Spotlight

Unlocking data for climate action requires widespread participation. Open transaction networks can enable it.

Joint Learning Network on Climate Action

digital impact alliance

Characterized by its far-reaching impacts and the urgent need for action, climate change stands as one of the biggest global challenges of our time. The findings of the first global stocktake at COP 28 concluded that governments all over the world need to do more. Despite policies reducing the worst-case scenario from 3.7°C to 4.8°C of warming by 2100, projected temperature increases remain between 2.4°C and 2.6°C, far from the goal of 1.5°C. This range could lower to 1.7°C to 2.1°C if nations fully implement net-zero Paris emission targets.[1]

To bridge the gap between current efforts and necessary actions, it is imperative to focus on sectors that contribute significantly to greenhouse gas (GHG) emissions: energy, materials, and mobility, which accounted for approximately 34%, 21%, and 19% of total global emissions in 2020, respectively.[2] To do so, frontline governments and communities - the sub-national actors who are most pressed to respond and adapt to the changing climate - require data-powered solutions, such as smart grids and weather-pattern predictions. These advanced capabilities depend on seamless access to diverse data flows. Similarly, effective data sharing between stakeholders is essential for accurately tracking progress against emissions targets. However, realizing the data-sharing capabilities needed to accelerate climate action faces significant challenges.

By unlocking and leveraging climate-relevant data, we can provide essential information to frontline governments, communities, and individuals, empowering them to take informed, meaningful actions toward climate adaptation and mitigation.

Much of this work was inspired by the multistakeholder Green Digital Action (GDA) initiative, convened by the International Telecommunications Union with participation from 40+ organizations.

Following our engagement on the GDA track at COP28, the Digital Impact Alliance launched the Joint Learning Network on Unlocking Data for Climate Action (Climate Data JLN.)

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 exchange, and digital public infrastructure (DPI) to understand new models for generating, sharing, and using data to create solutions to some of these challenges.

The JLN partners published its first paper in this series on data trusts, and this second Spotlight explores the role of decentralized open networks for climate action.

Launched at COP28 in Dubai, the Climate Data JLN will deliver recommendations in time for COP29 in Baku.

Overview of the key sectors in this report:

The ENERGY SECTOR, responsible for a third of global emissions, is crucial in the transition towards a sustainable future. The use of efficient digital solutions can revolutionize grid management, enhance the integration of distributed energy resources, and help mitigate adverse energy disasters.

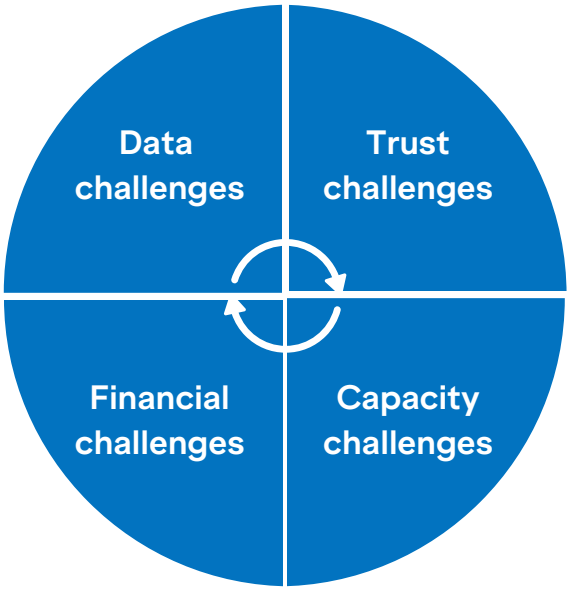
The MATERIALS SECTOR, which includes metals, plastics, chemicals, and concrete, contributes 21% of global emissions. Digital innovations can optimize existing processes to reduce emissions and support the development of circular economies. These models can significantly lower the environmental footprint of material production and consumption by promoting recycling, reusability, thereby promoting a more efficient model of resource utilization.

The MOBILITY SECTOR, which produces nearly 19% of global emissions, is undergoing a transformative shift from fossil fuels to electric or hydrogen-based vehicles. Digital technologies are essential in building the necessary infrastructure and supply chains to support this transition.

Challenges to the use of data for climate action

Several challenges impede the effective use of data for climate action. These challenges, identified through early discussions with the Climate Data JLN, were described in our first Spotlight Paper on Data Trusts. They were broadly categorized into issues related to data availability and quality, trust, financing, and capacity.

Some examples of challenges that fall into each category include:



Challenges related to data availability and quality:

- Data may be incomplete, inaccurate, or out-of-date.
- Data may take too long to move from collection through processing to use, a critical obstacle for climate data where people's lives are at stake and time is of the essence.
- Climate-relevant data is often fragmented and scattered across various non-interoperable platforms, leading to inefficiencies
- Current technology stacks are not always interoperable, meaning that data cannot be easily shared between systems on a real-time basis.
- When data is collected at a global, regional, or even national level, the utility of that data at the local level may be limited due the lack of granularity or comparability.

Challenges related to lack of trust:

- Many countries lack applicable or robust legal and regulatory frameworks for issues such as intellectual property rights and data transfer restrictions, and where these frameworks exist, cross-border border disparities can provide additional obstacles.

- Current data owners may be hesitant to share data due to data privacy concerns, their inability to negotiate proper terms and conditions, or the lack of oversight and dispute mechanisms.

Challenges related to financing:

- Data owners often do not want to share data without getting some return on investment, which can result in paywalls that are unaffordable for many frontline responders who operate in low-resourced environments.
- Governments, particularly sub-national governments, often do not have continuous budget streams allocated to the on-going purchase of data.

Challenges related to capacity:

- Frontline, sub-national governments report that they often do not know what data exists.
- If they do know, they often lack access to technology such as high-speed internet to view and use the data, a culture of data-driven decision making, and/or staff trained to analyze data and translate it into relevant information.

Consequently, there is a significant gap in fast, efficient, and secure data-sharing solutions critical for climate action. This gap results in inactivity and the underutilization of vast data resources.

To bridge these gaps and overcome challenges – open transaction networks (OTN) – systems that ensure interoperability between platforms and services– present a promising solution. As we will see in the following case studies, OTNs solve for some of these challenges, particularly those related to capacity and financing. Ultimately, OTNs can create new distributed marketplaces that increase participation by solving challenges related to monopoly, promoting innovation, and individual access to data generation and use.

The decentralized open transactions network (OTN) approach

An open network refers to a network system where the nodes—computers, individuals, or organizations—are free to join and interact without a centralized controlling authority. This decentralized approach allows for a dynamic exchange of information and resources.

Open networks are also characterized by their horizontal connectivity, which facilitates unrestricted and non-hierarchical interactions among nodes.[3] This feature contrasts with contemporary networks and platforms controlled end-to-end by single corporations, and instead fosters a more inclusive and collaborative ecosystem for diverse stakeholder

OTNs aim to create an interoperable ecosystem where different platforms and applications can interact and transact using a common set of protocols and standards. Key features include:

- Open protocols and standards: OTNs use open protocols like HTTP, SMTP, and Beckn to enable communication and transactions between platforms. These protocols ensure that any compliant platform can join the network and participate in transactions, promoting inclusivity and interoperability.

- Decentralized architecture: OTNs promote a decentralized architecture where no single entity has control over the entire network. This architecture ensures that multiple independent platforms can coexist and transact without relying on a central authority.

- Asynchronous APIs: Transactions are managed through a series of asynchronous API calls and callbacks, ensuring that each request and response pair is processed independently.

- Unbundling: OTNs break down complex systems into granular activities or microservices, allowing different actors to perform individual activities. This approach encourages innovation and allows specialized service providers to participate without building complete platforms.

- Interoperability and scalability: By adhering to common standards and protocols, OTNs ensure interoperability between different systems, making it easier to scale and integrate new platforms. This approach minimizes the need for custom integrations and promotes a plug-and-play environment.

To understand OTNs better, consider the example of the email. When you send an email from Gmail to Outlook, the seamless interaction is possible because both services use open protocols like SMTP and IMAP. There is no single central server; instead, multiple independent servers communicate in a decentralized manner. This system handles emails asynchronously, where messages are queued and delivered without requiring real-time interaction. The email system is also unbundled into services like sending, receiving, storing, and filtering emails, allowing different providers to specialize. This interoperability and scalability are mirrored in OTNs, enabling diverse platforms to work together seamlessly and integrate new platforms efficiently. By breaking down complex systems into smaller activities and adhering to common standards, OTNs minimize the need for custom integrations and promote a plug-and-play environment, encouraging innovation and making it easier to scale and integrate new platforms.

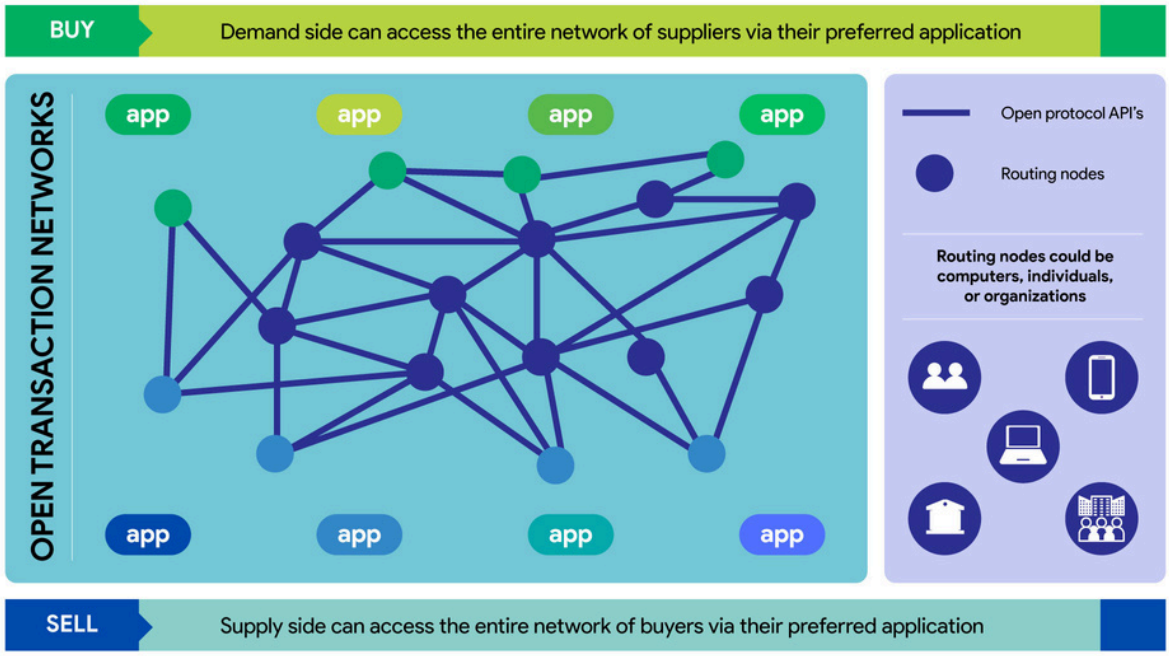


Figure 1: Open Transaction Network Ecosystem

OTNs have the potential to revolutionize climate action by creating interconnected, scalable, and efficient digital ecosystems. These networks bring together various stakeholders and systems to address critical environmental challenges. For example, by uniting diverse energy systems such as EV charging networks, charge point operators, battery aggregators, community microgrids, and energy storage providers, OTNs can minimize waste, reduce complexity, and optimize energy usage. This integrated approach ensures that energy needs are met efficiently, reducing idle times and maximizing resource utilization.

Beyond energy systems, OTNs can streamline the creation and operation of carbon markets by ensuring transparency and trust among participants, tracking carbon credits accurately, and facilitating easier trading. They can also support the development of a circular economy by connecting suppliers, manufacturers, recyclers, and consumers, promoting sustainable production practices and enhancing resource efficiency. In urban governance, OTNs can improve service delivery and reduce operational costs by integrating city services such as waste management, water supply, and public transport.

OTNs also play a crucial role in the green transition by connecting training providers, employers, and job seekers, facilitating the reskilling of workers for green jobs. By leveraging OTNs, these networks can reduce marginal costs, expand inclusion, and scale up climate solutions, making trust, identification, and data sharing easy, interoperable, and secure.

Beckn protocol

In our analysis, we chose to focus on the Beckn Protocol, as it is a well-developed technology for open networks that is already being applied to climate relevant data-sharing needs. Beckn Protocol facilitates the creation of open, peer-to-peer decentralized networks for a wide range of economic transactions. This protocol can be adopted by platforms, organizations, and governments to build integrated open networks across various sectors including e-commerce, mobility, energy, manufacturing, and more.

Beckn is an open protocol designed to enable location-aware local commerce across different industries. The protocol consists of a set of recommendations and rules that define specific technical standards. These standards can be adopted by any industry, region, or market to enable open and interoperable interactions among participants. Beckn specifications allow the protocol to function as a transaction layer that supports discovery, ordering, fulfillment, and payment processes between buyers and sellers (consumers and providers) in the digital marketplace. Beckn Protocol provides a standardized approach for digital commerce interactions, similar to how HTTP functions for the World Wide Web or SMTP for emails. It offers a common framework that enables interoperability in digital commercial transactions across various platforms and services.[4]

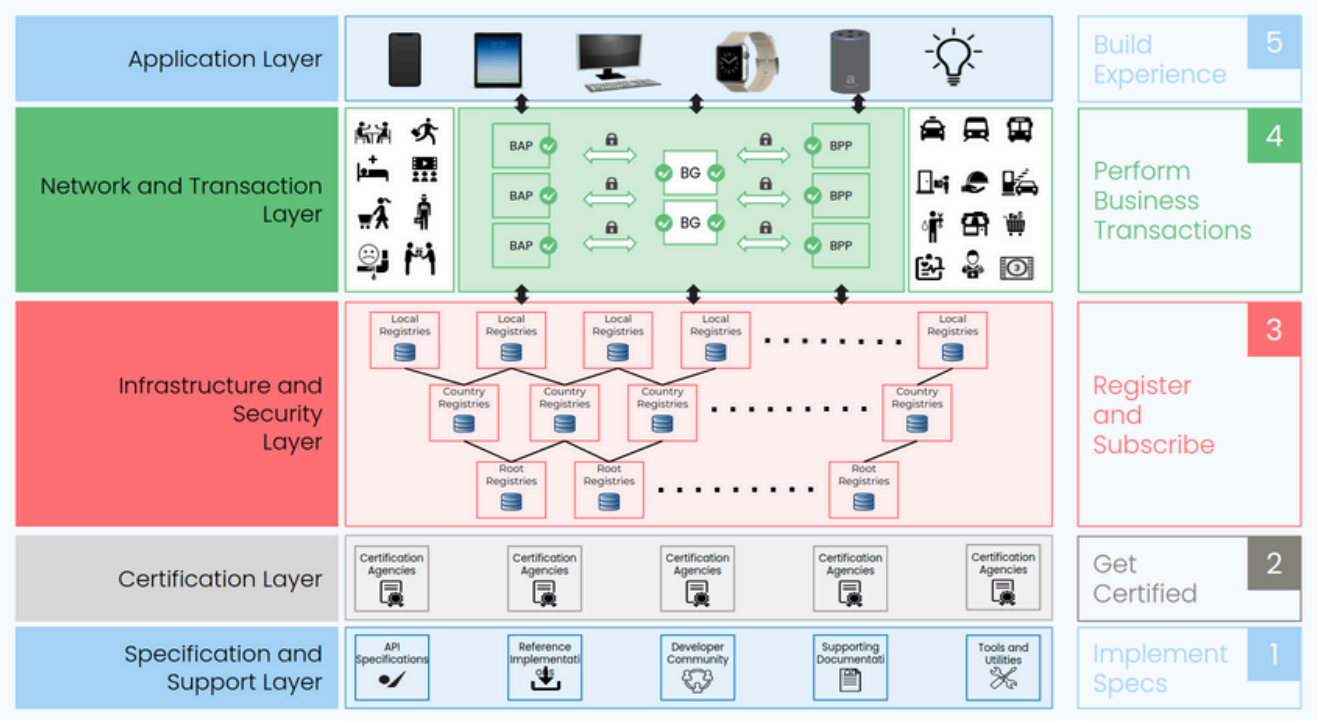


Figure 2: Beckn Ecosystem Architecture (Beckn Protocol, 2023)

The Foundation for Interoperability in Digital Economy (FIDE), formerly known as Beckn Foundation, is the original author of the Beckn Protocol specification and its primary supporter.[5] In collaboration with a global community of developers, national and subnational governments, and various stakeholders, FIDE has facilitated the establishment of Beckn-enabled networks for OTN in countries such as India, Kenya, Gambia, Brazil, and others. These networks are increasingly being utilized in areas related to renewable energy, climate action, and sustainability at both local and national levels.

While still in its early stages, more and more implementations of Beckn are emerging. There are various pilots and concept-building efforts underway for initiatives such as battery monetization, peer-to-peer energy trading networks, climate data sets transactions, and farm-to-fuel circular economies.

Here, we learn from three examples that are relatively mature and which highlight the application of Beckn-powered OTNs for climate and sustainability:

- Open Network for Digital Commerce (ONDC): An open digital commerce network in India that facilitates platform-agnostic discovery of products and services, connecting buyers and sellers across various sectors. It aims to democratize e-commerce by enabling small businesses to compete effectively, enhancing consumer choice, and driving innovation in the digital marketplace.

- Unified Energy Interface (UEI): An open energy network in India that facilitates platform-agnostic discovery of EV charging stations, optimizing energy usage and reducing idle times.

- Kuza One Network: An agricultural network in Kenya that creates a common marketplace for farmers, providing access to information and input products for sustainable farming.

Open transaction networks in practice

Open Network for Digital Commerce

URL: https://ondc.org/
Type of data: Retail, food and beverage, mobility, logistics, etc.
Climate use cases: No direct climate use cases
Geographies served: India

Description

Open Network for Digital Commerce (ONDC) is a decentralized, open network protocol designed to democratize digital commerce in India. Built using the Beckn protocol, ONDC facilitates the integration of various digital commerce solutions, enabling seamless interactions between buyers and sellers for services such as retail, food delivery, and mobility. Launched in April 2022, the ONDC network has expanded to over 1000 cities across 15 domains as of March 2024. The network includes member companies like Paytm, PhonePe, Meesho, and Magicpin, among others.

ONDC creates a unified ecosystem where buyers and sellers can connect and transact using a standardized vocabulary. It supports various commerce transactions, including retail, food and beverage, mobility, and logistics. This allows different entities to discover, communicate, and perform transactions efficiently, promoting the inclusion of small businesses and optimizing the e-commerce landscape. The network supports various applications, including buyer apps, seller apps, and logistics service providers, facilitating the creation of digital contracts that enable both direct and indirect transactions between participants.

One of the key challenges in scaling up digital commerce is the dominance of large e-commerce platforms and the exclusion of small businesses. ONDC addresses this by enabling direct transactions between buyers and sellers, reducing dependency on any single platform. While transactions occur directly between peers, ONDC provides the necessary infrastructure for discovery, ordering, and fulfillment, ensuring a level playing field for all participants.

Unlike existing e-commerce platforms like Amazon and Flipkart in India, ONDC presents a broader, more flexible approach to digital commerce. It offers a decentralized, interoperable network that extends beyond individual platforms to encompass the entire digital commerce ecosystem. This design allows for greater integration across various sectors and potentially offers more adaptability to future needs, while supporting a wide range of payment methods suited to the digital commerce market.

Kuza One Network

URL: https://www.kuza.one/
Type of data: Weather, soil quality, agriculture markets etc.
Climate use cases: Good agricultural practices, climate smart technologies, regenerative agriculture practices
Geographies served: Kenya

Description

Kuza One Network, launched in 2024, is a decentralized, open network protocol for agricultural transactions and services in Kenya. Built on the Beckn protocol, it integrates digital agricultural solutions, connecting farmers to traders, suppliers, and financial institutions through young entrepreneurs. The network, facilitated by Kuza Biashara and Kenya Agriculture and Livestock Research Organization (KALRO), aims to address key challenges in market access, information asymmetry, and climate resilience.

One Network supports a range of agricultural transactions, from input purchases and crop sales to equipment rentals and advisory services. This unified ecosystem enables efficient discovery, communication, and transactions, promoting modern farming practices and optimizing productivity. Applications include weather advisory services, precision farming techniques, and supply chain management.

One of the key challenges in scaling up agricultural projects is the fragmentation of the value chain and limited access to markets for smallholder farmers. One Network simplifies this process by enabling direct transactions between participants, reducing intermediaries and increasing transparency. While the actual transactions occur directly between peers, the network facilitates fair pricing through its negotiated pricing structure and commission distribution model.

One Network creates a comprehensive agricultural ecosystem. Unlike specialized platforms such as DigiCow[6] that focus on specific services like livestock management, One Network offers an interoperable solution across the entire agricultural value chain, eliminating the need for multiple contractual agreements.

Unified Energy Interface

URL: https://ueialliance.org/
Type of data: Energy transaction data, consumption data, pricing data, location data, energy generation and storage data
Climate use cases: Electric vehicle (EV) charging, battery swapping, renewable energy management
Geographies served: India

Description

Unified Energy Interface (UEI) is a decentralized, open network protocol designed specifically for energy transactions. Built using the Beckn Protocol, UEI facilitates the integration of various digital energy solutions, enabling seamless interactions between energy providers and consumers for services such as electric vehicle (EV) charging, battery swapping, and renewable energy management. Launched in February 2024 in India, the UEI network handles over 1.4 GWh worth of energy transactions monthly.[7] The Alliance includes member companies like ChargeZone, Pulse Energy, Kazam, Sheru, Trinity, and Turbo, among others. It aims to promote global development, adoption, and compliance with unified standards for energy-related economic transactions.

UEI creates a unified ecosystem where providers and consumers of energy-related services can seamlessly connect and transact using a standardized vocabulary. It supports various energy transactions, including peer-to-peer (P2P) electricity trading, energy storage, and EV charging. This allows different energy-related entities to discover, communicate, and perform transactions efficiently, promoting the adoption of renewable energy sources and optimizing energy consumption. The network supports various applications, including energy storage, battery banks, EV vehicles, rooftop solar panels, and other local energy generation systems. Just like physical goods, energy can be consumed or stored. UEI facilitates the creation of energy contracts that enable both consumption and storage of energy (in batteries, capacitors, etc.).[8]

One of the key challenges in scaling up P2P energy projects is the payment settlement between peers. Traditionally, these payments are managed by utilities, which can be cumbersome. UEI simplifies this process by enabling direct P2P payments between participants. While the actual energy transaction occurs directly between peers, utilities can still levy energy wheeling charges on electricity bills, ensuring they are compensated for using the infrastructure.

UEI is designed for a wide range of energy transactions, providing mechanisms for payments using various methods suited to the energy market. While there is Open Charge Point Interface (OCPI),[9] a well-established protocol facilitating communication between charging station management systems and service

providers specifically for EV charging, UEI presents a broader, more flexible approach to energy transactions. UEI offers a decentralized, interoperable network that extends beyond EV charging to encompass various energy services. This design allows for greater integration across the energy ecosystem and potentially offers more adaptability to future needs. While OCPI is focused specifically on EV charging interoperability, UEI's broader approach aims to facilitate a wider range of energy transactions.

Making OTNs work for climate action

Based on these case studies, we have identified three key focus areas for OTNs based on well-tested use cases that offer significant potential for climate-related applications. These areas range from deployed solutions to pilot projects in various countries.

Discovery and Fulfillment of Climate-Aligned Goods and Services: As we see with UEI and its ability to make it easier for consumers to access renewable energy resources, protocols like Beckn can amplify and propagate demand signals from diverse sources more quickly.[10] By unlocking data relevant to both supply and demand, OTNs overcome challenges associated with financing, bypassing stakeholders who are unwilling to release data at price points that are accessible to frontline climate actors. Furthermore, by making climate-aligned goods and services more discoverable, open networks can help the market to sense and build capacities and inventories, thereby driving the market towards more sustainable options.

Transparency: The Kuza One Network highlights how open networks can enhance visibility across complex systems with many different stakeholders operating at different levels. By increasing transparency, OTNs help to overcome challenges associated with data quality, since more actors are involved in data generation - and it is easier for people to understand and use data if they are involved in its generation. As Kuza One Network brings individual farmers and entrepreneurs in contact with suppliers and government services, it follows that OTNs can ensure that individuals are able to actively participate in climate data ecosystems.

Attestation and Credentialing: OTNs can facilitate the attestation and credentialing of small businesses, farmers, and skill sets related to workers in sustainability. Credentialing the sustainable value chain components can unlock value beyond optics, such as unlocking formal credit from financial institutions and subsidies from the government.

This has happened with ONDC where ONDC, partnering with the Quality Council of India, launched a Digital Readiness Certification program to assess and certify sellers' online business capabilities. This initiative classifies sellers as "DigiReady" or "Requiring Support," enhancing credibility, expanding market reach, and providing targeted assistance to improve digital readiness. The program streamlines the onboarding process for Network Participants and connects verified sellers with relevant opportunities.

Limits to the OTN approach for climate action

While OTNs demonstrate significant potential for climate action, they are in nascent stages of development and implementation. As early adopters and innovators deploy these systems, they are uncovering and addressing a range of challenges inherent to this novel approach. The learning curve associated with these initial applications of ONDC, UEI and One Network, will be steep but invaluable. As the ecosystem of stakeholders invested in OTNs expands—encompassing donors, technologists, climate experts, and policymakers—there emerges a substantial opportunity to refine and enhance this data-sharing model. By collaboratively addressing the challenges identified, these stakeholders can work towards optimizing OTNs to more effectively drive positive impact in climate initiatives.

Governance

Regulating decentralized open networks involves navigating a complex landscape of sector-specific regulations, network rules, and enforcement mechanisms for digital contracts. The decentralized nature of OTNs complicates the tracking and resolution of grievances, as there is no central authority to oversee and address disputes. Thus, many stakeholders need to help address grievances and loss recourse: network operators must ensure that issues are resolved promptly and appropriately; civil society can contribute research to the discourse around open networks; and governments need to actively work to enforce data protection laws and regulations.

Furthermore, while laws for the traditional model of e-commerce are being codified, governments and network orchestrators need to adapt and calibrate rules and regulations. This involves creating flexible frameworks that can address the unique challenges of open networks, ensuring they are as robust and reliable as traditional e-commerce systems.

Data protection

The infrastructure required to support an OTN can be complex, especially with a wide array of participants, platforms and integration involved. Protecting sensitive climate data from unauthorized access is critical, as data security breach at any level can undermine trust and disrupt operations. While this is true in all cases, there are some unique characteristics of decentralized networks that need to be addressed. For example, there are more entry points for attackers to exploit, increasing the risk of data breaches. Other unique challenges include distributed consent management across different types of uses and the need for consistent encryption across network nodes.

Early implementations of Beckn are testing ways to address these unique challenges. The Beckn protocol incorporates a dedicated security layer within its layered architecture.[11] This layer enforces security measures that safeguard data, transactions, and communications across the decentralized network. For example, ONDC addresses these challenges by implementing a robust Network Data Governance Policy that mandates data isolation between participants and enforces consent-based data sharing. ONDC emphasizes strong encryption and security measures across the network while developing its own privacy policy and governance framework to ensure compliance with India's Digital Personal Data Protection Act (DPDP Act) Therefore, addressing the unique data protection challenges of open networks - including distributed consent management, consistent encryption across nodes, and cross-jurisdictional compliance - is essential to secure the trust of all participants.

Encouraging widespread use

As we see with Kuza's efforts to drive the One Network over the past decade, encouraging widespread use of open networks requires dedicated capacity building among customers, organizations, and government agencies.

An effective anchoring organization with secure funding is needed to coordinate and build this capacity. Network creation, including onboarding, expansion, and promotion, requires substantial funding. This can be a significant challenge without support from governments or the private sector. This anchoring organization can manage key aspects such as outreach to potential users, coordination of various stakeholders, and ensuring fairness in the open network so that no one participant captures a large enough market share to hinder competition. The anchoring organization may benefit from partnering with existing marketplaces and positioning to drive adoption and increase revenue, although we have not yet seen examples of this practice.

Looking forward

OTNs offer immense potential for advancing climate action. We have already witnessed their impact in areas such as EV charger discovery, sustainable agriculture, and circular economy applications. As the demand for climate-aligned goods and services grows, there will be an increasing need for efficient discovery mechanisms and reliable attestation of sustainable value chains.

As OTNs mature and early adopters help to overcome existing challenges, OTNs could become core components of digital public infrastructure (DPI). We know that DPI is more effective in driving benefits to people when it is built using open, interoperable protocols and specifications with transparent, accountable, and participatory governance frameworks, and robust public and private innovation ecosystem. Building on the core foundations of DPI (identity, payments, and data sharing), we see the potential of OTNs to support a new layer of infrastructure that enables the private sector and others to build new climate-oriented solutions. This “Climate DPI" could thereby empower citizens by giving them ownership and control over their data related to carbon footprints, energy consumption, and more. This data can drive more sustainable choices and foster a culture of accountability and sustainability.

This paper has identified the potential of open networks for climate action while acknowledging the associated challenges. Further research is needed to explore the nuances of open networks, particularly in terms calibrating regulations for OTNs, ensuring effective grievance redress mechanisms, and channeling more financing for the development of such networks.

Climate change is a challenge that requires collaborative innovation from diverse sectors of society. The open network approach, akin to DPI, can break through the tendency of one or two large entities to control the generation and use of data, thereby empowering individuals and small businesses to fully participate in data-driven climate adaptation, resilience, and recovery.

End Notes

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