November 2022

Climate Warehouse

End-to-End Digital Ecosystem for Carbon Markets

Climate Warehouse Program: Building an End-to-End Digital Ecosystem for Carbon Markets

Climate Warehouse
End-to-End Digital Infrastructure for Carbon Markets

Digital Methodology

Digital MRV
(UNFCCC, ISO or Independent Standard)

Program Level MRV
- Equipment
- Sensors
- Meters
- Satellite

Facility Level MRV

Centralized Database/ optionally to **National MRV System**

Digital Carbon Assets (Tokenization Engine)

Registries
(Independent Standards, Sovereign Registries, UNFCCC Registries)
+
WB registries

Exchange A

Exchange X

Climate Action Data Trust
Climate Warehouse Digital Ecosystem

Metadata Layer

Services Layer
- Compliance reporting
- Benchmarking
- Due diligence checks
- Certifications
- Conflict resolution
- Ratings
- Forecasting

verification of units

Reporting for markets, UNFCCC

Digital work-flow
project preparation from document development, approval, validation to registration in applicable standards

Climate Action Data Trust

Climate Warehouse
Digital Ecosystem

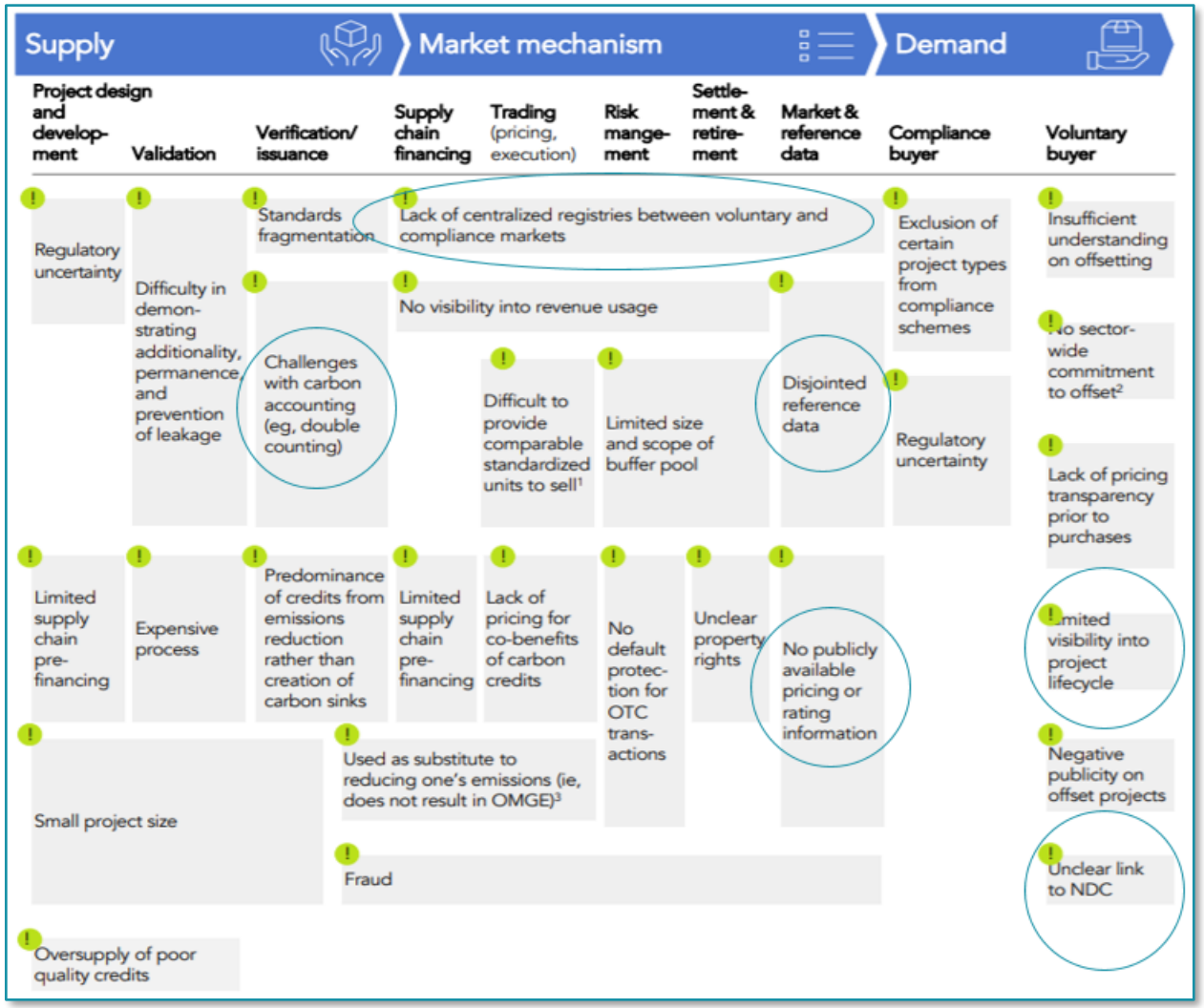
A global public metadata layer to foster greater transparency, integrity and security in the carbon markets

CLIMATE ACTION DATA (CAD) TRUST: Overview

Post-2020 markets under the Paris Agreement

- **Individual commitments through nationally determined contributions (NDCs).** The Paris Agreement introduced a bottom-up approach for addressing climate change.
- **Decentralized cooperative approaches to achieve their NDCs.** This is expected to lead to heterogeneous climate markets, which may have differences in governance rules and operate under different technological systems.
- **Climate Action Data Trust:** a decentralized information technology approach to connect climate markets systems.

Report by Taskforce on Scaling Voluntary Carbon Markets (TSVCM)



Source: *Adams, Tim. Winters, Bill. Nazareth, Annette and Mark Carney Taskforce on Scaling Voluntary Carbon Markets Phase 1 Final Report: January 2021, TSVCM, pg. 45*

Climate Action Data Trust – Value Proposition

Climate Action Data Trust

Climate Warehouse
Digital Ecosystem

An open-shared infrastructure

Global public good that aims to empower a new global carbon market infrastructure.
Metadata platform that aims to link, aggregate and harmonize underlying registry data to enable transparent accounting as per Article 6.

Designed as an open shared infrastructure with a common taxonomy of data that facilitates connection and communication between entities enabled by blockchain technology.

Registry service providers and **countries** share data to the platform and **public and private sector market players** can host a node and build out the service layer.

Provide visibility into corresponding adjustment procedures and the lifecycle of carbon offsets from issuances to retirement, which will safeguard against double counting and ease reporting requirements.

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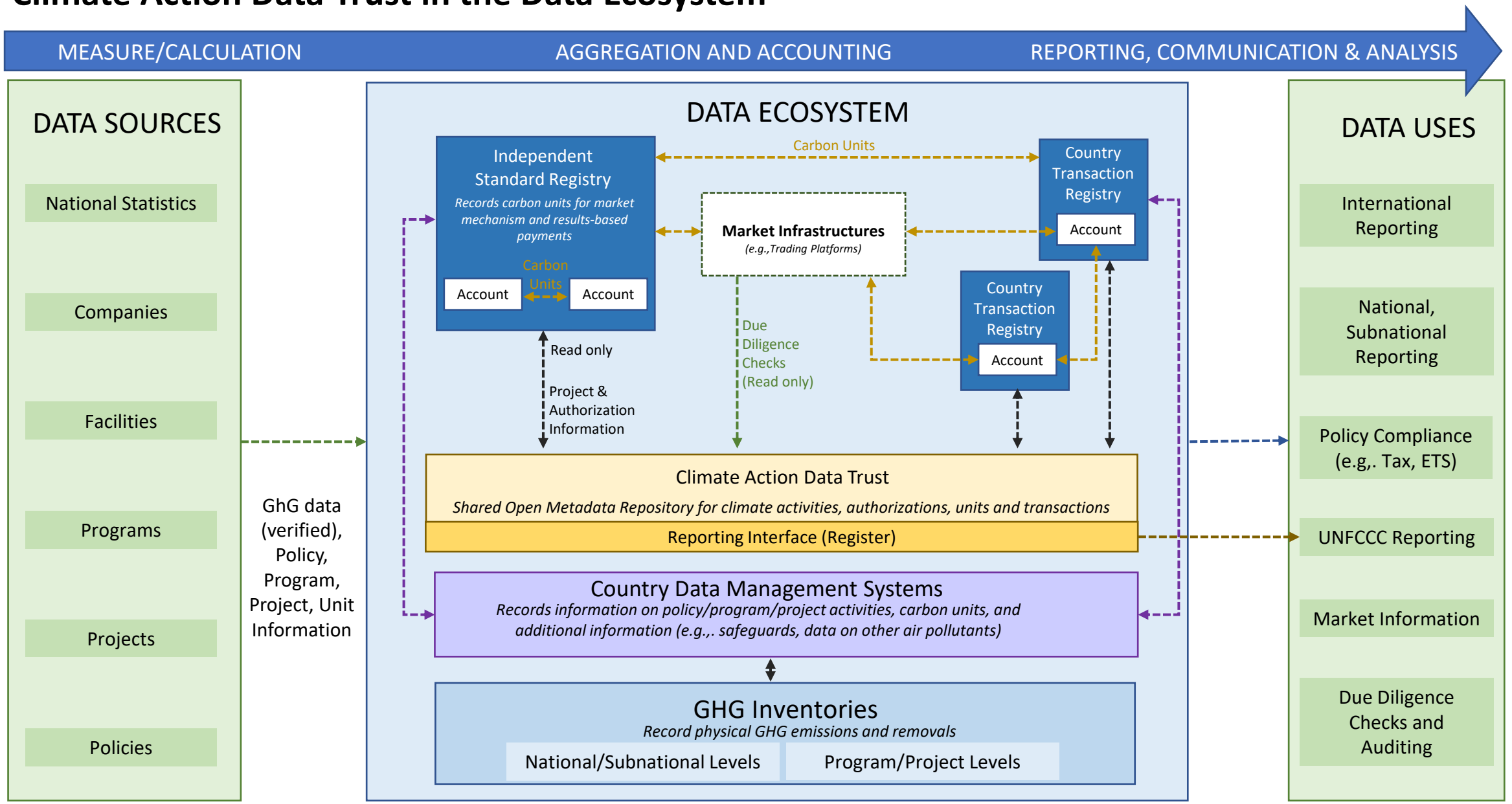
Value Proposition for carbon market stakeholders

Stakeholder type		Benefits
	**Governments**	• Increases visibility and credibility of a country's climate activities • View MOs to potentially purchase • Promotes new project activity • Can increase market participation of private sector • Can provide an aggregate view of projects within their jurisdiction, ability to identify duplicative projects • Increases accountability
	**Independent Standards**	• Reduces burden on monitoring external systems for due diligence processes because of the ease of aggregating information together • Facilitates trust and transparency between systems
	**UNFCCC**	• Aggregate reporting
	**Exchanges**	• Decreases market fragmentation and eases integration • Promotes standardization and asset integrity • Adds information security to the data needed from registries for transactions • Increases volume of standard asset types
	**Project Developers**	• Building trust in the accounting of MOs will enable transparency and trade, benefiting project developers
	**Verification Bodies**	• Access to aggregated information, ability to audit transactions and changes to data
	**Buyers and Traders**	• Aggregated trustworthy data to search through. Easier access to project developer information

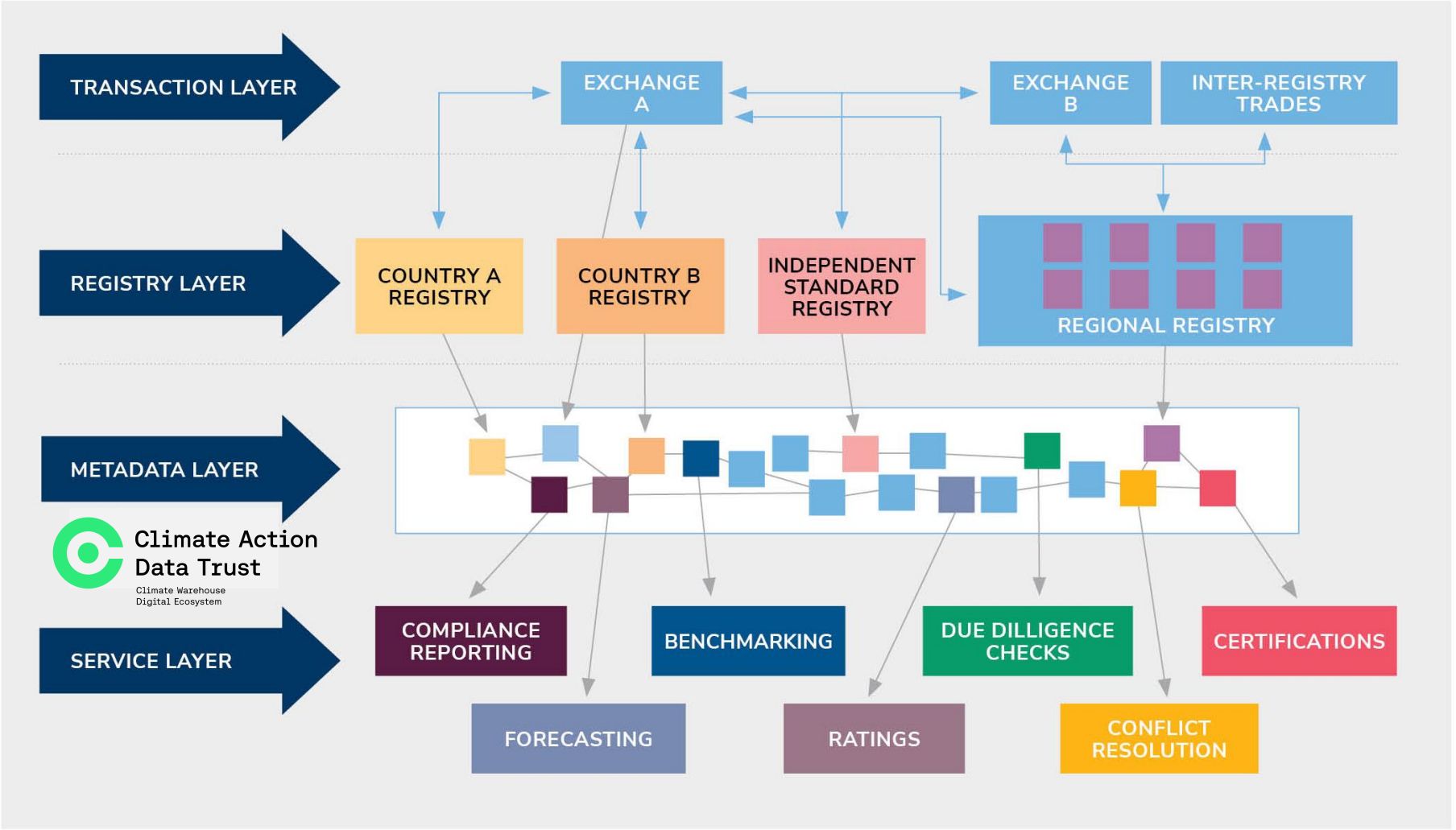
CLIMATE ACTION DATA (CAD) TRUST: Data Ecosystem

Climate Action Data Trust in the Data Ecosystem



Building a public good data layer

- Designed as an open shared infrastructure layer
- Common taxonomy of data facilitates communication between entities
- Registry service providers and countries share data to the Climate Action Data Trust (CADT)
- Public and private sector market players can host a node and build out the service layer



CLIMATE ACTION DATA (CAD) TRUST: Overview of Testing and Simulation Activities

Timeline of WB Testing Activities

Product development, Stakeholder participation and Governance model

Phased Approach Participation in Simulation III

Phase I

Phase II

Phase III

Phase IV

Group 1 (Internal testing)

- World Bank Carbon Assets Tracking System
- World Bank Carbon Markets and Innovation Unit

Observers:
- International Emissions Trading Association
- Open Earth Foundation

March – April 2022

Group 2

- Chile
- Japan
- Singapore
- Sweden
- Switzerland
- IHS Markit
- Verra
- Climate Action Reserve
- American Carbon Registry
- Gold Standard
- Global Carbon Council

Observers:
- Spain
- UNFCCC
- EBRD
- UNDP

April – May 2022

Group 3

- Rwanda
- Senegal
- Peru
- Uganda
- United Kingdom
- EcoRegistry Colombia
- GenZero
- IFC
- SK Certification Center

Observers:
- Climate Ledger Initiative
- ClimateCheck

May – July 2022

Feedback consolidation and documentation

Capture feedback in six tools:
- Test scripts
- Feedback notes
- Feedback survey
- Feedback tracker
- Action items tracker
- Participant & feedback profiles

Produce documentation:
- Simulation III final report
- Transition plan
- Simulation III onboarding package

July - August 2022

Key Results of Simulation III

Platform

- **Developed operational prototype as a global public good that aims to empower a new global carbon market infrastructure** through a decentralized information technology platform built on blockchain technology
- **Designed as an open shared infrastructure** with a common taxonomy of data that facilitates connection and communication between entities and secured on blockchain technology
- **Registry service providers** and **countries** share data to the CADT and **public and private sector market players** can host a node and build out the service layer.

Testing activities

75 **individual testers**

30 **participating organizations**

11 **governments**

40 **weekly office hour sessions**

58 **testing sessions**

30 **kick-off and onboarding meetings**

514 individual **points of feedback,** which helped identify **156** **development actions**, 139 of which were implemented during Simulation III and reflected in the final version of the operational prototype at the end of the simulation.

Key lessons learned and a complete log of all participant feedback shared with the governing body of the operational CAD Trust at the end of Simulation III in August 2022 (Climate Warehouse Simulation III – Final Report)

Governance

- Implemented the recommendations from the **governance consultations on the operational CADT** conducted by IETA and the Government of Singapore:
  - Conducted fundraising
  - Formation of governing bodies
  - Set up independent legal entity anchored in Singapore

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Climate Action Data Trust - Insights from Simulation III

Simulation III scope

- Sim III **pushes participants to envision an interconnected ecosystem**, beyond their own standalone system
- Data added to the CADT must be able to **bridge process flows across participants**
- Participants must validate the Climate Action Data Trust's level of **data granularity, status information and units transfer methodology**

Benefits & Feedback

Benefits

- Increased transparency and data sharing
- Addressing double counting risks across registries
- Identifying a common data model
- Interaction with experts across registries
- Ability to access information outside of their own systems

Feedback

- Difficulty defining minimum standards needed to link registries
- IT complexity, upgrades to existing systems, building integration
- Ability to connect regional registry systems
- Multiple groups within the same organization will need to coordinate and play a role

3 types of experts are needed

Policy Setter

- Provides policies, guidelines, strategy for implementing, projections on future impacts on the inner workings of the organization
- Needs to understand how the data will be used internally and by partners in the future, what changes need to occur for this to happen, and what is possible due to technology advances.

Registry Administrator

- Create procedures for implementing policies
- Needs to understand how workflows will change in the future, implications for their technology tools and the data that needs to be available and captured.

IT Support

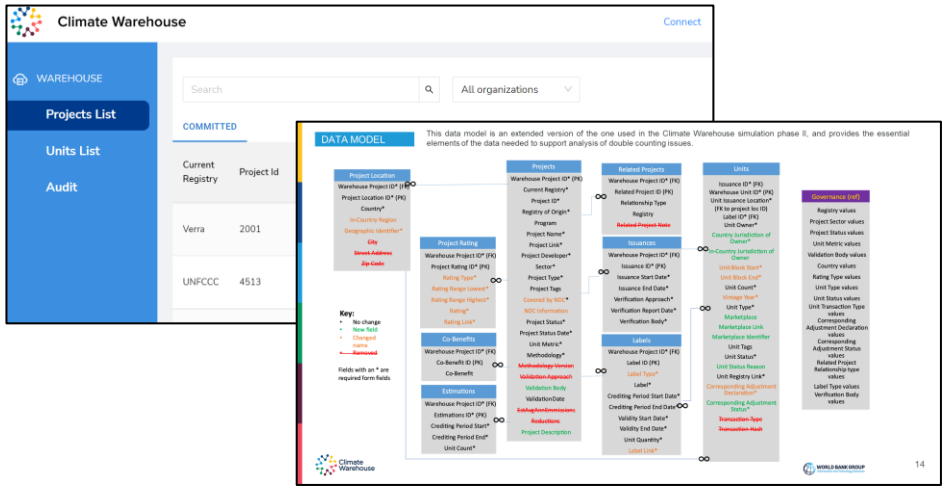
- Ensure data structure and registry functions are fit for purpose
- Needs to understand direction of policies, field definitions to figure out equivalencies for integration.

CLIMATE ACTION DATA (CAD) TRUST: Technical Architecture and Data Model

Prototype Architecture

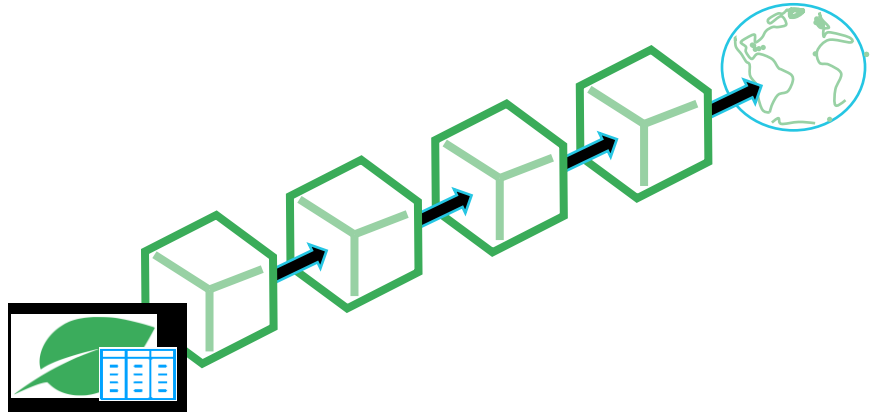
The architecture has 2 layers –
the data layer and the public blockchain layer

Data Layer…



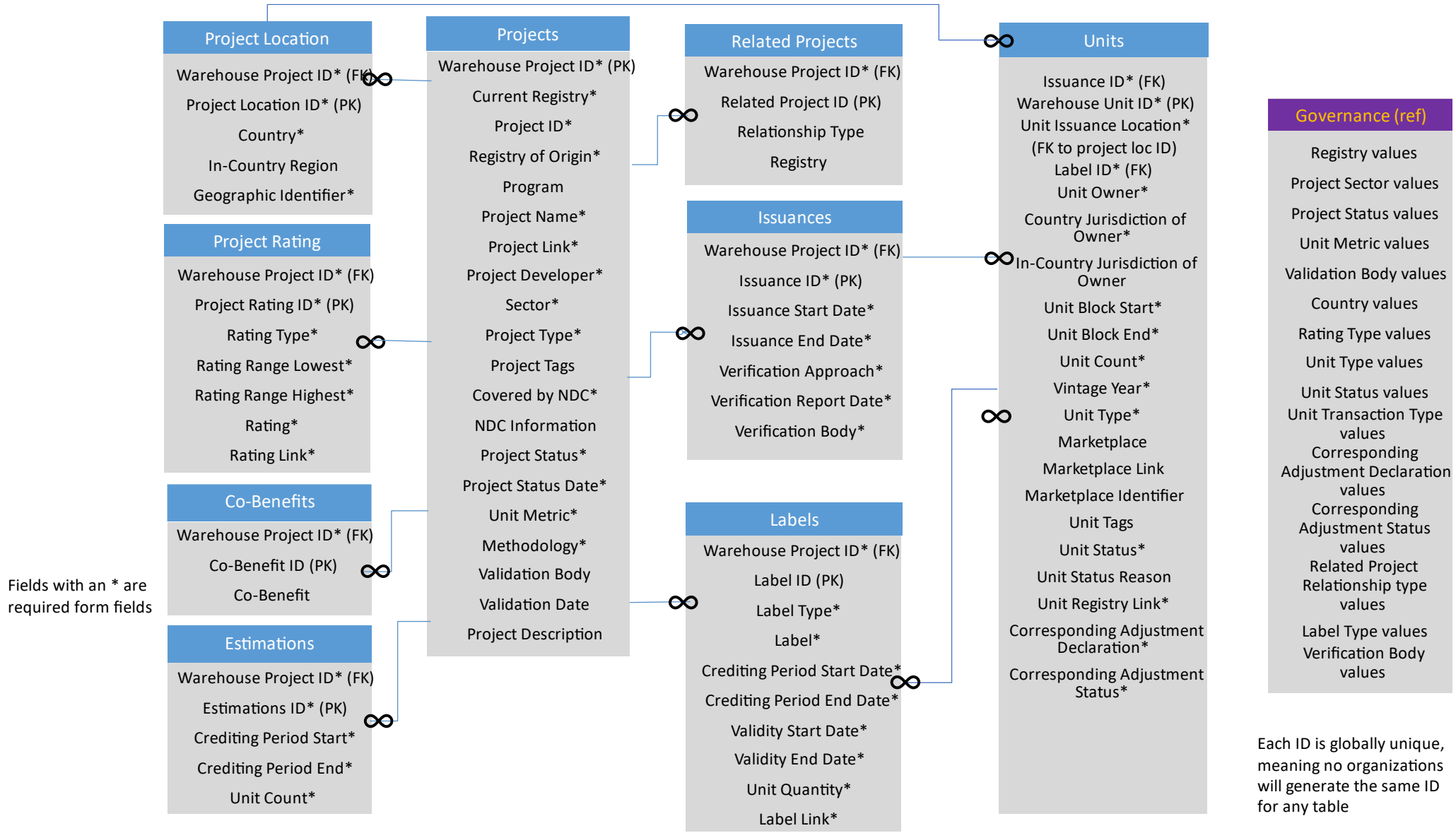
- Defines a common data model and taxonomy
- Reconcile data across registries
- Identify potential double counting
- Enable auditing and reporting

… on a Public Blockchain Layer



- Transparent and Immutable Data
- Auditable
- Accessible and Inclusive
- Public and Transparent
- Open source
- Peer-to-peer governance

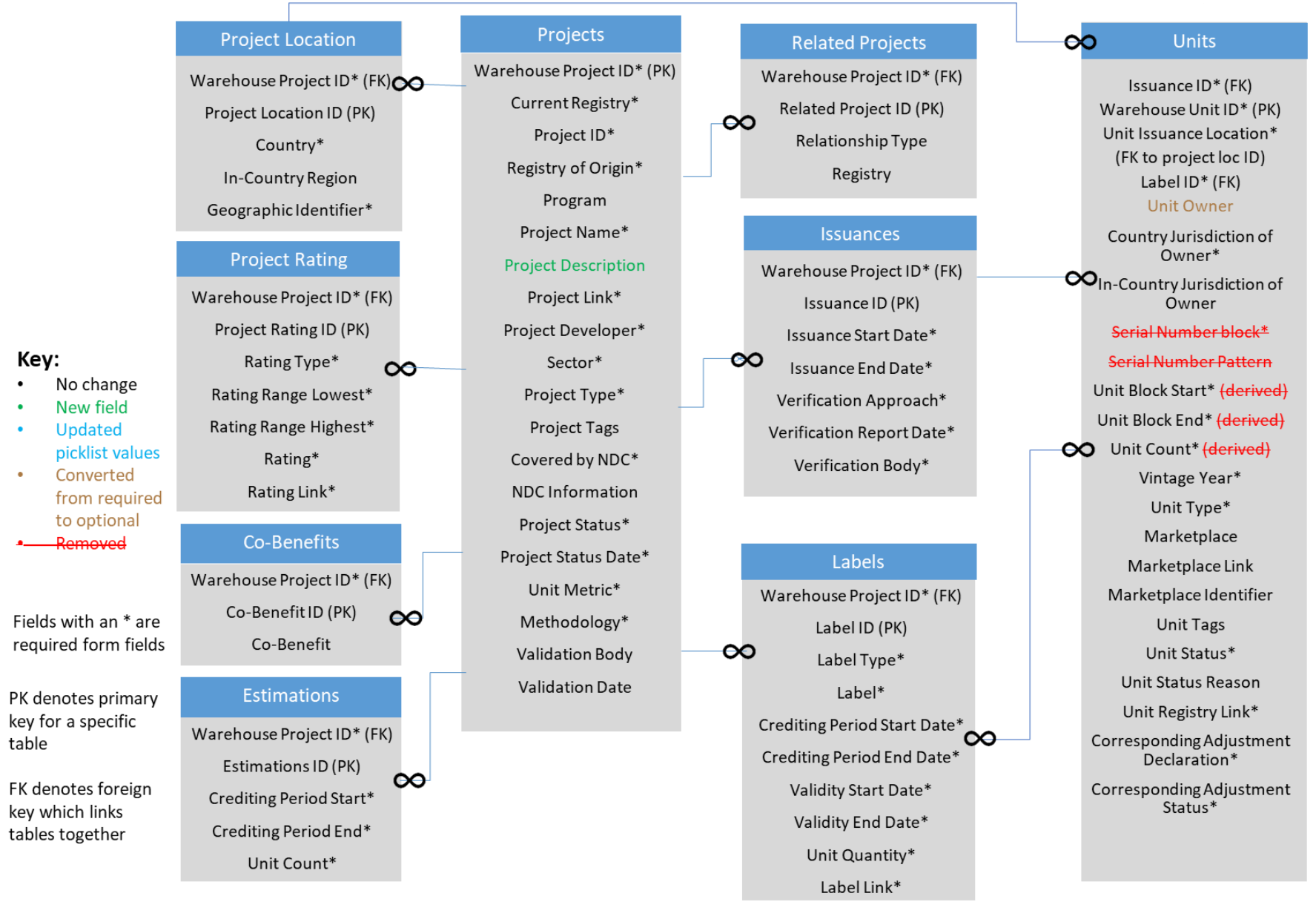
Initial Simulation III Data Model (March 2022)



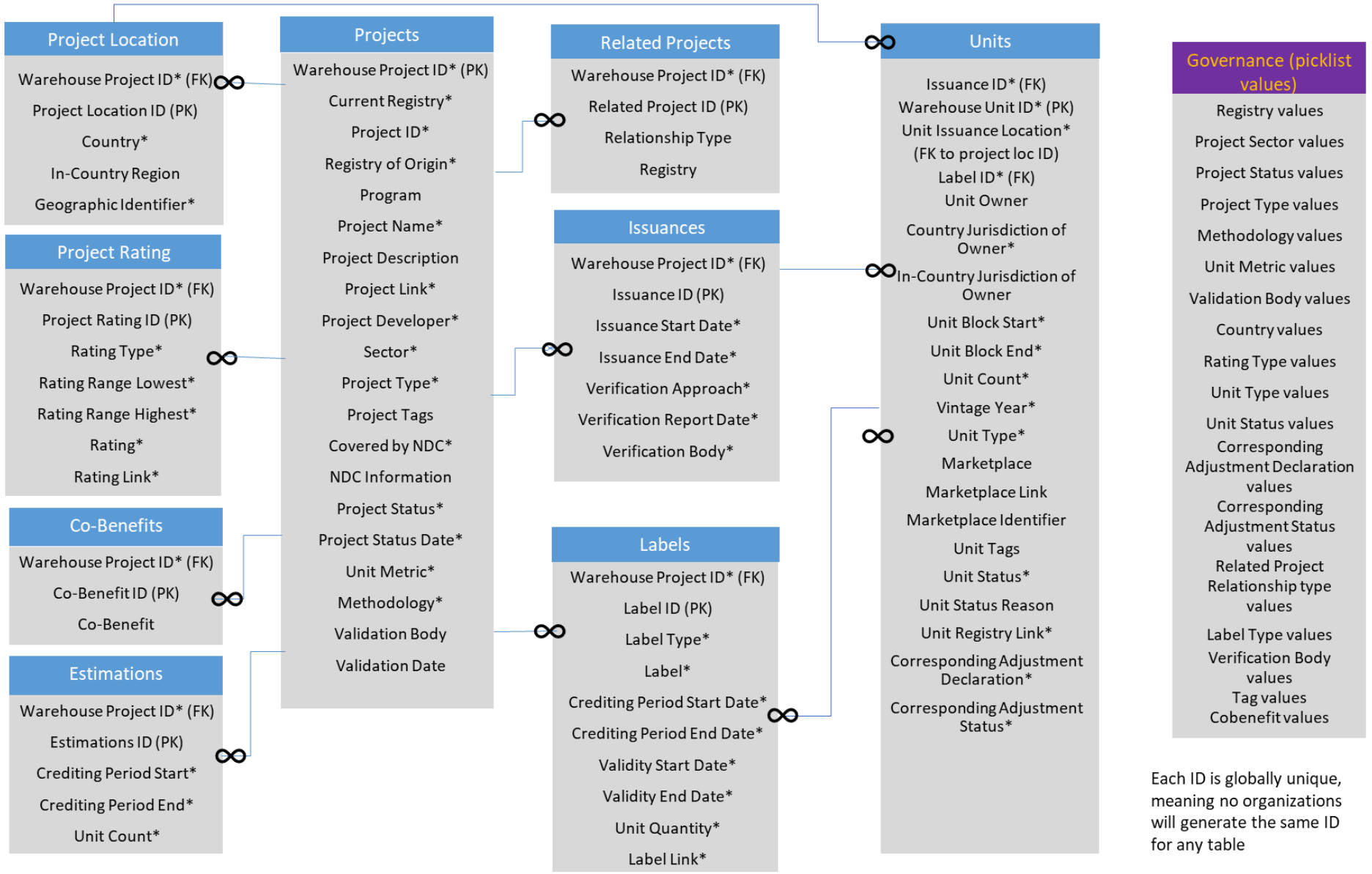
Fields with an * are required form fields

Each ID is globally unique, meaning no organizations will generate the same ID for any table

Updates to the Simulation III Data Model Based on Feedback



Updated Simulation III Data Model (August 2022)



Fields with an * are required form fields

PK denotes primary key for a specific table

FK denotes foreign key which links tables together

Each ID is globally unique, meaning no organizations will generate the same ID for any table

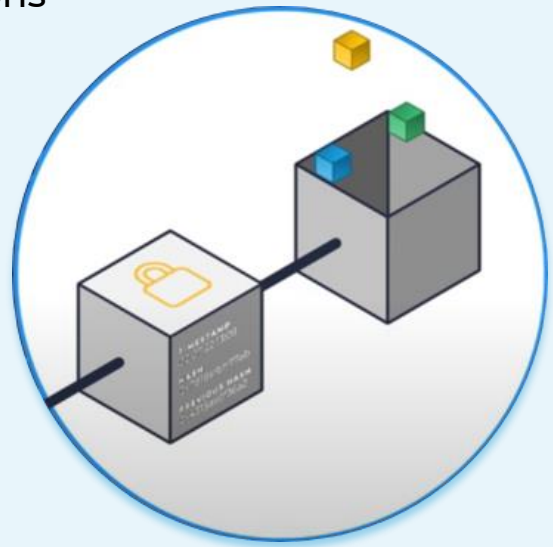
Prototype Architecture

The blockchain layer supports inclusiveness, accountability, transparency and integrity

Transparency
Fully auditable and secure record of transactions

Integrity
Fully immutable and traceable

Accountability
- Decentralized governance/peer-to-peer support
- Only registries can edit their own data, allowing countries to flexibly choose their approaches
- Follows the Article 6 bottom-up approach



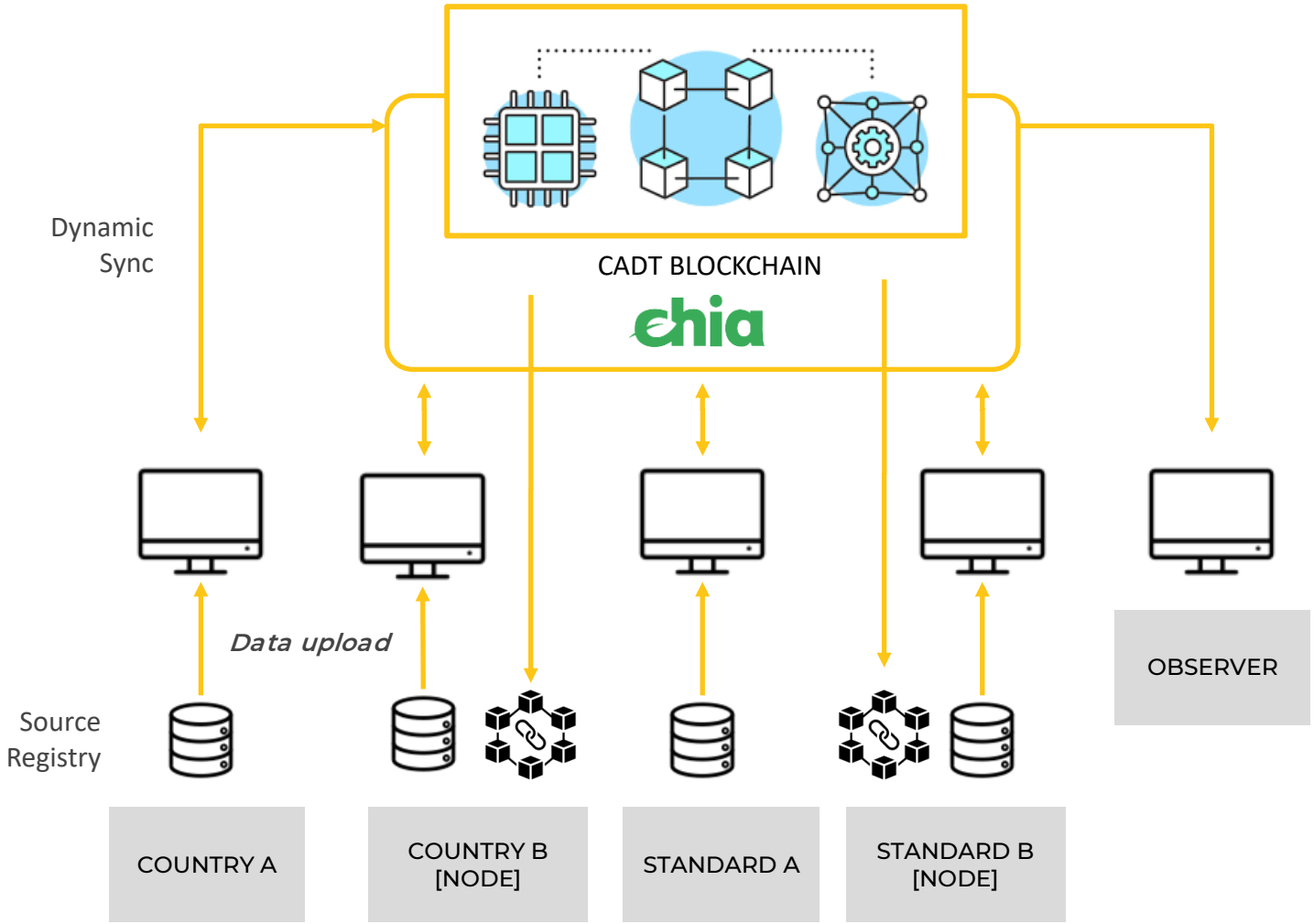
Inclusiveness
- Public, fully open source and permissionless
- Anyone in the network can access both the data layer and Chia Network blockchain node and add blocks

The Chia Blockchain Layer

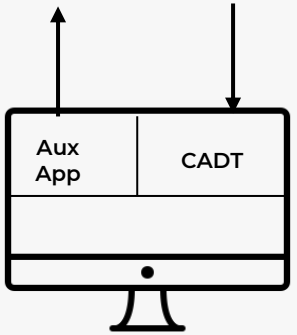
The World Bank's collaborative partnership with Chia is non-exclusive. It is for open-sourced public good, bears no costs or intellectual property rights from the World Bank and promotes interoperability.

Prototype Architecture

There are 3 ways to integrate data – User Interface, API and Spreadsheet import/export



User Interface



The CADT web application has two main interfaces with the blockchain. One is the **Auxiliary App**, which helps *Integrated Participants* manage their data sync and entry point into the Climate Action Data Trust (CADT). The other is a tab that showcases the data in the CADT blockchain. *Node Participants* hold a full copy of the blockchain via direct integration. *Observer participants* view the CADT data via an Auxiliary App made available by the WBG.

Testing Areas – Who Should Test By Functional Area

Installation – Testing that is solely focused on installing and running the prerequisite software to run the CADT	**Tester Profile** – Person who would be managing the software in the production state. This person wants to know how to properly install and maintain the Climate Action Data Trust (CADT) software	**Importance** – Allows the person managing the software in the future to be confident in what is needed from an infrastructure perspective and how to manage new releases of Climate Action Data Trust (CADT) software
User Interface (UI) – Testing that is centered around entering, manipulating, or viewing data within the Climate Action Data Trust UI	**Tester Profile** – Anyone who is curious about what the Climate Action Data Trust (CADT) displays, or anyone who will be replicating data in the Climate Action Data Trust using the UI. We recommend most participants test this area.	**Importance** – The Climate Action Data Trust UI is the visual representation of the power of the CADT. It is imperative that the UI works well for everyone involved with the Climate CADT.
API – Testing the CADT API endpoints to understand how they are structured with the intent to integrate own registry with CW APIs	**Tester Profile** – Technically sophisticated registries that intend to integrate with the CADT to automatically update CADT based on registry transactions.	**Importance** – Understanding the API endpoints will allow testers to think about how they build the automated integration between their registry and the CADT.
Mirrored Database – Testing the ability to perform SQL queries using a traditional MySQL database	**Tester Profile** – Any person who has previous SQL experience and is comfortable performing database functions to manipulate data in a specific manner	**Importance** – Testing the mirrored database will allow users to understand how they can use traditional tools to create dashboards (like for double counting) while still using the decentralized blockchain
Excel Import/Export – Testing the excel upload/download features	**Tester Profile** – Any registry personnel that will have the data expertise to update the CADT using data file uploads.	**Importance** – This testing area is important for registries that choose to integrate using file transfer instead of using the API or Auxiliary App.

CLIMATE ACTION DATA (CAD) TRUST: Governance

Governance and Finance consultation

September 2021 – March 2022

70+

Entities involved

- Governments
- Independent standards
- Exchanges
- Traders
- Project developers
- Private sector
- Financial institutions
- Technology providers
- NGOs
- Think tanks
- Law firms
- Multilateral development banks
- Observer: UNFCCC

5

Governance models reviewed

- Western Climate Initiative, Inc (WCI, Inc.)
- Integrity Council for Voluntary Carbon Markets (IC-VCM)
- EU-Swiss ETS link
- Joint Crediting Mechanism (JCM)
- British Standards Institution (BSI) & Enterprise Singapore (ES)

6

Focus groups conducted

- 4 on governance (46 entities)
- 2 on finance (45 entities)

+ polls and surveys for participant feedback throughout

Interim governance structure of the operational Climate Action Data Trust (CADT)

Council (~10 members)

Leads strategy/policy mandate

Secretariat

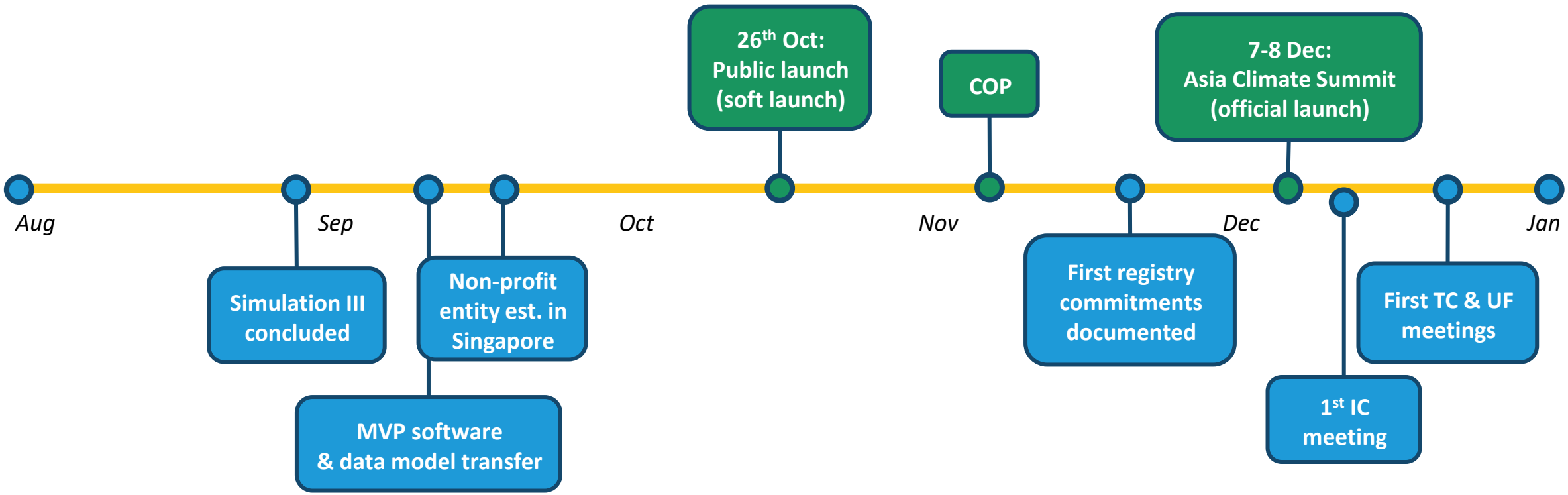
Technical Committee

- Data specification development
- IT development

User Forum

- Open to registered and approved Warehouse community participants
- Community consultation forum
- Potentially: Council recruitment

2022 Outlook



Climate Warehouse

For further information:

Climate Warehouse

- Website: https://www.theclimatewarehouse.org/work/climate-warehouse
- Testing Activities Video: https://www.youtube.com/watch?v=cXwTV2bAnvI
- Online Library: https://olc.worldbank.org/content/climate-warehouse-learning-series

Climate Action Data Trust

- Website: https://climateactiondata.org/
- Launch Video: https://olc.worldbank.org/content/introduction-climate-action-data-trust

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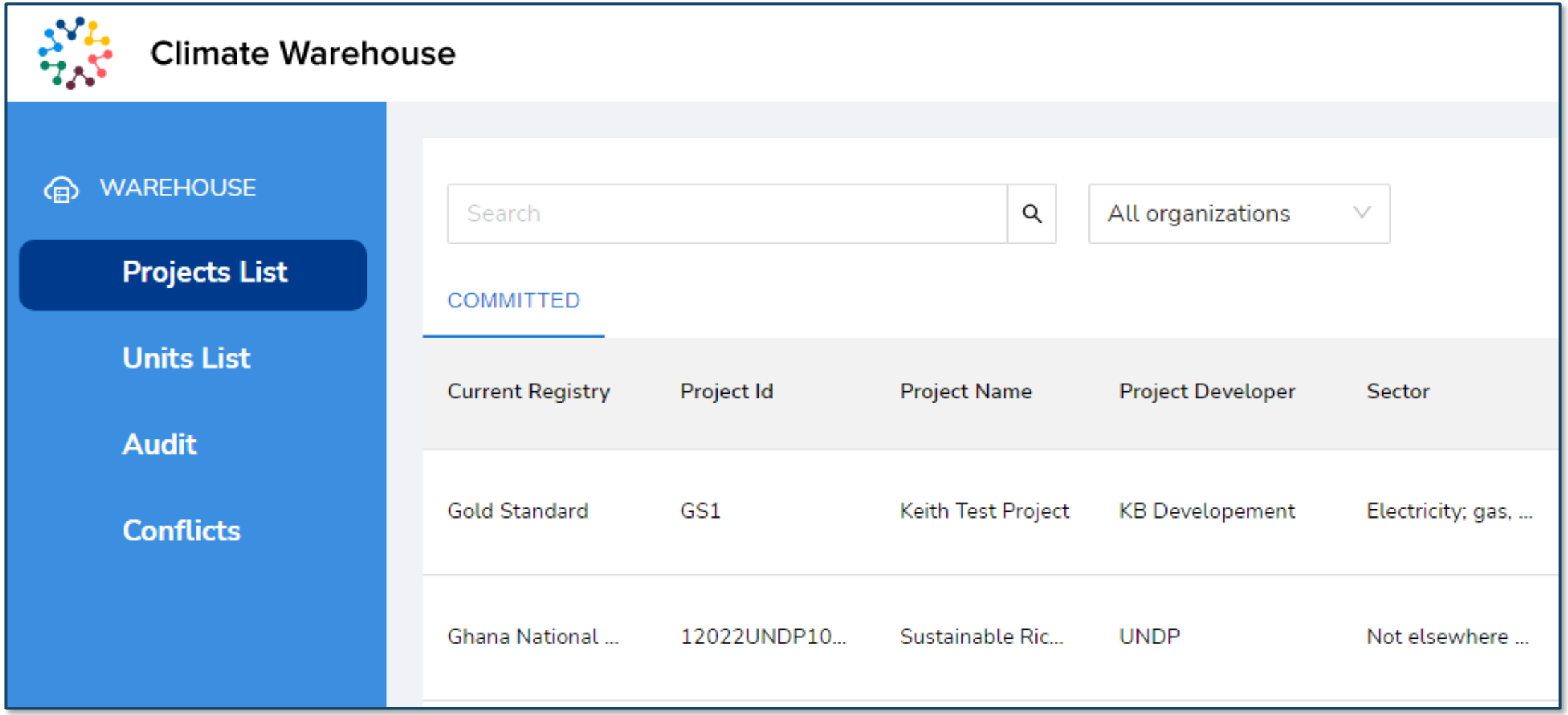
Annex

Wireframe – CAD Trust



Knowledge and Capacity Building

Resources

Websites

- Website: Climate Warehouse Program
  - Webpage: CAD Simulation III
- Website: Climate Warehouse Library – Open Learning Campus (OLC)

Webinars:

- Webinar: Climate Warehouse: End-to-End Digital Ecosystem for Carbon Markets (2022)
- CAD Workshop: A meta-data infrastructure to support transparency and integrity of climate markets (2022)
- Webinar: Climate Warehouse: A Meta-data Infrastructure to Support Transparency and Integrity of Climate Markets (2022)
- Webinar: Is Blockchain/DeFi the Future for Carbon Credits? (2022)
- Workshop: Building an enabling environment for operationalizing Article 6 (2021)
- Webinar: Benchmarking A Global Price For Carbon. (2021)
- Webinar: Emerging Digital Technologies for Post-2020 Climate Markets (2020)
- Webinar: Testing the use of blockchain to build a meta-registry for decentralized climate markets (2019)
- Webinar: Catalyzing the next generation of climate markets through the World Bank´s Climate Warehouse Initiative. (2019)

Blog:

- Blog Post: Carbon Markets: Why Digitization Will Be Key to Success(2022)
- Blog Post: Lessons from creating mitigation outcomes(2021)

Reports:

- Final Report: Climate Warehouse Simulation III (Report) (2022)
- Summary Report: Simulation II – the Connecting Climate Market Systems (2022)
- Summary Report: Simulation I – Connecting Climate Market Systems (2019)
- Report: Digital Reporting, Monitoring and Verification Systems (2022)
- Blockchain and Emerging Digital Technologies for Enhancing Post-2020 Climate Markets (2018)

Technical papers:

- Test Scripts: Simulation III (2022)
- Technical Guide for Testing: Simulation III (2022)
- Data Model: Simulation III (2022)
- Chia White Paper: Blockchain technology for the Climate Warehouse (2021)
- Article 6 Approach Paper Serie (2020)
- Summary Report on Enhancing Carbon Pricing and International Carbon Market Readiness Through the Mitigation Action Assessment Protocol (2021)

Videos:

- Net Zero: The Integrity Pathway (2022)
- Climate Warehouse: Helping countries leverage climate markets and carbon pricing (2022)
- Demo: Climate Warehouse Simulation II (2021)

Data visualization:

- Tool: How do we ensure environmental integrity under the Paris Agreement?

Knowledge and Capacity Building

Media Articles

	Ledger Insights	World Bank backs blockchain project to harmonize carbon registry data (28 Oct 2022)
	Regulation Asia	Singapore to Host Platform to Unify Carbon Market Registry Data (29 Oct 2022)
	Ledger Insights	World Bank backs blockchain project to harmonize carbon registry data (28 Oct 2022)
	Finextra	Climate Action Data Trust launched to unify carbon credit registry data (26 Oct 2022)
	ESG Investor	This Week's Tech and Tools News: MSCI Launches Climate Action Index (28 Oct 2022)
	Disruption Banking	Climate Action Data Trust to unify carbon credit registry data (26 Oct 2022)
	BeSpacific	Climate Action Data Trust (27 Oct 2022)
	Político	Crypto, but for the climate (27 Oct 2022)
	Business Time	Global platform to unify carbon credit registry data to be domiciled in Singapore (26 Oct 2022)
	IETA	IETA Article "Climate Action Data Trust to unify carbon credit registry data" (26 Oct 2022)
	Carbon Pulse	Carbon Pulse Article "World Bank to launch carbon credit metadata layer in December"(11 Oct 2022)
	Financial Times	Financial Times Article "World Bank to launch carbon credit metadata layer in December" (11 Oct 2022)
	Carbon Pulse	Carbon Pulse Article "Interview: World Bank to launch metadata project to clean up carbon market's information problem" (7 Jul 2022)
	Financial Times	Bureaucratic World Bank goes experimental with a blockchain for carbon offsets (7 Feb 2022)