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BLASTING QUARRY OPERATIONS: ADVERSE AND CUMULATIVE EFFECTS, LAWSUITS AND COMPLAINTS, AND SUGGESTED REMEDIES

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ABSTRACT

Breaking rock for road construction, installation of infrastructure or for extraction typically involves detonation of explosives. Any time explosives are detonated there are undesirable impacts on the environment and its inhabitants, which are always more severe in populated areas of significant human and non-human activity. The primary focus of this paper is on the impact that blasting quarry operations have on the environment and its inhabitants. A number of civil cases, investigations, published articles and press releases documenting the adverse and cumulative effects of blasting rock are presented, discussed and analyzed. The extensive number of documented cases and media reports of the adverse and cumulative effects of blasting quarry operations on the environment and its inhabitants shed light on the gas lighting strategy employed by the aggregate industry and their explosives engineers to alter the public's perception of reality by consistently and repeatedly claiming that blasting within regulatory limits cannot cause structural damage and that the vibrations felt from blasting are no more than a minor inconvenience. Gas lighting is a form of psychological manipulation in which the abusers, in this case the aggregate industry and its explosives engineers, attempt to sow self-doubt and confusion in the minds of their victims, and to mislead approval authorities and cause them to question their own judgment and intuition from a practical non-theoretical perspective. The research conducted supports reducing Peak Particle Velocity (PPV) to a maximum of 2 mm per second measured along the entire perimeter of a blasting quarry operation, combined with a permanent onsite 500-metre setback and offsite minimum separation distance of 1,000 metres from incompatible land uses to minimize damage from structural response to ground vibrations and airblast (concussion), and to eliminate or reduce substantially lawsuits and complaints from residents exposed to the adverse impacts of blasting. None of the *adverse effects* prohibited under the *Ontario* Environmental Protection Act are permitted to impact public or private third-party properties beyond the boundary of an existing or proposed blasting or non-blasting quarry operation.

Keywords: Quarry; Blasting; Mining; Environmental impacts; Legislation

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Blasting Quarry Operations: Adverse and Cumulative Effects, Lawsuits and Complaints, and Suggested Remedies

1. INTRODUCTION

The aggregate operations of rock quarrying and stone crushing continue to grow in scale globally (Marzouk, 2018)[1] and a quarry can remain operational for a significant period of time, especially, in jurisdictions such as Ontario, Canada, where a licence issued by the Ministry of Natural Resources to an aggregate operator has no expiry date. In the U.S, growth in the mining sector has been accompanied by an increase in the demand for explosives from 153,000 tonnes in 1989-90 to 450,000 tonnes in 2010 (Mishra & Rout, 2011).[2] An aggregate extraction operation can remain operational for 100 years plus, adversely impacting the environment and the health, safety and welfare of its inhabitants (Maponga et al., 2001)[3] for five or more generations. Assuming an average of two blasts a week, 50 weeks a year for 100 years would expose the environment and its inhabitants to the cumulative adverse effects of 10,000 blasts over the life of a quarry. About 50 blastholes per blast results in 500,000 separate detonations over a period of 100 years.

Rock quarrying and stone crushing are now part of a global phenomenon that has been the cause of concern everywhere in the world, including the advanced countries (Lameed & Ayodele, 2010).[4] Quarrying negatively affects the environment in a variety of ways from exploration and blasting, transport and disposal of waste rocks. The major environmental effects are the destruction of vegetation, disruption of animal habitats, diversion and blockage of natural drainage systems, soil erosion and river siltation, noise,…vibration [, flyrock debris] and dust pollution (Maponga & Munyanduri, 2001).[5] According to the Nova Scotia Supreme Court's ruling in *Macdonald v. Construction LTEE et al.* (1972),[6]

> *"…[T[he use of explosives, on the balance of probabilities, does involve danger to another's property. I cannot see how anyone can possibly describe such an operation as not being, in the language of the cases on the subject, "extra hazardous" or "inherently dangerous."* (Citing J. P.

[1] Marzouk, S.H., 'Influences of limestone stone quarries on groundwater quality' 2018 3 (4) International Journal of Human Capital in Urban Management 315-324. <https://www.ijhcum.net/article_34117_cb311e43b286d3457041ebfec70faa52.pdf> accessed 13 January 2023.

[2] Mishra, A.K. and Rout, M., "Flyrocks – Detection and Mitigation at Construction Site in Blasting Operation" (2011) 1(1) World Environment 1-5. <https://doi.org/10.5923/j.env.20110101.01>

[3] Lameed, G.A. and Ayodele, A., "Quarrying activity on biodiversity: Case study of Ogbere site, Ogun State Nigeria," (2010) 4 (11) African Journal of Environmental Science and Technology 740-750, <https://www.researchgate.net/publication/268000866_Effect_of_quarrying_activity_on_biodiversity_Case_study_of_Ogbere_site_Ogun_State_Nigeria> accessed 10 April 2023.

[4] Maponga, O. and Munyanduri, N., "Sustainability of the dimension stone industry in Zimbabwe — challenges and opportunities," (2009) 25(3) Natural Resources Forum 203-213. <https://doi.org/10.1111/j.1477-8947.2001.tb00762.x>

[5] Marzouk, S.H. and Mohamed, Abuo El-Ela A., "Influences of limestone stone quarries on groundwater quality," (2018) 3(4) Int. J. Hum. Capital Urban Manage 315-324. <http://www.ijhcum.net/article_34117_cb311e43b286d3457041ebfec70faa52.pdf> accessed 10 April 2023.

[6] *Macdonald v. Desourdy Construction LTEE et al*., 1972 CanLII 1150 (NS SC), <https://canlii.ca/t/gwg69> accessed 10 April 2023.

Porter Co. Ltd. v. Bell, [1955] 1 D.L.R. 62, 35 M.P.R. 13, and Rylands v. Fletcher)

According to Gui et al. (2018),[7] rock blasting can induce many adverse effects on the surrounding environment, including structural damage, business disruption and emotional traumatization of humans and non-humans (pets, livestock and wildlife):

> "*Explosion induces ground and structure vibration [1, 2] and annoying noise. When the explosive is detonated, an extremely high pressure pulse from the chemical reaction induced energy is generated which is transmitted into rock mass adjacent to the blast hole, producing a dilatational wave that propagates away from the charge. Stress wave due to blasts may cause damage to the surrounding rock and, furthermore, when the wave reaches a free face*[8] *or open fissure (non-transmission), it will be reflected and converted into tensile wave, which may produce tensile cracking and spalling if the tensile strength of the rock is exceeded by the tensile wave [3, 4]. Also due to the fact that some rock blasting projects are close to the inhabitant area, the surrounding buildings may be damaged due to blasting induced ground vibration if large strength wave propagates in the soil foundation and shock wave propagating through the air [5]. Disruption of some business activities, possible structural damage and emotional-traumatized residents are the problems that need to be addressed.*"

Before a blasting quarry is established, it is of critical importance to define and assess how the blasting quarry operation might impact neighbours, animals, structures, utilities and the environment in general (Bhandari & Jain, undated)[9] during the anticipated life of the quarry operation, a procedure that is consistent with the precautionary principle. Charles et al. (2019)[10] describes quarrying as follows:

> "*Quarrying can be defined as the blasting, breaking, crushing, cutting, grading, and washing of rocks for desirable economic purposes (Nwachulwu, 2000).*[11] *Quarry is a type of open-pit mining from which rock or minerals are extracted, quarries are generally used for the*

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7 Gui, Y.L., Zhao, Z.Y., Jayasinghe, L.B., Zhou, H.Y. Goh, A.T.C. and Tao, M., "Blast wave induced spatial variation of ground vibration considering field geological conditions," (2018) 101 International Journal of Rock Mechanics and Mining Sciences 63-68. <https://doi.org/10.1016/j.ijrmms.2017.11.016>.

8 *Face* is defined as "the end of an excavation toward which work is progressing or that which was last done. It is any rock surface exposed to air." The Blasting Primer, Second Edition, 2002.

9 Bhandari, S., and Jain, S., "Managing Social and Environmental Issues Due to Blasting Quarries," (2016) Earth Resource Technology, Jodhpure, India. <https://www.mineexcellence.com/download.php?filename=%27YWRtaW4vYXJ0aWNsZXMvTWFuYWdpbmcgQmxhc3RpbmcgYW5kIFNvY2lvbG9naWNhbCBJbXBhY3QgIC5kb2M=%27> accessed 23 February 2023.

10 Charles, E.H., Maxwell, E.N., and Stanley, I.E., "Health Impact Assessment of Commercial Rock Blasting: A Study of the Julius Berger Quarry in Mpape (An Area Highly Concentrated With Quarry Sites) in Abuja", (2019) 4 (8) International Journal of Engineering Applied Sciences and Technology 334-349 <https://www.ijeast.com/papers/334-349,Tesma408,IJEAST.pdf> accessed 23 February 2023.

11 Nwachukwu, A.E., "Industrial and Occupational Health and Safety," (2000) Owerri: Totan Publishers Limited.

> *production of building stones, dimension stones, construction aggregates, ripraps, sandstone and gravels (Rieke & Goldberg, 1972).*"[12]

2. ADVERSE EFFECTS OF AGGREGATE EXTRACTION FAR REACHING

The *adverse effects* of aggregate extraction are far reaching, some permanent and irreversible and potentially deadly, more so with a blasting quarry operation where detonation of explosives result in *airblast, ground vibrations, toxic fumes* and *flyrock* (Sevelka, 2022;[13] Eltschlager, 2001),[14] all of which are known to negatively impact the environment and the health, safety and welfare of its inhabitants. The daily lives of those people who live, work and play in the communities in proximity to a blasting quarry operation are disrupted, with many living in a constant state of anxiety and fear of being injured or, worse yet, permanently disabled or killed. Numerous complaints and lawsuits (Lwin & Aung, 2019)[15] brought against the aggregate industry speak to the need for more stringent regulatory controls over aggregate extraction, especially in vulnerable populated areas of human and non-human activity. *Noise*, *vibration*, and *toxic fumes*, along with *flyrock*, are *contaminants* under the Ontario Environmental Protection Act (EPA), and have the potential to

- temporarily or permanently impact the environment
- compromise the health or safety of human and non-human life[16]
- negatively impact the quality of human and non-human life
- damage personal and real property
- damage public roads
- damage or preclude crop production (e.g., organic, specialty farming, etc.)
- disrupt business operations, including home occupations, and recreational activities (indoor and outdoor)
- cause subsidence (gradual caving or sinking of ground)[17]

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[12] Rieke, F.E. and Goldberg, O.P., "Industrial Clinic Services to Small Industries," (1972) 62 (1) American Journal of Public Health 69-72. <https://doi.org/10.2105/ajph.62.1.69>

[13] Sevelka, T., "Blasting Quarry Operations: Land Use Compatibility Issues and Property Value Impacts," (2022) 02 (03) Journal of Environmental Law & Policy 1-78. <https://doi.org/10.33002/jelp02.03.01>

[14] Eltschlager, K.K., "Regulatory Review of Blasting Related Citizen Complaints," (2001) <https://files.dep.state.pa.us/Mining/BureauOfMiningPrograms/BMPPortalFiles/Blasting_Research_Papers/OSM%20Reports/ISEE%202001-complaints.pdf> accessed 23 February 2023.

[15] Lwin, M.M. and Aung, Z.M., "Prediction and Controlling of Flyrock due to Blasting for Kyaukpahto Gold Mine," (2019) 5 (10) International Journal of Scientific Research and Engineering 338-346. <https://doi.org/10.31695/IJASRE.2019.33574>.

[16] In connection with the "Amaruq – Quarry amendment" project, the Environmental Assessment and Regulation Department of Economic Development and Transportation, Nunavut, in February 2017 expressed concerns about the impact blasting would have on wildlife: "Blasting activities associated with the operation of quarries have the potential to disturb and displace wildlife dependent on factors such as frequency of blasting, size of charges and the distance between the blast site and wildlife. Blasting can also cause injuries or death to wildlife from flying rocks."

[17] In *Jeans v. Carl B. Potter Limited and Lester Archibald Drilling & Blasting Ltd.* 1976 CanLII 2506 (NS SC), vibrations from blasting damaged two houses. According to the engineer testifying on behalf of the homeowners, blasting for road construction produced vibrations in the

- cause nuisance or trespass

According to a 2012 presentation by Morin of Explotech in the City of Ottawa, Ontario,[18] *"The derivatives of blasting which cause the greatest amount of concern to property owners adjacent to blast sites are flyrock, ground vibrations and overpressure (air blast). [Slide 90]"* Airblast, Ground Vibrations and Flyrock are described as follows:

- *"Air Overpressure or Airblast is a shock wave traveling through the air as a result of explosives detonation. It may be caused by rapid movement of burden or the release of expanding gas into the atmosphere (Figure 5.6). Audible airblast is called noise. Airblast at frequences below 20 Hz, inaudible to the human ear, is called concussion. Airblast annoyance and damage are related to the blast design, terrain, weather conditions and human response. It is measured with special gauges, pressure transducers or wide-response microphones. The seismograph shown in Figure 5.1 is equipped to monitor and record both ground vibrations (through the geophone) and airblast (through the microphone pick up). As with ground vibrations, both amplitude (in decibels) and frequency (in hertz) are measured [p. 62].[19] Air over Pressure (air blast) is often used to describe the air waves, which are generated by blasting activities. Air waves are compressed waves that travel through the air. Under certain weather conditions and poor blast design, air blast can travel considerable distances. Audible air blast is called noise, while air blasts at frequencies below 20 Hz and inaudible to the human ear are called concussions. Over pressure is usually expressed in pounds per square inch (PSI) or in decibels. (dB)*

soil. The vibrations compacted or densified the soils (a mixture of gravel, sand and silt) under the foundations of the two houses, causing movement in the buildings resting on the soil. One of the houses rested partly on bedrock, and as the soil settled on one end, the structure twisted. The movement of the two buildings in response to the vibrations caused cracking and twisting, resulting in twisted and jammed windows and doors, and cracked foundations. The explosions also caused changes in the subsoil water patterns, resulting in basement flooding. The two properties were also subjected to flying debris (flyrock) from blasting. Archibald, no longer a party to this action, acknowledged by its settlement a considerable responsibility for the damage to the two houses. [Jeans v. Carl B. Potter Limited and Lester Archibald Drilling & Blasting Ltd., 1976 CanLII 2506 (NS SC), <https://canlii.ca/t/jsk1g> accessed 30 January 2023].

[18] <https://www.slideserve.com/ami/city-of-ottawa-explosives-information-session-2012-exploedtech-engineering>

[19] Self-Study Guide for West Virginia Surface Mine Blasters Certification Examination, 3rd ed. revised 1998, Office of Explosives and Blasting, Virginia, USA.

(Bollinger, 1971;[20] Siskind et al., 1980;[21] Konya & Walter, 1985;[22] ABC, 1987,)[23] [p. 103]."

- *"Ground Vibrations is a technical term that is used to describe mostly man-made vibrations of the ground, in contrast to natural vibrations of the Earth studied under seismology. For example, vibrations caused by explosions, construction works, railway and road transport, etc. – all belong to ground vibrations.[24] Ground vibrations from blasting are acoustic waves that propagate through the Earth, termed "seismic" waves, because their propagation characteristics are similar to the vibrations produced by earthquakes (Crum et al., 1995).[25] Prediction of ground vibrations is difficult for the predetermined distances since the rocks, through which seismic waves propagate, are non-isotropic. Many factors affect the propagation of ground vibrations, making it almost impossible to include all the parameters (displacement, velocity, acceleration and frequency) with human disturbance and damage to structures (Erten et al., 2009).[26]" "Flyrock means any material propelled through the air from a blast[27]and can be gravel, rocks, tree trunks, construction materials, mud or even water.[28] Every blasthole has the potential to launch flyrock debris. Flyrock is rock that is propelled through the air or along the ground from a blast. It is extremely dangerous and is a potential cause of death, injury and property damage. Excessive flyrock may be caused by poor blast design, zones of weakness in the rock, or powder factors too high for the rock being*

[20] Bolinger, G.A., "Blast vibration analysis," South IL Univ. Press, Carbondale, IL (1971) p. 129. <https://scholar.google.com/scholar_lookup?title=Blast%20vibration%20analysis&publication_year=1971&author=G.A.%20Bollinger> accessed 10 April 2023.

[21] Siskind, D.E., Stachura, V.J., Stagg, M.S., and Kopp, J.W., "Structural response and damage produced by airblast from surface mining", US Bureau of Mine, RI 8485. <https://www.resolutionmineeis.us/sites/default/files/references/siskind-et-al-1980.pdf> accessed 10 April 2023.

[22] Konya, C.J. and Walter, E.J., "Rock Blasting," (1985) US Dept of Transportation, Federal Highway Administration, Virginia 199-257, <https://scholar.google.com/scholar_lookup?title=Rock%20blasting&publication_year=1985&author=C.J.%20Konya&author=E.J.%20Walter> accessed 10 April 2023.

[23] ABC, 'Atlas powder company, explosives and rock blasting. In: Field Technical Operations, Atlas Powder Co., Dallas, Texas, (1987) 321-411. <https://www.abebooks.com/book-search/kw/atlas-powder-company-explosives-and-rock-blasting/> accessed 30 January 2023.

[24] <https://en.wikipedia.org/wiki/Ground_vibrations>

[25] Crum, S.V., Siskind, D.E., Pierce, W.E., and Radcliffe, K.S., "Ground Vibrations and Airblasts Monitored in Swedesburg, Pennsylvania, from Blasting at the McCoy Quarry," U.S. Bureau of Mines, Minneapolis, March 19, 1995. <https://files.dep.state.pa.us/Mining/BureauOfMiningPrograms/BMPPortalFiles/Blasting_Research_Papers/State%20Reports/Ground%20Vibrations%20and%20Airblasts%20Monitored%20in%20Swedesburg%20PA%20from%20Blasting%20at%20the%20McCoy%20Quarry.pdf> accessed 10 April 2023.

[26] Erten, O., Konak, G., Kizil, M.S., Onur, A.H., and Karakus, D., "Analysis of quarry-blast-induced ground vibrations to mitigate their adverse effects on nearby structures," (2009) 1 (4) International Journal of Mining and Mineral Engineering 313-326. <https://www.academia.edu/25495122/Analysis_of_quarry_blast_induced_ground_vibrations_to_mitigate_their_adverse_effects_on_nearby_structures> accessed 10 April 2023.

[27] <https://docs.legis.wisconsin.gov/code/admin_code/sps/safety_and_buildings_and_environment/301_319/307.pdf>.

[28] Workers Hazard Alert issued by the National Institute for Occupational Safety and Health (NIOSH), 2019, p. 3.

> *blasted. It is a leading cause of onsite fatalities and equipment damage from blasting. Flyrock has killed people over a mile [>1,609 metres] from the blast site. Flyrock has two sources, the open face of the bench and the surface of the bench. Even with good blast design and careful planning and loading, flyrock may occur. A blast area should be established which encompasses an area which would contain all flyrock. All persons not required by the blasting activities should be removed from the blasting area and the area should be guarded against unauthorized entry [p. 64].*" [29]

A *misfire*, a charge (explosive) or part of a charge, which, for any reason, has failed to detonate as planned, is also problematic and can result in the following adverse impacts (Taiwo et al., 2022):[30]

- Production of noxious (NO_x gas) fumes and toxic dust
- Inadequate ground movement
- Poor fragmentation
- Unusual blast sounds and ground vibration rate
- Generation of flyrock
- Evidence of undetonated explosive in bench face or muck pile.

While flyrock, an unavoidable by-product of blasting rock (Sevelka, 2022),[31] launched offsite and landing on private third-party property is a direct invasion and constitutes *trespass*, most jurisdictions also consider *airblast (concussion)* and *vibrations* emanating from the same blasting events as *trespass*, making no distfinction between a direct or indirect invasion of neighbouring properties. Courts have ruled that blasting is an extremely dangerous or ultra-hazardous activity, and those engaged in blasting that causes property damage, injury or death are held to strict liability or the rule of *Rylands v. Fletcher* (1866).[32]

In *John Rotert and Elizabeth Rotert v. Peabody Coal Company* (1974),[33] there were *physical* invasions of the Roterts' property by *vibrations* and *concussions*. The Roterts first noticed Peabody's blasting operation in 1968, at which time the Roterts spoke to Shorty Powell, the defendant's land man, about possible damage to their well. Subsequently, as the mining operation moved closer, the Roterts noticed cracks appearing in the living

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[29] Self-Study Guide for West Virginia Surface Mine Blasters Certification Examination, revised 1998, Office of Explosives and Blasting. <https://dep.wv.gov/dmr/blasting/Documents/Blasters%20Study%20Guide%20Chapters%201%20thru%208.pdf> accessed 10 April 2023.

[30] Taiwo, B.O., Abdulkadir, S.B., Moshen, J., Akinsode, K.A., and Oluwasanmi, E.A., "Blasting Misfire: A Review of Causes, Economic Effect, Control and Handling Techniques," (2022) 3 (1) International Journal of Research Publication and Reviews 967-972.

[31] Sevelka, T., "Blasting Quarry Operations: Land Use Compatibility Issues and Property Value Impacts," (2022) 02 (03) Journal of Environmental Law & Policy 1-78. <https://doi.org/10.33002/jelp02.03.01>

[32] The person who for his own purposes brings on his land and collects and keeps there anything likely to do mischief if it escapes, must keep it in at his peril, and, if he does not do so, is prima facie answerable for all the damage which is the natural consequence of its escape .... ." Fletcher v. Rylands, L.R. 1 Ex. 265, 279 (1866), and, Rylands v. Fletcher, L.R. 3 H.L. 330, 339-40 (1868).

[33] *John Rotert and Elizabeth Rotert v. Peabody Coal Company*, 513 S.W.2d 667 (1974). Mo. Court of Appeals. < https://casetext.com/case/rotert-v-peabody-coal-company > accessed 10 April 2023.

and dining rooms of their home, and Powell advised them not to do anything for three years. The mining operation continued toward the Roterts' home, and blasting was occurring any time of the day or night. Elizabeth Roterts started keeping a calendar log of some of the times the blasting was done, and of the severity of the explosions and there intensity, e.g., "hard", "very hard", "hardest yet" and "very, very hard." She wrote the notes:

> "*By months, the calendar describes these explosions, which when related to appellant's map showing dates and distances from appellant's property line…show this approximate information: July 1969, 4 explosions, when the strip was about 2,000 feet away; August 1969, 14 explosions, one hard, 1,850 feet away; September 1969, 6 explosions, 1,700 feet [610 metres] away; October 1969, 13 explosions, 3 very hard, 1,550 feet away; November 1969, 33 explosions, 1 hard, 6 "big shots", 1,450 feet away; December 1969, 34 explosions, 1,300 feet away; January 1970, 63 explosions, 10 hard, 2 very hard, 1,150 feet away; February 1970, 97 explosions, 15 hard, 20 very hard, 1,000 feet away; March 1970, 47 explosions, 15 hard, 13 very hard, 850 feet away; April 1970, 48 explosions, 16 hard, 9 very hard, 1 "hardest yet", 750 feet away; May 1970, 96 explosions, 2 hard, 47 very hard, 3 very, very hard, 600 feet away; June 1970, 87 explosions, 14 very hard; and on June 6, 1970, 3 very hard shots, and rocks fell from respondents' basement wall, 500 feet away; July 1970 (during which respondents were away for 9 days), 73 explosions, 23 hard, 10 very hard, 450 feet away; August 1970 (during which respondents were away 3 days), 37 explosions, 16 hard, 7 very hard, 350 feet away; September 1970, 85 explosions, 24 hard, 3 very hard, 300 feet away; October 1970, 66 explosions, 24 hard, 1 very hard —apparently about 1,000 feet to the northeast of appellant's property line in front of respondents' dwelling; on November 28, 1970, 3 days after suit was filed, there were 3 hard shots, about 250 feet from appellant's property line. Appellant stopped mining when it was 175 feet from its property line when ordinarily it would go to within 50 feet of the line. To the above distances, there should be added 125 to 175 feet [38.1 to 53.3 metres], as the evidence variously shows, from the property line to respondents' dwelling. By Elizabeth's log on the calendar there were more than 800 explosions from July 1969, through December 1970, after which she got to the place where she could no longer keep the log. Appellant's records show far more explosions than Elizabeth recorded, but undoubtedly, since its mining trenches were running in a north-south direction, many were a sufficient distance away from respondents' home not to be noticed.*"

The court noted the following:

> "*Elizabeth was awakened many times at night by the blasting, and the family was awakened and she would have trouble getting the children back to sleep. She lost so much sleep that she "simply couldn't function any more"; she could hardly live with the blasting and became crabby, nervous and jumpy as did John. She took medication, and developed a lot of epigastric distress and an ulcer for which she took Maalox and ate a bland diet. She was hospitalized two weeks. The medical testimony is*

> *omitted from the record at appellant's direction, and no issue is made as to the cause or extent of Elizabeth's physical condition, but it is conceded that she suffered no direct physical injury or contact from the blasting (other than from vibrations and concussions).In general, the evidence showed cracks in the plaster of the house, damage to the chimney, broken windows, damage to the basement walls and flue; cracking of a concrete floor of a pig farrowing barn, necessitating replacement, and from which little pigs developed E. Coli scours and died from a pathogenic strain of bacteria which built up in the cracks of the floor, and which could not be controlled by cleaning and disinfectant. There was also a kind of loosely packed, gritty dirt which blew over to respondents' house continuously when the wind was from the direction of the pits, which dirt stuck between the storm windows and the window and stayed there. In the fields there was a sulphur odour from the pits, and the water which built up in the pit was highly acidic. Elizabeth was in a constant state of worry lest her husband, who was blind, or her children would get into the pit.*"

Elizabeth Rotert made over 100 calls, including one to the president of the mine, but there really was no change in the blasting being done. The mine employees showed a great deal of indifference to the homeowner's complaints, and Powell would say, "Those shots aren't that hard," and would argue that it was the humidity, not the shot. Never did they give respondents an answer that indicated appellant was going to do anything about the blasting, which got worse and worse as appellant's blasting got closer to respondent's home. Other homeowners had also experienced the impacts from the blasting, and lodged numerous complaints with the mine company. One neighbour's livestock would sometimes get up and run after being frightened by a blast. The trial court ruled in favour of the Roterts on seven counts, five of which were upheld by the Missouri Court of Appeals, consisting of the following:

- Count I: Respondent's course of conduct in its strip-mining operations was willful, wanton and malicious in that it used high explosives indiscriminately and caused great noise, vibrations of earth, air concussion and shock waves, creating noxious fumes, odour, dust and smoke and damaged respondents' property and persons.
- Count III: for blasting damage occasioned by losses in respondent's pig farrowing business losing 400 pigs
- Count IV: Elizabeth Rotert was awarded $4,500 actual and $9,500 punitive damages for her emotional distress and illness.
- Count V: John Rotert was awarded $5,000 actual and $22,500 punitive damages for his loss of Elizabeth's consortium and for her medical expenses.
- Count VI: John Rotert was awarded $500 actual damages individually for nuisance because of fumes and dust, and the deep pit left by appellant across the road from respondents' home.

Count II, award for damage to buildings, and Count VII, Elizabeth and John, joint award for damages, were remanded for a new trial.

2.1 Airblast and Ground Vibration

A distant blast may produce noticeable airblast response even though the airblast amplitude could be relatively low. This airblast will be relatively low frequency, with little energy above 5 Hz, because the atmosphere selectively attenuates the higher frequencies. The occupants inside a house may not hear or notice the direct sound. However, if the house has a natural vibration frequency (structural response) near 5 Hz it will respond to the airblast and produce higher frequency secondary noise (rattling or shaking) (Crum et al., 1995)[34]

According to Ancich (1982),[35] where a residence is more than 500 metres from a quarry, air blast overpressure rather than ground vibrations is the source of residents' complaints, and that blasting overpressures are related to structural displacement and some aspects of housing design. Reportedly, spectral analysis (calculation of waves or oscillations) of airblast overpressure and sonic boom N-waves confirms the presence of significant energy at frequencies as low as 1Hz. Air-overpressure can cause structural damage and harm people (or non-human life) in the vicinity of quarry sites (Chen et al., 2022).[36]

Air-blast is that loud noise or "sonic boom" that is created by large blasts (with a frequency greater than 20 Hz) (Fretz, 2013).[37] At far receptor distances from a large blast, it is normally the air-blast, instead of ground vibration, that can be felt and can potentially cause anxiety, emotional distress and damage. The air-blast can cause a house to vibrate and could potentially shatter windows, and dislodge and damage fragile household contents (e.g., paintings, mirrors, crystal China). Air-blast generated from a blast can be disturbing to persons, pets, livestock and wildlife. The intensity of air-blast is affected by:

- the size and location of the blast;

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[34] Crum, S.V., Siskind, D.E., Pierce, W.E., and Radcliffe, K.S., "Ground Vibrations and Airblasts Monitored in Swedesburg, Pennsylvania, from Blasting at the McCoy Quarry," U.S. Bureau of Mines, Minneapolis, March 19, 1995. <https://files.dep.state.pa.us/Mining/BureauOfMiningPrograms/BMPPortalFiles/Blasting_Research_Papers/State%20Reports/Ground%20Vibrations%20and%20Airblasts%20Monitored%20in%20Swedesburg%20PA%20from%20Blasting%20at%20the%20McCoy%20Quarry.pdf> accessed 10 April 2023.

[35] Ancich, E., "The Environmental Aspects of Structural Response to Blasting Overpressure," 26th Annual Conference of the Institute of Quarrying, Australian Division, Hobart, Tasmania, Australia, November 1982, <https://www.researchgate.net/publication/259577550_The_Environmental_Aspects_of_Structural_Response_to_Blasting_Overpressure> accessed 10 April 2023.

[36] Chen, L., Asteris, P.G., Tsoukalas, M.Z., Armaghani, D.J., Ulrikh, D.V., and Yari, M., "Forecast of Airblast Vibrations Induces by Blasting Using Vector Regression Optimized by the Grasshopper Optimization (SVR-GO) Technique," (2022) 12 Applied Sciences 9805. <https://doi.org/10.3390/app12199805>

[37] Fretz, J., 'Comments on Exclusion or Inclusion of Air-Blast From Ajax EA Assessment, Technical Memorandum' May 21, 2013, Golder Associates. <https://www.kamloops.ca/sites/default/files/docs/our-community/13-05-21-golder-exclusioninclusionopinion-airblast.pdf> accessed 10 April 2023.

- the blast design, which includes number of blastholes, charge weight per delay and stemming depth;[38] [39]
- the blast shot direction;
- the terrain;
- wind direction and speed;
- cloud cover; and
- temperature inversions.

The effects of blasting on persons, property and wildlife, farm animals or pets are of concern to neighbouring residents. Residents who have experienced blasts may mistake the sudden noise and shaking of their house to be the result of ground vibration rather than air-blast, but nonetheless residents have a common concern for the effects of blasting on their persons and houses. Air blast is a matter of specific concern to sound-sensitive individuals, including persons suffering from Post-Traumatic Stress Disorder (PTSD), who may be adversely affected by air-blast events. Residents may also be concerned about effects on pets, farm animals or wildlife. Pets and farm animals with sensitive hearing, such as dogs and horses, may be disturbed by air-blast. Air-blast can frighten wildlife, particularly birds, and as such air-blast may have effects on nesting. The effects of blasting on property values are also of concern to residents. The nuisance, distress and/or damage from air-blast have an impact on desirability of affected neighbourhoods, with a corresponding impact on property values (Sevelka, 2022).[40]

2.2 Ontario Blast Design and the Use of Seismographs

Rock extraction typically involves the use of explosives, and requires preparation of a proponent-driven Blast Design Report (typically misleadingly labelled as a Blast Impact Assessment and devoid of meaningful analysis of potential *adverse effects*), which, theoretically, is only concerned with *noise (audible)* and *ground vibrations* under static environmental conditions and unknowable subsoil conditions, and does not reflect the dynamic and changing nature of aggregate operations over time. Often, the proponent-driven Blast Impact Assessment concludes with a speculative statement that there will be "no adverse effects" occasioned by the proposed blasting quarry operation. The standards for a Blast Design Report for a proposed blasting quarry operation in Ontario under the Aggregate Resources Act (ARA) are as follows:

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[38] Stemming is the inert material such as drill cuttings used in the collar portion or between explosives charges in a column (decks) of a blasthole so as to confine the gaseous products formed in an explosion. Also, the length of a blasthole left uncharged (Ludwiczak, 2002)."…Stemming significantly influences the control of flyrock, air-blast, and toxic fume generation (van der Walt and Spiteri, 2020; Oates and Spiteri, 2021)."

[39] "All fragmentation models predict the right tendencies when primary factors like specific charge and blast-hole pattern are altered. Quite often though the models make contradictory predictions e.g. about the influence of spacing to burden ratio and hole diameter etc. (Finn Ouchterlony, Swerec, Lulea University of Technology, 2003).

[40] Sevelka, T., "Blasting Quarry Operations: Land Use Compatibility Issues and Property Value Impacts," (2022) 02 (03) Journal of Environmental Law & Policy 1-78. <https://doi.org/10.33002/jelp02.03.01>

> Applications for a Class A licence or for an aggregate permit, for a quarry that would authorize the extraction or removal of more than 20,000 tonnes of aggregate per year must complete the following:
>
> "*A blast design report is required if a sensitive receptor [often code for human targets in occupied structures] is within 500 metres of the limit of excavation to demonstrate that provincial guidelines for blast overpressure and ground vibration can be satisfied.*"
>
> "*A Blast Design Report must be based on the Ministry of the Environment's Model Municipal Bylaw (NPC 119) with regard to guidelines for blasting relating to noise (concussion or overpressure) and ground vibration. The allowable limits as stated in NPC must be adhered to and if monitoring is not being routinely done then the cautionary limits will apply.*"
>
> "*Monitoring should normally be conducted at locations representative of the closest residence to the blast behind the face and/or closest residence to the blast in front of the face. The monitoring equipment locations should be between the blast and the residence and as close to the residences as possible.*"[41]

A government directive that instructs a quarry operator to install monitoring equipment (e.g., seismograph) on privately owned or tenant-occupied neighbouring residences without the consent of the homeowner or tenant is culpable for a civil action of trespass. It is equally unlawful to install monitoring equipment on public lands without authorization of the municipality or region.

The Ontario Aggregate Resources Act (ARA) Blast Design *standards*[42] are deficient as they fail to ensure that the 500 metres "from the extraction limit" be measured internally from the boundaries of the quarry site along the entire perimeter and contained entirely on the land owned by the proponent (i.e., quarry operator), which is inconsistent with the statutory obligation that *flyrock* not leave the site "if a sensitive receptor is located within 500 metres of the boundary of the site."[43] (Ontario Regulation 244/97)

The Blast Design standards also ignore existing or proposed short- and long-term land uses (e.g., zoning by-law, municipal or regional official plan) of the lands within a radius of 500 metres beyond the proposed quarry site. The standards also ignore entirely the rights of the owners of the lands within a radius of 500 metres to the lawful use and enjoyment of

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[41] Licence Applications: Noise Assessment and Blast Design Report Standards, Policy No: A.R.2.01.09, Date Issued: March 15, 2006, Ontario Ministry of Natural Resources. <https://files.ontario.ca/environment-and-energy/aggregates/269184.pdf> accessed 10 April 2023. A site plan for a quarry operation where there will be no blasting onsite, a condition must be added to the licence indicting that no blasting will occur during the life of the operation (see A.R. 2.00.03).

[42] Aggregate resources of Ontario standards: A compilation of the four standards adopted by Ontario Regulation 244/97 under the *Aggregate Resources Act*. <https://files.ontario.ca/mnrf-aggregates-combined-standards-en-2020-08-27.pdf> accessed 10 April 2023.

[43] *Site* is defined as "a piece of ground that is used for a particular purpose or where a particular thing happens, Collins Dictionary. <https://www.collinsdictionary.com/dictionary/english/site> accessed 22 January 2023.

their lands (vacant or improved) for the entire life of a quarry, which could remain operational for 100 years or more (five generations or more). A separation distance of 500 metres between a blasting quarry and incompatible land uses is also inadequate and should be increased to a minimum of 1,000 metres (Sevelka, 2022).[44] This deprivation of third-party property rights constitutes a de facto taking (i.e., expropriation) without compensation, for which the government or proponent should be held accountable.

An October 9, 2003 letter from the Director of the Northern Region of Ontario's Ministry of Environment (MOE) in reference to Land Use Guideline D-6 advises municipalities to determine the minimum separation distance and potential area of influence for a Class III industrial use (such as a quarry) in the vicinity of sensitive land uses (such as homes and farms). It establishes the following parameters[45]:

- 1,000 metres potential area of influence for any adverse effects "to be identified, mitigation proposed and an assessment made on the acceptability of the proposal" (MOE, D-6, Appendix C).

It is noteworthy that th[is] distance[] appl[ies] regardless of whether it is a new sensitive land use proposed in the vicinity of an existing Class III Industrial Use such as a quarry, or whether it is a new quarry proposed in the vicinity of existing sensitive land uses. As a matter of good planning, the primary consideration should be to minimize conflicts between incompatible land uses, regardless of which is exists and which is proposed.

In June 2018, the Town of Greater Napanee, Ontario, denied a lot severance application (PLCOR 2018 023) for land designated "Rural" in the Official Plan near a non-compatible blasting quarry operation, effectively depriving the homeowner from maximizing the use and value of his property. The denial of the homeowner's severance application results in an unwarranted financial benefit to the owner of the 40-hectare (98.842-acre) quarry (Thomas Contracting) who should be responsible for providing his own internal setback (even if it reduces the amount of aggregate that can be extracted) to protect the health, safety and welfare of third-party property owners, and who objected to the severance:

> *"I do not support this application as it does not meet the required MNR setbacks from an active quarry or pit operation. These regulations were put in place to prevent problems with home owners when blasting takes place and the daily operations of a licensed quarry/pit. Mr. Pietrangeli's existing house does not meet the required setbacks and he has frequently complained in the past whenever we blast (As recently as 2017). I am a little shocked he is applying for severance that would put a house closer*

[44] Sevelka, T., "Blasting Quarry Operations: Land Use Compatibility Issues and Property Value Impacts," (2022) 02 (03) Journal of Environmental Law & Policy 1-78. <https://doi.org/10.33002/jelp02.03.01>

[45] House Quarry Application, Township of Bays File: Z39/05 <https://static1.squarespace.com/static/5c59cf4c7a1fbd06dcdc52b6/t/5c6dff67f4e1fc98466d9c20/1550712680419/House+Quarry+Application+.pdf> accessed 10 April 2023.

> *to our quarry operation. In conclusion I am strongly against this severance being approved."*[46]

In *Martin Marietta Materials, Inc., et al. v. Board of Zoning Adjustment of Cass County*, (2007),[47] the Missouri Court of Appeals alluded to the Cass County Comprehensive Plan, which states that the use of land has adverse impacts, including reduction of property values and homeowner equity, beyond the boundary of the land being used (e.g., proposed blasting quarry operation), and the best way to avoid an externality is to separate incompatible land uses (e.g., residential use of neighbouring properties):

> *"One of the most basic factors affecting the use of a given parcel of land is the use of adjoining parcels. This is due to the fact that the use of land has an impact that goes beyond the boundary of the land being used. Economists refer to this impact as a `land use externality' because it is generally not included in the property owner's decision-making process since it is external to the efficiency and profitability of the property being used. As an example of land use externalities, a house surrounded by sand and gravel pits is less enjoyable to live in and has less value for residential purposes than the same house surrounded by similar houses. The noise, smoke and heavy truck traffic generated by the excavations are so incompatible with residential life that the value of the house declines. Yet the gravel pit owners [blasting quarry operations] have no economic incentive to lessen the impacts of their activities since the declining value of the house does not affect the profitability of their businesses. In effect, it is a cost imposed by the gravel pit [or quarry] owners on the owner of the house....The best way to minimize these external costs is to separate incompatible land uses or buffer them from each other [para. 15]".*

In *Wagner et al. v. Miami County Board of Zoning Appeal et al.* (2005),[48] the Ohio Court of Appeals upheld the trial court's judgment, which denied Wagner's rezoning application to permit a blasting limestone quarry operation on the following grounds, including the impacts of the proposed quarry operation on future neighbouring uses:

- The applicant failed to demonstrate that the proposed use will not change the essential character of the area.
- The applicant failed to demonstrate that the proposed use will not be hazardous or disturbing to existing and/or future neighbouring uses.
- The applicant did not comply with Section 21.11(C)(7) of the Miami County Zoning Code in that the proposed mineral, soil,

[46] <https://greaternapanee.civicweb.net/document/129127/Committee%20of%20Adjustment%20-%2025%20Sep%202018.pdf?handle=9BF5E6BF3E9F412282056785E1E76485> accessed 10 April 2023.

[47] *Martin Marietta Mater v. Bd of Zoning Adj.*, 246 S.w.3d 9 (2007) <https://law.justia.com/cases/missouri/court-of-appeals/2007/wd66637-2.html> accessed 10 April 2023.

[48] *Wagner et al. v. Miami County Board of Zoning Appeal et al.*, 2005-Ohio-1377, Ohio Court of Appeals, 2nd Appellate Dist. 2005. <https://www.supremecourt.ohio.gov/rod/docs/pdf/2/2005/2005-Ohio-1377.pdf> accessed 10 April 2023.

> and/or gravel extraction use will involve uses, activities, processes, material, equipment, and conditions of operation that are detrimental to any persons, property, or the general welfare by reason of excessive production of noise, smoke, fumes, etc.

These same concerns over the adverse effects of blasting quarry operations on neighbouring properties apply equally in the case of a rezoning request to expand an existing non-conforming quarry operation. For example, the purpose of Marin County's zoning ordinance is to "*discourage the expansion of non-conformities*, but to permit them to exist and to be maintained and enhanced to protect public safety and property values"[49]

In Ontario, Canada, a Blast Design report only addresses *noise* (the audible part of airblast above 20 Hz) and *ground vibration*, not the damage or harm that can be caused by blasting (detonating explosives), while ignoring other *adverse effects* associated with the detonation of explosives such as *flyrock* and *toxic fumes*, and the attendant diminution in property values. (A noise assessment report is only required if proposed excavation and/or processing facilities are within 500 metres of a sensitive receptor, [50] for a quarry operation, ignoring entirely land that is undeveloped or in agricultural or passive recreational use.) As reiterated below is pertinent:

> "*For every kilogram of ANFO [ammonium nitrate fuel-oil] that is detonated approximately 1,000 litres of gas are produced. These reaction gases principally consist of carbon dioxide (CO_2), nitrogen (N) and water vapour (H_2O). However, as such detonations do not occur under ideal conditions, other toxic gases may also be formed, such as carbon monoxide (CO), nitrogen dioxide (NO_2).*" (Rob Farnfield, publication AggNet)[51]

In surface blasting, much of the detonation presents itself as a cloud of gas and dust coming off the blast. In addition, the gases generated from detonation of the explosives may be present in the muck pile[52] and may also move into cracks and fissures in the ground. The gases move through the ground and may collect in nearby confined spaces such as underground sewers, pipeline trenches, or basements of nearby homes and businesses. In most cases the fumes will spread slowly through the ground

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[49] *Point San Pedro Road Coalition v. County of Marin et al.*, 33 Cal.App.5th 1074 (2019) 245 Cal.Rptr.3d 580. <https://casetext.com/case/point-san-pedro-rd-coalition-v-cnty-of-marin-1> accessed 10 April 2023.

[50] "Summer time noises have the greatest potential for causing annoyance because of open windows, outside activities, etc. During the winter people tend to spend more time indoors and have the windows closed. In general, building walls and windows that are closed provide a 15 dB reduction in noise levels. Building walls with the windows open allow for only a 5 dB reduction in SPL [Sound Pressure Level]. Assessing and Mitigating Noise Impacts, New York Environmental Conservation Law Articles, Jeffrey Sama, February 2, 2001. <http://www.airandnoise.com/NYDEP-00-1.pdf> accessed 10 April 2023.

[51] Farnfield, R., "Blast Fumes From ANFO Mixtures," *AggNet*, undated. <https://www.agg-net.com/resources/articles/drilling-blasting/after-blast-fumes-from-anfo-mixtures> accessed 21 January 2023.

[52] *Muck Pile* is defined as "the pile of blasted and broken rock or dirt after the shot [blast] has been detonated, that has to be loaded and removed." The Blasting Primer, Second Edition, A Study Guide for Blasters and Students of Explosives Engineers, Progress Printing Company.

in all directions, and, in some cases, a preferential pathway may exist which allows the gases to move in one direction (Mainiero et al., 2007).[53]

A review of US accident statistics undertaken by Santis (2003)[54] since 1992 related to incidents involving the use of explosives detailed 11 occasions where after-blast fumes had seriously affected the public, three occasions where a worker had been affected, and one work-place fatality. Toxic fumes, fugitive dust, sound (noise) and vibrations, along with flyrock, are *contaminants* under the Ontario Environmental Protection Act (EPA) (RSO 1990. c E.19, s 1(1), defined as follows:

> "*contaminant*" *means any solid, liquid, gas, odour, heat, sound, vibration, radiation or combination of any of them resulting directly or indirectly from human activities that causes or may cause an adverse effect.*
>
> And, "*adverse effect*' under the *Ontario* EPA, means one or more of,
>
> (a) impairment of the quality of the natural environment for any use that can be made of it,
> (b) injury or damage to property or to plant or animal life,[55]
> (c) harm or material discomfort to any person,
> (d) an adverse effect on the health of any person,
> (e) impairment of the safety of any person,[56]
> (f) rendering any property or plant or animal life unfit for human use,
> (g) loss of enjoyment of normal use of property, and

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53 Mainiero, R.J., Harris, M.L. and Rowland III, J.H., "Dangers of Toxic Fumes from Blasting" (2007) <https://www.cdc.gov/niosh/mining/userfiles/works/pdfs/dotff.pdf> accessed 10 April 2023.

54 Santis, L.D., "An analysis of recent accidents during the use of commercial explosives," (2003) International Society of Explosives Engineers, Nashville Conference. <https://www.agg-net.com/resources/articles/drilling-blasting/after-blast-fumes-from-anfo-mixtures> accessed 10 April 2023.

55 In *Ontario (Natural Resources and Forestry v. South Bruce Peninsula (Town)*, 2022 ONCA 315, the Ontario Court of Appeal upheld the decisions of the lower courts, which ruled that the Town had "damaged" the habitat of a *species at risk*, pursuant to section 10(1) of the Endangered Species Act (ESA), which states, in part, "No person shall damage or destroy the habitat of (a) a species that is listed on the Species at Risk in Ontario List as an endangered or threatened species…." The Court of Appeal also referred to the goals set out in the preamble to the ESA, namely to prevent the "loss of species caused by human activities which damage the habitat of the species" and to "prevent damage to avoid or minimize threats to endangered species." The appeal court also reiterated the statement in the Supreme Court of Canada decision *Castonguay Blasting Ltd. v. Ontario (Environment)*, 2013 at para. 9 regarding the need to generously interpret the ESA in light of its remedial nature and its objective of environmental protection. "Damage," as defined by the trial judge, namely to cause something to be "less attractive, useful or valuable," was found to be appropriate and should be understood from the perspective of the species at risk. The Court of Appeal also noted that "the application of the *de minimus* [small or trivial] defence to charges under the ESA must be undertaken with caution "because of the potential cumulative effect of small damage over an extended period of time," as is typical of the damage caused by repeated detonation of explosives. As *minor damage* to the environment and its inhabitants can build over time and become irreversible, this finding by the Court of Appeal is equally applicable to the Environmental Protection Act (EPA).

56 In *Ontario v. Canadian Pacific*, [1995] 2 SCR 1031, the Supreme Court of Canada, quoting favourably from *R. v. Stellato* (1993), 78 C.C.C. (3d) 380, aff'd, [1994] 2 S.C.R. 478, concluded that "[i]f the evidence of impairment establishes any degree of impairment ranging from slight to great, the offence has been made out."

(h) interference with the normal conduct of business; ("conséquence préjudiciable")

Adverse effect has the same meaning in the 2020 Ontario Provincial Policy Statement, p. 39. The adverse effects, individually or collectively, associated with a blasting (or non-blasting) quarry operation are inconsistent with planning, building and maintaining *healthy and sustainable communities*, and have the potential to reduce residential and non-residential property values, and, in turn, erode a municipality's tax base for the entire life of a quarry operation (C4SE, 2009[57]; Smith, 2014[58]).

An examination of 12 Blasting Impact Assessments (BIAs) prepared by explosives engineers on behalf of the aggregate industry were found to focus entirely on (undefined) "sensitive receptors" and to completely disregard addressing property damage, quality of life and the health and safety of human and animal life. Other shortfalls or omissions routinely identified in a Blasting Impact Assessment are listed as follows:

- Potential *Nuisances* occasioned by blasting operations not mentioned;[59]
- "Adverse effects" not defined, inadequately addressed or overlooked;
- *Flyrock* (the ultimate adverse effect) not defined, inadequately addressed or overlooked;
- Calculations of rock throw (distance) made without provision for a safety factor (e.g., for protection of onsite quarry employees, for weather conditions, for uncontrollable factors and for unforeseen factors such as human error);[60]
- Reciprocal setback measurements from lot limits of sensitive receptors (e.g. homes, farms, parks, heavily-travelled roads, school bus routes) closest to a proposed quarry not provided;
- Presence of nearby above-ground and below-ground utilities not identified or disclosed;
- Presence of school bus routes, biking routes, trailways, bridges, etc., not identified or disclosed;
- Character of the area not described or inadequately addressed (some land uses are more sensitive than others, but virtually none are compatible with a proposed blasting quarry and its adverse effects);
- Present and future population demographics (permanent, seasonal and transient) for an appropriately defined external

[57] The Potential Financial Impacts of the Proposed Rockfort Quarry, C4SE, February 26, 2009 <https://files.secure.website/wscfus/6880241/uploads/C4SE.pdf> accessed 21 January 2023.

[58] Smith, G., "Economic Costs and Benefits of the Proposed Austin Quarry in Madera County," October 23, 2014 <https://www.stop3009vulcanquarry.com/wp-content/uploads/2018/01/Austin-Quarry-Economics-Report.pdf> accessed 21 January 2023.

[59] Only one Blasting Impact Assessment examined mentioned "nuisances."

[60] There are numerous formulas for calculating rock "throw," but none are particularly accurate as they cannot capture the dynamic and unpredictable nature of detonating explosives in rock (Lwin and Aung, 2019).

zone of influence or planning district during the expected life of the quarry operation not provided;

- Description of "sensitive receptors" not provided;
- Activities associated with each "sensitive receptor" not disclosed;
- Size (scale), age, construction and condition of each "sensitive receptor (i.e., structure, bridge, monument, etc.)" not provided (every structure has a different level of tolerance to ground vibrations and airblast from repeated detonation of explosives);
- Number of occupants and pets (if applicable) and use of "sensitive receptor (e.g. residential, business, institutional or recreational) that will be adversely impacted by blasting not addressed;
- Expected life of proposed quarry operation (i.e., all phases) not disclosed; and
- Estimated frequency and number of blasts, including average number of detonations per blast, during the expected life of the quarry operation not disclosed.

The superficial nature of the Blast Impact Assessments examined precludes meaningful analysis of potential health and safety risks, quality of life issues and potential nuisances that residents (and passers-by, visitors, workers, business employees and patrons) can expect to experience as a result of quarry blasting operations during the anticipated life of the quarry. A Blast Impact Assessment that fails to include a meaningful analysis of *flyrock*, the ultimate adverse effect, is, at best, misleading, and, at worst, points to incompetence, negligence or depraved indifference. Just because the Ontario ARA does not specifically mandate an analysis of flyrock as part of a Blast Design, no responsible and ethical engineer preparing a proponent-driven BIA would ignore or dismiss the issue of flyrock (an unavoidable by-product of blasting rock), which is considered the ultimate adverse effect of blasting, and deemed an extremely dangerous or ultra-hazardous activity by the courts.

Suspicions and root causes behind *flyrock* and the under-reporting of *flyrock* incidents in Ontario were discussed by participants during an interactive forum at the 2011 annual general meeting of the Western Canada Chapter of the International Society of Explosives Engineers in Vernon, BC (Loeb, 2012):

> *"Flyrock incidents in Ontario are probably just not being recorded. The fine is for flyrock leaving a property onto another property. Often that is not seen and the evidence would be swept off the street. I would strongly suspect that several flyrock incidents in Ontario are not recorded…."* (A. Grogan, pers. comm., October 16th 2011).

A Blast Design, even with the limited criteria under the Ontario ARA, prepared by an explosives engineer for a proposed quarry operation is not a science: it is very much an after-the-fact trial and error process

(Pugliese, 1972)[61] left entirely to the discretion of the blaster-in-charge throughout the anticipated life of the quarry, which does not bode well for the environment and the health, safety and welfare of human and non-human life. In Ontario, Canada, a blaster does not require a license as proof of some measure of competency in blast design.

The earth consists of many particles of soil or rock which are cemented together. There is a small amount of elasticity in the cementing material and even in the rock as well, and vibration is actually the displacement or movement of these particles caused by the seismic wave as it passes through the earth. The displacement of these particles is only a small fraction of an inch. The elastic nature of the cement causes the particles to oscillate. As the seismic wave alternate completely, the particles come back to the original position. It is these oscillations of the individual particles that are measured to find the magnitude of blast vibration (Tariq, undated).[62]

Drilled blastholes filled with explosives are detonated behind the working face of the materials to be quarried to blast loose the rock mass for harvesting. When the explosives are detonated a detonation moves through the explosive at a speed of about 18,000 feet per second (5,486 metres per second) changing the solid material to a gas at a very high rate. This detonation wave and rapidly expanding gas will create a cavity, crushing, cracking and moving the surrounding material. It will generate two types of waves into the earth around the explosion. First a surface wave, or Ryleigh wave, that will damp out and disappear in a relatively short distance. Then a second wave will travel great distances in the bedrock (under any barrier). It is this second body wave that will move through the bedrock and cause the earth above the bedrock to vibrate and shake homes and other structures, even at large distances from the explosion site. There is no way to mitigate or block the movement of these body waves. Following statement is worth mentioning in the context:

> "*Onsite barriers and buffers will not shield neighbouring properties from the sound and vibration damages of blasting. The hemispherical shock wave emanating from an explosion is similar to a sound wave in that the wave expands in all directions and will simply move over any barrier as though it was not there.*" (Pers. Comm. of Dr. Kiger, explosives expert, proposed Granite Quarry in Alvaton, Meriwether County, GA, 2018)

[61] Pugliese, J.M., "Designing Blast Patterns Using Empirical Formulas, A Comparison of Calculated Patterns With Plans Used in Quarrying Limesotne and Dolomite, With Geologic Considerations," Twin Cities Mining Research Center, Minneapolis, Minn., 1972 <https://miningandblasting.files.wordpress.com/2009/09/designig_blast_patterns_using_emperical_formula.pdf> accessed 21 January 2023.

[62] Tariq, S.M., "A Comparative Study of Calculated and Measured Particle Velocities," Pakistan Engineering Congress, 69th Annual Session Proceedings, 2001. <https://pecongress.org.pk/images/upload/books/657.pdf> accessed 21 January 2023.

The stress wave from the detonation of the explosives causes radial fracturing of the rock mass at 1.5 to 8 feet per millisecond.[63] Blasting to fragment (break) and move rock unfortunately produces ground vibrations and airblast as wasted energy, which results in unintended consequences exposing the environment and human and non-human life to numerous *adverse effects* each time explosives are detonated, in addition to the potentially deadly consequences of flyrock. It is further explained as:

> "*Ground vibration, flyrock and noise consume about 80% of the total energy produced by explosives, and only 20% is used in rock fragmentation (Parida and Mishra, 2015[64]). See the YouTube video of a Blasting Crew Loading Explosives and Blowing Up Solid Rock.*"[65]

Blasting of rock causes irreversible transformations such as ruptures, cracks, fissures or subsidence in the area surrounding a quarry site after every blast (Garaliu-Busoi et al., 2021),[66] which are exacerbated by the cumulative effect of repeated blasting. Subsidence is defined as:

> "[A]ny movement of the soil from its natural position. This movement may be in any direction. It may be of surface or subsurface soil. A shifting, falling, slipping, seeping or oozing of the soil is a subsidence within the meaning of the term as used in this Chapter (*Restatement (Second) of Torts* § 817, comment *h* at 68 (1977)".[67]

Knowledge of the type and intensity of the rock defects is much more important than the rock type to be encountered in blasting. A discontinuity is defined as a significant mechanical fracture that has low shear strength, negligible tensile strength, and high fluid conductivity with the rest of the rock material. Rock mass is rarely continuous or isotropic and is composed of intact blocks of rock separated by discontinuities like faults, cleavages, fissures, fractures, joints, bedding planes, shear zones, etc. The behaviour of the rock mass is dependent on the nature and frequency of these discontinuities, the shape of the intact rock defined by the discontinuities and the properties of the intact rock. It is the discontinuities that control

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63 Blaster's Training Module 3 –Surface Blast Design. <https://www.osmre.gov/sites/default/files/inline-files/Module3_0.pdf> accessed 21 January 2023.

64 Parida, A., and Mishra, M.K., "Blast Vibration Analysis by Different Predictor Approaches-A Comparison," (2015) 11 Procedia Earth and Planetary Science 337-345. <https://www.sciencedirect.com/science/article/pii/S1878522015001216> accessed 21 January 2023.

65 <https://youtu.be/fg2hefTwZ00> accessed 21 January 2023.

66 Garaliu-Busoi, B., Kovacs, A., Gheorghiosu, E., Radeanu, C., and Miclea, O., "The importance of seismic protection of strategic objectives, in the area of influence of useful rock quarries, in which blasting in carried out," (2021) National Institute for Research and Development in Mine Safety and Protection to Explosion. <https://www.matec-conferences.org/articles/matecconf/pdf/2021/11/matecconf_simpro21_02002.pdf> accessed 21 January 2023.

67 In *Island Creek Coal C. v. Rodgers*, 644 S.W.2d 339 (1982), Ky Court of Appeals, an April 29, 1977 blast at the surface coal mine, consisting of 16 blastholes 32 feet deep, each containing 275 pounds of ANFO for a total of 4,400 pounds (1,996 kgs), caused subsidence which damaged homes in a subdivision located 13,200 feet (4.023 kilometres) at the closest point from the blast site.

the engineering performance of a rock mass, not the intact rock (Quarry Magazine, 2012).[68]

In the case of *Gateway Estates Park Condominium Association* (2018),[69] the condominium association manages a mobile home community of 220 homes and two vacant lots. The condominium association holds title to a number of common elements, including man-made South Lake which was excavated sometime before 1975 when the condominium was registered. In 2005, *SDI Quarry*, which operates the only mines at which blasting is conducted in close proximity to the community, began blasting at three mines near South Lake, no closer than 7,000 feet (2.13 kilometres) from the mobile home community, averaging about 20 blasts a year. Each blast was monitored and the vibrations recorded. All were within lawful levels established by state law (the limit is a peak particle velocity (PPV) of 0.5 inches per second or 12.7 mm/sec). None exceeded 0.2 ips (5.08 mm/sec) PPV at South Lake, with most being 0.1 ips (2.54 mm/sec) PPV. No damage to South Lake was evident for five to six years of blasting until 2011, when its shore first began to show signs of destabilization and the ground collapsing:

> "*In 2011, about five or six years after Appellee began its blasting activities, the shore of the South Lake began to destabilize, and saturated soil at the edge of the lake began to slough and slump into the water. This opened up fissures in the slope, which undermined the upward bank. In time, holes appeared in the bank, and pieces of the once level surface fell off, resulting in a narrowing of the horizontal area from roughly five feet to about a foot and a half. Residents observed the ground falling into the water in close temporal proximity to the blasting.*"

In late 2014 or early 2015, *Gateway Estates* retained James McNew, owner of Upper Keys Consulting, to give recommendations concerning restoration of the lake bank. Upper Keys Consulting prepared an estimate in the amount of $840,000 for restoring the shore of South Lake and installing preventive devices to protect the shoreline against erosion from further blasting. This led to litigation against *SDI Quarry* under Florida's Construction Materials Mining Activities Administrative Review Act. Blasting continued without interruption, and between July 1, 2015 and October 17, 2016, there were 25 blasts. Based on this figure, the administrative law judge inferred that the number of historical blasts that had impacted South Lake was 200 to 250. Whether the detonations caused harm to South Lake's shoreline was the focal point of the administrative proceedings, quoting:

> "*[That] the blasts were all within state standards…doesn't negate potential liability.*"

It was acknowledged that "no generally accepted scientific standard exists as to relevant threshold PPV levels for when man-made lakeshores would be adversely affected by vibrations from afar." McNew, over the

[68] Quarry Magazine, "Reducing piles through better blasting," (2012) PCM_ADMIN. <https://www.quarrymagazine.com/2012/07/08/reducing-piles-through-better-blasting/> accessed 21 January 2023.

[69] *SDI Quarry v. Gateway Estates Park Condominium Association*, 249 So.3d 1287 (2018)

objections of the *SDI Quarry*, was qualified to testify "as an expert on causation." McNew, holding a degree in mechanical engineering, had no training or significant education in seismology, geotechnical engineering, or geology. McNew testified that he consulted extensively with an engineer, and they produced a set of notes based on their extensive research of the literature, and these formed the basis of his opinion as the causes of the slope stability failures around South Lake.

> "*McNew opined that vibrations from Appellant's blasting caused the problems at Appellee's lake. Specifically, he explained that these vibrations acted upon the soft layer of silt atop the shore and bank of the South Lake, causing the liquefaction of this saturated soil extending up to eight feet beneath the surface. This led to the compaction of the loose, wet soil around the edges of the lake, opening up cracks and holes and weakening the slope, which began to erode and fail. McNew conceded that there were no legal standards in Florida or elsewhere establishing thresholds above which lakeshore slope instability would be expected under the stress of blast-related vibrations. In formulating his opinion, McNew stated that he used Transit Authority Guidelines rather than mining guidelines because the transit guidelines provided a more realistic standard where the damages were not to buildings. McNew also ruled out other possible causes such as earthquakes or heavy truck hauling near the lake.*"

Ruling in favour of *Gateway Estates*, the administrative law judge found McNew's opinion on causation more persuasive than the competing view offered by *SDI Quarry's* experts. In doing so, the judge noted that:

> "*Steven Black's categorical opinion that blasting could not be a cause of the damage to Appellee's lake was undercut by his concession that heavy truck traffic could affect the silt layer of a lakeshore over a continuous period of time. The administrative law judge also found that the circumstantial evidence supported McNew's opinion. Specifically, he noted that 'the South Lake had existed for at least 35 years without experiencing the deterioration of the shore and bank that became noticeable within just five or six years after the start of the blasting, and which worsened over time as the blasting has continued.' He also noted 'the persuasive evidence that visible damage occurs in the wake of individual blasts'.*"

Black's evidence was accepted by the administrative law judge to the extent that wind, wave and rainwater was a natural cause of some of the bank erosion at South Lake, and found that *SDI Quarry's* blasting combined with the natural forces constituted a legal cause of the claimed property damages. Adding, "*as a matter of fact,' the property damage at issue is present and continuing; the harm to the lakeshore is cumulative, indivisible, and inseparable.*"

Finding that blasting is an ultra-hazardous activity for which strict liability is imposed, the administrative law judge concluded that *Gateway Estates* was not required to prove *SDI Quarry* was negligent or that *SDI Quarry's* blasting was the sole cause of *Gateway Estates'* damage. *Gateway Estates* was awarded $840,000 in damages. In a continuing tort (trespass),

the statute of limitations runs from the time of the last tortious act.[70] The Florida appeals court, in a unanimous ruling, upheld the administrative order.

2.3 The Use of Seismographs and its Limitations in Measuring the Adverse Effects from Blasting Rock

A seismograph is an instrument that measures earth-borne vibrations at a specific location induced by an earthquake or blasting, and, at best, it can be used to determine movement of the ground surface. Sometimes the intensity of blasting reverberates to such an extent that it is heard and felt at a great distance from the blast site that the blast is mistaken for an earthquake. For example, a blast at a quarry in the Town of South Bruce Peninsula, Ontario, in 2019, was initially mistaken for an earthquake:

- At 5:19 pm on December 13, 2019 a large area on the Bruce Peninsula was shaken by what was initially reported as a small earthquake by Natural Resources Canada. It registered 2.1 on the Richter scale. Seismic events at that level are not usually felt, not until they reach 3.5 on the scale. But this one was felt, and heard, for several seconds from Cape Croker north-east of Wiarton, to Lion's Head, about halfway up the peninsula. The blast turned out to be from the Hunter Haulage & Excavating Inc. quarry in the Town of South Bruce Peninsula, Ontario, with the Richter scale reading revised to 1.9. The location of the blast was about 15 kilometres north of Wiarton, southwest of Hope Bay on the Georgian Bay side of the peninsula.
- In February 8, 2021, the owner of the 80.65-acre quarry (1562 Bruce Road 9, Town of South Bruce Peninsula), Hunter Haulage & Excavating Inc. pleaded guilty in Provincial Court for permitting the contravention of conditions of its licence (Scott, 2021),[71] resulting in an insignificant fine of $3,500, nothing more than the cost of doing business. "There was no blast monitoring equipment [i.e., seismographs] in position at the site, which was a permit condition to confirm compliance with blasting standards," and "the blast happened after 5 p.m., later than allowed in the site plan."

A scaled distance mathematical equation is used to predict ground vibration and airblast from blasting rock. As commonly applied in blasting rock, the calculation of scaled distance equals the distance between the blast to the point of concern (impact), measured in feet or meters, divided

[70] In *Plaunt v. Renfrew Power Generation Inc*., 2011 ONSC 4087 (CanLII) the reference to "The Law of Torts, 9th ed., John G. Fleming (Sydney: LBC Information Services, 1998), at page 48," that [i]n many American blasting cases it has been held that damage from flying rocks is trespass, but from vibration or concussion at most nuisance," no longer reflects the state of common law. Claims of damages occasioned by "vibration or concussion" as a consequence of blasting are now treated as the tort of "trespass."

[71] Dunn, S., "Company fined for Hope Bay quarry blast that shook houses," *The Sun Times*, Mar 11, 2021. <https://www.owensoundsuntimes.com/news/local-news/company-fined-for-hope-bay-quarry-blast-which-shook-houses> accessed 10 April 2023.

by the square root (for ground vibration) or by the cube root (for airblast)[72] of the charge weight of explosives per delay, in pounds or kilograms Normally, when using the equation the delay period must be at least 8 milliseconds for the sequential detonation of each blasthole. A seismograph does not measure structure response to the vibrations generated by a blast, which can be more damaging than the direct damage caused by vibrations, nor is a seismograph capable of accounting for differences in

- the footprint of a structure;
- the type of structure;
- the design of a structure;
- the age and condition of a structure;
- the type of structural materials;
- the height of a structure;
- the size and layout of a structure; or
- the contents of a structure.

In addition to variation in each of these physical variables of a structure, each structure is spatially unique (i.e., in location and distance) in relation to the blast site. Vibrations from blasting spread out in all directions from the blast site, and usually not equally so. Accordingly, the impact of blasting on every structure (and occupant) is unique, as testified to by two experts representing a quarry owner in a 2004 class action lawsuit[73] involving an estimated 11,075 people within five square miles (12.95 km^2) of the quarry:

- "*…[T]he Salter report found that "[t]he variation in noise is due to the wide range of distances between the noise sources and homes and shielding of the noise provided by natural terrain, intervening homes and vegetation. Because of these factors, in many locations, neighbours within a few hundred feet of each other have dramatically different exposure. The report notes that noise exposure also varies inside of individual homes due to the orientation of rooms, nature of furnishings, size and construction of windows and whether windows are open or closed.*"
- "*The…report, prepared by Blast Dynamics, Inc., analyzed how blasting at the Quarry affected neighbouring residents. This report identified a number of variables in the way that different residents would experience vibration from blasting. These variables include the presence of rock or soil formations that alter the frequency of blast waves, the natural or "resonant" frequencies in each structure that changes the response to vibration, distance from the blast site and differences in the duration of the blasts. The report included a geologic map of the area showing a combination of soil, rock,*

[72] Pennsylvania Blaster's License Training Manual, Department of Environmental Protection, Bureau of Mining Programs, 5600-MN-DEP4778 8/2017. <https://files.dep.state.pa.us/mining/District%20Mining/DistrictMinePortalFiles/Blasting/Blaster%20Manual%205600-MN-DEP4778.pdf> accessed 10 April 2023.

[73] *Frieman v. San Rafael Rock Quarry, Inc.* 10 Cal. Rptr.3d 82 (2004) 116 Cal.App.4th 29, <https://casetext.com/case/frieman-v-san-rafael-rock-quarry-inc> accessed 10 April 2023.

> *sandstone, artificial fill, bay mud and marshland under the relevant area. The report noted that soil typically filters out high frequency energy, while rock transmits it. Test blasts were detonated at the Quarry and instruments were placed at various locations to evaluate the differing effects. The results of the velocity measurements showed a decrease in impact with distance from the blast site, but the frequency measurements showed no consistent pattern. The report concluded that: "[t]he test data shows that it is unreasonable to expect that any two sites will experience the same blast related vibration...."*

According to Dr. Kiger, former Dean of Engineering at the University of Missouri, vibration damage from blasting is almost an absolute certainty.[74] Kiger was the expert for the Bim blasting case, which was tried in court in Boone County in March 1999. Kiger is an international expert in protecting federal buildings from blasting damage. After examining 6,000 blasting logs, he testified that there is about a 95 per cent chance of damage at a vibration limit of 0.5 inches/second (12.7 mm/sec), if you count each of the blastholes shot (50 on average) as a separate vibration. He also testified that low-frequency waves (2 Hz-11 Hz) generated by some blasts can be more damaging. The frequencies can match that of a house and amplify the shaking [p. 16]. Kiger concedes that all homes undergo daily and seasonal dimensional changes due to things like humidity variations and changing temperatures. For example, a "sticking" door that will not close or open during certain times of the year. The environmental effects will cause strains in the walls, ceilings, structural framing, the covered surfaces, etc.

These strains are known by engineers as prestrains that are strains that exist before an event like a blast-induced ground vibration. The prestrain condition may be such that a very small vibration will push the item, like a wall panel, a framing connection, or piece of tile, over its strain limit and result in a crack or loosening of a structural frame connection. It also means that:

> "*Once a crack is initiated the crack will grow at a much lower level of vibrations than was required to initiate the crack. This is because of the stress concentration that exists at the crack tip, envision for example a small crack in an automobile windshield where even a small bump from one's hand can cause the crack to grow.*"

Thus, even low levels of repeated occurrences of blast-induced ground vibrations can cause significant damage to a visible damage and cracks in masonry. For example, the German vibration standard is 0.16 ips [inches per second] [4.06 mm/sec] for buildings with visible damage and cracks in masonry. Regulatory authorities in the United Kingdom have established a peak particle velocity (ppv) of 0.24 ips; in Australia the common limit is 0.2 ips and it is 0.001 ips [0.0254 mm/sec] for historical

[74] Vivian Stockman, Ohio Environmental Coalition, *Ohio Valley Environmental Coalition v. Hobet Min*, 702 F. Supp. 2d 644 (S.D.W. Va. 2010) <https://casetext.com/case/ohio-valley-environmental-coalition-v-hobet-min> accessed 21 January 2023.

buildings and monuments for frequencies less than 15Hz.[75] The fact that these prestrain conditions can produce a condition in the home such that damage to a home will occur at even very low levels of vibrations is acknowledged in BOM [Bureau of Mines] RI 8507[76] in their Conclusion 7 [p. 68]…This conclusion, agreed to by the 4 experts that authored RI 8507 (Siskind et al., 1980),[77] clearly states that "…there may be no absolute minimum vibration damage threshold…," that is, when inevitable pre-strain conditions are present in a home, any blast induced ground vibrations might cause damage to the home.

All homes eventually crack because of a variety of environmental stresses, including humidity and temperature changes, settlement from consolidation and variations in ground moisture, wind, and even water absorption from tree roots. Consequently, there may be no absolute minimum vibration damage threshold when the vibration (from any cause, for instance slamming a door) could in some case precipitate a crack about to occur.[78] Following quote is important in this context:

> "*It is sometimes suggested that dropped weights, door slams, or foot falls will generate a ppv [Peak Particle Velocity] of 1.0 ips [25.4 mm/sec] as recorded by a nearby seismometer. While it is true that the recorded ppv may be similar to the ppv recorded for a blast generated vibration wave; the effect of these vibrations on people or homes is in no way equivalent. In fact, suggesting that vibrations created by these methods are similar to those created by a quarry blast event are very misleading and are unconvincing to any individual knowledgeable about vibration effects. While it is true that using an instrument like a seismograph to measure the peak velocity near the point of impact of a dropped weight will likely record a peak velocity similar to the peak velocity produced by quarry blast at a distant location; these vibrations are not equivalent in their effects. The ground waves generated by the quarry explosions are hundreds of feet in length and will move entire buildings as described above. The vibrations generated by dropping a weight, slamming a door, or stepping on the floor are very short in duration and in length. The localized vibrations generated by a dropped weight, door slam, or foot fall*

[75] See for example Table 1 in Konon and Schuring, "Vibration Criteria for Historic and Sensitive Older Buildings" by Konon and Schuring, ASCE Preprint 83-501; American Society of Civil Engineers (ASCE), Houston Texas, October 17-19, 1983.

[76] US Bureau of Mines RI 8507, "*Structural Response and Damage Produced by Ground Vibration from Surface Mine Blasting*," 1980. <https:// https://vibrationmonitoringcourse.com/wp-content/uploads/sites/7/2014/03/RI-8507-Blasting-Vibration-1989-Org-Scanned-Doc.pdf> accessed 21 January 2023.

[77] Siskind, D.E., Stachura, V.J., Stagg, M.S., and Kopp, J.W., "Structural response and damage produced by airblast from surface mining", US Bureau of Mine, RI 8485. <https://www.resolutionmineeis.us/sites/default/files/references/siskind-et-al-1980.pdf> accessed 21 January 2023.

[78] In Bureau of Mines RI 8507, they suggest a maximum allowable ground vibration peak particle velocity (PPV) of 0.5 inches per second (ips) or 12.7 mm/sec at which there is a 0.5 percent probability of damage. However, the standards in many other countries are much lower. For example, regulatory agencies in Leicestershire County, UK, have established the upper limit on allowable PPV as 0.24 ips (6.1 mm/sec). In Australia, the common PPV limit is 0.2 ips (5.08 mm/sec) and it is 0.001 ips (0.2 mm/sec) for historical buildings and monuments for frequencies less than 15 Hz. Frequencies less than 15 Hz are very likely in blast induced ground vibrations at large distances from the blasts.

> *generate wave with much higher in frequency and smaller length dimensions than a building and have far too low an energy level to excite an entire building. If the front door slams very hard you might hear it in the back bedroom, but the entire house will not shake.*" (Proposed Granite Quarry in Alvaton, Meriwether County, GA, 2018)

The size of the blast induced ground vibration waves shaking the homes is large in comparison to the footprint dimensions of a typical home. The length of the ground vibration wave train is the duration of the blast induced ground vibration shaking at homes, typically about 3 to 4 seconds, times the speed of the ground wave, typically about 800 ft per sec [244 metres per sec]. Thus, for a typical blasting event with multiple individual explosions the ground vibration wave train is about 3,000 ft [914 metres] long. These ground vibrations at long distances, i.e. more than 1,000 ft, [305 metres] have a dominant frequency of the ground vibration equal to about 8 to 10 Hz (cycles per sec); for a frequency of 10 Hz a single cycle of the ground shaking is 80 ft [24 metres] in length (one cycle is up down and back up) so that the leading edge of the home is picked up then pulled down while the back of the home is being picked up; this up and down of the front and then back of the house occurs repeatedly for the full 3 to 4 second duration of the ground vibration; in this example that would be about 30 to 40 complete cycles (10 cycles per second for 3 or 4 seconds). When these repeated distortions of the house match the natural frequency of the house, the motions will be amplified and damage to the house will be significantly increased.[79]

Freda Harris reached a similar conclusion finding that geological "hot spots" in a community can make vibrations from blasting worse:

> "*Freda Harris, who had a blasting case with a mine in Indiana, gathered many documents during the case and subsequent FOIAs of OSM [Office of Surface Mining]. She wrote a manual for Citizens Coal Council*.[80] *One of her most intriguing findings was that there can be "hot spots" in a community where the geography can make blasts worse. She emphasizes that damage and vibrations can feel worse if a house's natural frequency is approximately between 4 Hz and 12 Hz. The above-ground part of the house often vibrates more than the ground outside and the foundation. Yet, the DEP [Department of Environmental Protection]/OSM standard is based on ground vibration [p. 16]."*

An often-quoted blasting study (RI 8507) conducted by Siskind et al. (1980)[81] on behalf of the former United States Bureau of Mines (USBM) arguing that a vibration limit at 0.5 in/sec (12.7 mm/sec) constitutes a safe blasting limit has been criticized by other experts and successfully challenged in the courts:

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79 *Fontaina Scott v. Mountaineer Grading Co.*, Putnam Co. Vir. Act. No. 09-C-286.

80 Freda Harris and Will Collette, "The People's Guide to Blasting: How to Protect Your Home, Family and the Environment," (1999) <https://www.crmw.net/files/Blasting_Summary.pdf > accessed 21 January 2023.

81 Siskind, D.E., Stachura, V.J., Stagg, M.S., and Kopp, J.W., "Structural response and damage produced by airblast from surface mining", US Bureau of Mine, RI 8485. <https://www.resolutionmineeis.us/sites/default/files/references/siskind-et-al-1980.pdf> accessed 21 January 2023.

> "*Most of the blasting studies of the Bureau of Mines were done by David Siskind. The FOIAs provided much correspondence between Siskind and other experts, some of it quite critical. A top official of Vibra-Tech, a leader in designing blasting technology, said: "Any criteria…which ignores the frequency of a structure, and the frequency content of the ground motion is overly simplistic…Your criteria, as proposed, will neither protect the interest of the citizen and the homeowner, nor will it protect the blaster from alleged damage claims [p. 16].*"[82]
>
> "*After the Bureau of Mines was shut down by Congress [in 1996], Siskind became a private consultant. He testified for the coal company that lost the Bim case. The majority of the blasting cases have overturned his studies, and thereby the limits used by DEP and OSM. As he wrote an OSM official on June 17, 1997: "The battles I am now seeing are not 0.5 in/sec [12.7 mm/sec] versus 1.0 in/sec [25.4 mm/sec]. Complainants are trying to dismiss all the science as biased, wrong or non-applicable. For the most part, they are succeeding in ways that pay off [p. 16].*"
>
> "*Evans [an expert blaster and regional manager of explosives firm Dyno-Nobel in south-western Virginia (1982-2002)]*[83] *said they concentrate much more on the effects of the low frequencies than on per particle velocity [PPV]. The per-particle [velocity] reading almost never goes higher than 0.3 inches [per second] [7.62 mm/sec], well below the regulatory limit of 1 inch per second [25.4 mm/sec]. However, just as Sam Kiger and Freda Harris determined, the low frequencies are bothersome [p. 18].*"

The vibration levels routinely cited by the aggregate industry and its explosives engineers or blasters also overlook or ignore the following underlying critical and generic assumptions when relying on the blasting standards of the OSMB RI 8507 study conducted by Siskind et al. (1980)[84] in the preparation of a proponent-driven Blast Impact Analysis:

> "*Safe vibration levels for blasting are given in Table 13…Implicit in these values are assumptions that the structures are sited on a firm foundation, do not exceed 2 stories, and have the dimensions of typical residences, and that the vibration wave trains are not longer than a few seconds [p. 58].*"

According to Mann (2003),[85] studies published by the U.S. Bureau of Mines and the private sector have well documented the phenomenon commonly known as "frequency matching:"

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[82] Vivian Stockman, Ohio Valley Environmental Coalition, <https://www.c-span.org/person/?108142/VivianStockman>

[83] Subsequently, Evans founded Geoscan Seismic Services Inc. and is only one of four people in Kentucky currently approved to teach Basic Blaster 30-hour class, which is required by law prior to blasting on surface mines in Kentucky (Source: Geoscan Seismic Services Inc. website).

[84] Siskind, D.E., Stachura, V.J., Stagg, M.S., and Kopp, J.W., "Structural response and damage produced by airblast from surface mining", US Bureau of Mine, RI 8485. <https://www.resolutionmineeis.us/sites/default/files/references/siskind-et-al-1980.pdf> accessed 21 January 2023.

[85] Mann, M.J., "Response of Manufactured Houses to Blast Vibrations," (2003) Ohio Department of Natural Resources, Division of Mines and Reclamation, New Philadelphia, Ohio, USA. <https://files.dep.state.pa.us/Mining/BureauOfMiningPrograms/BMPPortalFiles/Blasting_Research_Papers/State%20Reports/2003%20Mann%20-2003%20BAI%20modular%20Homes.pdf> accessed 21 January 2023.

> "*If the blast vibrations contain frequencies that tend to match the "natural" frequencies at which a house "likes" to vibrate--typically in the range of 4 to 12 Hz--the house will respond significantly. The Bureau (RI 8507) recorded upper-corner responses as high as 4 times the particle velocities measured in the ground beside the houses, with 1.5 being a typical amplification factor for conventional houses up to two stories high. Because of the amplification factor and the resulting strains across interior walls, the greatest potential for damage exists when a house is vibrated at or near its natural frequency.*"

A similar criticism of PPV in measuring ground vibration levels from blasting has also been voiced in Australia. According to Jordan (2013),[86] permitted peak particle velocity (PPV) levels governed by Australian Standard AS 2187.2 (Storage and use of explosives) fail to consider the frequency or frequencies in blast vibrations and their relationship with the natural frequencies of a structure or building and the potential for damage. Even at the low Australian standards governing PPV, which are based on human perception criteria, "complaints from mine neighbours are common."

> "*Except in an informative appendix (i.e. not forming part of the standard) to the latest edition of AS 2187.2, no consideration is given in the criteria to the frequency or frequencies in the blast vibrations and their relationship with the natural frequencies of the building or structure.*"
>
> "*Resonance effects in structures are well known and form the basis for response spectrum analysis in earthquake engineering. Whilst the behaviour of whole structures is the main concern in earthquake actions analysis, the behaviour of individual elements of buildings and structures can be considered and this is applicable in determining whether, for example, a wall or ceiling panel, or even a pane of glass, may be vulnerable to damage at quite low vibration levels….[R]esonance effects measured by the author have seen PPVs amplified by factors of more than 60× [in a single charge trial blast].*"
>
> "*…PPV levels commonly applied, whilst designed to prevent damage, did not give any indications of a structure's likelihood of damage: in most cases no damage could be found at PPVs many times those prescribed, whereas at other times damage seemed to be occurring with vibrations of low PPV.*"

Jordan (2013)[87] also describes unexplainable damage to historical structures even when blasting is measured at lower PPVs of 5 mm/sec or even 2 mm/sec. He adds:

> "*In recent times there has been damage noted in some of the buildings being monitored which cannot be explained simply on the basis of the peak particle velocity [PPV] in the ground wave. In particular, cosmetic*

[86] Jordan, B., "Mine blasting vibration and its effects on buildings and structures – implementing a frequency-based approach," *Bill Jordan & Associates Pty Ltd., Newcastle NSW.* <https://aees.org.au/wp-content/uploads/2013/11/29-JORDAN-Bill-MineBlastingVibration.pdf> accessed 21 January 2023.

[87] Ibid.

> *cracking has been noted in some large ceilings when the recorded resultant PPV was close to the allowed maximum, which in itself has been set very conservatively.*"
>
> "*Elastic modelling of the ceilings and derivation of the vertical frequencies in the ground wave suggested that resonance was involved, with both ground wave frequencies and ceiling vibration modes being in the 12 Hz to 16 Hz range. In general, frequencies much above 30 Hz are usually attenuated at the typical distances between workings and sensitive buildings.*"
>
> "*It is interesting to note that individual wall panels tend to have resonant frequencies above 30 Hz, even in very large houses. Whole building vibration could be being experienced at much lower frequencies, but the difficulties of modelling such structures elastically does not give confidence in obtaining a sensible result. Even constructing a very detailed finite element model of such a building would be both costly and of doubtful accuracy.*"

Notwithstanding that placing seismographs (or any other monitoring or testing equipment) on third-party property, public or private, without authorization, is unlawful and constitutes trespass, unless a continuous string of seismographs are placed along the entire perimeter of a proposed quarry site,[88] relying on one or two seismographs to measure off-site ground vibrations in the form of (PPV) Peak Particle Velocity (longitudinal, vertical and transverse components) of the closest sensitive receptors cannot possibly be representative of the PPV level that any other sensitive receptor would experience. (Blasting seismographs usually also have a microphone attachment which can be used to measure sound from the quarry operations).[89]

The theoretical predictions of ground vibration in order to be credible would have to be measured by seismographs placed along the entire perimeter of the proponent's site to ensure that *contaminants*, as identified in the Ontario EPA, do not escape and cause external *adverse effects*. As for flyrock, the most dangerous and potentially deadly consequence of blasting, a zero policy for its prevention is essential. Complete subsurface conditions of the lands where blasting is to occur are unknowable, as are the subsoil conditions between the blast site and neighbouring private third-party properties over which a quarry owner/operator has no legal right of trespass.

Other concerns have been raised as to the relevance of seismographs, which render them ineffective in preventing adverse effects from a blasting quarry operation:

- Blasts within regulatory limits are not difficult to achieve, and seismographs can back up quarry operator claims that blasts

[88] As an example, an Irving owned company "placed nine seismographs around the site to keep tabs on vibrations from the blasting" at its quarry on the west side of the Saint John River at South Bay, City of Saint John, New Brunswick. Four seismographs were placed offsite at the homes of neighbouring residents, with the permission of the homeowners. (See CBC News article "Residents criticize Irving quarry work," August 1, 2001, <https://www.cbc.ca/news/canada/residents-criticize-irving-quarry-work-1.294598>).

[89] <https://vibrationdamage.com/vibration_monitoring.htm>.

were within regulatory limits. (Significant damage can be caused by blasts that are well within regulatory limits of a PPV of 12.5 mm per second in Ontario, Canada.)

- Peak particle velocity (PPV) levels can vary significantly from one spot to another. Quarry operators will usually try to locate seismographs away from known "hot spots" or that are likely to produce unfavourable results.
- Improper installation, use or misuse of seismographs[90]

2.4 Government Says Low Frequency and Repeated Blasting Can Cause Structural Damage

According to the Surface Mining Control and Reclamation Act (SMCRA) and F-SMRCA, low frequency blasting is problematic, and can cause structural damage, as cited in *Jarrett v. DNR* (1992),[91] and as described below:

> "*109. On one occasion, the United States District Court, Southern District of Indiana, has seen fit to reduce blasting limits in a surface coal mine blasting case. While this case originated out of a complaint for nuisance, in Massa v. Peabody, IP 88-63-C, decided August 4, 1989, Judge Tinder found that blasting with frequencies in the 4-12 Hz range was a problem and ordered a .50 ips [12.7 mm/per second] peak particle velocity limitation for any blast in the frequency range regardless of its distance from the blast.*"
>
> "*113. As with all other structures, homes have one or more natural (or harmonic or resonant) frequency. The mathematical effect of a natural frequency is that induced vibrations which are the same frequency as a natural frequency will cause vibrations to increase with time rather than decrease with time. As a practical matter, this means the midwall response of a home subjected to vibrations from a blast (or any other source) could be a displacement of up to four times the displacement at the foundation. It can also cause "racking" or shaking of the structure." See Exhibit 197.*
>
> "*114. When such a phenomena occurs, it clearly places considerable stress on the mortar between bricks, plaster walls and corners of a structure.*"
>
> "*115. Exhibit 197, OSM report RI 8507, indicates natural frequency of wood frame structures is in the 5-10 Hz range for racking. Natural frequencies of one story homes can be as high as 18 Hz, but of course the initial displacement at 18 Hz is only 1/2 of the displacement of a 9 Hz*

[90] According to a February 2023 lawsuit, after complaints to Holcim, "Holcim's Midlothian plant manager directed employees to reduce the intensity of limestone quarry blasts to create seismic data suggesting the explosions were not strong enough to cause damage or interfere with the use and enjoyment of area homeowners' property." The lawsuit accuses Holcim of gross negligence, fraud, trespass, and intentional infliction of emotional distress. <https://curated.tncontentexchange.com/partners/pr_newswire/subject/legal_issues/plant-manager-manipulated-quarry-blast-intensity-lawsuit-claims/article_cbe36cc5-0264-5020-bdd6-27230ffa94ec.html> accessed 10 April 2023.

[91] *Jarrett v. DNR and Amax Coal Company*, 5 CADDNAR 265 (1992) <https://www.in.gov/nrc/decision/89-106r.v5.html>.

> *frequency for the same peak particle velocity [PPV]. This study concludes that frequencies below 10 Hz are the most serious ones.*"
> "*116. The DNR (and NRC) has a duty to approve blasting plans which will not cause damage to offsite property.*"

Even at the court-imposed PPV limit of 0.5 inches per second (12.7 mm/sec), all structures at a long distance from the blast site will eventually experience damage from repeated blasting, which has been shown to occur at significantly lower PPVs, as low as 0.5 mm/second. PPV does not measure structural response to ground vibrations.

2.5 Contaminant Vibration and Cumulative Effect of Repeated Blasting Damaged Residence

In *R. v. Chenard* (2005)[92], the accused was charged with discharging a contaminant, namely *vibration*, from blasting explosives into the environment in contravention of Section 14(1) of the Environmental Protection Act of Ontario (EPA), R.S.O. 1990, c.E.-19[93]. The vibrations from blasting rock damaged and disrupted the use and enjoyment of the nearby Websters' property. Section 14(1) of the Environmental Protection Act sets out: "Despite any other provision of this Act or the regulations, no person shall discharge a contaminant or cause or permit the discharge of a contaminant into the natural environment that causes or is likely to cause an adverse effect."

"Adverse effect" is defined in the Act and means one or more of:

(a) impairment of the quality of the natural environment for any use that can be made of it,
(b) injury or damage to property or to plant or animal life,
(c) harm or material discomfort to any person,
(d) an adverse effect on the health of any person,
(e) impairment of the safety of any person,
(f) rendering any property or plant or animal life unfit for human use,
(g) loss of enjoyment of normal use of property, and
(h) interference with the normal conduct of business ("conséquence préjudiciable)".

"Contaminant" is defined in section 1 of the Environmental Protection Act as follows:

> "contaminant" means any solid, liquid, gas, odour, heat, sound, vibration, radiation or combination of any of them resulting directly or indirectly from human activities that may cause an adverse effect".

Chenard, a *blaster* by trade, was retained by Mr. Tulloch to excavate a trench to accommodate the installation of water and sewer lines to service a new residence on the lakefront. The Websters own the adjacent property, whose 30-year-old residence is situated approximately 114 feet (35 metres) from the blast area. Certain points are important in this regard:

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92 *R. v. Chenard*, 2005 ONCJ 501 (CanLII), <https://canlii.ca/t/1mfqs> accessed 01 April 2023.
93 <https://www.canlii.org/en/on/laws/stat/rso-1990-c-e19/latest/rso-1990-c-e19.html>

- [10] Prior to any blasting taking place, a pre-blast survey was made at the Webster residence by a contractor who identified certain damage accepted by Mr. Webster as being caused by his own personal renovations. The damage was documented.
- [11] Mr. Chenard began a series of 30 blasts through bedrock on July 17, 2001 with the last blast planned for July 25, 2001.
- [12] Because of the fact that the first 30 blasts were insufficient to accommodate the proper flow for the sewer and water line, it was necessary to perform two more blasts on September 6, 2001 [bringing the total blasts to 32].
- [13] While there was a pre-blast inspection of the Webster residence before the start of the first series of blasts, there was no pre-blast assessment prior to the commencement of the September 6 blasting.
- [15] On the 8th of September, 2001, Mr. and Mrs. Webster discovered a leak in the basement bathroom ceiling. A pipe had bust in the ceiling, water was pouring in, and it became necessary to retain the services of a local plumber on an emergency basis. Eventually the ceiling tile and the entire bathroom area had to be refinished.

Following a four-day trial, the Justice of the Peace accepted the evidence of the homeowners, which is summarized as follows:

- "*First of all, there was a vibration. Ms. Webster's evidence about the jolt she felt was credible and it was uncontradicted. She was at the best position to feel the jolt. She was standing on a floor beneath the surface of the ground, and the foundation of their home rested on the same bedrock as that being blasted. She was within 114 feet [34.7 metres] of the blasting. Also, the evidence of the boat rocking and all of the pictures being askew in the home support the finding that there was a vibration.*"
- "*The second, that the vibration was discharged into the natural environment, was also proven. Mr. Chenard put explosives into some of the holes, although not all. The Court is satisfied that Mr. Chenard discharged the contaminant, that being the vibration, into the natural environment.*"
- "*Number three, that there was an adverse effect. The Court is satisfied that there was an adverse effect. There were numerous damages to the Webster home. Two days after the blast of September 6 the Websters found a major repair that they had to do in their basement bathroom.*"

While the homeowners' evidence was accepted by the Justice of the Peace, she had concluded that the discharge of the *vibration* contaminant occasioned by the blast on September 6, 2001 had not been proven as the cause of the *adverse effect* (i.e., damage to, and disruption of use and enjoyment of the Websters' residence). Following statement is noteworthy:

> "*Finally, and this is the element that was not proven, the discharge of the contaminant on September 6 [, 2001,] caused the adverse effect. There was little evidence to support a finding that the Websters' loss of*

> *enjoyment of normal use of their property was directly attributable to the blast that was the substance of the charge. Witnesses describe the September 6th blast as the largest blast. However, they also admitted that their comparison took into account the fly rock that they saw, the blasting mats lifting off the blast area, and the sound of the explosion. The only witness who felt the actual vibration was Mr. Webster.*"

The Crown appealed the ruling of the Justice of the Peace to the Ontario Court of Justice, and, while the appeal court accepted the findings of the Justice of the Peace, the appeal court concluded that the trial court failed to consider the secondary aspect: "or was likely to cause an adverse effect." In defining the term "likely," the appeal court relied on the following:

> *[40] The word "likely" carries with it a tremendous amount of responsibility to the trier of fact and to any appellate review. In Black's Law Dictionary (Fourth Edition) it equates to "probable" and "in all probability". In the Oxford Illustrated Dictionary "likely" is referred to as "probable" and "such as may well happen".*
>
> *[41] In the case of R. v. Walter Wood (28 April 1987), Provincial Offences Court, [unreported], a decision by Justice of the Peace W. G. Jacklin, he refers to R. v. Carbone, 1973, 20 Criminal Reports, New Series, 313, relating to substantial likelihood.*
>
> The learned Judge in dealing with substantial likelihood:
>
> *"Does not mean proof beyond a reasonable doubt, but is 'more akin to the balance of probabilities in that the evidence should substantially weigh in favor of the likelihood of a repetition of the offence."*
>
> *Here, we're dealing with likely. I am of the opinion that in fact likely is something less than substantial likelihood. It has been found that substantial likelihood is akin to the balance of probabilities and in the matter of Labatt Breweries of Canada Limited, it connotes a probability.*
>
> *[42] Also,*
>
> > *Dealing with the issue under Regina v. Toronto Refiners and Smelters, the Ontario High Court of Justice,[1977][94] the Divisional Court, Volume 20, Ontario Reports, 2nd Series, at page 772. At page 774.*

The questions stated should be determinative of the issue before the Court. It is argued by the respondent that the words "causes or is likely to cause harm or material discomfort to any person" are descriptive of the contaminant. In our view, in order to succeed, it must be shown that the contaminant did in fact cause or was likely to cause, in the circumstances that existed, harm or material discomfort to a person.

In reversing the judgment of the lower court, the Ontario Court of Justice found that the Justice of the Peace had failed to consider the words "or was likely to cause an adverse effect" or to consider "the accumulative effect of all 32 blasts":

> *[43] Based on the evidence that was adduced during the course of the four day trial, it is evident to me that the Justice of the Peace did not*

[94] *Regina v. Toronto Refiners and Smelters Ltd.*, 1977 CanLII 1299 (ON SC), <https://canlii.ca/t/g16cv> accessed 10 April 2023.

> *consider the words "or was likely to cause to an adverse effect" or to consider the accumulative effect of all 32 blasts, including those on 6th of September, 2001.*

As for the accumulative effect of repeated blasting, in *Whitney v. Ralph Myers Contracting Corp.*, (1961),[95] the Supreme Court of Appeals of West Virginia reached a similar conclusion, where it held:

> "*Plaintiffs were not required to show that the damages to the basement walls were the result of any particular or isolated explosion, but only to establish facts that would fairly raise an inference to the cause thereof. That repeated vibrations of the earth, at or in the vicinity of plaintiffs' property, occasioned by the blasting operations, occurred during times material, appears to be clearly established by the proof and, we believe, the evidence sufficiently establishes that the damage to the basement walls did not occur because of normal pressures or circumstances.*"
>
> "*Several witnesses testified to the nature and severity of the vibrations resulting from the blasting operations of defendant, which reach the plaintiff's property and its vicinity, and of complaints made to defendant relating thereto.*"

In this case, the Whitney residence was relocated on January 15, 1959 and placed on a new concrete block basement foundation (cinder blocks eight inches wide, eight inches high and sixteen inches long) to facilitate acquisition of the right-of-way for new Interstate Highway No. 64. A deep cut through an elevation of the right-of-way required breaking of rock, which was accomplished by detonation of explosives. The Whitney residence was relocated a distance of approximately 1,800 feet (549 metres) from the nearest point of the blasting operation. After the Whitneys reoccupied the house, cracks began to appear in the basement walls and continued to increase in number and size until April 10, 1959, when the basement walls, or, at least, the largest part thereof collapsed, causing the house to fall. No witness observed any cracks or breaks in the basement walls appear simultaneously with experiencing any ground vibrations. Nonetheless, on the claim of trespass, the Whitneys were awarded $1,288.95 for the damages to the basement walls caused by ground vibrations from the use of explosives, an extremely dangerous undertaking. As noted by the appeal court,

> "*The use of dynamite in blasting is a well-recognized practice, but the injurious results often occasioned thereby are equally well known. Any person who uses it in such manner as to cause damage to his neighbour must be held absolutely liable therefor.*[96]
>
> *We can see no reason for imposing a different liability for the results of an explosion, whether the dynamite explodes when stored or when employed in blasting. To be sure there is a greater likelihood of damage*

[95] *Whitney v. Ralph Myers Contracting Corporation*, 118 SE 2d 622, 146 W Va Supreme Court of Appeals, 1961, <https://www.casemine.com/judgement/us/59149cdfadd7b049346490ef> accessed 10 April 2023.

[96] See Exner v. Sherman Power Construction Co., 2 Cir., 54 F.2d 510, 80 A.L.R. 686; Weaver Mercantile Co. v. Thurmond, 68 W.Va. 530, 70 S.E. 126, 33 L.R.A.,N.S., 1061; Wigal v. City of Parkersburg, 74 W.Va. 25, 81 S.E. 554, 52 L.R.A.,N.S., 465; Dallas v. Whitney, 118 W.Va. 106, 188 S.E. 766. In the Exner case, supra, the Court, by Judge Augustus N. Hand, stated [54 F.2d 514].

> *from blasting than from storage, but in each case the explosion arises from an act connected with a business conducted for profit and fraught with substantial risk and possibility of the gravest consequences*."[97]

The research conducted supports the finding that quarry blasting conducted within regulatory limits does not eliminate property damage from ground vibrations or airblast, and has a negative impact on health and quality of life of residents in nearby communities. The standard response from quarry operators to complaints from residents of communities impacted by blasting is that "the quarry is operating within regulatory limits" and, thereby, avoid acknowledging and accepting legal responsibility for payment of damages. It was emphasized:

> "*Various sources of vibrations are involved in construction and mining projects such as blasting, heavy equipment, pile driving and dynamic compaction. Elastic vibrations that are generated by these sources may harmfully affect the nearby residential areas. Their effects include annoyance of people and cosmetic and structural damage to the buildings [p. 1]*".[98]

2.6 No Safe Level of Vibration for Threshold Damage to Nearby Structures from Blasting

The susceptibility of a structure or dwelling to damage from blasting depends on vibration levels, Peak Particle Velocity (PPV)[99] excitation frequencies [frequency at which body is made vibrate in forced vibration], and related site and structure factors (Singh and Roy, 2010),[100] and there is no absolute minimum vibration damage threshold whereby blasting or environmental or occupant-related vibration could precipitate a crack.[101] Further explanation is as under:

> "*…The threshold level of cracking is highly dependent on the level of residual stresses present that may reduce the apparent PPV level causing damage. It is widely accepted among blast researchers that the lengthening of old cracks and formation of superficial "hair-sized new cracks constitutes a threshold damage level (Rainer, 1982;*[102] *Northwood*

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97 See *Wilson v. Phoenix Powder Manufacturing Co*., 40 W.Va. 413, 21 S.E. 1035, 52 Am.St.Rep. 890.

98 "A Case Study of Blast Vibration Modelling in The Hanason Servtex Quarry, Garden Ridge City, Texas," A Thesis by Mohamed Mahmoud Ahmed Radwan, Texas A&M University, December 2016. <https://oaktrust.library.tamu.edu/handle/1969.1/159103?show=full> accessed10 April 2023.

99 The maximum velocity amplitude (rate of displacement change with respect to time, measured in mm/sec) with which a particle would travel due to propagation [detonation of explosive charge] through the ground. Seismographs are used to measure the PPV.

100 Singh, P.K. and Roy, M.P., "Damage to surface structures due to blast vibration," (2010) 47 (6) International Journal of Rock Mechanics and Mining Sciences949-961. <https://www.sciencedirect.com/science/article/abs/pii/S1365160910001073> accessed 10 April 2023.

101 Heath, D. J., Gad, E. F. and Wilson, J. L., "Vibration and Environmental Loads Acting on Residential Structures: State-of-the-Art Review," (2015) American Society of Civil Engineers.

102 Rainer, J.H., "Effect of vibrations on historic buildings: an overview," (1982) 14 (1) Bulletin of the Association for Preservation Technology 2-10. <https://nrc-publications.canada.ca/eng/view/ft/?id=c60d365a-a3c7-4c3f-b8de-4b205aec9d2c> accessed 10 April 2023.

> *et al., 1963;[103] Singh and Roy, 2010;[104] Siskind et al., 1980;[105] Stagg et al., 1984;[106] Dowding, 1996).[107] Few publications present observations of damage and corresponding ground motion measurements. Dowding (1996)[108] notes the only definitive method of correlating the incidence of cracking with blast vibrations is to conduct a pre- and post-vibration crack survey, which will also reduce complaints and lawsuits. The identification of an appropriate limit unlikely to cause any damage is made all the more difficult by the presence of residual stresses, particularly older structures, resulting from settlement, poor maintenance, weather cycles, and prior repair and renovation (Konon and Schuring, 1983).[109] For this reason, Siskind et al. (1980)[110] note there may be no absolute minimum vibration damage threshold whereby blasting or environmental or occupant–related vibration could precipitate a crack."*

Granular soils (sands and gravels) are also susceptible to vibration-induced damage in the form of densification (increased soil density or compaction of unconsolidated soils from blasting and removal of air voids) as described in Structural Forensics Technical Note #105 (Origin and Cause, July, 2021) at vibration levels as low as 0.5 mm/second (Siskind, 2000),[111] far below the maximum permitted Ontario Provincial standard of 12.5 mm/ second (Model Municipal Noise Control Bylaw NPC-119). Following point is noteworthy:

> *"…[G]ranular soils (sands and gravels) are susceptible to vibration-induced densification at vibration levels as low as 2.5 mm/s PPV (Lacy and Gould, 1985).[112] Such vibrations can lead to significant foundation*

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[103] Northwood, T.D., Crawford, T.D. and Edwards, A.T., "Blasting vibrations and building damage," (1963) 215 (5601) Engineer 973-978. <https://nrc-publications.canada.ca/eng/view/ft/?id=ed987490-420b-429d-85a8-00de96ec260d> accessed 10 April 2023.

[104] Singh, P.K. and Roy, M.P., "Damage to surface structures due to blast vibration," (2010) 47 (6) International Journal of Rock Mechanics and Mining Sciences949-961. <https://www.sciencedirect.com/science/article/abs/pii/S1365160910001073> accessed 10 April 2023.

[105] Siskind, D.E., Stachura, V.J., Stagg, M.S., and Kopp, J.W., "Structural response and damage produced by airblast from surface mining", US Bureau of Mine, RI 8485. <https://www.resolutionmineeis.us/sites/default/files/references/siskind-et-al-1980.pdf> accessed 10 April 2023.

[106] Stagg, M.S. and Engler, A.J., "Measurement of Blast-Induced Ground Vibrations and Seismograph Calibration," (1984) Report of Investigations 8506, US Department of Interior. <https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=41c42eed489376b182c93dfcc0afd7b47070ca00> accessed 10 April 2023.

[107] Dowding, C.H., "Construction Vibrations," Prentice Hall, 1966, <https://books.google.ca/books?redir_esc=y&id=w4lGAAAAYAAJ&focus=searchwithinvolume&q=pre>

[108] Ibid

[109] Konon and Schuring, "Vibration Criteria for Historic and Sensitive Older Buildings," ASCE Preprint 83-501; American Society of Civil Engineers (ASCE), Houston, Texas, October 17-19, 1983.

[110] Ibid, n.105

[111] Siskind, D.E., 'Vibration from blasting', (2000) International Society of Explosives Engineers, Cleveland, OH, USA.

[112] Lacy, H.S. and Gould, J.P., "Settlement from pile driving in sands," (1987) 24 (6) International Journal of Rock Mechanics and Mining Sciences 233.

settlement if the foundation is bearing on loose or poorly compacted sand. Siskind (2000)[113] found that loess[114] soils may sometimes be even more sensitive to vibration-induced settlement, and reported that damage had occurred from blasting operations at PPV of just 0.5 to 1.5 mm/s."

2.7 Ontario Municipalities Can Enact Noise and Nuisance By-laws to Protect the Health, Safety and Welfare of the Public From the Adverse Effects of Aggregate Extraction

Under the Ontario Municipal Act, 2001, as amended,[115] municipalities can prohibit noise and vibrations that are likely to disturb the peace, rest and quiet living spaces, including outdoor recreational and amenity space, of residents. Municipalities have the authority to create and enforce bylaws that control or prevent noise disturbances.

According to the Province of Ontario, "noise pollution is any form of sound that disrupts a natural ecosystem or causes a person's property to become unusable or unpleasant" or that impacts your quality of life,[116] Noise pollution can have negative impacts (adverse effects) on human health, especially children, including:

- loss of sleep
- loss of concentration
- increased stress and anxiety levels
- hearing loss
- high blood pressure
- heart disease.

The province of Ontario does not have jurisdiction over municipal bylaws provided that the municipal bylaw does not conflict with guidance provided by the Environmental Protection Act (EPA). An "Ontario Model Municipal Noise Control Bylaw" is available online.[117] [See Publication NPC-119 for Blasting in quarries and surface mines.] A municipality is empowered to enact and implement a noise and nuisance bylaw under the Municipal Act, that offers a greater degree of health and safety, similar in substance to the one passed by the City of Burlington, which prohibits *noise and vibrations* to be heard or felt outside of the property of a blasting (or non-blasting) quarry operation. The City of Burlington Noise and Nuisance bylaw (No. 19-2003),[118] in part, states,

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<https://www.sciencedirect.com/science/article/abs/pii/0148906287924041?via%3Dihub> accessed 10 April 2023.

113 Siskind, D.E., 'Vibration from blasting', (2000) International Society of Explosives Engineers, Cleveland, OH, USA.

114 Loess soils are composed primarily of silt particles deposited by wind.

115 Municipal Act, 2001, S.O. 2001, c. 25, as amended. <https://www.ontario.ca/laws/statute/01m25>.

116 Environmental Noise Guideline – Stationary and Transportation Sources – Approval and Planning (NPC-300). <https://www.ontario.ca/page/noise-our-environment>

117 Ontario Model Municipal Noise Control By-law, <https://jcaa.caa-aca.ca/index.php/jcaa/article/view/374/34>

118 The Corporation of the City of Burlington By-law No. 19-2003, "The Nuisance and Noise Control By-law," <https://www.burlington.ca/en/by-laws-and-animal-services/resources/By-laws/By-law-Search/019-2003-By-law.pdf>

> "*No noise or vibrations shall be made, caused or created so as to be heard or felt or otherwise perceived outside the property and which are, in the view of all the circumstances including the nature of the neighbourhood and the use to which adjoining properties are put and the time of day during which such noise or vibrations are made, caused or created excessive or which are, or may cause a nuisance to the public generally or to others residing or carrying on a manufacture, trade or business in the vicinity.*"[119]

2.8 Noise Pollution Impacts on Non-human Life

Like humans, domestic animals are clinically affected by rock-blasting, as testified to by Dr. Lisa Dietrich (Public hearing July 13, 2015) in the application for a permit by Tory Sand & Gravel submitted to the Town of Nassau. Following is the testimony of Dr. Dietrich:

> "*…Testimony from Veterinarian Dr. Lisa Dietrich…indicates that domestic animals are clinically affected by dust, allergens and other irritants that may result from blasting at the quarry, and suffer stress from anxiety related to equipment and blasting noise. We think that those same things could also cause safety concerns for the handlers of the animals. It is reasonably foreseeable that there could be impacts on domestic animals which could result in added expenses for the household, lower the animal's quality of life, and as related to agriculture, reduce farming and agri-tourism opportunities.*"

Noise pollution also impacts the health and well-being of wildlife. Studies have shown that loud noises can cause caterpillars' dorsal vessels (the insect equivalent of a heart) to beat faster, and cause bluebirds to have fewer chicks. Animals use sound for a variety of reasons, including to navigate, find food, attract mates, and avoid predators. Noise pollution makes it difficult for them to accomplish these tasks, which affect their ability to survive (National Geographic, Resource Library).[120]

2.9 Strict Liability Extends to Ground Vibrations and Concussions (Airblast) from Blasting

A number of jurisdictions have reached the conclusion that indirect impacts such as *Airblast (Concussion)* and *ground vibrations* stemming from blasting rock with explosives are just as much an invasion of public and private third-party property as if struck directly by flyrock, with all three impacts emanating from the same event (i.e. detonation of explosives to break rock) held to strict liability.

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[119] *Nuisance* is "the unreasonable, unwarranted and/or unlawful use of property, which causes inconvenience or damage to others, either to individuals and/or the general public. Nuisances can include noxious smells, noise, burning, misdirection of water onto other property…and a host of bothersome activities. Where illegal they can be abated (changed, repaired or improved) by criminal or quasi-criminal charges. If a nuisance interferes with another person's quiet or peaceful or pleasant use of his/her property, it may be the basis for a lawsuit for damages and/or an injunction ordering the person or entity causing the nuisance to desist (stop) or limit the activity (such as closing down an activity in the evening)." ALM Law.Com Dictionary. <https://dictionary.law.com/Default.aspx?selected=1358>.

[120] "Noise Pollution," <https://education.nationalgeographic.org/resource/noise-pollution> accessed 10 April 2023.

In *Aikman v. George Mills & Co. Ltd. et al.* (1934),[121] the trial judge held that ground vibrations from blasting to deepen the Livingstone Channel in the Detroit River caused damage to the Aikman Residence in Amherstburg, Ontario, a ruling which was upheld on appeal to the Ontario High Court of Justice. The Aikmans' residence, newly constructed in 1931, located about 3,500 feet (1,067 metres) from the closest point at which work was commenced by George Mills & Co. in 1932. Both George Mills & Co. and the blaster (Arundel Corporation) were found strictly liable for the damage done by the escaping vibrations, pursuant to the rule of *Ryland v. Fletcher* (1868), L. R. 3 H.L. 330, and held jointly and severely responsible for the full amount of the damages awarded by the court to Aikman. The court explained:

> "*The first of the work in the channel with which we are concerned in this case was done by the defendants George Mills & Company on section B. The method followed on this section was spoken of as the "dry" method. Coffer-dams were built…around the part of the channel that was to be deepened, the area was dewatered, and the rock was blasted away to the required depth. The first blasting was done on December 17, 1932, and there was blasting on many later days in December; but the charges of explosion used were relatively small, and it was not until January 11, 1933, that any charge was used that, on the evidence, can reasonably be found to have been heavy enough to cause damage to the plaintiff's house. On January 11 there were two blasts in each of which more than 2,000 lbs [907 kilograms] of dynamite were used; and from that time until August 2, blasts of that magnitude were of very frequent occurrence…. The heaviest seems to have been on July 18, when 5751 lbs [2,609 kilograms] were used. After August 2 there were only (relatively) light blasts on any part of the work until the Arundel Corporation began work in section C. on September 27. From that time until the end of October there was blasting in section C. almost daily, on some days several blasts, until the latter part of October; but the work on this section was done under water, the drills being operated from scows, and the area blasted, and consequently the quantity of dynamite used, in any one blast being less than in the "dry" work done in section B. On only three occasions was as much as 2,000 pounds [907 kilograms] of dynamite exploded at one time; but explosions of 1,500 or 1,600 pounds [726 kilograms] weight were frequent.*"

Mr. Aikman described the extent of the damage to his home as follows:

> "*…[I]n the summer he found some 200 cracks, of which seventeen were in the foundation where he had found two on his first examination and one was in the stone work; that in November there were twenty cracks in the stonework, and that all cracks had opened considerably; that he glued strips of paper across some of the cracks and a fortnight later found some six or eight of these strips broken. He says that on one occasion a crack appeared at the moment of a blast and that on another occasion some*

[121] *Aikman v. George Mills & Co. Ltd. et al*., 1934 CanLII 99 (ON SC), <https://canlii.ca/t/g1g6g> accessed 10 April 2023.

> *article was jolted from a shelf in the kitchen. Both he and the plaintiff swear to the trembling of the house at the time of blasts, and the plaintiff speaks of windows and dishes rattling*."

While the Aikmans' evidence of damage lacked some specificity, other homeowners in the area were able to corroborate the timing of various blasts and the impact on their homes. The writ described that:

> "*Neither the plaintiff nor Mr. Aikman gives any very precise evidence as to the time of the appearance of the several signs of damage; but a witness, Mrs. Teeter, who lives in the neighbourhood and who, apparently, has in contemplation a claim for damage done to her house, had kept some notes and was able to tell of the rattling of the crystals of a lamp, almost at the moment of the explosion of a heavy charge of dynamite by George Mills & Company on April 20, and of the appearance of a crack in one of the walls of her house at the time of the firing of a much lighter blast (2,027 lbs.) [919 kilograms] on February 20; and Mrs. Wilson, who is not a claimant but is tenant of an old and solidly constructed building tells of much damage caused and of vibration at the time of blasts sufficient to shake articles from a table and a picture from its place; and other witnesses give evidence upon which it is perfectly certain that houses in Amherstburg were shaken by the blasts and were to a greater or less extent damaged*."

As to the cumulative effect of repeated blasting on the Aikmans' residence, the Ontario High Court of Justice had this to say:

> "*The fact is, however, that what the plaintiff sues for is not the damage done to a wall by a certain blast, to a chimney by another, to the foundations by a third, and so on, but for the damage done to the house as a whole by the whole series of blasts, and that a finding that any part, or any definable part, of that damage was caused by the blasting done by the Arundel Corporation in section C. (where no very heavy charges were used;…) would be speculative in the extreme. Indeed, it is probably correct to describe the plaintiff's house in its present condition as a house the fabric of which has suffered from the cumulative effect of a series of shocks, rather than as a house in which there are many defects each of which is attributable to a shock*."

The judge was unimpressed by the superficial and theoretical nature of the evidence presented by the defendant's expert, saying that:

> "*The impression created by the evidence was that such investigation as there was superficial, and that there was too much reliance upon theoretical opinion*."

And, while it was possible that shrinkage could cause damage to the Aikmans' residence, the judge favoured the expert opinion of Mr. Allan, testifying on behalf of the homeowners, who found no indication of shrinkage. He lamented that:

> "*…I have come to the conclusion that it is safe to adopt the opinion expressed by Mr. Allan when called in reply and cross- examined, to the effect that while it cannot be said that there was no shrinkage of timber, or no cracks caused by shrinkage, it can be said that more than half of the cracks are attributable to something other than shrinkage. Mr. Allan*

> *would not swear positively that it was impossible that 90 per cent. of the cracking had been caused by shrinkage; but he said that he could find no evidence of shrinkage, and, as has been stated, that he believed that the greater part of the cracking seen must be attributed to another cause. It cannot be found that there had been any settlement (or unusual settlement) of the house; and, as I have said, my conclusion is that the opinion that at least the greater part of the damage was caused by the blasting is well supported by the evidence.*"

In *J. P. Porter Co. v. Bell et al.* (1954),[122] the Nova Scotia Court of Appeal upheld the trial court's ruling that Porter was responsible for structural damage from ground vibrations to three dwellings distant 1,430 feet (436 metres), 2,250 feet (686 metres) and 2,275 feet (693 metres) from where Porter conducted 198 blasts during the period of August 15, 1951 to April 3, 1952. Porter was found strictly liable for the damages caused to the Plaintiffs' houses by the escaped vibrations under the rule of *Rylands v. Fletcher*. The court maintained:

- "*From August 15, 1951, to April 3, 1952, inclusive, the defendant engaged in blasting and dredging operations at the Seaward Defence Site; but its blasting operations ceased on February 2, 1952. From this site the houses of the plaintiffs Bell, Overstone and MacDonald were situated westwardly about 1,430, 2,250, 2,275 ft, [693 metres] respectively.*"
- *According to the trial Judge "the rock being blasted and removed was of sedimentary origin and was stratified formation and that same formation extended westerly from the point of blasting to and beyond the location of the plaintiffs' houses and dipped about 10 degrees toward the west. This stratified rock was broken or cracked approximately at right angles to the dip at various intervals."*
- "*There is no doubt that the detonation of the dynamite during the period in question in 198 blasts, comprising a total of 38,343 pounds [17,392 kilograms] of explosive, did cause vibrations in the submarine rock which extended to the adjoining land-rock formation and caused the houses to vibrate.*" *["The individual blasts involved the detonation of dynamite in amounts ranging from 15 to 720 lbs.] [327 kilograms in drill-holes ranging in number from 1 to 12."]*
- *The first essential question, whether the blasts and the resultant vibrations caused the damage complained of, was answered by the trial Judge, after an exhaustive examination of direct and opinion evidence, as follows: "I accordingly find that each of the plaintiffs' houses was substantially damaged by their vibratory motion which was in turn caused by the rock vibrations originating at the defendant's blasting operations and transmitted through rock from the point of origin to the rock beneath the houses on which they stood." In evaluating the weight of this evidence he was quite justified in preferring the former.*

[122] *J. P. Porter Co. Ltd. v. Bell et al*., 1954 CanLII 303 (NS CA), <https://canlii.ca/t/gwcvk> accessed 10 April 2023.

- "*In my opinion there was ample evidence to support this conclusion on the issue of causation in fact. The trial Judge was faced with evidence which on this issue consisted "of what a large number of credible witnesses actually saw, felt and heard" supported by competent opinion evidence on the one hand; and of competent opinion evidence to the contrary effect on the other hand.*"

In *Enos Coal Mine v. Schuchart et al.* (1963),[123] the Indiana Supreme Court ruled there is no logical reason not to extend strict liability for property damage from *vibrations* simply because there is no physical trespass as in falling debris (flyrock) from an explosion on nearby land. The court ruled that the common law principle of liability in trespass applies equally where damage is caused only by *vibration*, commenting by way of analogy, as follows:

> "*In these days of nuclear explosions, the breaking of sound barriers by airplanes and missiles, violent explosions from artillery and gunnery practice (to mention but a few of the advances of science), nearby buildings and property can be shattered or destroyed as effectively as by an earth quake without any physical invasion of the property.*"

The United States Supreme Court has recognized these modern problems in holding that property owners are entitled to compensation for deterioration in property values caused by noise and vibration of jet planes in the use of air space near an airport. Griggs v. Allegheny County (1962), 369 U.S. 84, 82 S.Ct. 531, 7 L.Ed.2d 585. In *Spano v. Perini Corp.* (1969),[124] the Court of Appeals of New York declared that "one who engages in blasting must assume responsibility and he is liable without fault for any injury he causes to neighbouring property." The Spano Court overturned the need to prove *negligence*[125] for non-trespassory blasting damages for the following reasons:

1) Existing and out-of-state court decisions use strict tort liability for construction blasting;
2) Individual property rights are a concern;
3) Strict tort liability is used for accidental explosions;
4) It is difficult to prove negligence in blasting cases;
5) Blasting involves a substantial risk of harm; and
6) It is problematic to determine which party should bear liability for blasting damages [p. 209].[126]

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123 *Enos Coal Mining Company v. Schuchart et al.*, 243 Ind. 692 (1963) 188 N.E.2d 406, <https://casetext.com/case/enos-coal-mining-co-v-schuchart-et-al> accessed 10 April 2023.

124 *Spano v. Perini Corp.*, 25 N.Y.2d 11 (1969), <https://www.lexisnexis.com/community/casebrief/p/casebrief-spano-v-perini-corp> accessed 10 April 2023.

125 A claimant must prove (4) elements to have a successful negligence claim in New York state. The elements to a negligence case are duty, breach of duty, causation, and damages. <https://lawsuit.org/personal-injury-law/torts-law/new-york-negligence-guide/> accessed 10 April 2023.

126 Stark, T.D., "Is Construction Blasting Still Abnormally Dangerous?," (2010) 2 (4) Journal of Legal Affairs and Dispute Resolution in Engineering and Construction <https://www.researchgate.net/publication/245492954_Is_Construction_Blasting_Still_Abnormally_Dangerous> accessed 10 April 2023.

In *Wiley v. Pittsburg & Midway Coal Min. Co.* (1987),[127] the Missouri Court of Appeals acknowledged that damage to property by *concussion* or *vibration* from blasting must be demonstrated by circumstantial evidence *because the concussions or vibrations that travel through the air or the earth cannot be seen.*[128] It is substantiated as:

> "*From cases such as* Summers v. Tavern Rock Sand Co., 315 S.W.2d 201 (Mo.1958)[129], *it appears that a submissible case for damages caused by blasting may be made on testimony that vibrations were felt coincidentally with the detonation of the explosive and that physical evidence of structural damage was observed thereafter. Thus, in the present case, plaintiffs' testimony of the vibrations sensed, corroborated by the calendar diaries, and the perceived cracks in walls and floors was enough at least to survive a motion at the close of plaintiffs' evidence.*"

In *Frye et al. v. Kanawha Stone Co., Inc.* (1998),[130] in upholding the decision of the lower court, the West Virginia Supreme Court of Appeals ruled that vibrations from blasting were the proximate cause of damage to the Fryes' home. In 1992 and 1993, construction for the upgrading of a highway near the Frye residence, and blasting operations continued on an intermittent basis from late 1992 until at least June 1993. On May 25, 1993, Kanawha Stone detonated an explosive blast at a distance of 962 feet (293 metres) from the Frye residence, which caused the following damage:

> "*The blast, like most large explosions, rattled windows and cabinets in the Frye home and in other homes in the Fryes' neighbourhood. Mr. Frye had a habit of going out after each large detonation to inspect for damages to his property, due to the proximity and severity of the blasting. On this occasion, he claimed that numerous cracks suddenly appeared in the mortar joints and blocks of his home's cinder block walls.*"

A seismographic record of soil vibration on each blast was kept by Kanawha Stone. That the soil vibration measured for the May 25, 1993, blast "was well below any state imposed limits" and supporting testimony of the blasting expert that the recorded vibrational level was insufficient to have caused any damage to the Frye home was rejected in favour of the corroborating evidence of the neighbours who had observed the cracks. The Fryes were awarded $20,000, allocating $10,000 for costs and repairs and $10,000 for annoyance and inconvenience.

In *Associated Contr. Stone v. Pewee Val. San. & Hosp.* (1963),[131] the Kentucky appellate court upheld the lower court's injunction preventing a

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[127] *Wiley v. Pittsburg & Midway Coal Min. Co*., 729 S.W.2d 228 (1987), <https://cite.case.law/sw2d/729/228/> accessed 10 April 2023.

[128] *Donnell v. Vigus Quarries, Inc.*, 526 S.W.2d 314, 316 (Mo.App.1975); *Poston v. Clarkson Construction Co.*, 401 S.W.2d 522, 525 (Mo.App.1966). <https://scholar.google.ca/scholar_case?case=11912900217179761342&hl=en&as_sdt=2006> accessed 10 April 2023.

[129] <https://scholar.google.ca/scholar_case?case=16366987539217898125&hl=en&as_sdt=2006>

[130] *Clarence Frye, et al. v. Kanawha Stone Company, Inc.*, 505 S.E. 2d 206 (1998) 202 W.Va. 466, <https://case-law.vlex.com/vid/frye-v-kanawha-stone-885869106> accessed 10 April 2023.

[131] *Associated Contr. Stone v. Pewee Val. San. & Hosp.*, 376 SW 2d 316 (1963), <https://law.justia.com/cases/kentucky/court-of-appeals/1963/376-s-w-2d-316-1.html> accessed 10 April 2023.

proposed quarry from being established a short distance southeast of the City of Pewee Valley, in a rustic neighbourhood with no industry and no public water supply. The suit to prevent operation of a blasting quarry was brought by over 50 parties, with proof clustered along three salient issues:

1) Lowering of the "water table" likely to result from drainage of underground waters, by force of gravitation, to and out of the face of the quarry when the rock formations are cut open;
2) Damage to the natural water supply through disturbance, by the use of explosives at the quarry, of underground barriers that now serve to impound the water; and
3) Disruption of the peace and quiet by vibrations from blasting.

Apart, however, from the water phase of the case, there is other and more positive proof that the operation of the quarry will materially affect the peace and quiet of the neighbours in the enjoyment of their homes. It so happens that before the institution of this proceeding the defendants set off at the quarry site a 2,000-lb.[907 kilograms] test charge of dynamite, a quantity they admit to have been substantially smaller than they expect to use routinely. This blast was heard and the tremor felt by several of the plaintiffs in their homes nearby. One said that his television set, the chimney, and "every window in the house" shook. Another said the noise caused his wife to jump up and scream and the concussion "actually blew the curtains out." Some of the plaintiffs live directly across the road from the quarry property. If their homes were shaken by the test shot, it is certain that they would be repeatedly shaken by the larger shots expected to be used in the regular course of business. We think this is an interference they should not be forced to suffer. [Kentucky has expressly renounced the 'negligence theory' *Island Creek Coal Co. v. Rodgers*, (1982),[132] in blasting cases; as 'blasting' is an activity which has repeatedly been held to strict liability.]

The Kentucky appeal court concluded that the rule of nonliability for damage by *concussion* or *vibration* is inconsistent with the principles set forth in Louisville Refining Company v. Mudd, Ky. 1960, 339 S.W.2d 181,[133] for the determination of what is a nuisance. The appeal court held that the lower court's finding that "a nuisance necessarily would result was not clearly erroneous," as supported by the stipulations and admissions of the defendants:

> "*…[B]y their own stipulations and admissions during the course of trial the defendants left no room to suppose that they could or would conduct their operations in any manner or on any scale that would not involve a shaking of the environs occupied by the plaintiffs. Their case was honest and forthright. They made no pretence that this particular result would not be a necessary incident of their business as they intended to operate it.*"

[132] *Island Creek Coal Co. v. Rodgers*, 644 SW 2d 339, Ky. Court of Appeals, 1982.
[133] *Louisville Refining Co. v. Mudd*, 339 S.W.2d 181 (Ky. Ct. App. 1960) <https://casetext.com/case/louisville-refining-company-v-mudd> accessed 10 April 2023.

As noted in the Northern Kentucky Law Review (Vol. 8/323), in reference to an Ohio case, *Louden v. City of Cincinnati*, 90 Ohio St. 144 (1914),[134] involving property damage caused by *concussions* and *vibrations* from blasting,

> "*If the means employed [blasting] will, in the very nature of things, injure and destroy his neighbour's property, notwithstanding the highest possible care is used in handling of the destructive agency, the result to the adjoining property is just as disastrous as if negligence had intervened. If one may knowingly destroy his neighbour's property in the improvement of his own, it is little consolation to the neighbour to know that his property was destroyed with due care and in a scientific manner [p. 334]*".

2.10 Every Property Near a Quarry is Uniquely Impacted by Blasting

In *Freeman v. San Rafael Rock Quarry Inc.* (2004),[135] pursuant to a June 2001 Marin County (California) Grand Jury report, which was critical of the county's handling of complaints about the quarry and recommended the district attorney institute a nuisance abatement action against the quarry, the homeowners were unsuccessful in their motion for a class action. The nuisances identified in the Grand Jury's report consisted of *dust, noise, blasting* and *truck traffic* attributed to a substantial unlawful expansion of the quarry in 1986 without permits. The appellate court upheld the trial court's refusal to certify the class action for the group of homeowners residing within five square miles of the quarry, which sought non-economic and economic damages based upon allegations of "public nuisance for annoyance, inconvenience, and discomfort."

In denying the motion for class certification, the trial court stated "common questions of law or fact do not predominate," and that "special injury" involves another element where proof would vary significantly amongst the estimated 11,075 class members. The trial court's ruling was supported by two reports prepared on behalf of the quarry owner, both of which acknowledge that the noise and vibration experienced by each class member would vary considerably depending on a number of environmental and property-specific factors:

> "*…[T]he Salter report found that "[t]he variation in noise is due to the wide range of distances between the noise sources and homes and shielding of the noise provided by natural terrain, intervening homes and vegetation. Because of these factors, in many locations, neighbours within a few hundred feet of each other have dramatically different exposure." The report notes that noise exposure also varies inside of individual homes due to the orientation of rooms, nature of furnishings, size and construction of windows and whether windows are open or closed.*"
>
> "*The…report, prepared by Blast Dynamics, Inc., analyzed how blasting at the Quarry affected neighbouring residents. This report identified a*

[134] <https://cite.case.law/ohio-st/90/144/>.

[135] *Frieman v. San Rafael Rock Quarry, Inc.* 10 Cal.Pptr.3d 82 (2004) 116 Cal.App.4th 29, <https://casetext.com/case/frieman-v-san-rafael-rock-quarry-inc> accessed 10 April 2023.

> *number of variables in the way that different residents would experience vibration from blasting. These variables include the presence of rock or soil formations that alter the frequency of blast waves, the natural or "resonant" frequencies in each structure that changes the response to vibration, distance from the blast site and differences in the duration of the blasts. The report included a geologic map of the area showing a combination of soil, rock, sandstone, artificial fill, bay mud and marshland under the relevant area. The report noted that soil typically filters out high frequency energy, while rock transmits it. Test blasts were detonated at the Quarry and instruments were placed at various locations to evaluate the differing effects. The results of the velocity measurements showed a decrease in impact with distance from the blast site, but the frequency measurements showed no consistent pattern. The report concluded that: "[t]he test data shows that it is unreasonable to expect that any two sites will experience the same blast related vibration...."*

2.11 Quarry Noise Causes Infliction of Emotional Distress - Joint and Several Liability Imposed

In *Town of Stonington et al. v. Galilean Gospel Temple et al.* (1999),[136] the Supreme Judicial Court of Maine affirmed the trial court's award of $5,000 to the Eatons for *Negligent Infliction of Emotional Distress* (NIED) caused by the operation of the quarry. Notes of the court:

> *"[15]…[T]he Eatons state that the defendants' operation of the quarry "generated noise, dust and interfered with Plaintiffs' possession and use of their property and residence," and that the defendants' "cutting and burning ... deprived Plaintiffs of the safe and quite enjoyment of their home." By echoing language that describes the essence of a private nuisance complaint, the Eatons' complaint provided Cormier and the Temple fair notice of a claim that the operation of the quarry resulted in a nuisance."*
>
> *"[12] Competent evidence supports the court's finding that the Eatons suffered from serious emotional distress. Mr. Eaton testified that he suffered from throbbing headaches and depression. Mrs. Eaton testified that the noise has caused her neck muscles to tighten. As a result, she was given muscle relaxants and a collar. Given this testimony, the court did not err in finding that the Eatons suffered serious emotional distress. See* Gammon, 534 A.2d at 1283 *(holding that the evidence supported plaintiff's NIED claim where plaintiff had nightmares, his personality was affected and his relationship with his family deteriorated)."*

In *Manford F. Eaton et al. v. Francis A. Cormier et al.* (1999),[137] the trial court found Cormier and Galilean Gospel Temple jointly and severally responsible for a private nuisance and awarded $20,000 in damages to

[136] *Town of Stonington et al. v. Galilean Gospel Temple et al.*, 722 A.2d 1269 (1999) 1999 ME 2, <https://law.justia.com/cases/maine/supreme-court/1999/1999-me-2-0.html> accessed 10 April 2023.

[137] *Manford F. Eaton et al. v. Francis A. Cormier et al.*, 748 A.2d 1006 (2000) 2000 ME 65, <https://cite.case.law/a2d/748/1006/> accessed 10 April 2023.

Manford and Helen Eaton. The award was affirmed by the Supreme Judicial Court of Maine, with the following remarks:

> "*[2] This is the second time this case is before us. See generally* Town of Stonington v. Galilean Gospel Temple, 1999 ME 2, 722 A.2d 1269.[138] *We previously determined that the Eatons had properly pled a cause of action for nuisance against Cormier and the Temple and remanded for a trial on the issue, as well as for a determination of whether Cormier and the Temple should be held jointly and severally liable should a nuisance be found.*" *See id. at 13-16,* 722 A.2d at 1272-74.
>
> "*[3] Following our remand, the court conducted a hearing in which it took notice of evidence introduced in the prior proceeding and heard additional evidence regarding conditions on the Eatons' property since the prior proceeding. It also heard testimony from officials of the Town of Stonington regarding their monitoring of the noise levels generated by the quarry and testimony from Cormier's son who acts as foreman at the quarry. The court then issued its decision in which it found that the quarrying activities constituted a private nuisance…*"
>
> "*[7]…[A]s we noted in our last opinion in this case, a landowner is liable for a nuisance created by the activity of a third party on the land if (1) the possessor knows or has reason to know that the activity is being carried on and that it is causing or will involve an unreasonable risk of causing the nuisance, and (2) the possessor consents to the activity or fails to exercise reasonable care to prevent the nuisance.*" [citations omitted]

2.12 Concussions from Recurrent Blasting Caused Property Damage and Distress in Body and Discomfort, Annoyance, Fright and Shock, and Expert Evidence Ruled not Entitled to Preferential Treatment as to Facts

In *Alonso v. Hills et al.* (1950),[139] as a consequence of recurrent quarry blasting operations, the California appeal court upheld the trial court's damages award of $2,650, consisting of $1,650 for damage to and depreciation of the property, and $1,000 for the plaintiff's distress in body and discomfort, annoyance, fright and shock. According to the homeowner, the residence is located in Rockaway Beach, a community of 300 homes and 200 yards (183 metres) distant from the quarry. The evidence that there were 85 homes and the distance was 300 yards (274 metres) from the quarry had no bearing on the outcome of the case.

Blasting conducted at the quarry on November 2, 1946, February 3, 1947, and on many occasions before and after caused violent concussions in the nature of earthquake thereby injuring the plaintiff's real property and building, and disturbed the enjoyment of the dwelling by plaintiff and his family, shocked plaintiff's nerves and injured his health, and caused his children great fear. The February 3, 1947 quarry blast launched a 3-pound rock (flyrock) that destroyed a bench on the property near which one of the plaintiff's daughters was standing, causing the plaintiff to lose sleep

[138] Town of Stonington v. Galilean Gospel Temple, 1999 ME 2, 722 A.2d 1269. <https://caselaw.findlaw.com/me-supreme-judicial-court/1386037.html> accessed 10 April 2023.

[139] *Alonso v. Hills*, 95 Cal.App.2d 778 (1950) 214 P.2d 50, <https://casetext.com/case/alonso-v-hills> accessed 10 April 2023.

and fear for his security and that of his family. Following noting is important:

> *"[2] The recurrent blasting in the operation of defendant's quarry, causing cumulative injury to plaintiff's property and interference with its enjoyment and requiring injunctive relief could conceivably be considered as one line of conduct in the character of a nuisance giving rise to one cause of action, without necessity of separate statement of separate blastings."*

On the issue of the relevance of expert evidence argued by the quarry owner, the appeal court ruled that expert testimony was not entitled to preference over testimony as to facts, and that inferential evidence can overcome direct evidence:

> *"…[R]egular scientific expert testimony is not entitled to preference over testimony as to facts; the relative weight must be decided by the trier of facts." (Rolland v. Porterfield, 183 Cal. 466,469 [191 P. 913].)*
>
> *"[8] The finding that on November 2, 1946 [before the blast], plaintiff's property was of the reasonable value of $5,000 finds competent support in plaintiff's testimony that he figures the valuation of his house at that time in the neighborhood of $5,500. (Isenberg v. Sherman, 212 Cal. 454, 483 [298 P. 1004, 299 P. 528], 10 Cal.Jur. 1023.) Appellant's attack on plaintiff's evidence on the ground of contradictions in his statements as to his cost price go to the weight of this evidence only, of which the trier of facts is the sole judge."*
>
> *"[9] It is true that there was no direct evidence as to structural weakening. However, plaintiff testified that after the November 2 blast there were cracks all through the exterior of the house, the stucco outside was buckled, the window sills and frames all knocked out of proportion, the plumbing leaking, barbecue pit and terrace ruined. From such evidence of visible injury an inference can be drawn that also the general structural strength of the building must have suffered. Whether the inference should be drawn in this case was again for the trier of facts. (Blank v. Coffin, 20 Cal. 2d 457, 461 [126 P.2d 868]; 10 Cal.Jur. 738,739.) Such inferential evidence can also overcome direct evidence to the contrary." "[I]t is elementary that direct evidence may be disbelieved and contrary circumstantial evidence relied upon to support a verdict or finding." (Gray v. Southern Pacific Co., 23 Cal. 2d 632,641 [145 P.2d 561].)*

2.13 Property Damage From Vibrations Caused by Repeated Blasting (Especially at Low Frequencies) an Absolute Certainty

Repeated blasting causes damage to structures, especially at low frequencies below 20 Hz (or 20 cycles per second). Amplification factors of four (4) are reported in BOM RI 8507.[140] Dr. Sam Kiger, a now-retired Civil and Environmental Engineering professor at the University of Missouri, presented, in part, the following in connection with expert evidence in

[140] US Bureau of Mines RI 8507, *"Structural Response and Damage Produced by Ground Vibration From Surface Mine Blasting,"* 1980.

Fontaina Scott v. Mountaineer Grading Co. – Putman Co. Civ. Act. No. 09-C-286:[141]

> *"At relatively low dominate frequencies that is below about 20 Hz (or 20 cycles per second), blast induced ground vibrations are amplified by structures….Amplification factors of 4 are reported in BOM RI 8507. Michael J. Mann of the Ohio Department of Natural Resources Division of Mines & Reclamation investigated the response of structures at larger distances from surface mining operations where lower ground vibration frequencies are much more likely to dominate (Mann, 2003).*[142] *The data published by Mann…indicate measured structural amplifications as high as 10….This is the most damaging type of ground vibrations because [of] amplification induced in…homes at these low frequencies."*
>
> *"Blast induced ground vibrations can be amplified by local soil and other geological conditions. For example in BOM 656*[143] *they report that the thickness of overburden, i.e. the thickness of the soil layer over bedrock, has a direct effect on amplitude and frequency of ground vibrations from blasting. They go on to indicate that the effect is to increase amplitude and lower frequencies. Note that both increased amplitude and lower frequencies will result in increased damage to structures. The Soil layer frequency, f, can be estimated from the textbook by Woods & Hall (1970)*[144] *as f = V / 4H, Hz; where V is the seismic velocity in the soil layer, H is the soil layer thickness, and the units of the frequency, Hz, is cycles per second. Whenever vibration frequencies generated by blasting operations match the soil layer frequencies, amplification will occur. The thickness of soil layers often vary significantly between hilly terrain and low lying valley terrain. Thus, unexpected local amplifications of the blast induced ground vibrations can occur resulting in peak ground motions being larger at relatively far away locations than they are at locations relatively close to the blasting."*
>
> *"All homes undergo daily and seasonal dimensional changes due to things like humidity variations and changing temperatures, like the sun moving from one side of the home to the other (the warm side will expand relative to the cooler side); or seasonal variations of temperature and humidity. For example most of us have experienced a "sticking door" or a door that will not close (or easily open) during*

[141] "Scott owns property in Fraziers Bottom and says the defendant company's blasting operations on the new U.S. 35 in 2008 affected her and her property. She lists property damage, nuisance, trespass, negligence and/or gross negligences and strict liability in her complaint. She seeks compensatory and punitive damages, attorney fees, costs and other relief." <https://putnam112.rssing.com/chan-8516446/all_p14.html> accessed 10 April 2023.

[142] Mann, M.J. "Response of Manufactured Houses to Blast Vibrations," Ohio Department of Natural Resources, Division of Mines and Reclamation, New Philadelphia, Ohio, USA, 2003. <https://files.dep.state.pa.us/Mining/BureauOfMiningPrograms/BMPPortalFiles/Blasting_Research_Papers/State%20Reports/2003%20Mann%20-2003%20BAI%20modular%20Homes.pdf> accessed 10 April 2023.

[143] Bureau of Mines Bulletin 656, "*Blasting Vibrations and Their Effects on Structures*," 1971.

[144] Richart, F. E. Jr., Hall, J. R. Jr., and Woods, R. D., "*Vibrations of Soils and Foundations*," Prentice-Hall, 1970. <https://www.amazon.com/Vibrations-Foundations-Prentice-Hall-International-Theoretical/dp/0139417168> accessed 10 April 2023.

certain times of the year. These environmental effects will cause strains in the walls, ceilings, structural framing, tile covered surfaces, and etc. These strains are known by engineers as prestrains, that is strains that exist before an event like a blast induced ground vibration. The prestrain condition may be such that a very small vibration will push the item, like a wall panel, a framing connection, or piece of tile, over its strain limit and result in a crack or loosening of a structural frame connection. Once a crack is initiated the crack will grow at a much lower level of vibrations than was required to initiate the crack. This is because of the stress concentration that exists at the crack tip; envision for example a small crack in an automobile windshield where even a small bump from ones hand can cause the crack to grow. Thus, even low levels of repeated occurrences of blast induced ground vibrations can cause significant damage to a home over time. For example the German vibration standard is 0.16 ips [4.06 mm/s] for buildings with visible damage and cracks in masonry. See for example Table 1 in "Vibration Criteria for Historic and Sensitive Buildings" by Konon and Schuring (1983)."[145]

"The fact that these prestrain conditions can produce a condition in the home such that damage to a home will occur at even very low levels of vibrations is acknowledged in BOM RI 8507[146] *in their Conclusion 7 on page 68…This conclusion, agreed to by the 4 experts that authored RI 8507, clearly states that "…there may be no absolute minimum vibration damage threshold…"; that is, when inevitable pre strain conditions are present in a home, any blast induced ground vibrations might cause damage to the home."*

"In Bureau of Mines RI 8507 they suggest a maximum allowable ground vibration peak particle velocity [PPV] of 0.5 inches per second (ips) [12.7 mm/s] at which there is a 0.5 per cent probability of damage. However, the standards in many countries are much lower; for example…regulatory agencies in Leicestershire County, UK have established the upper limit on allowable peak particle velocity (ppv) as 0.24 ips [6.1 mm/s]; [I]n Australia the common limit is 0.2 ips [5.1 mm/s] and it is 0.001 ips [0.025 mm/s] for historical buildings and monuments for frequencies less than 15 Hz. Note that frequencies less than 15 Hz are very likely in blast induced ground vibrations at large distances from the blasts. The Australian standard for historical buildings of 0.2 mm/sec (0.001 ips) implies that if a building is really important the allowable vibration to prevent damage is extremely low.[147] *Therefore, standards in reality represent an economic decision. Since at almost any vibration level some homes might be damaged,*

[145] Konon and Schuring, "Vibration Criteria for Historic and Sensitive Older Buildings," ASCE Preprint 83-501; American Society of Civil Engineers (ASCE), Houston, Texas, October 17-19, 1983.

[146] US Bureau of Mines RI 8507, "*Structural Response and Damage Produced by Ground Vibration from Surface Mine Blasting*," 1980.

[147] See Table 2 in Pesch, R. and Robertson, A., "Drilling and Blasting for Underground Space," Wollongong, NSW, 3-4, September 2007, <https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.500.4403&rep=rep1&type=pdf> accessed 10 April 2023.

but for the mine to operate at an economic level, some probability of damage is tolerated. The level of 0.5 ips [12.7 mm/s] widely adopted in the US is far greater than the standards adopted in other countries."

"The size of the blast induced ground vibration waves shaking the homes is large in comparison to the footprint dimensions of a typical home. The length of the ground vibration wave train is the duration of the blast induced ground vibration shaking at the homes, typically about 3 to 4 sec, times the speed of the ground wave, typically about 800 ft per sec [244 m per sec]. Thus, for a typical blasting event with multiple individual explosions the ground vibration wave train is about 3,000 ft [914 metres] long. These ground vibrations at long distances, i.e. more than 1,000 ft [305 metres], have a dominate frequency of the ground vibration equal to about 8 or 10 Hz (cycles per sec); for a frequency of 10 Hz a single cycle of the ground shaking is 80 ft [24 metres] in length (one cycle is up down and back up) so that the leading edge of the home is picked up then pulled down while the back of the home is being picked up; this up and down of the front and then back of the house occurs repeatedly for the full 3 to 4 second duration of the ground vibration; in this example that would be about 30 to 40 complete cycles (10 cycles per second for 3 or 4 seconds). When these repeated distortions of the house match the natural frequency of the house, the motions will be amplified and damage to the house will be significantly increased."

"It is recognized that the probability of damage to a home is relatively small in any single blast. However, numerous opportunities for an unlikely occurrence, like damage to the home, will result in a very likely occurrence of damage. For example, if the probability of damage to the home, Pd, in any single blasting event is 0.05, or 5 per cent; then the probability of not being damaged, Pu, is 95 per cent. One can use the probability Law of Independent Events to calculate the probability of damage occurring at least once in 100 events. Thus, assuming the probability of damage is the same for each event, 0.05, then the probability of ***not*** *being damaged at least once in 100 events (explosions) is:*

Pu-100 = (0.95)100 = 0.006

and the probability of the home ***being*** *damaged in 100 explosions is 1 minus the probability that it is not damaged, thus:*

Pd-100 = 1 - 0.006 = 0.994

This implies that the probability of damage in 100 events is about 99 per cent and that implies damage to the home would be almost certain. Therefore, even though damage is unlikely for any single blasting event, some damage in the form of cracking of walls, ceiling, tile, concrete,...etc. becomes very likely with numerous repetitions of blast induced ground vibrations. And once damage occurs (like cracking, nails pops, or framing joints loosening) that damage will increase at even lower levels of vibrations with repeated exposure to the vibrations."

> *"The quarry application states that blasting will occur at least twice a month, which means that there is a 99 per cent probability of damage to the more than 100 homes within about the first four years of quarry operations (about 8 years if blasting occurs only 6 out of 12 months per year)."*

And, according to Sayed-Ahmed & Naji (2006),[148] ground vibrations can have a damaging effect on residential buildings, as occurred in the two case studies undertaken and presented at the 2006 International Structural Specialty Conference held in Calgary, Alberta:

> *"Subsurface construction blasting generates ground vibration which may have a damaging effect on residential buildings. Codes of practice define damage criteria to limit the effect of the vibrations resulting from the subsurface blasting on nearby structures. All these criteria are based on the soil Peak Particle Velocity (PPV) generated due to blasting on the ground surface close to the structure. The real culprit, however, is not the ground PPV but it is the structural response to the ground vibration. In this paper, the currently adopted safe limit criteria of ground vibrations generated by subsurface construction blasting are presented. Two case studies have been performed on two residential houses located nearby an excavation-by-blasting construction site [ST-051-1]…"*
>
> *"When a charge is detonated in a solid medium (like rock), a family of waves is generated. These waves generate different particle movement and travel at different wave velocities. The resulting ground-borne vibrations may have an effect on residential buildings ranging from disturbing the occupants to causing severe threshold "cosmetic" or structural damage. Problems may occur as a result of large amplitude (low frequency) vibrations, repeated occurrence of smaller amplitude vibrations, or from differential settlement induced by soil particles rearrangement [ST-051-1]."*
>
> *"Two case studies have been performed and discussed for two residential houses (one and two storeys) located adjacent to an excavation where blasting was to be used for excavating the rock. Analysis of the accumulated data recorded during blasting is presented and compared to the currently adopted ground vibration safe limit criteria. The PPV and the vibration frequency due to excavation by blasting measured close to these houses satisfied the existing safe limits criteria for subsurface blasting ground vibration. Despite this fact, both houses suffered threshold cracks and one of them even had structural cracks [ST-051-2]…"*

In another study of damaged residences beyond 300 metres from a Ugandan quarry undertaken by Yomekpe-Agbeno & Affam (2008),[149] the

[148] Sayed-Ahmed, E.Y. and Naji, K., "Residential Houses Cracking Due to Nearby Construction Blasting: Critical Review of Current Safe Limits," 1st International Structural Specialty Conference, Calgary, Alberta, May 2006, <https://www.researchgate.net/publication/280530625_Residential_Houses_Cracking_Due_to_Nearby_Subsurface_Construction_Blasting_Critical_Review_of_Current_Safe_Limits> accessed 10 April 2023.

[149] Yomekpe-Agbeno, S. K. and Affam, M., "Establishing Ground Vibration Threshold Level for Open Pit Mining Environment – A Case Study," (2009) 10 Ghana Mining Journal 19-24, < https://doi.org/10.4314/gm.v10i1.42804>

authors conclude that *frequencies* and *weather conditions* are important considerations when assessing damage potential of a particular blast, as are other factors related to type and quality of construction of structures and residences, and distance from the blast site.

Since 2003, when blasting activities started at the Plant North Pit quarry, residents living close to the pit have complained of cracks and general deterioration of their buildings, damages to electrical and electronic appliances and general nuisance by way of fright and noise, In October 2005, the Environmental Protection Agency ordered the temporary suspension of blasting operations at the Plant North Pit quarry:

> *"Damage caused to the building structures…cannot be attributed to a single cause alone. There are several causative agents such as; poor building materials quality, poor, foundation problems, differential settlement, ground vibration, ageing and building maintenance culture. The ground vibrations from the extensive open pit blasting activities can however, worsen the already precarious conditions of the buildings or they can act as catalysts to worsen the already deplorable state of the structures [p. 19]."*
>
> *"A total of 542 blasts were recorded and out of this only 20 blasts (representing about 6% of total blasts) had ground vibration levels above 1.5 mm/s while 9 blasts had blast values in excess of 120 dB(L) which is the recommended Environmental Protection Agency (EPA) of Ghana levels. The records also show that attention was not paid to Frequencies (at vibration levels were recorded) and weather conditions at the times of the monitoring exercises. Frequencies and weather conditions are important parameters when assessing the damage potential of a particular blast in terms of ground vibration and air blast. According to Konya and Walters (1990), frequency is an important factor in assessing the damage potential of vibrations as structural resonance lies in the low frequency range typically of 5 to 20 Hz and blast vibration in this frequency range can cause a resonance response in structures which produces increased displacement and strain, giving serious problems in the structures. Also air blast levels rise with increased overcast skies with a corresponding increased damage potential [p. 22]."*

Considering the substandard quality of the buildings in the Prestea Township, the authors of the study conclude that the German Standard of 8 mm/s Peak Particle Velocity (PPV) is too high, and recommend that the maximum ground vibration not exceed 2 mm/s:[150]

> *"Even though this level [2 mm/s] can increase drilling and blasting costs considerably, it is considered a better option than expensive lawsuits in the likely event of any further damages that may be caused to building structures in the township [p. 19]."*

[150] In *Seismograph Service Corporation v. Buchanan*, Okla., 316 P.2d 185, 187, [1957], the Oklahoma Supreme Court ruled that the "defendant cannot be aided by the substandard construction of the building if in fact the explosion caused the damage resulting in the substantial loss of value for which damages are claimed."

2.14 Insurance Company Denies Damage Claim Caused by Vibrations from Quarry Blasting

In *Hernandez v. Citizens Prop.* (2020),[151] the Florida appellate court held that insurance coverage is excluded for cracks in walls and floors that occurred due to vibrations from off-site quarry blasting operations by a policy's earth-movement/settlement exclusion. Following is the observation of the court:

> *"The insured filed a claim for cracks in the walls and flooring of his house. The insured's engineer concluded that the damage was the result of soil underneath the house shifting from vibrations caused by blasting explosions at a nearby rock quarry. The insurer denied coverage, asserting an earth-movement/settlement exclusion of the policy. The insured filed suit and argued that the exclusion did not apply. The insured noted that the policy lists nine causes of loss that are considered "earth movement," and that the alleged cause of loss, blasting, is not included. The insurer moved for summary judgment, which the trial court granted, finding that the policy did not cover indirect damage to property as a result of earth movement that may have been triggered by off-site explosions. The appellate court affirmed. The earth-movement exclusion of the policy excluded coverage for damage caused by earth movement "unless direct loss by explosion ensues." The appellate court found that the earth movement at the property did not cause an explosion, but rather that the earth movement was caused by explosion."*
>
> *"The appellate court noted that the exclusion contains anti-concurrent causation language that "loss caused directly or indirectly" by certain causes is excluded "regardless of any other cause or event contributing concurrently" to the loss. It held that the policy's terms excluding "earth sinking, rising, or shifting," "settling, cracking, or expansion of the foundation," "whether caused by natural or manmade activities," unambiguously precluded coverage under the policy."*[152]

2.15 Diminution in Property Value and Loss of Property Use Occasioned by Blasting

In *Clay v. Missouri Highway Transp. Com'n* (MHTC) et al. (Rieke), (1987),[153] the Missouri Court of Appeal awarded the Clays $19,640 as the diminution in property value caused by blasting of rock either against MHTC or Rieke, the contractor, and $2,700 for the loss of use against Rieke only.

The Clays' residence sits above an aquifer, and the aquifer had supplied a well on their property with unusually high-quality drinking

[151] *Hernandez v. Citizens Prop.*, 308 So. 3d 102 – Fla. Dist. Court of Appeals, 3rd Dist. 2020, <https://www.lexology.com/library/detail.aspx?g=7a837bcd-6ebb-46b3-97d3-42fac4688214> accessed 10 April 2023.

[152] Lenzen, D. R., "Florida Appellate Court Holds Earth-Movement Exclusion Excludes Coverage for Cracking Damage Caused by Off-Site Blasting Vibrations," Phelps Dunbar LLP, August 25, 2020, <https://www.lexology.com/library/detail.aspx?g=7a837bcd-6ebb-46b3-97d3-42fac4688214> accessed 10 April 2023.

[153] *Clay v. Missouri Highway and Transp. Com'n*, 951 S.W.2d 617 (1987), Mo: Court of Appeals, Western District, <https://law.justia.com/cases/missouri/court-of-appeals/1997/wd51894-2.html> accessed 10 April 2023..

water since 1945. In November 1989, MHTC retained Rieke to cut a roadway for a new highway. Rieke used explosives to break up and remove rock from the roadway site, and caused damage to the Clays' property, which is 0.85 miles (1,368 metres) from the blasting site. Court observations were:

> *"Rieke tried to blast in a controlled fashion. Specially-placed explosive charges cut the rock and left smooth walls of rock for the sides of the highway. At trial, some experts testified that this controlled blasting only caused shock waves to move about twenty feet [6.1 metres] into the rock. The Clays alleged, however, that the blasting caused vibrations at their home some .85 miles [1,368 metres] away and that it affected the quality and quantity of the water coming from the aquifer. More specifically, they alleged that due to cracks in the aquifer caused by the blasting, sediment such as sand and oil contaminated the aquifer and, ultimately, their well-water, that the water level of their well dropped, and that the water flow in their well was drastically reduced."*
>
> *"…[T]here was evidence to support the submission that vibrations or concussions resulting from the explosion entered the plaintiffs' property, for there was testimony that the Clays and their neighbours felt and heard the blasting. They also testified that they began to have problems with their water supply after the blasting. Thus, they do claim a trespass, and they do claim their damage resulted from the blast. What they do not claim, however, is that the vibrations or concussions which they felt directly caused their damage. Rather, they claim that the same blasting that caused the vibrations also, but separately, split and cracked rock outside their property, and that as a result, it caused a lowering of the water level in the entire aquifer, including that on their property, and polluted the aquifer that supplied their well."*

The Clays were not required to prove that the vibrations and/or concussions were the direct cause of the damage to their property, but only that blasting caused the damage. The following is worth noting:

> *"…[T]he trial court properly refused to require the Clays to prove that it was the vibrations or concussions from the blasting that directly caused their damage; they were required to submit only that it was the blasting that caused their damage. We so rule because we conclude from a review of the history of the doctrine of strict liability for blasting that, while such a claim may be established by proof of vibration and concussion, see Wiley v. Pittsburg & Midway Coal. Mining Co., 729 S.W.2d 228, 232 (Mo.App.1987), it may also be established by other methods of proof."*

As a matter of public policy, innocent parties whose properties have been damaged should not bear the costs of blasting by either the state or an industry, as noted below: :

> *"Policy considerations support such imposition of strict liability for blasting even though no physical invasion of the premises has taken place. Neither an industry nor the State should be allowed to use its property in an abnormally dangerous way that injures the property of its neighbours with impunity, because to do so is effectively an appropriation of the neighbour's property for the industry or State's use. The blaster, and not the wholly innocent party, should assume the costs*

> *of its blasting. See Atlas Chem. Indus., 514 S.W.2d at 316 (characterizing the damage inflicted on other people's property as inverse condemnation); Branch, 657 P.2d at 275."*
>
> *"…[T]hese principles have application here, where the Clays similarly claim that the blasting caused physical damage to their property by damaging the rock formations underlying nearby property, thereby causing injury to the aquifer or to other subterranean aspects of the property in question. They presented expert testimony by Dr. Paul Hilpman, a Professor Emeritus of Geology at the University of Missouri and the Director of the Centre for Underground Studies, to support this theory. He testified that the blasting damaged geological structures that resulted in the contamination of the Clays' well. Dr. Hilpman testified that the blasting fractured rock and sandstone layers in the aquifer and that these fractures in turn caused the water table to drop and allowed oil to migrate up into the water-producing area of the rock strata. This resulted in a lower water level in the Clays' well and in pollution of their well water. This type of damage is equally serious and equally likely to affect the value of property as is damage caused by vibrations or concussions on the property. We find the Clays' proof of damage was sufficient to support their strict liability for blasting and inverse condemnation claims."*
>
> *"Dr. Hilpman testified that some of the rock had to be blasted and that the blasting would cause more subterranean fracturing than simple cutting. He also testified that the oil showed up in the Clays' well because it was able to migrate up into the water zone through fractures in a limestone layer that were caused by blasting."*

In *Davis v. L & W Construction Company*, (1970),[154] *air concussions* and ground *vibrations* from blasting at a quarry about six-eighths of a mile (1,207 metres) away damaged the Davis residence. Their two-storey residence, stucco covered and hollow tile structure with basement, measuring 32′ × 32′, was in "good solid condition prior to the blasting" by the quarry operator.

When quarrying operations were in progress, which had worsened by 1966, the Davis' house shock, a window broke, and structural cracks began to appear. An experienced building contractor testified on behalf of the homeowners, stating that one time while in the home the building was in good condition and that during a second visit he found cracks, "both diagonal and vertical." He concluded,

> *"[V]ertical or horizontal cracks cannot result from settling and are usually caused by jar, shaking or possibly wind."*

Neighbours Albert Poli and John Head also testified as to the damages each sustained to their home as a consequence of the blasting quarry operations.

- *Albert Poli stated he lives about three-fourths mile [1,207 metres] west of the quarry, in a 24′ × 48′ frame house with cement block*

[154] *Davis v. L & W Construction Company*, 176 NW 2d 223(1970) Iowa Supreme Court, <https://www.casemine.com/judgement/us/5914c7a3add7b049347e4377> accessed 10 April 2023.

basement. The structure had never settled, but the foundation is shaken and cracking all over.

- *John Head testified he resides approximately 70 rods [352 metres] southeast of plaintiffs [Davises], or about one and a fourth miles [2,012 metres] from the quarry. He had seen cracking and hairline cracks in the Davis home. His more remote residence trembled whenever there was blasting at defendant's quarry, and every room reveals damage to plaster and paper.*

The Iowa Supreme Court ruled in favour of the Davises and awarded damages, measured as the loss in market value, based on a before- and after-blasting analysis, while holding the quarry operator "liable without fault" for engaging in a notoriously hazardous activity, as noted below:.

> "*Surely it is a matter of common knowledge, and we accord judicial notice to the fact, that blasting by use of dynamite or other explosives is a hazardous activity and as such likely to damage others. See Boyce v. United States, D.C., 93 F. Supp. 866, 868;*[155] *31 C.J.S. Evidence § 9, page* *226 *824; and 29 Am.Jur.2d, Evidence, section 23, page 60.*
>
> *Since 1916 we have consistently adhered to that concept sometimes previously referred to as strict liability, but in cases of the nature here involved, now more appropriately termed "liability without fault".*" [citations omitted]
>
> "*…[I]f one engages in an activity on his own land of such hazardous nature as to involve risk of harm to the person, land or chattels of neighbouring parties, he is liable for the consequences proximately resulting therefrom without regard to degree of care, scientific manner in which done, purpose or motive.*" [citations omitted]
>
> "*And, as stated in Monroe v. Razor Construction Co., supra*[156]*, loc. cit., 252 Iowa 1252, 110 N.W.2d 252*[157]*: "Under this rule, negligence of the defendant need not be shown as an essential element of plaintiffs' recovery.*" See also Cronk v. Iowa Power & Light Co., 258 Iowa 603, 613, 138 N.W.2d 843[158].
>
> "*Consequently the user of explosives acts at his own peril and is liable if damage proximately results to another, either from the direct impact of debris thrown by the blasting, or from consequential concussions or vibrations. In addition to authorities cited, supra, see Exner v. Sherman Power Const. Co., (2 Cir.) 54 F.2d 510, 512-513;*[159] *Garden of the Gods Village v. Hellman, 133 Colo. 286, 294 P.2d 597, 600-601;*[160] *Morse v. Hendry Corporation, Fla. App., 200 So.2d 816, 817;*[161] *Berg v. Reaction Motors Div., 37 N.J. 396, 181 A.2d 487, 492-494;*[162] *Davis v. Georgia-*

[155] *Boyce et al. v. United States*, *Huiskamp et al. v. United States*, *Wells v. United States*, *Campbell et al. v. United* States, 93 F.Supp. 866 (1950), <https://law.justia.com/cases/federal/district-courts/FSupp/93/866/1971773/> accessed 11 April 2023.
[156] *Monroe v. Razor Construction Company*, 110 NW 2d 250 (1961), Iowa Supreme Court,
[157] *Monroe v. Razor Construction Company*, 110 NW 2d 250 (1961), Iowa Supreme Court,
[158] *Cronk v. Iowa Power and Light Company*, 138 N.W. 2d 843 (1965), Iowa Supreme Court, <https://law.justia.com/cases/iowa/supreme-court/1965/51567-0.html> accessed 11 April 2023.
[159] <https://law.justia.com/cases/federal/appellate-courts/F2/54/510/1498099/>
[160] <https://casetext.com/case/garden-of-the-gods-village-v-hellman>
[161] <https://casetext.com/case/morse-v-hendry-corporation>
[162] <https://law.justia.com/cases/new-jersey/supreme-court/1962/37-n-j-396-0.html>

Pacific Corporation, supra, loc. cit., 445 P.2d 483; Bedell v. Goulter, 199 Or. 344, 261 P.2d 842, 845-846;[163] *and Annos. 20 A.L.R.2d 1372, 1377*[164]*.*

2.16 Vibration Damage Awards Caused by Blasting Restricted to Five-Year Limitation Period

In *Harrod Concrete and Stone Co. v. Melton III, et al.*, (2007),[165] eight homeowners and one tenant (Appellants) had their respective damage awards set aside by the appellate court of Kentucky and remanded to the lower court for further proceedings, consistent with a five-year limitation period successfully argued by Harrod (the quarry owner), restricting the computation of proven damages subsequent to August 1996. The failure to timely file the claims for damages caused by vibrations from blasting reduced the amount of damages to which each homeowner (and one tenant) should have been entitled, had the claims been filed in the early 1980s rather than in August 2001. Following observations were important:

> *"The homes allegedly all had varying degrees of damage, including cracks in the interior and exterior walls and slabs, cracks in chimneys and joints, bowed walls, cracked drywall, nail pops, and fogged and/or cracked windows. All of the homes are located in Franklin County, Kentucky over an area of roughly two square miles."*
>
> *"…[The damage here was known and present as far back as the early 1980's for some of the Appellees. We agree with Harrod that "[c]racks are not latent or inherently undetectable. Neither are nail pops, drywall cracks or cracked and fogged windows. These conditions are patently obvious." Certainly, all the Appellees had knowledge of the blasting vibrations occurring as a result of Harrod's limestone operation from the first day of moving into their respective homes. Additionally, Harrod introduced evidence at trial showing that many Appellees knew or should have known of the damages and the possible cause before August 1996. For example, the Dunns and Devers filed insurance claims for blast damage and received payments before 1996. Moreover, the Olivers filed insurance claims before 1996, which were denied; however, they had been advised in June 1996 by an engineering firm that they had blast damage. Nor are we persuaded that Appellees were unable to determine the cause of the damage because they allegedly complained to state mining officials and to Harrod directly about the alleged blast damage and were told that the blasting was not causing their property damage. The Appellees [homeowners and one tenant] are not relieved of their responsibility to exercise reasonable diligence to discover the cause of their damages merely because Harrod may have denied responsibility. Thus, the trial court erred and its instructions to the jury should have limited the award, if any, to only those damages proven to have occurred subsequent to August 1996. Accordingly, we reverse and remand."*

[163] <https://casetext.com/case/bedell-et-ux-v-goulter-et-al>

[164] <https://revistas.pucp.edu.pe/index.php/iusetveritas/article/download/15319/15780>

[165] *Harrod Concrete and Stone Co. v. Melton III, et al.* Ky: Court of Appeals 2007, <https://law.justia.com/cases/kentucky/court-of-appeals/2007/2005-ca-001712.html> accessed 11 April 2023.

The property damage attributed to vibrations from repeated blasting at the quarry was supported by the evidence of the Appellees' expert, Dr. Deatherage, whose qualifications were unsuccessfully challenged by Harrod. Important observations include:

> *"Dr. Deatherage testified that he is a professor of civil engineering with a Ph.D. in civil engineering. Moreover, he has numerous peer reviewed publications which he has authored. Dr. Deatherage's education, training, and experience were sufficient to qualify him as an expert. To the extent that Harrod argues Dr. Deatherage's opinions fall outside the scope of scientific, technical or other specialized knowledge pursuant to Daubert, we disagree."*
>
> *"The principles established in Daubert and its progeny concerning the admissibility of expert testimony "apply not only to expert testimony based on scientific knowledge, but are equally applicable to expert testimony based on technical or other specialized knowledge."*
>
> *"…[I]n forming his opinions, Dr. Deatherage visually inspected the homes and interviewed the occupants. Dr. Deatherage also reviewed countless photographs of the alleged damage, reviewed the opinions of Harrod's experts, as well as reviewed technical publications regarding blast vibrations."*

2.17 Quarry Permit Denial Supported by Substantial Evidence of Land Use Incompatibility

In *Vulcan Materials Co. v Guilford County Board of Cty.com'Rs* (1994),[166] the Board denied Vulcan's application for a quarry comprising approximately 235 acres, with an initial 10-acre quarry pit 300 feet (91.44 metres) deep, and eventual expansion to 17 to 20 acres. Vulcan's appeal resulted in the reversal of the Board's decision by the Superior Court, which then led to a further appeal by the Board to the North Carolina Appeals Court, which restored the Board's decision to deny the quarry permit.

Those opposed to the issuance of the quarry permit offered competent and material evidence as follows in summary form:

- there are 119 homes within 3,000 feet [914 metres], and 450 homes within one mile [1,609 metres], of the quarry site;
- Mt. Hope Church Road, a two lane paved road, is traveled twice a day by ten school buses;
- the area immediately surrounding the quarry site is residential and agricultural, although a commercial business, Replacements Ltd., has a 100,000 square foot facility some 11,000 feet [2.08 miles] from the proposed quarry site;
- area residents obtain their water from wells which are generally 80 [feet] [24.4 metres] to 140 feet [42.7 metres] deep;
- the proposed quarry site is located in part of a watershed for a planned drinking water source;

[166] *Vulcan Materials Co. v Guilford County Board of Cty.Com'Rs,* 444 S.E.2d 639 (1994) 115 N.C. App. 319, <https://law.justia.com/cases/north-carolina/court-of-appeals/1994/9318sc750-1.html> accessed 12 April 2023.

- one area resident testified that when she put her home, which is located directly across from the site, up for sale and disclosed that a quarry was proposed for the site, no one even looked at the house;
- the Guilford County Comprehensive Plan adopted in 1986 reserves the area of the site for residential use;
- neighbours of a Vulcan quarry in Elkin, North Carolina, stated through affidavits that they have suffered broken windows, cracked walls, dried up wells, dust, noise and falling rocks as a result of the operation of that quarry;
- Vulcan was fined $10,000 by the United States Department of Labour for an incident in which a man was killed by flying debris [flyrock] from a quarry blast while mowing his lawn some 900 feet [274 metres] from a Vulcan quarry in Weston, Illinois; and
- there are several quarries already operating in Guilford County; and, according to the National Environmental Journal, Vulcan is the seventh worst emitter of toxic chemicals in the United States, based on air, water, land, underground, public sewage, and off-site releases.

The Carolina appeal court rejected Vulcan's argument that because "quarrying" is a permitted use within the context of the zoning ordinance, it necessarily is in "harmony with the area." As concluded by the Carolina appeal court, the proposed quarry is not in harmony with the character of the area:

> *"…[C]ompetent, material, and substantial evidence reveals that the use contemplated is not in fact in "harmony with the area in which it is to be located" the Board may so find. See 3 Robert M. Anderson, American Law of Zoning § 21.13, at 682 (3d ed. 1986); 3 Rathkopf § 41.13, at 41-83; see Triple E. Assocs. v. Town of Matthews, 105 N.C. App. 354, 358, 413 S.E.2d 305, 307-08, disc. rev. denied 332 N.C. 150, 419 S.E.2d 578 (1992); Piney Mountain Neighbourhood Assoc., Inc. v. Town of Chapel Hill, 63 N.C. App. 244, 251, 304 S.E.2d 251, 255 (1983); People's Counsel for Baltimore County v. Mangione, 85 Md. App. 738, 584 A.2d 1318, 1322-23 (1991)."*

2.18 Council Ignores Complaints of Damage Attributed to Quarry Blasting – A "Civil Matter"

Residents in the communities surrounding Roadstone's Belgard quarry complaining of damages to their houses from blasting operations were advised by South Dublin County Council in March 2021 that their only remedy was to pursue costly and time-consuming civil actions against the owner of the quarry (O'Flaherty, 2021).[167]South Dublin County Council has advised that alleged damage to residential properties from the

[167] O'Flaherty, A.., "Alleged damage to property from blasting is a 'civil' matter,'" Echo.ie, March 29, 2021. <https://www.echo.ie/alleged-damage-to-property-from-blasting-is-a-civil-matter/> accessed 12 April 2023.

operation of commercial activities "are a civil matter", when asked about alleged damage to houses near Roadstone's Belgard quarry. As previously reported in The Echo, a resident near the quarry claimed that the routine blasting that is carried out has worsened in recent months, causing the windows and mirrors in his house to shake.

> When the story went online, a number of commenters claimed that reverberations from the quarry blasts, which occur on Friday afternoons, could be felt further afield in Hazelgrove, Citywest, Kingswood, Brookview, Fettercairn and Ard Mor. The issue was raised at Monday's monthly meeting of the Tallaght Area Committee, when Fianna Fáil councillor Charlie O'Connor asked the council's CEO if he was "dealing with complaints from local residents claiming alleged damage to their homes from constant blasting at the Roadstone Quarry." The council advised that, "damage to residential properties from the operation of commercial activities are a civil matter"….
>
> …Brownsbarn resident Michael Fogarty claims that the blasting at the site started occurring twice a week for several months last year, and the level of disruption to nearby residents has increased.[168] Mr Fogarty, who has lived in the area for 14 years, told The Echo: "When we first moved here there was always an explosion on a Friday – you got used to it".
>
> "But a few months ago, they started doing them on Tuesdays as well. Having explosions once a week was horrible, but twice a week is a disaster. I was at home on a Tuesday before Christmas and the mirror fell off the fireplace, the windows shook and my four-year-old started bawling crying. The houses were shaking. Some of the explosions aren't bad, but some of them are really, really bad."

2.19 St Marys' (Votorantim Cimentos) Blasting Quarry Continues to Generate Complaints

A sampling of homeowner complaints and environmental damage attributed to Votorantim Cimentos' Bowmanville, Ontario, blasting quarry and cement plant are summarized as follows:

- "Higher incidence of blasting concerns in past month and a half [Jan–Feb 2021]." "Vibrations have been within [regulatory] limits, but…the blasts are being felt and disturbing the community members." Complaint referenced where frame fell of[f] a wall." "Strong odour experienced during some blasts… There have been comments about odours at the time of the blasts before. In the 1st quarter of 2020, there were four complaints about blasting; in the 2nd quarter 2020, there were three noise complaints; in the 3rd quarter 2020, there were 18 noise complaints, 4 dust complaints and 1 odour complaint; and in the 4th quarter of 2020, there were two noise complaints.

[168] <https://www.echo.ie/residents-claim-explosions-at-belgard-quarry-have-worsened/>

(February 23, 2021 Community Relations Committee Meeting Minutes)

- "Many complaints are related to blasting and come from outside the immediate surrounding area." (September 11, 2018 Community Relations Committee Minutes).
- Received eight complaints (vibration, noise and dust) in third-quarter of 2017 (to October 4). (October 3, 2017 Community Relations Committee Minutes)
- Received four complaints (noise, flooding and odour) in the second quarter 2017, and St. Marys refused to discuss shoreline erosion (Cedar Crest Beach) with community members on advice of legal counsel due to legal proceedings, an issue that had been raised at previous community meetings. "Community believes that St. Marys should not be able to decline a new member to the committee, and that discussion should be allowed to continue even if the member chosen was involved in legal action against St. Marys." "Complaints reported to MNRF/MOECC etc can't be reviewed with the complainant unless he/she authorizes the MNRF/MOECC." (June 6, 2017 Community Relations Committee Minutes)
- Received 26 complaints (blasting, plume, noise and dust) in 2016 (November 29, 2016 Community Relations Committee Minutes)
- "St. Marys Cement reported exceedances in air emissions on five occasions in 2015 (Swinson, 2016).[169] "According to St. Marys "it is not abnormal to have exceedances." "St. Marys' operations released 4,096 tonnes of sulphur dioxide between January 1 and December 31, 2015," whereas, "[t]he Ministry of Environment and Climate Change allows for 3,511 tonnes."[170]
- "Clarington council…heard there were 13 community complaints in 2015."
- In 2014, St. Marys' Bowmanville operation was the 10th largest emitter with 7,135 tonnes (combined emissions for a group of contaminants known as "criteria air contaminants" that cause air-quality-related issues such as smog and acid rain). These contaminants include sulphur oxides, nitrogen oxides, volatile organic compounds, carbon monoxide and ammonia.[171]
- Received "a large number of complaints about blasting during the 2010 winter [Christmas] holidays (Hatherly, 2011)."[172]

[169] Swinson, S., "St. Marys Cement reports several exceedances in air emissions in 2015," *toronto.com*, June 15, 2016, <https://www.toronto.com/news-story/6722518-st-marys-cement-reports-several-exceedances-in-air-emissions-in-2015/> accessed 12 April 2023.

[170] Ibid.

[171] Ministry of the Environment and Climate Change, Chapter 3, Section 3.05, p. 337, <https://www.auditor.on.ca/en/content/annualreports/arreports/en16/v1_305en16.pdf> accessed 12 April 2023.

[172] Hatherly, T., "St. Marys Cement to stop blasting during winter holidays this year," DurhamRegion.com, August 3, 2011, <https://www.durhamregion.com/news-story/3452188-st-marys-cement-to-stop-blasting-during-winter-holidays-this-year/> accessed 12 April 2023.

- Accelerated erosion rates along the Port Darlington shores (Cedar Crest Beach), primarily in the area bounded by 37 and 155 Cedar Crest Road, have been clearly identified in reports and substantiated by property owners through years of historical photos and documentation to have started following the original construction of St Marys Cement Pier in the 1970s [which protrudes 650 metres out from the shore]. It has been clearly seen, despite empirical models that the pier has modified the natural beach dynamics in the area and cut off the movement of sand along the north shore which is necessary for the maintenance and preservation of the beach. (Municipality of Clarington, Report EGD-015-17, p. 14)

A vast number of complaints lodged over a number of years by neighbouring homeowners at a considerable distance from the 556-acre Bowmanville quarry are related to blasting, even though St Marys has an agreement with the nearby OPG Darlington Nuclear Generating Station, about 5 kilometres away, to ensure that St Marys' blasting "do[es] not result in ground movement [vibration] greater three millimetres per second [3mm/sec] [para. 66]."[173] It is unknown as to where the seismograph(s) are positioned to measure the ground vibrations from blasting at the quarry.

The closest residence is 250 metres from the quarry, which operates between 10 and 20 hours each day (Scales, 2017).[174] Somehow, to the detriment of the health and safety of the community, St Marys Cement's predecessor (Blue Circle Canada Inc.) was able to convince the Municipality of Clarington to exempt the operations from enforcement of Municipal Noise By-law 2017-071, as amended.[175] It is doubtful that anyone residing in the subdivisions surrounding the quarry and cement plant operation is even aware of the noise exemption. The municipal noise by-law is far more restrictive than MECP noise guideline NPC-300 or NPC-119 (blasting). Now, the only effective remedy available to residents living in proximity to the quarry and cement plant and who continue to be subjected to intolerable noise levels (e.g., blasting, equipment, etc.) on an ongoing basis is to initiate a civil action against St Marys Cement (Votorantim Cimentos) for *nuisance* and *trespass.* All *adverse effects*, including noise, airblast, vibrations, dust, toxic fumes and flyrock, are not permitted to leave the licensed site.

> "*The Municipality of Clarington confirmed that in accordance with section 2.2(e) of Noise By-law 2017-071, St. Marys Cement (referred to*

[173] Record of Proceedings, Including Reasons for Decision, Dec 3 to Dec 6, 2012, Application to Renew Power Reactor Operating Licence. <http://nuclearsafety.gc.ca/eng/the-commission/pdf/2012-12-03-Decision-DarlingtonEA-e-Edocs4105509-final.pdf> accessed 12 April 2023.

[174] Scales, M., "St Marys Cement builds lasting legacy," Canadian Mining Journal, April 1, 2017. <https://www.canadianminingjournal.com/featured-article/st-marys-cement-builds-lasting-legacy/> accessed 12 April 2023.

[175] Office Consolidation of By-law 2007-071, as amended. <https://weblink.clarington.net/WebLink/DocView.aspx?dbid=0&id=58848&page=1&cr=1> accessed 12 April 2023.

> *in the By-law by its former name, Blue Circle Canada Inc.), its licenced pit and quarry operations and all related accessory uses are granted an exemption from the noise restrictions that the by-law puts into place. This exemption applies to the entirety of the site. Further, the noise curfew provisions of the by-law are not applicable to these activities at the site."*[176]

At the Sept 11, 2018 Community Relations Committee meeting[177] Votorantim Cimentos (St Marys/CBM) blasting quarry complaints were raised, to which Votorantim Cimentos simply responded as follows without taking any corrective measures:

> *"…[N]ot much can be done to muffle the noise from twice weekly blasts that takes place at the limestone quarry [a continuing nuisance that residents in neighbouring subdivisions will have to endure for 65 more years from 2022 to 2087.]…"*[178]

At two blasts a week, assuming 50 weeks in a year, and a quarry life expectancy of 65 years as of 2022, means that three more generations of homeowners in the neighbouring subdivisions will be subjected to the adverse effects of 6,500 blasts at Votorantim Cimentos (St Marys/CBM) quarry operations. Assuming an average of 50 blastholes per blast, three generations of homeowners will be exposed to the adverse and cumulative effects of 325,000 explosions.

Clairington Noise By-law 2007-071, as amended, from which St Marys Cement (Votorantim Cimentos) has been exempted to the detriment of homeowners in the neighbouring subdivisions, has a number of provisions, including one that does not permit disturbing noises to be heard beyond the property:

> *(g) any noise which may be heard beyond the lot upon which it is made at sufficient volume to disturb persons beyond such lot;*

2.20 On-going Complaints of Damage Attributed to Blasting at Vulcan's Quarry (Lorton, VA)

Residents within a mile or two [3.22 kilometres] of the Vulcan quarry in Lorton, Virginia, have been complaining for years about the adverse impacts caused by blasting quarry operations.[179] From the edge of the quarry, there is a separation of 320 feet (97.5 metres) to the closest homes in Occoquan Overlook and 180 feet (54.9 metres) in SouthPointe, Lorton, Virginia.

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[176] St Marys Cement Community Relations Committee, September 29, 2020. <https://www.stmaryscement.com/Documents/Bowmanville%20CRC/2020%20September%2029th%20CRC%20Minutes.pdf> accessed 12 April 2023.

[177] <https://www.stmaryscement.com/Documents/Bowmanville%20CRC/2018%20Sept%2011th%20CRC%20Minutes.pdf>.

[178] Scales, M., "St Marys Cement builds lasting legacy," Canadian Mining Journal, April 1, 2017. <https://www.canadianminingjournal.com/featured-article/st-marys-cement-builds-lasting-legacy/> accessed 12 April 2023.

[179] "Shockwaves of Dissent from Quarry Neighbors," *The Connection Newspapers*, December 7, 2006, <http://m.connectionnewspapers.com/news/2006/dec/07/shockwaves-of-dissent-from-quarry-neighbors/> accessed 09 April 2023.

> *"For years, residents within a mile or two of the Vulcan quarry in Lorton have heard the twice-weekly thuds of explosions, watched vases bounce across tables and pictures rattle on walls…."*
> *"Those who live near the quarry, located on Ox Road just south of the new Fairfax Water treatment plant, have two major complaints they want Vulcan to address: the amount of traffic created by trucks loaded with tons of stone leaving the quarry daily, and the impact the blasting has on their lives, through the noise and tremors caused by the explosions…."*
> *"Although the quarry has been in business since the 1950s, the area surrounding it has undergone drastic changes in the past few years since the prison closed, said Mike Grogan, another Southpointe resident. As the population has increased, homes have been built closer to the quarry, and the people who live there weren't prepared for the blasts".*
> *"Many of the residents who live near the quarry thought they were the only ones feeling the aftershocks of the blasts in their homes, Grogan said, and didn't report their concerns or complaints to anyone. It was only at the November [2006] meeting of the South County Federation that Supervisor Gerry Hyland (D-Mount Vernon) became aware of the situation, he said."*
> *"The Fairfax County requirements demand a 0.4 [inch/sec] [10.16 mm/sec] peak particle velocity [PPV] and a 130 air over pressure [airblast] decibel reading…. Vulcan detonates between 20,000 pounds and 25,000 pounds of explosives twice a week at the quarry….The operating hours for the quarry are 7 a.m. until 6 p.m. during the week…"*[180]
> *"While Vulcan has never been found to be operating in excess of Fairfax County requirements, McKernan [Deputy Chief of the Fire Prevention Division] said he believes the blasting industry needs stricter regulations…."*
> *"McKeeman said there's a long list of books that state the damages found in these neighboring homes are common and can be found in neighborhoods that are nowhere near quarries."*

2.21 Ongoing Complaints of Damage from Blasting at Rogers Group Quarry (Hendersonville)

Residents as far away as one mile (1,609 metres) have been complaining for years about the damage to their homes, which they attribute to the Rogers Group Inc. blasting quarry operations. By 2018, more than 330 residents joined a Facebook Group (Saundersville Area Blasting Concerns), with the following conversations:

> *Some neighbours in Hendersonville [Tennessee] say far too often the earth is moving beneath them and loud blasting at a nearby quarry is making them lose control of their homes. Now, the city is coming forward with something that might help. There's a crack in a window on*

[180] "Vulcan's Uncertain Future in Lorton, Vulcan Quarry's special-use permit may not be renewed based on neighbor's complaints of structural damage," *The Connection to your community*, April 4, 2007, <http://www.connectionnewspapers.com/news/2007/apr/04/vulcans-uncertain-future-in-lorton/> accessed 09 April 2023.

> *Saundersville Road. The homeowner believes it's not because of anything in her neighbourhood, but rather the rock quarry nearby. "I'm hearing from some of the neighbours about the impact on their homes," said Hendersonville Mayor Jamie Clary. "They're seeing that pictures are being moved, glasses are being rattled. They're worried it's having an impact on their foundations or walls or other parts of their homes." [Mayor] Clary said he lives in the area hit by blasting. Another neighbour told News4, "he feels helpless investing in a house when he has no control over damage to it. He said he would never have built in the neighbourhood if he knew the problem was this bad." A lot of the worries were voiced in the Facebook group, Saundersville Area Blasting Concerns, now* with more than 330 members.[181]
>
> *Wyncrest resident Tasha Buttrey had just moved in three weeks prior when she first felt the ground shake in 2018. She says it wasn't long before she learned from neighbours that a quarry owned by Rogers Group was nearby. "The house shook and knocked a mirror off the wall," she said. "We heard a pop and we watched it crack the dry wall around the door frame." Buttrey says, "she didn't bother filing a formal complaint with the state fire marshal's office who regulates the blasting, or Rogers Group."*
>
> *"Proving the damage is directly due to blasting, is nearly impossible," she said. To make matters worse, when one files a complaint with the fire marshal's office, the state office obtains its readings from Rogers Group itself, Buttrey noted. The readings rarely if ever show the quarry is in violation of state standards.*
>
> *"The community is left with very little recourse," she added. "Everybody feels pretty hopeless about it." For their part, Rogers Group and the third-party company it hires to monitor its blasting, has consistently said it is well within the state guidelines. "We are always way under the state requirements," Rogers Group Area Vice President Bryan Ledford told the Hendersonville Standard in March of 2018. While the state requirements are one to two inches per second peak particle velocity, Rogers Group targets.5 inches [per second or 12.7 mm/sec], he said. "Just to make sure we stay below the legal limits." State Rep. Terri Lynn Weaver (R-Lancaster) says, "she would like to see the state limits lowered to meet federal standards, and has introduced legislation that revises portions of the state's Blasting Standards Act of 1975".*[182]

2.22 Public Complaints of Damage from Blasting as Far Away as Two Miles from the Quarry

Some forty residents within two miles (3.22 kilometres] have filed a litany of complaints against Arkhola Sand and Gravel Co.'s Roberts

[181] <https://www.wsmv.com/news/neighbors-claim-rock-quarry-blasting-creates-problems-for-nearby-homes/article_cba4c58e-5ae3-51a0-a272-8431dff528c8.html>

[182] <https://www.hendersonvillestandard.com/news/blasting-complaints-about-local-quarry-prompts-bill-to-revise-state/article_f59581dc-5f34-11ea-9a0e-6fc489384d49.html>.

Quarry, a blasting quarry southwest of Tahlequah, Oklahoma (Palmer, 1985).[183]

> *There was a rapid series of muffled detonations, and 8,000 tons of limestone slowly peeled away for the 40-foot thick formation. Over a ridge, roughly 4,800 feet [1,463 metres] west of the explosion, Elsie Torix noted the blast on her calendar. "I felt everything start to shak[e]," she recounted later that afternoon. "It was just like an earthquake. It was a small one, compared to what they usually put off."*
> *Superintendent Darwin Tackett said Friday's [March 15, 1985] "shot" was typical of a normal working day at Arkhola Sand and Gravel Co.'s Roberts Quarry…*
> *Friday's blast couldn't possibly have damaged Elsie and Louie Torix's mobile home, Arkhola officials said. Neither could any of the other shots that since 1978 have opened up the limestone quarry, Tackett said. But the Torixes and 39 other property owners in around the Zeb community cite a litany of grievances against the quarry. Residents blame the blasting for drying wells, dirtying well water, cracking brick veneer, breaking windows and wrecking mobile homes.*
> *Confronted with claims of structural damage in homes one and two miles from the quarry, Arkhola officials point to their cinder-block control block building at the very edge of the quarry. If the blasting damaged buildings, they say, it would certainly have damaged the control house by now….*
> *1n a 1980 jury trial, the Torixes won a $31,000 judgment against Arkhola. They said Arkhola's blasting ruined their well and destroyed their mobile home. At the 1980 trial, expert witnesses for Arkhola testified that the blasting could not possibly have affected the well and trailer. The Torixes' first trailer sat atop a ridge overlooking the quarry. The Torixes said when the blasting ruined that trailer; they mortgaged a new mobile home and set it up below the ridge, away from the blasting. Still, they claim, the trailer is beginning to show the same structural stresses that eventually destroyed the other trailer. When the Torixes sued Arkhola in 1980, the firm offered to buy them out for $500 an acre. The Torixes spurned the offer. The farm is worth twice that, they said. The Torixes said they took a live-and-let-live attitude when they first learned Arkhola had leased 900 acres from a nearby landowner. But the Torixes' benevolence quickly faded. "The first shot they put off out there, those damned dishes fell out of the cabinet," Louie Torix said….*

2.23 Complaints of Damage Persist Over Quarry Blasting Operations in Victoria, Australia

As reported in the 2017 issue of Quarry Magazine,[184] the number of complaints from communities in proximity to blasting quarries in Victoria,

[183] Palmer, G.., "Quarry Blasts Rattle Residents, Stir Up Lawsuit," The Oklahoman, March 17, 1985, <https://www.oklahoman.com/article/2101866/quarry-blasts-rattle-residents-stir-up-lawsuit> accessed 09 April 2023.

[184] "Managing safer blasting under community scrutiny," Quarry, May 2, 2017, <https://www.quarrymagazine.com/2017/02/05/managing-safer-blasting-under-community-scrutiny/> accessed 09 April 2023.

Australia, has been on the rise. As is typical, quarry operators/blasters inevitably respond by denying responsibility for any property damage occasioned by blasting operations.

> *"Flyrock, lack of blast area security, premature blasts and misfires are the four major areas of injuries and fatalities from blasting in open cut mines and quarries…. More recently, quarries and mines close to houses, along with regulators, have been responding to complaints from the community that blasting is causing damage to their homes. Approvals of residential developments near existing quarries are contributing to the increased number of complaints."*
>
> *"The common response from our industry, that the ground vibrations and air blast levels measured at their property are within the limits specified in approvals, will not alleviate the concerns of householders that cracks in plaster or brickwork are attributed to blasting."*

3. CONCLUSION

Blasting quarry operations cause untold adverse effects on the environment and its inhabitants. A number of jurisdictions have reached the conclusion that indirect impacts such as *Airblast (Concussion)* and *ground vibrations* stemming from blasting rock with explosives are just as much an invasion of public and private third-party property as if struck directly by flyrock, with all three impacts emanating from the same event (i.e. detonation of explosives to break rock) held to strict liability.

The only effective remedies for reducing or eliminating adverse effects, such as those listed under the *Ontario* Environmental Protection Act (EPA), are mandatory minimum setbacks of 500 metres provided and confined to the lands of the quarry owner, accompanied by minimum separation distances of 1,000 metres between the quarry and incompatible land uses. The permitted PPV of 12.5 mm/second for ground vibrations in Ontario, Canada, is far too high, and should be reduced to 2.0 mm/second, measured along the entire perimeter of the quarry site, not offsite on public or private property, to minimize and protect the environment and its inhabitants from the adverse effects of blasting such as toxic fumes, noise, flyrock, vibrations, subsidence, etc. Based on the research conducted, here are the concluding observations:

- Blasting rock is an ultra-hazardous activity, and has the potential to injure or kill onsite workers and people offsite, as well as non-human life (e.g., pets, livestock, wildlife, etc.).
- Blasting within regulatory limits does not prevent property damage, even at great distances. (The regulatory limit for ground vibrations of Peak Particle Velocity of 12.5 mm/second in Ontario, Canada, is too high.)
- Vibrations and airblast from blasting rock can cause damage at great distances from the blast site.
- Blasting can traumatize people (especially children, the elderly and disabled), including those suffering from Post-traumatic Stress Disorder (PTSD), and pets, livestock and wildlife.

- Commercial and homeowner insurance policies do not cover property damage caused by blasting.
- Citizen complaints and private lawsuits are common occurrences in response to the adverse effects occasioned by blasting rock, as provincial oversight is often ineffective or non-existent.
- Owners whose property is damaged or depreciated by airblast and ground vibrations from blasting operations are forced to initiate time-consuming and costly civil litigation, which often takes years to resolve, with no guarantee of success.
- Blasting that injures or relies on the use of the property of its neighbours, directly or indirectly, with immunity, is effectively an appropriation (de facto taking) of the neighbours' property without compensation.
- Current residents and future generations lose control over what happens once a blasting quarry operation is established, and are forced to endure the adverse and cumulative effects of quarry operations for the rest of their lives, as quarry operations can last for 100 years or more (five generations); in Ontario, a permit or licence to extract aggregate typically has no expiry date.
- Blasting quarry operations depreciate the value of nearby non-residential and residential property, and erode investor and homeowner equity.
- Non-residential and residential properties near blasting quarries are more difficult to sell, and mortgage financing on favourable terms and conditions is not readily available.
- *Blasting Design* reports as required in Ontario pursuant to the ARA are typically misleadingly labeled as *Blast Impact Assessments*, and the mandated scope of work is so superficial as to render them virtually meaningless and incapable of protecting the environment and its inhabitants from the adverse and cumulative effects occasioned by blasting during the entire life of a proposed blasting quarry operation.

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Research involving human bodies or organs or tissues (Helsinki Declaration)
The author(s) solemnly declare(s) that this research has not involved any human subject (body or organs) for experimentation. It was not a clinical research. The contexts of human population/participation were only indirectly covered through literature review. Therefore, an Ethical Clearance (from a Committee or Authority) or ethical obligation of Helsinki Declaration does not apply in cases of this study or written work.

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The author(s) solemnly declare(s) that this research has not involved any animal subject (body or organs) for experimentation. The research was not based on laboratory experiment involving any kind animal. The contexts of animals not even indirectly covered through literature review. Therefore, an Ethical Clearance (from a Committee or Authority) or ethical obligation of ARRIVE does not apply in cases of this study or written work.

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CLIMATE CHANGE REGULATIONS OF CORPORATIONS IN TANZANIA: A CASE FOR *DILUTE INTERVENTIONISM* AND *VETO FIREWALL* PARADIGM

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ABSTRACT

Corporations operating in developing countries generally adopt an obstructionist approach to climate change and environmental regulation, particularly in states with weaker economic bargaining strength. Tanzania is one of the African states suffering the disproportionate impacts of climate change but with a weak regulatory capacity to restrain adverse corporate climate change impacting activities. This article critically analyses the climate change regulatory framework of corporations in Tanzania and proposes the implementation of the *Dilute Interventionism* Model as an innovative solution for regulating corporate activities in climate change mitigation in the country. The model combines prescriptive and facilitative measures in regulating corporations to mitigate the effects of climate change. The article also identifies the need for *Veto Firewall* protection to safeguard the independence of the sole independent regulator established to regulate the climate change activities of corporations in Tanzania. This article adopts the *Dilute Interventionism* Pyramid which depicts the steps required to implement the *Dilute Interventionism* Model in Tanzania. The challenges to the implementation of the *Dilute Interventionism* and *Veto Firewall* Paradigm in Tanzania are also discussed, including resistance from corporations, inadequate funding, and lack of technical capacity and the potential solutions to these challenges are briefly highlighted.

Keywords: Tanzania; Climate change; Corporations; Dilute Interventionism; Regulatory framework; Veto Firewall protection

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Climate Change Regulations of Corporations in Tanzania: A Case for *Dilute Interventionism* and *Veto Firewall* Paradigm

1. INTRODUCTION

Tanzania's economy is mostly dependent on tourism, manufacturing, and rain-fed agriculture. These sectors are the most susceptible to the impacts of climate change. The agricultural sector contributes one-quarter of the GDP and employs approximately three-quarter of Tanzania's workers.[1] The significant contributors to the agricultural sector are the sub-sectors of crops, livestock subsectors and fishery subsector amounting to 18.93%, 4.70% and 2.25%, respectively.[2] A recent report shows that the agricultural sector constituted approximately 26% of the GDP in Tanzania, the industry stood at 29.28% and the service sector contributed approximately 30%.[3] Although tourism contributed to approximately 11 % of the GDP of Tanzania in 2020, the tourism sector is second only to the manufacturing sector in contributing to the national income of Tanzania.[4] Tanzania also experiences water scarcity, which is largely exacerbated by climate change's impact on Tanzania's 9 major river basins.[5]

Drought and flooding are the main climate-related hazards in Tanzania.[6] According to a 2018 report, Tanzania suffered from severe flooding in 2018 displacing approximately 2,000 households in the country's capital of Dar es Salaam. The reports put the normal of persons affected by the flooding to be approximately 1.7 million people. Contributing to an economic loss of 4% in its commercial capital, the affected households lost about 23% of their annual income, without taking into consideration the impact of flooding on their health and also on education.[7] Tanzania also witnessed severe flooding in 2020. With approximately nine of its regions affected by flooding, the impact of this flooding led to the displacement of families, destruction of properties, loss of livelihoods and lives, houses and serious infrastructure damage like the destruction of roads and bridges.[8] The Tanzania Red Cross reported that, in April 2022, flooding caused serious damage in several regions in

1 Joel Chongela, 'Contribution of Agriculture Sector to the Tanzanian Economy' (2015) 3(7) American Journal of Research Communication 12.

2 Ibid.

3 Statista, 'Tanzania - Share of Economic Sectors in The Gross Domestic Product 2017' (Statista2023) <https://www.Statista.Com/Statistics/447719/Share-Of-Economic-Sectors-In-The-Gdp-In-Tanzania/> accessed 25 February 2023.

4 Valensi Corbinian Kyara, Mohammad Mafizur Rahman and Rasheda Khanam, 'Tourism Expansion and Economic Growth in Tanzania: A Causality Analysis' (2021) 7 Heliyon.

5 Climate Risks, 'Tanzania' (Climatelinks2018) <https://www.Climatelinks.Org/Countries/Tanzania> accessed 25 February 2023.

6 Shardul Agrawala and Others, 'Environment Directorate Development Co-Operation Directorate Working Party on Global and Structural Policies Working Party on Development Co-Operation and Environment Development and Climate Change in Tanzania: Focus On Mount Kilimanjaro' <https://www.oecd.org/env/cc/21058838.pdf> accessed 25 February 2023.

7 Jun Rentschler, Ella Kim and Alvina Rman, 'Staying Afloat: New Evidence On How Firms in Tanzania Cope with Flooding' (www.preventionweb.net2021) <https://www.preventionweb.net/news/staying-afloat-new-evidence-how-firms-tanzania-cope-flooding> accessed 25 February 2023.

8 Relief Web, 'Tanzania: Floods - Final Report (Operation N° MDRTZ02) - United Republic of Tanzania | Reliefweb' (Reliefweb.Int2021) <https://reliefweb.int/report/united-republic-tanzania/tanzania-floods-final-report-operation-n-mdrtz02> accessed 25 February 2023.

Tanzania. The most affected by climate change-related flooding were the zones of Runge (Mbeya Region) and Ilija (Songwe Region).[9] The intended flooding in this region leads to the destruction of approximately 10,000 hectares of crops, and infrastructures such as drinking water wells, roads, and bridges. Over 400 homes were also damaged in these regions, and, of these 400 homes, 318 were destroyed. Schools and religious buildings were also affected in these regions. In the Kyela district, approximately 630 households constituting about 3,150 people were displaced because of climate change-induced flooding.[10] Climate change-induced flooding also has a significant impact on Tanzania's economy. A report by Nature Climate Change shows that Tanzania loses an average of US$ 2 billion due to climate-induced floods every year.[11]

Drought also affects Tanzania drastically. A 2012 Comprehensive Food Security and Vulnerability Analysis (CESVA) shows that rural households, which majorly depend on rain-fed agriculture, are the most hit by the impact of drought. The report shows that food insecurity is peculiar to rural households situated in rainfall zone (north and west) that are heavily dependent on Agriculture.[12] A recent report shows that northern Tanzania during the first quarter of 2022 received less than 35% of normal rainfall, which amounted to the worst rainy season in the 21st century. This drought led to the death of approximately 62,000 livestock in Tanzania during this quarter, with drought forcing herders to sneak into protected wildlife in a desperate search for water and pastures for their cattle.[13] The drought experienced during this period also affected the electricity sector, causing a huge drop in hydropower generation. The Tanzanian authorities had to resort to rationing electricity among its citizens.[14] A 2022 report narrows down the Northern region affected to Manyata, Arusha, Kilimanjaro, and Tanga, which puts the total number of persons affected by the drought at approximately 2.2 million.[15]

Though Tanzania is not a major contributor to global greenhouse emissions, the activities of corporations over the years particularly in the industrial sector has resulted in an increase in greenhouse gas emissions

[9] Francis Kajubi, 'Drought Forces People and Wildlife to Compete for Water in Tanzania' (Earth Journalism Network21 March 2022) <https://earthjournalism.net/stories/drought-forces-people-and-wildlife-to-compete-for-water-in-tanzania> accessed 25 February 2023.

[10] Ibid.

[11] Sylivester Domasa, 'Tanzania: Floods Cost Tanzania U.S.$2billion Annually', <https://allafrica.com/stories/201802280677.html> accessed 25 February 2023.

[12] Kahimba, F., Sife, A., & Maliondo, 'Climate Change and Food Security in Tanzania: Analysis of Current Knowledge and Research Gaps' (2015) 14 Tanzania Journal of Agricultural Sciences 21-33.

[13] Kizito Makoye, 'Fighting Drought, Tanzania Faces Loss of 62,000 Livestock' (www.aa.com.tr2022) <https://www.aa.com.tr/en/africa/fighting-drought-tanzania-faces-loss-of-62-000-livestock/2482330> accessed 25 February 2023.

[14] VOA, 'Tanzania Starts Rationing Power Because of Drought' (VOA2022) <https://www.voanews.com/a/tanzania-rations-electricity-because-of-drought-/6849172.html> accessed 25 February 2023.

[15] Relief Web, 'A Situation Analysis' (2022).

and increasing greenhouse gas emissions is one of the key drivers of climate change impacts such as floods, heat and droughts.[16]

Tanzania remains one of the African countries with a weak regulatory capacity to curtail the activities of corporations and currently, Tanzania does not have a Climate Change Act, or an independent climate change regulatory body. Climate change-related issues are, therefore, addressed within the confines of the provision of the Environment Management Act 2004, which fails to make any specific meaningful provision on climate change. There is, therefore, a need for Tanzania to enact a National Climate Change Act and includes provisions implementing the *Dilute Interventionism* Model to better curb corporate excesses. There is also a need for the Climate Change Act to make provisions for *Veto Firewall* protection, which will safeguard the independence of the sole regulatory body to be established by the Act.

This article will, firstly, succinctly examine the two innovative legal and regulatory models (*Dilute Interventionism* and the *Veto Firewall* paradigms) proposed in this article; secondly, it will examine Tanzania's carbon emission profile with emphasis on the corporate carbon emission contributions; thirdly, it will explore the country's climate change/environmental regulation, the climate change regulation of corporations and critically examine Tanzania's environmental regulation through the Environmental Management Act, highlighting its ineffectiveness in adequately regulating climate change activities of corporations in the country; fourthly, the article will critically examine the implementation of the two innovative paradigms proposed in this article and present its conclusion/recommendation.

2. THE *DILUTE INTERVENTIONISM* AND *VETO FIREWALL* PARADIGMS

Dilute Interventionism is a regulatory approach that combines punishment and persuasion to promote compliance with regulations.[17] This approach recognizes that punishment alone may not be enough to change behaviour, and instead emphasizes a balance between punishment and persuasion. By using both approaches, regulators can create a more effective regulatory environment.[18] Unlike other regulatory theories that prioritize facilitative measures, *Dilute Interventionism* starts with the most prescriptive measures first, rewarding compliance rather than punishing non-compliance.[19] This model uses a pyramid enforcement structure that outlines the progression of interventionist measures.[20] However, unlike

[16] Raúl Cassia and others, 'Climate Change and the Impact of Greenhouse Gasses: CO_2 and NO, Friends and Foes of Plant Oxidative Stress' (2018) 9 Frontiers in Plant Science <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5837998/> accessed 17 April 2023.

[17] Kikelomo Kila, 'Corporate Regulation for Climate Change Mitigation in Africa: A Case for Dilute Interventionism (1st Edition, Routledge, 2022).

[18] Ibid.

[19] Ibid.

[20] Ibid.

other regulatory theories that have a broad base and increasingly narrower structures, *Dilute Interventionism* has an inverse pyramid structure.[21] This means that the interventionist measures become broader and less prescriptive as one moves up the pyramid, reflecting the practical structuring required preventing corporate excesses while incentivizing corporate participation in the regulatory framework.[22]

The *Dilute Interventionism* model provides corporations with a range of increasingly less severe prescriptive sanctions, such as criminal sanctions, civil liability sanctions, administrative sanctions, and penalties.[23] As corporations progress higher up the pyramid, the options become wider and less prescriptive until they reach the top, where they find the widest variety of facilitative and self-regulatory instruments available.[24]

Veto Firewall, on the other hand, relates to the mode of securing the independence of a regulator by instituting safeguard steps to shield it from executive and political interference either in a single or double-tier veto process. The term 'firewall' is derived from the context of computer network security where it refers to a piece of technology that protects against unauthorized access to a network by analysing incoming and outgoing data against specific criteria.[25] The term 'veto' refers to the power of a person or body to reject a decision or proposal. Combined, these terms refer to the use of veto powers by specified persons to create a shield/protection for a regulator in order to secure its independence and insulate it from external executive or political intrusion.

Similarly, with respect to the proposed sole independent climate change regulator in Tanzania's regulatory framework (discussed later in this article), a similar concept applies. In this instance, the term 'Veto Firewall protection' refers to a protective wall constructed around the climate change regulator using the veto power of the legislature to prevent undue influence or pressure from members of the executive for its regulatory decisions. In this context, the legislature exercises its veto power by approving or disproving the appointment or removal of the head and senior officials of the regulator. Where the legislature is the sole veto institution for the appointment and removal of officials of the regulator, it constitutes a single-tier veto firewall system. Conversely, there could be an independent appointment body which also exercises veto powers in relation to the appointment and removal of the regulator's officials and this would constitute a double-tier veto firewall system.[26]

Therefore, to provide additional protection for the prospective climate change regulator in Tanzania, this article argues the need for a veto-firewall system, which can be a single or dual-tier structure, as an

[21] Ibid.
[22] Ibid.
[23] Ibid.
[24] Ibid.
[25] Ben Lutkevich, 'What is a Firewall and Why Do I Need One?' (Search Security May 2021) <https://www.techtarget.com/searchsecurity/definition/firewall> accessed 25 February 2023.
[26] See Kikelomo Kila, Corporate Regulation for Climate Change Mitigation in Africa (n 17), chapter 6.

essential ingredient to safeguarding the regulator from any undue influence.[27]

3. TANZANIA'S CARBON EMISSION PROFILE

Tanzania's greenhouse gas emission (GHG) has seen a rapid increase over the years. A report shows that greenhouse gas emissions in Tanzania increased by approximately 3% between 1990 and2014.[28] The bulk of GHG emissions from Tanzania came from the land use change and forestry sector.[29] Agriculture within the period of 1990-2014 contributed approximately 17.3% of the total gas emissions whilst the energy waste and industrial processes also contributed to 7.8%, 1.6% and 0.5%, respectively.[30] A report in 2014 shows that from 1990 through 2014, the energy sector emissions grew by 171%. This was a result of fuel combustion and transportation activities. While the Energy sector saw an exponential increase within this period, the agricultural sector increased by 65% within the same period.[31]

As it relates to carbon dioxide, CO_2 emissions were approximately 9,732,560 million tons in 2016 increasing by 2.5% from the figures recorded in 2015. The figures for 2015 stood at 9,494,242 million tons. Tanzania saw a steady increase from the 1971 to 2016. In 1971, Tanzania emitted a total of 1,542,209 million tons and saw its highest increase in the 1990s, increasing by 38.5%.[32] These increases were mostly attributed to the increase in industrial activities over the years.[33] The largest source of CO_2 emissions in the country is transportation, electricity, and industry, respectively.[34] Transportation contributes a staggering 51% of Tanzania's emissions whilst the electricity and the industrial sector accounted for nearly 25% of the country's total gas emissions.[35] There has, thus, been a steady increase in CO_2 in the country in the past decade.

Corporate activities have immensely contributed to the environmental challenges in Tanzania with many of the country's largest businesses mostly reliant on fossil fuels.[36] Majority of industries CO_2

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27 Ibid, 124.

28 Climate Links, 'Greenhouse Gas Emissions Factsheet: Tanzania' (www.Climatelinks.Org2018) <https://www.climatelinks.org/resources/greenhouse-gas-emissions-factsheet-tanzania> accessed 23 April 2023.

29 Ibid.

30 Ibid.

31 Ibid.

32 Worldometers, 'Tanzania CO_2 Emissions - Worldometer' (www.worldometers.info) <https://www.worldometers.info/co2-emissions/tanzania-co2-emissions/> accessed 17 April 2023.

33 Ceven Shemsanga, Anne Omambia and Yansheng Gu, 'The Cost of Climate Change in Tanzania: Impacts and Adaptations' (2010) 6 Journal of American Science 1545

34 Yida Sun and Others, 'Emission Accounting and Drivers in East African Countries' (2022) 312 Applied Energy 118805.

35 Ibid.

36 Kamukala, G.L. and Crafter, S.A., 'Wetlands of Tanzania', Proceedings of a Seminar on the Wetlands of Tanzania, Morogoro, Tanzania, 27-29 November 1991 (IUCN 1993).<https://books.google.com/books/about/Wetlands_of_Tanzania.html?id=kbLsJa81gpgC> accessed 17 April 2023.

emissions, for example, are mainly from corporations with the industrial sector comprising of construction (50%), manufacturing (31%), mining (15%) sectors, etc.[37] Regulating the climate change activities of corporations in Tanzania is, thus, vital towards achieving a lower carbon emission within the country and a globally sustainable climate.

4. TANZANIA'S INTERNATIONAL CLIMATE CHANGE PROFILE

Although Tanzania is a minor contributor to the global greenhouse gases (GHGs), it experiences drastic effects of climate change, which has threatened the life of humans, their health, safety, and food security.[38] The Tanzania Government recognized the problems linked with climate change, and in order to curb these issues, it ratified several international conventions. Key amongst them is the United Nation Framework Convention on Climate Change (UNFCCC), which was signed on June 12, 1992, and ratified on the 17th of April 1996. Tanzania signed the Paris Agreement on 22nd of April 2015 and ratified the same on 18th May 2018.[39] Tanzania also ratified the Kyoto Protocol on the 26th of August 2002.[40] The UNFCCC, for instance, spells out its key principles including: the requirement for State parties to take precautionary measures to anticipate prevent and minimize the effect of climate change and mitigate its advert effects, and the right of State parties to promote sustainable development.[41] Tanzania has ever since attempted to meet some of the objectives of the Convention. Tanzania, in compliance with Articles 4.1 and 12.1 of the Convention, which require a member State to periodically report to the Convention regarding its national circumstance and subsequent response to Climate change, through a National Communication prepared its first and subsequent report in 2014.[42] Tanzania in compliance with UNFFCC also developed a National Adaptation Programme of Action (NAPA) in 2007.[43] The NAPA seeks to promote the utilization of food crops, which are drought-tolerant in places susceptible to drought.[44] Tanzania in compliance with UNFCC again developed key strategies, which include the Zanzibar Climate Change Strategy (2014) and the National Climate

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37 Ibid.

38 Afrobarometer, 'News Release' (2021) <https://www.afrobarometer.org/wp-content/uploads/migrated/files/press-release/tanzania/news_release_in_tanzania_farmers_lead_concerns_about_climate-20oct21_final.pdf> accessed 25 February 2023.

39 UNFCC, 'United Republic of Tanzania' (Unfccc.Int2023) <https://unfccc.int/node/61230> accessed 25 February 2023.

40 Ibid.

41 UNFCCC, 'United Nations Framework Convention on Climate Change' (1992) <https://unfccc.int/files/essential_background/background_publications_htmlpdf/application/pdf/conveng.pdf> accessed 25 February 2023.

42 United Republic of Tanzania, 'Second National Communication to the United Nations Framework Convention on Climate Change' 2014 <https://unfccc.int/sites/default/files/resource/tzanc2.pdf> accessed 23rd February 2023.

43 Global Support Programme, 'Tanzania | National Adaptation Global Support Programme' <https://www.globalsupportprogramme.org/explore/eastern-africa/united-republic-tanzania> accessed 25 February 2023.

44 *Ibid.*

Change Response Strategy developed in 2021.[45] Tanzania has made persistent efforts to comply with other agreements.[46] For instance, Tanzania, in compliance with Article 4.2 of the Paris Convention, which specifically requires States to prepare and communicate Nationally Determined Contributions, drafted a Nationally Determined Contribution in 2021, which provides for key interventions on adapting and mitigating the impacts of climate change.[47] Tanzania has ratified some other conventions including the 1992 Convention of Biological Diversity (CBD) ratified in 1997, The Basel Convention on the Control of Transboundary Movement of Hazardous Wastes and their Disposal, which was ratified within 1993, the Vienna Convention for the Protection of Ozone Layer 1985, which was ratified in 1993, and, lastly, the Stockholm Convention on Persistent Organic Pollutants 2001, which was ratified in 2003.[48]

5. TANZANIA'S CLIMATE CHANGE REGULATORY FRAMEWORK

Tanzania is yet to enact a Climate Change Act. However, it has several legislative enactments[49] and regulations revolving remotely around Climate Change. The Disaster Management Act[50] provides guidelines for preventing disasters, preparedness, mitigation, and response measures. The Act establishes a Disaster Management Agency and the Disaster Management Fund. Some of the core functions of the Agency include formulating policies and plans on all activities relating to disaster management in Tanzania, Mainland (which could also include Climate Change Disasters), establishing an Emergency Operation and Communication Centre to act as the central planning, coordinating, and monitoring institution for the prevention, mitigation and response to post-disaster recovery having regards to potential risks on natural disasters.[51] Whilst the Disaster Management Fund is to be used to provide essential commodities and other relief to persons who are victims of any disaster, hazard, or emergency, these funds will also be utilized for preventing, mitigating, responding, and ensuring recovery from a disaster or other activities related to disaster management.[52]

The Public Health Act of 2010 also contains a few provisions relating to Climate Change. The Act provides the means to ensure the control of communicable diseases, pollution of water in ports, control of mosquitoes,

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45 United Republic of Tanzania, 'Nationally Determined Contributors', <https://unfccc.int/sites/default/files/ndc/2022-06/tanzania_ndc_submission_30%20july%202021.pdf> accessed 23 February 2023.

46 *Ibid.*

47 Ibid.

48 Olof Drakensberg, Goran E.K. and Karolina Fernqvist, 'Environment and Climate Change Policy Brief', <https://www.researchgate.net/publication/311935998_environment_and_climate_change_policy_brief_-_tanzania> accessed 23rd February 2023.

49 Tanzania Agricultural Research Institute Act 2016, Disaster Management Act 2015, Public Health Act 2010, and Environmental Management Act (EMA) 2004.

50 The Disaster Management Act 2015.

51 Section 5 (1) of the Act.

52 Section 29 of the Act.

solid, liquid, and hazardous waste management. Furthermore, the Act empowers the Minister to make regulations for carrying out the purpose of the Act and spells out a list on which the Minister can make regulations on. One of these includes regulations prescribing programmes and facilities to ensure that the issues of climate change are well addressed and curbed.[53]

The Environmental Management Act (EMA) though does not provide extensively for climate change, it makes minor provisions on climate change. For instance, the Act instructs the Minister for Environment and other relevant ministries to take adequate measures to address climate change, with particular emphasis on the impact of climate change and adaptation measures[54]. Additionally, it provides the right of every person living in Tanzania to a clean, safe and healthy environment.[55] It also provides citizens with the ability to commence environmental proceedings against persons whose act or omission is likely to occasionally harm either to human health or to the environment.[56] The Act creates the National Environment Trust Fund[57], which (amongst other things) is to be utilized to enhance research intended to further the requirement of environmental management. Additionally, the Act establishes a national Environmental Regulatory Body (ERB), which is charged with the function of supervising Environmental Units at both the district and sectorial levels.

With respect to regulations, on the 28th of October 2022, the Tanzania Minister for Environment (pursuant to sections 75 and 230 of the Environmental Management Act 2004) passed the Environment Management (Control and Management of Carbon Trading) Regulations of 2022. The Regulations provide regulatory control and management of carbon trading projects in Tanzania. The Regulation appoints the Minister of the Environment as the designated national authority or the national focal point and sets out some of its functions. This includes the responsibility of linking the country with international processes for climate change; coordinating all matters relating to justice; registering carbon trading projects under compliance and voluntary mechanisms.[58] This regulation was enacted pursuant to sections 75 and 202 of the Environmental Management Act and it provides the enabling power for the Minister to promulgate similar regulations for implementing the key features for *Dilute Interventionism* in Tanzania. The enactment of a similar, but more comprehensive and bespoke, framework legislation tailored specially to address climate change issues is required in Tanzania.

Whilst the above-discussed legislative enactments are utilised for regulating climate activities in Tanzania, these enactments are insufficient in providing a comprehensive legal framework for regulating corporate

53 Section 171 (2) (M) of the Act.
54 Section 25 of the Act.
54 *Ibid.*
55 EMA *supra 49*, Section 4.
56 Section 5 of the Act.
57 Section 213 of the Act.
58 United Republic of Tanzania, 'The Environmental Management Act-Subsidiary Legislation to the Gazette of the United Republic of Tanzania' (2022) 103.

participation in climate change mitigation in the country. There is, thus, a need for the incorporation of the key features (discussed below) of the *Dilute Interventionism* or *Veto Firewall* paradigms to provide a comprehensive legal/regulatory framework to effectively regulate climate change activities of the corporation in the country.

6. TANZANIA CLIMATE CHANGE REGULATION OF CORPORATION

Some of the laws already discussed above contain several provisions regulating corporate contribution to climate change in Tanzania. Additionally, the Mining Act of 2010 requires companies who own mining licenses to take effective measures for protecting the environment per the Environmental Management Act (EMA).[59] The EMA requires that an environmental impact assessment in mining projects or mining activities be conducted. This is very crucial because most of the sources of energy for undertaking mining activities have direct implications on greenhouse gas emissions.[60] It is, therefore, imperative to limit their impacts on climate change by setting up measures to limit the same. The Urban and Planning Act 2007, for instance, restricts any development activity, which will pose a serious impact on the environment. The Petroleum Act 2015 requires that a strategic assessment of the social and environmental impact of petroleum activities must be properly evaluated before using an area for petroleum activities.[61] Lastly, to ensure transparency and accountability in extractive industries, the Extractive Industries Transparency and Accountability Act requires the disclosure to the public of the environmental management plan by any extractive industry.[62] These laws help to regulate corporate activities to limit harms to the environment.

7. STRONGPOINTS OF TANZANIA LEGAL FRAMEWORK ON CLIMATE CHANGE

Although, several pieces of legislation remotely provide for Climate Change in Tanzania, this section shall focus solely on the Environmental Management Act because it provides a comprehensive framework for the sustainable management of the environment and natural resources in Tanzania.[63] The EMA provides a legal and institutional framework for sustainable management of the environment. It also outlines principles for management,[64] impact and risk assessments,[65] prevention and control of

[59] Vizzuality, 'National Climate Change Strategy 2021-2026 - Tanzania - Climate Change Laws of The World' <https://www.climate-laws.org/geographies/tanzania/policies/national-climate-change-strategy-2021-2026#:~:text=the%20national%20climate%20change%20strategy> accessed 25 February 2023.

[60] *Ibid.*

[61] The Petroleum Act, 2015.

[62] The Tanzania Extractive Industries (Transparency and Accountability) Act, 2015, section 16

[63] EMA, *supra 49.*

[64] Section 81 of the Act and the Environmental Impact Assessment and Audit Regulations 2005, Section 47.

[65] Section 14 of the Act and Section 12 of the Regulations.

pollution,[66] waste management,[67] environmental quality standards,[68] public participation,[69] compliance and enforcement.[70] It establishes the National Environmental Management Council (NEMC) as the main regulatory body responsible for environmental management in the country.[71] The Act also requires Environmental Impact Assessment (EIA) to be carried out for all projects that may have a significant impact on the environment, ensuring that potential environmental impacts are considered before a project is approved.[72] Additionally, the Act includes provisions for the conservation and sustainable use of biodiversity[73] and natural resources,[74] as well as measures for environmental monitoring, compliance, and enforcement.[75] Overall, the EMA provides a strong legal foundation for environmental protection and management in the country but a weak regulatory framework for climate change.[76]

8. SHORTCOMINGS OF THE TANZANIA CLIMATE CHANGE REGULATORY FRAMEWORK

While Tanzania has developed several regulations and policies related to climate change, the existing frameworks do not provide a robust and comprehensive approach to addressing climate change. The National Environmental Act for example which provides fragmented provisions relating to climate change has several shortcomings including:

8.1 Limited Focus on Climate Change

The Act does not provide a comprehensive framework for addressing climate change, and its provisions on climate change are limited to a few sections.[77] While it is true that the Act (EMA) includes provisions related to environmental issues such as pollution prevention and control,[78] these provisions may not be sufficient to address the complexity of climate change and its impacts. This is because the prevention and control of pollution is only one aspect of environmental management. Climate change, on the other hand, requires a more holistic approach as it takes into account the unique complexities of the issue and its impact. This includes strategies to mitigate greenhouse gas emissions, adaptation measures to reduce vulnerability to climate impacts, and approaches to build resilience to climate change. This limits its

66 Section 187 of the Act and Section 51 of the Regulations.
67 Section 114 of the Act and Section 44 of the Regulations.
68 Section 140 of the Act and Section 140 of the Regulations.
69 Section 178 of the Act and Section 17 of the Regulations.
70 Section 184-192 of the Act and Section 57 of the Regulations.
71 Section 16 of the Act and Section 16 of the Regulations.
72 Section 14 of the Act.
73 Section 230 of the Act.
74 Section 7 of the Act and Section 46 of the Regulations.
75 EMA *supra-49*.
76 Section 75 of the Act.
77 Ibid and the Second Schedule of the Regulations.
78 Section 106-113 of the Environmental Management Act.

effectiveness in addressing the complex and urgent issues associated with climate change.

8.2 Lack of Clear Enforcement Mechanisms

While the Act establishes legal obligations for various stakeholders, it does not provide clear enforcement mechanisms to ensure compliance with climate change provisions.[79] This limits the effectiveness of the Act in addressing climate change.

8.3 Insufficient Allocation of Resources

The Act requires significant resources to implement, including funding, technical expertise, and institutional capacity. Although the Act establishes the National Environmental Trust Fund,[80] the Act does not provide explicit funding for climate change mitigation and adaptation, technical expertise, and institutional capacity.

8.4 Limited Public Participation

The Act does not provide for meaningful public participation in environmental decision-making, including climate change-related decisions.[81] While the Tanzania Environmental Management Act (EMA) does include provisions related to public participation[82] in environmental decision-making, these provisions are not sufficient to ensure meaningful and effective public participation in climate change-related decisions. Section 178 of the EMA outlines the requirements for public participation in environmental decision-making processes. It requires public notice of proposed activities that may have significant environmental impacts, public access to relevant information, and an opportunity for interested parties to submit comments and participate in public hearings. While these provisions are a step in the right direction, effective public participation in climate change-related decisions requires more than just providing information and an opportunity to comment. It requires a meaningful and inclusive process that actively engages all stakeholders in the decision-making process, including marginalized and vulnerable communities that are often most affected by climate change. Failure to incorporate the participation of vulnerable communities and groups limits the effectiveness of the Act and the public buy-in needed for effective implementation.

8.5 Limited Integration with Other Policies

The Act does not appear to be fully integrated with other policies and strategies in Tanzania, which limits its impact and effectiveness. One example of the lack of alignment between the Tanzania Environmental Management Act (EMA) and the Tanzania Climate Change Strategy is in relation to the issue of greenhouse gas emissions. The Tanzania

[79] Section 142 of the Act.
[80] Section 213 of the Act.
[81] Section 46 of the Act.
[82] EMA, supra 49

Environmental Management Act (EMA) does not have a specific target for reducing greenhouse gas emissions. Rather, the EMA requires industries and other polluting activities to adhere to certain emissions standards and limits.[83] For example, the EMA sets emissions limits for pollutants such as carbon monoxide, hydrocarbons, other noxious emissions, and standards for exhaust emissions.[84]

The Tanzania Climate Change Strategy, on the other hand, sets a specific national target for reducing greenhouse gas emissions by 10% by 2030, relative to business-as-usual levels.[85] This target is intended to mitigate the impacts of climate change by reducing the amount of heat-trapping gases that are released into the atmosphere. So, while the EMA and the Tanzania Climate Change Strategy both aim to address environmental and climate-related issues, they approach the issue of emissions reduction in different ways. The EMA primarily focuses on regulating emissions from industries and other polluting activities, while the Tanzania Climate Change Strategy takes a broader approach that includes emissions reductions from all sectors of the economy and sets a specific target for emissions reductions. The author contends that the Tanzania Climate Change Strategy should be given a statutory footing to improve its effectiveness as it adopts the right approach to tackling climate change mitigation.

8.6 Limited Focus on Mitigation and Adaptation

The Act provides very limited provisions on mitigation and adaptation,[86] which is critical given Tanzania's vulnerability to climate change impacts. A vivid example is the lack of clear targets and timelines. The Act does not specify clear targets and timelines for reducing greenhouse gas emissions, which are essential for achieving the long-term goal of limiting global warming to well below 2°C.[87] Similarly, there are no clear targets or timelines for adapting to the impacts of climate change, which makes it difficult to measure progress and hold the government accountable for its actions. Also, the Act does not provide for adequate resources to implement mitigation and adaptation measures. This includes funding for research, development, and deployment of climate-friendly technologies, as well as capacity-building and awareness-raising activities to support adaptation efforts.

8.7 Lack of Regulatory Independence

By far the biggest shortcoming of the EMA is the absence of an independent regulator to implement the regulatory objectives, powers and functions vested in the Act. The independence of a regulator is vital for its effectiveness as it ensures that the regulatory policies and objectives are

[83] Section 131 of the Act.
[84] Section 132 of the Act.
[85] United Republic of Tanzania, supra-45.
[86] EMA, *supra 49*.
[87] UNFCCC, 'The Paris Agreement' (UNFCCC2022) <https://unfccc.int/process-and-meetings/the-paris-agreement> accessed 15 April 2023.

not influenced by political and other executive decisions. The main test of independence of the regulator can be gleaned from the process of appointment and removal of its senior officials. Where the executive maintains a dominant control of this process, then the regulator lacks independence. Tanzania lacks a clear climate change regulator and relies on the environmental regulator established in the EMA to regulate environmental activities including climate change matters. Apart from this absence of a specific regulator being a major concern, the environmental regulator under the EMA is also not independent as the appointment and removal of its senor officials are solely carried out by the President and the executive officers. This severely weakens the regulatory process for climate change framework in Tanzania.

8.8 Mixture of Facilitative and Prescriptive Measures

To ensure the effectiveness of the climate change regulatory process, there must be a useful blend of prescriptive and facilitative measures in the relevant statutory instrument to ensure a delicate balance between punishment and persuasion when seeking to incentivise corporations to participate in climate change mitigation projects in Tanzania. To unduly rely on prescriptive measures will be counter-productive and futile and fail to achieve the desired objectives; relying mostly on facilitative measures also runs the risk of being too weak and ineffective. Thus, the statute should incorporate a blend of both measures to ensure optimal effectiveness. Unfortunately, the EMA has not adopted this approach and missed the opportunity to punish and persuade corporations in equal measure.

9. IMPLEMENTING THE *DILUTE INTERVENTIONISM* MODEL IN TANZANIA

The model has been discussed in section 2 above. To effectively implement the *Dilute Interventionism* model, a regulatory framework that covers all aspects of climate change, including mitigation and adaptation, is crucial.[88] An autonomous regulator must be empowered to enforce obligations and responsibilities on corporations, government bodies, and individuals concerning climate change mitigation and adaptation.[89] The regulator must have sufficient powers to monitor and enforce compliance with the regulations, including the ability to issue licenses and permits, establish appropriate standards, and impose sanctions where necessary.[90] Tanzania's emissions reduction target, as outlined in its Nationally Determined Contribution (NDC), is to reduce its greenhouse gas emissions by 10% by 2030 compared to business as usual (BAU) levels.[91] The country

[88] Ibid.
[89] Ibid.
[90] Ibid.
[91] United Republic of Tanzania, *supra*-45.

also set a conditional target of reducing emissions by up to 20% by 2030, depending on the availability of international support.[92]

The *Dilute Interventionism* model can be used in Tanzania's climate change regulatory framework to motivate corporations to participate in climate change mitigation while exerting less interventionist burden on them.[93] This will involve restructuring some of the sanction mechanisms at the various stages of the enforcement pyramid in terms of their severity, targets, and impacts on regulatees, but still maintaining the general tenor of the pyramid flow from the most severe measures at the bottom de-escalating upwards based on compliance by corporations.[94] It should also be designed to incentivize corporations to reduce their carbon emissions by providing them with tax credits or other financial incentives.[95] The regulatory framework can also set emissions reduction targets for corporations in line with Tanzania's NDC, and these targets can be gradually increased over time. The regulatory framework can also require corporations to disclose their emissions data and adopt best practices for reducing carbon emissions.

However, it is important to note that while Tanzania's carbon emissions may be relatively low compared to developed countries, the impact of climate change on the country is still severe[96] as Tanzania is vulnerable to the impacts of climate change, including droughts, floods, and other extreme weather events.[97] It is important for the regulatory framework to strike a balance between incentivizing corporations to reduce their carbon emissions and protecting vulnerable communities from the impacts of climate change. This is pivotal because if the regulatory framework focuses too much on incentivizing corporations to reduce their carbon emissions without considering the impacts on vulnerable communities, it could lead to unintended consequences. For instance, it could lead to the displacement of people from their homes, loss of livelihoods, and exacerbate poverty, especially for those who rely on sectors that produce high carbon emissions. On the other hand, if the regulatory framework prioritizes protecting vulnerable communities without considering the need to reduce carbon emissions, it could result in a missed opportunity to mitigate climate change. Therefore, a balance must be struck to ensure that both goals are achieved effectively.

Implementing *Dilute Interventionism* model in Tanzania requires three key features - Framework legislation; statutorily protected independent regulator; and technical competence of the regulator.

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92 *Ibid.*
93 Kikelomo Kila, *supra-17.*
94 *Ibid.*
95 *Ibid.*
96 United Republic of Tanzania, *supra*-45.
97 Romy Chevallier, 'Tanzania's Vulnerability to Climate Change Impacts' (JSTOR2019) 8 <http://www.jstor.org/stable/resrep29563.6> accessed 4 March 2023.

9.1 Framework Legislation

Currently, Tanzania does not have comprehensive framework legislation that focuses only on climate change. To ensure compliance with climate change regulations, this comprehensive framework legislation must be drafted based on the principle of dilute interventionism.[98] The principle of *Dilute Interventionism* emphasizes the use of a combination of punishments and persuasion to encourage compliance with regulations.[99] It is important to use both approaches to create a balanced and effective regulatory environment that can incentivize corporations to reduce their carbon emissions while also protecting vulnerable communities from the impacts of climate change. In the case of Tanzania, a comprehensive framework legislation that focuses solely on climate change can help ensure compliance with regulations related to mitigating and adapting to climate change. Such legislation can establish appropriate standards and procedures for monitoring and enforcing compliance with regulations, as well as provide a range of sanctions and incentives for corporations and individuals to encourage them to take action to reduce their carbon emissions and adapt to the impacts of climate change.

By using the principle of *Dilute Interventionism* as a basis for developing this legislation, Tanzania can strike a balance between regulating carbon emissions and protecting vulnerable communities. Punishments such as fines, sanctions, and penalties can deter non-compliance, while incentives such as tax breaks, grants, and subsidies can encourage voluntary compliance. By using both approaches, the comprehensive framework legislation can create a regulatory environment that is effective, efficient, and fair, while also achieving the goals of mitigating and adapting to the impacts of climate change. As corporations comply with these measures, regulatory interventions can be de-escalated, and a co-regulatory approach introduced. This involves collaboration between regulatory bodies, the state, and corporations to achieve greater compliance. Once regulatory standards have been met, corporations can be entrusted to regulate themselves in certain areas of the regulatory framework.[100]

The Climate Change framework legislation for instance can begin with prescriptive measures, such as the closure of operating facilities, followed by criminal or civil sanctions, like imprisonment or fines against both corporations and their senior officers upon violation to a largely self-regulatory framework with incentives and assistance provided to corporations to encourage compliance with prescribed regulatory standards.[101] If a corporation takes action to address its lack of compliance with climate change regulations before being convicted, the penalty of losing its operating license may be reduced to just the closure of the facility. The overall goal is to encourage corporations to comply with the

[98] Kikelomo Kila, *supra-17*.
[99] Ibid.
[100] *Ibid.*
[101] *Ibid.*

Climate Change regulatory framework and for the enforcement structure to be designed in a way that allows corporations to participate in the regulatory framework and eventually self-regulate.[102] This means that as corporations comply with the regulations, they are given information on co-regulatory interventions they can use to address any gaps in compliance. If they can satisfactorily comply with the prescribed intervention measures up to a certain level, they may eventually become self-regulating entities.[103]

9.2 Statutorily Protected Regulator

The successful implementation of the *Dilute Interventionism* Model requires the appointment of an independent regulator with full authority to license corporations, monitor their activities, and enforce compliance with the relevant regulations.[104] This regulatory body will play a critical role in ensuring that corporations obtain the necessary licenses before undertaking any activities that may pose a risk to human health and the environment.[105] The Environmental Management Act (EMA) does provide for the establishment of the National Environment Management Council (NEMC),[106] which is responsible for regulating and supervising environmental activities in Tanzania. However, the EMA is a general environmental law that covers a wide range of environmental issues and does not specifically focus on climate change. A comprehensive climate change framework legislation based on the *Dilute Interventionism* Model would address this gap by empowering an independent regulator to license corporations for their carbon emissions and enforce compliance with relevant regulations. Therefore, the appointment of an independent regulator with full authority to license corporations for their carbon emissions, monitor their activities, and enforce compliance with relevant regulations is a critical component of the *Dilute Interventionism* Model and would be a significant improvement to the current regulatory framework.

The licensing process is vital, as it serves as an important tool for the regulator to assess the potential environmental impact of the corporation's activities and to implement appropriate control measures to mitigate any potential harm. By issuing licenses, the regulatory body can ensure that corporations operate within the bounds of the law and that they remain accountable for any negative environmental impact that may result from their actions.[107] It is pertinent to state that the issuance of a license by the independent regulator serves as the cornerstone for the continuous operation of corporations engaged in carbon emission activities. The license provides the necessary legal authority for such corporations to

[102] *Ibid.*
[103] *Ibid.*
[104] *Ibid.*
[105] *Ibid.*
[106] Section 16 of the EMA 2004.
[107] *Ibid.*

carry out their activities while ensuring compliance with the regulations outlined in the climate change regulatory framework.[108]

Given the importance of funding, licensing fees can be incorporated to cover the regulatory costs and other expenses incurred in implementing the Act. This not only ensures that the costs are borne by the corporations responsible for carbon emissions but also provides a means to support the continued operation of the independent regulator. By doing so, the regulatory framework can be sustained, ensuring that corporations comply with the regulations and that the environment is protected from harmful carbon emissions.[109] Thus, in developing a legislative framework for Tanzania, the appointment of an independent sole regulator to guarantee that corporations operate responsibly and within the confines of the law must be embedded in the provisions of the framework.

9.3 Technical Competence

For the regulator to effectively implement the *Dilute Interventionism* Model, they must possess the appropriate technical acumen to grasp the complexities of corporate operations.[110] This can be attained through the recruitment of external consultants who possess the requisite technical expertise or through the formation of strategic partnerships with technical institutions that can furnish the necessary proficiency and breadth of knowledge on mitigation issues. In this way, the regulator can ensure that it has the expertise required to evaluate the intricacies of corporate activities and make informed decisions in the implementation of the framework legislation.

10. *DILUTE INTERVENTIONISM* AND SUBSIDIARY LEGISLATION BY THE REGULATOR

The successful implementation of *Dilute Interventionism* hinges upon a robust and comprehensive regulatory framework that encompasses various aspects of climate change, such as mitigation and adaptation.[111] A comprehensive regulatory framework is necessary to address the complex and interconnected challenges posed by climate change. Climate change is not just an environmental issue, but also a social, economic, and political issue that requires a multi-faceted approach. Thus, a comprehensive regulatory framework that covers all aspects of climate change, such as mitigation and adaptation, can ensure that all relevant stakeholders are engaged and that all potential impacts of climate change are addressed.

Mitigation measures focus on reducing greenhouse gas emissions, which is crucial to limiting the extent of climate change. On the other hand, adaptation measures aim to help communities and ecosystems adapt to the impacts of climate change that are already occurring or are likely to occur in the future. Both mitigation and adaptation measures require regulatory

[108] *Ibid.*
[109] *Ibid.*
[110] *Ibid.*
[111] *Ibid.*

intervention to ensure that corporations and individuals are incentivized and held accountable for taking action.

This framework must be crafted in a manner that provides significant power to an autonomous climate change regulator to execute the *Dilute Interventionism* model by enforcing obligations and responsibilities on corporations, governmental bodies, and individuals concerning climate change mitigation and adaptation. Additionally, this regulatory framework should be resilient enough to withstand opposition from corporations that may not be receptive to regulatory oversight.[112]

The development of a Climate Change Act is imperative for Tanzania to institutionalize regulatory controls over corporations in the climate change sector. While the Environmental Management Act (EMA) provides a framework for the management of the environment in Tanzania, it does not specifically focus on climate change as a standalone issue. The EMA only briefly mentions climate change[113] and its impact on the environment.

A Climate Change Act would be specific legislation that deals solely with the challenges posed by climate change. It would outline the regulatory measures required to mitigate and adapt to the impacts of climate change. This would provide greater clarity on the specific actions required to be taken by corporations to address climate change issues, and it would help to ensure that these actions are effectively enforced. To effectively address resistance from corporations opposed to regulation, the regulatory framework must be drafted to empower the sole regulator to impose strict controls on corporations and enforce compliance using a combination of stringent punishments such as license revocation, facility closure, and criminal/civil penalties while providing government incentives to reward compliance and incentivize further compliance.[114] Although the regulators under the EMA have the power to enforce compliance with environmental impact assessment and certification regulations through penalties and punishments for offences related to non-compliance,[115] the EMA does not explicitly empower regulators to take strict actions against non-compliant corporations in the climate change sector or to incentivize compliance using government rewards. Thus, the regulatory framework must also be drafted to allow the regulator to make subsidiary legislation to give effect to the general provisions in the framework legislation.

By consolidating multiple sectors responsible for carbon emissions into a single comprehensive framework, corporations will know what is expected of them, from whom these expectations emanate, and when. Other sectoral regulators should be divested of their powers over carbon emissions and atmospheric pollution regulations, including regulators for the oil and gas, manufacturing, and electricity and power sectors, amongst

[112] *Ibid.*
[113] Section 75 of the Environmental Management Act.
[114] *Ibid.*
[115] Section 60 of the Environmental Management Act.

several others. Vested in the sole independent regulator, this approach will enable it to concentrate its efforts on achieving climate change mitigation and adaptation while preventing the duplication of regulatory functions between different entities carrying out the same or similar functions.[116]

11. IMPLEMENTING VETO FIREWALL PROTECTION FOR THE CLIMATE CHANGE REGULATOR IN TANZANIA

The *Veto Firewall* concept has been discussed in section 2 above. To ensure the independence of the proposed sole climate change regulator in Tanzania's regulatory framework, and to avoid undue pressure or influence of the executive on the regulator, there is need to provide additional protection for the appointment and removal of the senior officials of the regulator to be appointed by the President. In this context, a *veto firewall* system, which can be a single or dual-tier structure, is essential to safeguarding the sole regulator from any undue influence.[117] The single-tier system is already used in the appointment of the regulator in other sectors of the Tanzanian economy, e.g. the appointment of the Governor of the Central Bank of Tanzania. Article 8(1) of the Bank of Tanzania Act[118] provides that the Governor shall be appointed by the President who shall, unless he dies or resigns or vacates or is removed from his office for good cause or is disqualified, hold office for 5 years and shall be eligible for a re-appointment. Just like the appointment of the Governor of the Central Bank of Tanzania, the appointment of Chief Justice is appointed by the President, from amongst those who possess the qualifications.[119] However, unlike the appointment of the Governor of the Central Bank of Tanzania and the appointment of the Chief Justice, the most senior officials/officers of the climate change regulator should be appointed by the President as per the recommendation of an "independent body", subject to the approval of the National Assembly.

By having an independent body recommend candidates for these positions and subjecting the recommendations to the approval of the National Assembly, it reduces the likelihood of political interference in the selection process. This helps to ensure that the most qualified and capable individuals are appointed to these important positions based on their expertise and experience, rather than political affiliations or loyalties. This process can be referred to as "dual-tier veto firewall protection". This way, the sole regulator can carry out its duties without fear of retaliation from the executive.

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116 *Ibid.*
117 Kikelomo Kila, *supra-17*
118 The Bank of Tanzania Act, 2006.
119 The Constitution of The United Republic of Tanzania, Section 118.

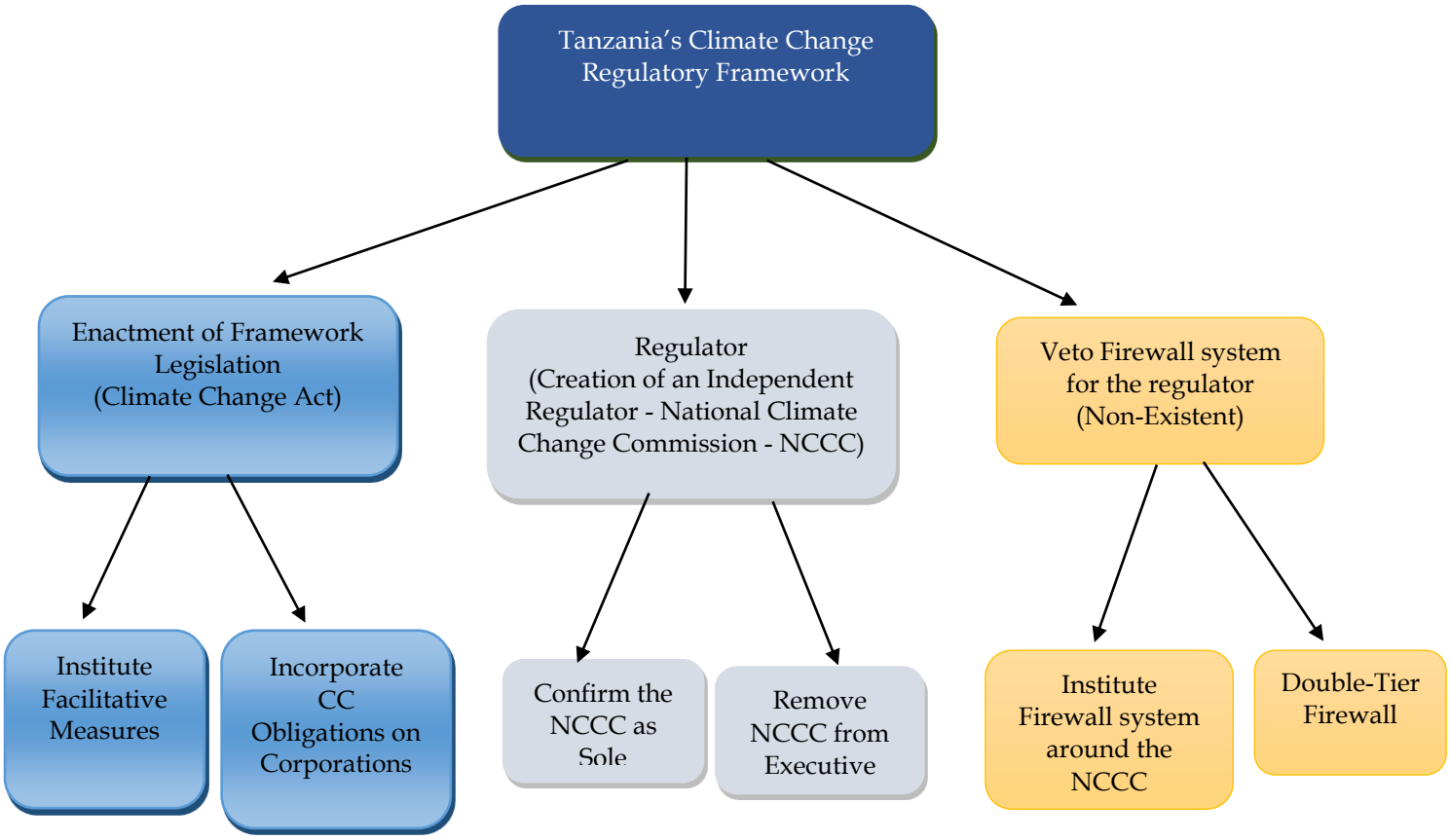

Figure 1: Strategy Map for Reforming the Climate Change Regulatory Framework in Tanzania.

12. DESIGNING A *DILUTE INTERVENTIONISM* PYRAMID IN TANZANIA

The idea of designing a *Dilute Interventionism* pyramid in Tanzania as a framework for climate change mitigation and adaptation in Tanzania is a promising approach. The use of a relatively mild prescription as the first step in the enforcement pyramid, such as the closure of operating facilities responsible for violating recommended carbon emissions, can serve as a deterrent for noncompliance without imposing criminal sanctions that may discourage participation in climate change mitigation and adaptation efforts.

As corporate compliance increases, the next recommended step of civil and administrative sanctions against the most senior officials of the corporation can be an effective tool for ensuring accountability and encouraging corporations to comply with climate change regulations. This can include fines or penalties, as well as administrative measures such as suspension or revocation of permits or licenses.[120]

The use of self-regulatory and voluntary guidelines for achieving climate change regulatory goals can also be an effective approach,

[120] Kikelomo Kila, *Supra 124.*

particularly when combined with a comprehensive legislative framework enacted by the Tanzania State Government. This approach allows corporations to take responsibility for their compliance and can lead to more sustainable long-term solutions for climate change mitigation and adaptation.[121] Finally, the use of economic and fiscal incentives can provide a powerful tool for encouraging corporations to fully implement climate change mitigation and adaptation projects. This can include tax incentives or rebates, as well as government grants or subsidies for sustainable initiatives.

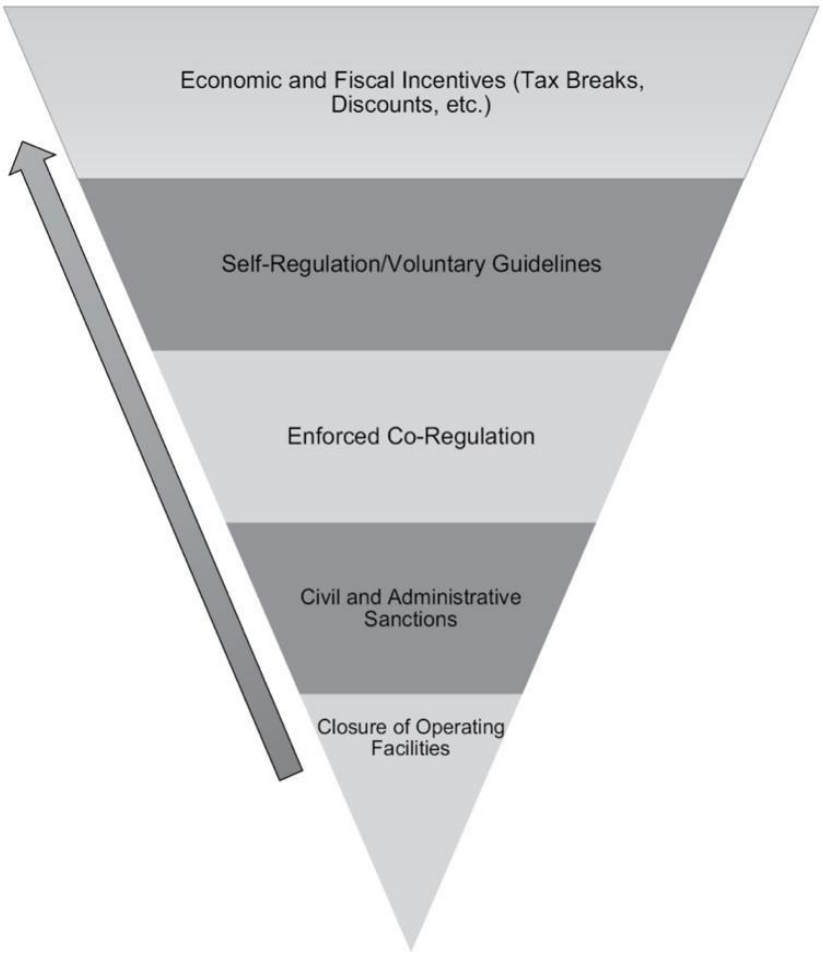

Figure 2: Corporate Regulation for Climate Change Mitigation in Africa (Source: Kikelomo Kila[122])

13. CHALLENGES TO IMPLEMENTING *DILUTE INTERVENTIONISM* AND VETO FIREWALL PARADIGM IN TANZANIA

The implementation of *Dilute Interventionism* and veto firewall paradigm in Tanzania faces some challenges and they are:

[121] *Ibid.*
[122] *Ibid.*

1. *Limited Capacity:* The successful implementation of *Dilute Interventionism* requires a team of qualified and well-trained regulators, lawyers, and policymakers. However, Tanzania faces capacity challenges, including limited resources and expertise, to implement the framework effectively.
2. *Resistance from Corporations:* Corporations may resist the implementation of dilute interventionism, as it may increase their compliance costs and reduce their profits. Corporations may also challenge civil and administrative sanctions and self-regulatory guidelines, leading to legal disputes.
3. *Weak Legal Framework:* The effectiveness of the *Dilute Interventionism* and veto firewall paradigm depends on the strength of the legal framework in place. In Tanzania, there is no legal framework solely for climate change, making it difficult to enforce the regulations effectively.
4. *Political Interference:* Political interference and corruption may pose a significant challenge to the implementation of *Dilute Interventionism* and *veto firewall* paradigms in Tanzania. Because the appointment of senior officials like the governor of the central bank of Tanzania and the chief justice is done without the recommendation of an independent body, introducing an independent body as a "dual-tier protection" may lead to political resistance and interference in the decision-making process of the sole regulator.
5. *Lack of Public Awareness:* The success of *Dilute Interventionism* and veto firewall paradigms depends on the active participation and cooperation of the public. However, limited public awareness of a new regulatory framework may hinder its implementation.

14. CONCLUSION AND RECOMMENDATION

In conclusion, the *Dilute Interventionism* Model and *Veto Firewall* Paradigm offer promising solutions for regulating corporations involved in climate change activities in Tanzania. However, successful implementation will require overcoming various challenges, including limited capacity, resistance from corporations, weak legal framework, political interference, and lack of public awareness. To achieve sustainability, Tanzania must prioritize climate change mitigation and adaptation and adopt a proactive and comprehensive approach to regulating climate change. This can be achieved by enacting a comprehensive regulatory framework for climate change mitigation and adaptation, which takes into account the unique circumstances of the country.

In light of the above, it is recommended that the Tanzanian government collaborates with stakeholders, including corporations, civil society, and international organizations, to develop a comprehensive framework legislation that incorporates the *Dilute Interventionism* Model and *Veto Firewall* Paradigm which ensures compliance with climate change regulations while supporting economic growth. To ensure the success of

these recommendations, the government must demonstrate a strong commitment to drafting and implementing this regulatory framework. This commitment can first be shown by collaborating with all stakeholders in Tanzania to develop and implement a comprehensive regulatory framework for climate change mitigation and adaptation. Furthermore, the government should prioritize public education and awareness campaigns to increase understanding and support for the regulatory framework. The *Dilute Interventionism* Model and *Veto Firewall* Paradigm can serve as effective tools to achieve this goal, but their success will depend on a strong commitment from the government and all stakeholders involved.

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Authors' Contributions (in accordance with ICMJE criteria for authorship)
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Research involving human bodies or organs or tissues (Helsinki Declaration)
The author(s) solemnly declare(s) that this research has not involved any human subject (body or organs) for experimentation. It was not a clinical research. The contexts of human population/participation were only indirectly covered through literature review. Therefore, an Ethical Clearance (from a Committee or Authority) or ethical obligation of Helsinki Declaration does not apply in cases of this study or written work.

Research involving animals (ARRIVE Checklist)
The author(s) solemnly declare(s) that this research has not involved any animal subject (body or organs) for experimentation. The research was not based on laboratory experiment involving any kind animal. The contexts of animals not even indirectly covered through literature review. Therefore, an Ethical Clearance (from a Committee or Authority) or ethical obligation of ARRIVE does not apply in cases of this study or written work.

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The author(s) solemnly declare(s) that this research has not involved the plants for experiment or field studies. The contexts of plants are only indirectly covered through literature review. Yet, during this research the author(s) obeyed the principles of the Convention on Biological Diversity and the Convention on the Trade in Endangered Species of Wild Fauna and Flora.

(Optional) Research Involving Local Community Participants (Non-Indigenous)
The author(s) solemnly declare(s) that this research has not directly involved any local community participants or respondents belonging to non-Indigenous peoples. Neither this study involved any child in any form directly. The contexts of different humans, people, populations, men/women/children and ethnic people are only indirectly covered through literature review. Therefore, an Ethical Clearance (from a Committee or Authority) or prior informed consent (PIC) of the respondents or Self-Declaration in this regard does not apply in cases of this study or written work.

(Optional) PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses)
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INTANGIBLE LOSSES, DAMAGES AND AT-RISK SETTLEMENTS: THE EXTENT OF CAUSALITY AND BURDEN OF PROOF FOR CLIMATE RELATED LOSS AND DAMAGE IN THE FIJI ISLANDS

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ABSTRACT

In this article, a plethora of social, cultural, legal and policy related remedies for harm caused by climate related loss and damage (L&D) were examined, particularly in rural and remote Fiji Islands. The meaning of loss and damage, and its relationship to climate mitigation and adaptation, was discussed. The concept of causality and attempt are considered to expose some criteria that the law uses to test causation in the hope to subject these to a much-needed discussion of climate change and causation affecting international law, domestic law, and climate science. A probabilistic event attribution (PEA) is explored having crucial implications in the development of PEA. When vulnerabilities and thresholds are known, changing risks can be calculated *ex ante* and, therefore, changing risks can be forecasted. The improvement of the methods allows geographically very specific events to be anticipated and, thus, appropriate adaptation measures can be designed. It is considered (at a conceptual level) how those harmed by loss and damage in Fiji from human-induced climate change may pursue remedies against those who have contributed to the harm. Finally, this article explores what that evidence needs to be (extent of causality and burden of proof) for loss and the damages to be awarded. It is concluded by highlighting the values of probabilistic event attribution (PEA), and how vulnerabilities in Fijian communities continue to be a deep concern. Further work needs to be done with respect to social, cultural, and biological interconnectivity that concretely underlines the importance of climate change and how it diminishes well-being and cultural integrity of Indigenous people by affecting endemic plant species. Disaster Risk Reduction (DRR) needs to be cognizant of social and cultural implications of forced migration. Causality and burden of proof within the legal context has its built-in complexities and, hence, it needs further research.

Keywords: Loss and damage; Burden of proof; Probabilistic event attribution; Vulnerabilities; Fijian communities; Climate change

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Intangible Losses, Damages and At-Risk Settlements: The Extent of Causality and Burden of Proof for Climate Related Loss and Damage in the Fiji Islands

1. INTRODUCTION

The Fifth Assessment Report of Intergovernmental Panel on Climate Change (IPCC) emphasizes that climate change is one of the greatest threats to human security because it undermines livelihoods, compromises cultures and individual identity, and disrupts the ability of States to provide the conditions necessary for human security[1].

The South-West Pacific region (Figure 1) is increasingly being recognised as one of the most immediately vulnerable regions in the world to potential increases in mass migration, displacement and relocation of people due to climate change impacts[2,3,4]. Loss and damage (or L&D) in low-lying island States in the Pacific Islands is integrated into a climate risk management framework proposed by Mechler and Schinko (2016) drawing on Nurse et al. (2014)[5] and UNFCCC (2015)[6]. This framework has been applied to the group of SIDS (Small Island Developing States) globally (see Schinko and others, 2018)[7]. It focuses on current risk exposure and future risk scenarios where the intolerable risk space is seen as being relevant already today and becoming even more critical in the medium to longer term (2030–2040 and 2080–2100). It is discussed how, for some Pacific-SIDS, there are already cases where communities find themselves impacted by intolerable climate-related risk, and where the risk management options suggested in the figure 1 are already being deployed. Small atoll countries, such as Kiribati and Tuvalu, have provided vivid images of the possible inundation projected for the future[8,9]. The atoll

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5 Nurse, L. A. et al. (eds.), 'Small Islands', in V. R. Barros et al. (ed.) Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, 2014), pp.1613-1654.

6 UNFCCC, 'Report on the Structured Expert Dialogue on the 2013-2015 Review' (2015) Decision FCCC/SB/2015/INF.1 http://unfccc.int/resource/docs/2015/sb/eng/inf01.pdf accessed 25 January 2016.

7 Schinko, T. et al., 'The Risk and Policy Space for Loss and Damage: Integrating Notions of Distributive and Compensatory Justice with Comprehensive Climate Risk' (2018) 380 Journal of Risk and Management, cited in Mechler, R. et al. (eds), 'Loss and Damage from Climate Change: Concepts, Methods and Policy Options' (Springer, 2018) pp.83-110.

8 Connell, J., 'DR16: Small Island States and Islands: Economies, Ecosystems, Change and Migration' (2011) Migration and Global Environmental Change Foresight, Government Office for Science, UK Government.

9 Mortreux, C. and Barnett, J., 'Climate Change, Migration and Adaptation in Funafuti, Tuvalu' (2009) 19 (1) Global Environmental Change 105-112.

countries have also been vocal about the plight of island nations[10], in particular in the United Nations Framework Convention on Climate Change (UNFCCC) negotiations through the Alliance of Small Island States (AOSIS) commanding significant media attention[11].

The goal of this article is to conduct a brief, but thorough, integrated and critical review of several examples of loss and damage in at-risk settlements. This review will also examine some characteristics of the extent of causality and burden of proof for climate related loss and damage in the Fiji Islands.

Figure 1: 20 SIDS (Pacific Islands Small Island Developing States). Adapted from: <http://www.scidev.net/global/water/feature/ocean-science-development-sids-facts-figures.html> (Grimms, 2014)[12]

2. METHODOLOGY

This review was carried out through the use of a qualitative scoping review in addition to an in-depth online literature search. As part of this process, a preliminary assessment of the available literature on a specific

[10] McAdam, J., 'Climate Change, Forced Migration, and International Law' (2012) Oxford Scholarship Online, May 2012.

[11] Handmer, J. and Johanna Nalau, J., 'Understanding Loss and Damage in Pacific Small Island Developing States' (2019), in R. Mechler et al. (eds.), 'Loss and Damage from Climate Change, Climate Risk Management, Policy and Governance' <https://doi.org/10.1007/978-3-319-72026-5_15> .

[12] Grimms, S. 'Ocean science for development in SIDS: Facts and figures' (2014). SiDevNet. <https://www.scidev.net/global/features/ocean-science-development-sids-facts-figures/> accessed 12 January 2023.

subject was carried out with the intention of determining the breadth of the literature, its most important concepts, and the areas where additional research is needed. On the topic of climate change in the South Pacific, particular literature was gathered by searching electronic databases (e.g. IPCC, NOAA, Australian Climate Change Centre, and Climate Scale[13]. An additional literature review and search of studies on loss and damage and at risks settlements in Fiji was also done. This search included pertinent literature from the USP-UniFiji and FNU Library, TEK literature searches, and the Web of Science database that focused on the extent of causality and the burden of proof. After that, the information gleaned from the literature review and the qualitative scoping review was subjected to thematic coding with the help of the Nvivo qualitative analysis software. The research covered a wide range of topics, including climate change, environmental law, loss and damage; the burden of proof; probabilistic event attribution; climate change impacts and vulnerabilities within the context of Fijian communities.

The results of the review provided a comprehensive and systematic search strategy to identify all relevant literature, using an integrative or critical review approach, to evaluate, critique, and synthesize the literature on a research topic in a way that makes it possible for new theoretical frameworks and perspectives to emerge. The purpose of this review is to create initial or preliminary conceptualizations and theoretical models of developing or novel conceptual or theoretical insights. Considering that loss and damage is a developing topic, this review's objective is to make these models.

3. LOSS AND DAMAGE POLICY INSIGHTS IN THE PACIFIC ISLANDS

On the policy end, intangible loss, damages and at-risk settlements that are linked to the concepts of L&D, are complex and interrelated. Tschakert et al. (2019)[14] eloquently describe this relationship as a:

> *"situated and socially engaged science of loss arising from climate change takes people's lived experiences with risk and harm as its fundamental starting point. It foregrounds what losses occur, where and how, which of these losses matter most to people and why and whether or not such losses are considered acceptable and potentially reversible. However, obtaining such insight is difficult if the many things people value, across space and time, are intangible, i.e. they cannot and perhaps should not be quantified, and hence are often overlooked and omitted. This is the case, for instance, for the symbolic and affective dimensions of culture and place, such as sense of belonging, personal and collective*

[13] Climate Scale, 'High Resolution Climate Data for Climate Change Risk Assessments.' (2023). <https://www.climatescale.com/?gclid=Cj0KCQjw_r6hBhDdARIsAMIDhV9WAoRGFXFSP6SdDfMXartfiaaZHfcTBMc1ImFdTOd9jq7N9ogyGokaAld3EALw_wcB> accessed 12 January 2023.

[14] Tschakert, P. et al., 'One Thousand Ways to Experience Loss: A Systematic Analysis of Climate-Related Intangible Harm from Around the World' (2019) 55 Global Environmental Change 58-72.

> *notions of identity, and ways of knowing and making sense of the world, all of which are already undermined by climate change"* (p.1).

It is often necessary for law and policy makers on both the domestic and international levels to pay attention to the key L&D and related policy insights. It is highly unlikely that L&D will be adequately equipped in their current form to respond to claims to remedy harm caused by L&D within the existing legal system that is in place in Fiji. The legal system in Fiji is intricate, and it will be difficult for it to develop over time in such a way that it can correctly identify appropriate claimants, appropriate respondents, appropriate remedies, and actionable wrongs. Different legal systems will make different choices on these critical issues.

According to Seck and Doelle (2019), attempts to address loss and damage (L&D) in the UN climate system effectively and provide for pathways to address associated harms have so far been unsuccessful[15],[16]. While these initiatives are still ongoing, it is becoming increasingly obvious that it will be difficult for a wide range of international regimes and domestic legal systems to react to demands for adequate remedies for persons hurt by L&D.

It has been suggested in the literature, however, that the phrase 'loss and damage' recognizes two categories of harm:

1) permanent harm, or irrecoverable 'loss', such as the loss of landmass from sea level rise;
2) reparable or recoverable 'damage', such as shoreline damage from storms[17,18,19].

Other ways, the concept of L&D has been delineated is between economic and non-economic L&D, and between slow onset and extreme weather events[20,21]. The focus has been on harm caused by human-induced

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15 Siegele, L., 'Loss and Damage (Article 8)' (2017), in D. Klein et al. (eds.), The Paris Agreement on Climate Change: Analysis and Commentary (Oxford University Press, Oxford, UK, 2017) 224-238.

16 Lees, E., 'Responsibility and liability for climate loss and damage after Paris' (2017) 17 (1) Climate Policy 59-70.

17 Climate Development and Knowledge Network (CDKN), 'Framing the loss and damage debate: A conservation starter'. International Centre for Climate Change and Development (ICCCD), Germanwatch, Munich Climate Insurance Initiative (MCII), & United Nations University – Institute for Human and Environment Security (UNU-HES) (2012). <https://germanwatch.org/sites/germanwatch.org/files/publication/6673.pdf> accessed 23 December 2022.

18 Morrissey, J., & Oliver-Smith, A., 'Perspectives on non-economic loss & damage: Understanding values at risk from climate change'. Retrieved from Loss and Damage in Vulnerable Countries Initiative (2013). <http://www.eldis.org/document/A71918> accessed 18 February 2023.

19 Nishat, A., Mukherjee, N., Roberts, E. & Hasemann A., 'A range of approaches to address loss and damage from climate change impacts in Bangladesh' (2013) <https://www.weadapt.org/sites/weadapt.org/files/2017/november/5555b2dbe48b47069.pdf> accessed 18 February 2023.

20 Fankhauser, S., Dietz, S., & Gradwell, P., 'Non-economic losses in the context of the UNFCCC work programme on loss and damage (policy paper)' (2014). London, UK: Centre for Climate Change Economics and Policy – Grantham Research Institute on Climate Change and the Environment.

21 Stabinsky, D. & Hoffmaister, J.P., 'Loss and damage: Defining slow onset events' (2012) (Briefing Paper 3).

climate change itself. A more controversial category of harm associated with climate change not clearly falling within the definition of L&D is harm caused by response measures, including by mitigation efforts, adaptation, and geoengineering.

According to Olsen et al. (2022)[22], however, a significant step in accepting losses and damages as a legitimate claim, though still contested, was the establishment of the Warsaw International Mechanism (WIM) for Loss and Damage. The (WIM), in 2014, aimed at "promoting the implementation of approaches to address loss and damage associated with the adverse effects of climate change". More recently, political demands for compensation for loss and damages have again been raised at COP26[23]. Even if the WIM covers L&D from both extreme events and slow onset events, such as sea level rise, the funding opportunities are almost exclusively for extreme events[24,25]. Parker, in turn, argued that this is an important reason why attribution science has become increasingly popular in recent years[26]. Before the WIM work process started in 2011[27], few scientific articles were published on attribution of extreme events to climate change but increasing rapidly from 2013 onwards. L&D in COP27 (Sharm-el-Sheikh, Egypt) was set against a difficult geopolitical backdrop. COP27 resulted in countries delivering a package of decisions that reaffirmed their commitment to limit global temperature rise to 1.5^{o}C above pre-industrial levels. The package also strengthened action by countries to cut greenhouse gas emissions and adapt to the inevitable impacts of climate change, as well as boosting the support of finance, technology and capacity building needed by developing countries (UNFCCC, 2022).[28,29]

<http://unfccc.int/files/adaptation/application/pdf/tp7_v03_advance_uneditted_version.pdf > accessed April 22, 2023.

22 Olsson, L. and others, 'Ethics of Probabilistic Extreme Event Attribution in Climate Change Science: A Critique' (2022) Earths Future 10 (3) <https://doi.org/10.1029/2021EF002258>.

23 Kaplan, S., 'The U.N. climate summit will take on 'adaptation, loss and damage' Monday. Here's what you need to know' (2021) The Washington Post <https://www.washingtonpost.com/climate-environment/2021/11/07/cop26-glasgow-climate-loss-damage > accessed 10 February 2023.

24 Gewirtzman, J., et al., 'Financing loss and damage: Reviewing options under the Warsaw international mechanism' (2018) 18 (8) Climate Policy 1076–1086. <https://doi.org/10.1080/14693062.2018.1450724>

25 Singh, C., et al., 'Losses and damages associated with slow-onset events: Urban drought and water insecurity in Asia' (2021) 50 Current Opinion in Environmental Sustainability 72–86. <https://doi.org/10.1016/j.cosust.2021.02.006>.

26 Parker, H. R., et al., 'Implications of event attribution for loss and damage policy' (2015) 70 (9) Weather 268–273. <https://doi.org/10.1002/wea.2542>.

27 Schäfer, L., & Kreft, S., 'Loss and damage: Roadmap to relevance for the Warsaw international mechanism-first version' (2014) <www.germanwatch.org/en/8366> accessed 20 December 2022.

28 UNFCCC, 'Creating a specific fund for loss and damage marked an important point of progress, with the issue added to the official agenda and adopted for the first time at COP27' (2022).

29 UNFCCC, 'COP27 Reaches Breakthrough Agreement on New "Loss and Damage" Fund for Vulnerable Countries' (2022). <https://unfccc.int/news/cop27-reaches-breakthrough-agreement-on-new-loss-and-damage-fund-for-vulnerable-countries> accessed 30 December 2022.

4. VULNERABILITY OF SMALL ISLAND DEVELOPING STATES AND FIJI

Fiji has extremely high exposure to tropical cyclones according to a recent World Bank report entitled, "Climate Risk Country Profile"[30]. Fijian islands experience the direct or indirect effects of cyclones on an annual basis, including frequent occurrences of multiple strikes in one year. Cyclones usually occur during the November-April wet season, and are less common during El Niño periods. Cyclones frequently result in loss of life and cause significant economic damage, which has hindered economic growth. Particularly, Fiji is exposed to rising sea levels, floods, and landslides. Fiji is one of the world's most vulnerable nations to climate change and climate-related disasters. Fiji has ratified the Paris Climate Agreement and submitted its Updated Nationally Determined Contribution (2020), which emphasizes the nation's need for external support to meet the high economic costs of mitigation and adaptation. Fiji submitted its Third National Communication to the UNFCCC (TNC) in 2020[31], extensively documenting the risks climate change presents to its communities and economy. Key vulnerabilities include its subsistence agriculture sector, its coastal and marine resources, including coral reefs, its freshwater resources, and its land management and uses. In 2017, the Government of Fiji, World Bank Group, and the Global Facility for Disaster Reduction and Recovery (GFDRR) completed an extensive assessment of Fiji's vulnerability to climate change[32].

Takamura (2020)[33] indicated that when small island states – the most affected by climate change but contributing the least thereto – eventually wish to bring a *claim for compensation* for damage caused by climate change vis-à-vis a large emitting State, several legal barriers would stand in the way of their success. The United Nations Framework Convention on Climate Change (UNFCCC) and its Kyoto Protocol lack clear rules on compensation for damage caused by climate change. These States may gain compensation by invoking State responsibility for breach of international obligations by other States, whether in treaties or customary law. However, it is not easy to claim successfully for such responsibility because of the very nature of climate change: difficulties exist in proving

[30] World Bank, 'Climate Risk Country Profile, Fiji.' <https://climateknowledgeportal.worldbank.org/sites/default/files/country-profiles/15854-WB_Fiji%20Country%20Profile-WEB.pdf> accessed 19 December 2022.

[31] Government of Fiji, 'Third National Communication Report to the United Nations Framework Convention on Climate Change (2020) <https://unfccc.int/sites/default/files/resource/Fiji_TNC%20Report.pdf> accessed 30 December 2022.

[32] Government of Fiji, 'Climate Vulnerability Assessment Making Fiji Climate Resilient' (2020). The World Bank Group, GFDRR. <https://www.gfdrr.org/sites/default/files/publication/Making%20Fiji%20Climate%20Resilient%20-%20Full%20Report_0.pdf> accessed 11 December 2022.

[33] Takamura, Y., 'Climate Change and Small Island Claims in the Pacific." Climate Change: International Law and Global Governance' (2013). <https://www.academia.edu/84556698/Climate_Change_and_Small_Island_Claims_in_the_Pacific> accessed 14 January 2023.

which part of damage caused is due exactly to climate change and is precisely attributable to the allegedly responsible state.

5. ADDRESSING LOSS AND DAMAGE AND DISASTER DISPLACEMENT IN VULNERABLE FIJI

We are on the precipice of monumental change in our climate. This resonates with Ord's (2020)[34] prediction/estimates that the anthropogenic risks (including risks from nuclear war, climate change, and environmental damage. Being significantly higher, these risks pose about 1 in 1,000 chance of existential catastrophe within the next 100 years[35]. However, the odds are much higher that climate change will result in non-existential catastrophes, which could in turn make us more vulnerable to other existential risks (Ord, 2020)[36]. At the recent COP27, L&D are of prime concern and important component of the negotiations under the UNFCCC. According to UNOPS (2022)[37], member States are at a pivotal moment for the definition of their commitments around the Santiago Network to coordinate and strengthen efforts to avert, minimize and address L&D in vulnerable developing countries. Discussions for the Glasgow Dialogue[38], established at COP26, to define relevant funding arrangements are also ongoing.

While the policy landscape continues to evolve, however, vulnerable countries and communities are already being affected by the adverse impacts of climate change. Everywhere around the world, L&D due to climate change translate into human mobility impacts, and with the displacement of millions of people from their homes. Urgent action is already needed to allow people to cope with current climate impacts and to prevent future ones – and human mobility considerations need to be a core part of these concerns and related operational efforts. The common challenges of displacement in the context of the impacts of climate change manifest in very diverse manners for different countries and communities. Hazards and risks, potential impacts, and related mobility outcomes are different across contexts, requiring diverse approaches to translate into practice the policy objectives of "averting, minimizing and addressing" L&D – especially as they relate to displacement and other population movements[39].

The community-based research revealed four 'pathways to loss and damage', or in other words, four situations in which actors in the case

[34] Ord, T., 'The Precipice: Existential Risk and the Future of Humanity' (Hachette, 2020).
[35] Ibid 3
[36] Ibid 4
[37] UNOPS, 'Platform on Disaster Displacement. Addressing Loss and Damage and Disaster Displacement in Vulnerable Countries. COP27 Side Event' (12 November 2022, 11:30am-12:30 pm Sharm El-Sheikh, Climate Mobility Pavilion, Blue Zone) <https://disasterdisplacement.org/cop27-side-event-addressing-loss-damage-and-disaster-displacement-in-vulnerable-countries> accessed 4 January 2023.
[38] UNFCCC, 'Glasgow Dialogue on Article 6 of the Paris Agreement and Supporting Mechanisms' (2022) <https://unfccc.int/event/glasgow-dialogue> accessed 17 March 2023.
[39] Ibid 2

study sites incurred residual impacts of climate stressors, leading to deepening poverty, erosion of household living standards and health[40]. The research showed that actors incur loss and damage when:

- existing coping/adaptation measures were not enough to avoid loss and damage
- measures had costs (economic, social, cultural, health, etc.) that were not regained
- despite short-term merits, measures had negative effects in the longer term
- no measures were adopted – or possible – at all. In the past two years, the case studies in the first special issue received over a hundred citations, underscoring the demand for more empirical data and insights on the emerging topic of loss and damage.

6. NON-ECONOMIC LOSS AND DAMAGE (NELD)

Westoby et al. (2021)[41] indicated that Pacific Islander worldviews, knowledge systems and cosmologies often make it difficult to separate and evaluate NELD independently, challenging the nomenclature of NELD categories developed through international mechanisms. Instead, NELD understandings are often centred on the interdependencies between losses, including the cascading flow-on effects that can occur and the nature of some losses as risk multipliers (i.e., one loss creating the risk for further losses).

Most notably, losses to biodiversity, ecosystem services and land are critically linked to, and have cascading effects on, livelihoods, knowledge, ways of life, wellbeing, and culture and heritage. It is argued that loss and damage are not always absolute, and that there are NELD that are arguably reparable. Concerning, however, is that the biodiversity loss, as a *risk multiplier*, was considered the least reparable by participants. Further, interconnectedness, biodiversity, and ecosystem protection and restoration are essential for gaining a thorough knowledge of NELD. Additionally, it needs to concentrate on measures to stop irreversible and cascading effects of climate change in the Pacific Islands, particularly in the very vulnerable Federated States of Micronesia, Fiji, Kiribati, Marshall Islands, Nauru, Palau, Solomon Islands, Tonga, Tuvalu, and Vanuatu.

McNamara et al. (2021a)[42] conducted a systematic review to understand what was already known about non-economic loss and damage (NELD) (i.e., those irreducible to economic terms) in the Pacific

[40] van der Geest and others, 'Climate change, ecosystem services and migration in the Marshall Islands: Are they related?' (2020) 161 Climatic Change 109–127 <https://link.springer.com/article/10.1007/s10584-019-02648-7> accessed 22 April 2023.

[41] Westoby, R., and others, 'Cascading loss and loss risk multipliers amid a changing climate in the Pacific Islands' (2021) 51 (5) AMBIO A Journal of the Human Environment 1-8. <https://doi.org/10.1007/s13280-021-01640-9>.

[42] McNamara, K.E., R. Westoby, and A. Chandra, 'Exploring climate-driven non-economic loss and damage in the Pacific Islands' (2021) 50 Current Opinion in Environmental Sustainability 1–11. <https://doi.org/10.1016/j.cosust.2020.07.004>.

Islands region and concluded that: "[n]on-economic loss and damage induced by climate change in the Pacific Islands region has been reported as fears of cultural loss, deterioration of vital ecosystem services, and dislocation from ancestral lands, among others". NELD is a critical area of focus, as loss and damage research and practice have tended to prioritise identifying and addressing economic losses and damages that are easier to quantify and monetise[43]. The same authors acknowledge that there are still limited in-depth understandings of NELD and how they can be addressed, rebuilt and worked through. This can discount certain experiences and distort or skew constructions of climate change and associated decision-making[44,45,46]. The interconnected and cascading nature of loss and damage in the Pacific has emerged in other studies. Ecosystem and biodiversity losses have, for example, been observed to have inherent cascading effects on people and livelihoods[47,48,49,50,51].

Ca´mara-Leret et al. (2019)[52] also talk about the impact of climate change on 'biocultural heritage', illustrating how climate change diminishes the wellbeing and cultural integrity of Indigenous peoples by affecting endemic plant species. Damage to the relationship between people and their customary lands from climate change also has severe implications for the material, cultural and social security as well as emotional and spiritual wellbeing of Pacific Islander people[53]. In this way, NELD affects the interlinked socio-ecological system with embedded cultural, social and ecological structures, rather than affecting people and ecosystems separately. McNamara et al. (2021b)[54] argue that, in the Pacific,

[43] McNamara, K.E., and Jackson, G., 'Loss and damage: A review of the literature and directions for future research' (2019) 10 Wires Climate Change e564. <https://doi.org/10.1002/wcc.564>.

[44] Magee, L., Handmer, J., Neale, T., and Ladds, M., 'Locating the intangible: Integrating a sense of place into cost estimations of natural disasters' (2016) 77 Geoforum 61–72. <https://doi.org/10.1016/j.geoforum.2016.09.018>.

[45] McShane, K., 'Values and harms in loss and damage' (2017) 20 Ethics, Policy & Environment 129–142. <https://doi.org/10.1080/21550085.2017.1342960>.

[46] Thomas, A.S., et al., 'Impact of Tropical Cyclone Winston on women mud crab fishers in Fiji' (2019) 11 Climate and Development 699–709. <https://doi.org/10.1080/17565529.2018.1547677>.

[47] Goulding, W., Moss, P.T., and McAlpine, C.A., 'Cascading effects of cyclones on the biodiversity of Southwest Pacific Islands' (2016) 193 Biological Conservation 143–152. <https://doi.org/10.1016/j.biocon.2015.11.022>.

[48] Sattler, D.N., 'Climate change and extreme weather events: the mental health impact' (2017), in W. Leal Filho (ed.), Climate Change Adaptation in Pacific Countries (Springer) 73–85.

[49] Pearce, T., et al., 'Adaptation to climate change and freshwater resources in Vusama village, Viti Levu, Fiji' (2018) 18 Regional Environmental Change 501–510. <https://doi.org/10.1007/s10113-017-1222-5>.

[50] Thomas, A.S., et al., 'Impact of Tropical Cyclone Winston on women mud crab fishers in Fiji' (2019) 11 Climate and Development 699–709. <https://doi.org/10.1080/17565529.2018.1547677>.

[51] van der Geest and others, 'Climate change, ecosystem services and migration in the Marshall Islands: Are they related?' (2020) 161 Climatic Change 109–127 <https://link.springer.com/article/10.1007/s10584-019-02648-7> accessed April 22, 2023.

[52] Ca´mara-Leret, R., et al., 'Climate change threatens New Guinea's biocultural heritage' (2019) 5 (11) Science Advances eaaz1455. <https://doi.org/10.1126/sciadv.aaz1455>.

[53] Campbell, J., 'Climate Change, Migration and Land in Oceania' (2019) Toda Peace Institute, Policy Brief No. 37, Tokyo, Japan.

[54] McNamara, K.E., et al., 'Understanding and responding to climate-driven non-economic loss and damage in the Pacific Islands' (2021) 33 Climate Risk Management 100336. <https://www.sciencedirect.com/science/article/pii/S2212096321000656?via%3Dihub> accessed April 22, 2023.

NELD can undermine entire socio-ecological systems, and are understood, perceived and experienced through the lens of intangible values, identity and cultural landscapes. Works by Epeli Hau'ofa[55] traversing the breadth of Oceania remind that this interconnectivity transfers to regional scales, as there is a deep connection between everything. The 'sea of islands' is a conglomeration of islands not restricted by geopolitical boundaries but connected by the sea and seafarers (Hau'ofa, 1998)[56].

7. THE PROBLEM WITHIN THE CONTEXT OF THE FIJI ISLANDS

Within the context of Fiji, what needed on the ground are more conceptual clarity and practical tools on L&D. This helps design adequate policies and practices to address loss and damage. Currently, there is no agreed-upon definition of loss and damage. In the past few years, since the rise of loss and damage in the climate change negotiations, there have been two main strands of framing loss and damage. The first strand suggests that loss and damage refer to current and/or potential manifestation of climate impacts affecting negatively human and natural systems. This type of definition does not clearly distinguish between impacts and loss and damage. By contrast, the second strand emphasises that loss and damage refer to adverse effects having not been mitigated, and that are beyond adaptation. The second strand's definition is gaining prominence among scholars and practitioners. A fit-for-purpose definition could be that "loss and damage refer to adverse effects of climate-related stressors that have not been or cannot be avoided through mitigation and adaptation efforts"[57]. Loss and damage are expected to occur in all countries, but vulnerable populations in vulnerable countries will be hit particularly hard[58].

8. PLATFORM FOR DISASTER DISPLACEMENT (PDD)

As reiterated by Brandam (2022)[59], the Platform on Disaster Displacement (PDD) organized an official side event in COP27 at the 2022 Global Platform for Disaster Risk Reduction entitled "Addressing Loss and Damage, Supporting the Most Vulnerable: Lessons from DRR and Climate Change Action." It was designed with a view to bridging important discussions held at the 2019 Global Platform for Disaster Displacement, the 26th UN Climate Change Conference of the Parties (COP26) and with a

55 Hau'ofa, E., 'We are the ocean: Selected works' (2008) (Honolulu: University of Hawaii Press). <https://www.degruyter.com/document/doi/10.1515/9780824865542/html> accessed 17 March 2023.
56 Ibid 9
57 Zommers and others, 'Loss and Damage: The Role of Ecosystem Services' (United Nations Environment Programme, 2016).
58 Ibid 2
59 Brandam, H, 'GP22 Side Event | Addressing Loss and Damage, Supporting the Most Vulnerable' (2022) <https://disasterdisplacement.org/gp22-side-event-addressing-loss-and-damage-supporting-the-most-vulnerable> accessed 14 December 2022.

view to preparing for the Sendai Midterm Review at COP27[60]. Disaster Displacement is increasingly recognized as a form of loss and damage and while realities around the world show that limits to adaptation have been reached and many vulnerable communities experience loss and damage, including displacement and planned relocation. The disaster risk reduction (DRR), climate change and humanitarian/development communities still grapple with a coherent response to the complex challenges associated with it.

9. EXTENT OF CAUSALITY AND BURDEN OF PROOF

Otto and Minnerop (2020)[61] valued the importance of setting the "high bar" for making causal assertions. This is normally set by the rigid application of legal standards to determine the cause of an occurrence, as well as the traditional emphasis on determining the required cause in a counterfactual investigation and a judicial need for certainty. This 'but for' test level has frequently been found to be overly exclusive.[62] The developing discipline of probabilistic event attribution in the context of climate change offers important information to explain previous events and predict forthcoming events connected to anthropogenic climate change[63]. The same authors explain that climate science focuses on making robust statements about the role of climate change, quantifying changes in the likelihood of extreme weather events and attributing these to greenhouse gas (GHG) emissions or even certain other emissions. For example, one study looking at the Argentina 2013-2014 heat wave found that the event was made five times more likely due to total anthropogenic emissions and attributed 37 per cent of that probabilistic increase to GHG

[60] UNDRR, 'Midterm Review of the Sendai Framework' (2022) <https://sendaiframework-mtr.undrr.org/> accessed April 22, 2023.

[61] Otto, F and Minnerop, P, 'Climate Change and Causation Joining Law and Climate Science on the basis of Formal Logic' (2020) <https://digitalcommons.law.buffalo.edu/belj/vol27/iss1/2/ > accessed 19 December 2022.

[62] Fairchild v Glenhaven Funeral Services [2002] HL 22 [40], Lord Nicholls of Birkenhead stated 'On occasions the threshold 'but for' test of causal connection may be over-exclusionary. Where justice so requires, the threshold itself may be lowered. In this way the scope of a defendant's liability may be extended.'; see also March v Stramare (E & MH) Pty Ltd [1991] HCA 12 (Lliuya v RWE AG, 2 O 285/15, 15 December 2016) where Judge Dean argued that there are 'convincing reasons precluding its adoption as a comprehensive definitive test of causation in the law of negligence' [Grundsatz der freien Beweiswürdigung (principle of independent judicial evaluation of evidence), see Heinz Thomas and Hans Putzo, Zivilprozeßordnung (25th edn CH Beck 2003) before § 286 para 2; German Federal Court (BGH) 52 245, 256, Neue Juristische Wochenschrift 2000, 953].

[63] The author understands that climate change as defined in Article 1(2) of the Framework Convention on Climate Change (UNFCCC): 'a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods.' The Intergovernmental Panel on Climate Change (IPCC) (the United Nations body for assessing the science related to climate change) refers in a broader sense to climate change as 'a change in the state of the climate that can be identified by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer.', IPCC 2018: Annex I: Glossary, in Valerie Masson-Delmotte and others (eds), Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C.

emissions of the European Union[64]. The prevailing legal system for causal analysis within the context of Fiji Islands is rather unique; however, the fundamental principle of any causal explanation in law is that mere correlation between components can be differentiated from processes that cause one thing to generate another, even though laws vary from jurisdiction to jurisdiction[65].

Causal explanations thus differ from statistical explanations, and a cause can be defined as a factor having the potential to affect an event without assuming a deterministic or probabilistic relationship between the component and the outcome[66]. In contrast, the phrase is used more broadly to indicate that an event has been generated, and a component will be considered the "cause" of an event if it has at least statistically significantly increased the chance of the event's occurrence[67]. Based on this definition, a "concurrent cause" is "an act, occurrence, or a state of nature that initiates or permits,... in conjunction with other causes a chain of events leading to an effect."[68]

No real concrete attempt has been made in the Pacific Islands with respect to analysis of causality or burden of proof. Zommers et al. (2016)[69] reiterated the connection between L&D and ecosystem services, which states:

> *"Loss and damage refers to the adverse effects of climate-related stressors on natural and human systems that cannot be, or have not been, avoided through mitigation or managed through adaptation efforts. To date, studies of loss and damage have focused primarily on human systems and tended to overlook the mediating role of ecosystems and the services ecosystems provide to society. This results in a serious knowledge gap. Climate-induced loss and damage to human systems may result from permanent or temporary effects of climatic stressors on ecosystems and the services they provide. More information is needed. Indeed, the Paris Agreement urges Parties to enhance understanding, action and support in areas such as, "Resilience of communities, livelihoods and ecosystems"* (p.3).

There still seems to be some disconnect between L&D, ecosystem services and causal links (causality) with respect to climate litigation.

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64 Otto, F and others, 'Assigning historic responsibility for extreme weather events' (2017) 7 Nature Climate Change 757.

65 Strevens, M, 'Depth: an Account of Scientific Explanation' (2008) 6. Wesley C Salmon, 'Statistical explanation' in Robert G Colodny (ed.), The Nature and Function of Scientific Theories (University of Pittsburgh Press 1970) 173.

66 Sosa, E, 'Varieties of Causation', in Ernest Sosa and Michael Tooley (eds.), Causation (OUP 1993) 234.

67 Strevens, M, 'Depth: an Account of Scientific Explanation' (2008) 6.

68 Rothman, K.J, 'Causes' (2018) 201 American Journal of Epidemiology 587, 588. The term concurrent cause is thus used here in line with judgment in the case Certain Activities carried out by Nicaragua in the Border Area (Costa Rica v. Nicaragua) General List No. 150 [34], [41], Judgment of 2nd February 2018, where the ICJ for the first time in its history adjudicated compensation for environmental damage.

69 Zommers, Z, Harrison, PA, Berry, P, Soussan, J, and Smith, J, 'Loss and Damage: The Role of Ecosystem Services' (United Nations Environment Programme 2016).

10. FINDING THE CAUSAL LINK IN CLIMATE LITIGATION

Minnerop and Otto (2020)[70] emphasized that climate change litigation faces many obstacles, often revolving around procedural questions of standing[71] and jurisdiction[72] but also as a consequence of applying criteria of established legal concepts - such as causation - to a new challenge.[73] This is neatly illustrated in the decision of the District Court of Essen in the case Lluiya v. RWE[74]. The claimant, a Peruvian farmer living in the Andes, asserts that his home and livelihood are threatened by the risk of flooding from a glacial lake outburst. The glacial lake, Palcacocha, is damming glacial melt-water. The water is held by a natural moraine (deposit of irregular mass of debris from a glacier) and controlled by a set of basic pipes to reduce pressure. He claims from the German Energy provider, RWE AG, a pro rata financial contribution to flood protection measures in proportion to the company's GHG emissions on the basis of Art. 1004 of the German Civil Code (BGB).[75]

The calculation of the compensation is derived from the report on the quantified contribution of "carbon majors" to cumulative global GHG emissions[76]. The report states that the company contributed 0.47 per cent to

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70 Otto F and Minnerop, 'Climate Change and Causation Joining Law and Climate Science on the basis of Formal Logic' (2020) <https://digitalcommons.law.buffalo.edu/belj/vol27/iss1/2/> accessed April 22, 2023.

71 Case T-330/18, Carvalho v. Parliament, 2019 E.C.R. 324, 54 (reasoning that the applicants were not individually concerned).

72 Am. Elec. Power Co. v. Conn., 564 U.S. 410 (2011); Native Vill. of Kivalina v. ExxonMobil Corp., 696 F.3d 849, 858 (9th Cir. 2012), cert. denied, 569 U.S. 1000 (2013); Comer v. Murphy Oil USA, 607 F.3d 1049 (5th Cir. 2010); Bundesverwaltungsgericht Nov. 27, 2018, A-2992/2017; Jacqueline Peel, Issues in Climate Change Litigation, 1 Climate Change L. Rev. 15, 16 (2011).

73 See Geetanjali Ganguly et al., 'If at First You Don't Succeed: Suing Corporations for Climate Change' (2018) 38 Oxford J. Legal Stud. 841; Jacqueline Peel & Jolene Lin, 'Transnational Climate Litigation: The Contribution of the Global South' (2019) 113 Am. Soc'y Int'l L. 679; Sophie Marjanac & Lindene Patton, 'Extreme Weather Event Attribution Science and Climate Change Litigation: An Essential Step in the Causal Chain?' (2018) 36 J. Energy & Nat. Resources L. 265; Jacqueline Peel et al., 'Shaping the 'Next Generation' of Climate Change Litigation in Australia' (2017) 41 Melb. U.L. Rev. 793; Jacqueline Peel & Hari M. Osofsky, 'Climate Change Litigation's Regulatory Pathways: A Comparative Analysis of the United States and Australia' (2013) 35 L. & Pol'y 150; Jolene Lin, 'Climate Change and the Courts' (2012) 32 Legal Stud. 35; Brian J. Preston, 'Climate Change in the Courts' (2010) 36 Monash U. L. Rev. 15.

74 Urgenda Foundation v The State of the Netherlands C/09/456689/HA ZA 13-1396 (24 June 2015) ECLI:NL:RBDHA:2015:7196. (unofficial English translation, only the Dutch text of the ruling is authoritative, ECLI:NL:RBDHA:2015: 7145) [4.90]; The State of the Netherlands v Urgenda Foundation 200.178. 245/01 (9 Oct. 2018) ECLI:NL: GHDHA:2018:2610 (unofficial English translation).

75 The provision does not require that the property is located in Germany. Further, even a party that acts lawfully may be held liable for damage caused, a legal principle that underlies Bürgerliches Gesetzbuch [BGB] [Civil Code], § 1004 but also (as noted by the Hamm court) Gesetz zum Schutz vor schädlichen Umwelteinwirkungen durch Luftverunreinigungen, Geräusche, Erschütterungen und ähnliche Vorgänge [BImSchG] [Federal Emission Control Act] § 14(a).

76 See Richard Heede, 'Tracing Anthropogenic Carbon Dioxide and Methane Emissions to Fossil Fuel and Cement Producers, 1854-2010' (2013) 122 Climatic Change 229 (presenting a ground-breaking quantitative analysis of the historic fossil fuel and cement production records of fifty leading investor-owned, thirty-one state-owned and nine nation-state producers of oil, natural gas coal, and cement, and finding He that ninety of these 'carbon major' entities are responsible for nearly two-thirds of historic carbon dioxide and methane emissions).

the global total.[77] The Essen court held that RWE would not qualify as a disturber of the claimant's property in the absence of equivalent and adequate causation.[78] Applying the strict "*condition sine qua non*" test of causation, the court was not satisfied that the contribution of RWE could be considered to be significant given the existence of multiple other pollutants, despite acknowledging that the company was a major emitter. However, "in the light of the millions and billions of emitters worldwide" the court was unable to conclude that anthropogenic climate change, and consequently the purported flood risks of the glacial lake, would not occur without RWE's emissions.

11. PROBABILISTIC EVENT ATTRIBUTION (PEA)

Within the realms of what we know about the science of climate change, a safe conjecture is that this is a relatively new area of detection and attribution: probabilistic event attribution or "PEA". This discipline has been made possible by the growing accessibility of huge ensembles of climate models. One of the major goals of this brief desktop study is to determine whether and to what extent anthropogenic climate change has changed the likelihood and severity of a specific extreme weather event to occur, despite variances in technique[79]. "In essence, a climate model is used to simulate global mean temperature with and without anthropogenic GHG emissions finding that without these emissions the observed increase (1°C today[80]) cannot be simulated. While traditional detection and attribution methods yield significant results only when trends are very strong, changes in the probabilities of extreme events are subtler and could thus not be attributed to global GHG emissions at the time of Hasselmann when climate models were extremely costly to run"[81].

Using climate modelling and statistical modelling, scientists estimate the probability of an event to occur with climate change (P1) and in a counterfactual climate of a world without anthropogenic GHG emissions (P0), thus causally linking the occurrence probability of severe weather events to external drivers of the climate system[82]. On that basis, it is then possible to quantitatively determine even the contribution of individual countries to the changing likelihood of certain extreme weather events as a

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77 See Heede, supra note 8.

78 In German civil law, equivalent causation is the first step of the test, and the theory of adequate causation functions as a normative corrective The theory of adequate causation is used to eliminate unlikely factors from the causal chain; See also Palandt, supra note 42, at § 249.

79 Mann, M.M., Lloyd, E.A and Naomi Oreskes, 'Assessing climate change impacts on extreme weather events: the case for an alternative (Bayesian) approach' (2017) 144 Philosophy of Science 131.

80 Haustein, K., Allen, M.R., Forster, P.M. and others, 'A real-time Global Warming Index' (2017) 7 Sci. Rep. 15417 <https://doi.org/10.1038/s41598-017-14828-5> accessed April 22, 2023.

81 Ibid

82 Hannart, A and others, 'Causal counterfactual theory for the attribution of weather and climate related event' (2016) 99 Bulletin of the American Meteorological Society on the use of the Bayes' theorem in science, see Pearl (n49) 14f; Perry (n 4) 320f.

result of these countries' emissions (Otto et al., 2017).[83] Results of event attribution studies are expressed in risk ratios (RR), describing the change in occurrence frequency of the event caused by anthropogenic climate change. RR=P1/P0. Risk ratios are given with confidence intervals representing sampling and methodological uncertainties (Otto et al, 2015)[84]. The causal statement, thus, entails the identification of a cause, such as increasing emissions, and represents a causal quantity in the shape of the attributable risks (Pearl, 2009)[85]. The design and framing of the attribution study is essential for the interpretation and any further use of results that it delivers.[86]

12. CONCLUSIONS

The present analysis is a synthesis of L&D's meaning, causality concepts, discussion of climate change and causation and probabilistic event attribution (PEA). This has implications within anthropogenic climate change and has changed the likelihood and severity of specific extreme weather events, despite variances in technique, as illustrated by Mann et al., 2017[87]. However, the remains as yet quantification of this estimate of probability of an event to occur with climate change and the counterfactual climate of the world without anthropogenic GH emissions, thus causally linking the occurrence probability of severe weather events to external drivers of the climate system. This is yet to be fully quantified and to some extent qualified, adding cultural and social indicators that provide a more rounded approach to PEA.

Within the Fijian context, vulnerabilities are well known to local communities. Therefore, when vulnerabilities and thresholds are known, changing risks can be calculated beforehand, and, therefore, be forecasted. The only caveat is that there needs to be clear methodological approaches on how local climate related specific events are anticipated and, thus, appropriate climate change adaptation measures designed and implemented.

NELD seems to be an approach that is been tried and tested in the Pacific, however, as McNamara and Jackson point out, there was still limited in-depth understanding of NELD. More work needs to be done with respect to social, cultural and biological interconnectivity, which concretely underlines the importance of climate change and how it diminishes well-being and cultural integrity of Indigenous people by

[83] Otto F and others, 'Assigning historic responsibility for extreme weather events' (2017) 7 Nature Climate Change 757.

[84] Otto, F.E.L., Philip, S., Kew, S., et al., 'Attributing high-impact extreme events across timescales — a case study of four different types of events' (2018) 149 Climatic Change 399–412. <https://doi.org/10.1007/s10584-018-2258-3 > accessed April 22, 2023.

[85] Pearl, J., 'Causes of Effects and Effects of Causes' (2009) 44 (1) Sociological Methods & Research 149.

[86] Friederike EL Otto and others, 'Attribution of extreme weather events in Africa: A preliminary exploration of the science and policy implications' (2015) 132 Climatic Change 531.

[87] Mann, M.M., Lloyd, E.A and Naomi Oreskes, 'Assessing climate change impacts on extreme weather events: the case for an alternative (Bayesian) approach' (2017) 144 Sociological Methods & Research 131.

affecting endemic plant species, for example. Further work needs to be done to define how NELD affects the interlinked social cultural system within embedded cultural, social, and ecological landscapes of tradition.

PDD (Platform for Disaster Displacement), as illustrated, is a form of loss and damage, however, it's limited to adaptation and as many vulnerable communities in Fiji, for example, experience loss and damage often times. This includes displacement and planned relocation or migration (fourth migration) in two other islands because there is no potable water, food or basic resources for families to survive (e.g., Kiribati's and Fiji's attempt to move or relocate families to one of the Fijian Islands). Disaster Risk Reduction (DRR) needs to be cognizant of social and cultural implications of fourth migration; yet to be inclusive to provide more coherent responses to a complex challenge.

Finally, causality and burden of proof within the legal context is much more complicated. There remains a significant knowledge gap between climate-induced loss and damage to human systems, because of climate stressors on ecosystems and services they provide. More significant research needs to be completed on causal links in climate litigation and how specific criteria can be established to strengthen legal concepts such as causation, to just compensation for cumulative global GH emissions. Therefore, much-needed local research needs to be done to address these important issues within the Fijian cultural context. These examples can be extrapolated and used as models for other SIDS (Small-Island Developing States).

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AUTHOR'S DECLARATION AND ESSENTIAL ETHICAL COMPLIANCES

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This article is 100% contributed by the sole author. S/he conceived and designed the research or analysis, collected the data, contributed to data analysis & interpretation, wrote the article, performed critical revision of the article/paper, edited the article, and supervised and administered the field work.

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Research involving human bodies or organs or tissues (Helsinki Declaration)
The author(s) solemnly declare(s) that this research has not involved any human subject (body or organs) for experimentation. It was not a clinical research. The contexts of human population/participation were only indirectly covered through literature review. Therefore, an Ethical Clearance (from a Committee or Authority) or ethical obligation of Helsinki Declaration does not apply in cases of this study or written work.

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The author(s) solemnly declare(s) that this research has not involved any animal subject (body or organs) for experimentation. The research was not based on laboratory experiment involving any kind animal. The contexts of animals not even indirectly covered through literature review. Therefore, an Ethical Clearance (from a Committee or Authority) or ethical obligation of ARRIVE does not apply in cases of this study or written work.

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The author(s) solemnly declare(s) that this research has not involved the plants for experiment or field studies. The contexts of plants are only indirectly covered through literature review. Yet, during this research the author(s) obeyed the principles of the Convention on Biological Diversity and the Convention on the Trade in Endangered Species of Wild Fauna and Flora.

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The author(s) solemnly declare(s) that this research has not directly involved any local community participants or respondents belonging to non-Indigenous peoples. Neither this study involved any child in any form directly. The contexts of different humans, people, populations, men/women/children and ethnic people are only indirectly covered through literature review. Therefore, an Ethical Clearance (from a Committee or Authority) or prior informed consent (PIC) of the respondents or Self-Declaration in this regard does not apply in cases of this study or written work.

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CLIMATE CHANGE AND CORPORATE REGULATION IN ANGOLA: REFORMING THE REGULATORY FRAMEWORK FOR CLIMATE CHANGE MITIGATION

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ABSTRACT

Angola, like many African countries, continuously suffers the deleterious impacts of climate change despite its minimal global carbon contributions. Despite this, it has not taken active steps to institute a climate change regulatory framework or established any strong regulatory regime to aid the regulation of corporate activities and participation in mitigation projects in the country. This article examines the regulatory landscape of climate change and corporations in Angola and assesses the country's ability to tackle the challenges posed by climate change. It examines the country's position in the international climate change arena and scrutinizes the contribution of corporations to Angola's carbon emissions. The absence of legislation on climate change in Angola creates a void which allows corporations in the country to avoid any responsibility for mitigation projects and activities. This article, therefore, analyses the strengths and weaknesses of the alternative regulatory frameworks such as judicial, market, and surrogate regulation that can operate to fill this void and the extent to which they curtail corporate excesses in climate change and incentivise participation in mitigation activities. In scrutinising the deficiencies of Angola's climate change regulatory framework, the article adopts the dilute interventionism model which employs both prescriptive and facilitative measures to regulate corporations and mitigate the impact of climate change. It highlights the structure of the legislative framework, regulator, and technical expertise necessary for the successful implementation of the said model. Additionally, the article argues in favour of adopting a veto firewall protection to maintain the independence of the proposed sole independent regulator to be responsible for regulating the climate change activities of corporations in Angola.

Keywords: Angola; Climate change; Corporations; Dilute Interventionism; Regulatory framework; Veto Firewall protection

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Climate Change and Corporate Regulation in Angola: Reforming the Regulatory Framework for Climate Change Mitigation

1. INTRODUCTION

Angola's economy is largely dependent on the oil sector and the service sector. The oil sector contributes approximately one-third of its GDP, amounting to more than 70% of the Government of Angola's revenue, and more than 90% of the total exportation of the country. In addition to the oil sector, the service sector also contributes heavily to Angola's GDP.[1] In the third quarter of 2021 alone, the service sector, particularly the wholesale and retail trade, contributed approximately 17.4% to the country's GDP.[2] Construction and agriculture contribute 9.6% and 8.5%, respectively, to Angola's GDP share.[3]

Angola is an epicentre of climate change-induced impacts.[4] A recent report shows that the economy of Angola has been severely hit by the impact of climate change. The report shows that prolonged drought, damaging flash floods, and reduced crop production, which are a result of drought, have had a major impact on the economy of Angola.[5] A recent World Bank report, released in 2022, showed that Angola suffered severely from the impact of climate change, particularly drought. The report estimates the loss in 2022 to be approximately US$749 million and the most impacted sectors were the agriculture, livestock, and fishery sectors.[6]

Currently, Angola is experiencing its worst drought-related emergency in the last 38 years as a result of climate change.[7] In 2013, the southern region alone experienced a high level of food insecurity, with 1.5 million people in the southern region suffering from food insecurity.[8] The southern provinces in Angola, particularly Cunene, Hulla and Namibe, have also suffered immensely from the impact of drought, severely affecting agriculture and the means of livelihood of people living in those regions.[9] Severe drought was recorded, particularly between November 2020 and January 2021, with average rainfall from 2018 to 2020, making it the worst drought recorded since 1981.[10] In Cunene, Hulla and Namibe, over 1.3 million people were estimated to have experienced high levels of

1 Lars Karnar, 'Africa: Share of Gross Domestic Product (GDP) in Angola as of the Third Quarter of 2021' (Statista, August 2022) <https://www.statista.com/statistics/1139303/share-of-gdp-in-angola-by-economic-activity/> accessed 3 March 2023.

2 *Ibid.*

3 *Ibid.*

4 Joseph C. Miller, 'The Significance of Drought, Disease and Famine in the Agriculturally Marginal Zones of West-Central Africa' (1982) 23 (1) The Journal of African History 17-61. <https://www.jstor.org/stable/181270> accessed 12 April 2023.

5 Mixed Migration Centre, 'Climate and Mobility Case Study January 2023: Cunene Province, Angola: Cahama' (February 2023) <https://reliefweb.int/report/angola/climate-and-mobility-case-study-january-2023-cunene-province-angola-cahama> accessed 15 March 2023.

6 Aleix Serrat-Capdevila, Natalia Limones, Javier Marzo-Artigas, Wijnen Marcus, and Bruno Petrucci, 'Water Security and Drought Resilience in South Angola' (January 2022) The World Bank <https://doi.org/10.1596/37189>.

7 ACAPS, 'Angola: Drought in Southwest' Crisis Updates <https://www.acaps.org/country/angola/crisis/drought-in-south-west> accessed 4 March 2023.

8 Carvalho, S.C.P., Santos, F.D. and Pulquério, M., 'Climate Change Scenarios for Angola: An Analysis of Precipitation and Temperature Projections Using Four RCMs' (2016) 37 International Journal of Climatology 3398. <https://doi.org/10.1002/joc.4925>

9 *Ibid*

10 Ibid

food insecurity between July 2021 and September 2021.[11] The world food security report highlights a higher number of persons in acute food insecurity within the period of October 2021 to March 2022. According to the report, over 1.59 million people were in food insecurity crises or worse in the Southern region, with drought reported as the leading driver of food insecurity within the region.[12] By 2023, these figures increased by over 2.3 million, which shows a staggering increase of approximately 138%. A UNICEF report shows that about 3.8 million were experiencing a high level of food insecurity in 2023 in the provinces of Cucene, Hulla, and Namibe.[13] Children constitute two million persons experiencing a high level of food insecurity.[14] This figure is reflected in Angola's ranking on the Children's Climate Risk, which is exceedingly high, putting children in Angola at increasing risk of climate changed induced disasters.[15]

Amongst the southern provinces, Cunene is the epicentre of drought in Angola. Most people in Cunene rely heavily on rain-fed agriculture. The ubiquity of rain-fed agriculture combined with the unavailability of water caused by the effect of climate change exacerbates the scarcity of water and massively contributes to food scarcity.[16] A report shows that approximately 55% of people living in the province were drastically impacted by drought during 2012, 2013 and 2014. In 2015, approximately 78% of persons suffered from the impact of drought within the region.[17] Angola also suffers from the impact of flooding. This is a serious cause for concern in the regions affected.[18] In January 2007, continuing rainfall led to the flooding of the Luanda and Moxico regions in Angola. In Luanda, the rain caused flash floods in Kilamba, Kiaxi, Cacuaco, and Samba regions destroying several infrastructures.[19] Rainfall in Lauda is very unpredictable, as it has shown over the years. The total yearly rain within this region can be as low as 52 mm (1982) and as high as 860 mm (1984). Most rainfall is short, and when they do come, they come in the form of flooding.[20] The flooding in 2007 within this region led to the displacement of approximately 3,000 families.

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11 *Ibid.*

12 FSIN - Global Network against Food Crises, 'Global Report on Food Crises 2022 (2022) United Nations <https://docs.wfp.org/api/documents/WFP-0000138913/download/?_ga=2.200613486.1530222563.1680892576-815969552.1680892576> accessed 4 March 2023.

13 UNICEF, 'Angola' (2023) <https://www.unicef.org/media/131461/file/2023-HAC-Angola.pdf> accessed 14 March 2023.

14 Ibid.

15 Ibid.

16 Mixed Migration Centre, *supra*-5

17 *Ibid.*

18 Castro, B., Filho, W.L., Caetano, F.J.P., Azeiteiro, U.M., 'Climate Change and Integrated Coastal Management: Risk Perception and Vulnerability in the Luanda Municipality (Angola)' (2018), In: Leal Filho, W. (eds.) Climate Change Impacts and Adaptation Strategies for Coastal Communities. Climate Change Management. Springer, Cham. <https://doi.org/10.1007/978-3-319-70703-7_21>

19 International Federation of Red Cross and Red Cresent Societies, 'Angola: Floods' (May 2008) <https://www.ifrc.org/docs/appeals/07/MDRAO002final.pdf> accessed 14 March 2023.

20 Allan Cain, 'Climate Change and Land Markets in Coastal cities of Angola' (2015) World Bank Conference on Land and Poverty, The World Bank, Washington DC, March 23-27, 2015. <https://angonet.org/dw/sites/default/files/online_lib_files/cain_-_climate_change_and_land_markets_in_coastal_cities_of_angola.pdf> accessed 12 April 2023.

The flooding also reported 117 deaths. In Moxico region, approximately 5,000 families were affected by the flood ultimately requiring urgent relief assistance.[21] In 2021, Launda was also affected by flooding. The flooding in this region led to the destruction of infrastructure in many areas of the city. The flood also led to the death of 14 persons and displaced approximately 8,000 people.[22] Rain-induced flooding also has its effects on health in Angola. Data on the cholera epidemic show that cases of cholera increased by 50%, peaking during February and March in 2007.[23] Also, under-five morbidity and mortality arising majorly from diarrhoeal diseases worsened drastically during the rainy periods.[24]

Angola is also rapidly losing its forestry, wildlife, etc.[25] Angola currently ranks amongst the top deforesting country losing approximately 520,000 ha forests every year from the period of 2000 to 2015.[26] This has contributed greatly to climate change and has negative impacts on agriculture.[27] There is, therefore, an urgent need to ensure the mitigation of climate change through the sustainable management of forests, reducing emissions as a result of deforestation and forest degradation due to the adverse effect it poses on the health, livelihood of people, and the economy of the country.

In addressing this urgent need for mitigating climate change impacts, the effectiveness of the regulatory framework is vital. In Angola's case, there is an almost complete lack of regulatory systems in place to coordinate the climate change response. There is no climate change regulator, no specific climate change regulatory framework, no climate change legislation, no obligations or policies incentivising corporate participation in climate change mitigation and no sufficient mitigation projects to minimise the impacts. The climate change regulatory void in Angola is a significant concern for its citizens who bear the brunt of climate change impacts discussed above.

This article argues that the government of Angola, in fulfilment of its legal obligation to safeguard the climate and environment for Angolans, can, and should, address these shortcomings by instituting a sustainable climate change regulatory framework that imposes prescriptive measures for corporations to incentivise their participation in mitigation projects and at the same time grant them sufficient flexibility to adopt and implement facilitative tools to promote mitigation. The combination of this

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21 *Ibid.*

22 Crisis24, 'Angola: Transport Disruptions Likely to Persist through April 22 Following Flooding in Luanda' (Angola: Transport disruptions likely to persist through April 22 following flooding in Luanda | Crisis24) <https://crisis24.garda.com/alerts/2021/04/angola-transport-disruptions-likely-to-persist-through-april-22-following-flooding-in-luanda> accessed 17 March 2023.

23 WHO, 'World Health Day – 7 April 2009 Floods and Public Health in Angola' (2009) World Health Organization, Regional Office for Africa <https://www.afro.who.int/news/world-health-day-7-april-2009-floods-and-public-health-angola> accessed 17 March 2023.

24 Ibid.

25 Ana Leite and others, 'Reducing Emissions from Deforestation and Forest Degradation in Angola: Insights from the Scarp Forest Conservation Hotspot' (2018) 29 Land Degradation & Development 4291.

26 *Ibid.*

27 *Ibid.*

prescriptive/facilitative measure will optimise corporate participation in climate change and is in fulfilment of the core tenets of the dilute interventionism model for ensuring corporate participation in climate change mitigation. In this regard, three key steps to be undertaken by the government, in accordance with the dilute interventionism model are – promulgating a framework climate change legislation; establishing a sole, independent climate change regulator; and instituting a veto firewall protection for the regulator to guarantee its effectiveness in achieving its regulatory objectives. The mechanisms for instituting these measures and their feasibility are the core focus of this article.

2. ANGOLA'S CARBON EMISSION PROFILE

In 1990, Angola's emission was 43,150 compared to the 79,680 recorded in 2019. The 2019 figure was, therefore, almost double the figures recorded in 1990.[28] In 2021, data shows that there was a 6.05% increase in CO_2 emissions in Angola.[29] The increase amounted to approximately 1.394 million metric tonnes, a sharp increase from 22 million metric tonnes recorded in 2020.[30] The figures for 2021 stood at 24,450,000 tons making Angola the 104th country in CO_2 emissions.[31]

In 2014, Angola's greenhouse gas emissions totalled 0.52 % of the global greenhouse emissions (GHG) emissions. Within that time, the energy sector contributed majorly to Angola's total greenhouse emissions contributing 49.4 % of the total number of emissions.[32] This was closely followed by the land use charge, which amounted to 37.4 % of Angola's total. Agriculture contributed to 11.7 % of its total, while waste and industrial processes contributed 0.9 % and 0.6 %, respectively.[33] Another report shows that, in 2015, CO_2 emissions and land use charges contributed approximately 70 % of CO_2 emissions in Angola,[34] and the energy sector contributions to the total CO_2 emissions in the country amounted to 18 %.[35] This growth in CO_2 was driven majorly by the corporate sector.

3. ANGOLA'S INTERNATIONAL CLIMATE CHANGE PROFILE

The government of Angola has recognised the impact of climate change in the country and, to reduce its effect, has ratified several

[28] Macrotrends, 'Angola Greenhouse Gas (GHG) Emissions 1990-2023' (2023) <https://www.macrotrends.net/countries/AGO/angola/ghg-greenhouse-gas-emissions> accessed 17 March 2023.
[29] CountryEconomy, 'Angola - CO_2 Emission 2021' (2021) <https://countryeconomy.com/energy-and-environment/co2-emissions/angola> accessed 17 March 2023.
[30] Ibid.
[31] Ibid.
[32] ClimateLinks, 'Greenhouse Gas Emissions Factsheet: Angola' (2019) <https://www.climatelinks.org/resources/greenhouse-gas-emissions-factsheet-angola#:~:text=The%20energy%20sector%20serves%20as> accessed 17 March 2023.
[33] Ibid.
[34] IMF, 'Angola Selected Issues' (2022) < https://www.imf.org/-/media/Files/Publications/CR/2022/English/1AGOEA2022002.ashx> accessed 17 March 2023.
[35] Ibid.

international conventions. Key amongst them is the United Nations Framework Convention on Climate Change (UNFCCC), which was signed on the 12th of June 1992, and ratified on the 17th of May 2002.[36] Angola signed the Paris Agreement on the 22nd of April 2016 and ratified the same on the 16th of November 2022.[37] Angola also ratified the Kyoto Protocol on the 8th of May 2007.[38] There are other notable conventions and agreements also which were ratified by Angola. Angola signed the Montreal Protocol on Substances that Deplete the Ozone Layer on the 17th of May 2000. The country is also a signatory to the United Nations Convention on Combating Drought and Desertification (UNCCD) having signed same on the 14th of October 1994 and ratified same on the 30th of June 1997.[39] Other notable conventions include: the Convention on the Conservation of Wild Migratory Species (CMS), the Convention on Biological Diversity (CBD) and the Stockholm Convention on Persistent Organic Pollutants (POPs).[40]

The UNFCCC, for instance, spells out its key principles some of these include: the requirement for state parties to take precautionary measures to anticipate, prevent and minimize the effect of climate change and mitigate its adverse effects, and the right of state parties to promote sustainable development.[41] Angola has since attempted to meet some of the objectives of the Convention. Angola, in compliance with Articles 4.1 and 12.1 of the Convention, which requires a member State to periodically report to the Convention regarding its national circumstance and subsequent response to Climate change, through a National Communication prepared and submitted its first National communication to the UNFCC in 2012.[42] Its second National Communications to the UNFCCC was made in 2021. The 2021 communication aims to provide a set of key actions, especially at the national level, having regard to the various commitments assumed with implementing the UNFCC.[43]

Angola has also made persistent efforts to comply with other agreements.[44] For instance, Angola in compliance with Article 4.2 of the Paris Convention, which specifically requires States to prepare and

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36 United Nations, 'United Nations Treaty Collection' <https://treaties.un.org/Pages/ViewDetailsIII.aspx?src=TREATY&mtdsg_no=XXVII-7&chapter=27&Temp=mtdsg3&clang=_en> accessed 17 March 2023

37 United Nations, 'List of Parties that Signed the Paris Agreement on 22 April' (United Nations Sustainable Development, 3 May 2016) <https://www.un.org/sustainabledevelopment/blog/2016/04/parisagreementsingatures/> accessed 17 March 2023.

38 UNFCCC, 'Nationally Determined Contribution of Angola Republic of Angola' (2021) <https://unfccc.int/sites/default/files/NDC/2022-06/NDC%20Angola.pdf> accessed 17 March 2023.

39 United Nations, *supra-37.*

40 UNFCC, *supra-39.*

41 UNFCCC, 'United Nations Framework Convention on Climate Change' (1992) <https://unfccc.int/files/essential_background/background_publications_htmlpdf/application/pdf/conveng.pdf> accessed 25 February 2023.

42 United Nations, 'National Communications (NC), Mitigation' (2023)<https://unfccc.int/documents/67469> accessed 17 March 2023.

43 UNFCCC, 'Republic of Angola, Ministry of Culture, Tourism and Environment, National Direction of Environment and Climate Action, Second National Communication' (2021) <https://unfccc.int/sites/default/files/resource/ANGOLA%20SNC.pdf> accessed 17 March 2023.

44 *Ibid.*

communicate Nationally Determined Contributions, drafted its first Nationally Determined Contribution first in 2015[45] and subsequently revised its 2015 edition by drafting an updated Nationally Determined Contribution in 2020.[46]

4. ENVIRONMENTAL REGULATIONS IN ANGOLA

All the environmental regulations of Angola draw their validity from the Constitution of Angola. The Constitution of Angola was first signed in 1992, but was, however, replaced in 2010 and a constitutional amendment introduced specific provisions for the protection of the environment and these provisions act as the basis for the Environmental Framework Law.[47] Article 39 of the Constitution provides for the right of every citizen of Angola to live in a healthy and unpolluted environment along with the duty to defend and to preserve the environment.[48] It further enjoins the states to take requisite measures aimed at protecting the environment and the species of flora and fauna throughout the boundaries of Angola, maintaining the ecological balance.[49] The Constitution further provides that acts posing danger or damaging the environment will be punishable by law.

In addition, Article 90(e) enjoins the state to promote social development by making sure that all citizens enjoy the accruing benefits resulting from collective efforts in terms of development specifically as it relates to an improvement in the standard of living of its citizens.[50] Though Angola's Constitution provides for environmental rights for its citizens, it fails to make any provision on how citizens can implement and enforce the right to a healthy environment. In essence, it leaves the enforcement of the constitutional rights to be determined in statutory enactments and the Environmental Framework Law fulfils this role by providing relevant environmental enforcement protocols.

One of the first pieces of the legal framework on the environment in Angola is the Environmental Framework Law. The 1998 Environment Framework Law No.5/98 provides a legal framework for environmental legislation and regulations in Angola.[51] Article 14 of the Environmental Framework Law gives way to the establishment of environmental protection areas and the setting of those areas. The Article also provides for the identification of activities that would either be prohibited or permitted in protecting the environment.[52] Article 16 of the law makes it compulsory to conduct an environmental impact assessment (EIA) of all undertakings that may have the likelihood of causing an imbalance to the

[45] UNFCC, supra-39
[46] *Ibid.*
[47] WIPO, 'WIPO Lex' <https://www.wipo.int/wipolex/en/text/196467> accessed 17 March 2023.
[48] *Ibid.*
[49] *Ibid.*
[50] *Ibid.*
[51] GOAFRICA, 'Angola' (2021) <https://www.dbsa.org/sites/default/files/media/documents/2021-05/Chapter%203b%20Angola%20English.pdf> accessed 17 March 2023.
[52] *Ibid.*

well-being of the environment and society. Article 17 provides for the issuance of environmental licensing and Article 18 deals with environmental auditing. Article 19 recognises the gravity of the effect of pollution as a by-product of economic development and makes provision for strict measures to curb or limit its effects. Clause 2 of Article 19 allows for the enactment of pollution control legislation to specifically address the production, discharge, deposit, and management of gaseous, liquid, and solid pollutants. The Minister of the Environment is responsible under the law for coordinating the environmental policy and implementing the National Environment Management Programme.[53] The Minister is also charged with the duty of implementing the law in collaboration with other ministries. In conducting EIA, the Minister is responsible for reviewing the environmental impact assessments after comments and recommendations of the National Directorate for the Prevention and Assessment of the Environmental Impact have been forwarded to him (as it relates to whether the environmental license should be granted or not).[54]

The National Environmental Management Programme was finalized by the Ministry of Environment in 2009. The document reiterates the need for incorporating an environmental management strategy for the protection of the environment.[55] The document provides five key sub-programmes. These include the promotion of inter-sectoral coordination, protection of biodiversity, flora and terrestrial and marine fauna, ecosystem rehabilitation and protection, environmental education, information and awareness, and environmental management.[56] The Environmental Fund was established by the Presidential Decree No:9/11 of 7th January 2011, with the main purpose of providing necessary funds for the activities provided for under the National Environmental Management Programme. Some of these activities include scientific studies and educational programmes.[57]

Angola has also developed a National Development Plan (2018-2022). This Plan recognises the peculiarity of environmental issues and their cross-cutting effects and proposes along with an Environmental Sustainability Policy aiming at guiding the environmental sector.[58] The Policy, as provided by the plan, provides for four programmes namely climate change, biodiversity and conservation areas, marine spatial planning, ecosystem health and risk prevention and environmental protection.[59]

In line with clause 2 of Article 19 of Environment Framework Law, Angola also has the Presidential Decree 194/11 of 7th July 2011. The Decree contains Environmental Damage Regulations and provides damage

53 *Ibid.*
54 *Ibid.*
55 *Ibid.*
56 *Ibid.*
57 *Ibid.*
58 *Ibid.*
59 *Ibid.*

regulations to all sectors including the petroleum and mining industries.[60] The regulations make provisions relating to the polluter pays principle, strict liability offence for environmental damages, and provide powers of the Ministry of the Environment to prevent and reduce the likelihood of environmental injury.[61] The law though not dealing specifically on climate change is relevant to climate change because it introduces damage regulations for environmental damages. These damages may include damages caused through the emission of greenhouse gas emissions, such as global warming, and air pollution as a result of corporate activities causing respiratory diseases.

5. CLIMATE CHANGE REGULATORY FRAMEWORK IN ANGOLA

Currently, there is no Climate Change Act and no specific climate change legislative framework in Angola. However, Angola has drawn up several laws through decrees which set up some climate change instruments and ministerial bodies providing bits and pieces of regulation for climate change mitigation.[62] The main forum in Angola that deals with climate change is the National Committee on Climate Change and Biodiversity.[63] The committee was created under the Ministry of Environment and composed of several representatives from the Ministry of Oil, the Ministry of Transport, the Ministry of Education, Science and Technology, the Ministry of Agriculture, the Ministry of Health, etc.[64] For instance, the Committee is responsible for the harmonization of programmes and policies aimed at implementing the Committee's Strategies, creating a plan for investments, integrating issues related to climate change, biodiversity and desertification, etc. The committee is also responsible for creating centres of excellence to research natural disasters and structured observation and investigation of the climate (Article 2) of Presidential Order 10/12 of 2012.[65] The Order also requires the coordinator of the Committee to present to the Minister of the Environment a detailed report regarding the activities conducted by the Committee. The Committee is required to present this report every three months.[66]

The Presidential Decree No. 45/18 was passed in 2018. This Decree contains 33 articles and is divided into 4 chapters. The Decree approves the

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60 *Ibid.*
61 *Ibid.*
62 Though Angola has through laws established few bodies for climate change, these laws fail to establish a solely dedicated agency for climate change. There exist also no dedicated funding (Climate Change Fund) to finance priority climate change actions and priority. None of these laws provide for how citizens can sue for climate change related breaches etc. None of these laws also provides for obligations of both the public, private entities in relation to climate change. It therefore becomes expedient for Angola to enact a climate change Act addressing these issues.
63 Vizzuality, 'Presidential Order 10/12 Which Creates the National Committee on Climate Change and Biodiversity - Angola - Climate Change Laws of the World' (2012) <https://www.climate-laws.org/geographies/angola/policies/presidential-order-10-12-which-creates-the-national-committee-on-climate-change-and-biodiversity> accessed 17 March 2023.
64 *Ibid.*
65 *Ibid.*
66 *Ibid.*

Statute of the Ministry of Environment and goes on to modify its functions and structure to include climate change-related functions. Some of these functions include coordinating and overseeing the implementation of measures, strategies, and plans on climate change.[67] The Ministry is charged with overseeing the implementation of strategies, plans, etc. on climate change developed by the National Committee on Climate Change and Biodiversity. The Ministry is also charged with the responsibility of promoting projects and programmes to stabilize GHGs. Other modifications include creating Climate Change Cabinet. The Cabinet oversees promoting and coordinating adaptation and mitigation projects.[68] The Decree also establishes a National Environment Fund, which is aimed at providing funding for priority environmental activities.[69]

Angola also has a National Strategy for Climate Change 2018-2030. This National Strategy aims at eradicating poverty in the country. The Strategy provides for actions that are targeted at adapting the country to the adverse impact of climate change, adopting a low-carbon development model, thus, striving at transitioning Angola to a low-carbon economy, deploying resources, and advancing the strengthening of national institutional capacity.[70] The document for the purpose of achieving these takes into account five pillars, namely: adaptation, capacity building, financing and research, systematic observation and analysis etc.

Presidential Decree No. 30/16 of 2016 approves the Strategic Plan for the Prevention and Reduction of Disaster Risk, within the framework of the National Development Plan 2013-2017. The plan is made up of 6 sections.[71] It creates the disaster risks management requirement and then sets out the procedures to be followed in the event of a natural emergency within the country such as drought, flood, fire, etc. The plan aims to contribute to Angola's sustainable development by reducing the country's vulnerability to climate change.[72] The Ministerial decision No. 223/17 of 2017 creates the Commission for a National Conference on Climate Change and Sustainable Development and provides for its duties and responsibilities. The commission is aimed at raising awareness of high-level policymakers on the dire need to include climate components in

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67 Michal Nachmany and others, 'Climate Change Legislation in Angola the 2015 Global Climate Legislation Study a Review of Climate Change Legislation in 99 Countries' (2015) Grantham Research Institute on Climat Change and the Environment, London School of Economics and Political Sciencees, London, UK <https://www.lse.ac.uk/GranthamInstitute/wp-content/uploads/2015/05/ANGOLA.pdf> accessed 17 March 2023.

68 Vizzuality, 'Presidential Decree No. 45/18 Approving the Statute of the Ministry of Environment (MINAMB) - Angola - Climate Change Laws of the World' (2018) <https://climate-laws.org/geographies/angola/policies/presidential-decree-no-45-18-approving-the-statute-of-the-ministry-of-environment-minamb> accessed 17 March 2023.

69 Ibid.

70 Ibid.

71 Vizzuality, 'Presidential Decree No. 30/16 Approving the Strategic Plan for the Prevention and Reduction of Disaster Risk - Angola - Climate Change Laws of the World' (2016) <https://climate-laws.org/geographies/angola/policies/presidential-decree-no-30-16-approving-the-strategic-plan-for-the-prevention-and-reduction-of-disaster-risk> accessed 17 March 2023.

72 Ibid.

sectoral planning for sustainable development.[73] Presidential Decree 171/18 of 2018 approves forestry regulations aiming at enabling the sustainable management of Angola's forest. Most importantly, it aims at increasing the knowledge on the risk climate change poses on the country's ecosystem.[74]

The Presidential Decree 184/12 creates the statute of the Centre of Tropical Ecology and Climate Change (CETAC). CETAC is charged with the duty of carrying out research and investigations as it relates to tropical ecology and the management of ecosystems aimed at designing and implementing environmental preservation policies and programmes. CETAC also has a climate change department which is aimed at developing models for studying variations in the climate, monitoring the effect of climate change on the environment, particularly its effect on air quality, water, and soil.[75]

Notwithstanding these disparate instruments and bodies, climate change mitigation in Angola remains largely unregulated, uncoordinated, and lacking a unified regulatory framework for managing Angola's climate change objectives. The absence of a single regulator, with specific legal regulatory powers to manage climate change, results into an inability of the government to control carbon emissions by major emitters – mostly the corporations. This absence of climate change regulation is compounded by the poor and undeveloped corporate regulation framework in Angola which results in corporations in the country not taking any step to participate in mitigation projects or devote any aspect of their business activities towards achieving mitigation goals, as is the norm in developed jurisdictions.

6. CORPORATE REGULATIONS ON CLIMATE CHANGE

A review of Angola's legal system reveals that it does not have any regulations on the climate change activities of corporations which recognise the likely risk climate change poses, and the important role corporation plays in aggravating them through their carbon emission. This is in contrast of environmental regulation of corporations in the country which is significantly more developed than the climate change regulation. However, as will be seen below, these environmental regulations are

[73] Vizzuality, 'Ministerial Decision No. 223/17 Creating the Commission for a National Conference on Climate Change and Sustainable Development - Angola - Climate Change Laws of the World' (2017) <https://climate-laws.org/geographies/angola/policies/ministerial-decision-no-223-17-creating-the-commission-for-a-national-conference-on-climate-change-and-sustainable-development> accessed 17 March 2023.

[74] Vizzuality, 'Presidential Decree 171/18 Approving Forestry Regulations - Angola - Climate Change Laws of the World' (2018) <https://climate-laws.org/geographies/angola/policies/presidential-decree-171-18-approving-forestry-regulations> accessed 17 March 2023.

[75] Vizzuality, 'Presidential Decree 184/12 Which Creates and Approves the Statute of the Centre of Tropical Ecology and Climate Change (CETAC) - Angola - Climate Change Laws of the World' (climate-laws.org) <https://climate-laws.org/geographies/angola/policies/presidential-decree-184-12-which-creates-and-approves-the-statute-of-the-centre-of-tropical-ecology-and-climate-change-cetac> accessed 17 March 2023.

unsuitable for the climate change regulation of corporations because, while they cover pollution control and regulation, they do not address the peculiar issues relating to carbon emissions and mitigation activities.

Some of the laws already discussed in the preceding sections contain several provisions regulating corporate contribution to climate change in Angola. The Environmental Framework Law, for instance, under Article 19, recognises the gravity of the effect of pollution as a by-product of economic development and makes provision for strict measures to curb or limit its effects. Clause 2 of Article 19 allows for the enactment of pollution control legislation to specifically address the production, discharge, deposit, and management of gaseous, liquid, and solid pollutants. The Minister is charged with the duty of reviewing the environmental impact assessments after receiving comments and recommendations from the National Directorate for the Prevention and Assessment of the Environmental Impact (as it relates to whether the environmental license should be granted or not).[76]

In line with clause 2 of Article 19 of Environmental Framework Law and the Presidential Decree 194/11, key principles of environmental pollution management such as the polluter pays principle[77], strict liability[78] for environmental damages, and the precautionary principles are incorporated within the country's environmental framework.[79] The law also confers individuals' and NGOs' legal standing to pursue legal actions to obtain compensation for environmental damage. It also provides for strict penalties, some of which include fines of up to US $100 million, as well as cancellation of environmental licences.[80]

The Decree on General Regulation on Environmental Impact Assessment and Environmental Licensing Procedures (Presidential Decree No. 117/2020), for instance, provides for rules and procedures for EIA for both public and private projects. It also provides for procedures for environmental licensing for activities that are likely to affect the environment.[81] Amongst other things, it makes provision for mandatory project registration through the integrated environment system (Article 6), and categories of projects that require licensing (Article 7). The Decree No. 39/00 on the Regulation of Environmental Protection recognizes the huge

[76] *Ibid*. The Presidential Degree 117/120 specifically categorizes projects to be licensed (Article 7) and which are listed in annexes I, II, II, IV and V of the Decree. Some of these includes activities located in areas of high biodiversity value, Activities with potentially irreversible impacts, Activities whose implementation directly affects coral reefs and primary dunes, mangroves, wetlands, Zones containing animal and/or plant species, habitats and endangered ecosystems; etc. Companies, individuals etc who intend to partake in these activities due to their complexity, location, and/or irreversibility and magnitude of possible impacts, must be subjected to an Environmental Impact Assessment for the purpose of ascertaining the potential impact of their activities on the environment. If the appropriate bodies find that the activities to be conducted will have little to no impact on the environment, they will be granted an Environmental license to undertake their activities.

[77] Article 2 of the Presidential Decree No. 194/11

[78] Article 6 of the Presidential Decree No. 194/11

[79] GO Africa, supra note 52.

[80] Ibid; Article 24 of the Presidential Decree No. 194/11.

[81] Presidential Degree No 117/120 <https://faolex.fao.org/docs/pdf/ang194840.pdf> accessed 16 March 2023.

impact of oil production activities and proceeds to regulate environmental practices in the oil industry.[82]

7. CRITIQUING ANGOLA'S CLIMATE CHANGE FRAMEWORK

As stated in the preceding section, Angola does not have climate change legislation. Nevertheless, it has attempted to pursue its climate change goals through the Angola National Climate Change Strategy (NCCS) which was launched in 2017. The aim is to promote sustainable development in Angola while reducing the country's vulnerability to the impacts of climate change and the strategy aims to achieve this goal by adopting a multi-sectoral and participatory approach that involves various stakeholders such as government agencies, civil society organizations, and the private sector.

This strategy has achieved some successes as it produced the National Strategy for Climate Change Adaptation in Angola (Estratégia Nacional de Adaptação às Alterações Climáticas em Angola) (ENNAC) which places emphasis on building resilience to climate change impacts. The Strategy identifies key sectors that are vulnerable to climate change such as agriculture, water resources, coastal areas, and health. To build resilience in these sectors, the Strategy outlines measures such as promoting sustainable agriculture practices, protecting water resources, and improving coastal zone management.[83]

Another success of ENNAC is its commitment to promoting low-carbon development in Angola. The Strategy recognizes that reducing greenhouse gas emissions is essential for mitigating the impacts of climate change. To achieve this, ENNAC outlines measures such as promoting renewable energy sources, improving energy efficiency, and promoting sustainable transport. An example of a practical measure that has been implemented to promote renewable energy sources in Angola is the development of the Soyo Combined Cycle Power Plant.[84] The plant has a total capacity of 750 megawatts and utilizes natural gas as its primary fuel source.[85] By generating electricity through natural gas instead of coal or other fossil fuels, the Soyo plant helps to reduce greenhouse gas emissions and promote cleaner energy sources in Angola.

Further, the strategy, through the NCCS, has promoted climate-smart agriculture, which aims to increase food production while also reducing greenhouse gas emissions and improving resilience to climate change. An example of Angola's effort to promote climate-smart

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82 *Ibid.*

83 According to the National Strategy for Adaptation to Climate Change (ENNAC), measures to promote sustainable agriculture practices include "improving soil fertility, introducing drought-resistant crops, promoting sustainable land use practices, and improving access to credit and agricultural inputs for smallholder farmers"^[National Strategy for Adaptation to Climate Change (ENNAC), para. 4.2.2].

84 Carmen, 'Soyo II Combined Cycle Power Plant, Angola' (Power Technology, 2 December 2021) <https://www.power-technology.com/marketdata/soyo-ii-combined-cycle-power-plant-angola/> accessed 7 April 2023.

85 Ibid.

agriculture is the Sustainable Land Management and Agricultural Productivity Project (PRODEMA).[86] The project aimed to promote sustainable land management practices, improve soil fertility, and increase agricultural productivity in several provinces of Angola.[87]

Furthermore, the NCCS also includes measures to improve climate resilience and adaptation, such as developing early warning systems for extreme weather events and promoting the use of drought-resistant crops. The government is also working to improve access to clean water and sanitation, which is a critical component of climate adaptation. Finally, the strategy recognizes the importance of enhancing the capacity of stakeholders to address climate change. ENNAC outlines measures such as improving climate change education and awareness, building the capacity of government agencies, and promoting research and innovation.

7.1 Shortcomings of Angola's Climate Change Regulatory System

The absence of a climate change legislation or legislative framework is an overriding shortcoming that looms large in Angola's climate change regulatory framework as it significantly undermines the enforceability of the climate change goals and the ability of the NCCS and ENNAC to achieve meaningful progress in pursuing mitigation goals.

However, there are other shortcomings that hinder the effective implementation of the climate change goals based on the current regulatory system. One of the key shortcomings is the lack of specificity and measurability in its goals and targets. The NCCS sets out broad objectives such as reducing vulnerability and enhancing resilience, but does not provide clear and specific targets that can be measured and tracked. This lack of specificity makes it difficult to hold responsible agencies accountable for achieving the objectives and to monitor progress towards them. Another shortcoming of the Strategy is the limited institutional capacity and resources for its implementation. The Strategy assigns roles and responsibilities to various agencies, but many of these agencies lack the resources, capacity, and expertise needed to effectively implement the Strategy. There is a need for adequate funding and capacity building to ensure that responsible agencies can conduct their assigned tasks.

The Strategy also lacks a clear plan for stakeholder engagement and participation in its implementation. It does not provide for adequate consultation and involvement of stakeholders such as communities, civil society organizations, and the private sector in the development and implementation of climate change mitigation and adaptation projects. This

[86] Land Portal, 'Angola, IFAD to Promote Sustainable Agric' (August 2021) <https://landportal.org/news/2021/08/angolaifad-promote-sustainable-agric> accessed 7 April 2023. See also, World Economic Forum, 'Angola Could Become Africa's Agricultural Powerhouse. Here's Why' (2022) World Economic Forum <https://www.weforum.org/agenda/2022/09/angola-agricultural-sector-powerhouse-of-africa/> accessed 7 April 2023.

[87] FAO, 'Sustainable Land Management in Target Landscapes of Central Angola (ZAEC): Geospatial Information for Sustainable Food Systems' (2023) Food and Agriculture Organization of the United Nations <https://www.fao.org/geospatial/projects/detail/en/c/1397691/> accessed 7 April 2023.

can limit the effectiveness and sustainability of the projects, as they may not fully reflect the needs and priorities of the local communities. In addition, the Strategy does not adequately address the issue of climate change adaptation, particularly for vulnerable communities. While it acknowledges the need for adaptation measures, it does not provide a comprehensive plan for identifying and addressing the specific adaptation needs of vulnerable communities such as those living in coastal areas and drylands. Finally, the Strategy does not provide a clear plan for monitoring and evaluating its implementation. It does not establish clear indicators or benchmarks for measuring progress, nor does it provide a plan for periodic evaluations to assess the effectiveness of the Strategy and its projects.

Finally, the biggest shortcoming (aside from the absence of climate change legislation), is the lack of any climate change regulatory goals for corporations that directly compel and incentivise them to participate in mitigation activities. Corporations are among the biggest carbon emitters and mitigation activities must include corporations to have any meaningful impact on Angola's climate change goals. The omission of corporations in the regulatory objectives set out by the government undermines the effectiveness of its climate change targets and goals.

8.0 ALTERNATIVE REGULATORY FRAMEWORKS IN CLIMATE CHANGE LEGISLATION

The absence of a legislative climate change framework leads to the consideration of potential alternative regulatory frameworks to fill this regulatory void and exert some of the control over corporate activities in the sector while ensuring the implementation of the climate change goals. There are three potential alternative regulatory frameworks for climate change regulation in Angola. These include, but are not limited to, judicial regulation, market regulation and surrogate regulation.[88]

8.1 Judicial Regulation

As the impacts of climate change become more apparent, there is a growing recognition of the need for legal frameworks and judicial regulation to hold responsible parties accountable for their actions and address the issue of climate change.[89] By utilizing the court system to enforce climate change laws and regulations, Angola can hold individuals, corporations, and government entities accountable for their contributions to climate change and for failing to take action to mitigate its effects. This can help raise public awareness about the issue of climate change and the need for action, as court cases can attract media attention and generate public interest.

[88] Kikelomo Kila, Corporate Regulation for Climate Change Mitigation in Africa, (1st Edition, Routledge, 2022) ch 12: 'Implementing Dilute Interventionism in Africa'.

[89] Catherine Higham and others, 'Accountability Mechanisms in Climate Change Framework Laws' (2021) Grantham Research Institute on Climate Change and the Environment, LSE, London, UK <https://www.lse.ac.uk/granthaminstitute/wp-content/uploads/2021/11/Accountability-mechanisms-in-climate-change-framework-laws.pdf> accessed 9 March 2023.

Additionally, court decisions can establish legal precedents and set the stage for future actions,[90] which can be an effective way to drive change at the institutional level in Angola. However, there may be challenges associated with using judicial regulation in Angola, including slow and expensive legal processes, and resistance from powerful actors who have a personal stake in maintaining the status quo. Despite these challenges, judicial regulation can be a valuable tool for addressing climate change in Angola by enforcing environmental laws and regulations, driving change at the institutional level, and building public support for policies and initiatives aimed at mitigating the effects of climate change.

The Constitution of Angola recognizes the right to a healthy environment in Article 24, which states that "Every individual has the right to a healthy environment and a duty to defend it".[91] The Angola National Climate Change Strategy[92] also provides a framework for mitigating and adapting to the effects of climate change in Angola. The law establishes national targets for reducing greenhouse gas emissions, promotes the use of renewable energy, and establishes mechanisms for monitoring and reporting on climate change activities. In addition, Presidential Decree No. 45/18, approving the Statute of the Ministry of Environment (MINAMB)[93], provides a framework for environmental protection and sustainable development in Angola. It requires that activities that may have a significant impact on the environment undergo an environmental impact assessment before being approved. Furthermore, Presidential Decree No. 261/11 approving the Regulation on the Quality of Water Law 23/11[94] provides for the protection and management of water resources in Angola. It establishes water quality standards and requires that activities that may negatively impact water resources undergo an environmental impact assessment.

In the *Angolan Government vs. the Cuango Mine Company*,[95] which was heard by the Lunda-Norte Provincial Court in 2017, the government accused the mining company of causing environmental damage and pollution through its diamond mining activities in the Cuango municipality. The court ruled in favour of the government and ordered the mining company to pay a fine and take measures to remediate the environmental damage caused by its activities.

Another notable case is the *Angolan Government vs. the Company China International Fund Limited decision of the Provincial Court of Luanda*.[96] In this case, the government accused the company of violating environmental

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90 Colarado Judicial Branch, 'Lesson: Implications and Impact of Court Decisions' <https://www.courts.state.co.us/userfiles/file/Media/Education/36%20Impact%20Appellate%20Decisions.pdf> accessed 16 March 2023.

91 Constituição da República de Angola, adopted on January 21, 2010, Article 24.

92 Visuality, *supra-88*.

93 Vizzuality, *supra-72*.

94 ECOLEX, 'Presidential Decree No. 261/11 Approving the Regulation on the Quality of Water.' (2011) <https://www.ecolex.org/details/legislation/presidential-decree-no-26111-approving-the-regulation-on-the-quality-of-water-lex-faoc119447/> accessed 16 March 2023.

95 Angolan Government vs. the Cuango Mine Company (Angola: Peace Monitor, IV, 5, 1/31/98).

96 Angolan government vs. the Company China International Fund Limited.

regulations by dumping waste in the sea near the city of Luanda. The court found the company guilty and ordered it to pay a fine and take measures to prevent further environmental damage.

8.2 Market Regulation

Although Angola has not implemented a comprehensive carbon tax or emissions trading scheme, it has taken some actions to protect the environment. For example, to promote the adoption of market techniques for low-carbon development in Angola, Angola developed the National Energy Strategy for 2025, which was approved in 2016, and sets out a target of increasing the share of renewable energy in the country's energy mix to 9% by 2025.[97] Additionally, the government introduced a Feed-in Tariff system to promote the development of renewable energy projects and has established the National Agency for Private Investment to facilitate investment in the energy sector.[98]

8.3 Surrogate Regulation

The government has instituted various policies and programs aimed at promoting actions that are in line with climate change regulations in the country. An example is the National Climate Change Strategy, which was developed in 2013 to promote sustainable development and address climate change issues.[99] The strategy includes several initiatives, such as promoting renewable energy, promoting sustainable agriculture, and reducing deforestation and forest degradation. It also aims to increase awareness and education about climate change issues.[100]

Another example is the Clean Development Mechanism (CDM),[101]which is designed to promote sustainable development and reduce greenhouse gas emissions. Under this program, companies in Angola can earn credits for reducing their carbon footprint through projects such as energy efficiency, renewable energy, and reforestation.[102] These credits can be sold on international carbon markets, providing companies with a financial incentive to reduce their emissions.[103]

Angola has also implemented the National Renewable Energy Program,[104] which aims to increase the share of renewable energy in the country's energy mix. The program includes initiatives such as expanding

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97 Vizzuality, *supra-72.*

98 Gesto Energy, 'New Renewables Strategy: Angola Energy 2025' (2023) <https://angolaenergia2025.gestoenergy.com/en/conteudo/new-renewables-strategy> accessed 16 March 2023.

99 Vizzuality, *supra-72.*

100 *Ibid.*

101 UNFCCC, 'Nationally Determined Contribution of Angola Republic of Angola' (2021) <https://unfccc.int/sites/default/files/NDC/2022-06/NDC%20Angola.pdf> accessed 16 March 2023

102 *Ibid.*

103 *Ibid.*

104 Vizzuality, 'Executive Decree No. 303/14 on the National Directorate of the Ministry of Renewable Energy - Angola - Climate Change Laws of the World' (2014) <https://climate-laws.org/geographies/angola/policies/executive-decree-no-303-14-on-the-national-directorate-of-the-ministry-of-renewable-energy> accessed 16 March 2023.

access to renewable energy technologies, promoting the use of clean energy sources in transportation, and improving the regulatory framework for renewable energy investments.[105]

Additionally, Angola has implemented Presidential Decree No. 29/16 of 2016 approving the National Plan for the Preparation, Resilience, Response and Recovery from Natural Disasters 2015-2017,[106] which outlines the country's strategy for adapting or developing resilience to climate change impacts. The plan includes initiatives such as improving water resource management, promoting sustainable land use, enhancing early warning systems for natural disasters, reducing pollution, and promoting the conservation of natural resources.[107]

While these alternative regulatory mechanisms address some of the loopholes in Angola's climate change regulatory framework, they fall far short of providing the required coverage and efficacy required to implement Angola's climate change goals, particularly in relation to compelling and incentivising corporate participation in climate change mitigation activities in the country. Consequently, this article proposes the reformation of Angola's regulatory framework through the adoption of the dilute interventionism model which has the prospect of addressing the key shortcomings of the current climate change regulatory framework – lack of climate change legislation, non-inclusion of prescriptive and facilitative measures for mitigation activities, absence of a sole independent climate change regulator and omission of corporate obligations in climate change mitigation. While all these shortcomings can be addressed by the enactment of climate change legislation, the dilute interventionism model helps to dictate the specific structure of the regulatory framework to optimise the effectiveness of the framework, particularly when dealing with corporations that have developed a culture of regulatory resistance and corporate pushbacks on the regulatory framework would be initially expected.

9. IMPLEMENTING THE DILUTE INTERVENTIONISM MODEL IN ANGOLA

The 'dilute interventionism' model is a regulatory approach that aims to promote compliance with climate change regulations by progressively increasing enforcement measures in response to violations.[108] It generally refers to a regulatory approach that emphasizes using both punishment and persuasion to encourage compliance with regulations.[109] The idea is that punishment alone may be ineffective in

[105] *Ibid.*
[106] Vizzuality, 'Presidential Decree No. 29/16 Approving the National Plan for the Preparation, Resilience, Response and Recovery from Natural Disasters 2015-2017 - Angola - Climate Change Laws of the World' (2016) <https://climate-laws.org/geographies/angola/policies/presidential-decree-no-29-16-approving-the-national-plan-for-the-preparation-resilience-response-and-recovery-from-natural-disasters-2015-2017> accessed 16 March 2023.
[107] *Ibid.*
[108] Kikelomo Kila, *Supra*-98
[109] Ibid

changing behaviour, but when combined with persuasion, it can be more effective.[110]

The key to successful dilute interventionism is establishing a synergy between punishment and persuasion.[111] Punishment can be used as a deterrent to discourage non-compliance, while persuasion can be used to encourage voluntary compliance.[112] By using both approaches, regulators can create a more balanced and effective regulatory environment.[113] Unlike other regulatory theories that prioritize facilitative measures, dilute interventionism starts with the most prescriptive measures first, rewarding compliance rather than punishing non-compliance.[114] The regulatory model uses a pyramid enforcement structure to outline the progression of interventionist measures.[115] However, unlike other regulatory theories that have a broad base and increasingly narrower structures, dilute interventionism has an inverse pyramid structure, with a narrow base and increasingly broader structures, as one moves up.[116] This change reflects the practical structuring of the interventionist elements required to prevent corporate excesses while incentivizing corporate participation in the regulatory framework.[117]

The model is based on the concept of providing corporations with a range of increasingly less severe prescriptive sanctions, such as criminal sanctions, civil liability sanctions, administrative sanctions, and penalties.[118] As corporations progress higher up the pyramid, the options become wider and less prescriptive until they reach the top, where they find the widest variety of facilitative and self-regulatory instruments available.[119]

To effectively implement the dilute interventionism model, a regulatory framework that covers all aspects of climate change, including mitigation and adaptation, is crucial.[120] An autonomous regulator must be empowered to enforce obligations and responsibilities on corporations, government bodies, and individuals concerning climate change mitigation and adaptation.[121] The regulator must have sufficient powers to monitor and enforce compliance with the regulations, including the ability to issue licenses and permits, establish appropriate standards, and impose sanctions where necessary.[122]

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110 *Ibid.*
111 *Ibid.* See also, Ian Ayres and John Braithwaite, 'Responsive Regulation: Transcending the Deregulation Debate' (Oxford University Press, 1992) <http://johnbraithwaite.com/wp-content/uploads/2016/06/Responsive-Regulation-Transce.pdf> accessed 12 April 2023.
112 *Ibid.*
113 *Ibid.*
114 *Ibid.*
115 *Ibid.*
116 *Ibid.*
117 *Ibid.*
118 *Ibid.*
119 *Ibid.*
120 *Ibid.*
121 *Ibid.*
122 *Ibid.*

The dilute interventionism approach can be applied in various sectors, including climate change.[123] However, climate change poses a distinct challenge that demands a reconfiguration of the model to achieve regulatory objectives efficiently while minimizing the intervention burden on corporations.[124] In simpler terms, the dilute interventionism model can be used to regulate climate change, but it needs to be adapted to the peculiarities of climate change to be effective without being overly burdensome on businesses.

Angola's Nationally Determined Contribution (NDC) under the Paris Agreement outlines the country's commitments to mitigate greenhouse gas emissions and adapt to the impacts of climate change.[125] Angola's NDC sets a target to reduce its greenhouse gas emissions by 35% by 2030 compared to business-as-usual scenarios, and up to 50% with international support.[126] The NDC also includes a goal to increase the share of renewable energy in the country's energy mix to 30% by 2025 and 50% by 2050.[127] To achieve these targets, the dilute interventionism model can be applied.[128] However, due to the unique challenge that climate change poses, the model must be adapted to ensure effective regulatory objectives while minimizing the burden of intervention on corporations.[129] One way to do this is to restructure the sanction mechanisms at different stages of the enforcement pyramid and incentivize compliance by offering tax credits or other financial rewards to corporations participating in climate change mitigation efforts.[130]

9.1 Regulatory Objective of Dilute Interventionism in Angola

Before discussing the modalities of implementing dilute interventionism in Angola, it is imperative to consider the main focus of the regulatory paradigm to be instituted by the model. Considering the necessity of reducing carbon emissions and its relationship with achieving mitigation goals, the dilute interventionism model restructures the regulatory system to focus on carbon emissions through various regulatory tools that promote mitigation projects and incentivise the regulatees to alter their behaviours in line with the regulatory goals.

One key element of a regulatory system under the dilute interventionism model is, therefore, setting emissions reduction targets for corporations which can be gradually increased or decreased over time depending on the corporate compliance rate. This can be accompanied by requirements for corporations to disclose their emissions data and adopt best practices for reducing carbon emissions. By doing so, the regulatory framework can encourage corporations to take concrete steps towards

123 *Ibid.*
124 *Ibid.*
125 UNFCCC, *supra -111*
126 *Ibid.*
127 *Ibid.*
128 *Ibid.*
129 Kikelomo Kila, *supra-98.*
130 *Ibid.*

mitigating climate change while providing transparency for monitoring progress.

Angola has relatively low carbon emissions compared to developed countries.[131] According to the World Bank, Angola's carbon dioxide emissions per capita were 0.6 metric tons in 2017, which is significantly lower than the average of 4.8 metric tons per capita for high-income countries.[132] However, it should be noted that Angola is a developing country with a growing economy, and its carbon emissions are expected to increase in the coming years as industrialization and urbanization continue.[133]

To effectively address climate change, Angola needs to balance the need to incentivize corporations to reduce their carbon emissions while also protecting vulnerable communities from the impacts of climate change. To achieve this balance, the government can offer incentives such as tax credits, subsidies, and grants to encourage corporations to adopt environmentally friendly practices.[134] For example, if a company invests in renewable energy sources like solar panels or uses energy-efficient equipment, it can receive financial rewards in the form of tax credits or subsidies. This can serve as a motivator for companies to reduce their carbon footprint while also benefiting financially. Incentives can be an effective way to encourage corporations to act on climate change, as they can offset the costs associated with implementing sustainable practices.[135] Additionally, incentives can help to stimulate the growth of green industries and create new job opportunities in the renewable energy sector.[136]

An additional approach to motivating corporations to reduce their carbon emissions is through the use of market-based mechanisms, including carbon pricing.[137] The government can impose a cost on carbon emissions, which would financially incentivize companies to decrease their emissions.[138] This would also generate income for the government, which could then be utilized to finance other initiatives aimed at mitigating climate change.[139] Carbon pricing can take many forms, including a carbon tax or a cap-and-trade system, and its effectiveness depends on its design

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131 UNDP, 'Angola' (2023) (UNDP Climate Promise) <https://climatepromise.undp.org/what-we-do/where-we-work/angola> accessed 16 March 2023.

132 World Bank, 'Angola | Data' (2023) <https://data.worldbank.org/country/AO> accessed 16 March 2023.

133 Olusanya Elisa Olubusoye and Dasauki Musa, 'Carbon Emissions and Economic Growth in Africa: Are They Related?' (2020) 8 Cogent Economics & Finance 1850400.

134 Kikelomo Kila, *supra-98*.

135 *Ibid*.

136 OECD, 'What Is Green Growth and How Can It Help Deliver Sustainable Development? - OECD' (2018) <https://www.oecd.org/greengrowth/whatisgreengrowthandhowcanithelpdeliversustainabledevelopment.htm> accessed 16 March 2023.

137 UNFCCC, 'About Carbon Pricing' (2022) <https://unfccc.int/about-us/regional-collaboration-centres/the-ciaca/about-carbon-pricing> accessed 9 March 2023.

138 Center for Climate and Energy Solutions, 'Carbon Tax Basics' (Center for Climate and Energy Solutions, 16 February 2018) <https://www.c2es.org/content/carbon-tax-basics/> accessed 16 March 2023.

139 *Ibid*.

and implementation.[140] However, if appropriately executed, carbon pricing can encourage companies to innovate and adopt new technologies that reduce their carbon footprint, while also supporting the transition to a low-carbon economy.[141]

9.2 Restructuring the Regulatory Framework through Dilute Interventionism - Incorporating Framework Legislation in Angola

The first step towards implementing dilute interventionism is the enactment of framework climate change legislation in Angola. To effectively address environmental challenges related to climate change, Angola should develop a comprehensive regulatory framework based on the principle of dilute interventionism.[142] This framework law should incorporate strict prescriptive instruments with specific and rigorous prescriptive measures initially to demonstrate the government's authority over corporations.[143] As corporations comply with these measures, the regulatory burden can be gradually reduced, and a co-regulatory approach can be introduced to encourage corporations to adopt sustainable practices and comply with climate change regulations.[144] This approach would strike a balance between regulatory enforcement and incentivizing corporations to participate in climate change mitigation, ultimately leading to a reduction in carbon emissions and a more sustainable future for Angola.

The Framework law should also adopt a co-regulatory approach for managing corporate participation in mitigation activities. The co-regulatory approach is a collaborative effort between regulatory bodies, corporations, and the state to enhance compliance.[145] This approach acknowledges that corporations can take responsibility for regulating themselves in specific areas of the regulatory framework once regulatory requirements have been satisfied.[146] By promoting cooperation between corporations and regulatory bodies, the co-regulatory approach can improve compliance and effectiveness in mitigating climate change. When drafting climate change regulations in Angola it is important to start with strict, prescriptive measures that demonstrate the government's authority over corporations, such as the possibility of losing their operating license.[147] As compliance improves, less severe measures can be used, such as the closure of facilities or criminal and civil sanctions against corporations and their senior officers.[148] The ultimate goal is to move

[140] UNFCCC, *supra-111*.
[141] Grant Jacobsen and Carolyn Fischer, 'The Green New Deal and the Future of Carbon Pricing' (Resources for the Future) <https://www.rff.org/publications/all-publications/the-green-new-deal-and-the-future-of-carbon-pricing/> accessed 16 March 2023.
[142] Kikelomo Kila, *supra-98*, ch 5: '*Dilute Interventionism and Framework Climate Change Legislation'*.
[143] *Ibid.*
[144] *Ibid.*
[145] *Ibid.*
[146] *Ibid.*
[147] *Ibid.*
[148] *Ibid.*

towards a self-regulatory framework by providing incentives and assistance to encourage compliance with regulatory standards.[149] This approach balances the need for effective regulation with the desire to minimize the regulatory burden on corporations. Thus, as corporations adhere to the intervention measures to a satisfactory extent, they eventually become self-regulating entities.

9.3 Establishing an Independent Climate Change Regulator

To effectively implement the dilute interventionism model, it is imperative to appoint an independent regulator that will be responsible for granting licenses to corporations and ensuring their compliance with regulations through monitoring and enforcement.[150] This approach is necessary to enforce the regulatory model, where corporations must obtain a permit from the regulator before engaging in any activity that may pose a threat to the environment or human health.[151] The regulator's role is to oversee and regulate corporations' operations to ensure they meet the required environmental standards and comply with regulations. This would promote accountability and encourage corporations to adopt sustainable practices and minimize their impact on the environment.

Angola currently lacks a climate change regulator conferred with legislative powers to oversee the climate change sector. Although there are different government offices currently overseeing NCC and ENNAC, these bodies are subject to ministerial (executive) control and lack independence to pursue the appropriate regulatory goals. Moreover, the absence of clear legislative powers significantly limits their enforcement powers over corporations and other major climate change stakeholders. Moreover, it is crucial that a single regulator is established for this purpose to avoid duplication of functions and regulatory uncertainty that can minimise regulatory effectiveness.

Additionally, the manner of establishment of the regulator is important and the relevant statutory provision must explicitly confirm the independence of the regulator, the exclusivity of its role as a regulator (i.e., a sole regulator) and the specific powers and functions conferred on the body. To ensure these criteria are satisfied, an exemplar of the proposed statutory provision is provided below:

Section 2 - Establishment of National Climate Change Agency (NCCA)

1. There is hereby established the National Climate Change Agency ('The Agency') which shall be independent and solely responsible for regulating all matters relating to climate change mitigation and adaptation in Angola.
2. The Agency shall not be subject to any direction or control of any other body, person or agency in the execution of its powers and functions vested in this Act.
3. The Agency shall have the power to –

[149] *Ibid.*
[150] *Ibid, ch:6: 'Veto Firewall' System and Technical Competence of the Climate Change Regulator'.*
[151] *Ibid.*

a. grant licenses to corporations engaged in carbon emission activities.
b. monitor and enforce compliance with the regulations on climate change mitigation and may include licensing fees to cover regulatory costs and other expenses related to the implementation of this Act.
c. set emission standards for meeting Angola's climate change targets.
d. institute mitigation measures and obligations on corporations and other private entities and enforce compliance with these measures/obligations.

9.4 Technical Competence

To ensure that corporations comply with the Climate Change Act, it is necessary to have an independent sole regulator with the technical expertise to understand the complexities of the corporations they are regulating.[152] This includes the ability to evaluate corporations' compliance, establish appropriate standards, and issue licenses with necessary conditions and restrictions. To acquire this technical expertise, the regulator may recruit external consultants with the necessary technical knowledge and experience to provide advice and support in assessing and monitoring corporations' compliance with the regulations.[153] Alternatively, partnerships may be established with technical institutions such as universities, research institutions, and professional bodies that have technical expertise in various fields related to climate change mitigation.[154]

The regulator must be well-equipped to address complex issues such as carbon pricing, emission trading, and other regulatory mechanisms that may require specialized knowledge. It is crucial to have access to the latest scientific and technological advancements to ensure that regulations remain current and effective. By collaborating with external experts and institutions, the regulator can expand its capacity to understand and address the complexities of climate change mitigation while ensuring that the corporations it regulates comply with the Climate Change Act. This collaboration will help foster innovation and ensure that regulatory frameworks are tailored to specific industries, allowing for the effective implementation of mitigation strategies.

9.5 Implementing Veto Firewall Protection for the Climate Change Regulator in Angola

A firewall is a piece of software or hardware that is used to protect against unauthorized network access.[155] To ensure the independence and

[152] *Ibid.*
[153] *Ibid.*
[154] *Ibid.*
[155] Chinmayee Deshpande, 'What Is Firewall: Types, How Does It Work & Advantages' (2022) Simplilearn <https://www.simplilearn.com/tutorials/cyber-security-tutorial/what-is-firewall#:~:text=Firewalls%20are%20network%20security%20systems> accessed 1 March 2023.

impartiality of the proposed independent climate change regulator in Angola, it is essential to establish a protective mechanism known as "veto firewall protection".[156] This mechanism creates a safeguard around the regulator using the State's veto powers to prevent any undue influence or pressure from members of the Executive.[157] Although the senior officials of the regulator will be appointed by the President, to ensure the regulator's autonomy, a single or dual-tier veto firewall system should be established. This system will prevent any executive member from interfering with the regulatory functions of the independent regulator.[158] By doing so, the regulator can carry out its mandate to mitigate and adapt to climate change without any external pressures or influences, thus ensuring the regulator's impartiality and independence.[159]

A single-tier veto firewall requires the approval of only one veto body (parliament) for the appointment and removal of the senior officials of the regulator. On the other hand, the double-tier veto firewall requires an additional veto player in the appointment or removal of the senior officials of the regulator. Usually, this additional veto player is an independent body that makes recommendations to the President in terms of the appointment and removal of the regulator's senior officials.

The dual-tier system is used mostly in the appointment of high-level officials in Angola as the Angolan Constitution provides for a system of checks and balances, with the President, National Assembly, and judiciary sharing power and responsibility.[160] For example, the appointment of the Governor of the National Bank of Angola, which is governed by the Law on the National Bank of Angola (Lei do Banco Nacional de Angola), outlines the qualifications, appointment process, and responsibilities of the Governor of the National Bank. According to Article 17 of the law, the President of the Republic appoints the Governor, after consultation with the Council of the Republic and with the approval of the National Assembly.[161] Similarly, the appointment of the Chief Justice of the Supreme Court and other judges is done after hearing the opinion of the Higher Council of the Judicial Magistracy and with the prior authorization of the National Assembly.[162]

Veto firewall protection is a concept based on the principle of good governance and is considered a best practice for ensuring the independence of regulatory bodies.[163] To ensure the independence of the climate change regulator in Angola, it is recommended to establish a dual-tier veto firewall protection process, which provides two layers of

[156] *Ibid.*
[157] *Ibid.*
[158] *Ibid.*
[159] *Ibid. See also*, Kikelomo Kila *supra-98.*
[160] Inge Amundsen, 'Good Governance in Angola: Parliamentary Accountability and Control' (2010) (CMI - Chr. Michelsen Institute) <https://www.cmi.no/projects/386-good-governance-in-angola> accessed 16 March 2023.
[161] Article 17, Lei do Banco Nacional de Angola.
[162] Article 176(1) of the Constitution of Angola. See also, Article 163 of the Angolan Constitution.
[163] Kikelomo Kila, *supra-98.*

protection against political interference.[164] The first layer of protection involves the creation of an independent body that will recommend candidates for key positions in the climate change regulator. The members of this body should be experts with relevant experience and knowledge in the field, and their recommendations should be based on merit and expertise rather than political considerations.

The second layer of protection involves making the appointment or removal by the President based on the recommendations of the independent body subject to the approval of the National Assembly. This additional layer of scrutiny and oversight by elected representatives ensures that the recommended candidates are qualified and suitable for the positions and reduces the likelihood of political interference.

Implementing this dual-tier veto firewall protection process will safeguard the climate change regulator in Angola against undue influence and pressure from political actors, ensuring its autonomy and impartiality in fulfilling its mandate to mitigate and adapt to climate change.[165]

An exemplar of a statutory provision instituting the veto firewall protection for the climate change regulator is provided below –

Section 3: Appointment and Removal of Members of the Agency

1. The Chairman and senior officials of the Agency shall be appointed by the President.
2. The appointment shall be based on a recommendation from an independent group of climate change experts to be set up by the Chief Justice.
3. The appointment shall be subject to approval by the Senate.
4. The Chairman and Senior Officials shall have a fixed tenure of 4 years renewable for another 4 years.
5. The Chairman and Senior Officials shall be removed from office by the President based on a recommendation by the Independent Group of Experts for proven cases of misconduct or incapacity of the mind or body subject to the approval of the Senate.

9.6 Mapping Regulatory Reforms for Climate Change Mitigation in Angola

Based on the foregoing, there are specific requirements that must be fulfilled for a comprehensive reform of Angola's climate change regulatory framework through the dilute interventionism model. Table 1 below encapsulates the relevant issues that must be addressed in the reformation of the climate change regulatory framework, the steps required to achieve the objective and what each step entails. By incorporating these action points, Angola can redesign its climate change regulatory framework for optimal actualisation of its climate change goals.

[164] *Ibid.*
[165] *Ibid.*

Table 1: Roadmap for Reforming Angola's Climate Change Regulatory Framework

Issue	*Action Point*
Absence of Framework Climate Change Legislation	Enact a Climate Change Act
Absence of Climate Change Regulator	Establish the National Climate Change Agency (NCAA) as the sole independent climate change regulator.
Corporate apathy to mitigation projects	Impose climate change obligations on corporations in the Climate Change Act with the regulator given enforcement powers
Securing the independence of the regulator through a Veto Firewall	Institute a Dual-Tier veto firewall system in the Climate Change Act. 1st Tier – recommendation by an independent group of experts 2nd Tier – Approval by Senate
Incentivising Corporate participation in mitigation projects through regulatory tools	Institute prescriptive and facilitative measures in the Climate Change Act. Prescriptive Measures (fines, loss of license etc.) Facilitative Measures (Tax incentives, self-regulation etc)

10. DILUTE INTERVENTIONISM AND SUBSIDIARY LEGISLATION BY THE CLIMATE CHANGE REGULATOR

For the dilute interventionism model to be effectively implemented, it is crucial to have a regulatory framework that covers all aspects of climate change, including mitigation and adaptation. This framework must empower an autonomous regulator to implement the model by enforcing obligations and responsibilities on corporations, government bodies, and individuals concerning climate change mitigation and adaptation.[166]

Furthermore, the regulatory framework must provide for subsidiary legislation by the regulator. This involves the development of rules, guidelines, and procedures by the regulator to provide additional details and clarity on how to comply with the regulations. To ensure transparency and accountability in the regulatory process, this paper recommends that the subsidiary legislation should be published and made accessible to the public. To ensure that the regulatory framework is effective, it must be designed in a way that can withstand opposition from corporations that may resist regulatory oversight.[167] This requires that the regulatory

[166] *Ibid.*
[167] *Ibid.*

framework demonstrates the state's authority over corporations.[168] Strict prescriptive measures should be included in the legal instruments to deter non-compliance with the regulations. These measures may include severe penalties such as the revocation of operating licenses, the closure of operating facilities, and criminal or civil sanctions against corporations and their senior officers.[169]

The regulatory framework should, therefore, be flexible enough to allow the regulator to create subsidiary legislation that complements the general provisions in the framework legislation. This ensures that the regulatory framework is adaptable to changing circumstances and can address specific issues that may arise.[170]

The power of the regulator to promulgate subsidiary legislation provides it with the power to develop and implement specific regulatory measures to enforce compliance with the Climate Change Act. This may include the establishment of standards, procedures, and rules that set out the required intervention measures to be implemented by corporations. These measures may also prescribe specific consequences for non-compliance, such as revocation of licenses, closure of operating facilities, and the imposition of civil or criminal sanctions against corporations and their senior officers.

Furthermore, to ensure that the regulatory framework is effectively implemented, it is essential to streamline the regulation of multiple sectors that contribute to carbon emissions under a single comprehensive framework.[171] This approach will provide clarity to corporations regarding their obligations, the regulatory body responsible for enforcing compliance, and timelines for meeting regulatory standards.[172] To achieve this, regulatory bodies responsible for various sectors contributing to carbon emissions, such as the oil and gas, manufacturing, and electricity and power sectors, should be stripped of their powers over carbon emissions regulations. These powers should instead be centralized under a single independent regulator responsible for climate change mitigation and adaptation.[173]

This consolidation will allow the regulator to concentrate on its goals without duplicating regulatory functions between different entities, making the regulatory process more efficient and effective in reducing carbon emissions and promoting sustainable development.[174] By consolidating regulatory powers under a single independent regulator, corporations will benefit from greater clarity and certainty in complying with regulations, while the regulator can focus on enforcing compliance and monitoring progress towards meeting targets set out in the Climate Change Act.

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[168] *Ibid.*
[169] *Ibid.*
[170] *Ibid.*
[171] *Ibid.*
[172] *Ibid.*
[173] *Ibid.*
[174] *Ibid.*

11. DESIGNING A DILUTE INTERVENTIONISM PYRAMID IN ANGOLA

One effective strategy for climate change mitigation and adaptation in Angola is to create a "dilute interventionism pyramid" framework.[175] This approach involves using a severe form of intervention as the first step in the enforcement process without resorting to harsh criminal sanctions that may discourage participation in climate change activities to a milder form of intervention as compliance persons.[176] For example, shutting down facilities that are not compliant with recommended carbon emissions levels can act as a deterrent without resorting to harsh criminal sanctions.

Once corporations comply with climate change regulations, the focus should shift to holding the highest-ranking officials accountable through civil and administrative sanctions.[177] These sanctions can include fines, penalties, or administrative actions such as suspension or revocation of permits or licenses.[178] By enforcing such measures, the regulatory framework can effectively encourage corporations to comply with climate change regulations and uphold their responsibilities to mitigate and adapt to the impacts of climate change. The imposition of these measures can also function as a deterrent to non-compliance and ensure that those in positions of power take responsibility for their corporation's actions. It is crucial to ensure that the regulatory framework can effectively enforce such measures to maintain compliance with climate change regulations and promote sustainable development.

The third step in the regulatory pyramid for climate change mitigation and adaptation in Angola involves allowing corporations to establish self-regulatory or voluntary measures to achieve regulatory objectives.[179] The government provides the overall framework within which these measures operate, ensuring that they align with national climate change goals. As long as corporations comply with these measures, the last step in the pyramid is activated, that is, the government can incentivize their efforts through economic and fiscal incentives.[180] These incentives may include tax breaks, rebates, and subsidies for sustainable projects, which can help promote the adoption of sustainable practices while simultaneously contributing to the overall economic growth of the country.[181] This approach can encourage corporations to fully commit to climate change mitigation and adaptation efforts, ultimately benefiting both the environment and the economy.

[175] Kikelomo Kila, *supra-98*.
[176] *Ibid.*
[177] *Ibid.*
[178] *Ibid.*
[179] *Ibid.*
[180] *Ibid.*
[181] *Ibid.*

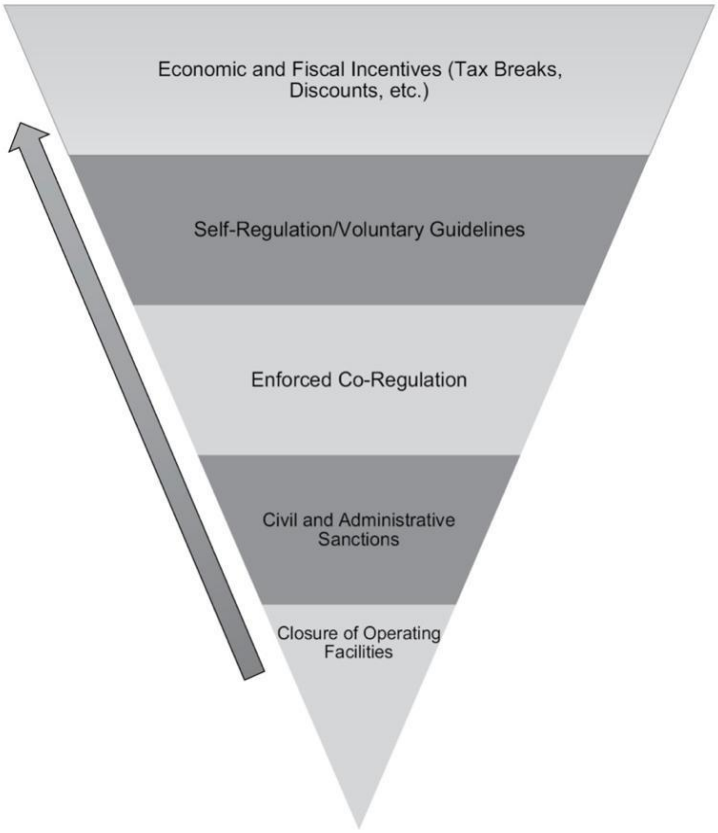

Figure 1: Corporate Regulation for Climate Change Mitigation in Africa (Source: Kila[182])

12. CHALLENGES TO IMPLEMENTING DILUTE INTERVENTIONISM AND VETO FIREWALL PARADIGM IN ANGOLA

The implementation of dilute interventionism and veto firewall paradigms in Angola may face several challenges. Some of them are:

12.1 Lack of Political Will and Commitment

A lack of political will and commitment to enforcing climate change regulations in Angola may lead to the failure to establish the necessary regulatory framework and institutions. Additionally, a lack of awareness and understanding of the importance of climate change mitigation and adaptation may hinder the implementation of the paradigm. This can be addressed through public education and advocacy campaigns, as well as engaging political leaders to emphasize the importance of climate change mitigation and adaptation.

[182] Kikelomo Kila, Corporate Regulation for Climate Change Mitigation in Africa, (1st Edition, Routledge, 2022)

12.2 Lack of Expertise and Technical Knowledge

Lack of expertise and technical knowledge in the field of climate change may limit the capacity of regulatory bodies and institutions to implement and enforce the necessary regulations effectively. The absence of local research and data on climate change and its impacts in Angola may also impede the development of effective regulations and policies. To address this, Angola may need to invest in building local capacity by training and hiring experts in climate change and related fields, as well as investing in local research and data on climate change and its impacts. This will enable the development of effective regulations and policies that are tailored to the local context.

12.3 Corruption and Political Interference

Corruption and political interference may pose a significant challenge to the implementation of the dilute interventionism and veto firewall paradigm. The independence of regulatory bodies and the judiciary may be compromised, leading to a lack of accountability and transparency in the implementation of climate change regulations. This can pose a significant challenge to the implementation of the dilute interventionism and veto firewall paradigm. To address this, the government must prioritize anti-corruption measures and ensure that regulatory bodies are independent and free from political interference.

12.4 Lack of Resources

Finally, the economic impact of climate change regulations may be a significant challenge, particularly for small and medium-sized enterprises that may lack the resources to comply with the regulations. The government may need to provide economic and fiscal incentives to encourage corporations to comply with the regulations and invest in sustainable projects, which may require significant resources and funding. However, providing such incentives may require significant resources and funding, which can be a challenge for the government. Hence, innovative financing mechanisms and partnerships with the private sector and international organizations may be necessary to mobilize the resources required for the implementation of the regulatory framework.

13. CONCLUSION

Angola must prioritize the reformation of its climate change mitigation framework by instituting a comprehensive regulatory framework that incorporates global best practices. The dilute interventionism model and veto firewall paradigm can be effective strategies for reforming the climate change regulatory framework in the country and its implementation can enable Angola to curtail corporate excesses and resistance to participating in mitigation projects. To achieve this, Angola must enact a framework climate change legislation that incorporates prescriptive and facilitative measures, impose climate change

obligations on corporations, establish an independent sole regulator for climate change and institute a veto firewall protection for the regulator.

However, the country faces challenges such as a lack of political will and awareness, resistance from the private sector, limited financial capacity, and bureaucratic obstacles, which must be addressed to ensure the successful implementation of these strategies. To secure a sustainable future for Angola, the government must work in collaboration with relevant stakeholders to create a comprehensive legislative framework that promotes economic growth while ensuring compliance with climate change regulations. This framework should prioritize climate change mitigation and adaptation and encourage the adoption of environmentally friendly practices, including the use of renewable energy, carbon capture and storage, and sustainable land use practices.

Furthermore, the government must prioritize the education and awareness of its citizens on the importance of mitigating climate change and adapting to its impacts. This can be achieved through capacity-building programs, increasing public education, and establishing effective monitoring and enforcement mechanisms. It will require close collaboration with private sector entities and other stakeholders, including civil society organizations, academia, and international partners, to ensure that the framework is tailored to suit Angola's unique circumstances.

By implementing these strategies, Angola can ensure long-term environmental sustainability and minimize the impacts of climate change within its jurisdiction. The government must take prompt action to tackle the urgency of the situation and adopt a comprehensive approach that incorporates best practices from around the world. This will require overcoming the challenges faced and prioritizing both climate change mitigation and adaptation to secure a sustainable future for the country.

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AUTHOR'S DECLARATION AND ESSENTIAL ETHICAL COMPLIANCES

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Research involving human bodies or organs or tissues (Helsinki Declaration)
The author(s) solemnly declare(s) that this research has not involved any human subject (body or organs) for experimentation. It was not a clinical research. The contexts of human population/participation were only indirectly covered through literature review. Therefore, an Ethical Clearance (from a Committee or Authority) or ethical obligation of Helsinki Declaration does not apply in cases of this study or written work.

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The author(s) solemnly declare(s) that this research has not involved any animal subject (body or organs) for experimentation. The research was not based on laboratory experiment involving any kind animal. The contexts of animals not even indirectly covered through literature review. Therefore, an Ethical Clearance (from a Committee or Authority) or ethical obligation of ARRIVE does not apply in cases of this study or written work.

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OIL PIPELINES VANDALISM AND OIL THEFT: SECURITY THREAT TO NIGERIAN ECONOMY AND ENVIRONMENT

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ABSTRACT

Nigeria is a middle income country whose economy depends largely on crude and refined oil from its natural environment. A larger percentage of Nigeria economy survives mainly on the incomes from oil production. Over the years, there is recurrent dwindling oil revenue orchestrated by oil pipelines vandalism and oil theft in the environment. This is predominant in the Niger Delta Region of Nigeria. This menace has wreaked havoc on the Nigeria's economy. Currently, the Nigerian National Petroleum Company Limited (NNPCL) claims the losses of 470,000 barrels per day of crude oil amounting to $700 million monthly due to oil theft. The disquiets of these menaces in the environment, which have posed serious threat to Nigeria's economy, are addressed in this paper. This paper employed the doctrinal legal research methodology in evaluating the recurrent oil pipelines vandalism and oil theft causing a devastating economic meltdown. On this premise, this paper finds that persistent loss of barrels of crude oil and degradation of the environment are due to the lack of adequate security measures and proper enforcement of Oil Pipelines Act together with other relevant environmental laws. Based on the findings, this paper recommends a review of the Oil Pipelines Act, the establishment of a strong environmental security surveillance, and creation of a special court for accelerated prosecution of vandals. It concludes that this will mitigate the alarming economic meltdown of the Nigeria's economy and promote a sustainable serene environment.

Keywords: Oil pipelines; Vandalism; Economy; Security; Theft; Environment

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**Oil Pipelines Vandalism and Oil Theft:
Security Threat to Nigerian Economy and Environment**

1. INTRODUCTION

Nigeria, as a middle income and oil producing nation has suffered drastic loss of revenue to the hands of vandals who are persistently engaged in oil pipelines vandalism and theft of crude oil in the environment. This situation is very alarming and calls for urgent attention as the nation's economy is going down day by day in a shattering condition.

Reports by The Pointer[1] newspaper discloses that Nigeria loses $700 million monthly due to pipeline vandalism and oil theft in the environment. The Senate President[2] made a call at a meeting with security chiefs in Abuja, lamenting that crude oil theft has badly affected the country in fulfilling its annual projections. This meeting with the head of security agencies was the second since the law-makers went on their annual vacation. According to the Senate President, security agents have fought well in dealing with bandits who were either killed or arrested alive while such efforts should be directed at dealing with oil thieves. He said:

> "We want to see trials of people who are caught because, when this happens, citizens will know that nobody, no matter how high that person is, can go scot-free, if he or she decides to get involved in this kind of criminal activity"[3].

The Senate President also filed suits in Nigerian courts across the country pleading to expeditiously adjudicate cases bordering on crude oil theft and expose those elements behind the racketeering that has brought the nation to its knees.[4] It suffices to say that due to oil pipelines vandalism and theft of crude and refined petroleum products, Nigeria has suffered huge financial losses. Oil pipelines vandalism has serious implications in the environment putting Nigeria in a great disadvantage with regard to ecological and socio-economic impact. It also leads to environmental degradation, loss of revenue, and loss of jobs. Based on the above, this paper is divided into four parts, including the introduction to allow for proper elucidation of issues. Part two discusses the catastrophe of vandalism and oil theft on the environment, which lays the background for the discussion on the effectiveness of the available legal framework to address the menace highlighted in part three. Part four, which is the last part, concludes the paper.

2. THE CATASTROPHE OF VANDALISM AND OIL THEFT IN THE ENVIRONMENT

Vandalism in the environment is the act of wilful or ignorant destruction of public or private property, actions or attitudes of one who maliciously or ignorantly destroys or disfigures public or private property.[5]

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1 The Pointer, 'Oil Theft: Senate Fumes, Demands Speedy Trial of Suspects' 'As Nigeria Loses $700 m Monthly' (2022) 1 Tuesday 13 September 2022.
2 Ahmed Ibrahim Lawan, President of the Senate of the Federal Republic of Nigeria, (2022)
3 Ibid, 1.
4 Ibid
5 Bryan A. Garner, et al, 'Black's Law Dictionary' 11th edn. (USA; Thomson Reuters) (2019) 1867

Petroleum pipeline vandalism in the environment has to do with the violation of the safety and functional integrity of a petroleum pipeline for political, economic or idiosyncratic reasons. This principally takes the form of sabotage, motivated by political reasons or theft motivated by economic need.[6] Oil pipelines vandalism in the environment is majorly confronted with two destructive factors, viz. sabotage and theft of crude oil, which entails a situation whereby the perpetrator intentionally hack into the oil pipelines in order to divert the product thereof for commercial purpose or conversion into personal use.

Oil theft in the environment involves the stealing of crude oil and its derivatives from pipelines through a variety of mechanisms including illegal bunkering and fuel pilfering.[7] The issues relating to oil pipelines vandalism can be best explained and understood from the general premise of its operational elements of crime. Propounded by criminologists, the structural theory holds that crime is a creation of the society and that people tend to take to crime principally as a consequence of existential conditions making a criminal living not only attractive but also compelling.[8]

Nigeria is a country well-endowed with environmental natural crude oil and its economy depends largely on the proceeds from crude and refined oil. Oil wealth and petroleum resources account for about 75% of Nigeria's foreign exchange earnings.[9] Thus, it can rightly be said that the petroleum sector is the mainstay of Nigeria's economy. It is justifiably seen as the backbone of Nigeria's economy. Notwithstanding, it has created a double-edged sword simultaneously centred as a platform for primeval accumulation of wealth as well as a means of violating oil regulations relating to oil rents from the natural environment. Within this sector, petroleum rents from the natural environment have been the object of an opportunistic scramble by corrupt political elites and their counterparts. In effect, the significance of oil wealth in Nigeria has been contradictory; it has been a blessing as well as a curse by generating both revenue and criminality in the Nigerian environment. This seeming paradox resonates with the resource-curse thesis, which holds, among other things, that oil-rich nations have the tendency to squander their development prospects through the abuse or mismanagement of their oil wealth.[10]

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6 Reuters and Akintunde Akinleye, 'Oil Pipeline Vandalism in the Niger Delta', 2 September (2019) <https://www.accord.org.za/conflict-trends/oil-pipeline-vandalism-in-the-niger-delta/> accessed 27 February 2023.

7 Odalonu Boris, 'The Upsurge of Oil Theft and Illegal Bunkering in the Niger Delta Region of Nigeria; Is There Any Way Out'? Mediterrean Journal of Social Sciences, (2015) 6 (3), 363-573.

8 Alemika Etannibi, 'The Impact of Organized Crime on Governance in West African', (ed.) (Abuja-Nigeria: Friedrich-Ebert Stiftung) (2013) 55-75.

9 Okoli Al Chukwuma, 'Petroleum Pipeline Vandalism and National Security in Nigeria', PhD Thesis Submitted to the School of Postgraduate Studies, Nigerian Defence Academy, Kaduna, (2012).

10 Ibeanu Okechukwu, 'Oil, Environment and Conflict in Coastal Zone of West Africa', cited in Ibeanu Okechukwu and Ibrahim Jibrin, 'Beyond Resource Violence' (Abuja-Nigeria, Centre for Democracy and Development "CDD") (2020) 1-34. <www.accord.org.za> accessed 27 October 2022.

It is sad to mention that all these menaces are befalling Nigerians in the face of numerous environmental law enforcement agencies and security agents such as the navy, army, police, joint task force, Nigeria Civil Defence Corps, et cetera. For instance, National Oil Spill Detection and Response Agency[11] (NOSDRA), which was established as an institutional framework to coordinate the implementation of the National Oil Spill Contingency Plan (NOSCP) for Nigeria[12], Oil Pipelines Act[13] and Environmental Impact Assessment Act,[14] have ample legal frameworks for the conservation and protection of the Nigeria environment and its rich natural resources, but what Nigerians experience in reality is vandalism of oil pipelines and theft of crude and refined oil especially in the Niger Delta Region of Nigeria.

The consequence of this laxity on the part of the Nigeria Government has over the years led to the illegal construction and operation of oil pipelines in the environment by those who do not have operational license, oil pipelines vandalism and theft of oil in the country. Thus, all these menaces have grossly reduced the Nigeria economy. It is alarming that the nation's revenue goes down day by day. It is almost at the verge of becoming nothing and the government seems to be reluctant in taking effective action to alleviate it, rather it resorted to borrowing from international financial Institutions and foreign governments.

Nigeria, as a nation, now runs a constant deficit budget instead of surplus budget due to incessant oil theft, oil pipelines vandalism, illegal construction and operation of oil pipelines in the environment whereby crude oil is being diverted. Presently, the federal government of Nigeria has made plan to borrow NGN 8.80 trillion (USD 20,203) to fund the 2023 budget. According to media report,[15] President Muhammadu Buhari has presented on 7 October 2022 a total budget proposal of NGN 20.51 trillion (USD 47,065) to the National Assembly for the 2023 fiscal year. The proposal came with a deficit of NGN 10.78 trillion (USD 24,749) which represents 4.78 per cent of estimated Gross Domestic Product (GDP) and above the 3 per cent threshold set by the Fiscal Responsibility Act.[16]

According to President Buhari, the deficit will be financed by new borrowing totaling NGN 8.80 trillion (USD 20,203), NGN 206.18 billion (USD 473,357) from privatization proceeds and NGN 1.77 trillion (USD 4.064) on bilateral multilateral loans secured for specific development projects. The budget as proposed was based on key parameters and assumptions, which include oil price benchmark of $70 per barrel; daily oil production estimate of 1.69 million barrels (inclusive of condensates of 300,000 to 400,000 barrels per day); exchange rate of NGN 435.57 (USD 1) and projected GDP growth rate of 3.75 per cent and 17.16 per cent inflation rate.[17]

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11 (Establishment) Act, 2006.
12 <https://www.un-spider.org/national-oil-spill-contingency-plan> accessed 31 March 2023.
13 CAP. O7, Laws of the Federation of Nigeria (LFN), 2004.
14 CAP E12 Laws of the Federation of Nigeria (LFN), 2004.
15 The Guardian, 'Buhari Plans Borrowing N8.80 trn To Fund 2023 Budget', Vol. 39: No.15,990, Saturday 8 October (2022) 1 & 2.
16 Established 30 July 2007 Act No. 31.
17 Ibid, n.15.

The above report revealed the extent to which the Nigeria economy has been battered and shattered. This paper submits that this crushing economic meltdown is as a result of lack of preservation and management of the natural resources in the environment. Oil pipelines are being vandalized and the nation's precious crude oil stolen by hoodlums but the government has continued to pay a deaf ear to the cry of the citizens to beef up securities in order to secure this natural precious gift from God. This menace and the lackadaisical attitude of the government to forestall it have led to several nation-wide protests by awaken citizens, members of Petroleum and Natural Gas Senior Staff Association of Nigeria. They demanded proactive action from the government and stakeholders' sequel to the economic havoc caused by oil thieves and oil pipelines vandals in the environment.

The government has been borrowing to finance fiscal gaps without planning how the huge amount of indebtedness can be refunded. Explaining the reason for the country's indebtedness, President Buhari quoted thus:

> "Over time, we have resorted to borrowing to finance our fiscal gaps. We have been using loans to finance critical development projects and programme aimed at further improving our economic environment and enhances the delivery of public services to our people. As you are aware, we have witnessed two economic recessions within the period of this Administration. A direct result of this is the significant decline in our revenue generating capacity. In both cases, we have to spend our way out of recession, resulting in higher public debt and debt services. It is unlikely that our recovery from each of the two recessions would have been as fast without the sustained government expenditure funded by debt."[18]

Evaluation of the above assertions made by the President revealed that the country has gone to its worst state of economic meltdown. It is, therefore, the view of this paper that the Government of Nigeria must stop this incessant borrowing as the level of indebtedness keep on rising without any improvement on the economy and the environment. It is appalling to note that a country with different security agents such as the Nigerian Navy, Nigerian Civil Defence Corps, Joint Task Force, et cetera have failed to protect its major source of income from the hands of thieves. These security agents, in their respective capacities, have in several occasions arrested these hoodlums but the outcome has always be an exercise of futility.

The rhetorical questions that are asked include: how can illegal vessels carry oil across the sea without the knowledge of the Naval Officers? How can private individuals construct illegal oil pipelines in the environment to divert Nigerian crude oil without the knowledge of the military or the Nigeria Civil Defence Corps? This paper argues that selfish

[18] Ibid

interest and corrupt practices of the government officials have over time truncated effective service delivery of these security agents.

Recently, there was a media report in Daily Sun[19] tagging "Government Officials behind Oil Theft". In a Private Sector Economic Forum organized by the Lagos Chamber of Commerce and Industry before the 2023 presidential election, Peter Obi, the Labour Party Presidential Candidate, who was guest speaker at the forum, asserted that no one can steal oil except the government. He added that, "subsidy is organized crime", "we need an aggressive production of local refining"[20]. Peter Obi blamed the Government of Nigeria for the rising incidence of oil theft in the environment, which has greatly crippled the country's economy. It is the view of this paper that the response of the government towards curbing the incessant vandalism and oil theft in the environment is not satisfactory and should be blamed for its inaction.

The country's legislators are good at making laws without any strong legal framework for implementation of the laws they make. Thus, Part II of the National Environmental Standard and Regulation Enforcement Agency (NESREA) Act provides for the functions and powers of National Environmental Standard and Regulation Enforcement Agency (NESREA) to the effect that NESREA, as an environmental enforcement agency, shall enforce compliance with laws, guidelines, policies and standards on environmental matters;[21] enforce compliance with the provisions of international agreement, protocols, conventions and treaties on the environment, including climate change, biodiversity, conservation, desertification, forestry, oil and gas, chemicals, hazardous wastes, ozone depletion, marine and wildlife, pollution, sanitation and such other environmental agreements as may from time to time come into force.[22]

The agency is saddled with the responsibility for the protection and development of the environment, biodiversity, conservation and sustainable development of Nigeria's natural resources in general, and environmental technology, including coordination and liaison, with relevant stakeholders within and outside Nigeria on matters of enforcement of environmental standards, regulations, rules, laws, policies and guidelines.[23]

Specifically, section 7(a) and (c) of NESREA Act empowers the agency to enforce compliance with environmental laws through collaboration with relevant agencies including NOSDRA on matters relating to pollution, oil and gas, among others.

NOSDRA Act[24] establishes the National Oil Spill Detection and Response Agency as the coordinating and monitoring body on the implementation of federal government policies on National Oil Spill Contingency Plan. The agency also has a governing board known as

[19] Daily Sun, Tuesday 20 September (2022) 1 & 25.
[20] Ibid
[21] Section 7 (a) NESREA Act, 2007.
[22] Section 7 (c) NESREA Act, 2007.
[23] Section 2 NESREA Act, 2007
[24] (Establishment) Act 2006 (No. 15 of 2006). <www.fao.org> accessed on 31 March 2023

National Oil Spill Response Governing Board. The agency is a body corporate responsible for surveillance and ensuring compliance with all existing environmental legislation and the detection of oil spills in the petroleum sector.[25]

It shall also receive reports of oil spillages and coordinate oil spill response activities throughout Nigeria and the implementation of the plan as may be formulated from time to time by the Federal Government. Furthermore, the agency shall coordinate the implementation of the plan for the removal of hazardous substances as may be issued by the Federal Government.[26]

Sequel to the above provisions of the NOSDRA Act, it is crystal clear that the government has a major role to play in terms of formulation of policies relating to effective security surveillance, implementation and compliance with all existing environmental legislation. On the contrary, the desired expectation of Nigerians from the Federal Government on effective policy making and implementation in securing and sustaining the Nigeria's environment and its natural resources, particularly the natural crude oil, is far from realization.

Recently, there was an outcry from the National Assembly calling on the Federal Government to beef up security and prosecute oil thieves, following the economic sabotage of oil theft in the country. The Senate President, Ahmed Lawan, and the Speaker of the House of Representatives said that the government must rise to halt the social malaise and arrest the thieves. Both presiding officers of the National Assembly spoke during the presentation of 2023 budget proposal by President Muhammadu Buhari before a joint session of the national parliament on September 7, 2022.[27]

Enraged by the unhealthy development and its negative impact on the economy and the environment, Lawan specifically said that oil thieves have declared war on the country. He further said that about 1 million barrels of oil were being lost on daily basis, saying that such was unacceptable.[28] In his statement, he lamented:

> "Mr. President, our economy is still challenged by dearth of revenues. The main source of revenue to the Nigerian Government is oil and gas. We always consider the diversification of the economy as crucial and its indeed crucial… with conflicting figures, projections have put our losses from this malaise at between 700,000 to 900,000 barrels of crude oil per day leading to about 29 to 35 percent loss in oil revenue in the first quarter of 2022. This represents an estimated total fall from N1.1 trillion recorded in the last quarter of 2021 to N790 billions in the first quarter of this year. The situation has worsened. Recently, the loss of our oil has reached 1 million barrels per day. Translated into monetary terms, our loss is monumental. The figures show we are

[25] Ibid
[26] Ibid
[27] Vanguard, 'Fight oil thieves, they have declared war on Nigeria' Vol. 19: No.9442, Saturday 8 October (2022) 1 & 11.
[28] Ibid

not able to meet the OPEC daily quota of 1.8 million barrels per day."[29]

Following the devastating state of the Nigeria economy and the environment, one will doubt if environmental laws and security agents actually exist in Nigeria owing to the increasing rate of oil pipelines vandalism and theft of crude and refined oil, which has posed serious threat to the nation's economy. In this regard, this paper examines some relevant provisions of the Nigeria's Oil Pipelines Act.

3. LEGAL FRAMEWORK OF THE OIL PIPELINES ACT

The Oil Pipelines Act, Cap O7 Laws of the Federation of Nigeria (LFN) 2004 (hereinafter referred to as the Oil Pipelines Act) commenced with a beautiful preamble to the effect that it is an Act to make provision for licences to be granted for the establishment and maintenance of oil pipelines incidental and supplementary to oilfields and oil mining and for purposes ancillary to such pipelines.[30]

3.1 Permit to Survey

Part II of the Oil Pipelines Act provides that any person may make an application to the Minister in accordance with the provisions of the Act and of any regulations made thereunder for the grant of a permit to survey the route for an oil pipeline for the transport of mineral oil, natural gas or any product of such oil or such gas to any point of destination to which such person requires such oil, gas or product to be transported for any purpose connected with the petroleum trade or operation.[31]

Procedurally, every application for a permit to survey shall specify the approximate route or alternative routes proposed[32] and the Minister may grant the permit to survey on payment of the fees required by section 31 of the Act to be paid by the applicant on the submission of the application and on grant of the permit to survey respectively.[33] The Minister may also refuse to grant the permit to survey for reasons that appear sufficient to him.[34] Where the applicant's application is not successful or if the Minister refuses to grant the permit to survey, he shall notify the applicant in writing of such refusal and the reasons thereof.[35]

It is important to mention that an applicant who is applying for a permit to survey shall pay a meagre sum of 20 NGN as an application fee upon submitting his application and a fee of 50 NGN upon the grant of such permit. The applicant for a licence shall pay a fee of 50 NGN upon submitting his application and a fee of 200 NGN upon the grant of such licence.[36] It is the view of the author that the provisions of the Act relating

[29] Ibid
[30] CAP. O7, Laws of the Federation of Nigeria (LFN), 2004
[31] Section 4 (1) Oil Pipelines Act
[32] Section 4 (2) Oil Pipelines Act
[33] Section 4 (3) Oil Pipelines Act
[34] Section 4 (3) (b) Oil Pipelines Act
[35] Section 4 (4) Oil Pipelines Act
[36] Section 31 (1) & (2) Oil Pipelines Act

to application for permit to survey and the respective meagre fees prescribed is not tenable in this present time. These provisions should be reviewed.

3.2 Notice before Entry, Damage, Compensation[37]

Sequel to the foregoing, section 6(1) provides that except with the precious consent of the owner or occupier, no person shall under the authority of section 5 of the Act enter any building or upon any enclosed court or garden attached to any building, without previously having given the owner or occupier at least fourteen (14) days' notice of his intention to do so, nor enter upon any cultivated land without having given such notice to the owners or occupiers thereof or having affixed such notice in some prominent position upon such land.

Moreover, no person shall under the authority of section 5 of the Act as stated above enter any of the lands described in section 15 of the Act except with the prior assent of the owners or occupiers or persons in charge of such lands.[38] The holder of a permit to survey acting under the authority of section 5 of the Act shall take all reasonable steps to avoid unnecessary damage to any land entered upon and any buildings, crops or profitable trees thereon, and shall make compensation to the owners or occupiers for any damage done under such authority and not made good.[39] That being as it were, in the event of any dispute as to the amount of compensation to be paid or as to whether or to whom any compensation shall be paid, the provisions of Part IV of this Act shall apply.

The above provisions on permit to survey, its effect and the meagre fees prescribed under the Oil Pipelines Act are very archaic and need serious review. The amount of money payable in respect of application for permit to survey and grant of permit make a whole jest of the Act. This paper recommends a serious upward review on the various fees. On this note, the paper proceeds on evaluation of the legal framework of oil pipeline licence and the oil and gas pipeline regulations.

3.3 Oil Pipeline Licence

The Oil Pipelines Act provides that a holder of a permit to survey may make an application to the Minister in accordance with the provisions of the Act and of any regulations made thereunder for the grant of an oil pipeline licence in respect of any oil pipeline, the survey of the route for which has been completed by the applicant.[40] The Minister may grant the licence on payment of the fees required by the Act as contained in section 31, to be paid by the applicant on the submission of the application and on the grant of the licence respectively or for reasons which the Minister considers sufficient, refuses to grant the licence, he shall notify the applicant in writing of such refusal and the reasons thereof.[41]

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37 Section 6 (1), (2) & (3) Oil Pipelines Act
38 Subsection (2) Oil Pipelines Act
39 Subsection (3) Oil Pipelines Act
40 Section 7 (1) Oil Pipelines Act
41 Section 7 (2) (a), (b) & (3) Oil Pipelines Act

Section 7 (4) of the Oil Pipelines Act provides that no person other than the holder of a license shall construct, maintain or operate an oil pipeline. Every person who acts in contravention of subsection (4) shall be guilty of an offence and shall be liable on conviction to a term of imprisonment not exceeding two years or to a fine not exceeding NGN 1,000 or to both such imprisonment and such fine.[42] This provision needs to be amended otherwise the original purpose of the Act is already defeated.

It is argued that these provisions of the Act do not meet international regulatory best practice. How can a nation like Nigeria, which depends largely on proceeds from crude and refined oil from the natural environment, operate such a watery legislations? In relation to the extant regime, it is obsolete to sustain a legislation, which provides that anybody who contravene its provision as in section 7(4) & (5) by constructing and operating illegal oil pipeline in the environment will be liable on conviction to a term of imprisonment not exceeding 2 years or to a fine not exceeding NGN 1,000.

Furthermore, the Act provides further that the Minister may require any person who is convicted of an offence under subsection (6) to have the pipeline in respect of which the offence was committed and any ancillary installation removed to the extent that the Minister does not elect to purchase such pipeline or any such installation or any part thereof and in the event of failure to agree on the purchase price the same shall be determined by arbitration.[43] Again, an offender who is required by the Minister under subsection (6) of section 7 to have a pipeline or any ancillary installation removed shall make good any damage done to any land by such removal.[44]

3.4 Application for License and Notice Thereof

Under this heading, the Act provides that an applicant who is applying for a license shall deliver to the Minister, an application for the same stating the terminal points and giving a description of the pipeline and accompanied by a plan of the proposed route of the pipeline sufficient to identify the environment affected thereby and the position of any pumping stations, tanks or other ancillary installations.[45] The Minister shall upon the receipt of the application shall in relation to subsection (1) of section 8 appoint a date not less than 6 weeks ahead for the hearing of objections, if any, and shall nominate the person or persons by whom and the place or places at which any such objection shall be heard, and shall thereupon cause a notification of such date and other particulars and of the places at which objections shall be lodged to be made in the Federal Gazette of each State concerned.[46]

[42] Section 7 (5) Oil Pipelines Act
[43] Section 7 (6) Oil Pipelines Act
[44] Section 7 (7) Oil Pipelines Act
[45] Section 8 (1) Oil Pipelines Act
[46] Section 8 (2) Oil Pipelines Act

Pursuant to the above, before or upon application being made in accordance with the subsection (1) of section 8, notice of the application shall be given by the applicant in the following manner:

(a) by publication thereof in the State Gazette of each State through which the route of the projected pipeline passes;
(b) by publication thereof in such newspapers circulating in the areas through which the route of the projected pipeline passes as the Minister may require;
(c) by posting or delivering the same to the following persons entitled to be carrying on operations in the area which would be affected by the grant of a license;
    (i) holders of exclusive prospecting licenses, mining rights, oil exploration, licenses, and oil prospecting licenses;
    (ii) lessees of mining leases, temporary mining leases or oil mining leases;
(d) by publication in areas likely to be affected by the license in such other manner as the Minister may direct and by delivering to administrative officers having responsibilities in such area or to such other officers as the Minister may specify such numbers of copies of such notice as the Minister may require for distribution to the occupiers or owners of land in the area so affected who might not otherwise become aware of such notice.[47]

By the provision of subsection (4) of section 8, such notice shall contain a description of the proposed pipeline and its route and the proposed ancillary installations and shall set out a list of places and times at which copies of a plan sufficient to identify the land affected thereby may be inspected; and each copy of such notice shall require that objections (if any) shall be made at least seven (7) days before the date to be appointed by the Minister for the hearing of objections and delivered at the places to be appointed by him for such lodgment.[48]

The legal framework on application for license and notice thereof are subject of mere theoretical work, good on paper but far from implementation in reality. Needful to state that these provisions are not enforced as contained in the Oil Pipelines Act, they have become quiescent legislations that need re-enforcement.

3.5 Rights and Obligations of the Holder of a License[49]

By the provision of section 11 subsection (1), a license shall entitle the holder, his officers, agents, workmen or other servants with any necessary equipment or vehicles, subject to the provisions of section 14, 15 and 16 of the Act, to enter upon, take possession of or use a strip of land of a width not exceeding 200 feet or of such other widths as may be specified in the license upon the route specified in the license, and thereon, there over or

[47] Section 8 (3) (a), (b), (c) & (d) Oil Pipelines Act
[48] Section 8 (4) Oil Pipelines Act
[49] Section 11 Oil Pipelines Act

thereunder to construct, maintain and operate an oil pipeline and ancillary installations.

For the purpose of the provisions of the Oil Pipeline Act, an oil pipeline means a pipeline for the conveyance of mineral oils, natural gas and any of their derivatives or components and also any substance (including steam and water) used or intended to be used in the production or refining or conveying of mineral oils, natural gas, any of their derivatives or components.[50] The power to construct, maintain and operate an oil pipeline shall include the power to construct, maintain and operate on the route of such pipeline and all other installations (referred to in the Act as "ancillary installations") that are ancillary to the construction, maintenance and operation of such pipeline, including roadways, telephone or telegraph lines (subject to section 4 of the Telegraphs Act), electric power cables (subject to the provisions of the Electricity Act), pumping stations, storage, tanks and loading terminals.[51]

The holder of a license shall have power to dig and get free of charge any gravel, sand, clay, stone or other similar substance (not being a mineral within the meaning assigned thereto in the Minerals and Mining Act) within any land included within the area covered by the license to the extent that such gravel, sand, clay, stone or other substance, will facilitate the construction or maintenance of a pipeline or any ancillary installation.[52] The holder of a license shall pay compensation:

(a) to any person whose land or interest in land (whether or not it is land in respect of which the license has been granted) is injuriously affected by the exercise of the right conferred by the license, for any such injurious affection not otherwise made good; and
(b) to any person suffering damage by reason of any neglect on the part of the holder or his agents, servants or workmen to protect, maintain or repair any work, structure or thing executed under the license for any such damage not otherwise made good; and
(c) to any person suffering damage (other than on account of his own default or on account of the malicious act of a third person) as a consequence of any breakage of or leakage from the pipeline or an ancillary installation for any such damage not otherwise made good, and if the amount of such compensation is not agreed between any such person and the holder, it shall be fixed by a court in accordance with Part IV of the Act.[53]

For the avoidance of any uncertainty, subsection (6) of section 11 provides to the effect that the power granted to the holder of a license under the Act shall be exercisable only subject to the provisions of the Act and of any other enactment or rule of law.

[50] Section 11 (2) Oil Pipelines Act
[51] Section 11 (3) Oil Pipelines Act
[52] Section 11 (4) Oil Pipelines Act
[53] Section 11 (5) Oil Pipelines Act

3.6 Use of Oil Pipeline by a Person other than the Owner[54]

This provision of the Act is appraised so as to ascertain its justiciability in the use of Oil Pipeline by a person other than the owner. Section 18 subsection (1) provides that an application may be made to the Minister with respect to an oil pipeline constructed, maintained and operated in pursuance of a license granted under the Act by any person other than the owner of the pipeline who seeks a right to have conveyed by the pipeline on his behalf any of the things mentioned in subsection (2) of section 11 of the Act, which the pipeline is designed to convey. Every such application shall be made in the prescribed manner and form containing the prescribed particulars,[55] in which case, the Minister shall consider every such application in consultation with the applicant and the owner of the pipeline to which the application relates.[56]

Pursuant to the above provision, if upon such consideration the Minister is satisfied that the pipeline could, without prejudice to the proper and efficient operation thereof for the purpose of the conveyance on behalf of the owner, in the quantity required by him of the thing which it is designed to convey, be so operated as to permit of the conveyance thereby on behalf of the applicant of the thing the right to the conveyance of which is sought by the applicant, the Minister shall declare that he is so satisfied.[57] The conditions of the use of the pipeline by the applicant may be determined by agreement between the owner and the applicant and failing such agreement, shall, subject as aforesaid, be determined by the Minister.[58]

By the provision of subsection (6) of section 18, where the Minister makes under subsection (4) of this section a declaration with regard to a pipeline, he may by notice served on the owner impose such requirements as he thinks it necessary or expedient to impose for all or any of the following purposes, namely:

(a) securing to the person whose application resulted in the making of the declaration the right to have conveyed by the pipeline the thing to which the application is related;
(b) regulating the charge to be made for the conveyance of such thing by the pipeline on behalf of that person;
(c) securing that the exercise of a right secured by virtue of paragraph (a) of subsection (6) of section 18 shall be so framed as in the Minister's opinion to secure that compliance therewith will not prejudice the proper and efficient operation of the pipeline for the purpose of the conveyance on behalf of the owner thereof, in the quantity required by him of the thing which it is designed to convey

A notice served on the owner of a pipeline under subsection (6) may authorize such owner to recover from the person to whom a right is

54 Section 18, Oil Pipelines Act
55 Section 18 (2) Oil Pipelines Act
56 Section 18 (3) Oil Pipelines Act
57 Section 18, (4) Oil Pipelines Act
58 Section 18 (5) Oil Pipeline Act

secured by the notice by virtue of paragraph (a) of that subsection, payment of such amount as may be determined in accordance with provisions in that behalf contained in the notice, being payment in consideration of the rights being secured to such person.[59] If the owner of a pipeline fails to comply with a requirement imposed by a notice served on him, under subsection (6) of this section with reference to the pipeline, he is guilty of an offence and liable on summary conviction to a fine not exceeding NGN 1,000, and if the failure continues after his conviction, he is guilty of a further offence and liable in respect thereof to a fine not exceeding 50 NGN for each day on which the failure continues.[60]

With regards to subsection (8), the Minister may by notice to the owner of a pipeline whose failure to comply with any such requirement as aforesaid continues after his conviction of a first offence, revoke the license of such owner.[61]

It is contended that these provisions of the Oil Pipelines Act of the Federal Republic of Nigeria need serious amendment. There is need for upward review owing to the fact that production of crude oil or refined oil from the natural environment is the major sustainable source of income of the country.

4. CONCLUSION AND RECOMMENDATIONS

Oil pipeline vandalism and oil theft menaces in the environment have created economic woes in the country. The Nigerian economy is dwindling day by day due to the incessant oil pipeline vandalism. There is illegal construction of oil pipelines in the environment diverting crude oil and refined oil without the government taking any proactive measures to stop this act of vandalism and theft of the nation's number one source of revenue. Nigeria is a nation that depends largely on proceeds from natural resources particularly crude oil. Vandalism and theft of oil in the environment pose a serious threat to Nigeria economy and until the vandals are caught and prosecuted, the challenge will persist.

It is the view of this paper that some government officials are involved in this unending vandalism and oil theft in the environment considering the fact that all these menaces are happening in the presence of the Nigerian Police Force, the Military, Nigeria Civil Defence Corps, et cetera.

It is recommended that a structural reorganization and establishment of strong environmental security surveillance on oil pipelines by the government should be set up. Government should create a special court for accelerated prosecution of vandals and also look inward in order to flush out officials who are involved in vandalism and oil theft in the environment.

[59] Section 18 (7) Oil Pipelines Act
[60] Section 18 (8) Oil Pipelines Act
[61] Section 18 (9) Oil Pipelines Act

Additional recommendation is that the Oil Pipelines Act should be reviewed as its provisions have become obsolete. A nation like Nigeria that depends largely on proceeds from crude and refined oil from its natural environment should not operate such archaic legislations. In relation to the extant regime, it is obsolete to sustain a legislation which provides that anybody who contravenes its provision as in section 7(4) & (5) by constructing and operating illegal oil pipeline will be liable on conviction to a term of imprisonment not exceeding two years or to a fine not exceeding NGN 1,000.

The government should also stop borrowing to service debt and finance budget as this act of borrowing will aggravate the economic meltdown of the nation. Furthermore, the government should be proactive by formulating effective regulatory policies with good enforcement mechanisms that will pave way for effective service delivery by National Oil Spills Detection and Response Agency (NOSDRA) and other relevant agencies. It is expected that implementing these recommendations will mitigate the alarming economic meltdown of the Nigeria's economy and as well promote a sustainable healthy environment.

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Collected the data	Yes	No
Contributed to data analysis & interpretation	Yes	Yes
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The author(s) solemnly declare(s) that this research has not involved any human subject (body or organs) for experimentation. It was not a clinical research. The contexts of human population/participation were only indirectly covered through literature review. Therefore, an Ethical Clearance (from a Committee or Authority) or ethical obligation of Helsinki Declaration does not apply in cases of this study or written work.

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CLIMATE CHANGE AND CORPORATE REGULATION: A CRITICAL ANALYSIS OF EGYPT'S LEGAL AND REGULATORY REGIME

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ABSTRACT

Corporations operating in African states generally have apathy to climate change/environmental regulation, owing to their weak economic bargaining strength in these states. Egypt is one of the African states suffering the disproportionate impacts of climate change and although it has drawn up several climate policy documents, it has not yet enacted a Climate Change Act and has a weak regulatory capacity to restrain adverse corporate climate change-impacting activities. This article critically analyses the legal/ regulatory regime in Egypt for regulating corporate participation in climate change mitigation and its effectiveness in addressing climate change challenges. It critically analyses the implementation of the *Dilute Interventionism* Model. It evaluates the required legislative framework, regulator, and technical expertise necessary for its successful implementation. This paper also highlights the importance of the *Veto Firewall* protection to maintain the independence of the sole independent regulator responsible for regulating the climate change activities of corporations. This paper argues that the *Dilute Interventionism* Model, in conjunction with the *veto firewall* paradigm, provides a practical and effective approach to regulating corporations. However, successful implementation will require political will, corporate compliance, and technical capacity. This paper provides policymakers, stakeholders, and interested parties in Egypt and elsewhere with useful insights for addressing climate change challenges.

Keywords: Climate Change, Climate Change Act, Corporations, Dilute Interventionism, Egypt, Regulatory Framework, and Veto Firewall Protection

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Climate Change and Corporate Regulation: A Critical Analysis of Egypt's Legal and Regulatory Regime

1. INTRODUCTION

Egypt's economy is largely dependent on the industrial sector, service sector and agricultural sector.[1] Statistics show that in 2021, the service sector contributed 52.23%, Industry contributed 30.79% and agriculture contributed 17.83% of the GDP in Egypt. Tourism, trade, banking and shipping services provide the main source of revenue generated from tourism.[2] According to the Climate Risk Country Profile, only about 2.8% of the land is arable, and the country's agriculture is entirely dependent on the flow of the Nile River and persistent high temperature makes the productivity of agriculture vulnerable to climate change.[3] Another report shows that Egypt hardly receives rainfall that is sufficient for agricultural productivity. According to the report, Egypt receives less than eighty millimetres of precipitation annually in most areas, and Alexandria, the area which receives a significant share of the total rainfall only receives approximately 120-200 millimetres of precipitation per year.[4]

The impact of drought on Egypt mostly affects crops like sugar cane, rice, maize, soybeans, etc. The scarcity of water also leads to an increase in sodium chloride, which leads to the death of land and negatively affects the agricultural sector.[5] A report shows that climate change can decrease the agricultural sector's production of rice by 11% and soybeans by 2050. The report also projects that, by 2050, climate change will increase water demand by 16% for these crops[6] and this will have an impact on the means of livelihood of people and the GDP of the agricultural sector.

Though Egypt hardly sees enough rainfall, when rain does fall, it often causes flooding. Egypt's River Nile providing 90% of Egypt's freshwater is vulnerable to short-line changes often linked with erosion and high sea level rise due to flooding. Rain-induced flooding destroys

1 Statista, 'Egypt - GDP Distribution across Economic Sectors 2011-2021' (Statista) <https://www.statista.com/statistics/377309/egypt-gdp-distribution-across-economic-sectors/#:~:text=In%202021%2C%20agriculture%20contributed%20around> accessed 10 March 2023.

2 Eman Ahmed Hashem, 'The Impacts of Climate Change on Food Security – Case Study: Egypt' (2020) 3 (2) Journal of Economics and Business 868-884. <https://doi.org/10.31014/aior.1992.03.02.244>

3 World Bank, 'Egypt Climate Risk Country Profile' (2021) <https://climateknowledgeportal.worldbank.org/sites/default/files/2021-04/15723-WB_Egypt%20Country%20Profile-WEB-2_0.pdf> accessed 10 March 2023.

4 Tamer A. Nada, 'Drought Condition and Management Strategies in Egypt' (2014) Egyptian Meteorological Authority <https://www.droughtmanagement.info/literature/UNW-DPC_NDMP_Country_Report_Egypt_2014.pdf> accessed 10 March 2023.

5 Samar Simir, 'Drought Fears Grow as Nile Talks Run On' (Egypt Today, 3 October 2020) <https://www.egypttoday.com/Article/15/92628/Drought-Fears-Grow-as-Nile-Talks-Run-On> accessed 10 March 2023.

6 Helmy Eid, Samia El-Marsafawy and Samiha Ouda, 'Assessing the Economic Impacts of Climate Change on Agriculture in Egypt: A Ricardian Approach' (2007) Policy Research Working Paper No. 4293. The World Bank Group. <https://documents1.worldbank.org/curated/en/690661468234308557/pdf/wps4293.pdf> accessed 10 March 2023.

property, claims lives and displaces several others.[7] These floods often come in a form of flash floods causing havoc. In 2010, a flash flood in the northern part of Sinai Peninsula destroyed over 780 homes, and 1,100 humans were submerged. The flood also destroyed approximately 59 km of road and killed approximately 1,900 animals. Sinai saw a huge loss of US$ 25.3 million, costing the Egypt government approximately $ 3.5 million in compensation payments.[8] A report states that the rising of the Mediterranean Sea by only 50 centimetres flooded approximately 30% of Alexandria. According to the report, 1.5 million people will be displaced, with approximately 19,500 jobs destroyed.[9]

Despite these devastating impacts of climate change on the health, livelihood of people, and the economy of the country, Egypt is yet to implement an effective legal and regulatory framework for regulating climate change activities of corporations in the country. It is yet to enact a Climate Change Act that will consider the domestic peculiarities of the climate change problem and provide the legal backbone/foundation for the regulation of climate change activities of corporations in the country.

To effectively argue for the implementation of an effective legal framework which will incorporate the innovative paradigms - *Dilute Interventionism* and *Veto Firewall* - as proposed in this article, this article will first examine Egypt's carbon emission trajectory highlighting its consistent annual increase and the various sectors responsible for this. Secondly, it will examine its current climate/environmental legal framework (internationally and nationally); climate change regulation of corporations and discuss the strengths/weaknesses of the current climate change legal regime in Egypt. Finally, the article will critically examine the implementation of the two innovative paradigms proposed and present its conclusion/recommendations.

2. EGYPT'S CARBON EMISSION TRAJECTORY AND SECTORAL CONTRIBUTIONS

Egypt is a minor contributor to the global greenhouse gases (GHGs) contributing less than 0.6% of global greenhouse gas emissions.[10] Though Egypt contributes a fraction of global emissions, Egypt still suffers from climate change-induced issues. A report shows that Egypt has seen a consistent increase in GHGs with an average of 2.5% from 2016 to 2019. In

[7] World Bank, 'World Bank Climate Change Knowledge Portal: Country Egypt' (2021) <https://climateknowledgeportal.worldbank.org/country/egypt/vulnerability> accessed 10 March 2023.

[8] Reliefweb, 'EGYPT: Report Details North Sinai Flood Damage – Egypt' (2010) ReliefWeb <https://reliefweb.int/report/egypt/egypt-report-details-north-sinai-flood-damage> accessed 10 March 2023.

[9] AfricaNews, 'Egypt: Alexandria Expected to Sink by 2100' (2022) <https://www.africanews.com/2022/11/03/egypt-alexandria-expected-to-sink-by-2100//> accessed 10 March 2023.

[10] The Arab Republic of Egypt, 'The Arab Republic of Egypt Sovereign Sustainable Financing Framework' (2022) <https://www.afdb.org/sites/default/files/egypt_sovereign_sustainable_financing_framework.pdf > accessed 10 March 2023.

2016, the total greenhouse house gas was 325,470,000 tons and in 2019 the emissions increased to 351.769.99 tons.[11]

A USAID report tracks Egypt's green gas emissions as far back as 1990. The report shows a staggering increase in greenhouse gas emissions. According to the report, Egypt's greenhouse emissions grew by 140% between 1990 and 2016 with an annual increase rate of 3.5%. The report states that the total emission growth in Egypt over that span was three times faster than the world's arrangement. This number, however, saw a decline between 2016 and 2019.[12] The emission of CO_2 in Egypt also poses similar numbers. In 2021, CO_2 amounted to 259.3 million tons. There was substantial growth from 27.2 million tons to 259.3 million tons at an increased annual rate that peaked at 15.83% in 1979 and saw a decrease in 2021 to 6.59%.[13]

Egypt's biggest contributor to greenhouse gas emissions is the energy sector. The energy sector contributed a staggering 71.4% of Egypt's total emissions in 2016. Electricity and heat were the major contributors to these figures.[14] Electricity and heat contributed over 45% of its total number. The transportation sector contributed over 25%. The report shows that emissions from the energy sector grew by an average of 3.5% from 1990 to 2016.[15] Agriculture contributes the second most to greenhouse gas emissions in Egypt. The agricultural sector contributed a total of 10.2% in 2016. Agriculture's emissions only saw a minor increase of 2% from 1990 to 2016.[16] This growth was also relative to the growth of the sector in terms of GDP. Agricultural sector contribution has remained static since then, though it saw a slight decrease to 11.05% in 2016.[17]

The manufacturing sector is the third largest contributor to greenhouse gas emissions constituting approximately 9.7% of Egypt's total. In terms of growth, manufacturing was the second fastest growing source of greenhouse gas emissions between 1990 and 2016, with a growth rate of 3.8% during that period.[18] Waste handling and management is the fourth largest contributor to greenhouse gases constituting 8.6% of Egypt's total greenhouse gas emissions. Between 1990 and 2016, waste management grew by approximately 5.6%.[19] This growth in CO_2 was

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11 Macrotrends, 'Egypt Greenhouse Gas (GHG) Emissions 1990-2023' (2023) <https://www.macrotrends.net/countries/EGY/egypt/ghg-greenhouse-gas-emissions> accessed 10 March 2023.

12 USAID, 'Greenhouse Gas (GHG) Emissions by Sector Change in GHG Emissions in Egypt' (1990) <https://www.climatelinks.org/sites/default/files/asset/document/GHG%20Emissions%20Factsheet%20Egypt_v6_11_02-15_edits%20%281%29%20Steed%20June%202016_rev08-19-2016_Clean.pdf> accessed 10 March 2023.

13 Knoema, 'Egypt CO_2 Emissions, 1970-2022' (2021) (Knoema) <https://knoema.com/atlas/Egypt/CO2-emissions#:~:text=In%202021%2C%20CO2%20emissions%20for> accessed 10 March 2023.

14 Enterprise Press, 'A Look at Egypt's Most Polluting Sectors' (2020) (Enterprise) <https://enterprise.press/hardhats/look-egypts-polluting-sectors/> accessed 10 March 2023.

15 *Ibid.*

16 *Ibid.*

17 *Ibid.*

18 *Ibid.*

19 *Ibid.*

driven majorly by the corporate sector. Corporate activities have immensely contributed to the environmental challenges in Egypt with many of the country's largest businesses mostly reliant on fossil fuels.

3. ENVIRONMENTAL REGULATIONS IN EGYPT

Egypt's Constitution has been making progress in ensuring the protection of the environment. The Constitution's first recognition of the environment came from the amendment to the Constitution in 1971.[20] It included Article 59, which goes on to provide that protecting the environment is a national duty and requires measures taken should be regulated by law. The 2012 amendment in Constitution goes beyond this and includes the right to health and an undamaged environment. It further requires states to safeguard the nation from all forms of pollution.[21] The 2014 addition to the Constitution in the form of Article 46 fully recognises the right of the citizens of Egypt to a healthy environment and requires the states to safeguard the environment against all forms of pollution, and promotes the use of natural resources in a manner that prevents any damage to the environment.[22] Though the Egypt's Constitution provides for environmental rights for its citizens, it fails to make any provision on how citizens can implement and enforce the right to a healthy environment.

One of the first pieces of a policy document on the Environment in Egypt was the Environmental Law (Law 4 of 1994) Amended by Law No. 9 in 2009. The provisions in Article 2 establish the Environmental Affairs Agency and charge it with the duty to enforce the law for the environment, preventing pollution and controlling and adapting International Environmental Agreements.[23] The Agency is also charged in Article 5 with formulating the general policies and laying down necessary plans which are necessary for protecting and promoting the environment and ensuring proper follow-up of such plans. Article 14 establishes a fund known as Environmental Protection Fund. The funds, according to the law, will be utilized by the Environmental Affairs Agency (EEAA) in fulfilment of its objectives. Though the funds are to be utilized by the EEAA, in order to ensure proper checks and balances, the law provides that all activities and transactions for which the funds are to be utilized will be subject to the Central Audit Agency.[24]

The law provides for synergy between the Environmental Affairs Agency and the Environmental Gas Holding Corporation (EGA), as it

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[20] Tadamun, 'The Right to a Sustainable Environment in the Egyptian Constitution - Tadamun' (2014) <http://www.tadamun.co/right-to-a-sustainable-environment-in-the-egyptian-constitution/?lang=en#.ZAoykVNKgfM> accessed 10 March 2023

[21] Ibid.

[22] Constitution of Egypt 2014 with Amendments through 2019.

[23] Egypt, 'Law Number 4 Of 1994* Promulgating the Environment Law and Its Executive Regulation Egypt * in Case of Difference of Interpretation, the Arabic Text Will Prevail' <https://faolex.fao.org/docs/pdf/egy4984E.pdf> accessed 10 March 2023.

[24] *Ibid.*

relates to conducting Environmental Impact Assessments of projects.[25] The EEAA is responsible upon agreement of the EGAS, for issuing elements, designs and specifications which will form the basis of assessment of the Environmental Impacts of the project for which the license is sought. The Board of Directors of the EEAA provided for in Article 6 develops the criteria for consultants to be assigned to the EEAA to review the Environment Impact Assessment.[26] Upon the review and evaluation of the documents, the EEAA proceeds to then transmit the document to the EGAS for its opinion and possible proposals to be taken as regards the protection of the environment.[27]

The Executive Regulations for Environment Law (Laws No. 4 of 1994) provides for key objectives, and some of these objectives include: Specifying the assignment of the Appeal Committee and the procedure for operation as well as the mechanism for laying complaint, defining the necessary specification which should be complied with by industrial establishment. The regulation also seeks to specify limits on air pollutants in emissions.[28]

Other laws are also applicable, as they provide key provisions for the Environment. The Investment Law No.72/2017 under Article 11 provides for special incentives one of these is providing a percentage deduction on net profits, set up at approximately 30% of the investment costs for projects that majorly depend on the production of new and renewable energy.[29] Article 20 goes on to provide that renewable energy, which is labelled as strategic, may be granted one approval for its establishment, operation, management, etc.[30] Law n.87/2015-Electricity Law, for instance, restructures the Electricity Unity and Consumer Protection Regulatory Agency and now gives the Agency the function of regulating the development and encouragement of renewable energy production and use; it also empowers the Agency to issue renewable source certificates that could be traded subject to the issuance of regulations detailing the processes.[31]

4. CLIMATE CHANGE REGULATORY FRAMEWORK IN EGYPT

The Egyptian government has recognised the impact of climate change in the country, and in order to reduce its effect, has ratified several international conventions. Key amongst them is the United Nation Framework Convention on Climate Change (UNFCCC), which was signed

[25] *Ibid.*
[26] *Ibid.*
[27] *Ibid.*
[28] *Ibid.*
[29] Vizzuality, 'Investment Law No. 72/2017 - Egypt - Climate Change Laws of the World' (2017) <https://climate-laws.org/geographies/egypt/laws/investment-law-no-72-2017> accessed 10 March 2023.
[30] *Ibid*
[31] Vizzuality, 'Law N. 87/ 2015 - Electricity Law - Egypt - Climate Change Laws of the World' (2015) <https://climate-laws.org/geographies/egypt/laws/law-n-87-2015-electricity-law> accessed 10 March 2023.

on June 12, 1992, and ratified on the 5th December 1994.[32] Egypt signed the Paris Agreement on the 22nd of April 2016 and ratified same on the 29th of June 2017.[33] Egypt has also signed the Kyoto protocol in 2005.[34]

The UNFCCC, for instance, spells out its key principles some of these include: the requirement for state parties to take precautionary measures to anticipate, prevent and minimize the effect of climate change and mitigate its adverse effects, and the right of state parties to promote sustainable development.[35] Egypt has since attempted to meet some of the objectives of the Convention. Egypt, in compliance with Articles 4.1 and 12.1 of the Convention, which requires a member state to periodically report to the Convention regarding its national circumstance and subsequent response to climate change, through a National Communication prepared and submitted its first, second and third National Communications to the UNFCCC in 1999, 2010 and 2016, respectively.[36] Egypt intends to submit its 4th National Communication by the end of 2024.[37]

Egypt, in compliance with Article 7.10 of the Paris Agreement, which requires all signatory States to submit and update periodically an adaptation communication, which can spell out its priorities, implementation and support needs, plans and actions, has developed its Adaptation Communication to the United Nation to the United Nations Framework Convention on Climate Change[38]. Egypt has also made persistent efforts to comply with other agreements.[39] For instance, Egypt in compliance with Article 4.2 of the Paris Convention, which specifically requires States to prepare and communicate Nationally Determined Contributions, drafted its first Nationally Determined Contribution first in 2015[40] and, subsequently revised its 2015 edition by drafting an Updated Nationally Determined Contribution in November 2022.[41] The updated version aims to decarbonize the industrial sector through the use of

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32 United Nations, 'United Nations Treaty Collection' (2023) <https://treaties.un.org/Pages/ViewDetailsIII.aspx?src=TREATY&mtdsg_no=XXVII-7&chapter=27&Temp=mtdsg3&clang=_en> accessed 10 March 2023.

33 United Nations, 'UNTC' (2009) <https://treaties.un.org/Pages/ViewDetails.aspx?src=IND&mtdsg_no=XXVII-7-d&chapter=27&clang=_en> accessed 10 March 2023.

34 UNFCC, 'Egypt's Submission of Additional Information on Progressin Implementing Decision1/CP.21, Section IV: Enhanced Action Prior to 2020', <https://www4.unfccc.int/sites/SubmissionsStaging/Documents/201805051558---Arab%20Republic%20of%20Egypt%20submission%20on%20Pre-2020.pdf> accessed 10 March 2023.

35 UNFCCC, 'United Nations Framework Convention on Climate Change' (1992) <https://unfccc.int/files/essential_background/background_publications_htmlpdf/application/pdf/conveng.pdf> accessed 25 February 2023.

36 *Ibid.*

37 UNFCC, 'Egypt's First Updated Nationally Determined Contributions' (2022) <https://unfccc.int/sites/default/files/NDC/2022-07/Egypt%20Updated%20NDC.pdf.pdf> accessed 10 March 2023.

38 Ibid.

39 *Ibid.*

40. *Ibid*

41 *Ibid.*

renewable and alternative fuels and low carbon process improvement, etc.[42]

Currently, there is neither Climate Change Act in Egypt nor any comprehensive legislation that effectively regulates the climate change activities in Egypt. However, Egypt has drawn up several policy documents that provide for climate change. For instance, the National Renewable Energy Strategy aimed at generating approximately 20% of electricity from renewable sources by 2020. 12% of this total energy was aimed to be generated from wind farms.[43] There is no data to show that Egypt has sustained 20% of its electricity from renewable sources in 2020 and even after 2020.

The main goal of the Egypt National Strategy for Disaster Risk Reduction, which was enacted in 2017, is to expand Egypt's flexibility in curbing climate change risks and disasters as well as enabling the Egyptian community's ability to contain, and reduce risks and disasters across all sectors in Egypt.[44] The overall goal of the Strategy was to preserve lives and property by creating a nationwide system for reducing the risk associated with disaster in a way that enhances the country's capacity and contributes to Egypt achieving sustainable development.[45] It also provides for key actions directed towards understanding disaster risks, early warning, investment, finance, development and disaster risk reduction.

Egypt's National Climate Change Strategy was developed to fuse all aspects of climate change into one piece of document. This document is aimed at being a reference that ensures the integration of the climate change dimension into the general planning of the different sectors in the country. The strategy provides five goals and goes on to set directions for achieving each objective.[46] Under the Goal 1,: the Climate Change Strategy aims to achieve sustainable economic growth and low-emission development in various sectors. Goal 2 aims at enhancing adaptive capacity and building resilience to climate change and reducing the negative impact of climate change.[47] Goal 3 enhances the climate change action governance goal. Goal 4 aims at enhancing climate financing infrastructure, and Goal 5, lastly, aims at enhancing scientific research, technology transfer, management of knowledge and increasing awareness to combat climate change.[48]

Though Egypt does not have a Climate Change Act, Egypt has different bodies, established under decrees that are directly charged with

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42 *Ibid.*

43 Vizzuality, 'New National Renewable Energy Strategy - Egypt - Climate Change Laws of the World' (2008) <https://climate-laws.org/geographies/egypt/policies/new-national-renewable-energy-strategy> accessed 10 March 2023.

44 Vizzuality, 'Egypt's National Strategy for Disaster Risk Reduction - Egypt - Climate Change Laws of the World' (2011) <https://climate-laws.org/geographies/egypt/policies/egypt-s-national-strategy-for-disaster-risk-reduction> accessed 10 March 2023.

45 Ibid.

46 Vizzuality, 'Egypt National Climate Change Strategy (NCCS) 2050 - Egypt - Climate Change Laws of the World' (2022) <https://climate-laws.org/geographies/egypt/policies/egypt-national-climate-change-strategy-nccs-2050> accessed 10 March 2023.

47 *Ibid.*

48 *Ibid.*

regulating climate change. For instance, in 2007, the National Committee on Climate Change was established by the Prime Minister's Decree no. 272. The primary duty of the Committee was to review and activate a National Strategy for Climate Change with the preparation of plans and programs in both long and short terms, to be integrated into national action plans for development in Egypt.[49]

The National Council of Climate Change was also formed by the Prime Minister's Decree no. 1912 in 2015, and was fully implemented in May 2019. The Prime Minister's Council consisted of 9 Ministries.[50] The council also consisted of 3 departments namely the Supreme Committee, the Executive Office and the Technical Working Group. The Council is required to meet at least once annually or during emergency cases. The Decree also provides for some of the functions of the Committee.[51] These include creating the state's policy regarding climate change having regard to international agreements and treaties, following agreements of the UNFCC with its supplementary protocols and agreement, drastically increasing scientific research, and ensuring publications on climate change. The publication on climate change should also include international publications.[52]

5. CORPORATE REGULATIONS ON CLIMATE CHANGE

Egypt from all indications appears not to have any corporate regulations on climate change. It recognises the likely risk climate change poses and the role a corporation plays in aggravating them. Egypt, at best in some of its laws, makes minor provisions relating to regulating companies.[53] Although this provision relates to general environmental regulations, some of the laws already discussed in preceding sections contain several provisions regulating corporate contribution to climate change in Egypt.[54] For instance, the Egyptian Natural Gas Holding Company (EGAS) was established through the Prime Ministerial Order No. 1009 of 2001. The EGAS is mainly responsible for promoting and developing gas activities in Egypt. The EGAS is also responsible for issuing licensing to gas pipeline construction and operation before issuing licenses.[55] The EGAS in collaboration with the EEAA is responsible for conducting Environmental Impact Assessments for corporate bodies undertaken to carry out projects likely to have an impact on the

[49] Hamsa Hefny and others, 'Climate Governance in Egypt' (2019) The Public Policy HUB, The School of Global Affairs and Public Policy, The American University in Cairo, Egypt. <https://documents.aucegypt.edu/Docs/GAPP/Public%20Policy%20Hub%20Webpage/17-%20Climate%20Governance%20in%20Egypt%20-%20En.pdf> accessed 10 March 2023.
[50] *Ibid*.
[51] *Ibid*.
[52] *Ibid*.
[53] PETROSAFE, 'GASCO Abr Sinai Onshore Gas Pipeline' (2007) <https://www.eib.org/attachments/pipeline/20070088_eia3_en.pdf> accessed 10 March 2023.
[54] *Ibid*.
[55] *Ibid*.

environment.[56] The Environmental (Law No. 4 of 1994) Amended by Law No. 9 for 2009 and its regulations also provide for synergy between these bodies requiring Environmental Impact Assessments on projects likely to have an impact on the environment.[57] The Executive Regulations of Law No. 4 of 1994 specifically provide that establishment must be subjected to an Environmental Impact Assessment having regard to the type of activity performed by it, the extent of its natural recourses exploitation, the type of energy used in operating the establishment etc.[58]

6. STRONGHOLDS OF THE EGYPT CLIMATE CHANGE LEGISLATION

As stated in preceding para, Egypt does not have comprehensive Climate Change Legislation. However, they have some strategies directed at regulating climate change activities. For example, the strongholds of the Egypt New National Renewable Energy Strategy 2008 include setting ambitious targets for renewable energy development, promoting private sector participation, enhancing research and development, and increasing access to financing for renewable energy projects.[59] Also, one of the key objectives of the Egypt's National Climate Change Strategy (NCCS) 2050 is to reduce the country's greenhouse gas emissions by 50% by 2030, and to achieve net-zero emissions by 2050.[60] Other key strongholds of this strategy include:

6.1 Energy Efficiency

The strategy aims to improve the energy efficiency of buildings, appliances, and transportation systems. This will involve the adoption of energy-efficient building codes, the promotion of energy-efficient appliances, and the development of public transportation systems that use clean energy.

6.2 Renewable Energy

The strategy aims to increase the share of renewable energy in the country's total energy mix to 42% by 2035, as outlined in the Egypt New National Renewable Energy Strategy 2008.

6.3 Sustainable Agriculture

The strategy aims to promote sustainable agriculture practices, such as the use of organic farming techniques, the conservation of water resources, and the promotion of agroforestry.

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56 *Ibid.*
57 *Ibid.*
58 *Ibid.*
59 Vizzuality, *Supra* 43
60 Vizzuality, *Supra 46*

6.4 Adaptation

The strategy aims to enhance the country's resilience to the impacts of climate change, such as droughts, floods, and sea-level rise. This will involve the development of early warning systems, the construction of sea walls and other coastal protection measures, and the implementation of measures to protect biodiversity and ecosystems.

7. SHORTCOMINGS OF THE EGYPT CLIMATE CHANGE LEGISLATION

There are several shortcomings in the New National Renewable Energy Strategy (NNRES) 2008 and the Egypt's National Climate Change Strategy (NCCS) 2050. Some of these include, but are not limited to:

7.1 Lack of Specific Climate Change Targets

The NNRES lacks specific targets for renewable energy generation and the reduction of greenhouse gas emissions. Although it sets a general goal of increasing renewable energy use to 20% by 2020, it does not provide specific actions or targets to achieve this goal. This lack of specificity makes it difficult to assess progress and identify areas that need improvement.

7.2 Limited Focus on Adaptation

The NCCS 2050 acknowledges the importance of adaptation to the impacts of climate change, but it does not provide specific actions or targets for adaptation measures. For example, the strategy does not include specific actions to address the impacts of rising sea levels on coastal communities or to improve water management in areas prone to droughts. These actions are critical for ensuring that vulnerable communities are adequately prepared for climate impacts. While mitigation is an essential component of any climate strategy, adaptation to the impacts of climate change is also critical, particularly for a country like Egypt that is vulnerable to extreme weather events such as droughts, floods, and rising sea levels. The strategy may need to pay more attention to adaptation measures to ensure that vulnerable communities are adequately prepared for climate impacts.

7.3 Limited Participation

The development of the strategy involved limited participation from key stakeholders, such as civil society organizations, private sector actors, and vulnerable communities. This limited participation may result in a strategy that does not reflect the diverse needs and interests of all groups. For example, the strategy does not include specific actions to address the needs of marginalized communities that are particularly vulnerable to the impacts of climate change. To be effective, climate strategies need to engage a broad range of stakeholders to ensure that they reflect the diverse needs and interests of all groups.

7.4 Inadequate Financial Allocations for Climate Change Mitigation

The NCCS 2050 does not allocate sufficient financial resources to implement the proposed actions. For example, the strategy includes a target of generating 20% of Egypt's electricity from renewable sources by 2022, but it does not provide details on the financing mechanisms that will be used to achieve this target. Without adequate funding, it may be difficult to achieve the desired outcomes and ensure the sustainability of the strategy.

7.5 Lack of Integration

The strategy is not fully integrated with other national policies and strategies, such as energy, water, and agriculture policies. This lack of integration may result in unintended consequences or missed opportunities for synergies. For example, the strategy does not include specific actions to improve the efficiency of water use in agriculture, which is a critical sector for both climate change mitigation and adaptation. To be effective, climate strategies need to be integrated with other policies to ensure that they are aligned with national development priorities and do not create unintended consequences.

8. ALTERNATIVE CLIMATE CHANGE REGULATORY FRAMEWORKS IN EGYPT

There are several alternative regulatory frameworks embedded in Egypt's climate change regulatory framework. These include but are not limited to judicial regulation, fiscal regulation and other regulatory mechanisms.

8.1 Judicial Regulation

Judicial regulation is becoming more widely recognized as a way to address climate change and hold responsible parties accountable for their actions.[61] By using the court system to enforce environmental laws and regulations, individuals and institutions can be held accountable for their contributions to climate change and for failing to take action to mitigate its effects.[62] One of the benefits of judicial regulation is that it can help to raise public awareness about the issue of climate change and the need for action. Court cases can attract media attention and generate public interest, which can help to build support for environmental policies and initiatives.[63] Additionally, court decisions can establish legal precedents and set the

[61] Catherine Higham and others, 'Accountability Mechanisms in Climate Change Framework Laws' (2021) <https://www.lse.ac.uk/granthaminstitute/wp-content/uploads/2021/11/Accountability-mechanisms-in-climate-change-framework-laws.pdf> accessed 9 March 2023.

[62] Anthony Heyes, 'Making Things Stick: Enforcement and Compliance' (1998) 14 Oxford Review of Economic Policy 50.

[63] United Nations, 'Five Ways Media and Journalists Can Support Climate Action While Tackling Misinformation' (UN News, 3 October 2022) <https://news.un.org/en/story/2022/10/1129162> accessed 9 March 2023.

stage for future actions, which can be an effective way to drive change at the institutional level.

However, there are also challenges associated with using judicial regulation as a mechanism for addressing climate change. For example, legal processes can be slow and expensive,[64] which can limit the effectiveness of judicial regulation as a tool for change. Additionally, there may be resistance from powerful actors who have a vested interest in maintaining the status quo, which can make it difficult to secure legal victories. Despite these challenges, judicial regulation has the potential to be an important tool for holding individuals, corporations, and governments accountable for their contributions to climate change.[65] By using the court system to enforce environmental laws and regulations, it may be possible to drive change at the institutional level and build public support for policies and initiatives aimed at mitigating the effects of climate change.[66]

The Constitution of Egypt[67] provides a basis for environmental protection and sustainable development in Egypt. It also provides a legal framework for citizens and activists to use judicial regulation to hold the government accountable for its actions related to climate change and the environment. Article 45 of the 2014 Egyptian Constitution[68] states that, "Everyone has the right to a healthy and clean environment, and the state is committed to taking the necessary measures to achieve this". The Constitution also recognizes the importance of sustainable development, stating in Article 46[69] that, "The state shall adopt a comprehensive strategy for sustainable development that balances the needs of present and future generations and achieves economic, social, and environmental objectives". Furthermore, Article 141 of the Constitution[70] grants citizens the right to access justice, which means that citizens and activists can use judicial regulation to hold the government accountable for its actions related to climate change and the environment. This constitutional provision allows citizens to file lawsuits against the government or private entities for violating environmental laws and regulations.

In addition, Egyptian Law No. 4 of 1994[71] on the Environment provides for the right to a healthy environment. This law aims to protect and enhance the environment, prevent pollution, and promote sustainable

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64 PricewaterhouseCoopers, 'Litigation Can Be Inefficient and Expensive. Why Litigate?' (PwC) <https://www.pwc.com/gx/en/services/forensics/dispute-services/litigation.html> accessed 9 March 2023.

65 Chuan-Feng Wu, 'Challenges to Protecting the Right to Health under the Climate Change Regime' (2021) 23 Health and human rights 121 <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8694293/> accessed 30 May 2022.

66 UNEP, 'Enforcement of Environmental Law: Good Practices from Africa, Central Asia, ASEAN Countries and China Acknowledgements' (2014) <https://wedocs.unep.org/bitstream/handle/20.500.11822/9968/enforcement-environmental-laws.pdf?sequence=1&isAllowed=y> accessed 9 March 2023.

67 Constitution of Egypt, *supra 22*.

68 Article 45 of the Constitution.

69 Article 46 of the Constitution.

70 Article 141 of the Constitution.

71 Egyptian Law, *supra 23*

development. Under this law, every person has the right to live in a clean and healthy environment, and it is the responsibility of the state to ensure the protection and conservation of natural resources. The law also establishes the Egyptian Environmental Affairs Agency (EEAA) as the main regulatory body responsible for enforcing environmental laws and regulations in Egypt.[72] In addition, Law No. 102 of 1983 on the Protection of the Nile River and Water Channels[73] also provides for the protection of the environment, as the Nile River is a crucial natural resource for Egypt. This law prohibits any activity that may cause pollution or harm to the Nile River and its water channels.

In *Red Sea Islands Case* (2016),[74] a group of citizens challenged the Egyptian government's decision to transfer the sovereignty of two islands in the Red Sea to Saudi Arabia, arguing that it would harm the environment and violate their right to a healthy environment. The case was initially ruled in favour of the government, but an appeals court later overturned the decision and ruled that the transfer of sovereignty was unconstitutional. Also, in *Manshiyat Nasser Case* (2015),[75] residents of Manshiyat Nasser, a neighbourhood in Cairo, sued the government for failing to collect and dispose of garbage properly, which led to environmental pollution and health problems. The court ruled in favour of the residents and ordered the government to improve waste management in the area. Furthermore, in 2018, an Egyptian court issued a ruling in favour of a group of Nubian activists who had filed a lawsuit challenging the government's decision to sell land in the Nubian region to private investors. The activists argued that the sale would harm the environment and violate their rights to ancestral land. The court ruled that the sale was unconstitutional and ordered the government to halt the sale of land in the area.[76]

8.2 Fiscal Regulation

Although Egypt has not yet implemented a comprehensive carbon tax or emissions trading scheme, it has introduced a corporate tax incentive to promote the adoption of market techniques for low-carbon development. In 2015, Egypt's Ministry of Finance introduced a tax incentive for corporations that invest in renewable energy and energy efficiency projects.[77] Under this incentive, corporations can claim a tax

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72 Article 6 of the Egyptian Law.

73 Law No. 102 of 1983 on the Protection of the Nile River and Water Channels.

74 *Red Sea Islands Case*, (The State Council's Case No. 25 of Judicial Year 68). See also, Aljazeera, 'Egypt Court Upholds Deal to Transfer Red Sea Islands' (2016) <https://www.aljazeera.com/news/2016/12/31/court-upholds-deal-to-transfer-red-sea-islands> accessed 9 March 2023.

75 *Manshiyat Nasser Case* (Court of Administrative Justice, First Circuit, Case No. 9654/68JY), the judgment of June 4, 2015.

76 Frontline Defenders, 'Egypt: Indigenous Rights Defenders in State Security Court' (Front Line Defenders, 18 January 2018) <https://www.frontlinedefenders.org/en/egypt-indigenous-rights-defenders-state-security-court> accessed 9 March 2023.

77 International Energy Agency, 'Egypt Renewable Energy Tax Incentives (Presidential Decree No 17/2015) – Policies' (IEA) <https://www.iea.org/policies/6105-egypt-renewable-energy-tax-incentives-presidential-decree-no-172015> accessed 9 March 2023.

deduction of up to 30% of the total investment cost of the project. The incentive is designed to encourage the private sector to invest in low-carbon development and reduce greenhouse gas emissions.[78]

In addition, Egypt has implemented several policies and initiatives to promote renewable energy and energy efficiency, including the development of a National Renewable Energy Strategy[79] and the implementation of several renewable energy projects, such as wind farms and solar power plants. Furthermore, in 2014, Egypt introduced a Feed-in Tariff (FiT) program to promote the deployment of renewable energy projects.[80] The FiT program provides fixed tariffs for renewable energy projects, which are guaranteed for a certain period, typically 20 years. The tariffs are designed to provide a predictable return on investment for renewable energy projects and incentivize private investment in the sector.[81]

Subsequently, in 2016, Egypt introduced a net metering policy to encourage the deployment of rooftop solar systems.[82] Net metering allows consumers who generate their electricity from solar panels to sell excess electricity back to the grid, which provides an incentive for consumers to install rooftop solar systems and reduces their electricity bills.[83] In 2017, Egypt established an Energy Efficiency Fund to finance energy efficiency projects in the industrial, commercial and residential sectors.[84] The fund provides loans and grants for energy efficiency projects, which are designed to reduce energy consumption and greenhouse gas emissions. In 2019, Egypt issued its first green bond, which was used to finance renewable energy and energy efficiency projects.[85] Green bonds provide investors with a way to invest in projects that have positive environmental and social impacts and can help mobilize private capital for climate action.[86] While Egypt's efforts to promote low-carbon development are still in the early stages, these policies and initiatives demonstrate the country's commitment to addressing climate change and transitioning to a low-carbon economy.

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78 Ibid.

79 Vizzuality, *Supra* 43. See also, Sustainable Development Strategy: Egypt Vision 2030.

80 ERBD, 'Egypt Renewable Feed-In-Tariff Framework' (2017) <https://www.ebrd.com/work-with-us/projects/psd/egypt-renewable-feedintariff-framework.html> accessed 9 March 2023

81 Salma I. Salah, Mahmoud Eltaweel and Abeykoon, C., 'Towards a Sustainable Energy Future for Egypt: A Systematic Review of Renewable Energy Sources, Technologies, Challenges, and Recommendations' (2022) 8 Cleaner Engineering and Technology 100497.

82 Dalia Abdelhamid Mahmoud Sakr and others, 'Scaling up Distributed Solar in Emerging Markets: The Case of the Arab Republic of Egypt' World Bank Policy Research Working Paper No. 8103, The World Bank Group. <https://ssrn.com/abstract=3006127> accessed 9 March 2023.

83 SEIA, 'Net Metering | SEIA' (2017) <https://www.seia.org/initiatives/net-metering> accessed 9 March 2023.

84 Sustainable Energy Egypt, 'Second: National Energy Efficiency Action Plan (NEEAP)' (2019) <https://sustainableenergyegypt.com/wp-content/uploads/2020/07/The-National-Energy-Efficency-Action-Plan-II.pdf> accessed 9 March 2023.

85 World Bank, 'EGYPT the First Sovereign Green Bond in the Middle East and North Africa' (2022) <https://thedocs.worldbank.org/en/doc/931e017a795e984d79cfcaccadac563f-0340012022/original/16341-WB-Egypt-Case-Study-WEB.pdf> accessed 9 March 2023.

86 OECD, 'Green Bonds Mobilising the Debt Capital Markets for a Low-Carbon Transition' (2015) <https://www.oecd.org/environment/cc/Green%20bonds%20PP%20%5Bf3%5D%20%5Blr%5D.pdf> accessed 9 March 2023.

8.3 Other Regulatory Mechanisms

The government has implemented other policies and programs that encourage actions that align with climate change regulations in the country. An example of such policies is the energy subsidy reform program, which was launched by the Egyptian government in 2014.[87] The program aims to reduce energy subsidies and increase energy prices to reflect the true cost of energy production and consumption.[88] This has led to increased energy efficiency and the adoption of renewable energy sources in the country.[89] Another example is the National Strategy for Sustainable Development 2030,[90] which was launched in 2016. The strategy aims to promote sustainable development in Egypt by addressing environmental challenges, including climate change.[91] It includes several initiatives to reduce greenhouse gas emissions, such as promoting renewable energy, improving energy efficiency, and increasing the use of public transportation.[92]

In addition, Egypt has implemented penalties for actions that harm the environment. For example, the government has imposed fines on factories that violate environmental regulations, such as exceeding emissions limits or discharging untreated wastewater into waterways. In Law No. 4 of 1994 on the Environment,[93] the law outlines the duties and responsibilities of the government, individuals, and entities in protecting the environment. The law also provides for penalties for activities that cause pollution or harm to the environment, including fines and imprisonment.[94]

The Environmental Law Enforcement Decree (Presidential Decree) No. 26 of 2016[95] also imposes fines and penalties for activities that harm the environment, such as the disposal of waste in public areas, the discharge of untreated wastewater into waterways, and the operation of factories without environmental permits. Law No. 102 of 1983 on the Protection of the Nile River and Waterways also provides penalties for activities that cause pollution or harm to the river, including fines and imprisonment.[96] Lastly, Law No. 48 of 1982 on the Conservation of Nature which regulates the use and management of natural resources, including protected areas, forests, and wildlife provides for penalties for activities that harm protected areas or wildlife, including fines and imprisonment.[97]

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87 Energy Subsidy Reform Program, 2014. See also, Clemens Breisinger and others, 'Energy Subsidy Reform for Growth and Equity in Egypt: The Approach Matters' (2019) 129 Energy Policy 661.
88 *Ibid.*
89 *Ibid.*
90 Vizzuality, *Supra 79.*
91 Ibid.
92 Ibid.
93 Law No.4 of 1994 on the Environment, *supra 23.*
94 Law No. 4 of 1994 on the Environment, Section 18 of the Law No.4 on the Environment.
95 The Environmental Law Enforcement Decree (Presidential Decree) No. 26 of 2016, Articles 56 and 57.
96 Section 14 of the Law No. 102 of 1983 on the Protection of the Nile River and Waterways.
97 Section 18 of the Law No. 48 of 1982 on the Conservation of Nature.

9. IMPLEMENTING THE *DILUTE INTERVENTIONISM* MODEL IN EGYPT

Dilute Interventionism is a regulatory framework that aims to enforce climate change regulations in a balanced and flexible way. Compared to other regulatory theories, the *Dilute Interventionism* regulatory theory emphasizes the use of prescriptive measures to incentivize compliance instead of punishing non-compliance.[98] The theory employs a pyramid enforcement structure to outline the progression of interventionist measures at each level, but with an inverse structure that begins with the most severe prescriptive measures at the base and progresses towards more flexible and facilitative measures at the top.[99] This approach is intended to prevent corporate excesses while encouraging corporate participation in the regulatory framework. The base of the pyramid consists of the strictest single prescriptive measure, such as loss of license, while higher levels offer a range of increasingly less severe prescriptive sanctions like criminal, civil, and administrative sanctions.[100] As the pyramid structure widens towards the top, the available interventionist options become less prescriptive, with a greater emphasis on facilitative and self-regulatory instruments available to the corporations.[101] This allows for flexibility and allows corporations to devise their own methods to mitigate the effects of climate change while remaining within the regulatory framework. After which, the theory posit that the Government prioritizes providing economic and fiscal incentives such as tax incentives, rebates, or government grants and subsidies for sustainable projects to encourage comprehensive implementation of climate change mitigation and adaptation projects.[102]

The *Dilute Interventionism* model is a regulatory framework that can be used in different sectors, including climate change.[103] However, climate change poses a unique problem that requires the model to be reconfigured to achieve regulatory objectives effectively while minimizing the intervention burden on corporations.[104] Egypt as part of its Nationally Determined Contributions under the Paris Agreement aims to reduce its greenhouse gas emissions by 50% from its business-as-usual scenario by 2030.[105] That is equivalent to 690 million tons of carbon dioxide per year.[106] To achieve this target, the *Dilute Interventionism* model can be used in Egypt's climate change regulatory framework to restructure sanction mechanisms at different stages of the enforcement pyramid and upon

98 *Ibid.*
99 *Ibid.*
100 *Ibid.*
101 *Ibid.*
102 *Ibid.*
103 Kikelomo Kila, *Corporate Regulation for Climate Change Mitigation in Africa*: *A Case for Dilute Interventionism* (1st Edition, Routledge, 2022).
104 Ibid.
105 UNFCC, 'Egypt's First Updated Nationally Determined Contributions, *Supra 37.*
106 Ibid.

compliance incentivize corporations to participate in climate change mitigation by providing them with tax credits or other financial rewards.[107]

Moreover, the regulatory framework can set emissions reduction targets for corporations, which can be gradually increased over time. Additionally, corporations can be required to disclose their emissions data and adopt best practices for reducing carbon emissions. Though Egypt has relatively low carbon emissions compared to developed countries,[108] the impact of climate change on the country is severe. The country is vulnerable to droughts, floods, and other extreme weather events.[109] Therefore, it's crucial to strike a balance between incentivizing corporations to reduce their carbon emissions and protecting vulnerable communities from the impacts of climate change. This is because the key to achieving this goal is to motivate corporations to participate in climate change mitigation while minimizing the regulatory burden on them.[110] The government can achieve this by using incentives such as tax credits, subsidies, and grants to encourage corporations to adopt climate-friendly practices. For example, if a company installs solar panels or uses more energy-efficient equipment, it can receive a tax credit or subsidy. This will encourage companies to reduce their carbon emissions while also benefiting financially. Another way to incentivize corporations to reduce their carbon emissions is by utilizing market-based mechanisms such as carbon pricing.[111] The government can put a price on carbon emissions, which would create a financial incentive for companies to reduce their emissions. This would also generate revenue for the government, which could be used to fund other climate change mitigation projects. Implementing the *Dilute Interventionism* model requires three key features (Framework Legislation, Independent/strong Regulator and Technical competence discussed below).

9.1 Framework Legislation

To ensure compliance with climate change regulations, Egypt must draft a comprehensive framework legislation based on the principle of *Dilute Interventionism* to address environmental challenges effectively. This approach would involve initially providing strict legal instruments with specific and rigorous prescriptive measures to demonstrate the state's authority over corporations.[112] As corporations comply with these measures, regulatory interventions can be gradually de-escalated, and a co-regulatory approach can be introduced to encourage corporations to

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[107] Kikelomo Kila, *Supra 103*

[108] Henrique Morgado and others, 'International Progress on Climate Action' (2022) <https://www.europarl.europa.eu/RegData/etudes/BRIE/2022/738187/EPRS_BRI(2022)738187_EN.pdf>. accessed 9 March 2023.

[109] World Bank, 'World Bank Climate Change Knowledge Portal' (2021) <https://climateknowledgeportal.worldbank.org/country/egypt/vulnerability> accessed 9 March 2023.

[110] Kikelomo Kila, *Supra 103.*

[111] UNFCCC, 'About Carbon Pricing' (Unfccc.int2022) <https://unfccc.int/about-us/regional-collaboration-centres/the-ciaca/about-carbon-pricing> accessed 9 March 2023.

[112] Kikelomo Kila, *supra 103.*

reduce their carbon footprint, adopt sustainable practices, and comply with climate change regulations.[113] The co-regulatory approach involves collaboration between regulatory bodies, the state, and corporations to achieve greater compliance.[114] This approach recognizes that corporations can play a role in regulating themselves in certain areas of the regulatory framework once regulatory standards have been met. The co-regulatory approach would promote cooperation between corporations and regulatory bodies, leading to greater compliance and effectiveness in addressing climate change.[115]

Thus, drafting this regulation should begin with strict prescriptive foundations like loss of operating license rather than a fine not exceeding ten million Egyptian pounds or imprisonment for a period not exceeding five years, or both; to less severe prescriptive sanctions like the closure of the operating facility, criminal/civil sanctions like imprisonments/fines against the corporations and most senior officers in the corporations and end with a largely self-regulatory framework by corporations made up incentives and assistance to the corporations to encourage compliance with the prescribed regulatory standards.[116] The regulatory provision on this point can be drafted as follows:

> The system of regulating climate change activities by corporations in Egypt shall be based on the following approach –
>
> *Section 2: Regulatory Objectives*
>
> (1) Corporations that fail to comply with the prescribed regulatory standards under this law shall face strict sanctions. These sanctions may include, but are not limited to, the following:
>
> (a) Loss of operating license.
>
> (b) Closure of the operating facility.
>
> (c) Criminal sanctions, including imprisonment and/or fines against the corporations and most senior officers in the corporations.
>
> (2) Once corporations comply with the prescribed regulatory standards, the regulatory interventions can be de-escalated, and a co-regulatory approach can be introduced.
>
> (3) The co-regulatory approach shall be based on incentives and assistance to the corporations to encourage compliance with the prescribed regulatory standards. The incentives may include, but are not limited to, the following:
>
> (a) Tax incentives for corporations that demonstrate compliance with the prescribed regulatory standards.
>
> (b) Technical assistance and training to help corporations comply with the prescribed regulatory standards.

[113] *Ibid.*
[114] *Ibid.*
[115] *Ibid.*
[116] *Ibid.*

(c) Public recognition for corporations that demonstrate exceptional compliance with the prescribed regulatory standards.

(4) Once corporations demonstrate compliance with the prescribed regulatory standards, they can be entrusted to regulate themselves in certain areas of the regulatory framework.

(5) The self-regulatory framework shall be based on voluntary compliance by corporations.

(6) The government shall monitor the self-regulatory framework to ensure continued compliance with the prescribed regulatory standards.

The primary objective of this approach is to incentivize corporations to adhere to the Climate Change Act and create an enforcement structure that permits their active participation in the regulatory framework, which ultimately leads to self-regulation.[117] This entails providing corporations with co-regulatory measures that can be used to rectify any non-compliance issues as they comply with the regulations. If corporations meet the required intervention measures up to a certain level, they may eventually become self-regulating entities.[118]

9.2 Climate Change Regulator

To effectively implement the *Dilute Interventionism* model, the appointment of a sole, independent climate change regulator is crucial.[119] The primary responsibility of this regulator will be to grant licenses to corporations and ensure their compliance with the regulations through monitoring and enforcement. This approach is necessary to enforce the *Dilute Interventionism* regulatory model, where corporations obtain a permit from the regulator before undertaking any activity that may pose a threat to human health or the environment.[120]

The license granted by the regulator will serve as legal authorization for corporations to engage in carbon emission activities and will form the basis for continuous operation.[121] In addition, licensing fees may be included to cover regulatory costs and other expenses related to the implementation of the Climate Change Act.[122] It is essential to note that funding is critical to the success of the regulatory framework, and the inclusion of licensing fees will ensure that corporations contribute to the costs associated with enforcing compliance with the regulations. The establishment of the climate change regulator in the relevant framework legislation can be expressed in the following form to achieve the desired objectives:

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117 *Ibid.*
118 *Ibid.*
119 *Ibid.*
120 *Ibid.*
121 *Ibid.*
122 *Ibid.*

Part 2: Climate Change Regulator
Section 2: Appointment of Independent Sole Regulator and Licensing of Corporations

(1) The National Climate Change Regulatory Commission (NCCRC) is hereby established as an independent body to oversee the implementation of the Climate Change Act and enforce compliance with the regulations.
(2) The Commission shall be independent and impartial in the exercise of their duties and shall be subject to review and oversight by an independent authority to ensure accountability and transparency in the implementation of the Climate Change Act.
(3) The Commission shall have the power to –
   a. grant licenses to corporations for the commencement or modification of activities that may pose a threat to human health or the environment. These licenses shall serve as legal authorization for corporations to engage in carbon emission activities.
   b. monitor and enforce compliance with the regulations and may impose penalties or revoke licenses for non-compliance.
   c. incorporate licensing fees to cover regulatory costs and other expenses related to the implementation of the Climate Change Act. These fees shall be paid by corporations as a contribution to the costs associated with enforcing compliance with the regulations.
   d. establish standards for licensing, monitoring, and enforcement to ensure the effective implementation of relevant regulatory models suitable for incentivising corporate participation in climate change mitigation in Egypt.
   e. Engage external consultants to advice and provide technical services on various aspects of its regulatory functions as highlighted in this Act.

The relevant provisions establishing the proposed regulator is vital in determining its effectiveness and ability to restrain corporate disregard for regulatory objectives and incentivising corporate participation in climate change mitigation. Consequently, the above draft provision declares the independence of the corporation and confers relevant powers on the regulator to implement the appropriate regulatory framework – dilute interventionism.

9.3 Technical Competence

To ensure effective regulation, the regulator must possess the necessary technical expertise to understand the complexities of the corporations they are regulating, evaluate the compliance of corporations with the Climate Change Act, establish appropriate standards and issue licenses with the necessary conditions and restrictions where necessary.[123]

This may be achieved through the recruitment of external consultants with the requisite technical expertise to provide advice and support to the regulator in the assessment and monitoring of corporations' compliance with the regulations and/or the establishment of partnerships with technical institutions to provide the necessary expertise and cover the breadth of mitigation issues.[124] Such institutions may include universities, research institutions, and professional bodies with technical expertise in various fields related to climate change mitigation.

10. *DILUTE INTERVENTIONISM* AND SUBSIDIARY LEGISLATION BY THE REGULATOR

The successful implementation of the *Dilute Interventionism* Model is contingent on a comprehensive regulatory framework[125] that covers various aspects of climate change, including mitigation and adaptation. The framework must be designed in a way that grants significant power to an autonomous climate change regulator to implement the *Dilute Interventionism* Model.[126] This includes enforcing obligations and responsibilities on corporations, governmental bodies, and individuals concerning climate change mitigation and adaptation. The regulatory framework must also be resilient enough to withstand opposition from corporations that may resist regulatory oversight.[127] This can be achieved by establishing clear and specific legal instruments with strict prescriptive measures to demonstrate the state's authority over corporations. Such measures may include the loss of operating licenses, the closure of operating facilities, and criminal or civil sanctions against corporations and their senior officers.[128]

The regulatory framework should also include co-regulatory approaches that foster collaboration between regulatory bodies, the state, and corporations to promote compliance. As corporations comply with the prescribed intervention measures, regulatory interventions can be de-escalated, and a self-regulatory approach introduced.[129] It is important to state that the regulatory framework must be drafted in a way that allows the regulator to create subsidiary legislation to put into effect the general provisions in the framework legislation.[130] This ensures that the regulatory

123 *Ibid.*
124 *Ibid.*
125 *Ibid.*
126 *Ibid.*
127 *Ibid.*
128 *Ibid.*
129 *Ibid.*
130 *Ibid.*

framework remains flexible and adaptable to changing circumstances, while also being able to address specific issues that may arise.

To ensure the effective implementation of the Climate Change Act, it is crucial to consolidate multiple sectors responsible for carbon emissions under a single comprehensive framework. This approach will provide clarity to corporations regarding their obligations, the regulatory body responsible for enforcing compliance, and timelines for meeting regulatory standards. To achieve this, regulators for various sectors responsible for carbon emissions and atmospheric pollution, such as the oil and gas, manufacturing, and electricity and power sectors, among others, should be divested of their powers over carbon emissions regulations. These powers should be vested in the sole independent regulator responsible for climate change mitigation and adaptation.[131]

This consolidation will enable the regulator to focus on achieving its objectives without duplicating regulatory functions between different entities.[132] As a result, the regulatory process will become more efficient and effective in reducing carbon emissions and promoting sustainable development. The relevant provision to achieve this approach can be drafted as follows:

> *Section 3: Consolidating Regulatory Powers on Carbon Emissions and Atmospheric Pollution*
>
> 1. To prevent duplication of regulatory functions and ensure a comprehensive and effective regulatory framework for climate change mitigation and adaptation, the following provisions shall apply with effect from the coming into force of this Act -
>   a. The regulatory powers relating to carbon emissions and atmospheric pollution shall henceforth be vested solely in the Commission established under this Act.
>   b. All sectoral regulators previously responsible for carbon emissions and atmospheric pollution regulations shall be divested of such powers and their functions transferred to the Commission.

11. IMPLEMENTING *VETO FIREWALL* PROTECTION FOR THE CLIMATE CHANGE REGULATOR IN EGYPT

A firewall is a piece of software or hardware that is used to protect against unauthorized network access.[133] To ensure the independence and impartiality of the proposed sole independent climate change regulator in

[131] *Ibid.*
[132] *Ibid.*
[133] Chinmayee Deshpande, 'What Is Firewall: Types, How Does It Work & Advantages' (2022) Simplilearn' <https://www.simplilearn.com/tutorials/cyber-security-tutorial/what-is-firewall#:~:text=Firewalls%20are%20network%20security%20systems> accessed 1 March 2023.

Egypt's regulatory framework, a *Veto Firewall* protection mechanism must be established. The term '*Veto Firewall* protection' refers to a legislative protective wall around the regulator using the legislative veto powers to prevent undue influence or pressure from members of the executive.[134] This means that the most senior officials of the regulator should be appointed by the President only upon the approval of the Senate (Upper Legislative House). Therefore, to provide additional protection, a single or dual-tier *Veto Firewall* system should be established to safeguard the sole regulator from any undue influence or pressure.[135] This is to prevent any executive member from interfering with the regulatory functions of the independent regulator, thereby ensuring the regulator's autonomy and impartiality in carrying out its mandate to mitigate and adapt to climate change.[136]

The single tier system operates where only one veto process is instituted prior to the appointment and removal of the senior officials of the regulator. In this case, the legislature (preferably Senate) can play the veto role. A dual-tier system, however, operates where an independent body is required to recommend the approval or removal of the senior officials of the regulator by the President which is then subjected to approval by the Senate. Such stringent veto system is usually instituted for the vital regulatory sectors with high risk of executive interference e.g., the banking, judicial and election sectors. In Egypt, the single-tier system is used in the appointment and termination of most senior political and regulatory officials including the Prime Minister, heads of authorities, public bodies and diplomatic missions as this is done without the approval of the House of Representatives.[137]

Nevertheless, the dual-tier system is used in the appointment of the Governor of the Central Bank of Egypt (CBE). This appointment is governed by the Central Bank and the Banking System Law No. 194 of 2020,[138] which outlines the qualifications, appointment process, and responsibilities of the Governor of the Central Bank of Egypt. The appointment is made by the President of the Arab Republic of Egypt upon the recommendation of the Prime Minister and approval of the House of Representatives. Specifically, Article 6 of the law[139] states that 'The Governor and the Deputy Governors of the Bank shall be appointed by a Presidential Decree, upon the recommendation of the Prime Minister and subject to approval of the House of Representatives'. The Governor is selected from a pool of experienced individuals in the field of finance and economics, and the appointment is based on qualifications and relevant experience in the field. The CBE Governor's term is typically 4 years, and the governor can be reappointed for additional terms.

Similarly, the appointment of the Chief Justice of the Supreme Constitutional Court, who is also the head of the judiciary, is done by the

134 Kikelomo Kila, *Supra* 103
135 *Ibid.*
136 *Ibid.*
137 See, for instance, Article 146 of the Egyptian Constitution.
138 The Central Bank of Egypt (CBE) Law No. 88 of 2003.
139 Article 6 of the Central Bank of Egypt Law.

President of the Republic after consulting with the Supreme Judicial Council with the approval of the House of Representatives.[140]

The idea of *Veto Firewall* protection is rooted in the principles of good governance and is a recommended best practice for ensuring the independence of regulatory bodies.[141] To implement the *Veto Firewall* protection for the climate change regulator in Egypt, the dual-tier *Veto Firewall* protection is recommended.[142] This is because it is arguable that the climate emergency and the requirement for urgent and effective mitigation and adaptation strategies places the climate change sector on a par with other vital sectors of Egypt's economy such as the banking, judicial and electoral sectors. Consequently, the regulator should be dual-protected by the dual-tier *Veto Firewall* protection by creating two layers of protection against political interference. In relation to the climate change regulator, the first veto layer should involve the establishment of an independent body responsible for recommending candidates for key positions. This body should consist of experts with relevant experience in the field, and their recommendations should be based on merit and expertise rather than political considerations.

The second layer of protection will then be the approval of the National Assembly (either the Senate or House of Representatives). This ensures that the recommendations are subject to scrutiny and oversight by elected representatives, providing an additional layer of accountability and reducing the likelihood of political interference.

The institutionalisation of *Veto Firewall* protection in the proposed framework legislation can be drafted as follows:

Section 4: Appointment and Removal of Members of the Commission

1) The appointment of the Chairman and Senior Officials of the NCCRC shall be done by the President based on recommendations by an independent body of experts to be set up by the Chief Justice.
2) The appointment by the President shall be subject to approval by the House of Representatives.
3) The Chairman and Senior Officials of the NCRC shall only be removed by the President on grounds of proven misconduct based on a recommendation by the body of Independent Experts in subsection (1) above and subject to the approval by the House of Representatives.

[140] Article 185 of the Constitution of the Arab Republic of Egypt.
[141] OECD, 'Independence of Regulators and Protection against Undue Influence - OECD' (2023) <https://www.oecd.org/gov/regulatory-policy/independence-of-regulators.htm> accessed 9 March 2023.
[142] Kikelomo Kila, *Supra 103*

12. DESIGNING A *DILUTE INTERVENTIONISM* PYRAMID IN EGYPT

Designing a *Dilute Interventionism* pyramid in Egypt as a framework for climate change mitigation and adaptation is a promising strategy. By using a mild intervention as the first step in the enforcement pyramid, such as shutting down facilities responsible for violating recommended carbon emissions, it can discourage noncompliance without imposing severe criminal sanctions that may hinder participation in climate change mitigation and adaptation efforts.[143]

As corporations increasingly comply with climate change regulations, the next recommended step is to hold the most senior officials accountable through civil and administrative sanctions.[144] These measures can include fines, penalties, or administrative actions, such as the suspension or revocation of permits or licenses. By imposing such measures, the regulatory framework can effectively encourage corporations to comply with climate change regulations and uphold their responsibilities to mitigate and adapt to the effects of climate change.

In the third step of the regulatory pyramid, corporations are allowed to establish self-regulatory or voluntary measures for meeting climate change regulatory objectives within the overall framework established by the Egyptian Government.[145] As long as the corporation complies with these measures, regulators and the government can prioritize providing economic and fiscal incentives to encourage comprehensive implementation of climate change mitigation and adaptation projects.[146] These measures can include tax incentives, rebates, or government grants and subsidies for sustainable projects. The use of such incentives can effectively encourage corporations to fully commit to climate change mitigation and adaptation efforts, promoting sustainable practices while also benefiting the economy.

The modalities of implementing this *Dilute Interventionism* pyramid will be determined by the regulator in a subsidiary legislation to be promulgated in exercise of its statutory powers. The importance of utilising a subsidiary instrument instead of the primary statute for this purpose is the flexibility for amendment and adjustments of the contents of the pyramid as needed from time to time, particularly in the early days of its implementation where flexibility is required to responding to changing dynamics of the regulatory field as the regulator establishes its regulatory dominance over corporations.

143 *Ibid.*
144 *Ibid.*
145 *Ibid.*
146 *Ibid.*

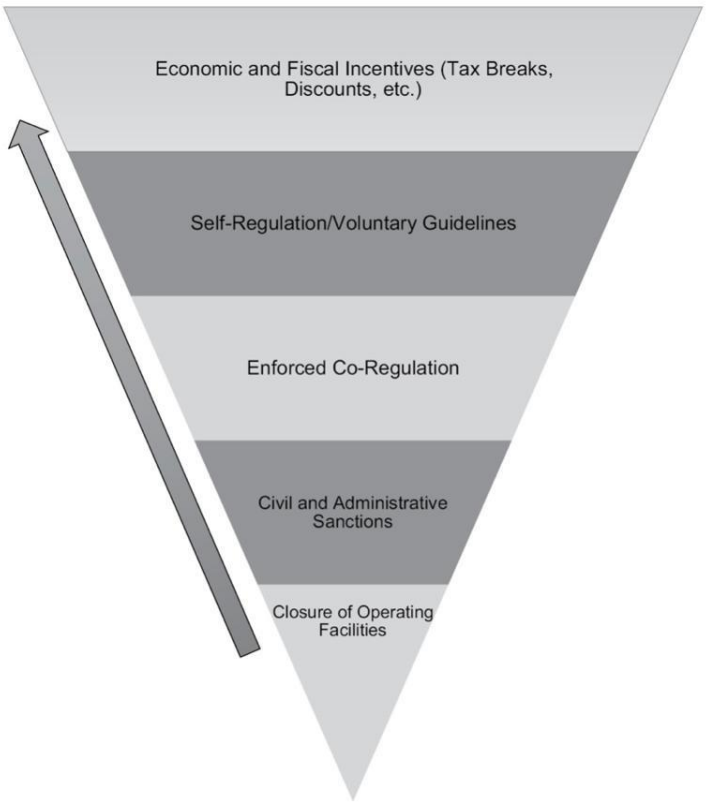

Figure 1: Corporate Regulation for Climate Change Mitigation in Africa (Source: Kila[147])

13. CHALLENGES TO IMPLEMENTING *DILUTE INTERVENTIONISM* AND *VETO FIREWALL* PARADIGM IN EGYPT

The implementation of *Dilute Interventionism* and *Veto Firewall* paradigm in Egypt may face several challenges and they are:

13.1 Lack of Political Will and Awareness of the Severity of Climate Change

The lack of political will and awareness of the severity of climate change may hinder the implementation of the proposed framework. Climate change may not be a priority for the government and policymakers, and they may not be willing to allocate resources to address it. For example, the New National Renewable Energy Strategy 2008 and the Egypt National Climate Change Strategy (NCCS) 2050 may lack the necessary funding or resources for their implementation, rendering them ineffective in achieving their goals. To overcome this obstacle, policymakers need to be educated on the impacts of climate change, the benefits of reducing emissions, and the potential for green economic growth.

147 *Ibid.*

13.2 Resistance from the Private Sector

Resistance from the private sector is another potential challenge to the implementation of the *Dilute Interventionism* model. Senior officials of corporations may resist civil and administrative sanctions as they may view such measures as excessive and harmful to their interests. For example, fines or the suspension or revocation of permits or licenses may have a negative impact on corporate profits. Overcoming this obstacle requires a significant shift in corporate culture and mind set towards environmental responsibility. The government may need to provide more comprehensive training and education to private sector actors on the benefits of sustainable practices and the risks of climate change.

13.3 Limited Financial Capacity of the State

Limited financial capacity of the state is another potential obstacle to the implementation of the *Dilute Interventionism* model. Providing incentives to corporations, such as tax incentives, rebates, or government grants and subsidies for sustainable projects, may require significant financial resources. If the government does not have sufficient funds to allocate to such measures, it may be difficult to encourage corporations to comply with climate change regulations. To overcome this obstacle, the government may need to explore alternative funding mechanisms, such as public-private partnerships, international climate finance, or green bonds.

13.4 Bureaucratic Hurdles

Bureaucratic hurdles are another potential challenge to the successful implementation of the *Dilute Interventionism* model. The establishment of an independent climate change regulator may face bureaucratic hurdles, as existing sectoral regulators may resist divesting their powers over carbon emission and atmospheric pollution regulations. Overcoming this obstacle may require a coordinated effort from various stakeholders and a significant push from the government to create a new regulatory body or to give existing regulators clear mandates for implementing climate change regulations. In addition, there may be a need for more extensive collaboration between sectoral regulators to ensure that their policies are aligned with climate change mitigation and adaptation objectives.

14. CONCLUSION

In conclusion, Egypt can utilize the *Dilute Interventionism* model and *Veto Firewall* paradigm to effectively regulate corporations involved in activities that contribute to climate change. However, challenges such as lack of political will and awareness of the severity of climate change, resistance from the private sector, limited financial capacity of the State, and bureaucratic hurdles must be overcome to ensure the successful implementation of these strategies. To mitigate the impact of climate change, Egypt must prioritize both climate change mitigation and adaptation through a comprehensive regulatory framework that incorporates best practices from around the world. Swift action is crucial given the urgency of

the climate change crisis and raising public awareness and educating citizens about the importance of mitigating climate change. This can be achieved by providing capacity-building programs, increasing public education, and establishing effective monitoring and enforcement mechanisms. By doing this, the Government of Egypt can ensure long-term environmental sustainability and mitigate the impact of climate change.

To ensure a sustainable future for Egypt, it is recommended that the government collaborates with relevant stakeholders to develop a comprehensive legislative framework that promotes economic growth while ensuring compliance with climate change regulations. The *Dilute Interventionism* model and *Veto Firewall* paradigm are promising strategies that could aid in this endeavour, but their effectiveness hinges on the government's commitment to implementing a tailored regulatory framework. Therefore, the government must take proactive steps to engage with stakeholders to develop a comprehensive legislative framework that covers all relevant aspects of climate change mitigation and adaptation, while balancing environmental protection and economic growth.

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AUTHOR'S DECLARATION AND ESSENTIAL ETHICAL COMPLIANCES

Author's Contributions (in accordance with ICMJE criteria for authorship)
This article is 100% contributed by the sole author. S/he conceived and designed the research or analysis, collected the data, contributed to data analysis & interpretation, wrote the article, performed critical revision of the article/paper, edited the article, and supervised and administered the field work.

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The author(s) solemnly declare(s) that this research has not involved any human subject (body or organs) for experimentation. It was not a clinical research. The contexts of human population/participation were only indirectly covered through literature review. Therefore, an Ethical Clearance (from a Committee or Authority) or ethical obligation of Helsinki Declaration does not apply in cases of this study or written work.

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