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Water Data Exchange

A Strategy for Global Water Security

How do we secure the water future of every individual on the planet through decentralized data-driven intelligence and universal digital infrastructure?

Introduction

Water is civilisation's oldest infrastructure. Cities rose and fell along rivers, empires collapsed in droughts, and migrations across history have been triggered by failing water systems. In the 21st century, securing humanity's water future may determine whether billions thrive, or whether entire societies disintegrate.

Water resources and freshwater ecosystems have an estimated annual economic contribution of $58 trillion, a sum equivalent to 60% of the world's Gross Domestic Product (GDP).[1] Access to clean and safe drinking water is critical for human survival and for reducing the burden of disease. Improving access to water, sanitation, and hygiene (WASH) services has the potential to prevent 1.4 million deaths annually.[2] Action on water is also central to achieving all 17 Sustainable Development Goals (SDGs), particularly SDG 6 which focuses on "ensuring the availability and sustainable management of water and sanitation for all".[3]

However, most countries are putting immense strain on their water resources. Projections indicate a 40% gap between water demand and available supply by 2030 if current practices continue. This growing scarcity, coupled with climate change related unpredictable weather patterns and water-related disasters like floods and droughts, is already a major threat to global prosperity and stability. Nearly 4 billion people, equivalent to half of the global population, experience severe water scarcity for at least one month each year.[4] By 2050, 60% of the global population is estimated to face acute water stress.[5] Agriculture alone accounts for nearly 70% of global water withdrawals. Irrigation for agriculture also relies heavily on groundwater.[6] To feed an estimated 9.6 billion people by 2050, food production needs to increase by 70%, which will lead to an almost 20% rise in agricultural water demand, straining existing water resources.[7]

Let's take India's case. Due to the escalating impacts of climate change, we could have 600 million people (40% of India's population) lacking drinking water access by 2030 and a 30-40% reduction in water availability by mid-century due to rising temperatures and decreased precipitation.[8]

With only 4% of the world's freshwater resources for 18% of the world's population,[9] India faces an escalating water crisis that is characterised by profound challenges in declining availability, variable accessibility, concerning quality, and excessive demand. India is also the world's largest user of groundwater, accounting for around 25% of the global groundwater extractions.[10] Projections indicate that water demand will outstrip available supply twofold by 2030.[11] This is driven by inefficient agricultural practices that consume 2-3 times more water per tonne of produce than many other nations.[12] This challenge is compounded by a projected 67% increase in per capita domestic water use from 2009 to 2050[13] and an estimated 1.7-fold rise in industrial water usage between 2010 and 2050.[14] Furthermore, the quality of water is a significant concern, with 46% of monitored rivers in India reported as polluted, and widespread arsenic and fluoride contamination impacting groundwater.[15] The severe implications extend to public health, with 163 million Indians lacking access to safe drinking water.[16]

In India, the governance of water is further complicated by the fact that multiple authorities at different levels manage the same water resources. Panchayats, municipalities, state departments, and central agencies each hold partial responsibility for water management, yet all draw upon the same interconnected water table. For instance, while a village panchayat may oversee local drinking water supply, a municipal body manages urban pipelines, state irrigation departments regulate canals, and central boards monitor groundwater. This creates a fragmented governance landscape where accountability is diffused: everyone is responsible, and yet no one is fully accountable. The result is overlapping jurisdictions, uncoordinated actions, and gaps that ultimately undermine water security.

The water security challenges India faces are not unique; they reflect a universal problem that demands a global perspective. And this is not just a crisis of scarcity or excess. It is a crisis of **coordination, intelligence, and governance**. Countries across the world are grappling with similar stressors: limited freshwater endowments relative to large, growing populations, contaminated groundwater and unsustainable extraction, inefficient agricultural practices, degraded river systems, and rapid growth in domestic and industrial water use. In regions experiencing similar governance fragmentation observed in India, a deeper systemic issue emerges: water flows across political and administrative boundaries, but its management remains trapped within siloed bureaucratic structures. Unlike electricity or roads, there is no single hierarchy of responsibility for water, making it especially vulnerable to mismanagement. Data governance becomes even more difficult in such a structure, since information is collected and held in silos, rarely harmonised or shared.

We, therefore, stand at an inflection point: **either we allow water to become the trigger of future wars, migrations, and systemic collapse, or we build the world's first planetary intelligence grid for water.**

To address this challenge, water management requires not just decentralised decision making, but networked governance supported by networked digital infrastructure. A Water Data Exchange (WDE) can provide this connective tissue by linking diverse authorities, communities, and institutions on a shared foundation of trusted intelligence, ensuring accountability and collective action.

To make progress towards this efficient management of water resources, several critical aspects must align, as highlighted by the SDG 6 Global Acceleration Framework.[17] This framework emphasises the need for optimised financing, robust data and information, enhanced capacity development, innovative solutions, and strengthened governance. Globally, a diverse array of stakeholders, including governments, corporates, farmers, households, academia, think-tanks, and civil society organisations, are already actively engaged in addressing these complex water challenges. However, their ability to deliver scalable, impactful solutions is significantly hindered by several critical coordination gaps across the five accelerators mentioned above. These gaps reveal immense opportunities, with one of the most compelling being "harnessing data as a foundation for action".[18]

Data and intelligence is a critical lever for global systemic change for water security. However, the water data ecosystem is fragmented, hindering overall resilience.

Robust water data is crucial for governments to manage water sustainably, estimate externalities, implement early warning systems, and stabilise the hydrological cycle. For citizens, access to water data empowers informed decision making and fosters locally relevant solutions. Private entities need this data to mitigate risks and guide sustainable investments.

The current state of water data is characterised by high fragmentation and significant gaps, making comprehensive analysis and effective management challenging. These impediments include:

- **Granularity:** Data is often not aggregated at the hydrological unit level (within which water flow actually happens), and is limited at administrative levels. This restricts effective local action that hinges on accurate water data. India's current official monitoring systems primarily focus on shallow wells, completely overlooking the deeper borewells that farmers are now increasingly relying on for their livelihoods.
- **Availability:** Crucial water data like water demand and consumption data are limited. As a result of these missing pieces, a full picture of water flows cannot be estimated. In India, corporations are investing over USD 30.2 million annually, into water conservation, according to a recent study by the Sattva Knowledge Institute. However, there's a significant problem: more than half of these funds are being spent on one-off studies that often end up hidden behind paywalls.
- **Uniformity:** Water data is collected and stored by various government and non-government stakeholders which suffers from a lack of standardisation in data collection and reporting, and limits access for end-users.

- **Usability:** Water data is fragmented, often in non-digital and disaggregated formats, rendering it difficult to leverage for actionable insights. Additionally, a dependable sense-making of emerging data through effective intelligence, to translate it to real-world insights, is a missing step.

Traditional data consolidation models are inherently challenged by the wide range of data types, reluctance of sources to share data openly, varied data refresh frequencies, cumbersome contribution protocols, limited incentives for sharing, and difficulties in enforcing access privileges and traceability. This results in a non-standard data architecture, with centralised consolidation efforts, redundant data stores, and a restrictive "one-view" approach that fails to provide tailored insights. As a result, the utility of such data consolidation systems often dwindles with time.

Currently, we see a powerful shift in how we approach water management, with a strong drive towards decentralised, data-driven decision making.

This is amplified by emerging technologies, such as satellite imaging, which is making high-quality, granular water data more ubiquitous, accessible, and affordable to generate. Sensors are emerging for ground up data collection, and artificial intelligence/machine learning (AI/ML) is making sense-making possible. There is a heightened willingness among farmers, officials, and organisations to use this data for planning and action, fostering a collaborative environment where a wide range of stakeholders are actively engaging in data-driven decision making.

In India, we are also seeing several water-focused or water-adjacent policies and schemes that employ data-driven decision making (like Atal Bhujal Yojana for participatory groundwater management) and comprehensive data monitoring through robust management information systems (like Pradhan Mantri Krishi Sinchayee Yojana - Watershed Development Component, Mahatma Gandhi Rural Employment Guarantee Scheme).

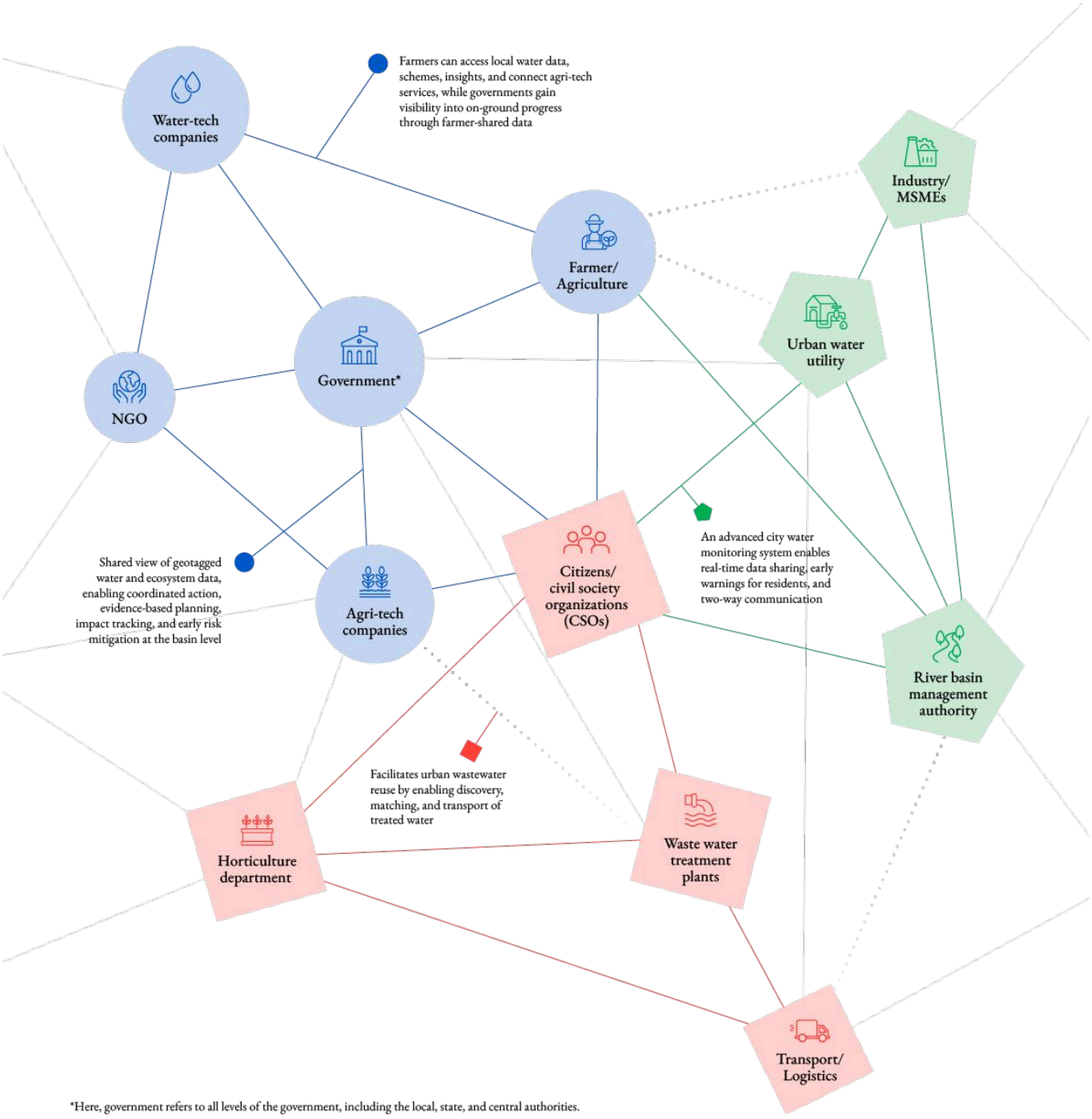
Imagine: what if we make such water intelligence accessible and actionable for the people who need it most with safe water access and availability?

The Water Data Exchange (WDE) proposes a paradigm shift from traditional consolidation to a decentralised universal digital infrastructure (UDI). Its core objective is to democratise access to high quality water data at scale and secure the water future of every individual on the planet.

WDE is not just another platform; it is envisioned as an AI-first **planetary scale infrastructure for water and associated data that secures the future of every individual, every household, every farm, every industry, and every city on Earth.**

This mission seeks to establish the foundational elements for a water-secure world through data-enabled action and accountability, ultimately driving equitable water access for all. The 5-year ambition for WDE is to empower 20 million households with credible, accessible, and actionable water data through 10 critical use cases across a minimum of 5 states in India.

The WDE can enable diverse use cases across multiple stakeholders.



Universal Digital Infrastructure for Water Resilience

WDE's strategic approach involves developing an open and interoperable digital infrastructure that leverages the principles of infrastructure thinking for the water ecosystem. This model is designed to be:

- **Open for access:** Enabling all stakeholders to access diverse water and water-allied data.
- **Open for collaboration:** Fostering cooperation among stakeholders through shared data.
- **Open for contribution:** Allowing stakeholders to contribute credible top-down or bottom-up data.
- **Open for innovation:** Supporting the development of custom solutions and models built on top of the WDE infrastructure.

This flexible and resilient architecture addresses previous limitations by supporting tailored views, and referencing data (rather than storing copies) for clear traceability.

The WDE's core design comprises four critical components:

1. **Registry of data sources:** A comprehensive index of all water and allied data sources, enriched with metadata on scope, frequency, source, accuracy, and type.
2. **Set of data collection standards:** Recommended standards to ensure comparability and analytical consistency across diverse data sources.
3. **Unified data framework:** A common taxonomy of water and allied terms to ensure consistency across different data sources.
4. **Discovery and fulfilment protocol:** A common industry standard protocol, specifically the **beckn protocol**, to facilitate seamless data discovery, order and fulfilment. Beckn offers a credible digital infrastructure partnership, with over 6+ domains identified and 8 live networks.

This architecture will support diverse data types (hydro-geological, meteorological, ecological, socio-cultural, economic, administrative) from various sources (government, satellite imagery, meteorological data, citizen/business-generated data, analysed insights from academia) and deliver them to data consumers through various data applications like dashboards and advisory solutions. The WDE will operate with principles ensuring data credibility, access contracts, traceability, easy discovery, and open innovation, supporting universal, conditional, and commercial data sharing models.

Beckn forms the digital backbone of the WDE, creating a UDI where diverse participants can seamlessly discover, access, and exchange water and water-allied data. Much like its successful implementations in commerce and mobility, beckn provides a decentralised, interoperable layer that allows data to remain at source, whether in government servers, private startups, or citizen-led initiatives, while still being discoverable and usable by others in a safe and consent based manner. This avoids the pitfalls of centralised consolidation and encourages participation by addressing concerns of data ownership, access control, and traceability. Standardised interfaces for data providers (Beckn Provider Platforms or BPPs) and consumers (Beckn Application Platforms or BAPs) ensure that data from varied sources, such as local panchayats or agri-tech sensors, can be discovered and transacted using a common vocabulary. This reduces the cost of coordination and improves efficiency.

Via open-source toolkits, onboarding guides, and reference implementations, beckn solves for the technical burden on participants. These resources allow stakeholders, including startups and district-level institutions, to integrate into the network without overhauling existing systems. Together, these elements ensure that participation in the WDE is not constrained by scale or technical capacity, but is made accessible to all, thus enabling data-led climate and livelihood resilience.

WDE and AI: A Symbiotic Relationship for Co-intelligence Flows

AI is a critical enabler for the WDE, unlocking actionable co-intelligence from highly diverse, unstructured, and distributed datasets. From parsing government reports with Natural Language Processing (NLP), to synthesising satellite, business-generated, and citizen-generated data, AI can transform raw inputs into context-rich insights for real-time decision-making. Predictive models powered by ML can forecast water stress, simulate policy impacts, and offer hyperlocal advisories, enabling WDE to serve a wide spectrum of users, from individual farmers to national policymakers. AI could thus become the intelligence engine that powers WDE's vision of universal, equitable water security.

Conversely, WDE can advance water-focused AI innovation. By making previously inaccessible or siloed datasets

discoverable and interoperable, WDE offers a rich training ground for AI models across domains like hydrology, agriculture, ecology, and public health. The diversity and granularity of data available through WDE can power next-generation AI solutions that are locally grounded and globally scalable. In doing so, WDE does not just consume AI, rather it actively accelerates the development of context-aware, responsible, and socially beneficial AI systems for water security and livelihood resilience.

The WDE will integrate an AI stack using four layers - data, context, intelligence and delivery.

Delivery layer

AI Application
AI-based whatsapp bots for gathering queries, AI-based translation services

Function
APIs, dashboards, bots as applications to serve insights at the right time, in a user friendly format, and to the appropriate user level, translation into local languages

Intelligence layer

AI Application
Hyperlocal personalization for farmers, AI-based risk scores for industry/ government decision-makers

Function
AI to generate forecasts, simulate scenarios, detect anomalies, and offer recommendations, ML based predictions learned from observed data rather than entirely physics-based models

Context layer

AI Application
Forecasting (rainfall, runoff), anomaly alerts, recharge mapping, irrigation suggestions, localised context

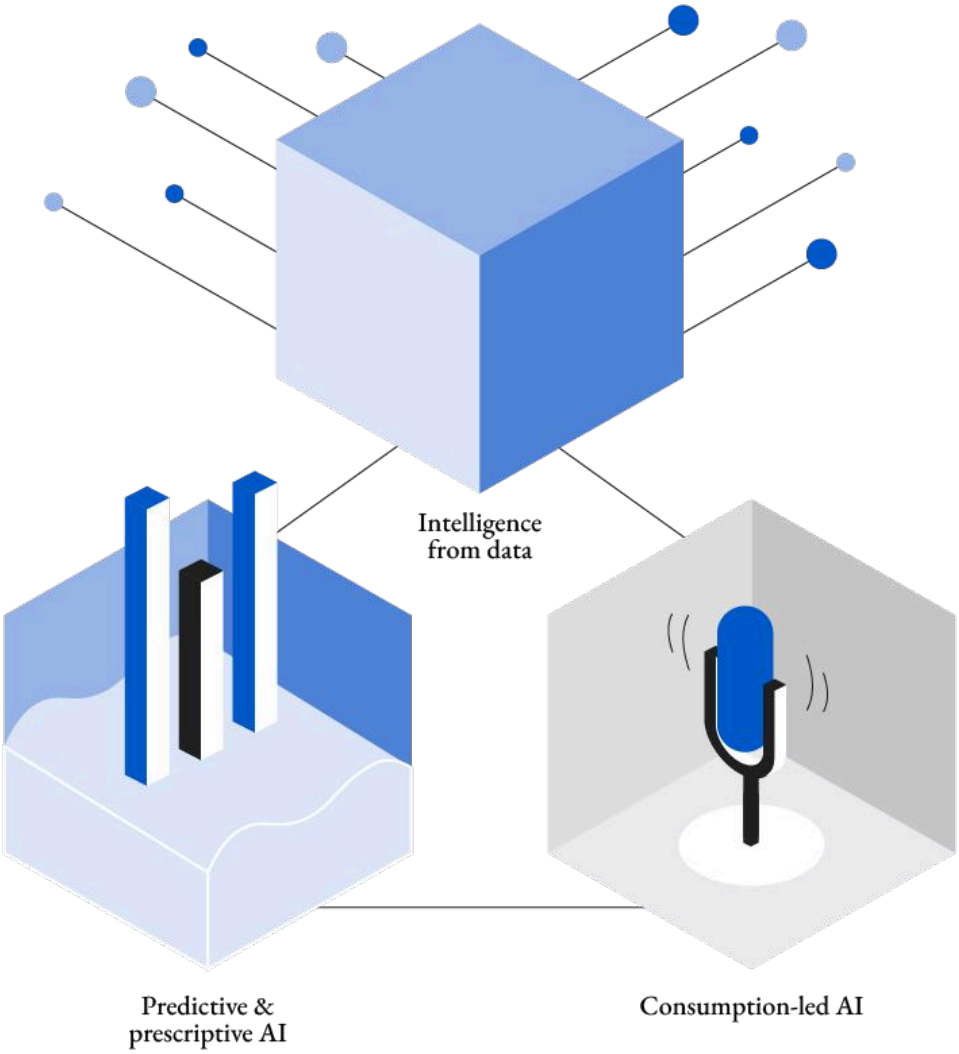
Function
Adds meaning using taxonomies, metadata, standards & local context

Data layer

AI Application
Intelligent ingestion, auto-tagging, Natural Language Processing (NLP) on PDFs, image/ audio processing, sensor harmonization

Function
Aggregates data (govt, satellite, sensor, business-generated, citizen science)

WDE's AI-first infrastructure can be summarised as consisting of the following three elements.



Intelligence from data

- Crop yield modeling, recharge planning, water stress forecasting
- Simulation engines to model the impact of different interventions, and for adaptive policy and resource planning

Predictive & prescriptive AI

- AI for unstructured and structured data parsing (e.g., NLP, computer vision)
- Enables cross-layer synthesis and pattern recognition

Consumption-led AI

- Interfaces like bots, voice commands, translation, vernacular access
- Democratizes access to intelligence for low-literate and rural users

Strategic Initial Use Cases

The WDE is designed to deliver tangible value across a broad spectrum of stakeholders, from smallholder farmers in remote Indian villages to rapidly scaling agri-tech enterprises. The following illustrative use cases demonstrate how this value is realized in practice:

Use case 1: Enabling farmer water numeracy for data-driven action

Imagine a small farmer in Sehore, Madhya Pradesh. She's planning her next sowing cycle and wants to know:

"Is it the right time to plant soybeans? Do I have enough groundwater? Will it rain soon?"

Instead of guessing or relying only on the local extension worker, she opens a mobile app WaterFirst (hypothetical name) or sends a message to a WhatsApp bot. This simple interface connects her to the WDE, which pulls together data from across the ecosystem:

- The IMD gives a 3-day rainfall forecast, and monsoon onset date estimations.
- The local borewell depth data accurate to her farm's conditions (data collected by the WDE's data collection team or citizen scientists).
- Soil health maps from national databases flag her plot's drainage capacity and slope.
- Crop prices hint at which crops might get her the best return.

Within seconds, she gets a clear recommendation:

> *"Monsoon rain is likely in 3 days. This year's monsoon is on-time and normal. Your borewell is at 30 ft. Conditions are good for soybeans. Start sowing now. Consider a contour trench to improve water recharge."*

This kind of advice helps her make smarter decisions, leading to better yields, smarter water use, and ultimately, higher income. It's not just precision agriculture—it is confidence in every decision.

Use case 2: Enabling agritech startups to support farmers through extensive water data

Consider an agritech startup, which installs on-farm sensors and provides irrigation alerts to farmers. Today, they operate in silos, using only the data they collect themselves. **But with WDE, they can both consume and contribute data.**

On one hand, the startup can plug into the WDE and layer in new data, like regional water stress levels, water quality alerts, or historical rainfall patterns, to improve the accuracy of their advisories.

On the other hand, the startup becomes a valuable data provider. Their real-time soil moisture readings, irrigation schedules, and crop-specific insights can be shared back into the network, helping other players like governments, researchers, and even insurance providers make better decisions.

Crucially, data providers can define how their data is accessed—free, licensed, or subscription-based and create a revenue stream in the process. It's a win-win: farmers get better advisories, the ecosystem gets richer data, and companies like the startup find new business models through fair data exchange.

Tangible Benefits for Key Stakeholders

The WDE is designed to deliver significant, quantifiable benefits across various stakeholder groups:

- **Small farmers:** By providing access to granular water data, WDE will enable farmers to adopt precision practices to improve yields, track usage, identify leaks, and plan initiatives. This translates into timely and efficient irrigation, informed crop planning, and enhanced risk management, ultimately increasing crop yields and farm incomes while sustaining soil and water health.
- **Agritech startups:** As an open network, WDE will foster innovation by supporting the development of custom solutions and models built on top of its water data infrastructure. This environment will encourage partners to create a wide range of tailored applications, providing significant opportunities for agritech startups to develop specialised dashboards, advisory solutions, and data portals that leverage the exchange's rich datasets.

- **Water data producers (e.g., Government, Academia, Corporations):** WDE will actively engage orgnanisations with credible water data through a **"Water Data Champion Program,"** offering recognition and showcasing their contributions to ecosystem-wide action. The WDE supports various data sharing models—universal, conditional, and commercial—allowing producers to define appropriate access contracts and even monetise data. This ensures fair value exchange, incentivises data sharing, and significantly enhances the overall data ecosystem.

A fair value exchange is envisioned to be set up for water through four main models: data as a public good, data at a price, mutual data sharing, and data for service.

1. **Data as a public good:** This will include data that is exchanged free of charge to users.

Example: Central Ground Water Board's data on groundwater depth and quality; data which is already available in the public domain free of charge.

2. **Data at a price:** Depending on the interest and need of the data supplier, some proprietary datasets may be hosted in the WDE which can be exchanged at a cost. This cost may also include the cost of collecting and collating the data.

Example: Data collected by a private company on water quality, groundwater depth etc for their operations. Data collected by citizen scientists on hyperlocal environmental indicators.

3. **Mutual data sharing:** Data users will be able to access data as long as they also contribute to the data in the WDE.

Example: An industry in a particular industrial zone shares data on various water parameters and consequently is able to access more data from other industries in the same location.

3. **Data for service:** Economic transactions for services can also be explored where consumers are connected to service providers.

Example: A farmer requiring an IoT solution for soil moisture monitoring can be connected to a service provider that suits their requirement based on their proximity and budget.

A governance mechanism for verifying data classification requests, licensing and usage conditions, data quality and standardisation, and grievance redressal will be established. A reputation system or credit mechanism (e.g., share more to earn more access) to align contributions with benefits may be instituted as well.

The vision is to secure the water future of every individual in the world. Given the diversity of data and the urgency of water scarcity in the region, India offers an opportune impact aperture for a first phase calibrated liftoff.

Call to Action

The WDE is not just infrastructure, it is a **civilizational safeguard**. If we fail to act, billions will be displaced by droughts, food systems will collapse, and water wars may define the century. If we succeed, WDE could become the **most important digital public infrastructure of the 21st century, alongside the internet and energy grids.**

We extend an invitation to all stakeholders, including governments, corporations, civil society organizations, academic institutions, technology builders, and data contributors, to join us in this transformative initiative. Your strategic participation is instrumental in co-creating the Water Data Exchange by contributing valuable data, developing innovative market models, synthesising solutions, and collectively securing a water-sustainable future for all.

Let us collaborate to leverage the power of data and intelligence for widespread impact and build a water-secure world!

References

1 World Wildlife Fund 2023
2 World Health Organisation 2023
3 Stockholm International Water Institute 2025
4United Nations Children's Fund
5World Resources Institute, Aqueduct 2023
6 The World Bank 2025
7 International Water Management Institute 2025
8 NITI Aayog, Composite Water Management Index (CWMI) Report 2018
9 World Bank 2023
10 International Water Management Institute 2024
11 NITI Aayog, Composite Water Management Index (CWMI) Report 2018
12 The Economic Times 2024
13 The Asian Development Research Institute 2017
14 The Energy And Resources Institute 2024
15 Press Information Bureau 2023
16 Matto & Singhal 2020
17 United Nations-Water
18 Global Commission on the Economics of Water 2024

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