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IMPACT OF DATA CENTRES ON THE ENVIRONMENT: WILL IT UNDERMINE CLIMATE CHANGE MITIGATION EFFORTS?

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The modern world is increasingly interconnected through the internet, transforming the global community into a single digital village, where information flows seamlessly across borders within milliseconds. As the world advances toward digitalisation, technology has significantly simplified tasks, leading to a radical transformation in many industries. With the new technological advancements, the efficiency, productivity, effectiveness, and profitability of industries have been largely enhanced. Thus, in today's world, it seems like nothing is beyond human capability.

With the advancements of Artificial Intelligence (AI), the world has stepped into a new digital era, and the execution of complex, sophisticated tasks has become much easier and more efficient than in the past. The ability to analyse big datasets, monitor real-time activities, detect errors, and improve decision-making processes has been profoundly augmented by AI. Due to its accuracy, effectiveness, and efficiency, modern industries have become increasingly reliant on these innovative technologies. Big tech companies such as Microsoft, Google, Meta, and X (formerly referred to as Twitter) are heavily investing in AI-powered data centres. Famous AI chatbots such as ChatGPT, DeepSeek, Meta AI, Google Gemini, Microsoft Copilot, and X's Grok have revolutionised data analysis and information retrieval, making knowledge more accessible. Thus, AI has become an indispensable tool in modern day, and it has quite visibly radicalised almost every sector. China, as a fast-developing country, has also invested massively in integrating AI into different sectors to enhance its efficiency. In 2024, Tsinghua University launched the world's first AI-powered hospital (Agent hospital), which blended virtual clinical care with AI-driven diagnostics and treatment agents, marking a major milestone in the integration of AI with healthcare. Thus, it can be observed that AI has become an undeniable factor of civilisational progress. However, while AI brings opportunities, development, and progress, it has sparked concerns. Many experts have highlighted the negative implications on the environment through AI-powered data centres and data centre proliferation due to increasing demand for data.

To bring data to our fingertips, tech giants are increasingly investing in building massive data centres around the world. These data centres are equipped with high-performance servers that operate around the clock to facilitate continuous data demand, processing, and storage. This brings a high environmental cost over benefits. Statistically, these data centres drink up gallons of water every day, which is considered a limited resource for human existence. Since the high-performance servers that operate non-stop emit a high amount of heat, water becomes a crucial factor for data centre cooling. Research of Barnuevo (2025) points out that the water consumption of large data centres per day is accounted as 5 million gallons, while a medium-sized data centre consumes 110 gallons per year. The consumption of water in these centres can quench the thirst of thousands of people. As per Barnuevo,

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this amount equates to the amount of water that is required to quench the thirst of 10,000-50,000 individuals, and the amount of water consumed by medium-sized data centres equates to the annual consumption of 1,000 households. As the demand for data and AI increases, there is a tendency for data centres to become thirstier, adding more burden to the existential crisis on freshwater resources, signalling towards more resource-based conflicts in the future.

Furthermore, data centres are ranked amongst the largest electricity consumers globally. Research shows that global electricity consumption of data centres is approximately 220-320 terawatt hours (TWh). As the demand for AI increases, data centres tend to use more electricity for their cooling process and other functions. Research points out that one ChatGPT query consumes 0.14 kilowatt hours (kWh) of electricity (Alkrush et al., 2024; Roundy & Kirwan, 2025). Even though it is a small amount of electricity, millions and billions of such queries are prompted per day, which can elevate consumption of electricity, and the heat that is generated is added to the environment, contributing to global warming.

Despite the current crisis, global tech giants such as Meta, Microsoft, Amazon, and Apple are on a full-scale mission to expand the number of data centres. In terms of sustainability, even though the companies have statutorily adopted methods and conducted evaluations on emissions, reports highlight that the emissions of these big tech companies are largely underreported, exposing a significant gap between sustainability and actual environmental impact. As per the Guardian reports (2024), between 2020 and 2022, the real in-house data centre emissions of Google, Meta, Microsoft, and Apple were found to be 662% higher than those they actually reported. This underreporting raises serious concerns about greenwashing- portraying that they are environmentally conscious and responsible while giving misleading information. Thus, it can be seen that mostly tech giants' sustainability pledges are often achieved through accounting strategies rather than genuine decarbonisation efforts.

Moreover, even though the world is on a global mission to cut down emissions and minimize environmental impacts, the commitment of countries, especially the countries that contribute to global emissions, is mostly questionable. In 2015, by the Paris Agreement, countries recognized the intensity of the climate crisis and pledged to cut down emissions to limit the global temperature rise to below 1.5°C. Currently, the world is failing to keep up to the promise, given that the global temperature has already reached 1.35-1.44°C above pre-industrial levels. When the situation remains, the number of data centres continues to grow at a remarkable pace, and countries are investing heavily in data centre development. Statistically, the United States of America (USA) leads in the number of data centres, despite facing a number of environmental disasters and being the biggest contributor to carbon emissions historically. As one of the top global emitters, the USA's withdrawal from key international climate bodies, including the Paris Agreement, has discouraged other countries. These actions signal a step back from collective environmental cooperation, even as states, businesses, and other nations continue efforts to address rising global temperatures. As of November 2025, the number of data centres in the USA was 4,165 by November 2025. While the United Kingdom (UK) ranks in second place, Germany, China, France, Canada, Australia, and India also host a large number of data centres (Statistica:2025).

Critics often argue that data centres contribute a relatively small share of global carbon emissions compared to other industries. However, this perspective overlooks the rapidly growing environmental footprint driven by increasing AI usage, electricity consumption, and fossil fuel dependency. According to Reuters (2024), data centres are projected to emit 1.9 gigatonnes of carbon in 2025, with emissions potentially reaching 2.5 billion metric tonnes by 2030. Further, it is revealed that the primary source of greenhouse gas emissions (GHGs) in data centres stems from their heavy reliance on fossil fuels. Although these major tech corporations have pledged to transition to renewable energy, several constraints persist. Geographical and climatic factors have become a barrier for such transitions. As an

example, data centres located in arid regions struggle to harness wind energy effectively, as hot, dry winds exacerbate equipment overheating. This highlights the need and urgency of implementing a proper mechanism to tackle the environmental impacts caused by the data centres without being delayed.

The world is already witnessing escalating climate-induced disasters such as rising sea levels, extreme heatwaves, prolonged droughts, erratic rainfall patterns, and biodiversity loss, jeopardising human security. Additionally, the scientific evidence of the Intergovernmental Panel on Climate Change (IPCC) confirms that the window to limit global warming to 1.5°C is rapidly closing, with current trajectories indicating a potential increase beyond 2°C by mid-century if decisive action is not carried out. This alarming trend reflects the limitations and weaknesses of multilateralism, as existing global governance mechanisms have failed to generate sufficient political will, coordinated action, and binding commitments among states to address the climate crisis collectively. Even though there are existing frameworks to mitigate climate change, particularly carbon credit systems and carbon markets, they have been largely unrealistic in addressing the scale of the crisis. These mechanisms were initially designed to motivate emission reduction, but in practice, they have evolved into instruments that allow major emitters to ignore their responsibilities. The commodification of carbon through market trading has prioritised economic benefit over environmental recovery. Furthermore, developing countries are struggling due to a lack of institutional capacity to meet their goals. In addition, as the world approaches COP (Conference of the Parties) 30, the inaction of governments has become increasingly evident. Numerous countries have failed to submit updated Nationally Determined Contributions (NDCs), undermining the global effort to accomplish the net-zero emissions target. This reflects not only a governance gap but also a moral failure to act upon scientific consensus, leaving the planet on a perilous path toward irreversible ecological damage.

In conclusion, while AI and digital technologies have undoubtedly contributed to civilisational progress, their environmental implications reveal a danger that cannot be ignored. Rapid expansion of data centres, along with their rising energy and water demands, has exacerbated crises over natural resources, signalling future conflicts over resources. Furthermore, increasing quantities of carbon, high dependency on fossil fuels, and high energy consumption contribute to derailing the target of cutting down emissions globally. Thus, while admitting to the fact that human development is an inherent necessity for environmental progress, it should be noted that there is an urgent need for collective accountability and sustainable digital infrastructure. Thereby, the nations may have the ability to get back on track in lowering carbon emissions, contributing to a better world for future generations.

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