A LEGAL-ENVIRONMENTAL REVIEW OF ARTIFICIAL INTELLIGENCE'S UNSEEN COSTS

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ABSTRACT

In this modern society, Artificial Intelligence (AI) has been part of human lives so crucial that no one can save without it. By far, AI also comes with vast disadvantages and challenges as far as Environment is concerned but these aren't so explored.

United Nations Environment Programme (UNEP) reports state that the amount of electricity, water etc. consumed by the AI data centers, which runs the AI model, causes pollution and emits greenhouse gas.

The aim of this paper is to give a holistic analyzing of EPA (environment protection agency) of the rapid pace AI introduces in to the pollution by its energy consumable processes. It shall examine how the issue of negative environment problems due to AI efforts is created at different stages of life cycle of the AI technologies. Moreover, this study will provide sustainable solution to overcome the problems resulting from AI with regard to environment. Also, they provide what the country should do to create a proper bridge between using AI as it's being used now and a sustainable environment. Finally, this study will look into the necessity of organized energy architecture and integration of renewable energy resources.

Following this, it aims to fill up the gap between technological advancement and environment sustainability, and in so doing, adequately address these concerns to develop AI with appropriate environmental measures and regulatory mechanisms.

Keywords: Artificial Intelligence (AI), Environmental Impact, AI Data Centers, Carbon Footprinting, Legal Frameworks.

1. Introduction

Artificial Intelligence has become a global race, a race that are chased by governments, corporations and academia, but it is also true that there's a dark side of AI that has gone unnoticed. AI carries an environmental toll. Although its use is widely celebrated for green enablers such as climate modeling and smart infrastructure, AI development, training and deployment significantly consume energy and entail massive amounts of greenhouse gas emissions. The environmental footprint of AI is an issue that is quickly rising. As nations pledge to solve sustainable development goals and decrease the amount of carbon being emitted from them. With computational intensity of training large AI models, reliance on data centers, and the growing requirement of special hardware, all this has become increasingly relevant questions on whether AI can be made to work with environmental sustainability. While there is growing discourse on AI ethics and regulation, the environmental dimension has not been considered at all, at least in a legal and policy aspect.

This paper closes this research gap by conducting a critical discussion about how AI is responsible for environmental degradation, where focus is given to the type of energy consumption, carbon emissions, electronic waste and resource extraction. In addition, it determines how the impact of these changes varies across the world as an indicator of issues of environmental inequality and sustainability.

Central research questions of this study are as follows:

(i) What major environmental problems does AI create?

(ii) How carbon foot printing and water sources fit to energy consumption of AI data center?

(iii) What problems do the AI infrastructure and chips create on the environment?

(iv) What are the existing and upcoming legal frameworks that deals with AI and environment?

The four objectives of this study are as follows:

(i) The aim is to analyze the effect of AI on the environment with regard to energy

consumption, water usage and e-waste in particular.

(ii) To evaluate the real-instances of environmental conflicts.

(iii) To assess the existing and coming legislations and policies regarding AI and environment

(iv) To put forward suggestions and recommendations to create a bridge between AI development and sustainable environment

This paper aims to create a viaduct between environment and legal-political dimensions of AI. Although discussions of technical aspects like algorithm optimization, or software engineering will occur where necessary, specific topic is not focused on technical aspects.

The study wishes to bring this overlooked dimension of AI into a public conversation in order to spark critical discourse and prepare the regulatory frame for AI developments that cannot be cast as environmentally stewarding.

2. What is Artificial Intelligence (AI) and AI in various province?

2.1: What is AI?

There is no strict or exclusive definition of artificial intelligence (AI) but the most simple and well-known definition of AI is- The reconstruction of human IQ in machines which allows them to perform tasks with more speed by their own means is termed as AI. [1]. Thus, an AI model is trained in such a manner that it has cognitive, critical, logical, problem-solving skills.

On a primary note, AI is categorized into 3 types:

i) Artificial narrow intelligence (ANI)

The machine is extremely good to perform a specific task but lacks to do several or multiple jobs. This type of AI is widely known as Narrow AI. The term Weak AI is interchangeably in this case. This was the first or initial stage of development of AI.

[1] Harnessing AI to optimize IT operations: Trends, tools and best practices. https://www.calibernetworks.com/post/harnessing-ai-to-optimize-it-operations-trends-tools-and-best-practices

This type of AI typically focuses to perform a distinct task therefore it is most efficient. Some examples of narrow AI include- Google search, chatbot etc.[2]

ii) Artificial General Intelligence (AGI)

AGI or strong AI is the future generation, which is capable to perform all types of tasks. The main feature of this type of AI is it has human like thinking, reasoning and problem-solving skills. It can mimic the cognitive abilities like a human brain. Whenever there is a decision that is creating a conflict or differences, AGI gives reasonable decision in such scenario.[3] Example- A patient visits a doctor with problematic symptoms. The doctor uploaded the patient's prescription in an AGI analysis system and the result which he got identifies a rare genetic mutation linked to a specific disease. Now this information is very critical for the doctor to create a roadmap for the patient's treatment and also this information might be needed for research purposes subject to the voluntary consent given by such patient.[4]

iii) *Artificial Super Intelligence (ASI)*

ASI is considered to be the most advanced form of AI that has been theorized. Hypothetically speaking, this type of AI is considered to be surpassing the human brain, it's accuracy, problem-solving skills and critical thinking. It is anticipated, ASI will outperform the brightest humans in task execution and autonomously invent new technology. ASI is a hypothetical idea as yet, but there are highly capitalized start-ups underway to build a "safe" super intelligence that would place safety and ethics above all else. Example- A technology performing work, employment, economy, governance, state, democracy etc.[5]

2.2: AI in various province

(i) AI in Healthcare: Considering the past five years, AI is making a tremendous impact in the healthcare industry and going to have a significant impact on this industry in the

[2] Khan, H. (2021, September). Types of AI: Different types of AI systems. ResearchGate. Retrieved from https://www.researchgate.net/publication/355021812
[3] "ibid"
[4] Mucci, T. & Stryker, C. (2024, April 18). Getting ready for AI with examples. IBM. Retrieved from https://www.ibm.com/think/topics/artificial-general-intelligence-examples
[5] Gill, K. S. (2016). Artificial super intelligence: Beyond rhetoric. AI & Society, 31(1), 137–143. https://doi.org/10.1007/s00146-016-0651-x

upcoming years. Healthcare industries are also using AI to make a better and efficient diagnosis than humans[6]. By uploading the prescription or test report, the AI tool provides a predictive analysis, including potential diagnoses and future health risks.[7]

(ii) AI in Data Security: Data is considered to be an asset. Therefore, it becomes essential for the companies as well as government bodies to protect it from growing concerns of cyber-attacks and data breaches. So, with the help of AI and blockchain technology, the companies and government bodies adopted measures like threat hunting, automated incident response to prevent cyberattacks.

(iii) AI in Finance: In finance, Generative AI is increasingly used to enhance productivity by streamlining tasks and boosting efficiency[8]. Also, AI in the form of machine learning and neural networks is used by investment firms essentially for high-speed trading[9]. GenAI is speculated to be able to eliminate barriers to entry for the quantitative investors into less liquid asset class, which may also have financial stability challenges[10].

(iv) AI in social media: Websites like Facebook, Instagram, twitter etc. contains billion of user profiles which needs to be archived, managed and processed timely. Earlier with the help of computer programmers this was used to be done in bulk. After the incoming of AI tools these personal information's of users are organized and managed in a more efficient manner and timely[11]. AI can analyze data in bulk to identify the latest trends, hashtags etc. for different users.[12]

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[6] (2024, November 6). The Three Different Types of Artificial Intelligence – ANI, AGI and ASI. https://www.marktechpost.com/2024/11/06/the-three-different-types-of-artificial-intelligence-ani-agi-and-asi/

[7] Patil, N. H., Patel, S. H., & Lawand, S. D. (2023). Artificial intelligence and its applications. Journal of Advanced Zoology, 44(S-8), 229–238, ISSN: 0253-7214.

[8] (2023, September 19). The era of generative AI: Driving transformation in financial services . https://www.microsoft.com/en-us/industry/blog/financial-services/2023/09/19/the-era-of-generative-ai-driving-transformation-in-financial-services/

[9] (2025, April 2). AI-Powered Trading: How Machine Learning Is Enhancing Financial Market . https://www.neosofttech.com/blogs/ai-powered-trading-predictions

[10] Adrian, T. (2024, September 6). Artificial intelligence and its impact on financial markets and financial stability. Speech presented at the Bund Summit 2024: Navigating a Changing World, Shanghai, China. International Monetary Fund (IMF), Retrieved from shttps://www.imf.org/en/News/Articles/2024/09/06/sp090624-artificial-intelligence-and-its-impact-on-financial-markets-and-financial-stability

[11] (2023, June 8). The impact of AI on social media - TechTarget. https://www.techtarget.com/WhatIs/feature/The-impact-of-AI-on-social-media

[12] Patil, N. H., Patel, S. H., & Lawand, S. D. (2023). Artificial intelligence and its applications. Journal of Advanced Zoology, 44(S-8), 229–238, ISSN: 0253-7214.

(v) AI in E-Commerce: Retailers from e-commerce are increasingly using chatbot as a bridge to connect between the interface and users. This chatbot provides 24x7 assistance to the online shoppers. Retailers are making big profits by leveraging AI to personalize product recommendations to customers as they have been observing and purchasing the customers past activity[13].

These above-mentioned applications of AI aren't exclusive but AI encompasses the ability to perform efficient tasks in different fields and sectors. Therefore, AI exhibits different types and stages, depending on the specific tasks that the AI tool is designed to perform. It must be noted that AI has made our lives much easier than before. It provides us with greater efficiency to perform our daily tasks and also gives us a roadmap or different advices to perform a specific job. Likewise, it is a fundamental reality that every benefit comes with its own set of drawbacks. Thus, AI is multifaceted, encompassing both advantages and disadvantages but the burden is on us to answer questions like-Whether AI is being used ethically or with an unreal intention? What negative implications it is creating in the society and how such AI barriers can be eliminated?

3. The Environmental fallout caused by AI

Environment is a concerned topic globally, therefore countries come up with different plans, strategies, agendas, etc. Countries need to adopt stringent regulations and policies for different environmental problems like wastewater management, air pollution, solid waste treatment, conservation of energy etc. Environmental pollution control is really complex issue as it involves dynamic factors that interact in unpredictable ways, making it challenging to find the effective solutions for improvement.[14]

To train an individual AI model, a massive one like a large language model (LLM), it takes about several thousand-megawatt hours of electricity and expels well over 100tons of carbon. Moreover, it causes AI model training to evaporate high volume of fresh water into the atmosphere during the heat cooling or helping to cool down the AI model, which places more

[13] (2024, November 20). Leveraging AI for Personalized Customer Experiences in Retail. Retrieved from https://www.aciinfotech.com/blogs/ai-retail-solutions-personalized-customer-experience

[14] Abubakar, I. R., Maniruzzaman, K. M., Dano, U. L., AlShihri, F. S., AlShammari, M. S., Ahmed, S. M. S., Al-Gehlani, W. a. G., & Alrawaf, T. I. (2022). Environmental sustainability Impacts of solid waste management practices in the global South. International Journal of Environmental Research and Public Health, 19(19), 12717. https://doi.org/10.3390/ijerph191912717

strain on our existing water resources[15].

As the demand for AI applications grows, the energy consumption to power the AI infrastructure also increases. Data centers which are responsible to store and running the AI systems requires significant energy, often relying on non-renewable sources of energy. Therefore, the exponential growth of AI also leads to negative impact of environment which largely remain unnoticed and unaccounted for.[16]

AI's environment impact can be broadly categorized into three key issues:

(i) High energy consumption and high carbon footprinting which eventually calls for negative implications on climate.

(ii) Consumption of water for data center cooling

(iii) E-waste generation caused by AI

3.1: Consumption of high energy and escalation of carbon footprinting: An overlapping issue

As explained by World Health Organization (WHO), Carbon footprinting is the number of tons of carbon dioxide a person emits, it is a measurement of the carbon dioxide produced when humans use the fossil fuel. A kind of subset to carbon footprint is the ecological footprinting. This often also takes place by means of utilization of fossil fuel for combustion purposes, heating, transportation, and even emissions needed to produce the energy. The emission of other gases of greenhouse gases such as chlorofluorocarbons (CFCS), methane etc, is also a part of this concept. It is a known human induced cause of global warming and are known to be major contributors of this phenomenon. Against the backdrop of growing urgency around the planet with regards to climate change, there is a great focus on weaning off carbon intensive energy technology. The global warming is stimulated by greenhouse gases. The decade from

[15] Ren, S., & Wierman, A. (2024, July 15). The uneven distribution of AI's environmental impacts. Harvard Business Review. Retrieved from https://hbr.org/2024/07/the-uneven-distribution-of-ais-environmental-impacts
[16] Li, X., Wang, Q., Tang, Y. (2024). The impact of AI development on urban energy efficiency- Based on the perspective of smart city policy, sustainability, 16(8), 3200. https://doi.org/10.3390/su16083200

2011 to 2020 was the hottest on record, it said. And from 1990 to 2005 there was a total emitting of 31%. It was the result of a 35 percent surge in radiative warming vs. 1990 levels by 2008[17].

In other words, the carbon footprint of AI consists of two parts: embodied emissions derived from manufacturing of IT Units and building Data centers, and operational ones, stemmed from electricity consumed by computer chip which have to do AI related calculations. The reason for this is that both of these aspects increase the emission of greenhouse gases since more data centers are being built to make AI more efficient and human friendly. In 2022, the 11,000 data centers in the world have consumed about 1.0-1,3 % of total electricity, and the demand for AI is rising in disregard of the environment issues. For the case of US, current data centers account for 4% of US electricity and US hosts around half of the world's data centers. From 2020 to 2023, Microsoft's carbon footprint grew 30 percent from the steel chip manufacturing etc. So, to counter it Microsoft started using wood in some of its data centers which can reduce the carbon footprint but this partially was a solution, and it wasn't able to fully make up for the emissions and it is to be mentioned that wood supply chains are somewhat limited[18].

Like the generative AI (GenAI) like ChatGPT, DALL – E, the large language models (LLMs) churned out by them demand huge energy and electricity to train, let alone process. In fact, by 2026, the electricity consumption of the data centers is said to be somewhere close to 1,050 terawatts – and that is surprisingly gigantic. Train Chatgpt-3 alone, according to Google and University of California at Berkeley scientist, it consumes 1,287 megawatts hours of electricity and thus makes 552 tons of carbon dioxide.[19]

While the strong demand for data centers for AI has contributed to the number of threats leading to the increment of carbon footprint; there are still a variety of approaches adopted to decrease the emission of greenhouse gas like engagement of new designs for the ROI of AI infrastructure, best optimization algorithms to shorten the time of AI training and inference, manufacturing of energy efficient GPU's and accelerators. Ways data center operators are building extensive solar farms, increasing the number of renewables they buy through

[17] Smriti. (2023, January 5). Carbon footprint and its effects. Time of India- Honest thoughts blog. Retrieved from https://timesofindia.indiatimes.com/readersblog/honestthoughts/carbon-footprint-and-its-effects-48856/
[18] "ibid"
[19] Zewe, A. (2025, January 17). Explained: Generative AI's environmental impact. MIT News. Retrieved from https://news.mit.edu/2025/explained-generative-ai-environmental-impact-0117

renewable energy certificates to reach "net zero" emissions[20].

The carbon footprinting from AI in the future is very unknown as AI has the ability either to increase the greenhouse gas emissions or to decrease them in the years to come. The results will depend on the new technologies implemented, investment decisions and policy making.[21]

3.2: Water consumed by data centers for cooling purposes

Due to intensive demand, data centers not only require vast amount of electricity for AI and LLM training but also consumes considerable amount of water for cooling. Data centers are buildings full of computers and storage that handle a company's data. They need to be kept cool and at the right humidity. Cooling them uses a lot of energy- about 40% of their total power. The availability of water is vital to the industry and agriculture. The projected demand of water will rise by 55 percent between 2000 and 2050 from manufacturing units, thermal power generation and the domestic use.

Water is used in 2 categories, i.e. indirectly through the electricity generation and directly for cooling, in data centers. In 2014, US data centers were seen to use 626 billion litres of water. Water is consumed by a medium sized data center in the same amount proportional to more than two 18-hole golf courses. Many research provides that about one fifth of data centers in states in US depend on watersheds and are being stressed even for moderate to high levels of stress due to drought and other environmental issues. About 300,000 gallons of water per day is consumed by a mid-sized data center (1,000 average American homes water usage per day). The water used by data centers undergoes chemical treatment to prevent corrosion and bacterial contamination which eventually becomes unsuitable for human consumption or agricultural purposes. As a result, data centers not only deplete the substantial amount of potable water, but also eliminate such from the local water cycle, which creates a major challenge in water-stressed regions. This must be noted that even before the breakthrough of AI in 2023, data centers consume a significant amount of water but this concern has been intensified by the growing demand of AI model training and usage, which escalated water consumption in these facilities. Many data centers are built in developing countries where environmental regulations

[20] Ren, S., & Wierman, A. (2024, July 15). The uneven distribution of AI's environmental impacts. Harvard Business Review. Retrieved from https://hbr.org/2024/07/the-uneven-distribution-of-ais-environmental-impacts
[21] Sandalow, D. (2024, November). Greenhouse gas emission from AI. In AI for climate change mitigation roadmap (second edition). Columbia University.

aren't strong enough, leading to over-extraction of water.[22] The growing footprint of data centers increased environmental concerns. Recently Microsoft disclosed that 42% of its water consumption occurs in areas facing water stress, while Google reported that 15% of its fresh water withdrawals came from regions with high water scarcity.[23]

In order to reduce the energy and excessive water dilution, data centers in 2000s adopted "hot and cold aisle containment technique". This is a method which separates hot and cold airflows with barriers, resulting in lower energy consumption and more consistent temperatures as compared to other systems. However, after the surge of AI in 2023, it dramatically increased the demand for data centers, consequently causing data center racks to generate considerably more heat than previously. So, modern and innovative ideas were implemented which includes evaporative and liquid cooling techniques to enhance efficiency and sustainability.[24]

Looking towards future cooling solutions, underwater data centers are being explored. Microsoft's 2018 Project Natick experiment in the North Sea demonstrated a feasibility of this technique as they found that submerged servers achieved high stability and exceptional energy efficiency. Following this lead, China's Highlander company, in collaboration with their government is building a large-scale underwater data center near Hainan Island which is scheduled to be completed by 2025. This strategy is adopted because underwater data centers reduce land use and stable operating environment highlighted by experts like Xie Qian and If successful this technology could become a significant part of future data center infrastructure[25].

3.3: E-Waste generation caused by AI

Due to limited research on AI's electronic waste, major solutions will be necessary to address this emerging problem. With the rise of powerful LLMs like GPT-4, BERT etc. alongside with the adoption of Generative (GenAI), is driving a global expansion of hardware infrastructure to meet future computing demands, underscoring the critical need for sustainable

[22] Sharma, L. (2024, December 19). AI data centers threaten global water security. Lawfare.
[23] Berreby, D. (2024, February 6). As use of AI soars, so does the energy and water it requires. Yale Environment 360. Retrieved from https://e360.yale.edu/features/artificial-intelligence-climate-energy-emissions
[24] Kseibati, R. (2025). Cooling innovation and circularity: addressing water stress in the age of AI driven data centers (Master's thesis). Massachusetts Institute of technology, center for real estate. Retrieved from https://hdl.handle.net/1721.1/158889
[25] "ibid"

computing practices.[26]

Basically, e-waste covers discarded electronic equipment like computers, smartphones, televisions and other consumer electronics. According to the 2019 estimate of The United Nations, the amount of e-waste that was generated globally was projected to surpass 53,6 million metric tons, and increase at an estimated annual rate of around 3-4%. Valuable elements like gold, silver, copper etc. coexist with toxic compounds like lead mercury in e-waste, requiring different recycling methods to recover resources and limit environmental damage.[27]

"One of the possibilities is that generative AI may generate up to 5 million metric tons of e-waste in 2030, according to a new study", according to 'The Davos Agenda'. The quantity being addressed here is relatively small fraction of the over 60 million metric tons of e-waste produced annually across the whole world. Still, it is still part of a growing concern, but out of everything. But overall, GenAI could send between 1.2 and 5 million metric tons of e-waste out into the world based on a study in nature computational science on the adoption of the technology by a breakneck pace in 2030. GenAI's e-waste is primarily for the most efficient of the computing devices in data centers and serve farms such as GPUs, CPUs and storage devices. Materials used in those devices include also copper, gold, silver etc. and some hazardous like lead or mercury, other computer hardware. As AI technologies and AI infrastructures are quickly adopted, very major reason is that E-waste formed by AI companies. Life span of computing devices is generally 2-5 years and it then has to be replaced with new or latest hardware's. "One of the biggest hindrances between the reduction of AI related waste is data security, according to Asaf Tzachor, research at Reichman University in Israel". Information does not leak out of shattering equipment's; this is until reusing or recycling equipment's and there are other means of securing data. If recycling is critical for a company that needs to tackle personal sensitive information's, then it is paramount that sensitive personal information must be erased from the hardware[28].

[26] Wang, P., Zhang, Ly., & Chen, W.Q. (2024). E-waste challenges of generative AI. Nature computational science. Retrieved from https://doi.org/10.21203/rs.3.rs-3978528/v1

[27] Dada, S. R., Ogbuagu, B. O., Dada, S. B., Ayorinde, O. S., & Osagie, B. (2025). The role of artificial intelligence and machine learning in enhancing e-waste sorting and recycling efficiency. International Journal of Multidisciplinary Research and Growth Evaluation, 6(1), 1927–1930. https://doi.org/10.54660/IJMRGE.2025.6.1-1927-1930

[28] Crownhart, C. (2024, October 28). AI will add to the e-waste problem. Here's what we can do about it. MIT Technology Review.

Different theoretical aspects have been provided by researchers, like to adopt more advanced chips that will help the server farms to produce less waste. Counties that do not have access to advanced chips may generate more waste as a result. Upgrading the chips to latest version will take one year delay and it will lead to 4 percent increase in e-waste. "Tzachor adds that by adopting circular economy strategies, its e-waste generation could be halved (16 percent reduction) or even reduced by 86 percent". There is an attempt to reduce waste and increase the circular efficiency of the computer hardware using circular economy strategies And Tzachor gave three main goals of the strategy.: -

(i) "Prolong the use of existing hardware to delay the need for new equipment"

(ii) "Reuse and remanufacture components"

(iii) "Extract valuable materials during the recycling of hardware".

He also emphasized that e-waste is a global concern and e-wastes from AI is a growing challenge that needs to be addressed via policies and different cross-border management waste strategies to mitigate the environment and health damage.[29]

4: Real-world examples of AI's environmental concerns

The following outlines several adverse environmental impacts resulting from the deployment of AI: -

4.1: Chile and Google's Data Center conflict

For the past 15 years, Chile is into an unprecedented drought, with the government enforcing water rationing in 2022. In January, 2024 deadliest wildfire took place in Chile which left at least 112 people dead and thousands were displaced.[30]

[29] Deutsche Welle. (2024, October 31). E-waste from AI computers could 'escalate beyond control': Study. Deutsche Welle. Retrieved from https://frontline.thehindu.com/news/e-waste-ai-computers-artificial-intelligence-escalate-by-2030-environmental damage/article68814329.ece#:~:text=Prolong%20the%20use%20of%20existing,materials%20during%20recycling%20of%20hardware

[30] Moss, S. (2024, February 28). Chile partially reverses Google data center permit over water use concerns. Data Center Dynamics. Retrieved from https://www.datacenterdynamics.com/en/news/chile-partially-reverses-google-data-center-permit-over-water-use-concerns/

A Chilean environmental court has partially revoked Google's permit for a 200-million-dollar data center in Santiago, citing concerns over water usage and climate change impacts on the local aquifer. The court ordered Google to revise its water usage assessment and consider alternative cooling methods. Google responded by stating they have updated their design to use air cooling and will cooperate with local authorities.[31] This case essentially highlights concerns regarding AI's water footprint.

4.2: *Approval of google' Data Center in Uruguay*

Uruguay's Environment Ministry has approved Google's Teros data center project in Canelones. This approval marks a major step, as the project faced delays due to environment concerns, particularly with respect to usage of water. Initially Google's plans began in 2020 and saw land acquisition in2021. Google proposed a daily consumption of 7.6 million litres of potable water which was a problematic figure given Uruguay's ongoing drought. Therefore, to address these concerns, Google revised its plans by reducing the project's size and opting for an air-cooling system instead of water-based cooling. They also committed to limit the data center's maximum annual energy consumption to under 560 GWh.[32]

4.3: *Environmental concerns over AI Data Centers in UK*

Keir Starmer's plan to boost AI capacity in the UK through "growth zones" with reduced planning restrictions for data centers is raising significant environmental concerns, particularly regarding water consumption. The proposed plan aims to establish AI growth zones in Culham. Oxfordshire which is situated near crucial reservoir intended for water stressed regions in the south-east England, where such area is already facing shortage of water. The proximity of these data centers to new reservoirs has sparked fear about exacerbating water shortages, given the substantial water requirements for cooling AI data centers. Projections indicate global AI water usage could reach levels comparable to 2/3rd of England's annual water consumption by 2027. Experts and critics argue that this strategy will intensify water stress,

[31] "ibid"

[32] O'Grady, V. (2024, July 29). Google gets go-ahead for Uruguay data center after water worries. Developing Telecoms. Retrieved from https://developingtelecoms.com/telecom-technology/data-centres-networks/17075-google-gets-go-ahead-for-uruguay-data-centre-after-water-worries.html

especially in areas like Culham, and that climate change will further strain water resources. This plan is also criticized for its energy implications, with data center electricity consumption projected to double by 2026, potentially consuming 4.5% of global energy generation by 2030.[33]

4.4: Regulatory Scrutiny of Underwater Data Centers in San Francisco Bay

Entrepreneurs proposed submerging AI data centers in San Francisco Bay to utilize seawater for cooling, aiming to reduce energy consumption. However, regulatory bodies and environmental scientists expressed concerns about potential ecological disturbances like toxic algae blooms. The lack of proper permits and environmental assessments led to regulatory pushback, highlighting the tension between innovation and environmental protection.[34]

4.5: ***Dispute over Energy Costs for AI Data Centers in Ohio***

Major tech companies like Google, Amazon, Microsoft etc. facing disputes with Ohio utility American Electric Power (AEP) over funding electric grid updates as it will be necessary for the new AI data centers. AEP proposed that these companies cover a significant portion of the upgrade costs due to the requirement of substantial energy for AI and LLMs training. Therefore, this leads to a conflict to determine the financial responsibility and address the environmental implications of increased energy consumption.[35]

4.6: ***New reactions to Elon Musk's new AI data center raise an alarm about pollution***

Musk's, xAI, who first dubbed the site Happy Farm (formerly known as Jeff Bezos's

[33] Horton, H. (2025, January 13). Water shortage fears as Labour's first AI growth zone sited close to new reservoir. The Guardian. Retrieved from https://www.theguardian.com/technology/2025/jan/13/labour-ai-datacentre-growth-zone-water-shortages-abingdon-reservoir#:~:text=2%20months%20old-,Water%20shortage%20fears%20as%20Labour's%20first%20AI,sited%20close%20to%20new%20reservoir&text=Labour's%20first%20artificial%20intelligence%20growth,water%20supplies%20in%20the%20area

[34] Dave, P., & Rogers, R. (2024, September 10). An underwater data center in San Francisco Bay? Regulators say not so fast. Wired. Retrieved from https://www.wired.com/story/networkocean-datacenter-san-francisco-bay-environment/

[35] Radtke, P. (2025, March 19). Power for data centers could come at 'staggering' cost to consumers. Ohio Capital Journal. Retrieved from https://ohiocapitaljournal.com/2025/03/19/power-for-data-centers-could-come-at-staggering-cost-to-consumers/

Cornfield Farm) had been run out to plan for the Tesla entrepreneur's AI venture, their newly unveiled deep learning AI model Grok 3 had set up a data center in Memphis. Apart from taking a lot of electricity and water, it has also alarmed residents around the facility, as well concerned officials, on how fast it was built and a large use of resources, electricity and water in particular, it will generate high level of pollutions and the undue number of gas turbines (unpermitted) that spew tons of nitrous oxides. This will foster the environmental apathy, as there would be none and at the same time increase an additional burden on an already straining of the city infrastructure. The environmentalists say that the signs of Boxtown's health are negative and if anything goes wrong, it will only add to the increasing air pollution, growing manufacturing units[36].

5. Existing and Upcoming Legal and Policy Frameworks for AI's Environmental Ethics

5.1: Recommendation given by UNESCO: Ethics of AI

In November 2021, the global standard on AI ethics, as promulgated by the first global standard developed by UNESCO in November 2021 that is bindable for all 194 member states, was created. This recommendation delivered is a move to protect human rights and dignity, principle of fairness and transparency. Although it mostly talks about ethical development, it additionally adds the significance of environmental sustainability in AI application[37].

The recommendation urges that we recognize, protect and promote the environmental and ecosystem flourishing at the whole life cycle of an AI system. It further declares that the ecological balance and biodiversity shall be conserved through AI systems which are to be designed and built in a way that they would assist in doing same. [38].

UNESCO declared sustainability as a core principle in the ethical deployment of AI. The recommendation calls for the assessment of AI technologies based on their

[36] Chow, A. R. (2024, September 17). Elon Musk's new AI data center raises alarms over pollution. Time. Retrieved from https://time.com/7021709/elon-musk-xai-grok-memphis/
[37] Kaushik, A. (2021, December 9). UNESCO's recommendation on the ethics of AI. Montreal AI ethics institute. Retrieved from https://montrealethics.ai/unescos-recommendation-on-the-ethics-of-ai/
[38] "ibid"

impact in various domains including environment. This assessment should align with evolving goals which are outlined in the United Nations Sustainable Development Goals. By integrating sustainability into AI evaluations, the recommendation ensures that AI applications contribute to long-term ecological balance and resource efficiency.[39]

5.2: UNESCO's Recommendation- Ethics of AI: Policy Actions and adoption into national frameworks

The recommendation basically covers all the policy action areas where one of which is about environment and ecosystem. Therefore, in short, this section would be a direction for the policy makers to ensure that actions must be taken for environmental sustainability. Likewise, such AI systems must also be developed in such a way that it reduces carbon emissions and to promote eco-friendly practices[40].

UNESCO encourages its member states to incorporate these environmental considerations into their national policies and legal frameworks governing AI. By doing so, countries can ensure that AI development aligns with global sustainability objectives and contributes positively to environmental preservation. This approach fosters international cooperation and harmonization in addressing the ecological impacts of AI technologies.[41]

5.3: Convention on AI by the Council of Europe

It is the world's first ever international legally binding treaty on AI. It was adopted under the aegis of the Council of Europe (CoE) and signed on 5th September 2024. More than 50 countries, including the EU member states have endorsed the framework convention on AI. The purpose of the treaty is to expand and utilize AI so that it remains in line with fundamental rights, democratic values, and the rule of

[39] Ramos, G. (2021). Ethics of artificial intelligence: The recommendation. United Nations Educational, Scientific and Cultural Organization (UNESCO). Retrieved from https://www.unesco.org/en/artificial-intelligence/recommendation-ethics
[40] Kaushik, A. (2021, December 9). UNESCO's recommendation on the ethics of AI. Montreal AI Ethics Institute. Retrieved from https://montrealethics.ai/unescos-recommendation-on-the-ethics-of-ai/
[41] "Ibid"

law[42].

This should be noted that the convention explicitly didn't spoke about AI's environment concerns but if

Article 4- Protection of Human Rights, Article 10- Accountability and responsibility,

Article 13- Safe Innovation[43] is interpreted in a broad and open manner then many environmental aspects can be deduced like healthy environment is increasingly being seen as a fundamental human right, safe innovation can also be interpreted to include environmentally sustainable innovation, Article 10 can be interpreted in manner to include the responsibility of the industries and data centers to control the environmental pollution

5.4: EU's AI act, 2024

EU's AI act of 2024 does address environment concerns, though its provisions in this area have been critiqued as limited and primarily voluntary.

If we consider article 9 of the said act which provides- requirements for high-risk AI systems[44] then a broad interpretation has to be done to include environmental protection under safety and fundamental rights and specifically energy consumption and resource efficiency of these AI systems can be considered within the risk assessment and mitigation measures provision.

Article of 40 of the said act provides Harmonized Standards and Standardization Deliverables which provides - in addition to asking for this standardization request, deliverables on processes for reporting and documentation related to resource performance of the AI system should also be specified by them. This is so that the

[42] Babická, K., & Giacomin, C. (2024, November 5). Understanding the scope of the Council of Europe Framework Convention on AI. OpinioJuris. Retrieved from https://opiniojuris.org/2024/11/05/understanding-the-scope-of-the-council-of-europe-framework-convention-on-ai/

[43] Council of Europe. (2024). Council of Europe Framework Convention on Artificial Intelligence and Human Rights, Democracy, and the Rule of Law (Council of Europe Treaty Series No. 225). Retrieved from https://www.coe.int/en/web/artificial-intelligence/the-framework-convention-on-artificial-intelligence

[44] Baig, N., & Kazmi, S. T. (2024, July 20). Article 9: Risk management system | EU AI Act. Securiti. Retrieved from https://securiti.ai/eu-ai-act/article 9/#:~:text=Article%209%20of%20the%20AI,a%20high%2Drisk%20AI%20system.

energy consumption of such perilous AI systems decreases in the life cycle and for the development of general-purpose AI models with small energy consumption[45].

Such said act include article 95 laying down codes of conduct for the voluntary application of specific requirements and their object, among others, to assess and minimize the impact of the AI on environment sustainability, in particular for energy efficient programming and efficient designing, training, and use of AI[46].

5.5: The Artificial Intelligence Environmental Impacts Act of 2024: A Proposal

On February of 2024, Senator Markey introduced the legislation, which has since several senators as cosponsors. This bill recognizes the positive and negative environmental effects of both AI, and attempts to take in decree to mitigate those harm through greater transparency and accountability[47].

The proposed legislation contains four essential provisions to face environmental issues connected to AI while NIST maintains responsibility for the following:

(i) Research with respect to effects of artificial intelligence shall take place and the report of such shall be given to congress.

(ii) The act task its creators to develop a consortium of stakeholders who will analyse the environment effects of AI.

(iii) A system should be developed where companies and industries will voluntarily report the effects AI on environment.

(iv) Congress received findings about the effects of AI through an official document.

The act's overall goal is to promote transparency, accountability, and a thorough

[45] Article 40: Harmonised Standards and Standardisation Deliverables (2024, August 1). EU Artificial Intelligence act. https://artificialintelligenceact.eu/article/40/

[46] Article 95, Codes of conduct for voluntary application of specific requirements, EU AI Act. https://www.artificial-intelligence-act.com/Artificial_Intelligence_Act_Article_95.html

[47] Sen, H. Y. (2024, March 13). The Artificial Intelligence Environmental Impacts Act of 2024: What you need to know. Holistic AI. Retrieved from https://www.holisticai.com/blog/artificial-intelligence-environmental-impacts-act

understanding of AI's environmental footprint, ensuring the development of AI along with sustainability through standardized measurement, collaboration and voluntary disclosure.[48]

AI while offer several benefits, it also comes with many potential risks like e-waste from hardware manufacturing, use of rare earth materials in hardware, high energy usage for model training and deployment etc. Thus, the act seeks to create a system for measuring and reporting the AI environmental footprint. Experts thus emphasized the need for standardized measurement and data collection to comprehend AI 's environmental impacts[49].

5.6: New York State's Sustainable Data Centers Act

The New York States Sustainable Data centers act is to be reintroduced by State's Senator Kristen Gonzalez. Currently it is in the legislative process and not yet in force but lawmakers are actively working on it.[50]

The said legislation would mean that by 2050, it would be mandatory for the data centers to operate on 100 % renewable energy. The bill has included provisions which mandates that data centers need to disclose information related to energy uses, greenhouse gas emissions, water usage etc. The act also includes to protect the local communities from increased energy costs due to data center operations such as community discount plans. The final section of the bill bars fossil fuel's incentives in power purchase agreements[51].

5.7: The National Engineering Policy Centre (NEPC)

The NEPC was launched in 2019. It is a partnership of professional engineering

[48] "ibid"
[49] Markey, E., Heinrich, M., Eshoo, A., & Beyer, D. (2024, February 1). Markey, Heinrich, Eshoo, Beyer introduce legislation to investigate, measure environmental impacts of artificial intelligence. Office of Ed Markey, U.S. Senator for Massachusetts. Retrieved from https://www.markey.senate.gov/news/press-releases/markey-heinrich-eshoo-beyer-introduce-legislation-to-investigate-measure-environmental-impacts-of-artificial-intelligence
[50] Sanchez, H. (2025, January 3). Lawmakers push to regulate data centers to protect ratepayers, environment. Pluribus News. Retrieved from https://pluribusnews.com/news-and-events/lawmakers-push-to-regulate-data-centers-to-protect-ratepayers-environment
[51] Hutchinson, D. (2025, January 20). States propose data center energy guardrails as demand soars. Bloomberg Law. Retrieved from https://news.bloomberglaw.com/environment-and-energy/data-center-energy-guardrails-proposed-in-states-as-demand-soars

organization under the umbrella of Royal Academy of Engineering a unified voice for the engineering profession, providing independent and impartial expert advice to policymakers on national and global challenges[52].

NEPC emphasizes on resilient and sustainable infrastructure development and provide recommendations for improved maintenance, digital infrastructure and robust resilience standards. Their aim is to adoption of green technologies, pushing for strong policies to achieve net-zero carbon emissions and they also focus on integrated materials strategy.[53]

The NEPC (UK's) has also asked the government to make sure that tech companies properly report how much energy and water their AI data centers use. Whereas, this initiative addresses the environmental risks of growing AI at an accelerated pace, in addition to calling for that transparency should be implemented in the management and reduction of potential ecological consequences of the spread of AI. The need to: Expand mandatory environmental reporting was the report, which is submitted by the NEPC to the government, recommended to the policymakers: -

(i) Update MIT Regional Environmental KPIs for Data Centers:

(ii) Provide information with respect to environmental impact of AI systems

(iii) Set environmental sustainability requirements for Data Centers.

(iv) Consideration of data collection, transmission, storage and management practices.[54]

5.8: AI Action Summit Declaration

France hosted the AI Action Summit in Paris on February 10 and 11, which greatly differed from the previous UK AI Safety Summit and AI Seoul Summit. There are

[52] Environmental News Network - Lancaster Expert Helping to Solve the Energy Crisis. https://www.enn.com/articles/71127-lancaster-expert-helping-to-solve-the-energy-crisis
[53] National Engineering Policy Centre. (2025, February). Responsible AI: Foundations for environmentally sustainable AI. Retrieved from https://nepc.raeng.org.uk/sustainable-ai
[54] Laville, S. (2025, February 7). Call to make tech firms report data centre energy use as AI blooms. The Guardian. Retrieved from https://www.theguardian.com/technology/2025/feb/07/call-to-make-tech-firms-report-data-centre-energy-use-as-ai-booms

64 signatories including India, China, The EU and its member states, the African Union etc[55]. They adopted the statement "inclusive and sustainable Artificial intelligence for people and the planet" which indicates a clear focus on sustainable development of AI.[56] The core focus of the summit was revolution and financing in AI and its effects on culture and inventiveness, environmental sustainability and the importance to make AI available and accessible to all.[57]

The meeting has resulted to develop knowledge and to boost-up investments for AI systems like its tools, equipment's, models, etc. to encourage more international discussion on AI and environment to reduce the energy problem caused due to AI in a partnership with International Energy Agency for the promotion of energy friendly AI innovation[58]. A "Coalition for Sustainable AI" was launched, which brought together tech companies and countries to create standard for measuring and reducing AI's carbon footprint[59].

Having identified these major legal and policy frameworks, encompassing both current and future initiatives that addresses AI's environmental ethics, we can now proceed to draw conclusions and formulate recommendations.

6. Conclusion and Recommendations

This analysis underscores the dual nature of AI, showcasing considerable number of benefits, yet simultaneously exposing a critical deficiency in addressing its negative implications, which urgently requires proactive solutions.

AI offers enhanced efficiency in different domains but due to the dynamic nature of AI, its challenges related to environment is yet to be addressed.

This paper concludes that AI leads to the following environmental complications:

[55] AI Action Summit. (2025, February 6-11). Proceedings of the AI Action Summit, Paris, France. https://www.elysee.fr/admin/upload/default/0001/17/786758b38da7b4c16f26dc56e51884b3346684aa.pdf
[56] Caroli, L. (2025, February 14). France's AI action summit: crtitical questions. Center for strategic and international studies (CSIS). Retrieved from https://www.csis.org/analysis/frances-ai-action-summit
[57] "ibid"
[58] France & India (2025, February 10-11). Statement on inclusive and sustainable AI for people and the planet. AI action Summit, Palais de I'Elysee, Paris.
[59] "ibid"

(i) High emission of carbon footprint caused due to the processing and training of LLMs and GenAI by the data centers.

(ii) Many tech giant claims that their data centers are carbon neutral and they have achieved net-zero carbon emission which is untrue as the technologies which they are using or which are recently developed doesn't guarantee that it will entirely wash out the problem of carbon emission.

(iii) The substantial energy demands of AI data centers, results in electricity scarcity for the local communities.

(iv) AI data centers that operate across multiple jurisdictions create conflicts about liability specifically regarding who should be held accountable for emissions.

(v) The water used by data centers undergoes chemical treatment to prevent corrosion and bacterial contamination, which eventually makes it unsuitable for human consumption or agricultural purposes. So where is this water discharged? Improper or careless discharge of the water can lead to water pollution, ecological damage and human health problems.

(vi) Companies find loopholes in the existing governance system and then works accordingly. Industries build their data centers in such jurisdictions where environmental regulations are not so stringent and this leads to over-extraction of water and electricity by the data centers.

(vii) Countries lack strict water use laws for AI data centers which allows tech giant to exploit natural resources without consequences.

(viii) Industries and companies usually do not disclose the amount of e-waste generated by their AI data centers thus hindering the transparency principle.

(ix) There are no specific regulations which will provide how companies or industries shall be discharging the e-waste generated from the training and processing of GenAI.

To address the environmental concerns related to AI, it's vital to create not only technological solutions but also new ethical guidelines and statutory compliance frameworks.

RECOMMENDATIONS

To ameliorate the environmental repercussions stemming from AI, the ensuing recommendations are presented: -

(i) There is no such law in force which specifically provides that companies and industries are bound to show a report of their carbon emissions caused due to training of AI model or LLM. This eventually breach the transparency principle.

(ii) There should be strict law and regulation that countries should adopt with respect to environmental impact assessment of AI and that should be conducted by either a third party or by an officer of the government.

(iii) Stringent legal regulations should establish clear thresholds for water and electricity consumption by data center by companies and industries, with substantial penalties imposed for exceeding limits.

(iv) AI hardware which includes GPUs and TPUs, has a short lifespan and rapidly becomes obsolete, leading to an increase in e-waste. Therefore, laws required with respect to e-waste management of AI hardware's.

(v) Usually, AI data centers rely on large number of non-renewable sources of energy but some of the tech giants uses renewable sources of energy for the generation of electricity but that has been proved not so efficient.

So, adopting nuclear energy will be the best suitable method that will increase the efficiency of AI data centers subject to rational safeguards adopted by the companies and industries.

(vi) Still, most of the countries haven't implemented legislation related to AI and neither they are bothered to curb the environmental impacts caused due to AI, which eventually leads the fact that industries establish data centers in jurisdiction with minimal or non-existent environmental oversight. While the EU has executed the AI act 2024, it insufficiently

addresses all environmental concerns and lacks robust enforcement measures.

The surge in environmental footprint of artificial intelligence demands immediate and concerted global action. The establishment of universally ratified model agreement, encompassing stringent environmental safeguards, represents a pivotal step towards sustainable AI development. This agreement, by compelling nations to enact and rigorously enforce domestic legislation, will not only mitigate current environmental harms but will also establish proactive frameworks for future AI advancements. Only through this unified, legally binding approach we can ensure the development of AI without compromising the health of our planet.