The Legal Management of Geoengineering and Climate Change in India: An Analysis

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Introduction

"Earth provides enough to satisfy every man's need, but not every man's greed".

By Mahatma Gandhi

Today, geoengineering is relatively a very new technology[1]. The term "geoengineering" is used to refer to a number of methods that humans could use to purposefully change the Earth's climate in order to lessen the effects of global warming, such as temperature rise, water shortages, severe droughts, depletion of ozone layer, impact on regional climate, persisted

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[1] ANTHONY HARDING ET. AL., 25 - THE ECONOMICS OF GEOENGINEERING 729-750 (Academic Press,
2019).

ocean acidification, increased acid deposition, etc.[2] These techniques or methods comprise things like injecting reflective particles into the upper atmosphere to reflect sunlight back into the space, fertilizing oceans with iron filings to stimulate the growth of carbon-absorbing plankton, and installing mirrors in space to redirect sunlight away from the Earth. Carbon Dioxide Removal (CDR), a major category of suggested geoengineering technologies, aims to reduce the likelihood or severity of climate change impacts by lowering the atmospheric concentration of carbon dioxide. As an illustration of CDR, Ocean Iron fertilisation (OIF) involves scientists deliberately promoting algae growth in order to capture atmospheric carbon dioxide through photosynthesis. Solar Radiation Management (SRM), a prominent class of suggested geoengineering technology, seeks to reduce the increase in global temperatures brought on by climate change by reflecting some of the incoming solar radiation, or sunlight, away from the Earth. The most widely used SRM strategy, known as Stratospheric Aerosol Injection (SAI), involves injecting a thin layer of particles into the stratosphere to reflect some solar radiation away, and simulate the cooling effect of an enormous volcanic explosion[3].

[2] Kerryn Brent, Jeffrey Mcgee, and Jan Mcdonald, The Governance of Geoengineering: An Emerging Challenge for International and Domestic Legal Systems?, 24 JLIS 1, 7-8 (2015).

[3] *Id.*

Interest in geoengineering has increased due to the reasonable progress being made in worldwide efforts to reduce greenhouse gas emissions[4]. Despite 20 years of debate under the United Nations Framework Convention on Climate Change (UNFCCC) [5], scientific analysis based on current policy estimates points that the Earth is currently on track for a 3.6-to-4.20-degree Celsius rise in average surface temperature above pre-industrial levels. This contrasts with the goals of the Copenhagen Accord and the Cancun Agreement, which called for a maximum average surface temperature increase above pre-industrial levels of 2 degrees Celsius[6]. In this attempt, the present global initiatives to lessen greenhouse gas emissions continue, and humans are unable to substantially mitigate the harmful consequences of climate change, hereby proponents of geoengineering argue that such techniques must be established and provided for implementation as an "emergency alternative" [7].

[4]Avantika Goswami, Why geoengineering is still a dangerous, techno-utopian dream, DOWNTOEARTH, (Mar. 10, 2023, 8:30 PM), https://www.downtoearth.org.in/blog/climate-change/why-geoengineering-is-still-a-dangerous-techno-utopian-dream-74828.

[5] CLIMATE ACTION TRACKER, https://climateactiontracker.org/global/temperatures/ (last visited Mar. 6, 2023).

[6] *Id.*

[7] Paul J. Crutzen, Albedo Enhancement by Stratospheric Sulfur Injections: A Contribution to Resolve a Policy Dilemma?, 77 CCH'E 211, 230-232 (2006).

Research problem

There are a number of legal issues surrounding the use of geoengineering to address climate change. One of the main concerns is that such techniques could have unintentional outcomes, such as altering the patterns of rainfall and disrupting ecosystems. It is also possible that geoengineering will be utilised in place of, rather than in addition to, more thorough and efficient approaches of lowering greenhouse gas emissions.

Another legal issue is the question of who has the authority to make decisions about the deployment of geoengineering technologies. International bodies, like the United Nations, should have a central role in deciding whether and how to use these technologies. With specific protections in place, individual nations or private entities should be allowed to decide on their own geoengineering practices.

Another concern is who would be responsible for any adverse outcomes of geoengineering. Any unexpected effects from geoengineering projects should be the responsibility of those who support or implement them. The liability should be shared by all those who contribute to greenhouse gas emissions, since climate change is a global problem that requires a global solution.

Overall, there are many different and complex legal issues related to climate change and geoengineering that will probably continue to be discussed and debated as the likelihood of utilizing these methods to combat global warming rises. In order to strengthen the supremacy of law about geoengineering governance, how the existing legal frameworks could

contribute to future geo-engineering governance is the most important concern. Most significantly, a stringent, comprehensive law on geoengineering and climate change is urgently needed in a developing nation like India. There are undoubtedly many laws and rules in India like the Environmental Protection Act 1986, the Biodiversity Act 2002, the Energy Conservation Act 2001, etc. to safeguard the environment, but none of them specifically aim to address the concern of geoengineering and climate change in a strict way. Thus, a sui-generis law in this regard is very important.

The development of geoengineering in India and its legal status

People have considered modifying the atmosphere for personal gain to stop climate change earlier. More people are becoming interested in developing sustainable and environmentally friendly technologies to address climate change in India, and geoengineering is one of the promising areas of research. While the weather is the daily variations in the atmosphere (such as temperature, wind, and rain), the climate is the long-term average of the weather.[8] Scientists in the United States developed weather modification technology soon after the Second World War, that attempted to quickly change the weather at a local level.[9]

[8] Sanjana Kulkarni, Reversing Climate Change with Geoengineering, Havard Ed'u (Jan. 3, 2023, 10:30 PM), https://sitn.hms.harvard.edu/flash/2022/reversing-climate-change-with-geoengineering/.

[9] *Id.*

Geoengineering in India is a relatively new field, with a focus on using technology to address environmental and climate challenges[10]. The government is making efforts to promote research and development in this field, including setting up research institutions and providing funding for projects. Some of the notable developments in India's geoengineering sector includes:

1. The Ministry of Earth Sciences established the Indian Institute of Technology, Bombay, for the study of science, technology and policy to focus on environmental and climate change research.

2. The government launched the National Action Plan on Climate Change (NAPCC) in 2008, which includes a component on geoengineering research and development.

3. The Department of Science and Technology has supported a number of geoengineering projects, such as developing drought-resistant crops and improving water management practices.

4. The Indian Space Research Organisation (ISRO) has developed a number of remote sensing technologies in order to monitor the environment and track changes in land use and land cover.

[10] Albert C. Lin, Does Geoengineering Present a Moral Hazard?, 40 ECO L QUAR' 673, 683-690 (2013).

While geoengineering in India is still in its very early stages of development, the government is taking steps to promote research and innovation in this field[11]. Geoengineering in India has been rapidly developing in recent years with a focus on addressing environmental challenges such as climate change and natural resource management.[12] Some key developments in India's geoengineering sector includes:

1. Solar Radiation Management (SRM) projects, like the use of reflective materials to reduce solar radiation and mitigate global warming.

2. Carbon Capture and Storage (CCS) technologies, aimed at reducing carbon emissions from industries and power plants.

3. Enhanced Weathering, a process that involves spreading minerals that absorb carbon-dioxide from the air on a large scale to mitigate the impacts of climate change.

4. Coastal safety and management, using geoengineering techniques such as sea walls, breakwaters, and mangrove planting to protect coastal communities from rising sea levels and extreme weather events.

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[11] Erica C. Smit, Geoengineering: Issues of Accountability in International Law, 15 NEV' LAW JOUR' 1060, 1073-1079 (2015).

[12] WORLD ECONOMIC FORUM, https://www.weforum.org/docs/WEF_The_Global_Risks_Report_2022.pdf (last visited Mar. 6, 2023).

5. Management of water resources, including water conservation, drought management, and flood control through the construction of dams, canals, and other structures.

India is also a signatory to the United Nations Framework Convention on Climate Change (UNFCCC), which aims to address global warming and promote sustainable development[13]. The government is actively investing in renewable energy and energy efficiency, and it has set considerable goals for reducing its carbon impact. Additionally, the government of India has started to invest in research and development in the field of geoengineering, with a focus on developing technologies that are low-cost, scalable, and effective in mitigating the impacts of climate change.[14] This investment has helped to establish India as a pioneer in the development of geoengineering technologies and has helped to build a strong research community in the country. Overall, geoengineering is an important part of India's efforts to address environmental challenges and promote sustainable development.

Despite this growth, the legal framework for regulating and guiding geoengineering practices in India remains relatively undeveloped. To date, there have been limited legal impacts of geoengineering in India. One notable example is the 2013 case of Swiss multinational Syngenta, which faced a lawsuit in India over its genetically modified eggplant crop. The

[13] Shahab Shabbir, Challenges of Climate Change, and India's Policy Options, 4 GJLS 118, 120-123 (2015).

[14] *Id.*

case established a precedent for further legal action in this field and addressed issues regarding liability and regulation of geoengineering operations in India.[15] In general, the regulation of geoengineering in India is still in its early stages, and there is a need for further development of legal frameworks and guidelines to ensure the safe and responsible use of these technologies. The first legal impact of geoengineering in India has been the implementation of regulations and guidelines for the safe and responsible deployment of geoengineering technologies. This includes the need for comprehensive impact assessments, risk assessments, and stakeholder consultations to ensure that any geoengineering activities are carried out in a transparent and accountable manner.

The various issues and effects of geoengineering in India are ozone layer depletion, effects on regional climate continued ocean acidification, more acid deposition, transboundary issues, etc. So, the greatest concern is that till date India has no proper legal mechanism to deal with the issue of governance of geoengineering, and thus, a sui-generis law in this regard is the need of the hour.

Legislative framework of geoengineering in India

No doubt, there are a plethora of laws like the Environmental Protection Act 1986, Biodiversity Act 2002, Energy Conservation Act 2001, etc. that addresses environmental issues, but no strict and comprehensive law till

[15] Ronald J Herring, On risk and regulation: Bt crops in India, 5 GMCF 204, 206 (2014).

date addresses the concern of geoengineering and climate change in India. There also exists the precautionary principle, but even today, India does not follow this principle in a strict manner[16].

Even the Constitution of India has various provisions which highlights how important it is to protect the environment or the biodiversity. Some of the most important provisions are:

1) Article 2, which deals with the right to life.
2) Article 51-A addresses every Indian citizen's obligation to protect and improve the natural environment, including lakes, rivers, forests, and animals, as well as to have empathy for every living being.
3) Article 48-A, which addresses the protection and improvement of the environment and safeguarding of forests and wildlife by the State.

Role of Indian Judiciary

In this regard, it is to be noted here that though there are no specific case laws on geoengineering in India till date, but there are instances where the Hon'ble Supreme Court of India in many of its judgements has rightly highlighted the importance of a clean and healthy environment from the various effects of climate change.

The Supreme Court has acknowledged several liberties indicated by Article 21 of the Constitution of India in the cases Subhash Kumar v. State of

Bihar[17], and Virendra Gaur v. State of Haryana[18]. One of these liberties is the right to a healthy environment. The State High courts have adopted the Supreme Court's approach, and almost every court now acknowledges that Article 21 has an important environmental component. In Rural Litigation and Entitlement Kendra & Ors v. State of U. P. & Ors[19], the Supreme Court observed that the ecological damage produced by the limestone quarries of Dehradun had a negative influence on the health and safety of the people residing there.

Again, in MC Mehta v. Kamal Nath[20], the Supreme Court recognized the Public Trust Doctrine and ruled that the State and its agencies are trustees with a responsibility to safeguard natural resources including rivers, lakes, forests, open spaces, and other common property resources. In the Taj Trapezium case[21], the Apex Court has observed the principle of Sustainable Development.

International scenario

There is a vast range of study on international law and geoengineering, ranging from general overview studies to more technical studies that

[17] Subhash Kumar v. State of Bihar, A.I.R. 1991 SC 420.

[18] Virendra Gaur v. State of Haryana, (1995) 2 SCC 577.

[19] Rural Litigation and Entitlement Kendra & Ors v. State of U. P. & Ors, AIR 1985 SC 652.

[20] MC Mehta v. Kamal Nath, (1997) 1 SCC 388.

[21] MC Mehta vs Union of India, AIR 1997 SC 734.

examine how law may apply to a specific geoengineering approach[22]. Broad surveys draw attention to a number of hard and soft international legal standards that may be important for the application of various geoengineering procedures.[23] To examine how specific laws or theories may be applied to geoengineering, such as the question of international liability for transboundary harm caused by geoengineering and how the precautionary principle may be applied to different geoengineering techniques, a more thorough legal analysis is required.[24] International law has certain major gaps that make it difficult to control geoengineering technologies. All suggested geoengineering technologies are not particularly governed by any international convention[25]. The London Protocol 1972, which has been amended to govern maritime geoengineering activities like Ocean Iron Fertilization (OIF), is the first legally enforceable international agreement that directly addresses geoengineering.[26] However, Solar

[22] BIDISHA BANERJEE, https://slate.com/technology/2010/09/could-an-obscure-international-treaty-protect-developing-countries-from-geoengineering-gone-wrong.html (last visited Mar. 6, 2023).

[23] ALEXANDER PROELSS ET. AL., GEOENGINEERING: METHODS, ASSOCIATED RISKS AND INTERNATIONAL LIABILITY 419–503(Corporate Liability for Transboundary Environmental Harm 2022).

[24] Jesse L Reynolds and Floor Fleurke, *Climate Engineering Research: A Precautionary Response to Climate Change?,*4 CCLR 101, 106 (2013).

[25] Virginia Simms, Making the Rain: Cloud Seeding, the Imminent Freshwater Crisis, and International Law, 44 INT'L LAW. 915, 916-920 (2010).

[26] *Supra* note 4.

Radiation Management (SRM) and land-based Carbon Dioxide Removal (CDR) plans are not covered by this amendment.[27] Activities involving geoengineering are unlikely to be covered by the 1976 Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques (ENMOD Convention), unless they are carried out with an aggressive or military intent (a highly unlikely scenario). Solar Radiation Management (SRM) and land-based CDR (Carbon Dioxide Removal) initiatives may, therefore, be outside the purview of current treaty frameworks.[28]

Geoengineering may or may not be covered by pertinent principles of customary international law. For instance, the International Court of Justice (ICJ) has affirmed that under customary international law, governments have a responsibility to stop severe transboundary harm to the territory of other States and to the ecosystem of the global commons.[29] However, some legal experts are unsure that this obligation would have a significant effect on the decisions of the government to involve in geoengineering because its legal requirements are unclear, and it is uncertain if an international court or tribunal could effectively enforce them. Additionally, geoengineering may not be addressed by the standards of customary law governing State accountability and liability for transboundary harm. These examples reveal

[27] *Id.*

[28] *Id.*

[29] Ralph Bodle, Geoengineering, and International Law: The Search for Common Legal Ground, 46 TLR 305, 309 (2010).

that there are serious concerns over the ability of current international legal norms to effectively regulate the geoengineering technologies currently under consideration.

Governance of geoengineering – its challenges

Geoengineering deployment needs to be governed by proper governance structures. However, aside from the notion that governance is required prior to full-scale deployment, there is little agreement on what governance should be used for and how it should look. It is becoming more universally recognized that legal rules and principles might influence how geoengineering governance will be shaped in the near future.

International and domestic laws are provided with numerous obstacles through the process of geoengineering. Some of these challenges are connected to geoengineering as a general idea, while others are associated with particular geoengineering approaches[30]. It draws attention to various problems like accountability and responsibility, uncertainty, etc. Questions of accountability, legality, and compensation in the event of geoengineering field testing or deployment results in various damages which are related to the problem of managing environmental hazards. Future liability system design and operation, however, raise several significant challenges that must be taken into consideration. There are actually a number of questions that

[30] SARAH FECHT, How Exactly Does Carbon Dioxide Cause Global Warming?, https://news.climate.columbia.edu/2021/02/25/carbon-dioxide-cause-global-warming/(last visited Mar. 6, 2023).

need to be addressed, including who should be held responsible for harm caused by geoengineering, to whom it should be paid in the event of compensation, whether all geoengineering activities should be subject to liability for the payment of damages, and what types of harms need to be made liable. Again, another important issue related to geoengineering is the concept of unilateralism.[31] That is, without the support of the larger international community, a single State, a small coalition of nations, or even a private entity (such as a firm or wealthy individual) might attempt geoengineering. Therefore, it is possible that unilateral geoengineering might undermine global efforts to mitigate and adapt to climate change in addition to undermining international peace and security. In this context, the term "moral hazard" is frequently used to describe the possibility for geoengineering to undermine efforts for adaptation and mitigation of climate change.

Again, looking into the international perspective, Article 2 of the Convention on Biological Diversity, 1992 (CBD) defines "sustainable use" as, "the use of components of the biological diversity in a way and at a rate that prevents its long-term deterioration, preserving its capacity to satisfy the needs and desires of both present and future generations". Article 14 of the CBD, 1992 highlights Environmental Impact Assessment and minimizing its adverse impacts. The United Nations Framework Convention on Climate Change (UNFCCC), the Kyoto Protocol, the Intergovernmental

[31] *Supra* note 4.

Panel on Climate Change (IPCC), the UN Convention on the Law of the Sea (UNCLOS), the Inter-Governmental Oceanographic Commission, the Convention for Protection of the Marine Environment of the North-East Atlantic, the High Time-Precautionary Principles, and the Intergenerational Equity Principle, also forms a part of the international framework of protecting the biodiversity, but the most important point to be noted here is that even though there exists so many international treaties, conventions, etc., nowhere the issue of geoengineering and climate change is strictly addressed.

Conclusion, suggestions, and recommendations

By establishing a set of guidelines for the variety of regulatory research, development, and application of geoengineering, more legal analysis is required to support the normativity of law in this domain. It is very important to identify the existing gaps in international law which will help in building a strict, comprehensive, and rigid regime to govern geoengineering and climate change in India. The regime should focus on proper governance of the scientific process of geoengineering. In this context, a proper research agenda for the governance of geoengineering is also very important. More consensuses should be given as to what the purpose of governance ought to be, and the form it should take. Infact, there should be proper way to address the uncertainty and risks associated with different geoengineering techniques. Also, proper mechanisms for responsibility, liability and compensation should be easily available if

geoengineering is attempted. There should be avoidance of unilateral geoengineering, wherein, consensus from wider international community is also very important.

One significant approach in dealing with the problem of geoengineering and climate change is mapping a proper research agenda on geoengineering governance. It is also essential to identify how Environmental Impact Assessment (EIA) investigates the spatial and temporal distribution of impacts from such technologies.

There should be proper applicability of the precautionary principle and the intergenerational equity principle in India, and the customary rules and practices must be strictly followed. Focus on intersections between law and ethics, that is, scientists, lawyers, policymakers, and stakeholders should always be observed.

Thus, no one nation can provide a solution to this issue. There must be unity and proper cooperation between all the nations to address the problem of geoengineering and climate change. And most importantly, there should be a strong governance regime in India, which should be in adherence to the Constitutional provisions. Thereby, it can be concluded by saying that in a developing country like India, today, a strict, comprehensive sui-generis law is the need of the hour, which can help in solving the issue of geoengineering and climate change in the real sense.