GLOBAL DATA ALLIANCE
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CROSS-BORDER DATA TRANSFERS & ENVIRONMENTAL SUSTAINABILITY

This report helps to illustrate how responsible cross-border data policies help to mitigate climate change. Climate change is a defining challenge of our time. Beyond its impact on our quality of life and various ecosystems, the effects of climate change are expected to reduce global Gross Domestic Product (GDP) by 10 percent—or $23 trillion by 2050—barring urgent action to stop rising global temperatures and address the root causes of climate change.[1]

Meeting this challenge requires globally coordinated action and the kind of digital transformation that enables all stakeholders to achieve ambitious climate targets.[2] Especially for purposes of carbon tracking and predictive climate modeling, the cross-border movement of data, cross-border exchange of knowledge, and cross-border access to analytical tools are critical to global efforts to address climate change. Restricting the ability to share information across transnational IT networks, and mandating the localization of computing resources in particular regions, undermines the ability to analyze and respond climate challenges, as discussed below.

CROSS-BORDER DATA TRANSFERS AND CARBON TRACKING

Addressing climate change requires assessing the carbon profiles associated with organizations, processes, and product and service offerings. To perform this assessment, it is necessary to gather data across transnational digital networks—transportation logs, meter readings, fuel purchase records, direct monitoring, or other methods for acquiring data from specific activities across the international value chain.[3]

Restricting the ability to share information across transnational IT networks undermines cross-border efforts to analyze and respond to climate challenges.

Under the Greenhouse Gas Protocol,[4] many enterprises now assess carbon-relevant data points across three phases of international supply and value chains.[5] This analysis requires cross-border access to diverse data sets and to cloud computing resources. For example, through Artificial Intelligence-of-Things (AIoT) integration, enterprises can more effectively integrate real-time activity level data and global asset inventory data, thus improving both data quality and data deployability to address real-world climate challenges.[6]

Similarly, cross-border data transfers and access to cloud resources are critical to improved understanding of the carbon profiles of power plants, transportation assets, and other major sources of global emissions. In this context, cross-border data analytics allow for the automated analysis of images of power plants and nearby infrastructure, accounting data, and other indicia of the carbon intensity of target activities.[7]

When countries impede the ability to access relevant data across transnational digital networks, they also complicate efforts to identify solutions to reduce carbon-intensive processes that contribute to climate change.

CROSS-BORDER DATA TRANSFERS AND PREDICTIVE CLIMATE MODELING

Cross-border data transfers are also critical to predictive climate modeling, which focuses on a wide array of climate risks, including hurricanes, typhoons, wildfires, floods, droughts, and their collateral impacts–such as property damage and supply chain disruptions.[8] Predictive climate modeling improves disaster planning and recovery, and also improves predictions of actuarial risk, an area of particular urgency given the estimated $171 billion gap in climate insurance globally.[9]

Cross-border predictive climate modeling requires the real-time application of data analytics to diverse climate-relevant data sets.

Cross-border predictive climate modeling requires the real-time application of data analytics to diverse climate-relevant data sets.[10] Relevant multi-regional data includes satellite data, weather station data, topographical data, and various other data from sensors in the field.[11]

The World Bank's Global Facility for Disaster Reduction and Recovery (GFDRR), which leverages cross-border data in the cloud to bolster resilience in developing countries, offers one case study in predictive climate modeling. In Bangladesh, the GFPRR helped make datasets available across international and national organizations to map vulnerable areas and improve preparation for cyclones and floods in the Bay of Bengal. Using data sources and models gathered from thousands of global sources, Bangladesh authorities produced cyclone risk maps to guide investment plans for cyclone shelters across the country. Further, authorities assessed 35,000 schools for overall resilience and survivability during a natural disaster.[12]

A second case study involves the use of cloud-based digital twins. One well-known example is "Destination Earth," which will use cross-border observational data to create a twin model of the Earth that will serve as a digital test bed for climate change mitigation and sustainability plans.[13]

Predictive climate modeling, an inherently cross-border data intensive process, is critical to anticipating and slowing and mitigating the effects of climate change.[14] Without the ability to access and transfer relevant data across borders, this promising area of data science will not reach its full potential, undermining collective efforts to combat climate change.

CROSS-BORDER DATA TRANSFERS AND SUSTAINABLE CLOUD COMPUTING

Carbon tracking and climate modeling depend upon cross-border access to cloud-based computing resources. Cross-border access to regionally centralized cloud computing infrastructure has greatly reduced the need for individual businesses to maintain onsite data centers that would otherwise require millions of servers and computing resources

Cross-border access to data and software in the cloud has been estimated to allow enterprises to shrink their computing energy footprints by 87 percent, saving 23 billion kilowatt-hours annually—enough to power the city of Los Angeles.[15] In some cases, cloud services accessed across borders can be up to 93 percent more energy efficient than local on-premise enterprise datacenters, and 98 percent more carbon efficient.[16]

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Nevertheless, more can be done to build upon the carbon-beneficial shift from on-premises to cloud-based computing environments.

First, policymakers should not mandate the unnecessary construction of cloud computing infrastructure. Requirements to build redundant computing infrastructure in local jurisdictions would undo much of the progress seen in the shift to the cloud, as countries would force service providers to build and run duplicative data centers in numerous jurisdictions—an inherently emissions- and carbon-intensive process.

Second, despite the broader sustainability benefits of the shift to the cloud, emissions from data centers can also be reduced. Emissions produced by all buildings—including residential housing, office buildings, factories, data centers, and other structures—collectively account for up to 20 percent all emissions.[17] To help reduce their contribution to overall building-related emissions, cloud service providers are working to develop "green" data centers with reduced carbon footprints, including by powering data centers with renewable hydro, wind, or solar energy; feeding excess heat produced back into local heating networks; installing more energy-efficient computing hardware; and deploying Building and Information Modeling ("BIM") software solutions to optimize cooling systems and improve the sustainability of construction.[18] For both data centers and other types of structures, BIM software solutions are particularly promising based on estimates that many buildings' carbon footprints can be reduced by nearly 90% through retrofit strategies.[19] Another area of promise is the development of sustainable coding and computing protocols and best practices that are less taxing on computing resources.[20]

CONCLUSION

Powerful analytical tools for combating climate change—including carbon emissions tracking and predictive climate modeling—depend on the ability to freely access cross-border data transfers. When countries restrict the ability to share knowledge, information, and data across transnational IT networks—and restrict the ability to track emissions and model climate change scenarios—they undermine coordinated international efforts to address this urgent global challenge.

Endnotes

1. https://www.swissre.com/institute/research/topics-and-risk-dialogues/climate-and-natural-catastrophe-risk/expertise-publication-economics-of-climate-change.html

2. https://www.bsa.org/files/policy-filings/12062022sustainabilityprinciples.pdf

3. https://www.forbes.com/sites/mikehughes1/2020/12/23/digital-transformation-the-key-to-tackling-climate-change/?sh=2a5a31f25bb7

4. Greenhouse Gas Protocol | (ghgprotocol.org); https://www.epa.gov/climateleadership/ghg-inventory-development-process-and-guidance

5. https://www.epa.gov/climateleadership/ghg-inventory-development-process-and-guidance; https://www.epa.gov/climateleadership/scope-3-inventory-guidance These three phases comprise direct emissions from the company's own operations (Scope 1 emissions); emissions required to generate the electricity that the company uses (Scope 2 emissions); and indirect emissions that go into the production and consumption of the company's products across its value chain, from upstream suppliers to downstream customers (Scope 3 emissions).

6. https://www.weforum.org/agenda/2021/07/fight-climate-change-with-technology/; https://www.zdnet.com/article/10-technologies-most-likely-to-help-save-planet-earth/ ("Networked sensors as small as a dime are already monitoring air and water quality, identifying pollutants, tracking acidification, and capturing real-time data on phenomena that are crucial to our social and economic wellbeing. Wearable air quality sensors are on their way, and localized sensor networks monitoring energy and water usage in buildings are cutting down on waste.")

7. For example, Carbon Tracker relies on cross-border data analytics to analyze emissions for 4,000 to 5,000 power plants around the world, supporting meaningful carbon accountability and effective climate change mitigation strategies. https://www.nationalgeographic.com/environment/article/artificial-intelligence-climate-change; https://news.microsoft.com/apac/features/ai-for-earth-helping-save-the-planet-with-data-science/ (AI-powered predictive modeling has enabled impressive "strides …in land cover mapping–traditionally a time-consuming, expensive tool that is essential for environmental management and precision conservation. Recently, the entire United States was mapped by machine-learning algorithms that processed nearly 200 million aerial images in just over 10 minutes. Done the usual way, such a project would have taken many months and cost a fortune. Deployed globally and locally, this new way of mapping could revolutionize how we mitigate the effects of urbanization, pollution, deforestation, and even natural disasters.")

8. https://www.weforum.org/agenda/2018/01/8-ways-ai-can-help-save-the-planet/ ("A new field of "Climate Informatics" is blossoming that uses AI to fundamentally transform weather forecasting and improve our understanding of the effects of climate change. … AI techniques may also help … predict extreme events and be used for impacts modelling."); https://hai.stanford.edu/news/environmental-intelligence-applications-ai-climate-change-sustainability-and-environmental ("Predicting, detecting, and mitigating or incentivizing environmental transitions: Understanding past changes in environmental behavior and their consequences (e.g., land and water use, agricultural practices, pest management) can lead to both the early detection of big transitions and the seemingly small transitions with potentially big ripple effects. Early detection of changes could lead to prepared responses, mitigation of bad outcomes, or the ability to incentivize promising responses.")

9. https://www.forbes.com/sites/robtoews/2021/06/20/these-are-the-startups-applying-ai-to-tackle-climate-change/; https://www.weforum.org/agenda/2021/08/how-is-machine-learning-helping-us-to-create-more-sophisticated-climate-change-models/ ("With machine learning, we can use our abundance of historical climate data and observations to improve predictions of Earth's future climate. And these predictions will have a major role in lessening our climate impact in the years ahead.")

10. https://www.techrepublic.com/article/how-ai-could-save-the-environment/ ("74% of the 200 environmental sustainability professionals agreed that AI, which involves cross-border data analytics, will help solve long-standing environmental challenges.")

11. https://www.zdnet.com/article/10-technologies-most-likely-to-help-save-planet-earth/ ("Sensing technology and more accurate prediction models will fine-tune energy production to avoid overproduction, and better battery technology will enable storage of renewably sourced energy.")

12. https://www.worldbank.org/en/news/feature/2021/04/19/deploying-digital-tools-to-withstand-climate-change-in-low-income-countries

13. https://www.asme.org/topics-resources/content/digital-twins-for-the-future-of-climate-change. Another example of cross-border data-driven digital twins for climate modeling is provided by the recently announced Earth-2 (E-2) system, which would create a digital twin of the Earth in an open platform built for virtual collaboration and real-time physically accurate simulation. This system would analyze data sourced from all over the world in a virtual environment that combines GPU-accelerated computing, deep learning and physics-informed neural networks.

14. https://www.nationalgeographic.com/environment/article/artificial-intelligence-climate-change ("Climate informatics covers a range of topics: from improving prediction of extreme events such as hurricanes, paleoclimatology, like reconstructing past climate conditions using data collected from things like ice cores, climate downscaling, or using large-scale models to predict weather on a hyper-local level, and the socio-economic impacts of weather and climate.")

15. https://software.org/wp-content/uploads/Every_Sector_Software_SmartEnergy.pdf

16. *See id.*

17. https://www.forbes.com/sites/robtoews/2021/06/20/these-are-the-startups-applying-ai-to-tackle-climate-change/. See also https://world101.cfr.org/global-era-issues/climate-change/how-can-artificial-intelligence-combat-climate-change ("[E]missions from the large data farms and processing centers underpinning the information and communications technology sector are comparable to those of the aviation industry.")

18. https://www.technologyreview.com/2018/08/17/140987/google-just-gave-control-over-data-center-cooling-to-an-ai/; https://www.technologyreview.com/2019/06/20/134864/ai-climate-change-machine-learning/ ("Intelligent control systems can dramatically reduce a building's energy consumption by taking weather forecasts, building occupancy, and other environmental conditions into account to adjust the heating, cooling, ventilation, and lighting needs in an indoor space. A smart building could also communicate directly with the grid to reduce how much power it is using if there's a scarcity of low-carbon electricity supply at any given time."); https://www.forbes.com/sites/robtoews/2021/06/20/these-are-the-startups-applying-ai-to-tackle-climate-change/ (In one case study, a data center operator used data analytics and machine learning techniques to optimize the data centers' cooling systems, reducing overall energy consumption by up to 40%–by other other things–taking advantage of winter conditions to produce colder than normal water and thus reducing the energy required for cooling.)

19. *See id.; See also,* https://www.nature.com/articles/s41558-020-0837-6.

20. https://www.sciencedaily.com/releases/2021/03/210302185414.htm; https://www.forbes.com/sites/robtoews/2020/06/17/deep-learnings-climate-change-problem/?sh=16fad9456b43

    Artificial Intelligence–and the training and implementation of data analytics and machine learning models–can be a particularly carbon-intensive process, leading to calls for "researchers to plot energy costs against performance gains when training models. Explicitly quantifying this tradeoff will prompt researchers to make more informed, balanced decisions about resource allocation in light of diminishing returns"; to use "more efficient hyperparameter search methods, reducing the number of unnecessary experiments during training, employing more energy-efficient hardware"; and developing new computer science disciplines focused on the discovery of more efficient "efficient ways to model intelligence in machines."