Spotlight

Climate action requires scalable and collaborative data sharing. Open data remains an important tool.

Joint Learning Network on Climate Action

digital impact alliance

In the coming years, as the effects of climate change continue to worsen across the world, the financial impact will be immense. A recent study projects the global cost of climate-related damage could reach as high as $38 trillion per year by 2049, with lower-income countries bearing a disproportionately higher burden than high-income ones. Yet even these estimates may understate the multiplier effect of climate change, which impacts broader indicators of well-being and prosperity for people and the planet. As climate needs escalate and many countries face domestic financial constraints, innovative, resilient financing solutions are essential to meet the scale of the challenge.

Recognizing these needs, the upcoming 29th Conference of the Parties (COP29) in Azerbaijan will center on establishing the New Collective Quantified Goal (NCQG) for climate finance. This year's "finance COP," as it has been dubbed, will aim to mobilize capital, expand contributions to the loss and damage fund, and accelerate adaptation efforts.

To further these goals, the global community is increasingly exploring digital and data technologies as powerful tools for cost-saving and efficiency. With the rapid

This is the fourth paper in the series of the Joint Learning Network on Unlocking Data for Climate Action (Climate Data JLN), which was launched under the ITU's multistakeholder Green Digital Action initiative.

Green Digital Action aims to enhance collaboration, fast-track industry-wide commitments to addressing climate challenges, and put digital solutions at the forefront of climate action.

The Climate Data JLN brings together experts in climate action, data sharing, and digital public infrastructure to explore new models for data sharing to help frontline actors, namely city governments in low-resourced countries, address people's urgent needs and build resiliency in the face of this global crisis.

evolution of artificial intelligence (AI), access to high-quality, timely data becomes essential for leveraging its full potential in climate initiatives. Data sharing technologies present a compelling cost-benefit incentive for scaling climate solutions and supporting resilient, sustainable actions on a global scale.

Open data has been long recognized as one preferred way to tackle known barriers to effective climate action because it has consistently delivered advantages where other models have faced limitations. This model offers a combination of reduced barriers to use, ease of global collaboration, and adaptability to local needs.

However, open data is not without challenges, particularly when it is dependent on various sources of public data and where participation is decentralized. Challenges to achieving long-term scale and sustainability persist, and without dedicated funding, open data can struggle to maintain consistent quality and provide ongoing support for data users.

Open data, as conceptualized decades ago, has evolved over time to incorporate handling of sensitive data more securely. As data privacy and security issues increase in prominence, the evolved concept retains its core principles – such as transparency, accessibility, reliance on contribution, and open source code, where relevant – while integrating safeguards that protect user privacy. With the growing momentum of AI, open data must uphold these principles while ensuring ethical considerations remain central to the global discourse.

This spotlight builds on insights from three other papers in this series – data trusts, open transaction networks, and data spaces. In this paper, we examine the open data model through the lens of the three other frameworks, highlighting lessons that open data can lean on to optimize its impact on climate action.

We spotlight examples from three organizations that are a part of the Climate Data JLN and explore the innovative ways they have approached open data for climate use cases:

- The Energy Access Explorer is a mapping tool that combines geospatial data and other climate-relevant data to identify energy needs in underserved areas, particularly for off-grid populations. As an open source platform, it supports the development of energy solutions and infrastructure planning, enabling a data-informed approach to energy access.

- Ushahidi was originally developed as a crisis-mapping platform. It now supports climate resilience efforts by allowing users to map and share real-time information on natural disasters, climate impacts, and social vulnerabilities. Its open nature has enabled global adoption, with communities adapting the platform to fit local needs.

- A global air quality platform, OpenAQ aggregates and harmonizes air pollution data from various sources to support public health initiatives and policy interventions. Its open-access framework allows researchers, governments, and NGOs to access ambient air quality data for free, fostering collective action on air pollution.

How open data can address the challenges to data sharing

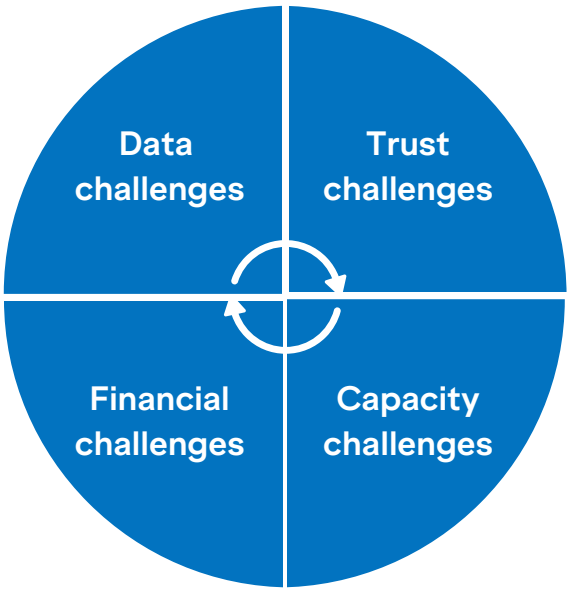
Open data is a subset of digital public goods in which data, methodologies, and often the code underlying the data platform itself are freely accessible for use and adaptation. This model allows users across geographies and sectors to adapt solutions to specific needs.

Digital public goods (DPGs) are defined as open source software, open data, open artificial intelligence models, open standards, and open content.

Unlike proprietary models, open data sharing models prioritize transparency and widespread access, enabling community-driven innovation.For subnational governments, this is promising news.

Open data offers significant advantages in climate contexts, particularly in low-resource settings where proprietary platforms can be costly and inaccessible. These tools support sectors such as energy, air quality monitoring, and disaster response – fields where real-time, accurate data is essential for timely climate action – therefore necessitating reduced barriers for sharing.

Open data can help address trust challenges that stem from lack of transparency, especially important as AI technologies become more ubiquitous. Its free and open nature allows for inspection of data, metadata, code, and data quality. With this level of transparency, trust and confidence issues can be mitigated.



Additionally, it can also help address capacity challenges that stem from top-down deployment. Open data encourages collaboration and can be localized without barriers to access and use.

Many open data tools operate through decentralized systems, often incorporating local talent that contributes to and adapts the data platform for regional contexts.

However, achieving scale and sustainability with open models can prove to be challenging. Without a centralized governance model, these platforms rely heavily on community participation and voluntary contributions, which can make consistent funding, long-term support, and coordinating improvements more difficult.

Open data in practice

Energy Access Explorer

URL:	https://www.energyaccessexplorer.org/
Type of data:	Geospatial, infrastructure, socioeconomic, resources, environment
Climate use cases:	Energy planning, clean energy, energy market access, household assessments, climate compatible agriculture
Geographies served:	Global
Legal Model:	Open-source licenses
Financial model:	Grants and partnerships

The Energy Access Explorer (EAE), developed by the World Resources Institute (WRI), is an open source platform designed to address the complexities of energy access across underserved and climate-vulnerable regions. Built entirely on open source programming languages, EAE's code and methodologies are freely accessible on GitHub. The tool combines spatial and socioeconomic open data to provide users with insights that support sustainable energy planning, from rural electrification to climate-resilient energy infrastructure.

The platform operates with flexible data sharing models: data can either be open access or restricted based on licensing agreements. While much of the data is openly accessible, sensitive datasets, such as last-mile household energy use, are securely protected. Unlike many proprietary solutions that often have short project cycles, EAE offers long-term support in each geography, committing to a minimum of five years of technical assistance. This includes bug fixes, software updates, training, and, when necessary, local capacity-building initiatives. WRI is also exploring generative AI to simplify the platform's interface, enabling users to interact directly by specifying their objectives.

To target sustainability issues, the program also emphasizes co-development with local institutions and government ministries. In Kenya, for instance, WRI works alongside the Ministry of Energy and local partners to align with the country's national energy goals. Through partnerships with local universities, the platform is incorporated into academic research, with an aim to foster long-term skill development and reduce dependence on external consulting.

Use cases:

Kenya: In Kenya, WRI collaborates with Makueni County to integrate EAE into county-level energy planning. This collaboration allows the county to identify priority projects and promote bankable energy initiatives that attract investment. The EAE is also considering artificial intelligence and how to future-proof the platform. In this case, they are working on features to assess solar panel penetration across Kenyan counties and to develop a climate vulnerability index that evaluates the resilience of power infrastructure against extreme climate events.

Tanzania: EAE also has a use case working with the Renewable Energy business association in Tanzania to provide businesses with market insights, helping them avoid redundant competition in regions and enabling targeted expansion in underserved areas.

Uganda: In partnership with Uganda's Ministry of Health, EAE maps healthcare facilities to assess their electrification status and electricity needs. By incorporating this data, WRI and the Ministry can design energy solutions that improve healthcare outcomes, ensuring clinics are adequately powered for medical equipment and services.

India: In Assam, a flood-prone state with high climate vulnerability, EAE is helping the Assam Science and Technology Council incorporate climate risk into energy planning. By combining precipitation, land use, and climate vulnerability data, the platform assists local authorities in identifying resilient areas for energy expansion, aiming to mitigate the impacts of frequent flooding on energy infrastructure.

Ushahidi

URL:	https://www.ushahidi.com/
Type of data:	Geolocated user generated reports
Climate use cases:	Documenting real-time climate impacts, mapping vulnerabilities, supporting planning
Geographies served:	Global
Legal Model:	Open-source licenses
Financial model:	Grants and partnerships

Ushahidi is an open source platform designed to collect, visualize, and validate public data from underrepresented communities affected by climate change. Through an approach centered on inclusivity, the tool allows individuals, especially those in low-resource and underserved areas, to report their experiences and needs related to climate impacts. Ushahidi collects data through online platforms and user-friendly, low-technology channels like SMS and USSD, making data collection accessible even in regions with limited technology access. This approach helps fill equity gaps found in traditional climate data, enabling better representation of marginalized voices.

Managing large volumes of unstructured, multilingual data presents challenges for grassroots organizations. To help address this, Ushahidi is experimenting with artificial intelligence (AI) for language translation, as well as for data structuring and geolocation. However, high computational costs limit AI deployment at scale. These capacity gaps underscore the need for continued support and innovation to make AI accessible to organizations handling large, diverse datasets to unlock insights.

Ushahidi's platform aggregates community data from grassroots organizations, individual citizens, and field partners to create datasets rich in localized perspectives on climate impacts. After data is collected, the team works with local stakeholders to validate and refine the information to ensure accuracy and minimize bias.

Use cases:

Kenya's Tana River Delta: This is a region recently affected by severe drought and subsequent flooding. Ushahidi collaborated with organizations like World Vision and GIZ to document how climate shocks impact local populations. This validated data is then shared with decision-makers at both national and subnational levels, creating a valuable resource that informs policies and interventions.

Uganda's Bidibidi refugee camp: Insights on climate impacts collected from refugees are used to shape support programs. For instance, Ushahidi deploys fact-checking and statistical inference tools, along with data from trusted news sources, to confirm information accuracy. Ushahidi's ability to validate data with local partners helps communities accurately document and respond to climate impacts while maintaining high data standards across diverse reports.

Filecoin: Recently, Ushahidi launched a blockchain-based data archive using Filecoin, allowing data to be securely stored without ongoing cloud computing costs. This archive preserves climate-related data indefinitely, ensuring that datasets remain accessible to researchers, governments, and citizens long into the future, even if Ushahidi's operations cease. Initially piloted with election data, this archive will soon include climate data, creating a permanent and accessible repository for critical insights on community-level climate impacts.

OpenAQ

URL:	https://openaq.org/
Type of data:	Geolocated air quality data, metadata
Climate use cases:	Monitoring air pollution trends, supporting public health interventions, and validating satellite data
Geographies served:	Global
Legal Model:	Open data
Financial model:	Corporate sponsorships, grants, and partnerships

OpenAQ is a global, open source platform that aggregates open air quality data from various monitoring instruments, including both highly accurate government-grade monitors and consumer-grade air sensors. This platform harmonizes the data into interoperable formats, making it easily analyzable across diverse applications. By providing raw, unmodified air quality data alongside metadata, OpenAQ allows users – ranging from researchers to citizen scientists – to apply their preferred data corrections, compare performance across monitoring technologies, and conduct their own analyses.

OpenAQ's open data model ensures that pollutant data is available for anyone to use. By standardizing formats, such as converting units to a consistent scale, OpenAQ streamlines the data for users worldwide while allowing them to adjust based on their needs. The platform also shares metadata, including details on the instrument's provider, type, and location, which helps users understand the reliability and context of each data point.

Data is also integrated into commercial and community-based products. Companies like ESRI and Airbus use OpenAQ's live air quality feeds in their products, making real-time air quality information available to a broader audience. Meanwhile, community organizations use OpenAQ's platform to supplement their own monitoring efforts, helping site and calibrate their instruments and adding locally relevant insights to the global air quality data ecosystem. The OpenAQ platform serves as a vital tool for a wide range of applications, supporting users from scientific researchers to policymakers.

Use cases:

Scientific research and air quality monitoring: The agricultural data space in Senegal is the furthest along. Senegal's existing national AgriData platform is being upgraded to operate as a data space which will provide targeted advice to small farmers and allow the government to deliver its services more efficiently. The initial work to establish partners and collaboration has begun in the climate sector and in Ivory Coast.

Public awareness and citizen engagement: Public-facing applications leverage OpenAQ data to raise awareness about air quality. For example, the Smokey air quality chatbot provides localized air quality information via Facebook Messenger, a Telegram app called @pm10check delivers local alerts, and another app contextualizes pollution data by equating air quality levels to cigarette smoke exposure.

Policy and regulatory impact: OpenAQ's platform supports organizations focused on targeted air quality interventions. Cities in the C40 network use OpenAQ data to monitor PM2.5 levels over time, measuring the effectiveness of policies and interventions. In Utah, for example, government offices access OpenAQ data to inform legislative action.

Educational resources: OpenAQ is widely used as an instructional resource, helping students and researchers practice data analysis and programming skills using real-world datasets. Learners can study big data applications, practice coding, and engage with environmental science through hands-on experience.

Lessons for strengthening open data

Open data can benefit from adopting certain features from other models to strengthen its scalability, governance, and interoperability. Here, we list a few of these recommendations:

Financial models: Open data models follow a decentralized financial model, which requires fewer legal constraints than other models and enables faster and broader access. But, for open data to appeal to a diverse range of commercial and government organizations, these models could benefit from an added-value approach, similar to those of data spaces. This would allow open data models to create optional paid features or premium services to sustain development, while keeping the core code and data free and open. By adopting an added-value approach, open data models can increase financial sustainability without compromising the principles of transparency and openness.

Data stewardship: Since open data models are pulling from publicly available data, there is usually a process of cleaning and aggregating the data involved. In contrast, other models may have more rigorous data processing. Data spaces, for example, allow participants to set their own standards and data sharing terms, while in the case of a data trust, that function is more centralized. Open data can also incorporate codes that emphasize standards for quality control and community-driven governance. In the case of OpenAQ, for example, the platform provides metadata to improve data usability for the end user.

Peer exchange: Open data emphasizes a distributed, community-driven approach to data sharing. With this in mind, open data models could benefit from incorporating peer-to-peer (P2P) protocols, similar to those of open transaction networks. P2P protocols allow for more direct, real-time, flexible data sharing between users with minimal oversight and no centralized control. This peer-to-peer structure has proven effective for enabling secure, transparent transactions and for creating dynamic networks where data can flow more freely and be adapted to varied contexts. The Energy Access Explorer models this feature by working bilaterally with different agencies to connect their data to the platform.

Interoperability: Interoperability with other platforms and tools is a compelling feature across models. For open data, adopting open standards and API-based frameworks allows open data to be used more seamlessly alongside other data sources and platforms, including AI tools and local data systems. In cases of sensitive data, the platforms should accommodate privacy controls, such as in the case of Ushahidi.

Looking forward

Looking ahead to COP29, with its focus on climate finance and capital mobilization, accessible and resilient data systems are required to meet climate goals. Open data remains a viable solution for scalable and collaborative data sharing.

One of the reflections from the Joint Learning Network is that choosing a data sharing model is not a binary choice between an open or commercial solution. Instead, there is a spectrum of openness. Some of the newer models we have featured in the Climate Data JLN series have designed solutions with innovative approaches to their governance, technology, financial, and data stewardship frameworks. Open data sharing models can also combine some of these features while keeping their source code open and freely accessible. If progress is to be made on climate goals, a high degree of innovation is required, which includes rethinking the business models of open data solutions.

As the international community sets new climate finance targets, open data will play an essential role in equipping stakeholders with the high-quality data needed to drive meaningful climate action.