifiables qui peuvent aider à réaliser les Objectifs de développement durable. C'est pourquoi la discussion ayant trait à cette problématique est de la plus haute importance, puisqu'elle est essentielle à la facilitation de la survie de l'espèce humaine, et qu'elle offre des possibilités immenses pour notre bien-être.

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"Out of suffering have emerged the strongest souls; the most massive characters are seared with scars" – Khalil Gibran

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CHAPTER ONE: INTRODUCTION

"We are the first generation to be able to end poverty, and the last generation to take steps to avoid the worst impact of climate catastrophe. Future generations will judge us harshly if we fail to uphold our moral and historical responsibilities" – Ban Ki-moon

I. THE CONTEXT

The current geopolitical climate is one where large democracies are crumbling internally, with over 40% of the countries in the world witnessing civil unrest.[1] While their citizens clamor to make ends meet in dire circumstances, governments across the world continue to fail, as the COVID-19 pandemic spreads at the rate of one hundred thousand case in every 24 hours.[2] The global health pandemic may be a symptom of a larger problem, however it has managed to consume world economies entirely. This economic meltdown has not only weakened all industrial giants but has also distracted us from other prominent threats rising on the horizon i.e., climate catastrophe. When artist Gan Golan and Andrew Boyd unveiled the "climate clock" on September 2020, they warned all of us that there are only seven years left until Earth's carbon budget is fully depleted, based on current emission rates.[3] A complete depletion would thrust the world into further turmoil, leaving citizens nowhere to turn in the wake of its chaotic reality.

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[1] David Reed, "Almost 40% of the world's countries will witness civil unrest in 2020,"16 January 2020, online: https://www.cnbc.com/2020/01/16/40percent-of-countries-will-witness-civil-unrest-in-2020-report-claims.html.

[2] World Health Organization, "WHO Coronavirus Disease (COVID-19) Dashboard", online: https://covid19.who.int/?gclid=Cj0KCQiA0fr_BRDaARIsAABw4EugSdg0i_6IHLtmNTu5pJKgrKNwyTvpR79ujP8U-OFzMKgpcEpzbtoaArbaEALw_wcB.

[3] Theresa Machemer, "Clock in New York Counts Down the Time Remaining to Avert Climate Disaster", 22 September 2020, online: https://www.smithsonianmag.com/smart-news/clock-new-york-counts-down-time-remaining-avert-climate-disaster-180975881/.

As the human catastrophe[4] of COVID-19 unfolds, it becomes increasingly critical to multiply our efforts of curtailing other issues by scrutinizing the viability of alternate solutions that have the potential of mitigating the current crisis. Recently it has become well known that space-based technologies offer the potential of providing wide range of services that include but are not limited to health care, improving communication, offering green substitutes for traditional machineries, etc. These direct benefits contribute to the achievement of related Sustainable Development Goals (SDGs) and helps bridge the socio-economic inequality that exists within the society.

Technologies that are specifically designed for being operated in space, can also be utilised for on ground usage, examples include artificial limbs, firefighting equipment, and global positioning systems (GPS). These technologies were all originally designed, funded and innovated by NASA for their Apollo missions[5] but later trickled down for on ground usage.[6] Over 1600+ technologies specifically designed for space have also been used in other industries[7] due to their potential to transform into interoperable technologies.[8] An analysis on the proliferation of space technologies

[4] https://www.amnesty.org/en/latest/news/2021/05/south-asia-urgent-action-needed-to-combat-deadly-covid-19-surge-across-region/

[5] National Aeronautics and Space Administration, "Benefits from Apollo: Giant Leaps in Technology", July 2004, online: https://www.nasa.gov/sites/default/files/80660main_ApolloFS.pdf.

[6] Ibid.

[7] For eg – (i) Instruments traditionally used for performing endoscopies are all bi-products of space technology[7] (ii) Canadarm2 was designed by the Canadian Space Agency to maneuver payloads into the International Space Station (ISS), but was later catalyzed to form the NeuroArm, the world's first robot capable of performing surgeries inside MRI machines[7] (iii) The RADARSAT-2 one of the world's most advanced commercially available Earth remote sensing technology, has been also used on ground to monitor changes in vegetation, humidity in soil, crop productivity and disease transmission pattern. It can also detect high heat, air pollution and vector-borne diseases (iv) Most countries across the world relied on international surveillance through satellite to respond to public health emergencies, especially in light of the global pandemic preparedness under the WHO International Health Regulations, 2005 (v) Cryogenic products are used in the health industry to manage exothermic reactions when preparing bulk drugs i.e. antibiotics, sulpha drugs, vitamins, steroids, and analgesics. These cryogenic products are also used in the space industry as propellants (vi) Medical oxygen and the oxygen tanks used in space suits follow the same mechanism and are similar technologies (vii) Water purification machines on the ISS, use the same technology that engineers use on ground to treat raw water used for agricultural purposes.

[8] Interoperable technologies are those which have the capability of sharing resources. These shared resources can be data, software, physical component or even people

offers an insight into the world of capabilities that sustainable and interoperable technologies have to create an inclusive future.

II. HYPOTHESIS

Breakneck speed in scientific and technological development has ensured that space has slowly started becoming accessible,[9] and with this continued increase in development of space infrastructure, States are now vying for the 'space-faring nation' status, in order to compete for resources in outer space. This inevitable commercialization of outer space has now opened up the space industry to several prospects, such as asteroid mining, space tourism and human settlements on celestial bodies. Despite tall claims, there exists a disparity in the rate at which States evolve and produce frontier space technologies, through which one can access these benefits from outer space exploration. This technological divide is further widened as States impose geo-political and legal restrictions upon the free trading of these space technologies.

As space exploration and use become a certainty due to advanced space technology, the central hypothesis of this study becomes that there is an absence of clarity in the current legal framework to govern equality in the functional access to outer space through space technologies. The existing *corpus juris spatialis* is often subjected to criticism for its failure to keep pace with the rapid technological advancements and the contemporary commercialisation.[10] The existing scholarship[11]

[9] Dave Mosher, "Forward thinking, Spaceflight technology's next 50 years", 3 October 2007, online: https://www.space.com/4425-thinking-spaceflight-technology-50-years.html.

[10] See generally, Bin Cheng, *The Commercial Development of Space: The Need for New Treaties*, 19 J. Space L. 17 (1991); Tare C. Brisibe, *Satellite Servicing on-Orbit by Automation and Robotics: Legal and Regulatory Consideration*, 29 J. Space L. 21 (2003); HANNEKE LOUISE VAN TRAA-ENGELMAN, COMMERCIAL UTILIZATION OF OUTER SPACE : LAW AND PRACTICE (M. Nijhoff [Rev. version]) (1993); 竜沢, 邦彦, LEGAL ASPECTS OF SPACE COMMERCIALIZATION (CSP Japan) (1992); BENKÖ MARIETTA ET AL., SPACE LAW: CURRENT PROBLEMS AND PERSPECTIVES FOR FUTURE REGULATION (Eleven International Pub) (2005).

[11] NATIONAL RESEARCH COUNCIL (U.S.). COMMITTEE ON ADVANCED SPACE TECHNOLOGY, SPACE TECHNOLOGY FOR THE NEW CENTURY (National Academy Press) (1998); NATIONAL RESEARCH COUNCIL (U.S.). STEERING COMMITTEE FOR NASA TECHNOLOGY ROADMAPS, AN INTERIM REPORT ON NASA'S DRAFT SPACE TECHNOLOGY ROADMAPS (National Academies Press) (2011); UNITED NATIONS INSTITUTE FOR DISARMAMENT RESEARCH. CONFERENCE (6TH : 2007 : GENEVA, SWITZERLAND), CELEBRATING THE SPACE AGE : 50 YEARS OF SPACE TECHNOLOGY, 40 YEARS OF THE OUTER SPACE TREATY : CONFERENCE REPORT, 2-3 APRIL 2007 (United Nations)

approaches this topic from a pragmatic view by analysing only the function and uses of these technologies from the perspective of their current - limited - users. It fails to observe and consider the deficiencies in the policies of the current innovation system and its failure to align itself with the goal of sustainability or meet the needs of the marginalized.

While there is no need for an amendment or reform in the current legal framework, it is however essential to effectuate an unambiguous interpretation of the existing provisions of international space law, which may be adequate to address the potential legal controversies arising from this frame of reference. While a separate treaty in this regard shall be desirable, negotiation for the same may amount to a diplomatic impossibility in the present geo-political environment.

III. SCOPE

The proposed research observes that, an increase in accessibility to interoperable frontier space technologies[12] has the potential to maximize efforts to achieve SDGs. The thesis aims in part to examine how the technologies in the space sectors have the capability of boosting a country's performance significantly, especially in the backdrop of a public health epidemic, environmental catastrophe and, agriculture crisis. The purview of this study does not include examining the export-control regime that States impose on the transfer or exchange of space technology, however, it briefly broaches the concerns that inevitably arise due to the dual-use nature of space technology. Further, this thesis distinguishes itself from the present literature as it moves beyond

(2007); ANDREW J BUTRICA, SINGLE STAGE TO ORBIT : POLITICS, SPACE TECHNOLOGY, AND THE QUEST FOR REUSABLE ROCKETRY (Johns Hopkins University Press) (2003); OUTER SPACE AND GLOBAL SECURITY CONFERENCE (2002 : GENEVA, SWITZERLAND) ET AL., OUTER SPACE AND GLOBAL SECURITY (UNIDIR) (2003).

[12] There is no universally agreed definition of frontier technology. However, there is a recurring common feature across the different technological advances in that they all "have the potential to disrupt the status quo, alter the way people live and work, rearrange value pools, and lead to entirely new products and services". Furthermore, what is deemed to be "frontier" depends on context. Although some frontier technologies are "new", in other cases they may be a different application or bundling of more established technologies. In light of the current crisis being faced by the world, these frontier technologies have become essential to our survival. Hence, throughout the research proposal the terms "essential" and "frontier" are interchangeable.

the divorced perspective of law that promulgates intellectual property rights as a barrier to technology transfer.

The objective of my analysis is to understand the socio-economic impacts of limiting access to space technology innovation to a small number of privileged users, and the potential of achieving immense well-being by making space technology widely available through a pluralistic and inclusive platform. This thesis investigates the gap in governance measures especially in the space industry, because what national rules exist now in this sector, do not readily synthesize with each other in operation and do not appear to deepen or make efficient existing rules regarding dissemination of frontier space technologies. The research also proposes to understand the historical and socio-political elements that condition the currently limited access to space technology innovation. This thesis then suggest methods that can be adopted to enhance accessibility of these specific technologies by adopting affirmative policies, ultimately, contributing to the achievement of SDGs.

IV. METHODOLOGY

Majority of studies regarding innovation technology, sustainability, public policy and philosophy have largely focused on only one category, rarely attempting to study them as complex, mutually reinforcing or contradicting processes,[13] but focusing on one category almost inevitably obscures and oversimplifies other interpenetrating realities. This raises a need for an intersectional analysis to appreciate the complex world of innovation technology and its impact on human life. This research shall be conflating different stakeholders in the space industry and their involute interests to demonstrate the viability of the hypothesis.

In the past 30 years while space innovation technology has developed exponentially, its governing externalities and implications remain unexplored, as a result barely any research focuses on

[13] HANDBOOK OF ETHICS, VALUES, AND TECHNOLOGICAL DESIGN : SOURCES, THEORY, VALUES AND APPLICATION DOMAINS (J. van den Hoven et al. ed., Springer) (2017).

interoperable and sustainable technologies in the space industry. My personal research in the field of public policy, law and philosophy, has led me to the observations that have modelled the foundation for this research.

In light of the following, this thesis suggests examining the research question from the perspective of cosmopolitan law. When dealing with it there are two important assertions made with respect to the categorical imperative – (i) people are seen as individuals and not mere citizens and; (ii) the point of concern is not just the interaction between States but with the status of individuals in their dealings with the States.[14] Other inspired works[15] also emphasized on the basic liberties and rights of individuals while stressing on the fact that socio-economic inequalities would only be permissible as long as they benefited the least well-off by ensuring equal opportunity for social positions in society. Cosmopolitans[16] further stressed that individuals represented the 'ultimate unit of concern'. Thus, international law and institutions must be able to justify their existence in terms of doing justice to the equal worth of all individuals of the world. Additionally, the moral theory[17] expressed that the ultimate condition of being a human was defined not by reference to the individual, but by the flourishing of an interconnected whole or 'collective humanity'. This concept was relied on by the International Criminal Tribunal for former Yugoslavia (ICTY) in the *Kupreškić* case,[18] where it held that in absence of State practice and *opinio juris*, the concept of "collective humanity" was sufficient to formulate a customary international law.

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[14] IMMANUEL KANT, IDEA FOR A UNIVERSAL HISTORY FROM A COSMOPOLITAN POINT OF VIEW, (New Hampshire Sociological Press) (1784) [hereinafter referred as 'KANT'].

[15] JOHN RAWLS, A THEORY OF JUSTICE (Belknap Press of Harvard University Press Revised) (1999); R PIERIK AND W WERNER, COSMOPOLITANISM IN CONTEXT: PERSPECTIVES FROM INTERNATIONAL LAW AND POLITICAL THEORY (CUP Cambridge) (2010).

[16] Fernando R. Teson, *Kantian Theory of International Law,* 92 COLUM. L. REV. 53 (1992); TW Pogge, *Cosmopolitanism and Sovereignty*, 103 ETHICS 48 (1992); A BUCHANAN, JUSTICE LEGITIMACY AND SELF-DETERMINATION: MORAL FOUNDATIONS FOR INTERNATIONAL LAW (OUP Oxford) (2004).

[17] KANT.

[18] Lašva Valley, Prosecutor v. Kupreškić (Zoran), Judgement, Case No. IT-95-16-Y, ICL 98 ICTY 2000 at 527.

Cosmopolitan law not only serves as a tool to transpose the reader's attention to the achievement of SDGs as they target individuals over States but also ameliorates the interpretation of the research question. The SDGs bind national and cultural differences together and gives scope and meaning to a shared human culture, defined by challenges and solutions. It aims to bridge the gap and failure in contemporary technological development by holding the values of community and individuals, as without measuring and monitoring of the SDGs at an individual and community level, human potential becomes an after-thought. The solution to our current challenges through space technology is not just rooted in finding innovative ways to be resilient, but also in reminding ourselves that the essence of humanity cannot be lost in solving these challenges, that these goals aren't mutually exclusive, just like human existence. The aim is not just to replace human culture with technology and thereby lose all the wisdom gained throughout the years to a mere technological revolution, but introducing human culture in the technological context and reminding ourselves that technology cannot replace the human touch.

Innovation systems often create ripple effects throughout the entire system that can create negative and positive externalities. Maximizing inclusive well-being requires directing the appropriate level of resources towards particular areas of technological innovation in a way that fully accounts for such positive and negative externalities.[19] For example, local policies adopted in many jurisdictions to introduce biofuels have affected global food prices negatively. On the positive side, innovation in one technology area can lead to 'innovation spill overs' that enable more rapid improvements and new applications in other sectors.[20] For example, GPS technology was developed for defence applications, but it has been applied in other contexts, including improving the targeting of disaster

[19] Zilberman D, Hochman G, Rajagopal D, Sexton S, Timilsina G, *The impact of biofuels on commodity food prices: Assessment on Findings*, 95 AM J AGRI ECON 275-281 (2013).

[20] Griliches Z, *The search for R&D spill-overs*, 94 SJE 29-47 (1992).

relief. Promoting inclusive well-being requires supporting innovation in a way that considers possible positive spill overs.[21]

Another quandary that current institutions shaping technological innovation in the space industry face is that they aren't aligned toward the goals of sustainable development, as impoverished and marginalized populations too often lack the economic and political power to shape innovation systems to meet their needs.[22] However, these institutions can be reformed, and many actors have the power to do so through research, advocacy, training, convening, policy making, and financing. Furthermore, mobilizing innovation for sustainable development can be greatly improved through structured, cross-sectoral comparisons that recognize the socio-technical nature of innovation systems. This is where the thesis has a crucial role to play, while both differences and similarities exist amongst the national legal structures governing space technologies, the fundamental ideology for outer space exploration through space technology remains the same – achieving 'common good'[23] through socio-technical nature of innovation systems. These regimes may be diverse and complex, however they can be simplified when looked at from a birds eye view.

Lastly, I intend to briefly analyse the *problematique* by appraising the government collaborations in the space industry, where States have successfully managed to balance commercial interests, national interests, and public interests. This analysis ensures that the spirit of socialism and collective well-being does not slip into totalitarianism, inhibiting innovation altogether.

[21] Stiglitz J.E.*, Knowledge as a global public good*, 1 GLOBAL PUBLIC GOODS 308-326 (1999).

[22] Mowery D., Rosenberg N., *The influence of market demand upon innovation: A critical review of some recent empirical studies*, 8 Res Policy 102-153 (1979).

[23] ARISTOTLE & CARNES LORD, THE POLITICS (University of Chicago Press Publications) (1985).

CHAPTER TWO: OVERVIEW OF THE PROBLEM

"It has become appallingly clear that our technology has exceeded our humanity" – Albert Einstein

I. INTRODUCTION

States aim to regulate transfer of space technology through export-control regimes, which aim to strike a balance between commercial development and the proliferation of sensitive technologies that could pose security threats. Achieving this balance is particularly difficult in an industry characterized by dual-use technology. Hence, States often juxtaposition national security concerns with the transfer of space technologies and continue legitimizing unilateral activity in the space industry. The growth of the space industry is currently stagnated due to the inability of States to cooperate internationally on civil space endeavours, as there is no platform that currently promotes or inculcates exchange or trading of space technology. The absence of open market, protectionist tendencies and hegemony over new age technology has resulted in tremendous loses not only for industry partners but also the indispensable stakeholder in space law i.e., humanity, as countries are slowly being politically isolated from participating in a global endeavour.

The thesis raises the question as to whether the exploitation of outer space necessitates forms of international cooperation that includes collective technology development, exchange, and/or transfer. Currently, States do cooperate on civil space activities which involve cooperative use of technology; however, the nature of such success resides in the fact that the arrangement conforms to the current geopolitical environment with no actual transfer of technology. This arrangement, raises auxiliary questions – *firstly,* what pressurizes States to cooperate on certain political forums and platforms and not on others? *Secondly*, is technology transfer an efficient method to improve indigenous capacity of States? *Thirdly*, is the tool of international cooperation sufficient to unify the global community in its aspiration to achieve SDGs? *Lastly*, should States insist on the negotiation of a new legal instrument that aims to clarify rules concerning transfer or trading of

space technology that can substantially improve functional access to outer space? The coming Chapters in this thesis aim to explicitly answer these questions.

II. PLURALITY IN THE UTILISATION OF SPACE TECHNOLOGY

a. DUAL-USE SPACE TECHNOLOGY

The term 'technology' has no generally accepted meaning, however in a broad sense it is considered to be the "practical application of knowledge".[24] Defining technology in a strictly geographic basis, space technology shall be any technology "designed, intended, deployed, or put into use in outer space or a celestial body."[25] In an export-control regime, "technology" has a specialized meaning as export-control systems aim to prescribe regulations not only for physical goods or items that are exported, but also for technology. These regulations distinguish between physical items and the information required for the development of that item.[26]

Space technologies are further conceptually categorized depending upon their characteristics, being that of – function, use, size, location, et al. In an export-control regime, space "items" are divided into three broad categories related to the function of the space system the technology supports – (i) Launch Vehicle[27] (ii) Spacecraft[28], and (iii) Ground Support Equipment[29]. While these categories can be conceptually useful, the technological distinctions between them are not

[24] The meaning of the word "technology" in the MERRIAM WEBSTER DICTIONARY (11th ed., 2016).

[25] M.C. MINEIRO, SPACE TECHNOLOGY EXPORT CONTROLS AND INTERNATIONAL COOPERATION IN OUTER SPACE (Springer) (2012) at 60.

[26] International Trafficking in Arms Regulations, United States Munitions List, 22 C.F.R. §120 (2009).

[27] JOSEPH A ANGELO, ENCYCLOPEDIA OF SPACE AND ASTRONOMY (FACTS ON FILE) (2006) at 349 [hereinafter referred as 'ANGELO']

[28] ANGELO at 556.

[29] ANGELO at 556; International Trafficking in Arms Regulations, United States Munitions List, 22 C.F.R. §120 (2009).

clearly demarcated as technology from one category assists in the development and operation of technology in the other.

Space technologies are by definition dual-use in nature as they are capable of being used for both non-military and military application.[30] Historically, creation of commercial launch vehicles and satellites would not have been possible in the absence of military funding[31]; consequently their design, development and manufacture ran parallel to ballistic missiles[32] as their technology and related technical knowledge are almost equivalent. Considering the intertwined history of ballistic missiles and development of commercial satellites, the international community now views them within the same technological category for weapons of mass destruction [WMD] and delivery mechanisms.[33]

Unlike expendable launch vehicles, satellites aren't generally considered 'dual-use' for their capacity to deliver an offensive weapon as they are still not yet been fully weaponized, and no publicly known satellites have been deployed with the function or purpose of delivering WMD or convention weapons.[34] Instead, satellites are considered 'dual-use' because of the (1) potential end

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[30] ANNA WETTER, ENFORCING EUROPEAN UNION LAW ON EXPORT OF DUAL-USE GOODS (OUP) (2009) at Glossary XV; JOHN HEINZ, U.S. STRATEGIC TRADE: AN EXPORT CONTROL SYSTEMS FOR THE 1990S, (OUP) (1991) at 9; Sam Evans, *Defining Dual-Use: An international assessment of the discourses around technology*, 27 February 2009, unpublished, paper presented to the ESRC New Directions Conference in WMD Proliferation Seminar Series.

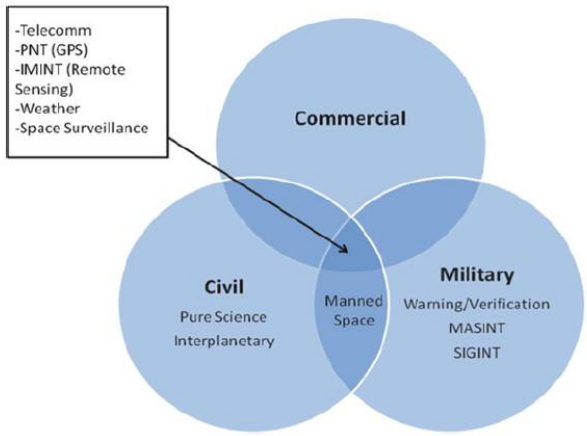
[31] Peter J. Manno, *Breaking the Monopoly: The D.o.D.'s Potential to Reduce Costs in its Evolved Expendable Launch Vehicle Program* (2013) 43 PUB. CONTRACT L. J. 87-104; and John A. Shaud and Adam B. Lowther, *An Air Force Strategic Vision for 2020-2030* (2011) 5 STRAT. STUD. Q. 8-31.

[32] Robert Lemos, "Sputnik Stunned the World, and Its Rocket Scared the Pentagon", Wired, at <https://www.wired.com/2007/10/sputnik-anniversary/>, 10 March 2007, last accessed on 11 August 2019; Michaell Gorn, NASA: THE COMPLETE ILLUSTRATED HISTORY (Merrell Publishers London, 2008), pp. 304; and CHRISTIAN LARDIER & STEFAN BARENSKY, THE SOYUZ LAUNCH VEHICLE : THE TWO LIVES OF AN ENGINEERING TRIUMPH (Springer) (2013), pp. 40-70; Wernher von Braun, *The Redstone, Jupiter, and Juno* (1963) 4 TECH. & CULTURE 452-464; Stanislav Nikolaevich Konyukhov, *Conversion of Missiles into Space Launch Vehicles* in HANS MARK, THE ENCYCLOPAEDIA OF SPACE SCIENCE AND TECHNOLOGY (New York: Wiley) (2003) at 73.

[33] UNGA, International Code of Conduct against Ballistic Missile Proliferation, GA/DIS/3286, 26 November 2002.

[34] Michael Mineiro, *The United States and Legality of Outer Space Weaponization: A Proposal for Greater Transparency and Effective Dispute Resolution Mechanisms*, 33 ANNALS OF AIR AND SPACE LAW 441 (2011) at 52 [hereinafter referred as 'MINEIRO'].

user application and/or (2) because components or subcomponents of their structure are deemed military sensitive. Satellites like other dual-use space technologies are categorized into three types on bases of end-user application: civil, commercial, and military.



[Image: M.C. Mineiro, *Space Technology Export Controls and International Cooperation in Outer Space*, Springer, 2012 at 20]

The cost involved in deploying and maintaining satellites are considerably high due to the substantial investments and often leaves States dependent on commercial providers due to their fluctuating operation requirements.[35] This raises concerns regarding the ambiguity in end-user application owing to the reverse-flow of technology, where civil technologies are often used for military purposes. Outer space has always been a domain of military strategization on account of which all space technologies inherently become dual use at some point. In the wake of military concerns and national interests, regulation of these technologies becomes a question of both law and policy, the implications of which significantly determines the difference between free or restricted trade, a weaponized or commercial industrial base, technological cooperation or competition, and proliferation or non-proliferation.

The interest of both suppliers and recipients in the transfer or trading of dual-use space technology can be best served not through selective control regimes but through co-operative measures, which

[35] J. Todd Black, *Commercial Satellites: Future Threats or Allies?* (1999) 52 NAVAL WAR COLL. REV. 99-114, at 102.

shall ensure that there exists an efficient way to control unwarranted proliferation of civil-use space technology, while still assuring their necessary transfer. It can be done by taking – (i) progressive steps to achieve cooperation between suppliers and recipients; (ii) ensuring transparency in technology transfer or trading to lead to greater predictability of the end use and; (iii) examining measures which could build confidence and security amongst States in so far as outer space technologies are concerned.

While looking at the friction and opportunities for international cooperation in technology development, our focus tends to shift towards dual-use technology, which in itself is a curious and elusive term. Inherently, all technologies tend to be susceptible to more than one application. The dual-use distinction is reserved for technology that has a significant government application and private sector participation, especially when the government application pertains to national security.[36] Usually States enlist industry partners to respond to their technology needs and dismiss commercial effects of their actions by imposing unilateral terms and conditions on R&D activities. However, recognizing the dual-use nature of a technology helps States to take greater account of commercial considerations and enter into more flexible contractual agreements such as partnerships. Chapter IV of this thesis shall deal with the concerns that arise due to the dual-use nature of space technology in a perfunctory manner, while elucidating on the steps taken by the government to restrict or improve access to these technologies.[37]

b. INTEROPERABLE & SPIN-OFF TECHNOLOGIES

Technologies are usually developed to respond to specific needs, but once created, their flexibility ensures multiple uses, making them prone to interoperability or capable of producing spin-offs.

[36] HWWA-INSTITUT FÜR WIRTSCHAFTSFORSCHUNG-HAMBURG ET AL., CONFLICT AND COOPERATION IN NATIONAL COMPETITION FOR HIGH-TECHNOLOGY INDUSTRY : A COOPERATIVE PROJECT OF THE HAMBURG INSTITUTE FOR ECONOMIC RESEARCH, KIEL INSTITUTE FOR WORLD ECONOMICS, AND NATIONAL RESEARCH COUNCIL ON "SOURCES OF INTERNATIONAL FRICTION AND COOPERATION IN HIGH-TECHNOLOGY DEVELOPMENT AND TRADE." (National Academy Press) (1996) at p. 130.

[37] Page 68 of the thesis deals with Militarization of Outer Space and its impact on trading of space technology.

While the term 'interoperable'[38] has been usually reserved for the information technology industry, it has now been employed by other industries which rely on data to perform their quotidian tasks, the space industry being one of them. Interoperable technologies have the capability of sharing resources, which can be data, software, physical component or even people.

The paramount reason why space technologies offer as an ideal candidate to transform into an interoperable commodity is because a singular space technology has the potential of reducing redundancy of utilizing assorted technologies for performing the same task, especially concerning the procurement of data and information. Furthermore, the unique environment of outer space requires space technologies to not only efficiently employ limited resources but also function sustainably so as to preserve a pristine environment.

In generic terms, a spin-off is usually 'something' that is created as a by-product of a displacement, process, reaction or event. While there are various kinds of spin-offs created from innumerable technologies, the focus of this thesis are spin-offs created from space technologies that were commercialized by space agencies through funding, research, licensing, and assistance. Since 1976, NASA has profiled nearly 2000 spin-off technologies to sectors as varied as health and medicine, transportation, manufacturing practices and materials, or computer technologies.[39] In Europe, documented applications of space technology transfers to the mentioned sectors include, air purification systems in hospital intensive care wards, radar surveying of tunnel rock to improve the safety of miners, and enhanced materials for a wide variety of sporting products from racing yachts to running shoes.[40] In France, ultrasound probes were tested by Universities during the first French human spaceflights in the early 1980s, and based on these innovative echocardiography

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[38] The meaning of the word "interoperable" in the MERRIAM WEBSTER DICTIONARY (11th ed., 2016).

[39] National Aeronautics and Space Administration, "NASA Spinoffs", online: www.spinoff.nasa.gov.

[40] European Space Agency, "Applications of Technology Transfer", online: www.esa.int/Our_Activities/Technology/TTP2.

probes were developed and commercialised by a still very active spin-off firm, with cumulated sales representing around EUR 200 million since 1984.[41] In the United States, a cardiac imaging system was developed commercially by the medical industry in 1990, derived from camera technologies onboard NASA's Earth Observation (EO) satellites. The benefit was at the time a significantly improved real-time medical imaging, with the ability to employ image enhancement techniques to bring out added details while using a cordless control unit.

For some technologies the target market was so specialised or the product was so advanced that it took a long time to be commercialised. For example, rotating cellular bioreactors took nearly twenty years to reach commercial maturity, as their application in cellular-level biological research was more advanced than current state-of-the-art technology.[42] Some medical technologies also require regulatory certification or clearance for public use nationally or internationally in case of export, thus taking even longer to reach market. At the other end of the spectrum, there are also several technologies which have been rapidly commercialized and instantly tricked down to civilian use, often introduced to the public under different names.

Without getting into the semantics and the lexicography of the term 'spin-off', it is vital to mention that even across the global north, States rely on dissimilar designations to identify the same term. NASA traditionally uses the term spin-off to introduce by-products of their space technology to the public, whereas, the ESA uses the term "technology transfer" to share the benefits of their research with the public. The principal difference in the terms used by both the agencies, resides in the fact that ESA's Technology Transfer Programme Office identifies industrial needs and then maps them to suitable space technologies, as a way of enabling new applications and business

[41] Centre National D'études Spatiales ,"Transfert technologique de l'innovation technologique au marché", 24 October 2013, online: https://cnes.fr/fr/media/iscnesmag59jpg-0.

[42] Stephen Navran, *Rotating Bioreactors for Manufacturing*, 26 GENETICS AND BIOTECHNOLOGY NEWS 18 (2006).

opportunities,[43] in contrast to NASA which simply lists down possible by-products of their new technological innovation as spin-offs.

As the spin-offs created from space technologies have a terrestrial application, the scientific and technological data and research available from its development and construction stage can also be utilized to yield practical SDG-relevant applications. The repercussions of these space technologies and their potential spin-offs on the achievements of SDGs shall be elaborated upon in part V of this Chapter.

c. DUAL-USE V. INTEROPERABLE & SPIN-OFF TECHNOLOGIES

The life cycle of technology begins from conception and ends at final production where it becomes a commodity intended to fulfill its purpose and eventually reach the stage of commercialization and mass production. However, space technologies do not reach the stage of mass production due to its niche use and exuberant costs. In order to justify the said costs, engineers and scientists aim to diversify its use so as to ensure that it can serve multiple purposes, one of the reasons due to which space technology are inherently designed to have dual-use functions. While dual use strictly distinguishes between commercial/civil use and military use, the fruits of research of such technology can be utilized to design spin-offs or interoperable technologies, which fall under the category of civil use of space technology.

When a State or industrial partner intends to provide direct access to a specific space technology it inevitably brings up the export-control regime as concerns with respect to national security may be raised. The actual space technology if utilized in *toto* falls under the ambit of the dual-use universe and the legal implications that arrive with it change. However, if the transfer of technology is effectuated by merely sharing the design of the space technology, through a collaborative or

[43] OECD, The Space Economy at a Glance, 2014, online: http://dx.doi.org/10.1787/9789264217294-en.

cooperative venture, then such technology can be openly traded and various market restrictions over such technology can be astutely circumvented. Furthermore, spin-off technologies or interoperable technologies are specifically categorized as benefits that accrue from the R&D stage of the space technology and hence manage to evade the complexities that arrive from simply being classified as 'dual-use'.

As shall be discussed in Chapter IV of this thesis, the export-control regime continues to remain the most pervasive barrier when it comes to the trading of space technology. The legal rules surrounding the 'dual-use' space technology should be delicately tweaked considering that the benefits accrued from these technologies, far outweigh the concerns raised by States. During such times, it is essential for all industry partners and stakeholders to conduct a cost-benefit analysis of endorsing the trading space technology and the relating legal implications and aim to compartmentalize the human benefits received from it. As long as States view space as a military asset, free trading of space technology shall be limited. The question then arises, how long can national interest be justified, as even in domestic law, national interest can only be invoked to impose a restrictive rule of law in exceptional cases. We must move past the 'sovereignty' based Westphalian model of international law[44] and view outer space from a Cosmopolitan perspective, having the capability of serving humanity at large.

III. GEOPOLITICAL NARRATIVE OF SPACE & THE CLASSIFICATION OF STATES

Subsequent to World War II, the Soviet Union successfully launched the Sputnik in 1957 and became the first country to launch an artificial satellite in outer space.[45] It continued to effectuate several firsts and kicked-off the beginning of the space age that lead to the progression of space

[44] The Westphalian system or model is a term frequently used in international relations to show the transformation in international order consisting exclusively of sovereign States. The model recognized States as the supreme or sovereign power and has often been criticized due to its European or Western approach towards international law which has often overlooked the colonial history of most States.
[45] NASA History Division, "Sputnik and the Dawn of Space Age", online: https://history.nasa.gov/sputnik.html.

technologies and the development of hundreds of applications that use satellite data.[46] Amidst these developments, the Americans foisted themselves into the proposed 'space race', being the Soviet Union's only antagonist. This rivalry fostered a spirit of competition and revealed to the world that only those with financial resources could vie for a spot in this convoluted extra-terrestrial race. The exploitation of a 'public good' or a 'global common' is often subject to competition, leading up to an inevitable gap that follows amongst the competing States aiming to acquire such resources, and space remains no exception to it.

The gap in this specific environment may be termed as a 'space gap' which actually refers to a 'capability gap' between States that are capable of accessing space through technological opportunities and States which have no access to those technologies or pay exorbitant amount of money to foreign governments for basic levels of access.[47] As this gap gradually widens and indicates the broader economic challenges, it also portrays the pursuit of space technology as a solution to global poverty. This interconnection of access to space technology to other larger issues raises an interesting debate of whether access to space technology should be a human rights issue, a theme explored in Chapter V of the thesis.

While a discourse on the human rights component of outer space exploration is pivotal, it should not impede the more conspicuous discussion on equality in access to outer space, as once societies are established in outer space, it shall become extremely strenuous and demanding to negotiate equality from ground zero.[48] Certain analysts in the discipline of international relation state, that it is the burden of the entire international community to educate themselves and mitigate the issue

[46] PELTON, J. N., MADRY, S., AND CAMACHO-LARA, S., HANDBOOK OF SATELLITE APPLICATIONS, (Springer)(2017).

[47] Joe Papparlardo Joe, *A Satellite For (and From) Africa*, AIR AND SPACE SMITHSONIAN MAGAZINE (2017).

[48] EDYTHE WEEKS, OUTER SPACE DEVELOPMENT, INTERNATIONAL RELATIONS AND SPACE LAW: A METHOD FOR ELUCIDATING SEEDS, (CSP) (2012) at 171.

of inequality,[49] while others in stark contrast view such gap and inequality as inevitable, and the competition between those who have access to technology and those who are disconnected from it, as nothing more than a cultural battle between majority and minority.[50] States often rely on non-decision on important subjects to maintain such status quo[51] and outer space is no anomaly to it. Non-decision is the strategy to deliberately avoid making a decision regarding an issue in order to preserve the power structure put in place.[52] In International Relations, non-decision can also be a tool of realism in a zero-sum system.[53] Specifically with respect to technology development and access to technology, States can decide not to act or aid in the development process as giving this aid would be equal to giving up the power these States hold over the technology-starved States.

When economist Vernon Ruttan raised the question as to whether a military threat was indeed prerequisite to the development of space technology,[54] fellow economists Moltz[55] and DeVorkin[56] stated that without the knowledge that ballistic missiles could be used as rockets, as discovered by the German scientists during World War II, space exploration might still be a dream. Currently, while these technologies are used for communications and observational purposes, their primary purpose, however, was to engage in a military technology race between superpowers.

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[49] Ibid.

[50] Julian Reid, *Politicizing Connectivity: beyond the biopolitics of information technology in international relations*, 22 Camb. Rev. Int. Aff. 4 (2009) at 613.

[51] Ibid.

[52] Robert A. Dahl, *Non Decision Making* in ENCYCLOPAEDIA OF POWER, (ed. Keith Dowding) (2011).

[53] Richard E. Quandt, *On the Use of Game Models in Theories of International Relations*, 14 WORLD POLITICS 1 (1961) at 69-76.

[54] VERNON W RUTTAN, IS WAR NECESSARY FOR ECONOMIC GROWTH? : MILITARY PROCUREMENT AND TECHNOLOGY DEVELOPMENT (OUP) (2006).

[55] JAMES CLAY MOLTZ, CROWDED ORBITS : CONFLICT AND COOPERATION IN SPACE (CUP) (2014).

[56] David H. DeVorkin, *Science With a Vengeance*, National Air and Space Museum Archives (1992).

After the Second World War, the main driver of innovation was national security, and the field of scientific exploration was no exception. Similarly, developing new technology that had national security applications was the most important prerequisite for scientific development during the Cold War space race.[57] This competition between West and East fuelled a frenzy of technological innovations without which the contemporary world would not be the same. Thus, the participation in this new world order of space exploration and utilization proved to be a path to further economic development and increased involvement in the global market

Innovations that were made during the space race have benefited the lives of the citizens as well as the economies of the technologically advanced States, however these benefits have not trickled down to all States that have the right to participate in outer space exploration but are unable to do so due to socio-economic and political barriers. This has led to the inevitable creation of the suggested 'space gap', perpetuated till date by the global north.

The only way to challenge the dominance of industrialized countries is to develop independent technologies that can provide alternatives to the oppressive space regimes established and reproduced by the so called 'developed' world. However, such regimes cannot be toppled due to the Westphalian model of international law that supports the current status-quo.

Although outer space is from a normative perspective still considered a 'common good' accessible to all mankind, *de facto* only a few wealthy States have been able to enjoy the privilege of exploring and exploiting the advantages outer space has to offer. Therefore, States who have access to these advantages can leverage their capabilities in their relations with those States that have no access. By analysing how policy-makers make use of the issue of sovereignty to promote their achievements in outer space can lead to a deeper understanding of how developed States use this

[57] Ibid.

technological power to perpetuate the poverty of developing States; they limit access to the technology necessary to participate in the market economy of the space age.

Lastly, it is also important to understand that the terms developed and developing or global south or global north in itself are outdated. While the *lex lata* traditionally employs these terms, one must understand that usage of such term in itself constitute as a structural violence.[58] Developing countries and developed countries, at first glance, seem to be harmless and objective terms of classification. The word developing indicates prospect for growth and improvement. However, this nomenclature still assumes both a dichotomy and hierarchy between countries. It presumes Western countries to be ideal blueprints for other countries to aspire to, incorrectly paints development as a linear process and suggests that development has an ending. Despite the heterogeneity of different factors impacting development, such as culture, demographics, geography and socio-economic problems, disparate countries are clubbed in the same group merely based on gross national income.

By giving economic indicators too much significance, "China, India, and Japan, which fall in three different income groups, are all lumped together as "developing"[59] – a classification that is limited and out of date with current realities. Moreover, this lexicon replaces the colonizer-colonized relationship in that they do not acknowledge centuries of pillage and oppression. In the name of modernity and growth, developed countries often exploit developing countries for their resources, capital and labour.[60]

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[58] Tim Fernholz, "The World Bank is eliminating the term 'developing country' from its data vocabulary", Quartz, 17 May 2016, online: https://qz.com/685626/the-world-bank-is-eliminating-the-term-developing-country-from-its-data-vocabulary/ [hereinafter referred as 'Tim Fernholz'].

[59] Tim Fernholz.

[60] Jing Wei, "If You Shouldn't Call it The Third World, What Should You Call It?", 4 January 2015, online: https://www.npr.org/sections/goatsandsoda/2015/01/04/372684438/if-you-shouldnt-call-it-the-third-world-what-should-you-call-it.

While the term global south was first used in 1969 by writer and activist Carl Ogles as a less hierarchical alternative to terms like third world and developing countries, it remains a blanket term that encompasses a large and diverse group of countries with historical, cultural, power and wealth differences among them. It can also be argued that 'north' and 'south' are broadly synonymous with 'rich' and 'poor' and 'developed' and 'developing'.[61] While these terms shall be used over the course of the thesis when dealing with *lex lata*, it is essential to highlight that the usage of these terms in itself is controversial.

IV. LIMITATIONS IN ACCESS TO SPACE TECHNOLOGY

Despite decreasing costs of space technologies and the increasing availability of open source data, there are several bottlenecks that hinder their application in certain fields and their use in some regions of the world. These bottlenecks include the – (i) lack of awareness concerning the benefits of space technologies; (ii) high costs and lack of financial resources to develop space programs, especially in developing countries; (iii) technology and skill gaps to develop, use and adapt space technologies; (iv) challenges with respect to user needs, access to and compatibility of the available data sets; (v) geographical constraints for developing space launch facilities and conducting astronomical research; (vi) emerging issues concerning regulations and the international governance of space commons; and (vi) some of the risks of using space technologies.

As the evolution of space technology has always been light years ahead of the policies and law that governs it, policymakers and the public often fail to grapple with its potential and legal implications. Due to this complexity, benefit of space technologies for sustainable development may not be immediately apparent, making States hesitant from fully harnessing these technologies. Additionally, many developing countries, lack the capability and expertise to produce satellite

[61] Luciana Ballestrin, "The Global South as a Political Project", 3 July 2020, online: https://www.e-ir.info/2020/07/03/the-global-south-as-a-political-project/.

information with local resources and providing user support can be a barrier to expanding the use of satellite technologies.[62]

Technological barrier plays a vital role in the acceptance and proliferation of these technologies, as the absence of a critical number of personnel can limit a States capacity to generate downstream applications of space technologies. Obstacles to the wider use of satellite technologies include restrictive data access, lack of standardization, data that are not fit enough for purpose, lack of analysis of ready data, and insufficient frequency of observations.[63]

Furthermore, deriving statistics from satellite data and integrating geospatial information into different national and international monitoring and reporting processes, including the monitoring of the SDGs, remains a great challenge. This is amplified when EO data is aimed to be used in support of the SDG indicators combined with official statistics, as methodologies for standardization still remain under development.[64] Furthermore, processing the vast amount of satellite data requires high computing and storage needs, including machine learning and AI capabilities. This also raises a challenge related to the data quality. At the global level, the Working Group on Geospatial Information of the Inter-agency and Expert Group on SDG Indicators requires that the satellite data used for monitoring the SDGs needs to be, among others, consistent, reliable, transparent, relevant, and open and free.[65] This data must also be accurate and be provided on a continuous basis.

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[62] David Turner, Tim Hayward, *Satellite Environmental Information and Development Aid: An Analysis of Longer-Term Prospects (Executive Summary)*, CAR/019.2, (United Kingdom, Caribou Space) (2018).

[63] International Telecommunication Union, "AI for Good: Global Impact, ITU News Magazine", 2 Nov 2020, online: https://www.itu.int/en/itunews/Documents/2020/2020-02/2020_ITUNews02-en.pdf.

[64] Ibid.

[65] UN Department of Economic and Social Affair, Inter-agency and Expert Group on SDG Indicators, online: https://unstats.un.org/sdgs/iaeg-sdgs/.

These issues are largely practical or technical in nature. While, this barriers inhibit the propagation of space technology, the lack of legal clarity regarding the obligation to reduce such barriers adds to the uncertainty and the difficulty of this problem. Through the next chapters, I shall elucidate the legal barriers that govern the regulation of outer space; a 'global common' that each State and private enterprise competes to exploit and monopolize. In the end, technical barriers are far easier to remove than geopolitical barriers between States. Legal obligation under binding treaties can help ensure that technical inequity does not transcend into geopolitical inequality amongst States.

V. SUSTAINABLE DEVELOPMENT GOALS AND SPACE (SPACE4SDGS)

a. INTRODUCTION

The crucial link between the current global crises and internal political strife is that they are all intrinsically related to conflict, poverty, human health, hunger, and natural disasters. However, these indicators have always been the focus of SDG – Agenda 2030. SDGs are a collection of 17 interlinked global goals designed to be a "*blueprint to achieve a better and more sustainable future*".[66] The SDGs were set by the United Nations General Assembly (UNGA) in 2015 and are intended to be achieved by the year 2030. These goals are broad and interdependent with specific targets, goals, and indicators. The spread of COVID-19 has had serious implications on all 17 SDGs in the year 2020.[67]

During the declaration of SDG – Agenda 2030, world leaders heralded the slogan of "*leaving no one behind*", ever since the concept of 'accessibility' has become the corner stone of the SDGs, as it shifted the focus from a State based narrative to an individual narrative. The reason 'accessibility' is important now more than ever, is because we are on the edge of an unprecedent crisis. While

[66] UNGA, Work of the Statistical Commission pertaining to the 2030 Agenda for Sustainable Development, Seventy-first session, A/RES/71/313, 10 July 2017.

[67] UNECOSOC, Progress towards the Sustainable Development Goals: Report of the Secretary General, High-level segment: Ministerial meeting of the high-level political forum on sustainable development, E/2020/57, 28 April 2020.

technology, science and capacity building are major pillars of the means of implementation of these goals, there is a need to reorient the current unsustainable development. In light of this, it is essential that affordable technological solutions are developed and disseminated worldwide by addressing socio-economic and political inequalities by relying on legal tools, especially during this COVID-19 era.

A positive scenario of a technology-enabled sustainable future for all won't emerge unguided and would require trade-offs, for which several elements need to come together across jurisdictions for these technologies to become widespread - from strong ethical frameworks to the evolution of legislation, the importance of education and training for new skill, and even labour market reforms.

Formed in global collaboration and agreed upon by 193 of the world's 195 countries, the SDGs represent a united vision of equality, justice, and sustainability for the future. These goals include 'no poverty,' 'zero hunger,' 'reduce inequalities,' and the creation of 'sustainable cities and communities.' While the question regarding the possibility of achieving these SDGs is highly debated, its relevance remains unfaded.

Space technologies in particular have the capability of directly contributing to over eleven out seventeen SDGs, making it a vital contributor in the SDG universe as increased 'accessibility' to space can ensure solution to a wide array of problems. While the benefits and application of space technology have been discussed by various scholars,[68] this thesis briefly touches upon relevant

[68] POST 2030-AGENDA AND THE ROLE OF SPACE : THE UN 2030 GOALS AND THEIR FURTHER EVOLUTION BEYOND 2030 FOR SUSTAINABLE DEVELOPMENT (A. Froehlich ed., Springer International Publishing) (2018); SCOTT MADRY ET AL., INNOVATIVE DESIGN, MANUFACTURING AND TESTING OF SMALL SATELLITES (Springer) (2018); J.A Dallas et al., *Mining Beyond Earth for Sustainable Development: Will Humanity Benefit from Resource Extraction in Outer Space?*, 167 ACTA ASTRONAUTICA 181–188 (2020); Werner R Balogh et al., *Towards a Results-Based Management Approach for Capacity-Building in Space Science, Technology and Applications to Support the Implementation of the 2030 Agenda for Sustainable Development*, 139 ACTA ASTRONAUTICA , 385–389 (2017); *Igarss 2020 - 2020 Ieee International Geoscience and Remote Sensing Symposium*, *in* ACCELERATING SUSTAINABLE DEVELOPMENT WITH EARTH INTELLIGENCE , 3727–3730 (Madison Musgrave et al.); Andreas Losch, *Developing Our Planetary Plan with an 18th United Nations Sustainable Development Goal : Space Environment*, 76 HTS : THEOLOGICAL STUDIES , 1–7 (2020); Rutwik Navalgund, *Reduce, Reuse and Recycle: An Environmental Law Approach to Long-Term Sustainabiy of Outer Space*, 45 AIR AND SPACE LAW (2020).

SDGs that can be achieved by improving access to space through space technology before dealing with the legality of such access.

b. SPACE 4 SDGs[69]

1. FOOD SECURITY

The main goal of global agriculture is to feed 7 billion people; a number likely to double by 2050. Grains are the principal branch that provides food and feed, making it a strategic commodity similar to energy and precious metals.[70] The amount of grain produced annually in a region depends on environmental resources, applied technology, and weather. In this scenario, space technology become a vital tool for agriculture innovation and provide value to farmers, agronomists, food manufacturers and agricultural policymakers. These technologies offer the capability of monitoring soil, snow cover, drought, crop development, rainfall assessment and provide critical data required for the anticipation and mitigation of food shortages and famines.

While the use of these technologies had initially been fairly limited, due in part to high costs, in recent years open access to geospatial data, data products, services, and the lower cost of geospatial IT facilities have stimulated its adoption across the world. Emerging priorities for the international collaborations in this field include the development of the agricultural geospatial data infrastructure, agricultural geospatial knowledge platforms, standards and protocols enabling interoperation and data sharing, analysis-ready agricultural thematic geospatial data products, and

[69] UNGA, Fiftieth anniversary of the first United Nationals Conference on the Exploration and Peaceful Use of Outer Space: Space as a driver of sustainable development, A/RES/73/6, Twenty-sixth plenary meeting, 26 October 2018 [hereinafter referred as 'A/RES/73/6 of 2018']

[70] Felix N. Kogan, *Operational Space Technology for Global Vegetation Assessment*, 9 BULLETIN OF AMERICAN METEOROLOGICAL SOCIETY 89 (2001).

the sharing of relevant software applications.[71] Furthermore, Earth observation data can support regional and international efforts to target those with the highest food insecurity risk.

Examples of space technology that have contributed to SDGs in this field include - (1) Canada's remote sensing Earth observation satellite program, RADARSAT, provides data to support farmers in assessing soil moisture and irrigation needs, thus helping farmers manage risks and improve planning of their crop productivity;[72] (2) The World Meteorological Organization (WMO) regularly provides weather and draught forecasting services to farmers, herders and fishermen in order to promote sustainable agricultural development;[73] (3) AfriScout is an application that supplies pastoralists in Ethiopia, Kenya, and Tanzania with data on water and vegetation in potential grazing areas;[74] (4) HASSAS-2 precision farming initiative in Turkey produces fertilization maps and applications and disseminates satellite images and analysis data to farmers over the internet[75] (5) The Asian Institute of Technology, the Cambodian Government Agriculture Department, and the University of Tokyo collaboratively developed an algorithm to predict rice yield at the time of harvest using MODIS data;[76] (6) Bangladesh's geospatial agency used EO data to estimate the production of its two major crops, Boro and Aman rice;[77] (7) Group on Earth

[71] FAO, "Geospatial information for sustainable food systems", online: http://www.fao.org/geospatial/en/.

[72] Government of Canada, RADARSAT Constellation Mission, online: https://www.nrcan.gc.ca/science-and-data/research-centres-and-labs/canada-centre-remote-sensing/radarsat-constellation-mission/21831.

[73] L.S. Rathore, Nabansu Chattopadhyay, *Weather and Climate Services for Farmers in India,* 2 WMO BULLETIN 65 (2016).

[74] PCI, "AfriScout: The Shepherd's Eye in the Sky", online: https://www.pciglobal.org/afriscout/.

[75] Salt M. Say, Muharrem Keskin, Mustafa Sehri, Yunus Emre Sekerli, Adoption of Precision Agriculture Technologies in Developed and Developing Countries presented at INTERNATIONAL SCIENCE AND TECHNOLOGY CONFERENCE (ISTEC), 17-19 July 2017, Berlin.

[76] Refer, National Aeronautics and Space Administration, "MODIS: Moderate Resolution Imaging Spectroradiometer", online: https://modis.gsfc.nasa.gov/.

[77] Dr. Hafizur Rahman, "Satellite Based Crop Monitoring and Estimation System for Food Security Application in Bangladesh", presented in the Expert Meeting on Crop Monitoring for Improved Security, 17 February 2014, online: http://www.fao.org/fileadmin/templates/rap/files/Project/Expert_Meeting__17Feb2014_/P2-5_BANGLADESH_PAPER_BY_HAFIZUR_RAHMAN.pdf.

Observations Global Agricultural Monitoring Initiative (GEOGLAM) initiative has been leading global cooperation in crop monitoring and market assessments to ensure transparency in crop markets.[78]

2. HEALTH APPLICATIONS

Space technology now plays a crucial role in achieving global health objectives. These technologies play a crucial role in supporting decision-making, providing improved care, education, early warning measures, monitoring disease pattern, and identifying environmental triggers for spread of disease.[79] Thus, the primary application of satellite technology in this field includes telemedicine, tele-health, disease surveillance systems and health mapping.[80] These technologies can further be modified or adapted to be used in complex surgeries.

Examples of space technology that have contributed to SDGs in this field include - (1) The Malaria Early Warning System (MEWS), based on geospatial data, was responsible for 500,000 fewer new malaria cases across 28 countries;[81] (2) Public Health Agency Canada's National Microbiology Laboratory (NML) undertakes research and risk assessment of emerging infectious diseases. The NML uses EO technologies, including RADARSAT data for disease surveillance and outbreak management such as - mosquito-borne diseases, tickborne diseases, chronic diseases, water-borne disease, vulnerable human populations, and epidemics such as Ebola and COVID-19;

[78] GEOGLAM: Global Agriculture Monitoring, "About GEOGLAM", online: http://earthobservations.org/geoglam.php.

[79] A/RES/73/6 of 2018.

[80] UNGA, International cooperation in the peaceful use of space, A/RES/71/90, Seventy-first session, 6 December 2016; Ramesh S. Krishnamurthy, Jason Hatton, *Space Science and technologies to advance health-related development goals*, 96 BULLETIN OF WORLD HEALTH ORGANIZATION 1 (2018).

[81] Calestous Juma, Wesley L. Harris, Peter B. Waswa, *Space Technology and Africa's Development: The Strategic Role of Small Satellites*, HKS FACULTY RESEARCH WORKING PAPER SERIES RWP17-043 (2017); NASA Science Mission Directorate, "Enhancing USAID Famine and Malaria Early Warning with NASA Earth Science Results, Annual Report: 1 October 2007 – 30 September 2008, online: https://www.nasa.gov/sites/default/files/files/09EWS_annual_FY08.pdf.

(3) In 2018 NASA used their EO satellite to forecast cholera in Yemen;[82] (4) JAXA uses Digital Elevation Models (DEMs) to map areas that are difficult to access, in order to implement efficient measures for infectious diseases.[83]

3. TELECOMMUNICATION

It is now well known that space technology has revolutionized the telecommunication industry. They specifically played a major role in compensating for shortcomings of terrestrial networks which till date are either limited or non-existent in many parts of the world. Furthermore, they can be utilized either by themselves, or in combination with other technologies. Expanding access to rural areas has been important yet a challenging SDG, as it requires balancing the economics of population, infrastructure and purchasing power.

Emerging technologies have the ability of transforming access to telecommunication by utilizing low/medium altitude satellites and using unused portions of the radio frequency spectrum.[84] While satellites play an extremely important role in providing internet access to unserved areas, they also present themselves as an essential tool for the aviation, maritime, and energy industry, thereby enabling new capabilities and applications and driving down costs. These technologies are also indirectly connected to other SDGs by helping create smart cities.

Examples of space technology that have contributed to SDGs in this field include - (1) The telecommunication satellite Bangabandhu-1 launched by Bangladesh not only broadcasts TV and radio programs but also provides internet, telemedicine, and distance learning facilities for people

[82] NASA, "NASA Investment in Cholera Forecasts Helps Save Lives in Yemen", Press Release, 28 August 2018, online: https://www.nasa.gov/press-release/nasa-investment-in-cholera-forecasts-helps-save-lives-in-yemen.

[83] Hay, A.J. Tatem, A.J. Graham, S.J. Gotez, D.J. Rogers, Global Environmental Data for Mapping Infectious Disease Distribution, ADVANCES IN PARASITOLOGY (2006) at 31-77.

[84] Shashi Buluswar, "Technology Breakthroughs to Achieve Sustainable Development Goals", Report for the UN Commission on Science and Technology for Development, 26 May 2019, online: https://unctad.org/news/technology-breakthroughs-achieve-sustainable-development-goals.

in remote areas;[85] (2) Amazon's Project Kuiper, SpaceX's Starlink constellation, Google's Project Loon, and others are planning to provide global internet access through nanosatellite constellations and high-altitude balloons.

4. DISASTER RELIEF

In recent times space technology has also helped save multiple lives around the world that could have been lost due to disasters. According to the United Nations Office for Disaster Risk Reduction (UNDRR), between 1998 and 2017, disasters killed 1.3 million people globally, while they displaced, injured, left homeless or in need of emergency assistance further 4.4 billion.[86]

Space-enabled technology applications have become an important element of regional, national and local disaster risk reduction strategies. Globally, the Sendai Framework for Disaster Risk Reduction 2015-2030[87] calls for the promotion and enhanced use of space and *in-situ* information through geospatial and space-based technologies to collect, analyse and disseminate data. The framework recognizes the role of space technologies in supporting risk-informed decision making.[88] Countries that face regular tropic cyclones are now slowly investing more in space technologies in order to develop early warning systems. Furthermore, developing countries can also use low cost drones instead of space technologies to tackle emergency situations.[89] These

[85] LyngSat, "Bangabandhu 1 at 119.1°E", online: https://www.lyngsat.com/Bangabandhu-1.html.

[86] Pascaline Wallemacq, Rowena House, "Economic losses, poverty & disasters: 1998-2017", Report for the United Nations Office for Disaster Risk Reduction, 2018, online: https://www.undrr.org/publication/economic-losses-poverty-disasters-1998-2017; UN-SPIDER, "CRED publishes 2019 disaster statistics", 20 August 2020, online: https://www.un-spider.org/news-and-events/news/cred-publishes-2019-disaster-statistics.

[87] UN, Sendai Framework for Disaster Reduction 2015-2030 presented in UN World Conference on Disaster Risk Reduction, 14-18 March 2015 (Japan), online: https://www.unisdr.org/files/43291_sendaiframeworkfordrren.pdf.

[88] Ibid at 14.

[89] UNCTAD, Technology and Innovation Report 2021: Catching technological waves; Innovation with equity, UNCTAD/TIR/2020, 2021.

drones can transmit images of the Earth's surface in real time and can be combined with GPS data to assess disasters such as floods, earthquakes and forest fires.

Examples of space technology that have contributed to SDGs in this field include - (1) Images provided by the United States Landsat Satellite[90] and the Sentinel satellites of the European Copernicus Earth observation program[91] are based on high-tech *in-situ* instruments which help monitor ocean currents, temperature and salinity, air quality, rain trends, sonars and radars to observe fish and bird population, seismic stations to monitor earthquakes, volcano hazards and tsunami; (2) Natural Resources Canada acquires time-series EO data from RADARSAT to provide real-time information for public safety to authorities before river ice-jams and break-up and flood events. These RADARSAT flood products are also integrated into and used by provincial, territorial and regional governments' civil security operations and are available to the public. Additionally, data is critical to monitor ice conditions in the Arctic. Due to the extent of its remoteness and isolation, EO often is the only cost effective and technically feasible method to observe and research these ice structures. The RADARSAT and Setinel-1 provide community ice service in order to decrease the risk associated with travelling over coastal sea ice in the Canadian Arctic. The service allows the selection of the shortest route around ice ridges and open water, helping to minimize travel time, fuel costs, and equipment wear, while maximizing safety; (3) The predictions from the WMO helped manage evacuations and save lives during the devastating 2017 Atlantic hurricane season (4) In 2016, the United Nations Development Programme (UNDP) in collaboration with the United Nations High Commissioner for Refugees (UNHCR) and in support of the Office of the Prime Minister of Uganda, launched a project to develop base maps for the

[90] USGS, "Landat Mission", online: https://www.usgs.gov/core-science-systems/nli/landsat.

[91] Copernicus, "Europe's Eye on Earth", online: https://www.copernicus.eu/en.

Oruchinga Refugee Settlement.[92] The settlement covers an area of approximately 8 km and has a population of around 6,300 refugees. The aim of the project was to support refugee settlement planning and management through a better understanding of the environment that refugees and their host communities live in. The maps showed where hazards are, helped to identify risks to livelihoods, and provided information on sand encroachment, environmental conditions and soil fertility. The maps were based on a high-resolution aerial photo-mosaic, produced using a lightweight, camera-bearing drone. The mapping exercise covered 17 km, resulting in more than 1,200 individual aerial photographs covering the settlement and surrounding areas. The individual photographs were stitched together to derive a single georeferenced ortho-photomosaic of the settlement. A three-dimensional digital surface model was derived from the overlapping aerial photographs using photogrammetry; (5) NASA and the company R4 developed the Finding Individuals for Disaster and Emergency Response (FINDER) device.[93] FINDER was used by first responders in the Nepal 2015 earthquake to successfully detect and save four men trapped in over 10 feet of debris, a feat previously unachievable by first responder technology.

5. NATURAL RESOURCE AND ENVIRONMENTAL MANAGEMENT

Currently, there are over 170+ EO satellites in operation, including around 30 weather satellites, by 62 different operating agencies.[94] These EO play an essential role in the management of natural resources and the environment. They also help overcome various other challenges such as water

[92] Samuel Okiror, "Uganda deploys drones to build refugee resilience", Press Release by UNDRR, 15 June 2016, online: https://reliefweb.int/report/uganda/uganda-deploys-drones-build-refugee-resilience.

[93] Elizabeth Landau, "FINDER Search and Rescue Technology Helped Save Lives in Nepal", 7 May 2015, online: https://www.nasa.gov/jpl/finder-search-and-rescue-technology-helped-save-lives-in-nepal.

[94] Committee on Earth Observation Satellites, "2021-2023 Work Plan - March 2021 v1.0", March 2021, online: https://ceos.org/document_management/Publications/CEOS_Work-Plans/CEOS_2021-2023-Work-Plan_Mar2021.pdf.

management, air pollution, and forest preservation. Thus, playing a very crucial role in achieving SDGs.[95]

EO is a powerful tool to monitor illegal mining activities as remote sensing can be used to see the natural variations in sand flux. It can also be used in identification systems to help law enforcements identify vessels that are not compliant and are more likely to be used in human trafficking. In addition to the application mentioned above, EO can be used to monitor country-specific environmental conditions and challenges.

Examples of space technology that have contributed to SDGs in this field include - (1) Australia relies on their EO satellites to observe and monitor drought conditions and illegal water diversions in the Murray-Darling Basin;[96] (2) JAXA has developed a precipitation monitoring system known as GSMaP[97], which offers global rainfall maps using satellite data. Additionally, in cooperation with international partners such as the Asian Development Bank and UNESCO, Japan contributes to the reduction of damage from water related disasters. Japan also supports the observation of atmospheric greenhouse gas and aerosol to learn about climate change issues. It's in light of this that JAXA collaborated with its Ministry of the Environment, the National Institute for Environmental Studies (NIES) to launch the world's first satellite, dedicated to monitoring greenhouse gases; (3) Furthermore, JAXA in collaboration with the Japan International Cooperation Agency has launched the forest monitoring satellite, ALOS2 that monitors forests of

[95] Anderson et al., *Earth observation in service of the 2030 Agenda for Sustainable Development*, 2 GEO-SPATIAL INFORMATION SCIENCE 20 (2017) at 77-96; D.R. Wood, K.J. Stober, Small satellites contribute to the United Nations Sustainable Development Goals presented at SMALL SATELLITE CONFERENCE (2018), online: https://digitalcommons.usu.edu/smallsat/2018/all2018/437/.

[96] Australian Government, "Remote Sensing and our satellite Imagery", online: https://www.mdba.gov.au/basin-plan-roll-out/monitoring-evaluation/remote-sensing-our-use-satellite-imagery.

[97] JAXA, Global Extreme Heavy Rainfall and Drought detected by GSMaP", online: https://global.jaxa.jp/projects/sat/gpm/topics.html#:~:text=Earth%20Observation%20Research%20Center%20(EORC)%20of%20Japan%20Aerospace%20Exploration%20Agency,%E2%80%9CJAXA%20Realtime%20Rainfall%20Watch%E2%80%9D.

more than 70 countries. The satellite contributed in detection of illegal deforestation in Brazil; (4) The RADARSAT Constellation Mission launched by Canada assess human activity, climate changes, and costal erosion. Additionally its automatic identification system also detects vessels navigating Canadian waters to engage in illegal fishing; (5) The BiomeSAT project is a specific initiative that monitors forest health in the Amazon using nanosatellite technologies;[98] (6) Bangladesh uses geospatial technologies to monitor its river network to identify changes in coastline and the erosion of the river system. The river monitoring system helps minimize loss of life and property.

VI. CONCLUSION

An overview of the problem indicates complex nuances that policy makers, researchers, government bodies and international jurist must successfully navigate in order to ensure equality in access to outer space. Each problem requires a distinct legal rule and tool in order to untwine the complicated legal questions that arise from them. While some problems maybe be purely legal, others are a good blend of politics, international relations, diplomacy, and economic power struggle. The purpose of this Chapter was to set context to the discussion below and highlight the three major concerns that must be addressed at all times – i) security ii) cooperation and iii) perceived benefits. The legal discourse of this thesis aims to navigate the difficulties that States must face to procure functional access to outer space that largely depends on space technologies. As discussed in length, these technologies have the potential to substantially alter the standard of living for each individual and their limited access continues to adversely impact the socio-economic condition of States.

[98] Alehandra Borunda, "See how much of the Amazon is burning, how it compares to other years", National Geographic, 29 August 2019, online: https://www.nationalgeographic.com/environment/article/amazon-fires-cause-deforestation-graphic-map.

CHAPTER THREE: OUTER SPACE TREATY & ACCESSIBILITY TO SPACE

"We live in a society absolutely dependent on science and technology and yet have cleverly arranged things so that almost no one understands science and technology. That's a clear prescription for disaster." - Carl Sagan

I. ACCESS TO OUTER SPACE

The Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, commonly known as the Outer Space Treaty (OST) was drafted by the United Nations Committee on Peaceful Uses of Outer Space (UNCOPUOS), and signed in 1967 at the beginning of the space age. It establishes the foundational principles upon which States, and their national entities, undertake space activities.[99]

The OST can be viewed as an instrument crafted to accomplish two distinct and substantive goals. The *first* is to serve as an arms control and disarmament agreement, which prevents an extension of the arms race into outer space.[100] The *second* purpose of the OST is to enunciate fundamental guiding principles for State activities in the 'peaceful exploration and use of outer space'.[101] These principles deal with a variety of issues, attempting to encompass the most important aspects of space exploration and use.

[99] S. Hosenball, T*he United Nations Committee on the Peaceful Uses of Outer Space: Past Accomplishments and Future Challenges*, 2 J. SPACE L. 95 (1979).

[100] COLOGNE COMMENTARY ON SPACE LAW, VOL. 1, (Stephen Hobe, Bernhard Schmidt-Tedd & Kai-Uwe Schrogl et al. eds.) (2009) at 89 [hereinafter referred as 'COLOGNE COMMENTARY']; J. Wulf, *Arms Control—Outer Space*, 2 J. SPACE L. 67 (1983); Ivan Vlasic, *The Space Treaty: A Preliminary Evaluation*, 1 CAL L. REV. 50 (1967); Zedalis Rex & Catherine L. Wade, *Anti Satellite Weapons and the Outer Space Treaty of 1967*, 8 CAL. W. INT'L L. J. 457 - 458 (1978).

[101] See generally, BIN CHENG, STUDIES IN INTERNATIONAL SPACE LAW, (Clarendon Press) (1997) at 238 [hereinafter referred as BIN CHENG]; Stephen Gorove, *Freedom of Exploration and Use in the Outer Space Treaty: A Textual Analysis and Interpretation*, 1 DENY J INTL L & POL'Y 93 (1971).

The degree to which a State may contribute to the global narrative of outer space exploration is largely dependent on external factors like – national space policy, government initiatives, labour, investment in R&D, etc.[102] While, these factors that affect space technology and proliferation may not necessarily fall directly under the regime of the OST, its principles provide an important starting point for contextualizing this discussion, because its legal rights and obligations generally relate to space endeavours.

The role of the OST with regards to providing functional access[103] to the outer space, can be best understood by analysing two particular provisions of the treaty along with discussions and supplementary resolutions that followed such drafting.

a. COMMON INTEREST PRINCIPLE

Article I expounds one of the most important principles of the OST, providing guidance to the entire treaty and having a direct impact on all space activities.[104] The pillars of Article I are the phrases **"***carried on for the benefit and interest of all countries*", "*province of all mankind*", and "*non-discrimination*".[105]

[102] Discussed in Chapter III.

[103] MERRIAM WEBSTER DICTIONARY, (11th ed., 2016) - defines 'access' as the "freedom or ability to obtain or make use of something", or "a way or means of entering or approaching". Appending the term 'functional' with 'access' stresses on the practical element of gaining access to outer space through space assets i.e. technology.

[104] N. Jasentuliyana, *Review of Recent Discussions Relating to Aspects of Article I*, in PROCEEDINGS OF THE THIRTY-SECOND COLLOQUIUM ONTHE LAW OF OUTER SPACE 7 (1989); Z. Qiwu, Some Reflections on the Most Important Principles of Outer Space Law: To The Common Interest of All Mankind, in PROCEEDINGSOF THE THIRTY-SECOND COLLOQUIUM ON THE LAW OF OUTER SPACE 25 (1989)[hereinafter referred as 'Z. Qiwu'] ; E. Galloway, The United States and the 1967 Treaty on Outer Space, in PROCEEDINGS OF THE FORTIETH COLLOQUIUM ON THE LAW OF OUTER SPACE 18 (1997).

[105] See generally, COLOGNE COMMENTARY at 126-141.

1. 'FREEDOM OF EXPLORATION AND USE' IS NOT ABSOLUTE AND MUST BE RECONCILED WITH THE PRINCIPLE OF 'PROVINCE OF MANKIND'

The 1959 UN Ad Hoc UNCOPUOS report recognized a generally accepted rule that, in principle, outer space is based on conditions of equality, freedom of exploration and use by all in accordance with existing or future international law agreements.[106] Through the perusal of literature surrounding the formative years of the OST, it can be reasonably construed that the 'freedom of exploration and use' in principle grants each State party access to outer space. The nature and the terms of such access are governed by the principles under Article I. However, it is important to understand that such 'access' banks on the shoulder of technological development, without which exploration of outer space shall not be possible.

The usage of **'**province of all mankind' exhibits the *res omnium communis* character of outer space and celestial bodies.[107] The concept serves as a limitation on the freedom of outer space in the sense that neither exploration nor use of outer space shall be undertaken for the sole advantage of one country, but done only for the benefit of the international community.[108] The specific phrasing of this provision is a predecessor of Article 11 of the Moon Agreement, namely the concept of common heritage of mankind.[109]

Article I does not define the term "mankind", and dichotomises its priorities between the benefit and the interest of countries *and* the province of all mankind.[110] The true meaning and goal of this

[106] U.N., Ad Hoc Committee on the Peaceful Use of Outer Space, Question of the Peaceful Use of Outer Space, GA Res. 1348 (XIII), U.N. DOC A/4141/25 at 23 (25 June 1959) [hereinafter referred as 'GA Res. 1348 (XIII)'].

[107] See generally, COLOGNE COMMENTARY at 126-141.

[108] STEPHAN HOBE, THE LEGAL FRAMEWORK FOR THE ECONOMIC USE OF SPACE, (Walther Schücking Institute for International Law at the University of Kiel) (1992) at 123.

[109] NICHOLAS M. MATTE, STATE ACTIVITIES AND EMERGING INTERNATIONAL ACTIVITIES, (Sweet & Maxwell) (1984) at 327-342.

[110] See generally, COLOGNE COMMENTARY at 126-141.

provision implies that States while exercising their freedom to explore should take into consideration the interest of all countries due to the specific usage of the phrase 'province of all mankind'.[111]

While the 'province of all mankind' concept was not designed to lay down specifications as to the distribution or sharing of the benefits and products derived from activities carried out in outer space, its obligatory nature remains unaffected.[112] The intent of the provision is to ensure that States comply with their duties as enshrined in the OST.[113] These duties or caveats are enlisted keeping in mind the *res communis* nature of outer space. However, this does not resolve the original predicament of accessibility to outer space, requiring us to look deeper into Article I of the OST.

2. EXPLORATION TO BE IN 'BENEFIT AND INTEREST OF MANKIND'

In order for the freedom of exploration to exists in its truest sense, States must have the basic requisites to explore outer space. In absence of space technology, a theoretical freedom does not grant functional access to outer space. Hence, the OST in Article I aims to juxtaposition the 'freedom of exploration' with other caveats so as to balance the inherent inequality that may exist amongst States. The aim is to reconcile opposing interests within the space faring and non-space faring community. Article I of the OST not only intends to grant States the freedom to explore but also takes cognizance of the privileges that States may have in such access due to their technology.

The concept of 'benefit sharing' as envisaged under the OST is not only the most discussed[114] but also the most debated principle of space law. However, the first mention of the term 'common

[111] Ibid.

[112] See generally, COLOGNE COMMENTARY at 126-141.

[113] See generally, COLOGNE COMMENTARY at 126-141.

[114] GA Res. 1348 (XIII) (1959) proclaimed that outer space should be "common interest of mankind" and for "the benefit of mankind"; U.N., Ad Hoc Committee on the Peaceful Use of Outer Space, International Co-operation in the Peaceful Use of Outer Space, GA Res. 1472 (XIV), UN Supp. A/4187 and Corr.1, (12 December 1959) also spoke

use' for the benefit of mankind was made by Hugo Grotius in his work *Mare Liberum*[115] where he introduced the idea of 'global commons'.[116] While the rule of law of seas played a vital role in the contextualization of space treaties, the drafters of the OST intended for the terms enshrined within the treaty to be strictly interpreted through the lens of space law.

In the preparation of the drafts for the OST, the principle of 'benefit and in the interest of all countries' originated for the first time in the Soviet draft I. However, despite differing opinions as to what constitutes as "interest of all countries" and compliance with that obligation, it was made clear that the fruits of space exploration shall be accessible to all.[117]

Even the International Law Association in 1960 stated that unlike the earthly precedents, the common interests of mankind should serve as the foundation for the international legal order in outer space, including the moon and other celestial bodies.[118] In the early stages of the drafting of the treaty, States also referred to the "Argentine Doctrine" which maintained that, benefits derived from harvesting space resources must be made available without discrimination to all humanity, and that an effort should be made to distribute these benefits in a way to promote higher living standards and conditions of economic development pursuant to Article 55(a) of the UN Charter.[119]

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of the "common interest of mankind" and the "betterment of mankind"; U.N., Ad Hoc Committee on the Peaceful Use of Outer Space, International Co-operation in the Peaceful Use of Outer Space, GA Res. 1721 (XVI), UN Doc. A/4987 (20 December 1961) states a belief in its preamble that "exploration and use of outer space should be only for the betterment of mankind and to the benefit of States irrespective of the stage of their economic or scientific development".

[115] HUGO GROTIUS, THE FREE SEA, translated by Robert Feenstra, (Leiden: Brill Academic Publishers) (2009) at 81.

[116] The goal of my thesis is limited – to focus on accessibility through space technology. Thus, the thesis shall no deal with the legal issue of whether outer space qualifies as a global common.

[117] UN Committee on Peaceful Use of Outer Space, A/C.1/SR.149 (17th December 1966) at 443 ¶72.

[118] International Law Associations 49th Report, Hamburg Conference, (1960) at 280; MODESTO SEARA VAZQUEZ, COSMIC INTERNATIONAL LAW (Detriort, Mich.) (1965) at 101.

[119] Silvia M. Williams, The Principles of Non-Appropriation Concerning Resources of the Moon and Celestial Bodies, in PROCEEDINGS OF THE THIRTEENTH COLLOQUIUM ON THE LAW OF OUTER SPACE, 157-158 (1970).

In academia, Professor Aldo Cocca was perhaps one of the first commentators to suggest using space to promote economic development. He suggested:

> By application of the principles contained in Resolution 1721, the celestial product should serve for the welfare of humanity and the benefit of the States, irrespective of the stage of their economic or scientific development .... W[e] should assign to Resolution 1721 an economic content-which it has not-solving the questions with an idea of a condominium universalis.[120]

Unfortunately, due to lack of State practice with respect to actual sharing of benefits in outer space,[121] these discussions and statements do not offer much insight into the interpretation of the 'benefit sharing' principle of the OST. Due to its normative nature, the principle of 'benefit sharing' appears as a mere token for inclusivity in outer space activities. Furthermore, it does not shed light over the issue of whether 'benefit sharing' is strictly restricted to space or extends to means to access space resources as well.

However, commentators and academicians argue that the contractual nature of the norm gives it binding force, and while its non-self-executing character may diminish efficacy, it does eliminate its operability,[122] since no written reservations were made by any country party to the OST. Furthermore, tacit reservations are invalid under Article 23 of the Vienna Convention on the Law of Treaties. Thus, Article I imposes a present obligation on States Parties to carry out their space activities for the benefit and in interest of all countries even though this norm remains vague and requires further clarification.

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[120] Aldo Armando Cocca, Legal Status of Celestial Bodies and Economic Status of the Celestial Products, in PROCEEDINGS OF THE SEVENTH COLLOQUIUM ON THE LAW OF OUTER SPACE 15, 20-21 (1964).

[121] Stanley B. Rosenfield, "Use" in Economic Development of Outer Space, IN PROCEEDINGS OF THE TWENTY-FOURTH COLLOQUIUM ON THE LAW OF OUTER SPACE, 73-74 (1981).

[122] Marco G. Markov, Implementing the Contractual Obligation of Article I, ¶1 of the Outer Space Treaty, 1967, in PROCEEDINGS OF THE SEVENTEENTH COLLOQUIUM ON THE LAW OF OUTER SPACE, 136-137 (1974).

Additionally, there are two *indicia* to suggest that the requirement actually imposes a positive duty. The *first* is that the requirement under Article I which utilises the plural form "interests" instead of the singular form, may indicate that this involves more than "just the vague, general interest of all countries" and, instead, represents specific, identifiable interests.[123] The *second* is that, while Article I may be considered to be "an aspiration couched on very general terms", the provisions of the Moon Agreement constitute further elaborations and guidelines to give effect to the "interests and benefits of all countries" requirement.[124]

However, despite the binding force of the benefit sharing obligation under Article I the same will only be rendered more precise when States Parties interpret these obligations themselves. It has been suggested that 'use for the benefit of all countries' should be interpreted in a way to neutralize economic inequalities between nations or States should take measures to give them effect through instances of actual interpretation.[125]

After the drafting of the OST, the trend towards discussing space issues from the standpoint of establishing a new international economic order (NIEO) had become particularly evident in connection with the discussions on the status of the natural resources of the moon as the common heritage of mankind.[126] States then drafted a proposal to balance the demands of different countries and maintain equal opportunity in access to resources by creating an international

[123] BIN CHENG at 234-235.

[124] BIN CHENG at 322.

[125] Wolfgang Hampe et al., The Legal Order for the Exploration and Use of Outer Space - Basic Principles, Scope of Application, Trends of Development, IN PROCEEDINGS OF THE THIRTY FIRST COLLOQUIUM ON THE LAW OF OUTER SPACE, 98, 103-104 (1988).

[126] During the negotiations on the legal regime for exploitation of lunar resources on the basis of the common heritage of mankind concept, a number of developing countries expressly stated that they regarded these negotiations as a important step in the establishment of a NIEO. See, e.g., U.N. Doc. A/AC.105/PV.171 at 68 (1977) (statement of the representative of Venezuela); U.N. Doc. A/AC.105/PV.172 at 26 (1977) (statement of the representative of Brazil); U.N. Doc. A/AC.105/C.2/SR.291 at 6 (1978) (statement of the representative of Colombia) all presented before the UN Committee on Peaceful Use of Outer Space.

licensing system for individual entities to explore common resources.[127] However, the Moon Agreement did not achieve the objective for which it was originally created. Thus, the question with respect to what truly qualifies as 'benefit sharing' remained unanswered.

3. THE CONCEPT OF 'NON-DISCRIMINATION'

The explicit usage of the word "non-discrimination" assures cooperation among nations in space exploration,[128] and with this, the OST emphasises an approach of material equality. Even if States are incapable of actually using or exploring outer space and its resources, they shall be entitled to do so.[129] The presence of this provision offers State Parties a right to be included in outer space endeavours. However, the applicability of this principle remains questionable because as sovereign bodies, States cannot be forced to cooperate with one another.

While the 'non-discrimination' clause prohibits legal discrimination amongst States in the exploration and use of outer space and guarantees free access to outer space and other celestial bodies,[130] in practice States have failed to provide substantive prohibitions against political, economic, or strategic discrimination, with regards to functional access to outer space and civil space technologies.[131]

In practice only active launching States have the functional technical capability to access outer space, but the general *opinio juris* is that launching States are under no legal obligation to provide

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[127] Nandasiri Jasentuliyana, Balancing the Conflicting Demands in Legislating Common Property Resources of the Oceans and Space, IN PROCEEDINGS OF THE TWENTY EIGHT COLLOQUIUM ON THE LAW OF OUTER SPACE, 149-150 (1985).

[128] UNCOPUOS, Legal sub-committee., Proposal relevant to the issue made by France in 1969, 7th Sess., U.N. Doc. A/AC.105/C.2/ SR.64, at 140-142 (June 18, 1968) – refer to comment made by Hungarian Delegate.

[129] M Marcoff, *Telediffusion par satellite et droit international* in BEITRAGE ZM LUFT-UND WELTRAUMRECHT: FESTSCHRIFT ZU EHREN VON ALEX MEYER, (Manfred Bodenschatz, Karl-Heinz Böckstiegel, Peter Weides eds.) (1975) at 331.

[130] Ibid at 45.

[131] MINERO at 67.

launch services to other States.[132] As a result, while it is true that in legal principle outer space is free for the exploration and use for all States, in practice States with launch capability can choose to deny launch services and practically prohibit another State from accessing outer space. In this sense, the 'non-discrimination' clause is more like a freedom to use and explore free from interference, as opposed to guaranteeing access to outer space.

The limitations of the 'non-discrimination' clause also extends to trade in civil space technologies and spacecrafts. State practice confirms that complete discrimination with regards to the sale, purchase, exchange, and trade in civil space technologies and spacecraft is legal.[133] Thus, States can exercise complete legal discretion with regards to space technology trade and controls under the guise of national interest and security through export control regimes.[134]

Despite evidence to the contrary, monopolization of space technology should not just be considered as a moral violation of the principles of Article I of the OST, but as a wilful intent to circumvent the necessary caveats placed over the freedom of exploration and use.[135] Due to the nature of space law, State practice remains scarce, but on analysing discussions during the formative years of the OST it can be understood that States were aware that primary issue concerning outer space exploration remained the accessibility to outer space itself, which is dependent on space technology [*refer to discussion of Group of 77*]. The murkiness with respect to interpretation of Article I should not affect its legally binding value[136] and the role it plays in ensuring inclusivity in outer space exploration.

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[132] MINERO at 68.

[133] Ibid.

[134] Refer to discussion in Ch III: Space as a tool for Cooperation & Competition.

[135] Ricky J. Lee, Commentary Paper on Discussion Paper Titled "Commercial Use of Space, Including Launching" by Prof. Dr. Armel Kerrest (2004), in CHINA INSTITUTE OF SPACE LAW, 2004 SPACE LAW CONFERENCE.

[136] JASENTULIYANA & LEE at 51; Z. Qiwu at 26; Christol (1997) at 73.

b. RELEVANCE OF THE GROUP OF 77

The Group of 77 (G-77) was established on 15 June 1964 by seventy-seven developing country signatories of the "Joint Declaration of the Seventy-Seven Developing Countries" issued at the end of the first session of the United Nations Conference on Trade and Development in Geneva. As the largest intergovernmental organization of developing countries in the United Nations, it provides the means for the countries of the south to articulate and promote their collective economic interests and enhance their joint negotiating capacity on all major international economic issues within the United Nations system, and promote south-south cooperation for development.[137] The G-77 aimed to use their bargaining power at the UNCOPUOS to discuss issues with respect to interpretation of Article I of the OST i.e. the 'benefit sharing' principle, especially in the wake of the failure of the Moon Agreement.

1. CONTEXT

The growing emphasis on equity in space was confirmed when a new item was added on the agenda of the UNCOPUOS relating to the distribution of benefits from space activities.[138] During the deliberations on this subject, the developing States stressed that the Legal Sub-Committee should develop a legal framework "*aimed at securing the equitable access of all States to the benefits derived from the use and exploration of outer space ... [to] eliminate inequalities among States*."[139]

[137] General Information on the Group of 77, online: https://www.g77.org/doc/.

[138] UNCOPOUS, [C]onsideration of the legal aspects related to the application of the principle that the exploration and utilization of outer space should be carried out for the benefit and in the interests of all states, taking into particular account the needs of developing countries, U.N. GAOR Supp. (No. 20) at 16, U.N. Doc. A/43/20 (1988).

[139] UNCOPUOS, Report of the Legal Sub-committee on its twenty-eight session, held in Vienna, U.N. Doc. A/AC.105/430 (1989) at 11 also reiterated in UNGA, International cooperation in the Peaceful Use of Outer Space, RES 43/56, GA Forty-third Session, 6 December 1988.

Thus, Venezuela, at the 1986 session of the UNCOPUOS took the initiative by suggesting a new item titled "*Equitable access by States to the benefits derived from space technology*."[140] This was the first time any State had directly mentioned space technology as an important component that constituted as access to space benefits. With respect to other space technologies, earlier attempts by developing countries at defining more precise responsibilities of States regarding international co-operation had been limited to one area of space activity i.e., remote sensing. In this the UNCOPUOS, following a decade-long discussion, agreed on a set of remote sensing principles which were subsequently adopted by the General Assembly in its resolution 41/65 in 1986[141] with the aim of reaffirming Article I of the OST.

2. RATIONALE

The rationale behind the proposal was the dissatisfaction of developing countries at the "*Principles relating to remote sensing of the Earth from outer space*"[142], as States believed that they were still unable to fully enjoy the benefits from outer space.[143] Despite this, the G-77 were unable to make the current agenda specifically worded. Even though the item did not deal with any specific legal aspect, it furthered the discussion with respect to benefit sharing. Primarily, because it was only this broadly worded agenda item which allowed the G-77 to take up the subject matter of international cooperation and the sharing of the "benefits" of space exploration; the more specific the proposal, the lesser the chance of having such a delicate subject matter discussed at all.[144]

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[140] UN Committee on Peaceful Use of Outer Space, Report of the Working Group Relevant to Peaceful Use of Outer Space, U.N. Doc. A/AC.1O5/SR.282 (1986).

[141] United Nations General Assembly, Principles relating to remote sensing of the Earth from outer space, GA Res. 3232 (XXIX), UN Doc. 41/65 (1986).

[142] Ibid.

[143] Edwin W. Paxson II, *Sharing the Benefits of Outer Space Exploration: Space Law and Economic Development*, 14 MICH J. INT'L 487 (1993).

[144] Gennady M Danilenko, Outer Space and the Multilateral Treaty-Making Process, 4 HIGH TECHN. L.J., (1989) at 217-226.

In the working paper, the G-77 pointed out that various principles, such as those to be found in international law, the United Nations Charter, the OST, and the conclusions of the UNISPACE 82 Conference, emphasized on international cooperation as a key element "in activities undertaken by governmental, non-governmental and transnational entities in outer space."[145]

Developing countries in the Committee insisted to go beyond the mere consideration of providing assistance through international space cooperation under Article I of the OST[146] and expressed their general goal under the new agenda item by stating that, the technological differences among States had brought about inequalities in the benefits derived from space activities and it could only be remedied by a set of new legal principles that elaborated and institutionalized international cooperation.[147]

After a lot of discussions, the Sub-committee finally agreed that the new agenda item should be read: "*Consideration of the legal aspects related to the application of the principle that the exploration and utilization of outer space should be carried out for the benefit and in the interests of all States taking into particular account the needs of developing countries*."[148]

3. DISSENT

Even when the framework of 'benefit sharing' was presented delicately so as to not accentuate the gap between the north-south relation, it was evident that developed States did not completely agree to the agenda item at hand. While it was clear that the objective of Article I of the OST was: calling attention to the essential needs of mankind and emphasizing the importance of cooperation with

[145] UNCOPUOS, Report of the Legal Subcommittee, U.N. Doc. A/AC.105/C.2/L.162 (2018) at ¶5.

[146] Ibid.

[147] UNCOPUOS, Report of the Legal Subcommittee, U.N. Doc. A/44/20 (2017) at ¶106.

[148] UNCOPUOS, Report of the Legal Subcommittee, U.N. Doc. A/AC.105/411, (1988) ¶ 41, 48.

respect to their space ventures. What was not clear, however, was the extent of the obligation involved.

Arthur Goldberg, the then chief negotiator for the United States stated that, *"Article I of the OST is a statement of general goals, and that a separate international agreements would be required to cover the use of particular space technology*".[149] The same view was shared by Yuri Kolosov the delegate of the Soviet Union, who stated that, "[*t]his is understandable, since the character and degree of participation of States in international space projects depend, ultimately, on their will.*"[150]

Despite the long-drawn-out discussion on the needs of developing countries with respect to their participation in the narrative of a global space agency, no concrete result could be achieved with respect to the issue of 'benefit sharing' or ensuring 'accessibility' to outer space.

c. SPACE BENEFIT DECLARATION, 1996

The Space Benefit Declaration, 1996 was a result of the agenda that was set by G-77 at the Legal Sub-Committee. Prior to the proposal of the Space Benefit Declaration, the initial draft proposed by the nine developing countries was rich in NIEO language aiming at forced cooperation and an automated transfer of financial and technological resources from north to south.[151] As expected such proposal failed due to its aggressive nature.

In light of its failure, Germany and France presented a working paper in 1995 session titled – "*Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in the*

[149] United States Congress Senate Committee on Foreign Regulations, Treaty on Outer Space: Hearing Before the Committee on Foreign Relations, Ninetieth Congress, First Session, 12 April 1967.

[150] G.P. ZHUKOV& KOLOSOV, INTERNATIONAL SPACE LAW (Praeger) (1984) at 77.

[151] UNCOPUOS, Principles Regarding International Cooperation in the Exploration and Utilization of Outer Space for Peaceful Purposes, UN Doc A/AC.105/C.2/L.182, (9 April 1991).

Interests of all States, Taking into Particular Account the Needs of Developing Countries'."[152] It rested on two basic considerations: *first,* that Sates are free to determine all aspects of their international cooperation, whether it is bilateral or multilateral or whether it is commercial or non-commercial. *Second,* that States should choose the most effective and appropriate mode of cooperation in order to allocate resource effectively.

The working paper was less redistribution-minded and diplomatically more constructive as it presented a far more conciliatory second revision.[153] It was essentially intended to have the effect that it would mark the end of a north-south debate which had focused on the introduction of forced cooperation and transfer of resources. By intending to provide an authoritative interpretation of the cooperation principle of Article I of the OST, the Declaration aimed to prevent further confrontation on a political level.

The UNISPACE Conventions were introduced to address the original concerns of the developing countries with respect to accessibility through space technology by stressing on the need for increased cooperation, particularly with respect to space science, technology and space application.[154] It reemphasized the Cooperation Principle of 1996 which stressed on the need for cooperation between developed countries and other countries to ensure that marginalized States can also avail the benefits of space technology. The Space Millennium Declaration or the Vienna Declaration on Space & Human Development[155] also discussed the importance of space technology and maintained that any use of space technology should be in accordance with the

[152] UNCOPUOS, Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in Interests of all States, Taking into Particular Account the Needs of Developing Countries, UN Doc A/AC.105/C.2/L.197, (27 March 1995).

[153] UNCOPUOS, Annotated Provisional Agenda, UN Doc. A/AC.105/C.2/L.182/Rev.2 (23 March 1995).

[154] UNISPACE Conferences, United Nations Office for Outer Space Affairs, http://www.unoosa.org/oosa/en/aboutus/history/unispace.html.

[155] Ibid.

principles set out in Agenda 21, for the benefit of all nations and people with space applications being extended to other countries.[156]

While these commitments and corrective measures are drawn out with the aim to address years of disparity and inequality amongst States, it remains unclear on how they tie in with State Party obligations under Article I of the OST. Resolutions in the past have made it abundantly clear that insistence on voluntary cooperative assistance is the only ideal solution to ensure a future of inclusivity which entails some form of 'benefit sharing'. However, policy analysts have often overlooked at how one may stimulate such cooperation in order to bridge the gap between space faring and non-space faring States.

Considering the discussion above, two assertions can be reasonably made – (i) Article I of the OST imposes a positive duty to share benefits from outer space without specifying what such benefits entails, and; (ii) the extent of this 'benefit sharing' remains unknown, leaving States to determine the degree of such sharing. On one hand, developing countries are deprived of benefits from a "global common", and on the other hand developed countries' sovereign authority is being compromised by mandating cooperation, leaving a lacuna in the current policy system.

II. NON-APPROPRIATION PRINCIPLE

Article II of the OST encompasses the 'non appropriation' principle, which is regarded as a fundamental rule regulating the exploration and use of outer space. The primary intent of Article II was to reinforce the underlying principles of Article I by confirming that the principle of territorial sovereignty does not apply to outer space.[157] The non-appropriation principle is a basic concept of space law which guarantees the "humanitarian" and idealistic approach to the

[156] U.N. Conference on Environment and Development, Rio Declaration on Environment and Development, U.N. Doc. A/CONF.151/26/Rev.1 (Vol. I), annex I (Aug. 12, 1992).

[157] JASENTULIYANA N., ROY LEE, (EDS.), MANUAL ON SPACE LAW, vol. II, (Oceana Publications, New York) (1979) at 383 [hereinafter referred as 'JASENTULIYANA & LEE']

management of the outer space, keeping in mind commercial interests.[158] Furthermore, Article II does not expressly limit itself to the purported actions of the State,[159] but rather seeks to prohibit any action that constitutes as 'national appropriation'[160] including that of appropriation through claim of sovereignty, use or occupation or any other means.

The phrase "any other means" represents a "catch all" phrase designed to ensure that there are no other methods,[161] not involving a claim of sovereignty, use or occupation, giving rise to a national appropriation in the sense of Article II. In practice, this prohibition establishes outer space as a 'global common', an area in which utilization and exploration is subject to the principles of international cooperation and peaceful use as enumerated in the OST, but with regards to exploitation of outer space, this principle has yet to be significantly tested.

To date, this principle has not been challenged based on unilateral exploration, use, or exploitation. Commentators have raised the point that future civil space missions, such as crewed missions to Mars[162] or Lunar resource exploitation, will require a refinement of this principle, both in political and legal practice, that may necessitate international cooperation on a level of technical development, exchange, and/or transfer currently not observed in international space cooperation.[163] Hence, this prohibition is also relevant to space technology export and trade control within the context of international civil and commercial cooperation in the exploration,

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[158] Ibid.

[159] Daniel Goedhuis, *Some Recent Trends in the Interpretation and the Implementation of the Rules of International Space Law,* COLUMBIA JOURNAL OF TRANSNATIONAL LAW 19 (1981) at 214.

[160] Stephan Hobe, *Adequacy of the Current Legal and Regulatory Framework Relating to the Extraction and Appropriation of Natural Resource*, xxxii ANNALS OF AIR & SPACE LAW (2007).

[161] Armel Kerrest & Lesley Jane Smith, *Article II*, in COLOGNE COMMENTARY ON SPACE LAW, VOL. 1, (Stephen Hobe, Bernhard Schmidt-Tedd & Kai-Uwe Schrogl et al. eds., 2009) at 231 [COMMENTARY Article II].

[162] Taylor Locke, "Mars & Beyond: To road to making humanity multiplanetary", 9 March 2020, online: https://www.cnbc.com/2020/03/09/spacex-plans-how-elon-musk-see-life-on-mars.html; Space X, "Mars & Beyond: The road to making humanity multi-planetary", online: https://www.spacex.com/human-spaceflight/mars/.

[163] Ernst Fasan, *Human Settlements on Planets: New Stations or New Nations*, 22 JOURNAL OF SPACE LAW (1997) at 47.

use, and exploitation of outer space and other celestial bodies. Currently, denying access to technology is completely legal, however it raises the question as to whether using technology for unilateral exploitation may trigger the principle of appropriation through 'any other means'.

Sharing or transferring of essential technologies in order to maintain a level playing field is not uncommon across various industries.[164] While this commercial doctrine cannot be directly imported or analogized with outer space due to its unique environment, similar lessons learnt from other industries may be useful to tackle circumstance where States may use export-import restrictions to deny trading of space technology thereby maintaining the status quo of their unilateral space activity.

a. ESSENTIAL FACILITY DOCTRINE

Under the Essential Facility Doctrine (EFD), a monopolist found to own a "facility essential to other competitors" is required to provide a reasonable use of that facility.[165] If the facilities are indispensable for other players to enter the market and if it would be virtually impossible for other firms to compete with the manufacturer of such technology in the absence of access to such technology, then such technology may be construed as essential to the industry.[166] Most jurisdictions,[167] both common law and civil law, apply some form of the essential facility doctrine to unjustifiable denials of access to infrastructure and other forms of facilities that are impossible to duplicate, but nonetheless essential for competition.

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[164] WTO, Doha Ministerial Declaration, Mandate point 37, WT/MIN(01)/DEC/1, 20 November 2001; WORLD HEALTH ORGANIZATION, WORLD INTELLECTUAL PROPERTY ORGANIZATION, WORLD TRADE ORGANIZATION, PROMOTING ACCESS TO MEDICAL TECHNOLOGIES AND INNOVATION: INTERSECTION BETWEEN PUBLIC HEALTH, INTELLECTUAL PROPERTY AND TRADE (2012) refer to Ch. 1: Medical technologies.

[165] Abbott B. Lipsky, Jr. & J. Gregory Sidak, *Essential Facilities*, 51 STAN L. REV. (1999) at 190-91.

[166] OECD, Policy Round Table Essential Facilities Concept, 1996, OCDE/GD(96)113 (1996) at 9.

[167] United States, European Union, Australia, Russia, Canada, India, Hong Kong, New Zealand, South Africa, and Israel.

While the doctrine is raised only in anti-trust cases, the underlying philosophy of the doctrine is that each player must have an equal opportunity to access the benefits of the market. As discussed in the previous Chapter, the advent of privatization in outer space has raised several new concerns within the community, especially concerning the regulation of competition between space-faring and non-space faring nations. Despite the legal ambiguity in the language of the OST with respect to the proliferation or trade of space technology, it is abundantly clear that the competition amongst States in the commercial field requires further scrutiny.

For example, country X finds an asteroid with abundant mineral resources essential to human survival and starts a mining mission on it. However, it is the only country to possess such advanced technology to mine on the asteroid. While the minerals on the asteroid are essential for all human beings, only the citizens of country X reap the benefit form such harvest. In this scenario, denying other nations access to an essential technology and maintaining monopoly over the access of such asteroid constitutes as a violation of Article II.[168] Read in conjunction with Article I, it may be argued that the "benefit sharing" principle only intends to protect the States access to benefits from space exploration and not the means of procuring such benefits, keeping essential technologies out of the purview of Article II. However, such a limited interpretation would undermine the importance and value of the non-appropriation principles in its application in the commercial sphere.[169] It is interesting to note that space technology operators face similar licensing and competition rules as other industries, making them open to the application of the EFD.

[168] H BITTLINGER, DAS GEBOT DER RUCKSICHTNAMHE' IN K.H. BOCKSTIEGEL (ED), HANDBUCH DES WELTRAUMRECHTS (Carl Heymans, Cologne) (1991) at 119.

[169] Fabio Tronchetti, *Non-Appropriation Principles under Attack: Using Article II of the Outer Space Treaty in its Defence, The*, 50 Proc. on L. Outer Space 526 (2007).

The doctrine of essential facility is a generally accepted doctrine later incorporated formally in various WTO treaties and national competition laws.[170] Due to its wide acceptance, the EFD may constitute as a 'general principle of law' embodied in Article 38(1) (c) of the Statute of the International Court of Justice as it falls under substantive principles of law widely recognised by leading legal systems.[171]

The fact that general principles of law as a source of international law can arise from national legal systems finds support in the *travaux* of the Statute of the Permanent Court of International Justice, and in particular the work of the Advisory Committee of Jurists, where there was general agreement that general principles of law were those found in *foro domestic*.[172] Furthermore, reference to national law is not uncommon as in the *Alabama*[173] case the ICJ accepted the pleading of the parties containing reference to their national laws in support of their arguments.[174] This practice also been reaffirmed in several ICJ cases which reiterated that principles generally accepted in jurisprudence of municipal law cannot be violated.[175]

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[170] Giorgio Gaja, *General Principles of Law* in MAX PLANCK ENCYCLOPAEDIA OF PUBLIC INTERNATIONAL LAW, (Rudiger Wolfrum ed.) (2012) at 704.

[171] Wolfgang Friedmann, *The Uses of "General Principles" in the Development of International Law*, 57 AM J. OF INT'L LAW (1963) at 279-285.

[172] R. KOLB, LA BONNE FOI EN DROIT INTERNATIONAL PUBLIC, (Geneva, Presses Universitares de France) (2000) at 56.

[173] Alabama claims of the United States of America v. Great Britain, Award, 14 September 1872, Reports of International Arbitral Awards (UNRIAA), vol. XXIX, ¶125–134.

[174] See, for example, The case of the United States, to be laid before the Tribunal of arbitration, to be convened at Geneva under the provisions of the treaty between the United States of America and Her Majesty the Queen of Great Britain, concluded at Washington, May 8, 1871 (Washington, D.C., Government Printing Office, 1872) at 150–158; See also HERSCH LAUTERPACHT, PRIVATE LAW SOURCES AND ANALOGIES OF INTERNATIONAL LAW (WITH SPECIAL REFERENCE TO INTERNATIONAL ARBITRATION) (Longmans & Green) (1927) at 216-223.

[175] Factory at Chorzow (Germ. v. Pol.), Indemnity, 1928 P.C.I.J. (ser. A) No. 17 (Sept.13); Gabčíkovo-Nagymaros Project (Hung. v. Slovk.), 1997 ICJ Rep 7; Corfu Channel, (U.K. v. Alb.), Merits Judgement, 1949 ICJ Rep 4, (April 9); Military and Paramilitary Activities in and Against Nicaragua, (Nicar. v. U.S.), Merits, Judgement, 1986 ICJ Rep. 14 (June 27); Temple of Preah Vihear, (Cambodia v. Thai.), Preliminary Objection, 1961 ICJ Rep. 17 (May 26) at 6; Reservations to the Convention on the Prevention and Punishment of the Crime of Genocide, Advisory Opinion, 1951 ICJ Rep 15 (28 May 1951); Western Sahara, Advisory Opinion, 1975 ICJ Rep. 12, (Oct. 16) at 24; Frontier Dispute (Burkina Faso v. Mali), Merit Judgement, 1986 ICJ Rep 554 (22 Dec) at 3.

As some authors have pointed out, recourse to such rules or principles may be explained, at least partly, by the fact that international law at the time was not sufficiently developed to address all situations, yet disputes had to be settled all the same.[176] Furthermore, in the proceedings of the Committee for the drafting the of the Statute of the ICJ it was specifically highlighted that -

> "[w]hat is true and legitimate in national affairs, for reasons founded in logic and not in the arbitrary exercise of sovereignty, cannot be false and illegal in international affairs, where, moreover, legislation is lacking and customary law is being formed very slowly, so that the practical necessity of recognising the application of such principles is much greater".[177]

While treaties and custom are adopted without hesitation, general principles of international law have always been subjected to a great length of discussion. Despite that, their usage remains crucial because limiting the law to be applied by the Court to treaties and custom may amount to a "refusal of justice" and would leave the judge in a "state of compulsory blindness"[178] Especially, in niche fields like space law where there exist lacunae in law and *non-liquet*[179] circumstances where a principle has been articulated but is not clear.

EFD in this particular circumstance can then prove to be a useful tool to stop the 'unjust enrichment'[180] that may occur due to monopolization of certain space technologies. While this

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[176] A. PELLET, RECHERCHE SUR LES PRINCIPES GÉNÉRAUX DE DROIT EN DROIT international (Université de droit, d'économie et de sciences sociales) (1974) at 7-15 ; See also CL. HUMPHREY M WALDOCK & HAGUE ACADEMY OF INTERNATIONAL LAW, GENERAL COURSE ON PUBLIC INTERNATIONAL LAW (Martinus Nijhoff) (1962) at 54.

[177] LEAGUE OF NATIONS. ADVISORY COMMITTEE OF JURISTS FOR THE ESTABLISHMENT OF A PERMANENT COURT OF INTERNATIONAL JUSTICE, PROCÈS-VERBAUX DES SÉANCES DU COMITÉ, 16 JUIN-24 JUILLET 1920, AVEC ANNEXES: PROCÈS-VERBAUX OF THE PROCEEDINGS OF THE COMMITTEE, JUNE 16TH-JULY 24TH 1920, WITH ANNEXES (Lawbook Exchange) (2006) at 346.

[178] Ibid at p. 323.

[179] In the realm of international law, the Advisory Committee of Jurists sought to avoid the possibility of a non liquet by including general principles of law among the sources of international law enumerated in Article 38 of the Statute of the Permanent Court of Justice (1920), thereby transforming the question of non liquet from a topic pertaining to judicial functions to one of legal theory: the completeness of law.

[180] Lena Goldfields Ltd. v. Soviet Government, 36 CORNELL L. REV. 31 (1950) arbitration considered this principle on an international level where it held that unjust enrichment by the Soviet Union with regard to appropriation of mines, is impermissible.

doctrine is usually invoked in domestic cases, it can prove to be a useful tool to interpret futuristic issues in space law governing denial in access to technology in breach of Article II of the OST.

III. CONCLUSION

The OST ensures States' basic freedom to access and explore outer space free from interference or claims of national appropriation while also imposing an obligation on States to explore and use outer space in the interest of maintaining international peace and security and promoting international co-operation and understanding. Regardless of whether one accepts the proposition that "mankind" is a granted agency under the global collective of "all countries" as articulated in Article I of the OST, States are still obliged by its terms. Thus, they must explore and use outer space keeping in mind the benefit of all countries. However, its current interpretation does not guarantee functional access to outer space or prohibit States from discriminating against non-space faring States on the basis of their personal national interest.

However, this general duty can be elevated to a specific duty to engage in global participation on civil space endeavours by relying on other tools. In this particular circumstance a lack of global engagement fundamentally threatens the legal principle of Article I to such an extent as to make the entire provision ineffective. While intricacies of benefit sharing and cooperation remain unclear, it is crucial to ensure that such global engagement is not absent. Thus, a State unilaterally benefiting from space activity without regarding the interests of all countries and refusing to globally engage in cooperative ventures will be violating the principles enshrined in Article I & II of the OST.

CHAPTER FOUR: SPACE AS A TOOL OF COMPETITION & COOPERATION

"Ignorance more frequently begets confidence than does knowledge: it is those who know little, not those who know much, who so positively assert that this or that problem will never be solved by science" – Charles Darwin

I. INTRODUCTION

The launch of Sputnik in 1957 and the subsequent beginning of the space age lead to the progression of space technologies and the development of hundreds of applications that use satellite data.[181] One of the earliest and highly publicized contribution from the field is that of a satellite measurement showing the extent of the ozone layer depletion in the atmosphere and the existence of exoplanets and black holes. This also includes the iconic imagery of the Blue Marble,[182] which would later go on to become the universally recognized symbol of our planet and its finite resources.

The rapid progress made in space technology led to extraordinary accomplishments for the entire human race and built the foundation for future missions including that of the International Space Station [ISS] and the robotic exploration of other planets and celestial bodies, including that of a landing on a comet.[183] However, after the initial phase of "exploration" of a new environment and the consolidation of relevant technologies, what followed was the explosion of business opportunities to exploit this new environment. Today we are in a period that has seen a shift of paradigms with change in motivations, actors, and technologies.[184] Currently, space serves as a tool for both competition and cooperation. While cooperation is an inherent feature of space

[181] PELTON, J. N., MADRY, S., AND CAMACHO-LARA, S., HANDBOOK OF SATELLITE APPLICATIONS, (Springer)(2017).

[182] Donald J. Wuebbles, *Celebrating the "Blue Marble",* 93 TRANSACTION AMERICAN GEOPHYSICAL UNION 49 (2012).

[183] Michael Greshko, 6 Amazing Discoveries From Rosetta's Epic Comet Encounter, National Geographic, 29 September 2016, online: https://www.nationalgeographic.com/news/2016/09/rosetta-crash-comet-spacecraft-esa-philae-science/.

[184] Ibid.

exploration, States shall continue to compete against each other in the battle of who develops the technology and brings back the riches from the celestial bodies first.

II. SPACE AS A TOOL FOR COMPETITION

The space industry is dominated by the rules and regulations of its institutional customers - high market-entry barriers, complex procurement rules, technology-driven competition and buying rules. These concepts define the space market segmentation which is often oligopolistic[185] in nature. There are several metrics for assessing a foreign space industry and its competitiveness, it can be broadly measured by looking at three factors – government policies, industry potential i.e., investment in R&D from a percentage of national GDP or exports/sales, and human capital.

Competitiveness in the space industry can be a subject matter of its own, however over the course of this discussion, we shall briefly analyse the space programs in which States are currently investing and the policies they have adopted to make such program viable. This shall be done by analysing investment trends and determining its impact on national regimes. These patterns shall then help us ameliorate the discussion on cooperative civil space endeavours – as countries only cooperate on matters, they are unable to compete on.

a. INVESTMENT IN THE R&D/INNOVATION OF SPACE TECHNOLOGY

Space based global utilities or space assets provide the user of these applications with multiple benefits. However, utility derived from these assets is directly proportionate to the investment behind these technologies. Civil space programs now account for approximately 65% of global space expenditures,[186] from this human spaceflight represents the largest civil space expenditure,

[185] Oligopoly is a market structure in which there are a few players that sell homogenous products and services and there are high market-entry barriers. It is especially used to describe a market structure where there very few dominant players.

[186] Euroconsult, "Government Spending on Space Programs Reaches $62-billion in 2016", 30 May 2017, online http://euroconsult-ec.com/30_May_2017.

estimated at $11.4 billion a year.[187] Space-faring countries have now increased their civil space expenditure to gain momentum in technological advancement which directly translates into global space leadership. In order to gain a competitive edge over their contemporaries, governments across the globe have also subsidized certain space industries, adopted enabling policies and regulations to bolster domestic space industry.

In the early years, the Soviet Union dominated human space flight industry and continues to do so even today by being the only one to maintain a domestic human spaceflight capability to the ISS with the Soyuz program. Their commitment to the ISS can also been in the 2016-2025 *Federal Space Program* which includes plans for the launch of the human-rating certified *Angara* rocket from a new launch pad at the Vostochny Cosmodrome.[188] In addition the Roscosmos is recruiting astronauts for their 2031 lunar mission in a new, crewed launch vehicle, the *Federatsiya*.[189] In terms of investment a State-owned Russian Venture Company intends to become the largest space technology investment fund with an aim to "widen the bottleneck in Russian Aerospace". This company then aims to partner with private industry players to fund start-up's and foster a commercial space industry in Russia.[190]

In comparison to the Russian space program, the first U.S. human space mission was also completed in 1961. This Space Shuttle program provided a human-spaceflight capability from

[187] Ibid.

[188] Anatoly Zak, "Russia Approves its 10-year Space Strategy," The Planetary Society, 23 March 2016, online: http://www. planetary.org/blogs/guest-blogs/2016/0323-russia-space-budget.html.

[189] Mariella Moon, "Russia's Space Agency Preps for its First Manned Moon Landing," Engadget, 15 March 2017, online: https://news.yahoo.com/2017-03-15-roscosmos-first-manned-moon-landing.html?guccounter=1&guce_referrer=aHR0cHM6Ly93d3cuZ29vZ2xlLmNvbS8&guce_referrer_sig=AQAAAM2pKVrERGgEJSjUBMhCcG_9if1MXHVhr9SNB9p30GJRVco06a-E3Rnttk6nRJUoOy4WRYNLacFsp_JSkGMa_lhbUPURMN99JzXXSstGOGM-WspfrpnulXz0trPMGBXdILBjAv1VuNw_gvX3GUVv-ocHwFKvMrUaY4EGrlba_YqF.

[190] The Moscow Times, "Russian Venture Firms Launch $60 Million Space Tech Investment Fund," 12 May 2015, online: https://www.themoscowtimes.com/2015/05/12/russian-venture-firms-launch-60-million-space-tech-investment-fund-a46495.

1981 until 2011, since then NASA has purchased flights to the ISS on Russia's Soyuz rocket. Meanwhile, NASA is also working with private companies like SpaceX and Boeing on the Commercial Crew Program to provide human spaceflight to the ISS, but the program is significantly behind schedule.[191] Thus, operational launches of the Dragon V and Starliner CST-100 spacecraft are unlikely before the ending of 2021.[192]

NASA's new heavy space launch system remains a priority which intends to support deep-space exploration, by one day taking astronauts to Mars. Ever since the announcement in 2004, NASA has made human exploration beyond LEO an elusive goal, whereby it aims to return humans to the Moon. Additionally, in 2017, the U.S. President signed *Space Policy Directive 1*, which again directed national space policy to a permanent human return to the Moon and beyond, in cooperation with the private sector.[193]

The United States adopted *the Commercial Space Launch Competitiveness Act* with an aim to support the budding private sector and intends to facilitate a "pro-growth environment for the developing commercial space sector."[194] Similar legislation has been adopted by Luxembourg and is being

[191] NASA, "Commercial Crew Transportation," 2017, online: https://blogs.nasa.gov/commercialcrew/2018/01/03/commercial-crew-program-2017-year-in-review/#:~:text=The%20missions%20will%20carry%20astronauts,to%20each%20provider%20to%20six.

[192] Cristina T. Chaplain, "NASA Commercial Crew Program: Continued Delays Pose Risks for Uninterrupted Access to the International Space Station, Testimony before the Subcommittee on Space, Committee on Science, Space, and Technology, House of Representatives", 17 January 2018, online: https://www.gao.gov/assets/gao-18-317t.pdf; Dave Gershforn, "Boeing Starliner: Timeline, Testing, and Specs for SpaceX Competitor", 5 May 2021, online: https://www.inverse.com/innovation/boeing-starliner.

[193] The White House, "Presidential Memorandum on Reinvigorating America's Human Space Exploration Program," 11 December 2017, online: https://trumpwhitehouse.archives.gov/presidential-actions/presidential-memorandum-reinvigorating-americas-human-space-exploration-program/.

[194] CBC News, "U.S. Space-Mining Law Seen Leading to Possible Treaty Violations," 26 November 2016, online: https://www.cbc.ca/news/technology/space-mining-us-treaty-1.3339104; 114th U.S. Congress, "U.S. Commercial Space Launch Competitiveness Act, Public Law," 25 November 2015, online: https://www.congress.gov/congressional-report/116th-congress/senate-report/172.

pursued by other States. Similarly, Europe, ESA and the EU also agreed to protect and develop their mutual interests in space[195] by keeping private and public space industries competitive.[196]

Space-faring countries like China, have also been inspired by the Soyuz program and its technical capabilities and in the spirit of international cooperation have taken assistance from Russia and developed the Shenzhou human-spaceflight program in the late 1990s, with a successful mission in 2003.[197] Subsequent missions followed in 2005, 2008, 2012, 2013, and 2016, following the launch of two Tiangong space laboratories in 2011 and 2016. China has now progressed towards the launch of a permanent crewed Chinese Space Station which is scheduled to open by 2022.[198] China is also focusing on human missions to the Moon.[199] In terms of policy boost, China's "Made in China" initiative also aims to increase "the profitability and efficiency of China's defence enterprises" and private-sector participation in the state-dominated industry.[200]

It is thus evident that, leading civil-space agencies and space-faring nations are increasing their spending on space programs, with seven of them now spending more than $1-billion annually.[201] Prioritizing deep space, and human space exploration and access to space, has led to the

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[195] European Commission, "Space Strategy for Europe", 26 October 2016, online: https://ec.europa.eu/transparency/regdoc/rep/1/2016/EN/COM-2016-705-F1-EN-MAIN.PDF; David Lumb, "EU and ESA Sign Deal to Keep ahead of Global Space Competition," Engadget, 27 October 2016, online: https://www.engadget.com/2016-10-27-eu-and-esa-sign-deal-to-keep-ahead-of-global-competition.html.

[196] David Schrieberg, "Luxembourg's Bet on Space Industry Shows Early Signs of Success," Forbes, 19 November 2017, online: https://www.forbes.com/sites/davidschrieberg1/2017/11/19/luxembourgs-bet-on-space-industry-shows-early-signs-of-success/?sh=421fae406114.

[197] FERNAND VERGER ET AL., CAMBRIDGE ENCYCLOPAEDIA OF SPACE (CUP) (2003) at 96-97.

[198] Center for Strategic and International Studies, "What's Driving China's Race to Build a Space Station?," 28 June 2018, online: https://chinapower.csis.org/chinese-space-station/.

[199] Andrew Jones, "China Developing New Launch Vehicle for Human Spaceflight, Future Moon Missions," Space News, 13 November 2018, online; https://spacenews.com/china-developing-new-launch-vehicle-for-human-spaceflight-future-moon-missions/.

[200] East Asia Center, University of Washington, "Made in China 2.0: State-led Commercialization of China's Space Industry," 7 April 2016, online: https://jsis.washington.edu/eacenter/2016/04/07/made-china-2-0-state-led-commercialization-chinas-space-industry.

[201] SSI GOVERNANCE GROUP, SPACE SECURITY INDEX 2019 (Waterloo Printing) (2019) at 62.

development of heavy lift launch vehicles, lower-cost launch technology, and human spaceflight capabilities. All of these technologies have created a competitive environment in the space exploration industry. This environment is further nurtured by pro-active policies issued by the government. However, space competitiveness is not limited to investment but revenue generated through the export of technologies.

b. EXPORT CONTROL REGIME

The market in the space industry is analogous to any economic space where the institutional customers define the market entry barriers in the industry. These market-entry barriers are the conditions under which new companies can enter a certain industry or market. The nature of these barriers can be regulative, legal or others, such as procurement rules for companies interested in supplying agencies with their products and services. These procurement rules are governed by national import-export regime.

A countries export control regime aims to strike a balance between commercial development and the proliferation of sensitive technologies that could pose security threats. These sensitive technologies are inherently part of commercial development as space launchers and intercontinental ballistic missiles use almost identical technology, and many civil and commercial satellites contain advanced capabilities with potential military applications.

The U.S. *International Traffic in Arms Regulations* (ITAR) is an example of such regulation, which controls the export and import of defence-related articles and services on the *U.S. Munitions List*. In 1999, satellites and satellite components became subject to ITAR, despite commercial objections.[202] Many commercial satellites and related items, including commercial communications

[202] U.S. Dept. of Commerce, "U.S. Space Industry 'Deep Dive' Assessment: Impact of U.S. Export Controls on the Space Industrial Base", Bureau of Industry and Security, February 2014, online: https://www.bis.doc.gov/index.php/documents/technology-evaluation/898-space-export-control-report/file.

and remote sensing satellites, have since been removed from the list.[203] However, national defence interests continued to restrict several commercial activities.

The U.S. access to Russian engine technology namely, the RD-180 used in the EELV program for national-security launches remained contentious, following events in Crimea in 2014 and subsequent U.S. sanctions on Russia.[204] China was also subject to specific U.S. export controls, including a restriction against the transfer of technology that would benefit its missile or space launch capabilities.[205]

At the same time, China has also been developing policies to regulate its growing commercial industry, including *Regulations on the Administration of Export of Space Products*.[206] Adherence to international arms and technology control regimes, such as the *Missile Technology Control Regime* (MTCR), has also impacted access to dual-use capabilities, such as those related to space launch.[207]

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[203] Office of Space Commercialization, "Revised Satellite Export Control Rules Published," 13 May 2014, online: https://www.space.commerce.gov/revised-satellite-export-control-rules-published/; U.S. Dept. of State, "Amendment to the International Traffic in Arms Regulations: Revision of U.S. Munitions List Category XV," 13 May 2014, online: https://www.federalregister.gov/documents/2014/05/13/2014-10806/amendment-to-the-international-traffic-in-arms-regulations-revision-of-us-munitions-list-category-xv; Industry and Security Bureau, U.S. Dept. of Commerce, "Revisions to the Export Administration Regulations (EAR): Control of Spacecraft Systems and Related Items the President Determines No Longer Warrant Control Under the United States Munitions List (USML)," 13 May 2014, online: https://www.federalregister.gov/documents/2014/05/13/2014-10807/revisions-to-the-export-administration-regulations-ear-control-of-spacecraft-systems-and-related; Office of Space Commerce, "New Rules Refine Satellite Export Controls," 10 January 2017, online: https://www.space.commerce.gov/new-rules-refine-satellite-export-controls/; U.S. Dept. of State, "Directorate of Defense Trade Controls," online: https://www.pmddtc.state.gov/FR/2017/82FR2889.pdf; Jeff Foust, "Federal Government Tweaks Space Export Control Rules," Space News, 12 January 2017, online: https://spacenews.com/federal-government-tweaks-space-export-control-rules/.

[204] Todd Harrison et al., "Beyond the RD-180, Center for Strategic & International Studies", March 2017, online: https://csisprod.s3.amazonaws.com/s3fs-public/publication/170321_Harrison_BeyondRD180_Web.pdf?xCcqM08DBsqdKdJOdUs3d7IBJnoTL8LP.

[205] Export.gov, "China-U.S. Export Controls," 30 July 2019, online: https://www.export.gov/apex/article2?id=China-Automotive-Components-Market.

[206] Information provided at the Space Security Working Group meeting in Montreal, 19-20 May 2018.

[207] Ankit Panda, "US Implementation of 'Major Defense Partner' Perks for India Underway," The Diplomat, 11 April 2017, online: https://thediplomat.com/2017/04/us-implementation-of-major-defense-partner-perks-for-india-underway; Agreement between the Government of New Zealand and the Government of the United States of America on Technology Safeguards Associated with United States Participation in Space Launches from New Zealand, art 3 s2(e), signed 16 June 2016 (entered into force 12 December 2016).

However, only 35 countries are regime members; non-members include China, Saudi Arabia, the UAE, Mexico, and Pakistan, as well as almost all African and Southeast Asian states.

Despite the development of new technology, competition in the space industry has been highly regulated due to the vested national interests and authoritarian export control regimes. This restrictions not only create hurdles for international cooperation but also limit the agency of private players. Such restrictions persists predominantly due to the oligopolistic nature of the space industry and the unwillingness of private players to introduce competition in their traditional market due to their perceived benefits accrued from sustaining such an oligopolistic structure.

Competition amongst States may also be driven by political decisions which may ultimately lead to the creation of a new market. For example, in order to circumvent US regulations, Europe initiated an ITAR-free, cost effective, commercially exploitable launch service and tapped into a niche launcher market. This not only benefited the European economy for employment but developed new markets and increased technology reliability and interoperability.[208] Heavy regulations due to ITAR created a knock-on effect of reducing manufacturing revenues for U.S. companies and encouraged the increase of the non-US manufacturing revenues coming from Europe, Russia, and China. Eventually, ITAR regulations lead to the loss of technology innovation for US companies and generated access to new markets in Europe, Asia, etc.

Strong protectionist policies favoured by all space powers are usually embedded in both politics and philosophy. Implementing such regulations can be a gamble because the repercussions of introducing them can go any which way, with private players refusing to participate and causing loss in revenue or States successfully protecting frontier technologies from crossing their borders.

[208] STELLA TKATCHOVA, SPACE-BASED TECHNOLOGIES AND COMMERCIALIZED DEVELOPMENT : ECONOMIC IMPLICATIONS AND BENEFITS (Engineering Science Reference) (2011) at p. 160.

In either scenario it is necessary to reassess our priorities and understand that competition can only flourish when States also cooperate with one another.

III. SPACE AS A TOOL FOR COOPERATION

International cooperation has been a defining feature of civil space programs, as it is only by pooling the extensive financial resources and technical capabilities required has space access, particularly space exploration, been possible. Cooperation in this way has led to the expansion of global capacity, as well as increased capacity by States and agencies. There is significant cooperation around global utilities, responding to the threat of NEOs, space weather, and space situational awareness, as well as between military space programs. Cooperation has enhanced transparency of certain civil programs that could potentially have military functions,[209] and amplified strategic competition, vertical economic integration and converging views in international relations.[210]

Cooperation under international law is often guided by the Declaration of Principles of International Law Concerning Friendly Relations and Cooperation Among States which proclaims that,

> "States have the duty to co-operate with one another, irrespective of the differences in their political, economic and social systems, in the various spheres of international relations, in order to maintain international peace and security and to promote international economic stability and progress, the general welfare of nations and international co-operation free from discrimination based on such differences." [211]

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[209] Roy Gibson, *The History of International Space Programs,* 23 SPACE POLICY (2007) at 155.

[210] Jana Robinson et al., "State Actor Strategies in Attracting Space Sector Partnerships: Chinese and Russian Economic and Financial Footprints, Executive Summary, Prague Security Studies Institute", 31 March 2019, online: https://www.pssi.cz/download/docs/8199_7930-pssi-space-sector-capture-executive-summary.pdf.

[211] Declaration on Principles of International Law Concerning Friendly Relations and Co-operation Among States in Accordance with the Charter of the United Nations, GA Res 2625 (XXV), UN GAOR, 25th sess, 1883rd plen mtg, Agenda Item 85, UN Doc A/RES/2625 (24 October 1970) [hereinafter referred as Declaration on Friendly Relations].

This duty is also reiterated in Article III of the OST, which obligates States to carry on activities in the "exploration and use of outer space, in the interest of promoting international cooperation and mutual understanding", however, this general obligation is broad in scope and serves primarily as a principle to guide State actions.[212] Unlike the obligation to maintain international peace and security, promoting international cooperation and mutual understanding are not attached to enforceable norms such as Article 2, Article 24 and Article 25 of the UN Charter, as a result, this general obligation has been criticized as simply reflecting the good intentions of States, but in no way firmly committing them to specific actions.[213]

However, the spirit of international cooperation continues to guide various space missions. The earliest being the Apollo-Soyuz Test Project, which saw two Cold War rivals work collaboratively to achieve a joint docking in space. The ISS is another prominent example of international civil space cooperation: a multinational effort with a focus on scientific research at an estimated cost of more than $150-billion to date, involving cooperation amongst five project partners being NASA, Roscosmos, ESA, JAXA, and the CSA.[214]

By the end of 2018, the ISS had hosted 236 astronauts from 18 countries,[215] ensuring that the Space Station transcended geopolitical tension.[216] All the State partners have committed to the

[212] See, Aldo Cocca, *The Advances In International Law through the Law of Outer Space*, 9 SPACE LAW 13 (1981) at 18.

[213] See, Henri A.Wassenbergh, "The International Regulation of an Equitable Utilization of Natural Outer Space Resources" in PROCEEDINGS OF THE THIRTY-NINTH COLLOQUIUM ON THE LAW OF OUTER SPACE at 138 (New York: AIAA, 1996).

[214] NASA, "NASA Signs International Space Station Agreement with Brazil," 14 October 1997, online: https://www.nasa.gov/centers/johnson/news/releases/1996_1998/h97-233.html.

[215] NASA, "International Space Station," 28 February 2019, online: https://www.nasa.gov/press-release/nasa-astronaut-nick-hague-set-for-new-space-station-mission-after-abort.

[216] Rossiya Segodnya, "NASA, ESA Understand Major Setback Inevitable if Cooperation Stops – Roscosmos," OANA, 31 July 2017, online: http://www.oananews.org/content/news/technology/nasa-esa-understand-major-setback-inevitable-if-cooperation-stops-roscosmos; Tass, "US Sanctions Do Not Apply to Russia's Lunar Projects with NASA and ESA," 14 November 2017, online: http://tass.com/science/975635.

operation of the ISS until 2024,[217] but the nature of cooperation around the ISS is slowly evolving. Russia now wants to end its reliance on the United States for satellite communication with the ISS,[218] while the United States is developing the public-private Commercial Crew Program to achieve independent access,[219] and is pursuing options for commercial use and operation of its segment.[220] Furthermore, next-generation projects to the Moon and Mars have the potential to broaden Russian cooperation with China[221] and India, as well as other emerging space programs.[222]

Allowing States to pool resources and expertise, international civil-space cooperation has played a key role in disseminating technical capabilities to access space. Such cooperation has been critical to the development of advanced capabilities in different countries for example, Iran and the UAE. Capacity-building is becoming a stronger feature of international cooperation, examples include the KiboCUBE initiative by UNOOSA and JAXA makes available Japan's Kibo module for the deployment of CubeSats from the ISS by educational and research institutions from developing countries.[223] Through JAXA's existing KiboCUBE program with UNOOSA, the ISS continued to

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[217] The White House, "Obama Administration Extends International Space Station until at Least 2024," Blog, 6 January 2014, online: https://blogs.nasa.gov/bolden/2014/01/08/obama-administration-extends-international-space-station-until-at-least-2024/.

[218] Jeff Foust, "Russia Plans to End Dependence on U.S. Satellites for Communication with ISS," Space News, 16 May 2017, online: http://spacenews.com/russia-plans-to-end-dependence-on-u-s-satellites-for-communication-with-iss.

[219] Stephen Clark, "NASA Could Extend Space Station Stays as Hedge Against Commercial Crew Delays," Spaceflight Now, 16 April 2018, online: https://spaceflightnow.com/2018/04/16/nasa-could-extend-space-station-expeditions-as-hedge-against-commercial-crew-delays/.

[220] NASA, "NASA Opens International Space Station to New Commercial Opportunities, Private Astronauts," Press release, 7 June 2019, online: https://www.nasa.gov/press-release/nasa-opens-international-space-station-to-new-commercial-opportunities-private.

[221] Sputnik News, "Russia Set to Boost Space Cooperation with India and China," 24 April 2014, online: http://sputniknews.com/russia/20140424/189350808.html.

[222] NASA, "NASA's Lunar Outpost Will Extend Human Presence in Deep Space," 2 May 2018, online: https://www.nasa.gov/feature/nasa-s-lunar-outpost-will-extend-human-presence-in-deep-space.

[223] UNOOSA, "The United Nations/Japan Cooperation Programme on CubeSat Deployment from the International Space Station (ISS) Japanese Experiment Module (Kibo) 'KiboCUBE,'" online: https://www.unoosa.org/oosa/en/ourwork/psa/hsti/kibocube.html.

deploy satellites for educational institutions from developing countries; in May, Kenya's first CubeSat was launched from the ISS,[224] while Bhutan's first satellite was launched in June 2018.[225]

Along with Japan, China and India are also making developmental plans.[226] China plans to train astronauts from developing countries,[227] while India aims to provide international training on civil space applications and the use of space data at the Indian Institute of Remote Sensing and the Centre for Space Science and Technology Education in the Asia Pacific Region.[228]

Even the latest UNISPACE+50 celebration, brought forward one of the first out of seven thematic priorities which intends to expand global partnerships on space exploration and innovation. The plan of the theme was to "promote cooperation between spacefaring States and emerging space States," so that exploration becomes "open and inclusive on a global scale."[229] To commemorate this occasion, ISRO announced UNI-space Nanosatellite Assembly and Training (UNNATI), a new capacity-building program to train 90 officials from 45 countries in the manufacture of nanosatellites,[230] also at this event, China formally invited participation by State Members of UN COPUOS in its planned Chinese Space Station.[231] The call reflected the 2016

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[224] Ibid.

[225] Penna Seldon, "Bhutan Launches its First Satellite into Space," The Bhutanese, 30 June 2018, online: https://thebhutanese.bt/bhutan-launches-its-first-satellite-into-space.

[226] UNOOSA, "Capacity-building," online: http://www.unoosa.org/oosa/en/ourwork/topics/capacity-building.html.

[227] Space Daily, "China, U.S. Hold First Dialogue on Outer Space Safety," 16 May 2016, online: https://www.spacedaily.com/reports/China_U_S__hold_first_dialogue_on_outer_space_safety_999.html.

[228] ISRO, "International Cooperation," 2008, online: www.isro.org/scripts/internationalcooperations.aspx.

[229] UNOOSA, "UNISPACE+50: Thematic Priorities", 2018, p. 3, online: https://aunl.org/document/9329967/unispace-50-thematic-priorities--unoosa.

[230] Gwyn D'Mello, "ISRO Is So Good at Launching Nano-satellites, We Will Now Teach 45 Countries on How to Do it," India Times, 18 January 2019, online: https://www.indiatimes.com/technology/science-and-future/isro-is-so-good-atlaunching-nano-satellites-we-will-now-teach-45-countries-on-how-to-do-it-360667.html.

[231] UNOOSA, "United Nations and China Invite Applications to Conduct Experiments On-board China's Space Station," 28 May 2018, online: http://www.unoosa.org/oosa/en/informationfor/media/2018-unis-os-496.html;

MoU between China and UNOOSA to "develop the space capabilities of United Nations Member States via opportunities on-board the CSS."[232] China and UNOOSA also signed a Declaration of Intent to cooperate on the Belt and Road Spatial Information Corridor.[233]

While critics may not consider the principle of international cooperation as a hard legal obligation under treaty law calling for specific actions, it still plays an important role in the realm of technology sharing, development, transfer and capacity building. However, it leaves us to wonder, (i) what makes States cooperate on certain projects and not on others? (ii) and, what is the philosophy behind international cooperation or competition in space?

IV. MILITARIZATION OF OUTER SPACE & NATIONAL SPACE POLICY

The development, publication and implementation of national policy and strategy promotes greater transparency and predictability of space activities by describing the principles and objectives of national space actors with respect to space access and use, however, few States publish comprehensive space policies that apply to all civil, military, and commercial domestic operators.[234] Despite lack of comprehensive space policies, virtually all national policies underscore the importance of international cooperation, suggesting that internationally all States do explicitly support the principles of peaceful and equitable use of space, however, the underlying theme of all their national policies remains promoting strategic competition in outer space.[235]

Andrew Jones, "Why China's Opening its Space Station to International Partners," GB Times, 31 May 2018, online: https://gbtimes. com/why-china-is-opening-its-space-station-to-international-partners.

[232] Ibid.

[233] Xinhua, "China, UN Enhance Ties on Outer Space Affairs," China Daily, 20 June 2018, online: https://www.chinadailyhk.com/articles/157/246/249/1529461756537.html.

[234] MINERO at 115.

[235] See generally, A. FROEHLICH & V. SEFFINGA, ED., NATIONAL SPACE LEGISLATION: A COMPARATIVE AND EVALUATIVE ANALYSIS, (Springer) (2018).

The lack of international controls in the transfer or trading of technology necessitates each individual State to be burdened with the unilateral responsibility of technology trade regulation with respect to civil and commercial space items. As elucidated earlier, the dual-use nature of space technologies complicates matters due to the nexus between space launch vehicles and ballistic missiles, as well as the abundance of military space applications and other military related benefits derived from space exploration, use, and technologies, creating additional technology proliferation and related security concerns for States.[236] The result is a non-harmonized, fractured system of trade and proliferation controls where each State imposes its own regulatory standards and makes unilateral decisions on exports, trade, and exchange.

This lack of an internationally harmonized control and proliferation regime also creates a political atmosphere of mistrust, due to which States are rightfully concerned about unauthorized technology transfers and the utilization of space technologies by foreign States/actors. The absence of international regulations, compliance, verification, and enforcement mechanisms compels States to restrict international civil and commercial space endeavours to the extent necessary to protect bona-fide national security interests.[237]

Under Article 2 of the UN Charter,

> "all Members shall refrain in their international relations from the threat or use of force against the territorial integrity or political independence of any State, or in any other manner inconsistent with the Purposes of the United Nations."[238]

This is considered a bedrock principle of the modern international State system; however Article 2 does not prohibit States from producing and/or procuring implements of military force, including space related goods and technologies. As sovereign States have the legal right to create

[236] MINERO at 130.

[237] MINERO at 131.

[238] The Charter of the United Nations, Article 1, 24 Oct. 1945, I UNTS XVI.

and maintain a military force, so long as the standing military force is not a threat to the territorial integrity or political independence of other State or to international peace and security.[239] This also includes space-based military assets.

In other words, the international legal system creates a community in which all States are granted legal sovereign rights based on equality, but that in practice States wield unequal power.[240] The sovereign power to maintain a standing military and to develop implements of war is shared equal amongst all States, but some States, due to their geography, resource allocation, or other factors, are able to sustain stronger military forces and its associated military technology base.[241]

Thus, established and emerging spacefaring nations alike emphasize the use of space systems to support national security, often pointing to the dual-use of assets for civil and military purposes. For example, Japan's third *Basic Plan on Space Policy*, adopted in 2015, is notable for its new focus on national security.[242] European space policy "recognizes that space technologies are often common between civilian and defence applications"[243]; the 2016 *Space Strategy for Europe* aims to enhance the use of European space capabilities for military and security purposes, specifically by "reinforcing synergies between civil and security space activities."[244] Space is also an element of

[239] See generally, IAN BROWNLIE, PRINCIPLES OF PUBLIC INTERNATIONAL LAW, 7th ed., (OUP) (2008) at 112.

[240] MINERO at 150.

[241] Ibid.

[242] Japan, "Current Status of Japan's Space Policy and Development of Legal Frameworks," UNOOSA, 14 April 2015, online: www.unoosa.org/pdf/pres/lsc2015/tech-03.pdf.

[243] ESA Director General, "Proposal for the European Space Policy", ESA BR-269, June 2007, online: http://www.esa.int/esapub/br/br269/br269.pdf; Council of the European Union, 4th Space Council Resolution on the European Space Policy, 22 May 2007, online: https://www.copernicus.eu/sites/default/files/2018-10/Resolution_EU_Space_Policy.pdf.

[244] European Commission, Space Strategy for Europe, 26 October 2016, p. 10, online: https://ec.europa.eu/transparency/regdoc/rep/1/2016/EN/COM-2016-705-F1-EN-MAIN.PDF.

the Commission's 2016 *European Defence Action Plan*[245] and the *Global Strategy for the EU's Foreign and Security Policy*.[246]

Space has long been used to support terrestrial military and security applications, but such use has traditionally avoided the placement of weapons in outer space. Almost all States formally support efforts to prevent the weaponization of outer space,[247] however, a growing number of States are now also seeing outer space as a warfighting domain and believe that conflict on Earth could extend to space or that conflict might begin in space.[248] Increasingly, the U.S. defence community sees space as a hostile environment that faces a growing probability of armed conflict or harmful activities; thus, as in other domains, warfighting is seen as a normal function of U.S. military forces operating in space.[249]

While the thinking that "space is no longer a sanctuary" is consistent with the 2011 *National Space Security Strategy* and 2016 *USAF White Paper*, the *Space Mission Force: Developing Space War fighters for Tomorrow*, stands out.[250] In this context, the 2017 *National Security Strategy* emphasizes unimpeded access to, use of, and freedom of action in space alongside a strategy of "peace through strength," and views freedom of action in space as a core element of U.S. national security.[251] Further, the

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[245] European Commission, "European Defense Action Plan: Towards a European Defence Fund," Press release, 30 November 2016, online: http://europa.eu/rapid/press-release_IP-16-4088_en.htm.

[246] EU, "Global Strategy," 24 July 2018, online: http://europa.eu/globalstrategy/en.

[247] See generally, A A Golroo & M Bahrami, *Distinction between Militarisation and Weaponisation of Outer Space, A Misleading Concept,* 51 PROCEEDINGS OF THE INTL INSTITUTE OF SPACE L 244 (2008) [hereinafter referred as 'Golroo & Bahrami'].

[248] See generally David Lihani, *Shifts in U.S. Export Controls Force Changes upon Commercial Satellite Manufactures and Space Launch Providers,* 42 PROCEEDINGS ON THE L OF OUTER SPACE 208 (1999).

[249] Ibid.

[250] USAF Space Command, "Space Mission Force: Developing Space Warfighters for Tomorrow", White paper, 29 June 2016, online: http://www.afspc.af.mil/Portals/3/documents/White%20Paper%20-%20Space%20Mission%20Force/AFSPC%20SMF%20White%20Paper%20-%20FINAL%20-%20AFSPC%20CC%20Approved%20on%20June%2029.pdf?ver=2016-07-19-095254-887.

[251] President of the United States, "National Security Strategy of the United States of America", December 2017, online: https://trumpwhitehouse.archives.gov/wp-content/uploads/2017/12/NSS-Final-12-18-2017-0905.pdf.

strategy declares an intent to respond to actions below the threshold of war that represent "continuous competition" and "irregular warfare."[252]

In comparison, while China is also formally against weaponizing outer space or making outer space a new battlefield,[253] China's first *Defense White Paper* on Military Strategy emphasizes the strategic concept of "active defence"—adherence to the unity of strategic defence and operational and tactical offense; to the principles of defence, self-defence, and post-emptive strike; and to the stand that "we will not attack unless we are attacked, but we will surely counterattack if attacked."[254]

The 2015 Russian *National Security Strategy* also articulates a desire to effectively use space for military and defensive purposes.[255] This strategy was preceded by an organizational shift in which Russia merged its air force and space command to form the Aerospace Forces.[256]

These examples highlight the existence of the security dilemma in the operation, use and trading of space technologies. It is this security dilemma that forces States to control the export of goods and technologies that may result in negative consequences for itself or for its citizens. This is most evident in military (or "sensitive") space goods and technologies, but it is not necessarily limited

[252] Ibid.

[253] Wang Qingyun, "Arms Race in Space Strongly Opposed," China Daily, 20 June 2018, online: http://www.chinadaily.com. cn/a/201806/20/WS5b29b943a3103349141dd3f8.html.

[254] The State Council Information Office (PRC), "China's Military Strategy", 26 May 2015, USNI News, online: https://news.usni.org/2015/05/26/document-chinas-military-strategy.

[255] Olga Oliker, "Unpacking Russia's New National Security Strategy," Center for Strategic & International Studies, 7 January 2016, online: http://csis.org/publication/unpacking-russias-new-national-security-strategy; Russian Federation President, "Russian National Security Strategy", December 2015 – Full text Translation, 31 December 2015, online: www.ieee.es/ Galerias/fichero/OtrasPublicaciones/Internacional/2016/Russian-National-Security-Strategy-31Dec2015.pdf; Olga Oliker, "Russia's New Military Doctrine: Same as the Old Doctrine, Mostly," The Washington Post Monkey Cage Blog, 15 January 2015, online: www.rand.org/blog/2015/01/russias-new-military-doctrine-same-as-the-old-doctrine.html.

[256] Matthew Bodner, "Russia Military Merges Air Force and Space Command," The Moscow Times, 3 August 2015, online: www.themoscowtimes.com/business/article/russianmilitarymergesairforceandspacecommand/526672.html.

to these goods.[257] Until the paradigm of self-interest is emasculated, export controls will exist, in one form or fashion, within the current national centric form.[258]

If the aforementioned security dilemma can be resolved, then export controls can evolve beyond the current paradigm of restrictions and limitations. For the limited purposes of facilitating greater international civil space cooperation, it may not be necessary to completely resolve this security dilemma, but instead to mitigate the potential risks faced by States engaging in cooperative outer space ventures. This type of mitigation may take the form of arms control, disarmament and proliferation agreements; however, it may still not necessarily incline States to cooperate with one another due to the relations States share with one another. This philosophy of the relationship between States and how it impacts security concerns shall be discussed below from the Kantian perspective of cosmopolitan law.

V. PHILOSOPHY OF SPACE EXPLORATION

Kant hypothesizes that the external relations among States are evolving towards a paradigm that he termed as 'league of nations' in which "even the smallest State could expect security and justice not from its own power and by its own decrees," but from "a united power acting according to the decisions reached under the laws of their united will."[259] In Kant's thinking, this teleological evolution is often frustrated because States have the legal authority to exercise an "unrestricted freedom in relations to others." This freedom of authority creates a self-justified security dilemma, a phenomena Kant terms the "guise of external well-being." [260]

[257] Golroo & Bahrami at 112.

[258] MINERO at 152.

[259] KANT at 19.

[260] Ibid at 21.

Kant reasons that there are two teleological propositions to the evolution of external relations amongst States. The first proposition, which Kant adopts, is that over time through "war, taxing and never-ending accumulation of armament" even in peacetime, States continue to suffer internally to a point of complete exhaustion without realizing that the appropriate action is to sacrifice their sovereign authority to wage war and cooperate with one another in the interests of a league of nations.[261] Fundamentally, this proposition is rooted in the logic and necessity of cooperation, when analogized to outer space it supports the proposition that appropriate State action is to relinquish unilateralism and engage in truly global civil space endeavours.[262]

The second proposition, which Kant declines to accept, is a teleological vision in which humanity fails to grasp the logic of cooperation. It is a rather apocalyptic vision in which he states that "discord is natural to our race, and no matter how civilized we may be now, we will be annihilating civilization and all cultural progress through our barbarous devastation."[263] In such a world, outer space would be but an extension of terrestrial conflict. Humanity would never achieve peaceful co-existence on Earth or in outer space. It is a future in which the failure of the international community to cooperate will result in a collective loss for mankind, perhaps even leading to the destruction of the human species.

However farce such proposition may appear, as a global community we are still obliged to cooperate as is necessary to resolve such threats. Today, threats to international peace and security go beyond traditional inter-State conflict and into diverse areas. Space law is no exception to this

[261] KANT at 18-19.

[262] MINERO at 120.

[263] KANT at 20.

evolution with emerging threats that include weaponization, space debris, and NEO collision threats.[264] Resolving these emergent threats legally require States to engage in greater cooperation.

International space law manifests within itself the philosophical principle, that international law should serve human interests.[265] Hence, the most important interest for humanity, under international space law regime, is that outer space is maintained as a province of mankind and not relegated to the terrestrial historical exemplar of sovereign appropriation. Comparing current State practice to the standards set by the principles in international space law; a lacuna is revealed. As reflected by the current legal mechanism of space technology trade and controls, the international community operates within a fractured non-harmonized system in which unilateral national security interests are paramount.

In absence of any international engagement towards a truly global civil space cooperation there will likely be an evolution towards an oligarchic world order.[266] In the field of space technologies, if left unchecked, this bias should manifest itself as the exclusion of less powerful States from the full benefits of cooperating on space activities, including space technology development. National export control policies of spacefaring States will evolve to reflect a preference towards particular oligarch partners viewed as strategic. Thus, justifying discrimination against particular States and the exclusion of non-space-faring States on the grounds of national security, trade, and proliferation concerns.

Contextualizing Kant's hypothesize we may either reach cooperation only when States are truly frustrated from over protectionist tendencies or we may collectively head towards our mutually assured destruction, despite how far-fetched it may appear. Considering that space technology is

[264] MINERO at 120.

[265] Declaration on Friendly Relations.

[266] MINERO at 113.

an important piece of puzzle for future sustenance, it is important the States voluntary incline towards cooperation. As discussed earlier, it may be difficult to find a pattern in such voluntary cooperation and even more difficult to prove that such act constitutes as State practice.

VI. CONCLUSION

Without an effective international regime of space goods and technology control, States shall continue to protect against unauthorized technology transfers and use through unilateral measures. This fractured system of controls shall continue to be a hindrance to international cooperation in civil and commercial space endeavours. However, principles enumerated in space law jurisprudence, often originating from General Assembly resolutions, can serve as an objective metric to measure State action in this regard and provide guidance on questions of cooperation and global engagement.

The way forward for the international community would then be to develop a new global paradigm of space technology trade and proliferation controls with its strategic logic being that States benefit more from cooperation and transparency in their space activities than from unilateralism. This logic can also be furthered by linking space technology controls to an outer space disarmament agreement. Should States be triumphant in achieving disarmament in outer space, then they shall be successful in removing all strategic benefit of continuing unilateral military space technology development and production.

CHAPTER FIVE: INADEQUACIES IN THE CURRENT LEGAL FRAMEWORK

"The Earth is a very small stage in a vast cosmic arena. Think of the endless cruelties visited by the inhabitants of one corner of this pixel on the scarcely distinguishable inhabitants of some other corner, how frequent their misunderstandings, how eager they are to kill one another, how fervent their hatreds. Think of the rivers of blood spilled by all those generals and emperors so that, in glory and triumph, they could become the momentary masters of a fraction of a dot." – Carl Sagan

I. INTRODUCTION

As a basic multilateral document, an international treaty or convention attempts to secure agreement among sovereign nations to act in a particular manner, or to refrain from certain behaviour, providing States three elementary reasons to comply with international law ; (a) the signatory States have a "genuine concern for the issue or a stake in the regulated industry and want to influence treaty rulemaking;"[267] (b) the cost of compliance is relatively low compared to the higher cost of noncompliance;[268] and (c) the of fear of the consequences of noncompliance.[269] Thus, public international law through the treaty mechanism examines the conduct of States among themselves as well as the conduct of States towards individuals.[270]

Similarly, the OST as an international treaty intends to prescribe behaviour, set norms and limitations with respect to the exploration and use of outer space. While its limited vocabulary may not encompass all issues pertaining outer space exploration, in context of the SDGs, it has been

[267] Daniel Vice, *Implementation of Biodiversity Treaties: Monitoring, Fact-Finding, and Dispute Resolution*, 29 N.Y.U. J. INT'L L. & POL. 577 (1997) at 631.

[268] Ibid at 632

[269] DAVID HARLAND, KILLING GAME: INTERNATIONAL LAW AND THE AFRICAN ELEPHANT (Praeger) (1994) at 8-10.

[270] Harold M. White Jr., *International Law and Relations* in NASA, SPACE SOCIAL SCIENCE (1980) online: https://er.jsc.nasa.gov/seh/law.html.

made abundantly clear by the COPUOS and UNOOSA that SDGs are an inextricable part of outer space exploration.[271] Discussions above pertaining OST were strictly limited to two essential themes - *first*, Article I of the OST and related principles and *second*, inaccessibility to space technology as an economic barrier with a focus on States and not individuals. The purpose of the current Chapter is to shift the focus from a State based narrative to an individual narrative and understand how the OST can serve individuals and the global community through a more inclusive interpretation, thereby achieving SDGs. Furthermore, it also focuses on the process of treaty making and how goals of treaty formulation can be aligned with geopolitical reality.

II. OUTER SPACE TREATY AND THE 'STRUGGLE FOR JUSTICE'

The current decade is slowly being shaped by the intention of making humanity 'multiplanetary' or a 'spacefaring' species, while some say it may not qualify as necessary, it is still going to be an enormous undertaking. If such an intention is to be realized, then it must not only be worth it, but also be justified. Leaders of capitalist economies, like Elon Musk and Jess Bezos consider human expansion into outer space inevitable,[272] however, they have successfully masked their capitalistic propositions under the guise of survivability; the argument being that if humanity is to survive, it must then move out into space and inhabit other worlds.

As tempting as it is to accept the world of human expansion, exploration of such distinct nature must always be accompanied by the ethical question of 'why'. Even when the OST was drafted the 'why' was implicit; the exploration of space was to benefit all of mankind and not the one side

[271] UNGA, Importance of Space Technology for Sustainable Development Among Issues Highlighted, Fourt Committee of the UNCOPOUS, Ga/SPD/239, 7th October 2002; Simonetta Di Piipo, "Space Technology and the Implementation of the 2030 Agenda", online: https://www.un.org/en/chronicle/article/space-technology-and-implementation-2030-agenda; UNOOSA, "Space Supporting the Sustainable Development Goals", online: https://www.unoosa.org/oosa/en/ourwork/space4sdgs/index.html.

[272] Kara Swisher, "Why are Elon Musk and Jeff Bezos, the world's richest men, so interested in space", 2 March 2021, online: https://cio.economictimes.indiatimes.com/news/corporate-news/why-are-elon-musk-and-jeff-bezos-the-worlds-richest-men-so-interested-in-space/81288772.

dominating terrestrial realms. Along with the 'why' another implicit assumption regarding space exploration is the 'who' - Why are we doing this? Who is it for?

It is necessary to raise this question as the space sector is overwhelmingly white and male and does not remotely represent our own society, let alone humanity as whole. This is particularly evident when they talk about values and visions. The multi-billionaires who aim to control the next generation of planetary exploration, aim to expand their riches from Earth to outer space. If the richest man on Earth plans on outer space exploration, it can be easy to imagine that he intends to capitalize its resources the way he capitalized resources on Earth.

These multi-billionaires suggest outer space as this powerful enabler for positive change without truly admitting that their aim will do absolutely nothing to change the status quo in society or eradicate the socio-economic or political inequality that exists. The law does not encumber explorers to be magnanimously philanthropic or munificent, however it does impose a positive duty to responsibly utilise the resources of outer space in a manner that best services mankind. It is essential that values such as empathy, solicitousness and compassion are recognised as being as fundamental to space exploration as the search for science and understanding. This cerebration was present even during the initial years of space exploration where funding's were primarily provided by the government.

For instance, the U.S. spent a whopping $25 billion for the Apollo program, a considerable investment in space for the 1960s. Due to this unprecedented governmental expenditure, thousands of demonstrators arrived at NASA's Kennedy Space Centre to meet with NASA's then administrator Thomas Paine.[273] The campaign leader, Ralph Abernathy believed that "a great nation ought to be able to take care of those who are less fortunate as well as undertake space

[273] Meghan Bartels, "Hundreds Demonstrated Against Poverty at Apollo 11 Moon Launch", 16 July 2019, online: https://www.space.com/apollo-11-launch-protest-poverty.html.

exploration." Roger Launius, former historian of NASA even acknowledged Abernathy's contention and said that the mission really showed "misplaced priorities of NASA". Thomas Paine then emphasized in his response to the protest that, great technological advances of NASA where child's play compared to the tremendously difficult task of solving of human problems. While the space program demonstrated what American people could accomplish with vision, leadership and adequate resources, the massive financial drain it caused in the government bursary wasn't unnoticed.

The meeting between Pain and Abernathy also tapped into the tenor of the administration lead by President Johnson and his slogan of declaring 'war on poverty'. Paine highlighted that this spirit of activism was also present at NASA during the time of his predecessor James Webb who planned the spin-off project. The aim of the spin-off project was to find space applications that could be utilised on Earth and account for the social aspect of the program. This discussion highlighted the need of space applications to transcend the limited world of outer space exploration by offering relief to the marginalized as well. Till date, space technologies are created with the intention of amplifying multiple use and ensuring interoperability to justify magnanimous government and private investments.

This brings us back to our basic questions – *first*, why is outer space exploration important? As in what activity must be prioritized? *Second*, who is this activity for? How can these people be accounted for during the innovation phase?

Outer space as a 'global common' is intrinsically tied to the well-being of the human race, as it offers immense potential to alter human life and provide alternative solutions to our problems. Instead of broaching the theme of human rights in outer space, this thesis rather aims to analyse how human rights are triggered if access to space technology and outer space is denied or granted. It also scrutinizes the triad between outer space, SDG and human rights. The discussion below ameliorates the nexus between these three varying concepts and establishes a foundation that can

help facilitate trading or access of space technology. Several links exist between space law and human rights, [274] however human rights may only be extended to space activities through Article III of the OST.

a. ARTICLE III OF THE OST AND HUMAN RIGHTS

Article III of the OST is considered as one of the most essential articles in the OST because it clarifies that international law, including the United Nations Charter applies to human activities in outer space. It is often read in conjunction with Article I, which also, refers to international law in relationship to the freedom of exploration of outer space.[275] It clarifies that space law is not a self-contained regime. [276] The general consensus states that while international law is applicable, OST shall be the *lex specialis* dealing with specific situations.[277] Thus, Article III of the OST is inclusive about the relation of space law to international law. Furthermore, the term 'activities' in Article III is inclusive of 'all activities' and does not limit itself to exploration and use of outer space, it also includes activities on Earth which are connected to outer space.[278]

While substantial part of international law applies to outer space, it cannot be applied in *toto*.[279] However, branches of international law that have undergone substantial developments in decades

[274] Paul Tavernier, Ilias I. Kuskuvelis, *Space Law and Human Rights: A Complementary Relationship Through the Right to Development*, Published by the AIAA, 11 May 1990.

[275] COLOGNE COMMENTARY at 275.

[276] Bruno Simma, Dirk Pulkowski, *Of Planets and the Universe – Self-contained Regimes in International Law*, 17 EJIL 484 (2006).

[277] OGUNSOLA O., INTERNATIONAL LAW AND OUTER SPACE ACTIVITIES (Martinus Nijhoff) (1975) at 24.

[278] COLOGNE COMMENTARY at 277.

[279] MANFRED LACHS ET AL., THE LAW OF OUTER SPACE : AN EXPERIENCE IN CONTEMPORARY LAW-MAKING (Martinus Nijhoff) (2010) at 15.

following the adoption of the UN Charter can apply to human activities in outer space. This includes international human rights.[280]

The human rights obligations of all UN Member States under the UN Charter, UN human rights Conventions and under general international law continue to evolve and confirm that '*(a)ll human rights are universal, indivisible and interdependent and interrelated'; 'it is the duty of States, regardless of their political, economic and cultural systems, to promote and protect all human rights and fundamental freedoms.*'[281]

The universality of human rights makes them extendable to outer space. Hence, denying access to space through a strategic or a political manoeuvre would then not only trigger the OST but also impinge upon human rights of those on Earth, who are being denied the prospect of a 'good life'. The human rights obligations of all UN Member States protects the 'moral powers' of individuals and allows them to pursue legal and social justice necessary for ensuring access to 'public good', in order to pursue a good life.[282] Thus, Article III of the OST allows individuals to pursue a 'good life' by gaining access to outer space and reaping benefits from space applications. SDGs overlap considerably with both human rights and ethics issues as well as space technology. This connection makes the SDGs, and their human rights components, a defining challenge of the emerging space generation. In order to define emerging space issues like that of 'access', we must also understand the overlap between SDGs and human rights.

[280] MENNO T KAMMINGA & MARTIN SCHEININ, THE IMPACT OF HUMAN RIGHTS LAW ON GENERAL INTERNATIONAL LAW (OUP) (2009).

[281] Vienna Declaration and Programme of Action, 25 June 1993, A/CONF.157/24; UN Resolution 63/116 of 10 December 2008.

[282] JOHN RAWLS & SAMUEL RICHARD FREEMAN, COLLECTED PAPERS (Harvard University Press) (1999) at 312 & 386.

b. SDG AND HUMAN RIGHTS

One of the reasons the SDGs and the 2030 Agenda are a transformative development framework is because they are based on human rights. Over 90% of the goals and targets of the SDGs correspond to human rights obligations. As Member States make progress on the SDGs, they make progress on their human rights obligations. This intersection between SDG and human rights is rather intentional as the earlier Millennium Development Goals (MDGs) served as a proxy for certain economic and social rights but ignored other important human rights linkages.

The SDGs are the result of the most consultative and inclusive process in the history of the United Nations, grounded in international human rights law, the agenda offers critical opportunities to further advance the realization of human rights for all people everywhere, without discrimination. The Office of the High Commissioner for Human Rights (OHCHR) aimed to ensure that in the process of defining SDGs there was a strong integration of human rights so that the implementation of SDG strategies and policies was human rights based.[283]

Achieving the 2030 Agenda SDG target requires disaggregated data that clearly reveals the most disadvantaged groups and those groups affected by discrimination, focusing on the need to progressively reduce inequalities across local, national, and global levels by strengthening the linkages to international human rights mechanisms. Achieving the transformational promise of the SDGs depends on ensuring the empowerment, inclusion and equality of all people by ensuring their interconnection with human rights.[284]

The intersection of space applications across different fields and international space law provides a unique environment for the realization of a governance framework, relevant to both individual

[283] UN OHCHR, "Human Rights and the 2030 Agenda for Sustainable Development", online: https://www.ohchr.org/en/issues/SDGS/pages/the2030agenda.aspx.

[284] UN OHCHR, "Empowerment, Inclusion, Equality: Accelerating Sustainable Development with Human Rights", online: https://www.ohchr.org/Documents/Issues/MDGs/Post2015/EIEPamphlet.pdf.

States and the international community. These space applications have the potential of achieving at least eleven SDGs from an overall seventeen SDGS.

In addition to the examples in Chapter II of this thesis, the following examples highlight the interplay of human rights, SDGs and space applications -

i. SDG-13 calls upon the international community to "take urgent action to combat climate change and its impacts". Particularly SDG 13.2 calls for the integration of climate change measures into national policies, strategies, and planning. The goal can be realized through a human rights approach, whereby space applications can be leveraged as a supportive tool for community-level human rights enforcement, such an approach directly addresses environmental impacts on the life of communities and individuals, promotes the rule of law in environmental practice, and broadens economic and social rights in embracing elements of the public interest in environmental protection. Conversely, the realization of human rights values and principles can help to address broader climate change initiatives. The rising threat of climate change has facilitated in the realization of the critical relationship between human rights and the environment, whereby space applications have been utilized to fulfil basic human rights like providing clean air, soil, and water to the population. Where human rights are inherent, inalienable, and universal; the use of space applications can support human rights by addressing climate change across local communities; and

ii. Space technologies in the context of international humanitarian law can be used on evidentiary basis to cover and monitor interstate civil and political conflicts. The Human Rights Watch has utilised satellite imagery from EO satellites to monitor and document the destruction of residential property in Myanmar to highlight the ongoing

human rights violations against the ethnic Rohingya population.[285] Thus, these examples offer an insight into the potential that the triad of space application, human right and SDG have to offer.

c. COSMOPOLITANISM IN OUTER SPACE AND HUMAN RIGHTS

As discussed in Chapter IV of this thesis, the function of outer space in context of space activities and human rights can be best understood through the lens of cosmopolitanism. Cosmopolitan human rights regime enables human beings to build a community of States that understands the promotion and protection of human rights worldwide as a common and shared responsibility,[286] such a community is based on the conviction that all human beings are members of a community and they share common human values that transcend the limits of Nation-States. Thus, cosmopolitan human rights regime provides standards and sets of values that no State can deliberately ignore.

In the current scenario with respect to SDGs, "cosmopolitan law creates and appeals to universal rights and duties beyond the claims of any one State. It is qualitatively different than national or international law, in the sense that it creates a larger community of States by providing a common vision and set of values"[287]

Even Habermas' model of cosmopolitan democracy insisted on reformation of the United Nations to not only include States but also citizens, the main focus being that a State's sovereignty is only valued as long as it serves its citizens, enforcing the need for sovereignty to be conceived as a

[285] Phil Robertson, "Burma: Satellite Imagery Shows Mass Destruction: 241 Villages Almost Totally Destroyed in Rakhine State", 19 September 2017, online: https://www.hrw.org/news/2017/09/19/burma-satellite-imagery-shows-mass-destruction.

[286] WILLY MOKA-MUBELO, RECONCILING LAW AND MORALITY IN HUMAN RIGHTS DISCOURSE : BEYOND THE HABERMASIAN ACCOUNT OF HUMAN RIGHTS (Springer) (2017).

[287] Ciaran Cronin, *Cosmopolitan Democracy* in BARBARA FULTNER, JURGEN HABERMAS : KEY CONCEPTS (Taylor and Francis) (2014) at 198.

responsibility and not mere autonomy. This ensures that sovereignty is no longer restricted to simply maintaining law and order but also includes proactive and effective protection of civil rights of citizens.[288]

The current Westphalian UN intergovernmental structures are focused more on maintaining 'sovereign equality of States' that protects governments rather than citizens and their human rights. Furthermore, human rights are rarely effectively protected in most worldwide or regional economic agreements.[289] Thus, it is important to assert that human rights are 'indivisible' and 'interdependent' on civil, political, economic, social, and cultural rights.[290] It is essential that "rights are granted in a way that is practical and effective and not theoretical and illusory."[291] This especially applies to principles enshrined under the OST, as rights granted under Article I often appear illusory and non-exercisable.

Viewing space applications, SDGs, and human rights from a cosmopolitan perspective entails the States 'duty to protect' and to 'struggle for justice' so as to avoid contributing to injustices.[292] Especially when we juxtaposition human rights and access to a 'public good' or 'global common', cosmopolitan law ensures that the 'public good' is viewed from a national security, economic and

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[288] INTERNATIONAL COMMISSION ON INTERVENTION AND STATE SOVEREIGNTY ET AL., THE RESPONSIBILITY TO PROTECT : REPORT OF THE INTERNATIONAL COMMISSION ON INTERVENTION AND STATE SOVEREIGNTY (International Development Research Centre) (2001) at 7.

[289] J. Habermas, *Plea for a Constitutionalization of International Law*, 40 PHILOSOPHY AND SOCIAL CRITICISM, 5–12 (2014) at 7.

[290] David Tan, *Towards a New Regime for the Protection of Outer Space as the Province of All Mankind*, 25 YALE J INTI L 1 (2000) at 145 [hereinafter referred as 'David Tan'].

[291] Jodie Kirshner, "The Role of the European Convention on Human Rights in the Wake of Kiobel, 25 July 2013, online: https://www.ejiltalk.org/the-role-of-the-european-convention-on-human-rights-in-the-wake-of-kiobel/.

[292] THOMAS POGGE, WORLD POVERTY AND HUMAN RIGHTS : COSMOPOLITAN RESPONSIBILITIES AND REFORMS (Polity) (2002).

human rights perspective.[293] This theory may also be applied to space technology which can be viewed as a military sensitive "public good" requiring substantial investment. However, such considerations may only be entertained so far as it does not impede upon the application of space technology from a human rights perspective.

III. INADEQUACY IN THE CURRENT LEGAL FRAMEWORK

Ostensibly the current legal framework suffices in answering complex questions of law despite the treaty being fifty-four years behind the current technology, however the system is plagued with procedural inadequacies that have resulted in failure of formation of substantive law that would prove to be more apt at handling contemporary challenges.

a. TREATY OBLIGATIONS AND CUSTOMS

As discussed above, traditional theories of the nature of obligation in international law are positivist and individualistic, reflecting a preoccupation with the preservation of State sovereignty i.e. States are bound by international law only insofar as they consent to its rules.[294] While treaty law binds only those States which have accepted its obligations, customary international law binds States generally, whether or not they have formally consented to its rules.[295] Custom comprises of

[293] GILLIAN BROCK, GLOBAL JUSTICE : A COSMOPOLITAN ACCOUNT (OUP) (2009); See generally Chapter III of MARTHA C NUSSBAUM, CREATING CAPABILITIES : THE HUMAN DEVELOPMENT APPROACH (Belknap Press of Harvard University Press) (2011).

[294] ANTONIO CASSESE, INTERNATIONAL LAW IN A DIVIDED WORLD (Clarendon Press) (1986) at 110-19; LOUIS HENKIN ET AL., POLITICS, VALUES, AND FUNCTIONS : INTERNATIONAL LAW IN THE 21ST CENTURY : ESSAYS IN HONOR OF PROFESSOR LOUIS HENKIN (Martinus Nijhoff) (1997) at 45-46; Michael Akehurst, *Custom as a Source of International Law*, 47 BRIT. Y.B. INT'L L. 1(1974) at 51; Michael Akehurst, *Nicaragua v. United States of America*, 27 INDIAN J. INT'L L. 357(1987) at 360 ; Prosper Weil, *Towards Relative Normativity in International Law*, 77 AM J. INT'L L 413 (1983) at 420.

[295] Michael Akehurst, *Custom as a Source of International Law*, 47 BRIT. Y.B. INT'L L. 1(1974) at 51; Jonathan Charney, *The Persistent Objector Rule and the Development of Customary International Law*, 56 BRIT. Y.B. INT'L L. 1 (1986) at 18 [hereinafter referred as 'Charney']; Christian Tomuschat, *Obligations Arising for States Without or Against Their Will*, 241 RECUEIL DES COURS 194 (1993) at 281-82.

two elements: the usage or practice of customary international law ('State practice') and *opinio juris sive necessitatis*, the belief that the usage is a legal right ('*opinion juris*').[296]

The reason customs are an important tool in international law is because it ensures that basic principles of law are adhered and cannot be circumvented on account of State sovereignty. This feature of custom may, however, be reconciled with the consensual theory of international law by the controversial "persistent objector" principle, which permits a State to opt out of a particular customary norm in the process of formation.[297] Nevertheless the persistent objector principle is consistently accorded a very restricted scope and is regarded as inapplicable to a norm of *jus cogens.*[298]

In space law while treaty obligations are vague and unclear there are no customary rules that specifically guide States with respect to 'benefit sharing'. State practices in this regard are sparce and it creates no legal right with respect to the practice that already exists, this is because the principle of 'province of all mankind' serves as a limitation on the freedom of exploration and appears to lack the requisite *opinio juris* to attain the status of a customary norm. It does not "constitute a principle sufficiently normative in character that it becomes capable of generating specific legal effects or enhancing particular value expectations."[299]

As discussed in Chapter III of this thesis, the use and exploration of outer space as the 'province of all mankind' is not well-defined enough to impose any concrete obligations on States to ensure

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[296] Continental Shelf (Libya v. Malta), 1985 I.CJ. 13, 20 (June 3).

[297] Nuclear Tests (Austl. v. Fr.; N.Z. v. Fr.), 1974 I.C.J. 253, 286-93 (Dec. 20); Fisheries (U.K. v. Nor.), 1951 I.C.J. 116, 131 (Dec. 18); Asylum (Colom. v. Peru), 1950 I.C.J. 266, 277-78 (Nov. 20); Herbert Briggs, *The Colombian-Peruvian Asylum Case and Proof of Customary International Law*, 45 AM J. INT'L L. 728 (1951) at 730; David Colson, *How Persistent Must the Persistent Objector Be?*, 61 WASH L. REV 957, 965-70 (1986); Ted Stein, *The Approach of the Different Drummer: The Principle of the Persistent Objector in International Law*, 26 HARV. INT'L L. J. 457 (1985) at 458-63.

[298] Vienna Convention on the Law of Treaties, Article 53-54, 1155 U.N.T.S. 331, 23 May 1969.

[299] Christopher Joyner, *Legal Implications of the Concept of the Common Heritage of Mankind*, 35 INT'L & COMP. L.Q. 190 (1986) at 197.

equality in access to space. Furthermore, there is no sufficiently broad-based State conduct and behaviour to attest to the widespread acceptance of 'benefit sharing' principle, due to vague treaty obligations and negligent customs. Hence, there may be a need to either create a new legal regime or address the procedural inadequacies in the current framework which creates such vague treaty obligations in the first place.

b. PROCEDURAL INADEQUACIES AND THE EFFICACY OF LEGAL INSTRUMENTS

1. CONSENSUS TRADITION AND UNCOPUOS

The negotiation process of the space treaties from the late 1950s to the 1970s highlights the competing interest of the States and each Party's intention to influence the rulemaking. It is due this vast disparity between the States that the consensus mechanism of the COPUOS was introduced to ensure legal equality amongst them. The consensus methodology, also known as the rule of 'unanimous consent,' impels each negotiating member to search for the lowest common denominator, this is because, 'compromises' or 'package deals' achieved in small circles"[300] may or may not survive to become the final result.

Despite its intentions, the consensus mechanism traditionally has contributed to the difficulty of the negotiation process.[301] Motivated by the highest of ideals, but constrained by political compromises, the consensus methodology employed by the COPUOUS has proven to give ineffective space treaty regimes as they fail to adequately address the current legal problems that plague the space environment.[302] The analysis of Article I of the OST in Chapter III of this thesis has clarified that its scope is sufficiently broad to give room to lengthy debates on the complex

[300] Winfried Lang, *Diplomacy and International Environmental Law-Making: Some Observations*, 3 Y.B. INT'L ENVTL. L. 108 (1992) at 113.

[301] David Tan at 145.

[302] Ibid.

meaning of international co-operation in the context of 'benefit sharing', especially between the relationship of developed and developing countries, and the particular nature of the obligation placed on those Sates that conduct space activities.[303]

Although the principle of unanimous consensus adopted as the working procedure of COPUOS can cause and has resulted in drawn-out negotiations, it has at times encouraged compromises.[304] As space treaty regime based on excessive influence by the space powers would eventually be rejected by subsequent spacefaring nations and could jeopardize the orderly operations of space activities in the future, making it is important to concentrate on finding the right balance between political exigencies and the need for precise legal wording that imposes obligations on signatory States.

Traditionally, the 'international regime' that emerges at the end of the day "frequently involves intense bargaining that leads to critical compromises".[305] The advantage of it, is the creation of a treaty which secures immediate widespread acceptance, however, the provision of a treaty does not of itself ensure a hard obligation. If a treaty is to be regarded as creating 'hard' obligations, i.e., possessing some autonomous binding norms, it must be precisely worded and specify the exact obligations undertaken by signatory States. The OST is a product of the 'unanimous consent' approach with acceptance from 111 Parties and 23 Signatories. Despite, its widespread acceptance, the drafting of the OST was encumbered by the political negotiations and the 'unanimous consent' approach and led to vague legal language that failed to provide binding legal obligations.[306]

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[303] N. Jasentuliyana, *Article I of the Outer Space Treaty Revisited*, 17 J. SPACE L. 129 (1989).

[304] Ibid.

[305] ORAN R YOUNG, INTERNATIONAL COOPERATION : BUILDING REGIMES FOR NATURAL RESOURCES AND THE ENVIRONMENT (Cornell University Press) (1989) at 22.

[306] IAN BROWNLIE, PRINCIPLES OF PUBLIC INTERNATIONAL LAW (OUP 7th) (2008) at 287-88; Geoffrey Palmer, *New Ways To Make International Environmental Law*, 86 Am. J. Int'l L. 259 (1992) at 27-278; See, Hague Declaration on the

An analysis of the unanimous consent approach often leads policy makers to question whether hard law through treaty making can resolve current global issues if they are riddled with vagueness. Should soft law then be an appropriate tool that offers clear obligation and precise duties for the community?

2. HARD LAW V. SOFT LAW

International space law as currently formulated neglects in providing a comprehensive and detailed framework for dealing with space exploration and use, as any convention that attempts to impose hard obligations at the outset without taking into account the interests of the space powers gets condemned to obsolescence,[307] an example being the Moon Agreement. In light of the inadequacy of hard law with respect to 'accessibility' in outer space, it may be advocated that use of other legal instrument may be preferable should it transpire wide acceptance.

Discourse on this subject matter has shed led on the insufficiency of the OST as regards to the inequality in accessing in outer space. However, attempts to bridge a legal gap in rights and duties through introduction of amendments to the OST, especially Article I, may amount to diplomatic impasse as treaties take time to replace or amend, and the attempt to do so can result in an awkward and overlapping network of old and new obligations between different sets of Parties. One of the better examples of the confused state of the law that sometimes results from repeated treaty revisions is the 1929 Warsaw Convention Relating to International Carriage by Air.[308]

Provided the Parties are in agreement, a soft-law resolution, recommendation, or decision can perform the function of interpreting and amplifying a more general treaty text without the need

Environment, 28 I.L.M. 1308, 11 March 1989, in which 24 states accepted the abolition of the unanimous consent rule.

[307] Jutta Brunnée, Stephen J. Toope, *Environmental Security and Freshwater Resources: Ecosystem Regime Building*, 91 AM J. INT'L L. 31 (1997) [hereinafter referred as 'Jutta & Toope'].

[308] Richard Gardiner, *Revising the Law of Carriage by Air: Mechanisms in Treaties and Contract*, 47 ICLQ 278 (1998).

for formal amendment of the treaty. Soft law obligations with respect to Article I of the OST can help amplify the intention of the treaty as it would be likelier to succeed, in the absence of *lex lata*.[309]

Now, there are four reasons why soft law represent an alternative to law making by treaty.[310] *First*, it may be easier to reach agreement when the form is non-binding. *Second*, soft-law instruments are more flexible.[311] *Third,* it may be easier for States to adhere to non-binding instruments because they can avoid the domestic treaty ratification process. *Last*, soft-law instruments provide immediate evidence of international consensus on an agreed text.[312]

While treaties may carry greater weight than soft-law instruments, they are only effective insofar as they become part of national law on ratification, or when they indicate a stronger commitment to the norms and principles in question.[313] For new law, however, non-binding instruments may be useful if they can show widespread and consistent State practice and/or provide evidence of *opinio juris* in support of a customary rule.[314]

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309 Jonathan Charney, *Universal International Law*, 87 AM J. INT'L L. 529 (1993) at 543-47; John Quigley, *The New World Order and the Rule of Law*, 18 SYRACUSE J. INT'L L. & COM. 75 (1992) at 108-09

310 Christine Chinkin, *The Challenge of Soft Law: Development and Change in International Law*, 38 ICLQ 850 (1989)[hereinafter referred as 'Chinkin']; Kenneth Abbott, Duncan Snidal, *Hard and Soft Law in International Governance*, 54 INT ORG 421(2000); Hartmut Hillgenberg, *A Fresh Look at Soft Law*, 10 EJIL 499 (1999); Hanspeter Neuhold, *The Inadequacy of Law-Making by International Treaties: 'Soft Law' as an Alternative?* in RÜDIGER WOLFRUM AND VOLKER ROBEN (EDS), DEVELOPMENTS OF INTERNATIONAL LAW IN TREATY MAKING (Heidelberg, 2010) at 40.

311 Anthony Aust, *The Theory and Practice of Informal International Instruments*, 1 ICLQ 787 (1986) at 791.

312 Alan Boyle, *The Choice of a Treaty: Hard law versus Soft law* in DAVID MALONE, SANTIAGO VILLALPANDO, SIMON CHESTERMAN (ED.), THE OXFORD HANDBOOK OF UNITED NATIONS TREATIES (2019) at 2.

313 Kenneth Abbott, Duncan Snidal, *Hard and Soft Law in International Governance*, 54 INT ORG 421(2000) at 427; Kal Raustiala, *Form and Substance in International Agreements*, 99 AJIL 581 (2005); Andrew T. Guzman, *The Design of International Agreements*, 16 EJIL 579 (2005).

314 Alan Boyle, *The Choice of a Treaty: Hard law versus Soft law* in DAVID MALONE, SANTIAGO VILLALPANDO, SIMON CHESTERMAN (ED.), THE OXFORD HANDBOOK OF UNITED NATIONS TREATIES (2019) at 4.

In this regard, the biggest difference between a treaty and a soft law is that, a treaty influences State practice and provides evidence for *opinio juris* or an existing law. [315] While, soft law is an evidence of State practice that generates new law. [316] It can also be an evidence of existing law or *opinio juris*,[317] however it is mostly relied to present a new legal clarification. Furthermore, widespread acceptance of soft-law instruments tends to legitimize conduct and make the legality of opposing positions harder to sustain.[318]

The reason why soft law is important is because soft-law instruments may acquire binding legal character as elements of a treaty-based regulatory regime, or constitute "a subsequent agreement between the parties regarding the interpretation of a treaty or the application of its provisions."[319] The ILC commentary to Article 31(3)(a) of the Vienna Convention on the Law of Treaties notes that "… *an agreement as to the interpretation of a provision reached after the conclusion of the treaty represents an authentic interpretation by the parties which must be read into the treaty for purposes of its interpretation*."[320]

The ICJ has acknowledged the relevance of soft-law instruments for the interpretation of treaty provisions,[321] provided they are adopted by consensus, they may constitute either a subsequent agreement on interpretation of the treaty or subsequent practice pursuant to Articles 31(3)(a) and

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[315] North Sea Continental Shelf Cases (Ger. v. Den..), 1969 ICJ Rep. 3, (Feb. 20); Legality of the Threat or Use of Nuclear Weapons, Advisory Opinion, 1996 ICJ Rep. 226, (July 8).

[316] Western Sahara, Advisory Opinion, 1975 ICJ Rep. 12, (Oct. 16) at p. 48-74, especially Judge Dillard at p. 120-123; Military and Paramilitary Activities in and Against Nicaragua, (Nicar v. U.S.), Merits, Judgement, 1986 ICJ Rep 14 (June 27) at p. 172-209.

[317] Legality of the Threat or Use of Nuclear Weapons, Advisory Opinion, 1996 ICJ Rep. 226, (July 8) at ¶68–73; Texaco Overseas Petroleum Company v Libya (1977) 53 ILR 389.

[318] Chinkin at 851.

[319] Vienna Convention on the Law of Treaties, Article 31(3)(a), May 23, 1969, 1155 UNTS 331.

[320] International Law Commission, *The Law of Treaties - Commentary to Article 27*, at ¶14 in ARTHUR WATTS ET AL., THE INTERNATIONAL LAW COMMISSION, 1949-1998 (OUP) (1999) at 689.

[321] Kasikili/Sedudu Island Case (Bots. V. Namib.) 1999 ICJ Rep. 1045 at p. 1075–1076 ¶47–51; See also, ILC Report, Preliminary conclusions by the Chairman of the Study Group on the subject of Treaties over Time, ILC, Sixty-third session, 2011, GAOR, Supp No 10 (A/66/10) at 281–84.

(b) respectively.[322] If the parties subsequently wish to add to or change their previous interpretation or practice they are free to do so by the simple expedient of adopting another resolution as long it does not change the object and purpose of the treaty.[323] Thus, obligations with respect to benefit sharing and access to space under Article I of the OST may be clarified be relying upon soft-law instruments that can constituent as subsequent agreements.

While soft law amplifies or supplements treaties[324] by providing different ways of understanding its legal effect, it can also be the first step in a negotiating process eventually leading to the conclusion of a multilateral treaty. Lastly, soft-law ensures inclusivity by ensuring maximum participation and helps elaborate subsidiary rules, standards and protocols.[325]

Its shortcomings include the lack of precision in such political commitments and the absence of enforceable legal sanctions,[326] as observed in various space law resolution. However, these shortcomings are equally applicable on all United Nations Space Treaties as they fail to impose sanctions upon State Parties. With respect to soft law, although individual States might be tempted by short-term gains to violate their soft-law obligations, in many situations they will find that their long-term goals are likely to be served better by compliance.[327]

Where hard law has failed, "soft law," combined with a committed regime building approach, may triumph. For example, Article 11 of the Moon Agreement requires the creation of a regime to

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[322] Whaling in the Antarctic Case (Aus. v. Japan: N.Z. intervening), 2014 ICJ Rep. 226 at ¶46, 83.

[323] Ibid at ¶56.

[324] Alan Boyle, *The Choice of a Treaty: Hard law versus Soft law* in DAVID MALONE, SANTIAGO VILLALPANDO, SIMON CHESTERMAN (ED.), THE OXFORD HANDBOOK OF UNITED NATIONS TREATIES (2019) at 106.

[325] Ibid at 118.

[326] Chinkin; Blaine Sloan, *General Assembly Resolutions Revisited (Forty Years Later*), 58 BRIT. Y.B. INT'L L. 39 (1987) at 106-125; Paul C. Szasz, *International Norm-Making* in EDITH BROWN WEISS, ENVIRONMENTAL CHANGE AND INTERNATIONAL LAW : NEW CHALLENGES AND DIMENSIONS (United Nations University Press) (1992) at 69-72.

[327] Charney at 529, 532.

enforce equitable distribution of space resources, however in view of the complex and evolving nature of technologies and the lopsided power dynamic between States, participation has been limited to a broad and general guideline as enshrined under Article I of the OST. Currently, States have now left the creation of a regime based off the Moon Agreement up to an international technical body that may establish standards and recommendations as and when resource mining may become feasible.[328]

It is clear from the discussion at hand that – *First*, accessibility to outer space may be improved by stimulating States to propose soft-law instruments that clarify obligations under the OST. S*econd*, while treaty law provides a binding assurance, amendment to treaties and treaty negotiation process can be rather cumbersome due to the consensus mechanism and the political reality amongst States. *Third*, a regime or recommendation based on treaty law can help clarify obligations and can be adopted as a subsequent agreement or practice to the OST.

c. CREATION OF A REGIME

The regime-building approach as understood in international relations theory is conducive to build a more specific, holistic and binding legal obligation arising from a treaty.[329] These regimes are specialized arrangements that provide implicit or explicit principles, norms, rules, or decision-making procedures.[330] They can be in the form a convention, action plan or system. An example of a regime in space law is the International Telecommunication Union (ITU) which simultaneously serves as a forum, multi-lateral treaty, and a governing body to standardize telecommunication across countries efficiently. Other examples of international regimes include

[328] Nandasiri Jasentuliyana, *Treaty Law and Outer Space: Can the United Nations Play an Effective Role?*, 11 ANNALS AIR & SPACE LAW J. 219 (1986) at 223.

[329] Robert O. Keohane, *The Demand for International Regimes*, 36 MIT PRESS INT'L ORG. 325 (1982) at 338-39.

[330] Stephen D. Krasner, *Structural Causes and Regime Consequences: Regimes as Intervening Variables* in STEPHEN D KRASNER, INTERNATIONAL REGIMES (CORNELL UNIVERSITY PRESS) (1983).

the International Monetary Fund, Biological Weapons Convention, and the Kyoto Protocol. If an international regime is powerful enough, it can also serve as an independent actor even though its origin and sustenance rely upon the States it is governing.

In space law, any attempt to establish a new space order can only be successful if it is based on a realistic assessment of the existing power structures within the international community.[331] The ephemeral notions of 'equitable access' and 'equitable distribution' often connected to outer space exploration, require a delicate balance of the special needs of developing nations with the largely commercial and military interests of the spacefaring States.[332]

Experience indicates that, when developing countries lack spacefaring capabilities but possess numerical superiority in the General Assembly, they often attempt to control the process of hard-law formation, resulting in a farrago of impractical propositions and vague obligations in multilateral conventions. For example, the CHM regime declared in Article 11 of the Moon Agreement finds few supporters, particularly amongst the developed nations, and appears condemned to a philosophical existence[333] Additionally, due to the unique nature of space law, customary international law often does not possess adequate content or scope to answer these questions.

Pragmatic use of space technologies can achieve SDGs when they are built into sophisticated regimes that are forged with the intention of knowledge-sharing and cooperation. It is only

[331] David Tan at 50.

[332] Ibid.

[333] Douglas Barritt, *A "Reasonable" Approach to Resource Development in Outer Space*, 12 L.A. INT'L & COMP. L. J. 615 (1990) at 627-35; Barbara Ellen Heim, *Exploring the Last Frontiers for Mineral Resources: A Comparison of International Law Regarding the Deep Seabed, Outer Space and Antarctica*, 23 VAND J. TRANSNAT'L L. 819 (1990) at 834-35; Carl Q. Christol, *The 1979 Moon Agreement: Where Is It Today?*, 27 J. SPACE L. 1; Carl Q. Christol, *The Moon Treaty and the Allocation of Resources*, 22 ANNALS AIR & SPACE L. J. 31 (1997) at 37 [hereinafter referred as 'Christol (1997)'].

through collective legal arrangements that one can intensify the legal content of discourse and heighten the actualization of international legal norms.

To facilitate 'access' in outer space it is important to understand that any regime governing outer space cannot be of a static structure. Likely to human rights treaty regimes, it must also evolve along a continuum from dialogue to the sharing of information and expertise, to more defined framework conventions for cooperation, to more precise binding legal norms contained in protocols.

Unfortunately, however, colloquiums and roundtables on space law, are often limited to the interaction of the five space law treaties. Furthermore, any dialogue between States is purely dependant on the geopolitical inclination of the States and their willingness to break the status-quo and clarify legal obligations. Establishing such roundtables and colloquia to facilitate discussions with a view to develop a framework convention, is typically a precursor to the final enunciation of international binding norms. This continuum of regime formation, in both a substantive and a procedural sense, is not always linear, as it allows for "overlapping cycles of cooperation and competition."[334]

Creating a regime that governs 'access to space' or 'access to space technology' requires the following considerations:

i. A smulti-stakeholder analysis that accounts for concerns from engineers, designers, entrepreneurs, consumers and policy makers with respect to creation, trading and use of frontier space technologies. A regime that would further inter-industry use by successfully promoting spin-offs or technology transfer.

[334] Jutta & Toope; Stephen D. Krasner, *Structural Causes and Regime Consequences: Regimes as Intervening Variables* in STEPHEN D KRASNER, INTERNATIONAL REGIMES (CORNELL UNIVERSITY PRESS) (1983) at 1; John K. Setear, *An Iterative Perspective on Treaties: A Synthesis of International Relations Theory and International Law*, 37 HARV. INT'L L. J. 139 (1996) at 142-47.

ii. A regime that identifies asymmetry in the current innovation system and moves beyond offering patchwork solution. A foundation built on aligning multiple institutions while accounting that innovation strongly presents itself in the private sector and does not receive full attention from governments and policy agencies, leading to regional and social asymmetries.

iii. A regime that reshapes institutions to meet national interests, such as increasing domestic economic growth, improving national security, or enhancing their citizens' well-being.

iv. A regime that successfully integrates technology, policy, human rights and legal obligations without suppressing the incentive for innovation

v. A regime that identifies essential technologies with respect to SDGs

vi. A regime with specific implementing mechanisms or body to enforce sanctions so as to successfully regulate commercial and social interest while balancing competition and cooperation.

Lastly, a fluid regime must have the ability of mimicking a living organism for when a regime is established through practice and a convergence of interests and expectations around that practice, its interests and expectations may persist even after the forces that shaped its evolution have changed."[335]

IV. CONCLUSION

Space technologies should be seen for the true potential they are meant to offer, instead of their limited dual-use potential which limits their focus to mere civil and military based usages. Almost all space applications capable of achieving SDGs including interoperable uses fall under civil use

[335] Stephen D. Krasner, *Regimes and the Limits of Realism: Regimes as Autonomous Variables*, 36 MIT PRESS INT'L ORG. 497 (1982) at 500.

of space technologies. While, national interest due to dual-use remains an important concern, it can no longer justify the bottleneck in technology as the benefits of technology trading and transfer far outweigh the cons.

In order to facilitate such trading and improve access to space, we must coordinate amongst different UN departments and technical experts i.e. COPUOUS, UNOOSA, OHCHR, UN Statistical Commission which monitors the achievement of SDGs, FAO, engineers and scientists. The aim is to create an epistemic community which has members from different professions to provide holistic results.[336] These communities are distinguished from ordinary interest groups and non-governmental organizations by four dimensions: shared principles, casual beliefs, validity tests, and policy orientation.[337]

This epistemic community can then rely on soft-law instruments and propose a regime capable of clarifying obligations under Article I of the OST and combine it with other important externalities such as – market economics, environmental costs, human rights, investment and copyright, and national interests. Through a multistakeholder analysis, such a community can propose a regime that can implement norms, rules and principles that ensure access to space and move beyond the limited and scare State practice that exist within the current legislative lacuna.

[336] Peter M. Haas, *Introduction: Epistemic Communities and International Policy Coordination*, 46 MIT PRESS INT'L ORG 1 (1992) at 2-3.

[337] Ibid at 18-20.

RECOMMENDATIONS & CONCLUSION

"I have no country to fight for; my country is the earth; I am a citizen of the world." – Eugene Deb

The thesis over the course of five chapters elaborated upon the relevance of space technology and its potential to transcend beyond its presumed limited use. While the analysis presented above successfully highlights the need and relevance of outer space vis-a-vis space technology, it also raised a question about the legal foundation of access to outer space. Questions in this regard where attempted to be answered through the OST in particular Article I.

However, no substantive duty to ensure 'access' could be ascertained from Article I and its obligations remained binding yet vague. This is mainly because the current regime of international space law is silent or ambiguous towards the 'benefit sharing' principle despite few soft law clarifications. The geopolitical relations between States and the desire to maintain status-quo within a Westphalian model has ensured that there is no real progress towards 'benefit sharing'. As discussed, soft law measures do promote technology transfer and sharing however, at their current stage they are inadequate to address the issue of 'access', requiring their adoption in conjunction with other measures.

The thesis analysed the *problematiqué* through a multi-disciplinary approach and highlighted the need for policy makers to rely on the principles of human rights law and SDGs to formulate a framework for governing 'access' to outer space. An intersectional analysis of space law with SDGs and human rights law has shown that the underlying fundamental principles of these branches of law are compatible with each other. Furthermore, principles from public international law can be relied upon to address the lacunae in the legal fabric of international space law.

The thesis has successfully investigated the gap in governance measures and has thus concluded that, while there exist historical and socio-political elements that condition the currently limited

access to technology innovation there is a need to move beyond our reliance upon the OST. It is essential to understand that space law is not a self-contained regime and exists in correlation with public international law. The inadequacy of the OST should not determine the future of 'access' for the humanity, as this question transcends a legal tool which simply aims to establish law and order.

The next step is for the international community to engage in a discourse for developing State practice and legal and policy guidelines on 'benefit sharing' and 'access'. Given the lack of political will on the international level towards the interpretation of Article I of the OST and the right of 'access', it might be prudent to undertake multilateral action and proactively encourage stakeholders across different fields to come together and develop a responsible space behaviour.

There is an urgent need to expedite this process before outer space succumbs to the greed of capitalism and becomes restricted to the chosen few. We must aim for a cosmopolitan, multistakeholder, and an intersectional approach that moves beyond the limited linear idea of economic wealth and collectively build a regime that monitors SDGs along with human rights and weaves them with their corresponding space applications.

Lastly, it has been established that the current institutions shaping technological innovation in the space industry are not aligned towards the goals of sustainable development because impoverished and marginalized populations too often lack the economic and political power to shape innovation systems to meet their needs. Thus, we must denounce these Westphalian models that fail to look at the world as a global community. This is especially relevant in space law, where we naively aim to govern a 'global common' that is bestowed upon all of humanity.

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