Climate Warehouse

Infrastructure for Connecting Climate Market Systems

Informal Forum on Implementation of Article 6of the Paris Agreement under the UNFCCC process,
ERCST, Madrid, November 30, 2019

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Technology & Innovation Lab

Climate Markets and Infrastructure for Decentralized Systems

> Paris Agreement allows for the creation of climate markets with differences in governance rules, and operate under different technological systems.

> Several countries are developing databases and country-level or national registries for participation in climate markets under Article 6; the sophistication of systems ranges from spreadsheets to full-fledged registry systems.

> Other countries are likely to collaborate through regional or centralized registries that currently exist under the UNFCCC's Clean Development Mechanism and voluntary standards (e.g., Gold Standard, Verra).

> Differences in systems can constrain market integration and scalability and add to the complexity of conducting transactions.

> There is a need to explore new architecture for transfer of climate assets across systems while ensuring integrity of trades and avoiding double counting.
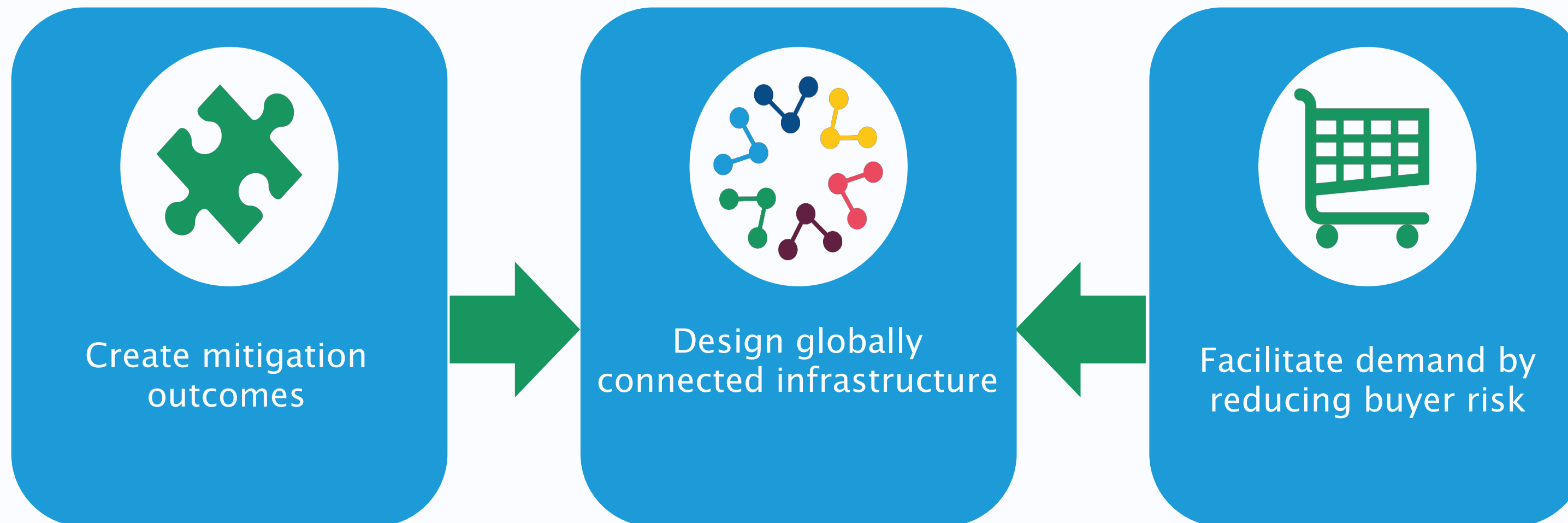
The World Bank's Role

The World Bank's climate change activities are focusing on:

❯ Piloting options to contribute to Paris Agreement Rulebook discussions and demonstrate opportunities and challenges.

❯ Building client capacities, including on emerging technologies.

❯ Supporting alignment of investments with Paris Agreement goals

❯ Enhancing international cooperation and collaboration.

❯ Consistent with the World Bank's role in piloting and testing development solutions and the bottom-up ethos of the Paris Agreement, there is value in demonstrating a decentralized information technology approach to connect climate markets systems. This is being done through the **Climate Warehouse** program.

The Climate Warehouse program

Create **enabling environment**, inform development of **regulatory framework**, and develop common and efficient **market infrastructure** and associated **governance arrangements**

Create mitigation outcomes

Design globally connected infrastructure

Facilitate demand by reducing buyer risk

Assist client countries to develop strategies, policies and institutional arrangement for using markets to increase investments and private sector contribution to the implementation and ambition of NDCs

See Climate Warehouse video at:
https://vimeo.com/376617339

Objectives of the Climate Warehouse infrastructure development

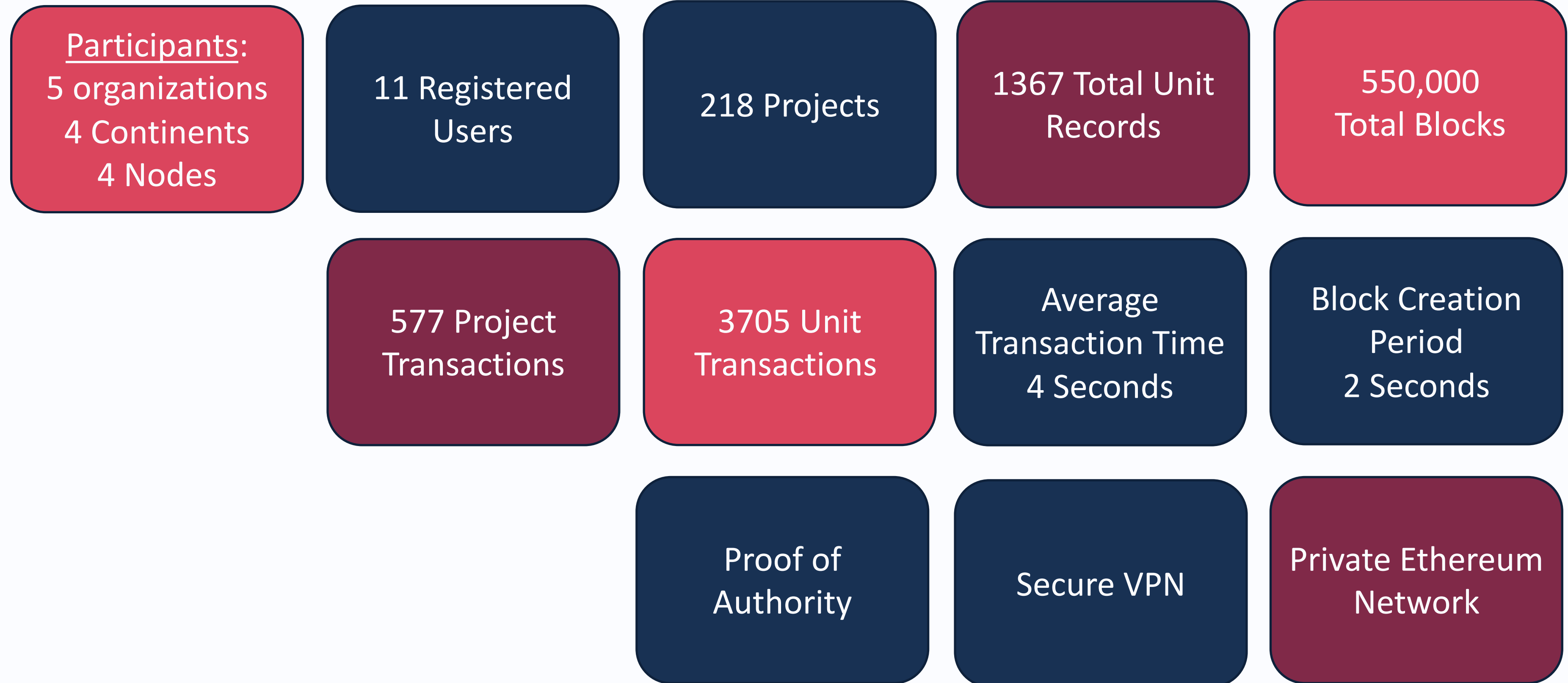| Goals	Co-Innovating	Co-Learning
• Explore how the Climate Warehouse meta-registry concept can track Mitigation Outcomes and avoid double counting • Through learning-by-doing, test the utility of blockchain as the underpinning technology for the Climate Warehouse meta-registry	• Utilizing the simulation as a backdrop, identify potential prerequisites and requirements for designing future climate market integrations to support the implementation of Paris Agreement Article 6.2 objectives • Jointly explore the modalities for connecting heterogeneous registry and database systems from different countries and institutions	• Identify options to prepare in-country/national/institutional climate markets infrastructure to deliver on the commitments under the Paris Agreement • Identify options for connecting systems and surfacing public information on Mitigation Outcomes • Share knowledge and insights to better understand the potential of blockchain

Statistics and Facts of the Climate Warehouse simulation

Participants: 5 organizations 4 Continents 4 Nodes	11 Registered Users	218 Projects	1367 Total Unit Records	550,000 Total Blocks
	577 Project Transactions	3705 Unit Transactions	Average Transaction Time 4 Seconds	Block Creation Period 2 Seconds
		Proof of Authority	Secure VPN	Private Ethereum Network

Note: Transaction here does not refer to carbon market transactions, but blockchain transactions. Each transaction refers to data additions on the blockchain.

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Simulation Results and Lessons Learned

> The decentralized blockchain meta-registry system can provide an inclusive platform to connect different country and institutional registry systems and can enhance transparency

> Joint learning between the World Bank and partners was a valuable experience and enhanced understanding of the requirements for an operational Climate Warehouse meta-registry.

> Sufficient time needs to be given to onboard partners. This includes putting legal agreements in place and for partners to coordinate internal resources, such as information technology staff or consultants needed to integrate systems and test functionalities.

> The system should support data analysis and different ways of using data, and user experience and data visualization will be important.

> All partners indicated interest in participating in possible further development phases, including potentially hosting a node to connect with the Climate Warehouse in the future, given adequate time and resources.

Next Steps

> The World Bank plans to expand testing to additional partners to gain further experience and learning.

> Moving forward, the World Bank hopes to continue to facilitate regular exchange with Governments, the private sector and other expert groups to explore opportunities to leverage emerging technologies for post-2020 climate markets.

Additional slides

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Simulation of Blockchain Meta-Registry

Meta-Registry: Opportunities for Blockchain Technology

> In 2018, the World Bank published "Blockchain and emerging digital technologies for enhancing post-2020 climate markets."

> World Bank's Technology & Innovation Lab also prototyped a meta-registry using blockchain technology to connect heterogeneous systems.

> The prototype and viability report indicate a promising application of this emerging technology to address key concerns in decentralized climate markets. The advantages of blockchain over other options are as follows:

- Blockchain provides capabilities to increase transparency and trustworthiness of data recording, reducing the risk of double counting.

- The decentralized and immutable nature of a blockchain-based system provides redundancy and resilience against attacks. Its architecture ensures confidence that information contained in the system can't be tampered with.

- Blockchain ensures that assets can be traceable from their origin through to their eventual retirement.

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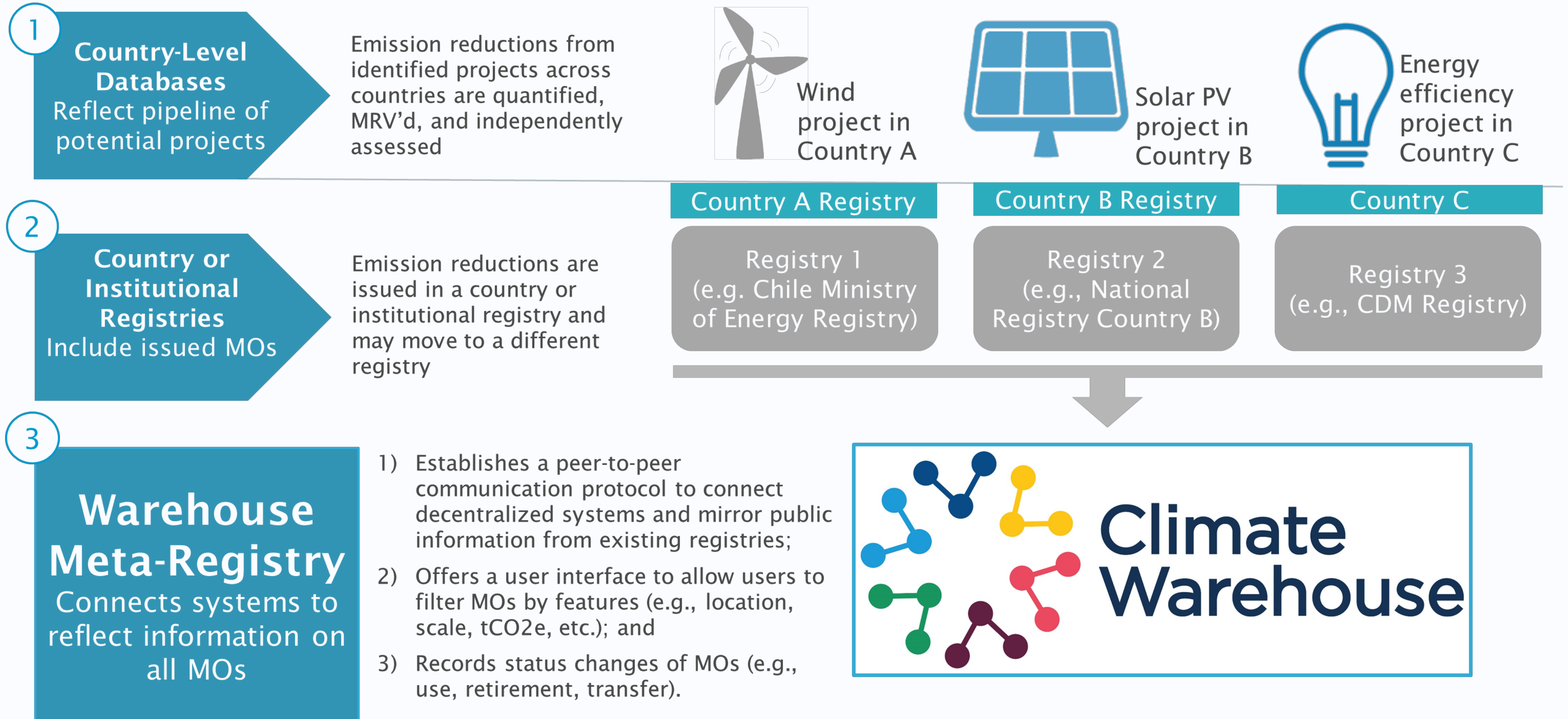
World Bank's Experience with Blockchain Technology

> The Technology & Innovation Lab is at the forefront of testing blockchain technology on a wide range of use cases, including climate markets.

> Established in June 2017, the Lab has explored blockchain's application to health and agriculture supply chains, payments and financial inclusion, education, and carbon markets applications including MRV and trading.

> The Lab's team includes IT specialists who can prototype and test blockchain-based systems to foster learning and knowledge sharing in a safe, lab environment.
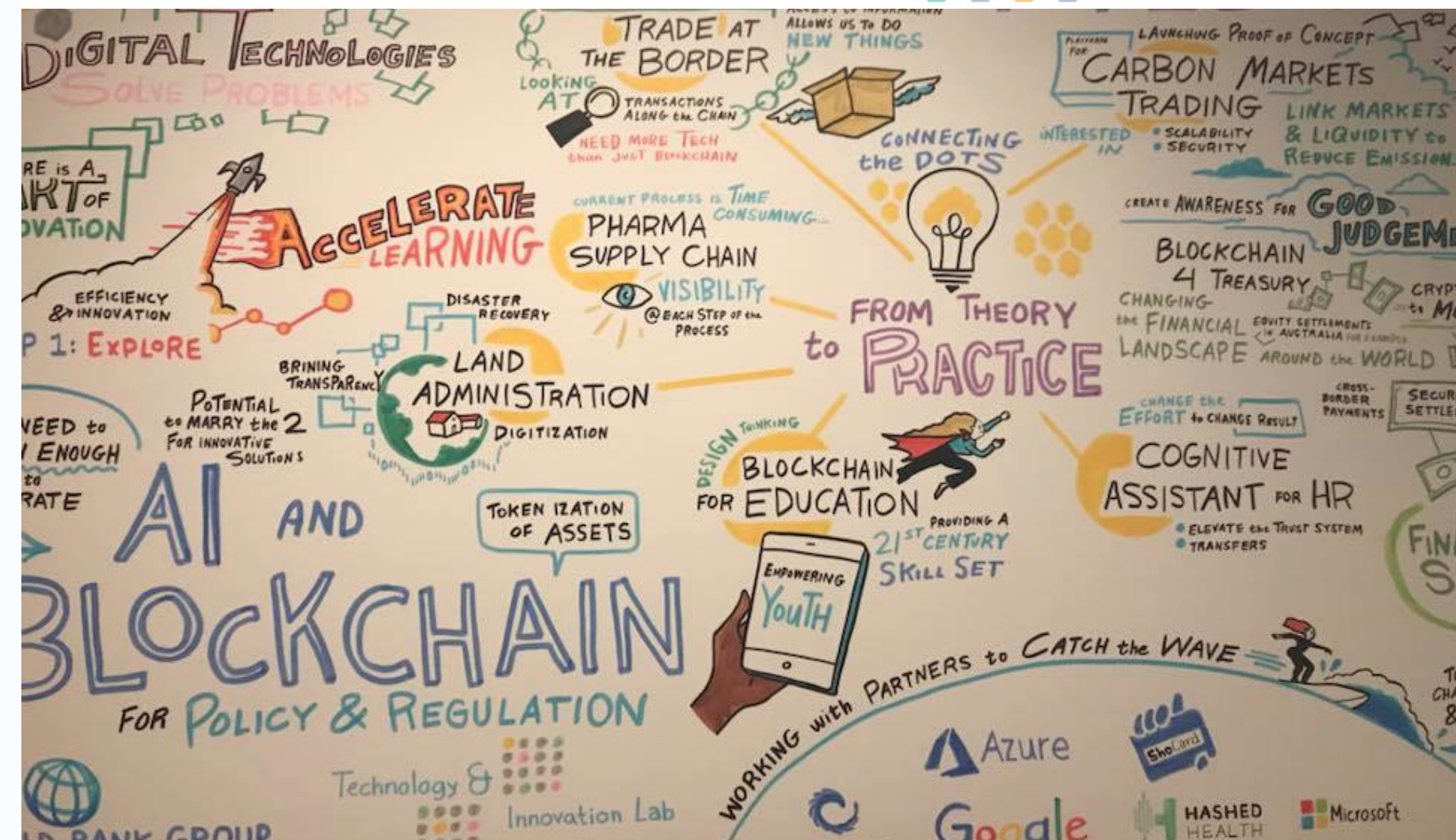
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Climate Warehouse Ecosystem

1

Country-Level Databases
Reflect pipeline of potential projects

Emission reductions from identified projects across countries are quantified, MRV'd, and independently assessed

Wind project in Country A

Solar PV project in Country B

Energy efficiency project in Country C

2

Country or Institutional Registries
Include issued MOs

Emission reductions are issued in a country or institutional registry and may move to a different registry

Country A Registry	Country B Registry	Country C
Registry 1 (e.g. Chile Ministry of Energy Registry)	Registry 2 (e.g., National Registry Country B)	Registry 3 (e.g., CDM Registry)

3

Warehouse Meta-Registry
Connects systems to reflect information on all MOs

1) Establishes a peer-to-peer communication protocol to connect decentralized systems and mirror public information from existing registries;

2) Offers a user interface to allow users to filter MOs by features (e.g., location, scale, tCO2e, etc.); and

3) Records status changes of MOs (e.g., use, retirement, transfer).

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User Interface

Simulation Limitations

> The entire simulation, including the drafting and signing of collaboration agreements was limited to a 12 week time period. This left two weeks for the actual simulation with partners.

> Three out of four of participants opted to use the Excel integration option. One participant used the node integration approach.

> Information uploaded into the Climate Warehouse was a combination of active and historical records.

> Integration with partners during the simulation was only to surface data into the Climate Warehouse. Partners did not build integrations to sync record changes into their own systems.

> The simulation did not address the suitability of potentially complementary technologies, such as artificial intelligence and machine learning (e.g., to identify potential duplicate data or other errors).