The Case for a Climate and Sustainability Data Exchange

Shared rails for a shared planet

NFH NETWORKS FOR HUMANITY

StepChange

Status and Intent

This paper is released to outline an evolving thesis and seeks to establish a shared conceptual foundation for data exchange in the climate and sustainability space. Realising this objective will require a series of collaborative, ecosystem wide conversations. We invite all interested stakeholders to join these discussions and help implement this vision. Please visit the Networks for Humanity or StepChange website for more information.

Authors

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About Networks for Humanity

Networks for Humanity (NFH) is an international network of labs focused on building open, interoperable digital infrastructure that enables value exchange at population scale. NFH approaches digital markets as a shared systems problem—where discovery, transactions, credentials, and trust should function as common infrastructure. Within this broader effort, Beckn is a pioneer of open networks, restoring agency, choice, and earning opportunity in digital markets across domains like mobility (Namma Yatri), energy (DEG), retail (ONDC), data (Decentralised Data Marketplace), and water (Water Data Exchange). Other missions of NFH include Finternet, DeDi, and OpenCred.

About StepChange

Founded in 2022, StepChange is an organisation of climate scientists, technologists and ESG domain experts focused on designing, developing and deploying climate and sustainability decision-making tools to empower financial institutions and businesses. StepChange offers a variety of highly specialised solutions across ESG management, carbon accounting, climate risk modeling, value-chain sustainability and sustainable finance. The organisation has contributed widely to the climate risk and Scope 3 assessment ecosystem in Global South, working closely with a large number of financial institutions, enterprises and regulators.

Executive Summary

The climate crisis is no longer a distant threat; it is now our lived reality. In 2025, global temperatures reached 1.44°C above pre-industrial levels, with the 2023–2025 average being the warmest 3 year span recorded across eight different global datasets, approaching 1.5 °C (C3S, WMO). Climate-driven disasters have also been on the rise, with natural perils resulting in an estimated $417B in global economic losses in 2024 alone (Gallagher Re). Solutions to this crisis are not lacking: solar and wind power, regenerative agriculture, electric vehicles, carbon markets, and countless other breakthroughs exist, pioneered by scientists, engineers, economists, policy advocates, and members of civil society across the globe. Yet despite this very real progress, the collective impact of these interventions is insufficient to match the scale and urgency of the challenge.

A key gap identified repeatedly by stakeholders across different modalities is the absence of accessible, high-quality and trustworthy data that can drive real-world decision-making and facilitate informed coordination. Climate action is systemic by nature, requiring producers, financiers, regulators, and consumers to coordinate across geographies and value chains. However, today's fragmented, low-quality, and costly data systems make this extremely challenging, resulting in mispriced capital, misaligned supply chains and slower progress.

There is thus a strong need to move beyond siloed localised fixes to this systemic problem. Building open, interoperable digital infrastructure that facilitates coordination, supports diverse contextual solutions and restores agency for action across society will enable previously fragmented efforts to compound into impact at scale.

The Climate and Sustainability Data Exchange (CSDX) is intended to bridge this missing infrastructure: serving as an open, global rail for decision-grade climate and sustainability information. CSDX is an interoperable digital network that allows any actor to publish, modify, and access records using a shared infrastructure at near-zero marginal cost. By systematically aligning the underlying data requirements across a diverse set of sustainability frameworks, lowering barriers to access data, and embedding trust and credibility into each transaction, CSDX transforms data from a source of friction into a foundation for accountability, innovation, and scale.

CSDX is built to serve three interconnected value propositions: ESG management, carbon accounting, and climate and nature risk. This network is intentionally designed to prevent sustainability metrics from being relegated to annual disclosure parameters alone; rather CSDX reimagines them as data points that can be used to guide markets, inform regulation, and drive business decisions. For example, CSDX could enable an exporter of machined goods in the Global South to disclose up-to-date climate data (such as emissions, energy mix, and water use) to an importer in the European Union (EU) via a shared auditable infrastructure, instead of across a set of fragmented ESG, audit, and compliance systems. Banks, clients, insurers, and regulators can securely pull the same trusted records should the exporter ever need to disclose information to these stakeholders (e.g. for a value-chain assessment or regulatory disclosure requirement). In aggregate, CSDX can enable

improved pricing of sustainability and climate risk, drive real-time sustainability compliance, and empower innovative market mechanisms to reward sustainable performance at scale.

Built for climate action and designed to bridge a key infrastructure gap, CSDX leverages a shared data rail to unlock coordination at local, regional and global scales. The guiding principle behind the network is to facilitate the strategic compounding of key factors: unification improves quality and access, access broadens participation, participation builds trust, and trust attracts capital and innovation.

We invite governments, businesses, financial institutions, and civil society to steward this digital rail together, mindful of the fact that every new connection strengthens trust, accelerates decarbonisation, mitigates risk, and scales collective action.

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1. The time for action is now

Global CO_2 emissions from fossil fuels in 2025 are estimated to be at an all-time high of around 38 gigatonnes, pushing mean global atmospheric CO_2 concentrations above 425 ppm. This is roughly 50 % higher than pre-industrial levels (GCB 2025). The IPCC estimates that avoiding a permanent overshoot of 1.5 °C requires a 43 % cut in global greenhouse-gas emissions by 2030, meaning the decisive window for action is now (IPCC 2022).

The world already has the technologies and tools to act: renewable power, electric vehicles, regenerative agriculture, carbon markets to name a few. However, despite decades of scientific progress, policy deliberations, and community advocacy, the pace of change is decidedly slower than what the crisis demands. Further, as the global AI revolution progresses, the industrial economy is transforming at unprecedented scale. This presents a critical juncture for climate action to seize the momentum and drive meaningful, lasting change, or risk deepening the climate crisis at an accelerated speed.

The climate crisis is a system-wide challenge, demanding coordinated, interdependent, and compounding solutions. Unfortunately, current efforts have been largely linear and isolated, resulting in fragmented impact from solutions that rarely interact or translate across borders, sectors, and supply chains. Meeting the climate challenge requires orchestrating a planetary-scale data and information system where each actor's performance contributes to and depends on similar signals from other stakeholders in the ecosystem, generating sustainable flywheel effects.

2. Climate action requires coordinated actors and a coupled system

Producers decarbonise processes; suppliers report upstream footprints; financiers price risk and channel capital; auditors attest truth; policymakers set guardrails and rules; technologists build the pipes; end-users validate (or reject) low-carbon products. Each role is indispensable, yet none can deliver the transition alone. A bank cannot structure a sustainability-linked loan without reliable borrower information; a borrower cannot reduce emissions intensity without trusted supplier inputs; regulators cannot steer policy without well-reported metrics that enable a complete view of the chain. All these actions ultimately rely on the credibility of the data that underwrites them, and the system can only move as fast as its weakest link.

Thus, progress on climate action depends greatly on something deceptively simple: trustworthy, comparable, and accessible data. Without reliable information, markets cannot reward decarbonisation, financiers cannot price risk, regulators cannot steer policy effectively, and enterprises cannot credibly prove progress.

Today, however, sustainability data—in the Global South especially—suffers from three fundamental structural challenges: it is limited in quality, expensive to access, and fragile in trust.

Data is limited in quality

Sustainability metrics are defined differently across forms and portals, so the same factory can report "Scope 3 Category 1" one way for a buyer questionnaire, another way for a CDP-style survey, and a third way for BRSR Core. Evidence that underpins these metrics often sits in PDFs or photos—utility bills, meter reads, invoices—rather than in machine-readable files, and updates to these "sources of truth" often arrive months after the annual disclosure deadline. Further, in practice, grassroots practitioners that are in charge of filling out ESG and sustainability data manually have a limited understanding of the subject matter and rely on their best estimates, leading to non-standardised, non-comparable data outputs.

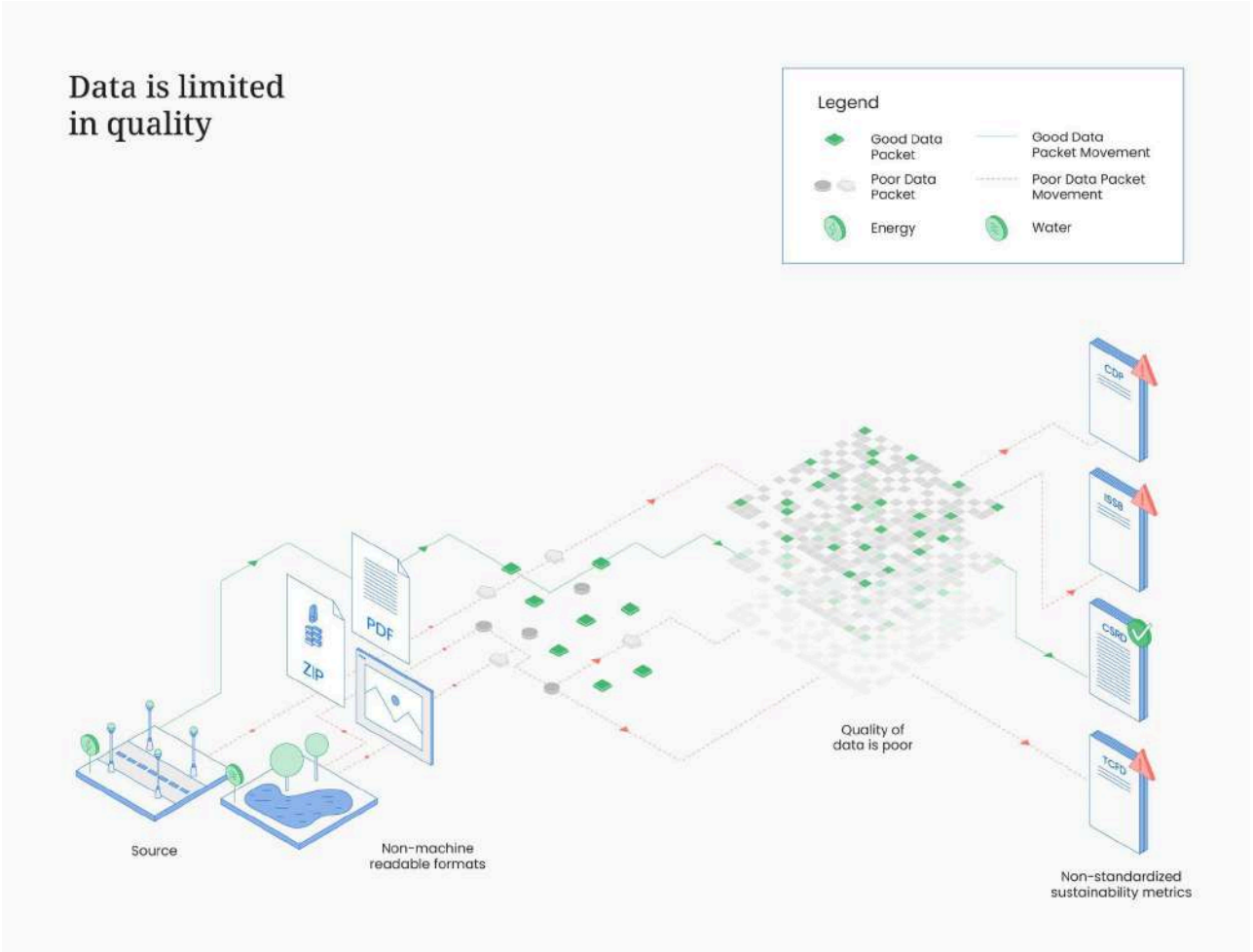

Figure 1. The same source data—electricity bills, water records, and activity logs—travels through non-machine-readable formats and fragmented portals, to arrive as non-standardised, non-comparable outputs across different reporting and disclosure frameworks. Poor data quality at the source compounds into unreliable reporting at the destination.

Accessing and reporting data is expensive

Sustainability tools are generally fragmented or paywalled, integrations are bespoke, and reporting is labour-intensive, especially for MSMEs that do not have modern Enterprise Resource Planning (ERP) software or dedicated sustainability staff. Despite these barriers, an auto-ancillary might be expected to copy figures from paper invoices into multiple domestic buyer portals, enter lender-defined KPIs to ascertain green financing eligibility, and input product-level emissions data into the EU's CBAM reporting format. These are all asking for similar information but define and structure their data requirements very differently, causing unnecessary duplication of effort, time, and capital for the information supplier. Therefore, the substantial time, high levels of sophistication, and costly external support required to meet these requirements drive stakeholders to opt out, leaving large parts of the value chain invisible to customers, investors, banks, and policymakers.

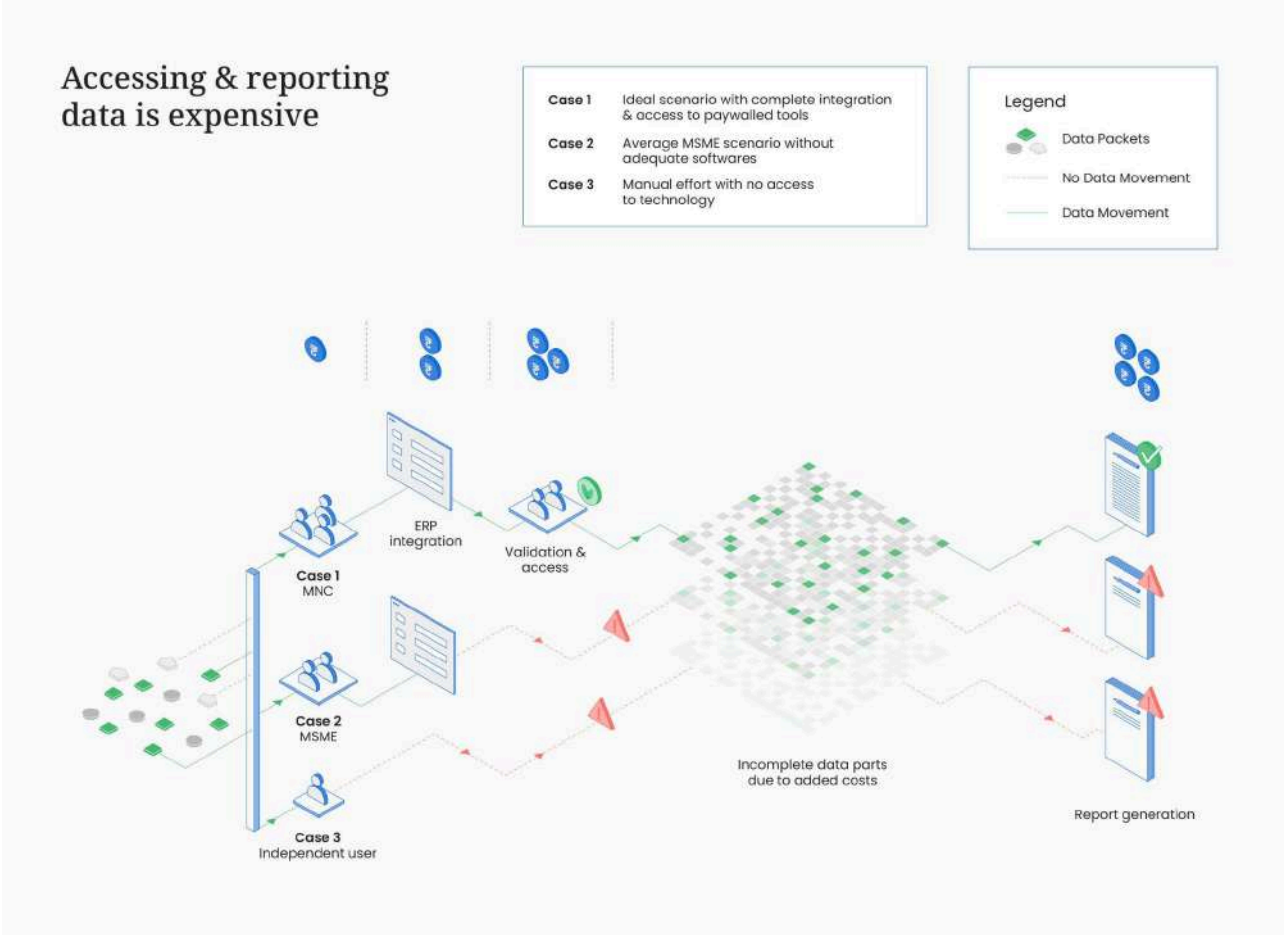

Figure 2. Different actors manoeuvre through the same data landscape with vastly different outcomes. A large MNC with ERP integration and access to validation tools reaches full report generation; an average MSME arrives with incomplete data due to the added cost of access; an independent user for a small MSME operating manually never makes it through. The infrastructure gap determines who gets to participate and benefit.

Trust is fragile

It is highly challenging to audit and trace sustainability metrics to their original source. Electricity, diesel, and water data are often entered without supporting bills, receipts, meter photos, or delivery records. Input data lacks timestamps, edits overwrite prior values, and units and boundaries vary across sites, making like-for-like comparisons extremely difficult.

There is also a lack of transparency around how data and goods actually move across the ecosystem. Information is obfuscated at each organisational boundary between suppliers and purchasers, investors and financiers, and exporters and regulators, making it hard to establish a consistent chain of environmental causality. As a result, sustainability data is difficult to verify, inconsistent across the organisation and supply chain, and hard to defend with confidence. In the absence of visibility and provenance across the underlying compounding flows, there is an erosion of trust in the resulting metrics, limiting their use in real-world decisions and disclosures.

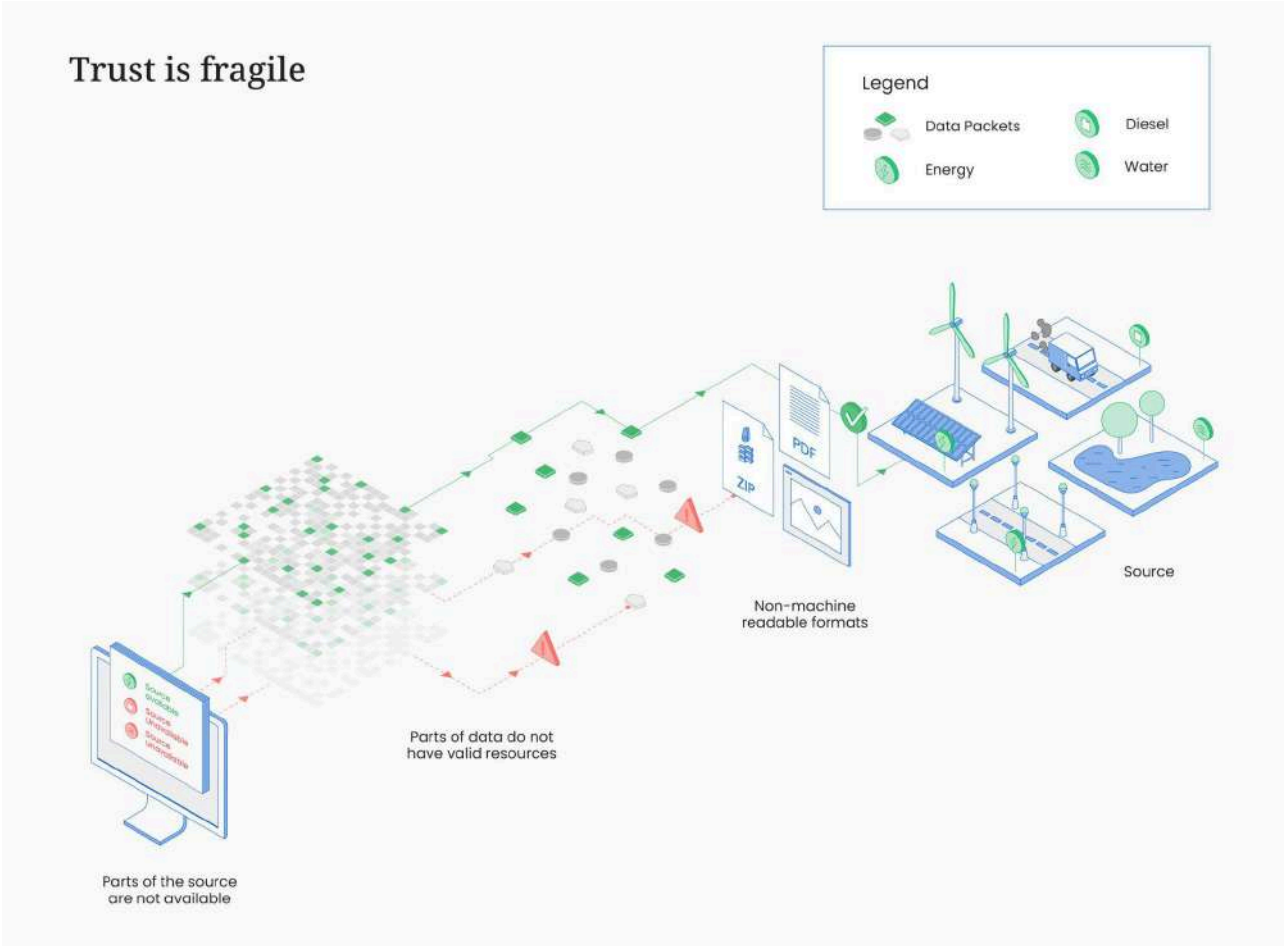

Figure 3. When source data arrives in non-machine-readable, non-unified formats, there is no trail to follow. Without timestamps, version histories, or links back to originating systems, it is challenging to audit the reported metrics. Trust erodes not because actors are misaligned, but because the system offers no way to verify the integrity of the data.

3. Data integrity gaps have systemic consequences

These gaps in data integrity have ripple effects across the entire system. When information is incomplete, inconsistent, inaccessible, or unverifiable, every actor in the climate transition is exposed to deleterious impacts. Producers cannot credibly demonstrate decarbonisation progress; suppliers struggle to gain recognition for improvements; financiers misprice risk or misdirect capital; auditors face gaps in assurance; policymakers regulate with blind spots; and end-users lose trust in claims of sustainability. What begins as a localised data integrity challenge at one node in the chain quickly cascades, slowing investment decisions, undermining credibility, and weakening the collective pace of the climate transition.

To strengthen this chain, it is highly valuable for every involved stakeholder to speak a common language, sharing data and information in a manner that is consistently defined, reliably sourced, and readily available to everyone who depends on it. The Global North has built parts of this infrastructure already by digitizing records, and establishing service layers (e.g., CDP, EcoVadis) and mature assurance mechanisms that help convert operational data into trusted, standardised datasets. However, even these systems falter when supply chains extend into the Global South. These regions operate under data-poor contexts with limited standardisation and a lack of dedicated sustainability infrastructure. Designing digital infrastructure solutions that incorporate this context is crucial. Without a reliable rail for information and data to flow seamlessly across global supply chains, markets, regulatory frameworks, and capital allocation mechanisms, the climate transition will continue to face barriers to speed and scale.

4. Shared rails are how systems scale

The global sustainability data landscape currently consists of a patchwork of isolated approaches with limited interoperability. For large corporations, this creates duplication, higher integration costs, and unreliable coverage. For smaller firms, it limits access and creates exclusion. At the system level, it entrenches asymmetry and results in a material barrier to economy-scale action.

System-level change almost always requires a shared system of rails. To state a canonical example: railroads only expanded to continental-scale transport systems once different regions agreed on a standard track gauge. Similarly, global trade exploded after the ISO shipping container unified box sizes and locks, allowing ports to mechanise, streamlining ships design around a single standard, and collapsing freight costs. Telephony scaled worldwide once carriers adopted SS7 signalling, which made interconnection and roaming predictable across networks. The internet took off after the introduction of TCP/IP, a minimal protocol suite that enabled any computer to access the network. More recently, the Unified Payments Interface (UPI) defined a bank-agnostic message format that created a digital rail that enabled third-party applications to move money at near-zero marginal cost. It is widely credited as enabling rapid financial inclusion in India, with ripple effects across sectors including commerce and mobility.

A study of capital markets tells the same story. After the Great Depression, GAAP (and later IFRS) provided a common language for financial statements. Decades later, XBRL enabled machine-readable versions of these statements. It was only then that application layer solutions begin to flourish, all because the rails were now open. These services no longer needed to negotiate bespoke integrations with every company or regulator, but were instead built on public standards and competed on product quality, speed, and service.

History has shown us that establishing a minimal and robust shared rail can enable entirely new ecosystems. A shared digital infrastructure that relates real-world activities, value exchange, and regulations to a rich set of corresponding sustainability, ESG, and climate and nature risk data would be equally transformative. It would knit together a diverse set of actors and resources in an interoperable network capable of powering simple bilateral or muli-lateral exchanges (without bespoke integration) while laying the groundwork for system-level collective action.

Such a vision already exists for the larger data ecosystem. The Decentralised Data Marketplace (DDM) is a globally connected, open data ecosystem that reinforces data ownership and sovereignty while enabling equitable access across sectors and geographies. DDM is conceived as a network of networks: a coordination layer that connects existing data initiatives and enables new ones.

CSDX is a key manifestation of this vision, applying the DDM framework to climate and sustainability data, where the need for shared, trusted, and interoperable infrastructure is both obvious and urgent. By unifying the exchange of decision-grade information, it turns fragmented reporting into shared infrastructure that unlocks efficiency, resilience, and scale across the climate transition.

5. Climate and Sustainability Data Exchange (CSDX): the open network for decision-grade sustainability data

CSDX is a global, open network that makes decision-grade sustainability and climate-related information usable across the economy. It is a common digital rail that allows any authorised system to publish, modify and access sustainability data using a shared infrastructure at near-zero marginal cost. Crucially, this is achieved through a decentralised architecture that enables the underlying data to be governed at source while simultaneously becoming globally discoverable and interoperable to authorized stakeholders.

A single, shared verifiable data layer. From a two-person MSME to a thousand-person ministry, every actor can access the full set of interoperable and comparable metrics, even as underlying data and control remains with the original contributors. Each metric and data store carries structured information on the underlying origination method, time, and source, along with enforceable permissions and provenance, so it can be trusted and transformed into extensible derivatives as required.

Open rails, universal access. The infrastructure is standards-based and has low-friction to join. Simple connectors, multilingual mobile/offline tools, and clear permissions and revocation rights are specifically designed to promote engagement from large enterprises, MSME suppliers, and public agencies at minimal cost.

Designed for innovation and extensibility. Rather than predefining use-cases and constraining metrics, CSDX enables market actors and ecosystem players to innovate around a shared infrastructure. Independent verification bodies, assurance providers, data transformation specialists, and sectoral intermediaries improve data quality, comparability, and trust by modifying and assuring information on the network. Similarly, builders create new products that leverage the newly available store of sustainability data (e.g. transaction-level emissions analytics for manufacturers, geolocation-based risk tools for developers, portfolio decision engines for finance, and national progress trackers for the government.)

Climate signals embedded in everyday activity. Purchase orders, invoices, loan decisions, logistics events, and regulatory permits form the backbones of key workflows that drive the global economy. With CSDX, they can now be underwritten by crucial sustainability and risk information that can enable informed pricing, procurement, supervision, and policy feedback.

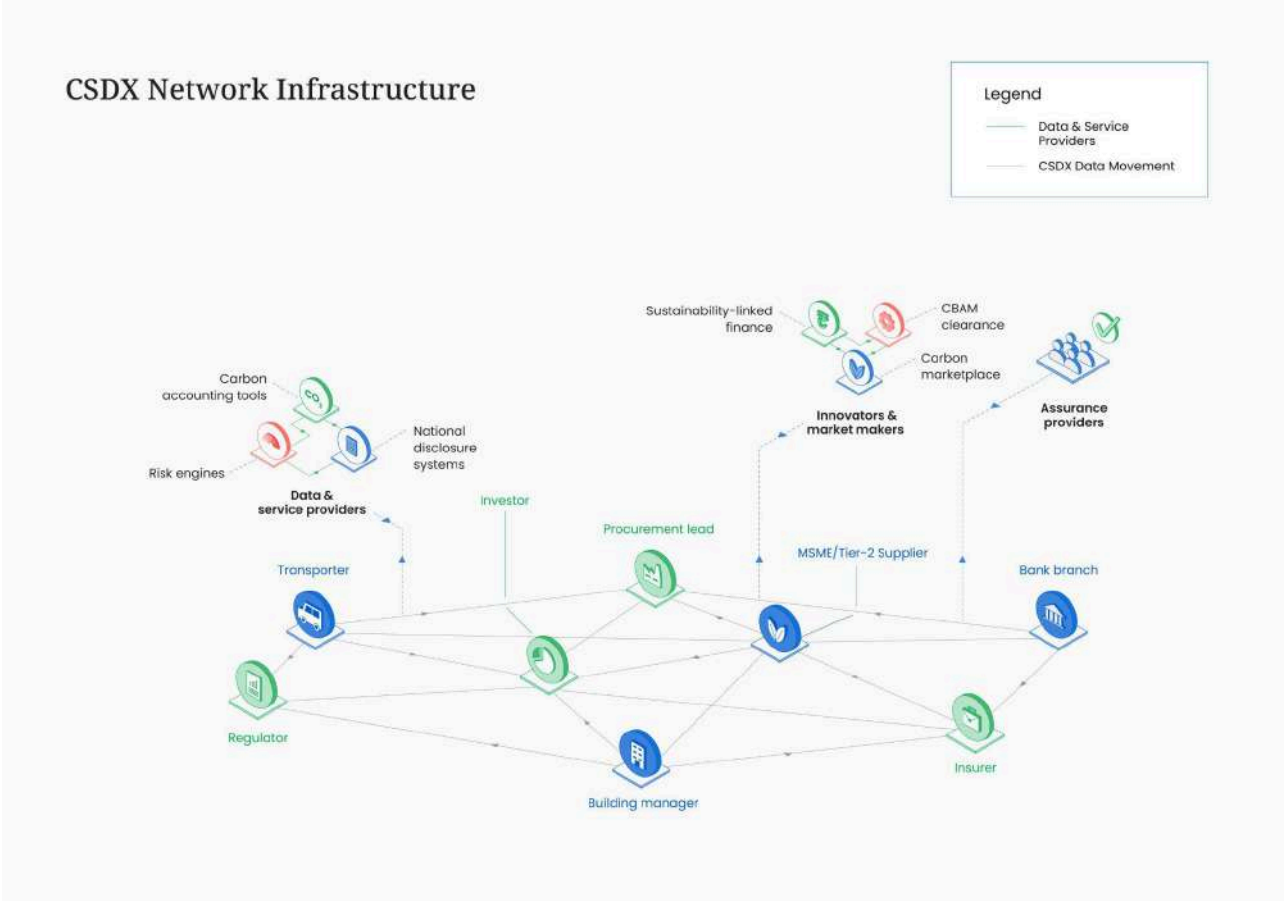

Figure 4. A sectoral manifestation of the Decentralised Data Marketplace (DDM), CSDX connects climate information producers, users, assurance providers, data providers, and innovators through open, interoperable digital infrastructure—enabling decision-grade sustainability data to flow seamlessly across value chains. No actor is at the centre–each connects as a peer, publishing and consuming sustainability data across the network.

6. Confronting structural gaps in the sustainability landscape

By using a shared infrastructure and common language, lowering barriers to access, and embedding verification into the network itself, CSDX transforms data from a source of friction into a trustable, scalable foundation to recognize, implement, and accelerate climate action.

Addressing data quality through a common language

CSDX is specifically designed to be interoperable and extensible to global frameworks and standards such as the International Sustainability Standards Board IFRS S1-S2, the European Sustainability Reporting Standards, the erstwhile Task Force on Climate-related Financial Disclosures (TCFD) and the Task Force on Nature-related Financial Disclosures (TNFD). It is also specifically designed to be compatible with nation-specific schemas like SEBI's Business Responsibility and Sustainability Reporting (BRSR) / BRSR Core

and the Reserve Bank of India's draft guidelines on climate risk disclosure. This ensures that granular metrics like "Scope 3 Category 1" or "water-withdrawal intensity" are harmonized across different inputs and can be used consistently across different tools and reports, addressing limitations in data quality and maintaining transparent provenance.

Figure 5. The same source data that previously arrived as incomplete and fragmented packets now travels through the CSDX network as consolidated data packets—emerging as high-quality, comparable sustainability metrics aligned across multiple climate frameworks. A shared infrastructure transforms quality at the point of use.

Tackling access issues through an open and interoperable exchange

CSDX offers ecosystem stakeholders the use of open, low-friction digital rails so that authorised actors can request, access, and share data across the network. It includes support for simple manual input by MSMEs, automated connectors for enterprise ERP systems, and integration of multilingual platform tools that could extend its capabilities across mobile and offline modalities. A public asset registry makes authorized metrics openly available. Together, these features enable a highly flexible, accessible and cost-effective digital infrastructure for ESG, sustainable finance and climate risk use-cases.

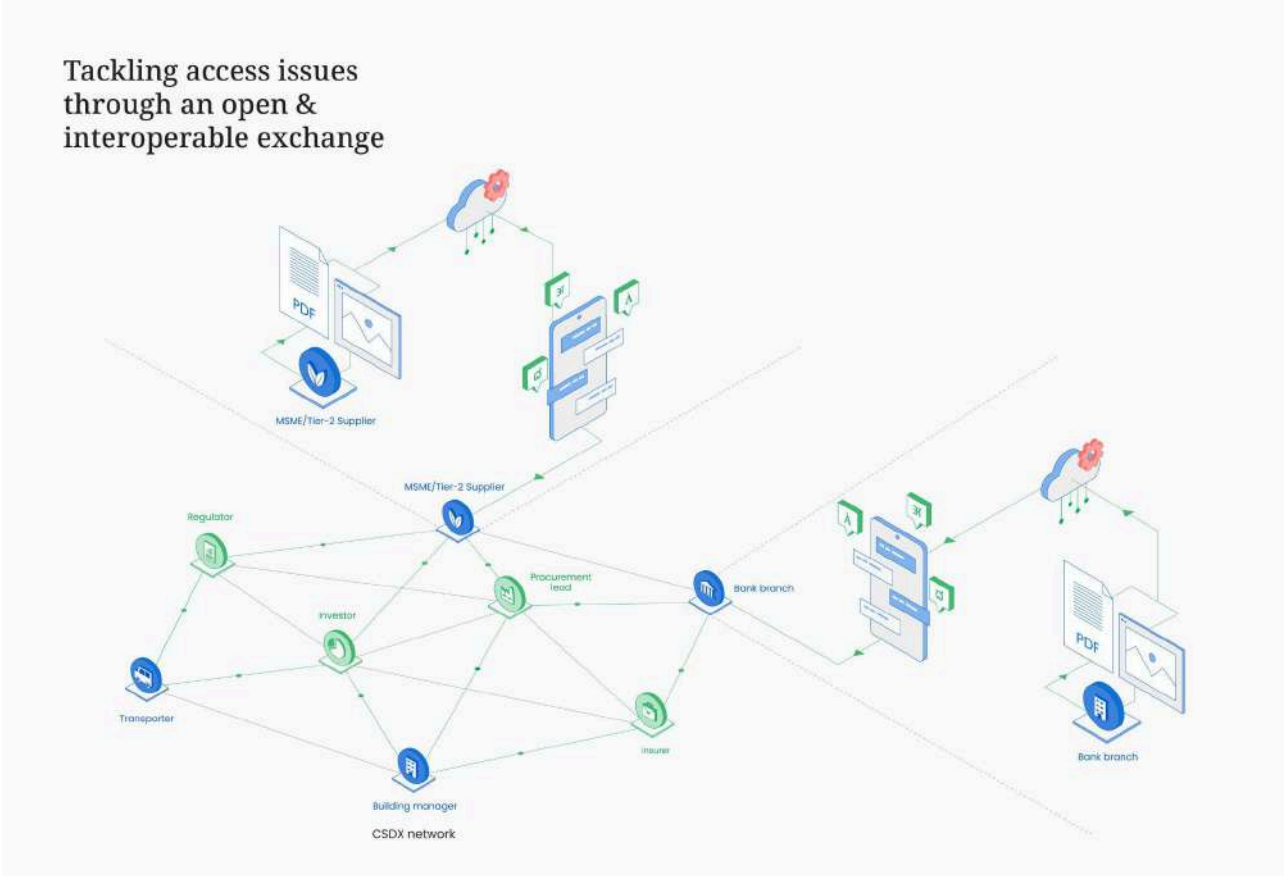

Figure 6. Across the CSDX network, actors of every size—MSME suppliers, regulators, investors, transporters, building managers, and bank branches—connect as peers through open, low-friction rails. Participation no longer depends on the size of an organisation's technology budget; the network meets each actor where they are.

Enhancing trust and transparency through audit-ready infrastructure

Every data packet on the CSDX network is digitally signed and timestamped, and links back to source systems such as meters, invoices, or GST/MCA records. The network maintains immutable logs and version histories, issues non-repudiation receipts, and supports third-party attestations. Each packet carries provenance and a confidence score, making tampering visible and reliability explicit.

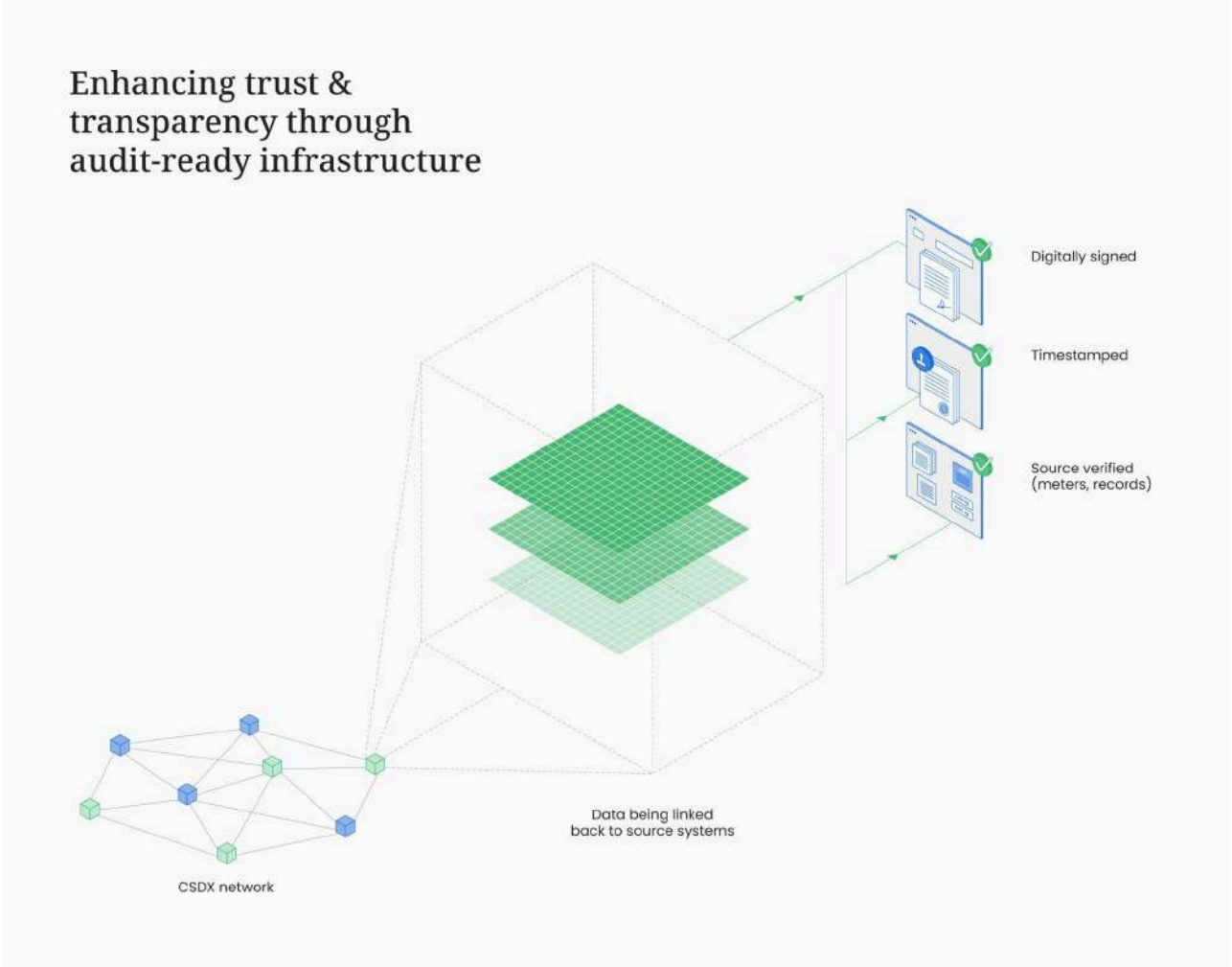

Figure 7. Every data packet moving through the CSDX network is digitally signed, timestamped, and linked back to source systems. Data being linked back to source systems at the point of origin makes sure that by the time a record reaches its destination, its integrity is maintained.

Enabling economies of scale to emerge through purpose-agnostic infrastructure

Historically, systems that achieve true scale do so not by optimising for a single use case, but by enabling best-in-class capabilities across a set of key use-cases, driving concrete value, and letting the ecosystem innovate further. The path to scaling climate and sustainability data is no different. Information generated

for compliance, reporting, or disclosure should also be usable for finance, procurement, insurance, policy, and risk management. CSDX is designed so that data, once published, can extend across these contexts without being re-created or re-verified—allowing the same record to unlock multiple forms of value over time.

It is also crucial to note that for climate data systems to endure, participation must be economically and operationally rational. CSDX reduces the marginal cost of compliance and disclosure by enabling verified data to be reused across producers, customers, financiers, regulators, and auditors. Over time, this allows good environmental performance to be rewarded more consistently—through access to capital, markets, and lower transaction costs.

The guiding logic is simple and compounding: unified data underwrites sustainable actions, trust in the data creates accountability and rewards good actors, and access to data across multiple layers of abstraction enables real scale—accelerating sustainability efforts across the whole system. The flywheel turns, each spin faster than the last, and the effects grow exponentially.

7. CSDX scope, utility and value proposition

The CSDX network is specifically designed to facilitate data and value flow across three broad value propositions: ESG management, carbon accounting and climate and nature risk mitigation.

ESG management

The Environmental, Social, and Governance (ESG) framework represents a comprehensive approach for assessing and managing non-financial metrics of economic activity. These dimensions shape long-term enterprise resilience, investor confidence, and societal trust.

- **Environmental (E)**: Captures a company's interaction with natural resources and ecological systems, beyond carbon alone. This includes biodiversity loss, water usage, waste management, deforestation, and pollution. For instance, an FMCG company may need to manage water withdrawal across stressed geographies, while a mining firm must account for biodiversity restoration in extraction zones. These impacts directly influence license(s) to operate, regulatory exposure, and reputational standing.
- **Social (S)**: Encompasses impacts on employees, communities, and customers. This includes labor conditions, diversity and inclusion, occupational health and safety, community engagement, and product responsibility. For example, a technology company may be evaluated on diversity in its workforce and governance of data privacy, while an apparel manufacturer may be scrutinized for working conditions in its supply chain. Social metrics often determine stakeholder trust, employee productivity, and customer loyalty.

- **Governance (G)**: Reflects the systems of decision-making, accountability, and oversight that ensure transparency and ethical conduct. Elements include board independence, executive compensation alignment, shareholder rights, anti-corruption practices, and compliance mechanisms. For financial institutions and corporations alike, strong governance is often the foundation for effective management of environmental and social risks.

ESG management converts a wide array of externalities into measurable, comparable, and actionable factors. It enables investors to allocate capital responsibly, regulators to enforce disclosure, and enterprises to embed sustainability into strategy and operations. The CSDX network will facilitate this by unifying taxonomies, and enabling data provenance and disclosure mechanisms across actors (while remaining extensible to new systems), ensuring that ESG metrics drive real-world accountability for non-financial performance.

Carbon Accounting

While ESG covers a wide spectrum of non-financial factors, carbon accounting merits special treatment due to its unique measurability and impact materiality. Almost all economic activity generates an invisible externality in the form of greenhouse gas emissions that, when aggregated across the economy, drive climate change. Unless these emissions are consistently measured and attributed, they cannot be effectively managed or reduced.

Carbon accounting functions as a unit-based ledger of climate externalities:

- It is usually fungible (tons of CO_2 equivalent can be aggregated across sectors and supply chains).
- It is usually allocable (emissions can be attributed to products, facilities, suppliers, or financed activities).
- It can be securitized (emissions can be embedded in targets, prices, and legally binding financial or commercial agreements).

Examples include manufacturers quantifying Scope 3 emissions across global suppliers, or banks attributing financed emissions to lending portfolios. The CSDX network will unify emission factors, allocation methods, and data-sharing protocols (while remaining extensible to alternate methods) so that carbon metrics can actually serve as a reliable foundation for decarbonization strategies, capital flows, and policy enforcement in the real-world.

Climate and Nature Risk

Climate and nature risk describe the impact of environmental change and policy transitions on enterprises and financial institutions. Climate risk analysis is essential for pricing resilience and vulnerability across the economy.

- **Physical risks** include the effects of acute hazards such as floods, heatwaves, and cyclones, as well as chronic changes such as sea level rise and shifting rainfall patterns. For example, an agribusiness may face declining crop yields under heat stress, while insurers may confront escalating losses from extreme weather events.

- **Transition risks** arise from regulatory, technological, and market shifts as economies decarbonize. These include carbon pricing, bans on high-emission products, changes in consumer preferences, and rapid adoption of alternative technologies. For instance, auto manufacturers must navigate declining demand for internal combustion engines, while utilities must adapt to renewable integration and stranded asset risks.

By standardizing climate risk data and leveraging industry best-practices to communicate risk, the CSDX network can enable coordinated and comparable approaches to scenario modeling, hazard mapping, and financial translation of risks, ensuring that banks, insurers, and corporates can incorporate climate resilience into valuations, lending spreads, and investment decisions. Comparable machine-readable data at scale can also enable advanced analytics—unlocking new models for risk forecasting, supply-chain optimisation, and climate intelligence that are currently challenging due to the lack of appropriate data and fragmented data storage and exchange systems. This flywheel results in compounding value: better data enables better risk models; better risk models improve pricing and decisions; better decisions shift capital and behaviour; and these shifts, in turn, strengthen data quality and participation. What begins as data exchange becomes a self-reinforcing system of coordination, innovation, and market signals.

A one-stop solution for sustainability data

By tackling ESG management, carbon accounting, and climate and nature risk, the CSDX network offers a comprehensive and flexible digital infrastructure for data and information that can drive sustainability decision-making and disclosures:

- ESG coverage captures the broad and extensible set of non-financial outcomes.

- Carbon Accounting coverage provides a rigorous, quantifiable subset of environmental impacts with unique salience for decarbonization and sustainable finance.

- Climate and Nature Risk coverage ensures that highly non-standard climate and nature risk metrics are normalized and validated, enabling efficient capital allocation and resilience planning.

The network establishes a positive feedback loop between impact measurement, corporate governance, and risk pricing, ultimately turning sustainability considerations from a reporting exercise into a decision-lever for the real economy. Crucially, this network is not static: CSDX is intentionally dynamic and extensible, designed to incorporate additional information (e.g., biodiversity, water stress, nature risk) as data maturity, regulatory requirements, and market use-cases evolve.

8. How CSDX works: network components & workflow

CSDX is organised around a few key components. A shared infrastructure that includes a registry and credentialing system, transaction protocols like Beckn, and audit capabilities that ensure transactions are interoperable and verifiable by default. A neutral network facilitator who stewards the underlying standards, onboarding, and verification rules. Network participants (supply-chain actors, financial institutions, public agencies, assurance firms, and builders) leverage this shared infrastructure to connect and facilitate flow of decision-grade information.

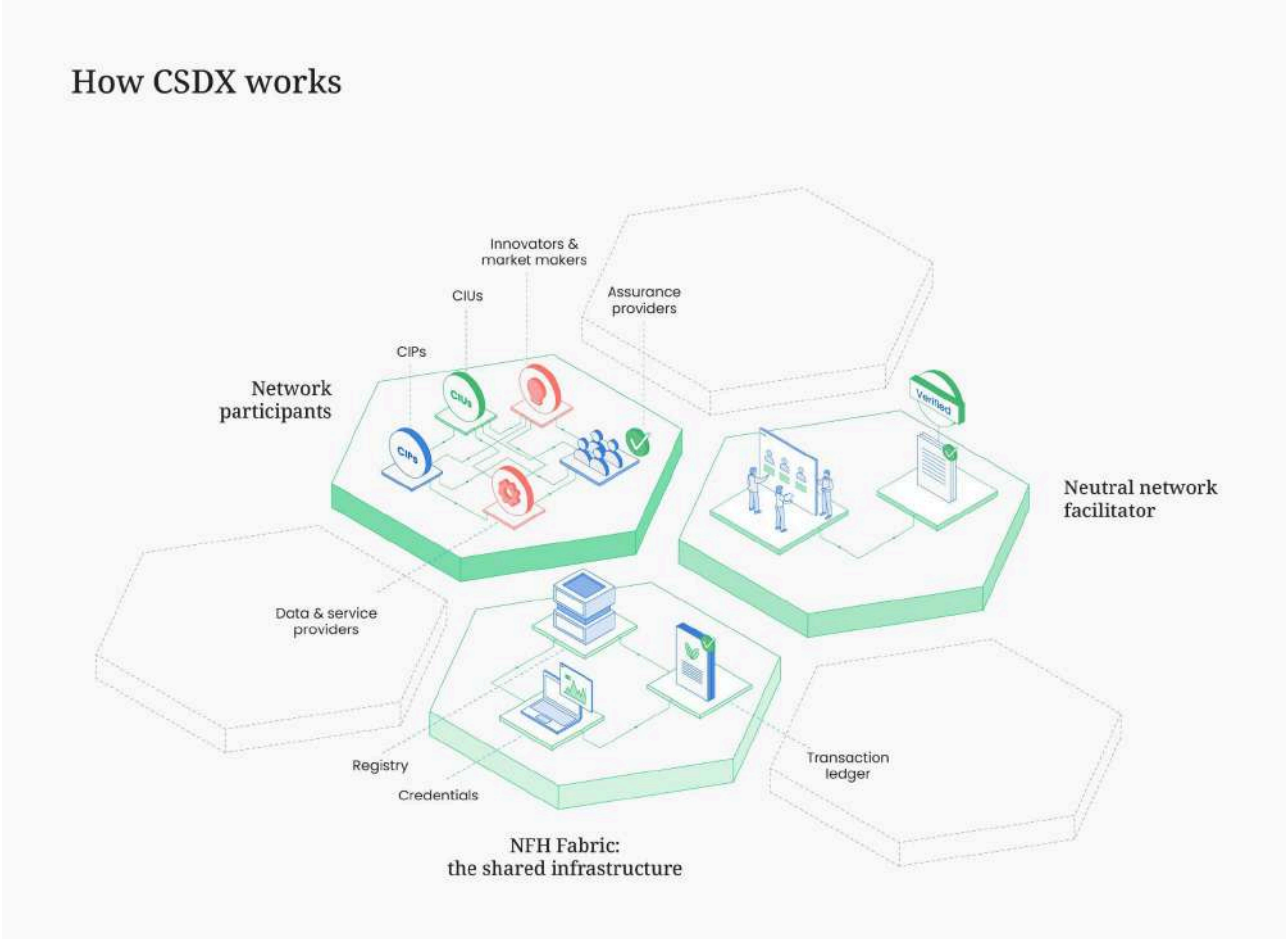

Figure 8. CSDX is organised around a few key interdependent parts. Network participants: CIPs, CIUs, assurance providers, data and service providers, and innovators connect through the NFH Fabric, the shared infrastructure layer comprising the registry, credentials, and transaction ledger. A neutral network facilitator stewards the standards and onboarding rules that hold the system together.

Note: The components shown (registry, credentials, and transaction ledger) are illustrative of the NFH Fabric, not exhaustive of it. The full fabric includes catalogue and discovery services, the Beckn protocol, Finternet UNITS for programmable asset transfer, and a growing set of capabilities designed to support end-to-end value transactions at scale.

Shared infrastructure

CSDX is anchored in the NFH Fabric, a shared infrastructure that includes multiple components that enable end-to-end value exchange at scale. This includes a public registry infrastructure (DeDi) that holds members on the network, their public keys, their roles, onboarding procedures, and the APIs that govern registration and discovery. With this sit cryptographically verifiable credentials (through OpenCred) and signing keys for tamper-evident records, policy enforcement for consent and throttling, and immutable audit logs that track who requested what and when. Further, domain-agnostic transaction protocols like Beckn enable end-to-end transactions from discovery, negotiation, order, fulfilment, and post-fulfilment. The financial layer draws on Finternet—an open infrastructure protocol for tokenised assets that enables programmable, cross-ledger value transfer, so that any asset class can move across institutions and jurisdictions under user-controlled rules. Since the infrastructure is neutral and interoperable by design, both new applications and legacy ERPs can integrate by leveraging a common and flexible underlying connector while maintaining their legacy data, UX, and business logic. Together, the infrastructure provides interoperability at scale and verifiable exchanges by default.

Trust in climate data systems depends on clear agency and control. A decentralised approach is therefore essential not only for technical scalability, but for participation and trust. Consent and permissions are embedded into the fabric of data exchange, enabling data to be shared in a purpose-bound, time-bound, and revocable manner. This allows data to remain with the entities that generate it—enterprises, suppliers, utilities, auditors, and public agencies—so that participation in the CSDX network does not require stakeholders to surrender control. This ensures that organisations can participate confidently, knowing that the same data can support multiple legitimate uses without loss of control or unintended exposure. Further, this model lowers barriers for smaller actors, respects regulatory and jurisdictional boundaries, and enables coordination across borders without centralising ownership.

Network facilitators: an alliance for collaborative stewardship

An alliance of core members within this ecosystem will steward the rail, acting as a neutral facilitator. Their role includes co-developing and co-creating the following:

- The core network layers for CSDX to maintain common schemas for ESG, carbon emissions, and climate-risk fields, standard IDs and units, and minimal provenance tags so metrics are comparable and reusable.
- MVP implementations and sandbox testing by bringing together working groups across government, finance, industry, MSMEs, auditors, and technology providers with the goal of iterating on the underlying network standards and driving adoption in an inclusive manner.
- Outlining network policies by publishing rules for onboarding (self-declared vs. verified tiers), verification and assurance levels, confidence scoring, versioning and revocation, and consent.

CSDX functions as a common horizontal rail, while allowing diverse sector-specific ecosystems to flourish on top of it. Industry tools, ESG platforms, carbon accounting systems, and regulatory workflows can innovate independently around the CSDX infrastructure, while relying on its shared definitions and exchange protocols. This ensures a steady state where coordination does not constrain innovation, and innovation does not fragment the ecosystem.

Network participants: building the ecosystem

The following network participants are crucial to building CSDX:

- **Climate Information Producers (CIPs)**: CIPs are the operational actors that generate primary activity data and supply-chain related information (e.g. Scope 3 emissions). This includes MSMEs, suppliers, logistics firms, transporters, warehouses, distributors, real-estate owners, building managers, franchise outlets, retail stores, bank branches, etc. By joining the CSDX network, they only need to publish their underlying data once (e.g. energy and material use, shipment logs, facility attributes, process outputs, and loan/facility details) via accessible and simple connectors. Each record is tagged (what/where/when/how), digitally signed, and ready for external use and transformation.

- **Climate Information Users (CIUs)**: Purchasers, customers, banks, investors, regulators, public agencies and other stakeholders discover, request, and consume the data records to run value-chain assessments, financed-emissions calculations, climate-risk assessments, procurement screens, etc.

- **Assurance providers**: Accredited auditors and validators review records and attach limited or reasonable assurance signatures, increasing trusts in the underlying records.

- **Data and software providers**: ESG software, climate risk engines, analytics vendors and other service providers help firms map internal fields to the CSDX schema, automate ingestion, and deliver insights, without owning the underlying rail or the underlying data.

- **Innovators and market makers**: Other stakeholders build new services on the rail (sustainability-linked finance tooling, CBAM clearance, carbon registries, marketplaces, etc.) by leveraging the data available on the CSDX network.

CSDX tackles the three key barriers—data quality, trust, and access. A shared infrastructure makes information consistent and comparable, built-in verification and assurance create confidence, and low-cost, open connectors bring MSMEs and emerging market participants into the fold alongside large corporations. Each actor (producer, customer, auditor, data provider, innovator, etc.) has a distinct role, and the system works best when they are all connected and operating in unison. When acting together on the CSDX network, the ecosystem has the ability to transform climate data from its current resting place in fragmented reports and siloed databases into a trusted, interoperable asset that underpins markets, regulation, and financial decisions at scale.

9. Sample Use Cases

Comparable Scope 3 metrics across entire value chains

Suppliers of every size publish standardised activity records (energy, materials, transport, process outputs) once, with clear units, timestamps, and proof-of-source. Purchasers use these records to assemble product-level footprints without the need for individual surveys or manual reconciliation. Scope 3 disclosures become an organic by-product of operations, and progress can be tracked at different frequencies.

At a mid-sized auto supplier in Pune, *Ravi* logs his monthly diesel and electricity use into a simple mobile application. Each entry is timestamped, tagged with meter photos, and signed at source. Up the chain, *Anika*, a procurement lead at a global OEM, accesses Ravi's records alongside hundreds of others. Her dashboard assembles product-level emissions footprints, without another round of surveys or reconciliation. At the bank, *Anish* runs the same data through financed-emissions models to evaluate loan terms, while *Sanket*, a regulator, pulls verified aggregates into a national disclosure system. What once took a year and numerous spreadsheets now flows at a monthly frequency via a transparent and trustworthy infrastructure rail.

Climate-aware capital that prices real performance

Borrower records flow, with full provenance, into lenders' loan management engines. Sustainability-linked loans reprice based on verified performance indicators. Project finance facilities draw down as agreed milestones are met, and green and sustainability bonds stream impact data directly to investors. As a result, the cost of capital reflects real, measurable improvements rather than narrative claims.

In Nairobi, *Adanna*, who runs a textile factory, connects her monthly energy and water records to CSDX. Each entry carries source tags—meter IDs, invoices, and timestamps—so they can't be disputed. At *David's* bank, the loan system ingests Adanna's records directly into its loan management system. When her verified energy-efficiency upgrades reduce emissions intensity, the interest rate on her sustainability-linked loan automatically steps down.

Meanwhile, *Elena*, a project finance officer in Madrid, releases the next tranche of funding for a solar park as CSDX confirms milestone delivery. *Jonas*, managing a green bond portfolio in Frankfurt, tracks live impact data streaming from investee firms instead of waiting for reports. The result: capital costs align with actual performance, not promises, rewarding those who decarbonise with speed and credibility.

Export-ready trade and trusted product evidence

Exporters attach standard emissions and ESG evidence to shipments. Customs and counterparties validate records in adherence with regulatory policies and, where present, assurance signatures. Compliance with CBAM-type regimes becomes routine; credible suppliers in the Global South gain access to premium markets.

In Ho Chi Minh City, *Lan* prepares a shipment of garments for a European buyer. Alongside her invoices and shipping documents, she attaches emissions and ESG records generated from CSDX—each tagged with timestamps, sources, and assurance signatures. At the border, *Marco*, a customs officer in Italy, validates the packet instantly against CBAM rules. The buyer's procurement head, *Clara*, sees the same verified data in her system, giving her confidence that Lan's products meet compliance standards. Instead of weeks of back-and-forth paperwork, clearance is routine and trusted. For Lan, this means access to premium markets once closed to smaller suppliers in the Global South—her credibility proven not by narrative claims, but by evidence embedded in every shipment.

A climate-risk utility for underwriting and permitting

Asset records are linked to geolocation and recognised hazard datasets. Banks and insurers price physical climate risk at loan and policy origination; developers and manufacturers choose resilient sites and suppliers; public agencies issue permits with embedded risk guidance and track outcomes over time.

In Manila, *Rogelio*, a developer, submits plans for a new *warehouse*. Through CSDX, the asset's geolocation is linked to flood-risk using unified metrics. At *Farida's* bank in Dhaka, the loan system leverages CSDX to price the physical risk as an input to default risk. *Naledi*, an insurer in Johannesburg, uses the same records to set a fair premium, while *Maria*, a city official in Manila, issues the construction permit with embedded resilience guidance. Years later, the same records track outcomes, showing which facilities held up during extreme weather. What was once fragmented risk analysis now flows seamlessly into finance, insurance, and public oversight—building resilience from the start.

MSME upgrades financed on verified savings

Micro- and small enterprises connect simple meters or upload bills; records are signed and, where needed, sampled by verifiers. Lenders underwrite efficiency upgrades (motors, compressors, boilers, rooftop solar) based on measured baselines and repay-from-savings structures. Capital reaches credible projects that were previously invisible.

A small textile unit in Coimbatore run by *Ramesh* operates aging motors that inflate electricity costs but he lacks the audited data or collateral needed to finance upgrades. Through the network, Ramesh uploads historical power bills and connects a low-cost meter to establish a trusted, signed energy baseline, spot-checked by a verifier where required. A local bank underwrites a high-efficiency motor replacement using a repay-from-savings structure, with repayments aligned to measured reductions in energy use rather than fixed instalments. Ongoing data confirms performance, lowering risk for the lender and upfront burden for Ramesh's business. What is a small, marginal loan in isolation becomes scalable in aggregate: repeated across thousands of similar units on a shared rail, these upgrades form a legible, repeatable asset class that channels capital to efficiency and emissions reduction at scale.

10. Ambitious vision meets calibrated action

The climate crisis will not wait, and neither can our data systems. Today, fragmented, low-quality, and inaccessible sustainability infrastructure slows down every actor in the transition—from producers, customers, and financiers, to policymakers and end-users. CSDX offers a concrete solution: a shared, open, and trusted network that turns isolated metrics and reports into actionable, system-wide intelligence. We urge and invite governments, corporations, financial institutions, auditors, innovators, and civil society to adopt, contribute to, and help govern this new network. Every connection strengthens trust, every standardised record accelerates the climate transition, and every new participant expands climate action.

The opportunity is clear: by coming together to build and scale these common rails, we can ensure that sustainability metrics are truly embedded into the daily workings of the global economy. The time to act is now—our planet, markets, and future generations cannot afford otherwise.

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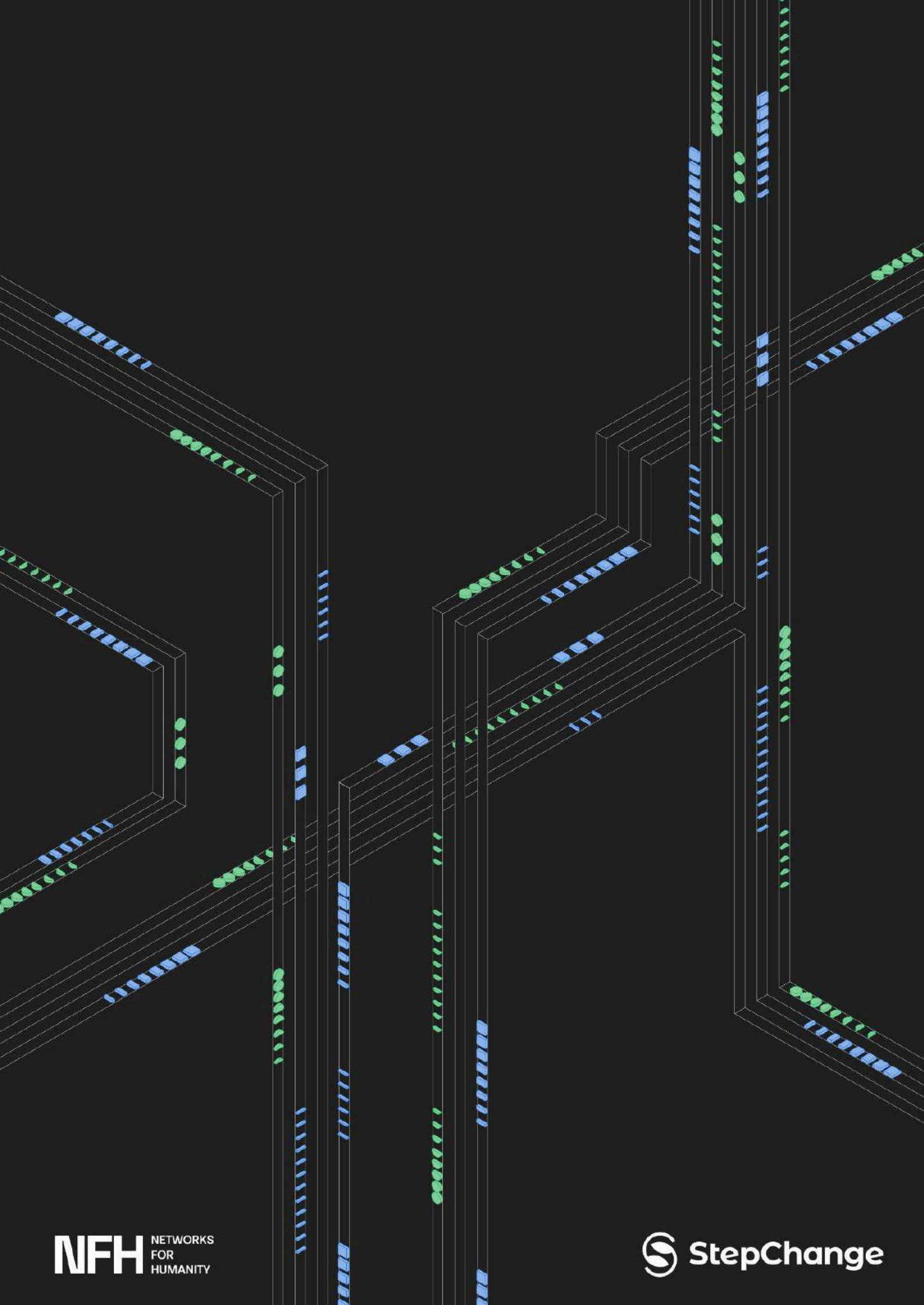
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