NTCC × ICP — Institutional Methodology White Paper

Institutional Methodology for Behavioral Carbon Credits, Internal Carbon Pricing Integration, and Cross-Standard Governance

Institutional White Paper V 1.0

Publisher: EMJ LIFE Holdings Pte. Ltd. (Singapore)

Institutional Operator: NTCC — Non-Tradable Carbon Credit Framework

NTCC defines the world's third sustainability calculation structure—Behavioral Non-Tradable Carbon Units—created through verifiable participation, mission-based action, and institutional-grade evidence flows.
Within the broader PADV Institutional Series, NTCC establishes the behavioral CO_2e verification logic that enables enterprises to integrate Internal Carbon Pricing (ICP) with evidence-first governance.

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Definition Statement

(Formal Institutional Definition for NTCC × ICP Integration Framework)

NTCC (Non-Tradable Carbon Credit)

NTCC is a **governance-grade, evidence-based carbon quantification unit**, defined as: **"1 NTCC = 1 metric ton of CO_2e derived from verified behavioral contribution, issued under the PADV institutional methodology, non-tradable, non-offsetting, and non-market by design."**

NTCC constitutes the **third global sustainability calculation structure**, positioned alongside:

1. **Natural Carbon Sinks** (biophysical sequestration)
2. **Carbon Credits / Offsets** (market and compliance instruments)
3. **NTCC Behavioral Carbon Units** (non-market, governance-only)

NTCC does **not replace nor interfere with** carbon sinks or offsets; instead, it supplements organizational climate accounting by introducing **a verifiable behavioral evidence layer**, primarily strengthening **Scope 3 attribution**, governance transparency, and internal sustainability decision-making.

ICP (Internal Carbon Pricing)

ICP is defined as an **internal governance mechanism** by which organizations assign a monetary representation to carbon-related impact for the purposes of capital allocation, risk management, and strategic decision-making.

ICP does **not** constitute a market price nor a financial instrument.

NTCC × ICP Integration

Within the ICP system, NTCC serves as the **Behavioral Carbon Block**: **"NTCC provides the behavior-based CO_2e evidence that complements traditional ICP structures, enabling organizations to incorporate verified multi-actor behavioral contributions into internal carbon pricing, governance, and evaluations."**

The integration creates a unified, multi-layered institutional methodology connecting:

- **PADV (Participation–Action–Data–Value)**
- **SFA (Sustainable Finance Architecture)**
- **ISA / PADV^2 (Institutional Syntax Architecture)**
- **ICTF (Institutional Credibility Tier Framework)**

This ensures consistency with international standards including **IFRS S1/S2, GRI 305, COSO ICSR, ISO 14064/67**, and aligns with **non-market mechanisms (NMM)** under UNFCCC.

Governance Boundary Conditions

- NTCC **cannot be traded, sold, purchased, or used for offsetting** emissions obligations.
- NTCC **does not constitute a financial product** and carries zero market value.
- NTCC exists solely as an **institutional evidence unit** for governance, verification, and disclosure purposes.
- ICP integration is **non-financial**, serving only internal governance and sustainability management.

Purpose of this Definition Statement

This definition establishes NTCC as a **globally distinct calculation structure**, clarifies the boundaries of its use, and provides the foundational institutional logic required for NTCC's formal alignment with Internal Carbon Pricing systems.

Value Statement

(Institutional Value Proposition of NTCC × ICP Integration)

NTCC × ICP establishes a new institutional value layer for global sustainability governance.

By defining NTCC as a **non-market, evidence-based behavioral CO_2e unit**, and

integrating it into Internal Carbon Pricing frameworks, this methodology provides organizations with a **governance-grade mechanism** to quantify, attribute, and validate behavioral contributions to climate performance.

The value of this integration lies in five institutional dimensions:

Evidence-Based Climate Governance

NTCC introduces **verifiable behavioral evidence** into climate-related decision-making.

This strengthens governance integrity, internal controls, and disclosure accuracy across IFRS S1/S2, GRI 305, COSO ICSR, and ISO 14064 frameworks.

The Third Global Sustainability Calculation Structure

By complementing natural carbon sinks and traditional carbon credits, NTCC provides a **third, previously missing dimension** of CO_2e attribution: **behavioral contribution to climate performance**.

This expands the analytical and governance capabilities of organizations without altering market mechanisms.

Behavioral Scope 3 Enablement

NTCC fills the long-standing gap in Scope 3 accounting: **high-resolution, multi-actor, evidence-backed behavioral attribution**.

This enables organizations to quantify actions that were previously unmeasurable or unverifiable.

Strengthening Internal Carbon Pricing (ICP)

NTCC forms the **Behavioral Carbon Block** within ICP, enabling organizations to:

- incorporate behavioral signals
- link actions to internal incentives
- support capital allocation
- enhance climate risk governance

This elevates ICP from a purely financial model to a **behavior–finance hybrid governance tool**.

Cross-Sovereign, Cross-Standard Consistency

The methodology is fully aligned with:

- IFRS Sustainability Standards
- GRI disclosures
- COSO ESG internal control frameworks
- ISO quantification methodologies
- UNFCCC non-market mechanism principles

This ensures that NTCC × ICP integration is **globally referenceable, audit-ready, and institutionally neutral**.

Value Summary

NTCC × ICP delivers a new institutional value layer: a verified behavioral carbon evidence system that strengthens corporate governance, enhances Scope 3 attribution, and elevates Internal Carbon Pricing into a multi-dimensional climate governance instrument.

It expands the frontier of sustainability management from "measurement of emissions" to **"measurement of behavior."**

Abstract

This white paper establishes the institutional integration framework between **NTCC (Non-Tradable Carbon Credit)** and **ICP (Internal Carbon Pricing)** within the broader governance architecture of PADV, SFA, PADV^2, and ICTF. It positions **NTCC as the world's third sustainability calculation structure**—a **behavior-based, non-tradable, evidence-driven CO_2e unit**—that complements but does not replace the two existing global mechanisms: **Natural Carbon Sink** and **Traditional Carbon Credit/Offset Systems**.

The purpose of this document is to define how NTCC can serve as the

behavioral enhancement layer within ICP models, enabling organizations to incorporate verified participation-based CO_2e contributions into internal carbon valuation, governance mechanisms, and Scope 3-related disclosures.

The NTCC × ICP methodology adheres strictly to **institutional neutrality**, is **non-commercial**, and introduces no pricing, offsetting, or market-oriented constructs. Instead, it provides a standardized governance logic consistent with international frameworks, ensuring compatibility with:

- **IFRS S1/S2** (sustainability and climate-related disclosures)
- **GRI 305** (emissions and Scope 3 transparency)
- **COSO Internal Control Framework** (ESG internal controls)
- **UNFCCC emerging verification and non-market mechanisms**

By integrating NTCC into ICP, organizations obtain a complete and audit-ready behavioral CO_2e evidence layer, enabling higher-resolution sustainability accounting, more robust internal climate governance, and cross-sovereign data verifiability aligned with global regulatory expectations.

Disclaimer

This white paper is an institutional methodology document. It does **not** constitute financial advice, legal advice, investment solicitation, commercial promotion, or any form of regulatory submission. NTCC (Non-Tradable Carbon Credit) is a **non-market, non-financial, non-offset, non-tradeable behavioral evidence unit**, and must not be interpreted as a carbon credit, carbon offset, asset, commodity, security, derivative, or financial product of any kind.

Nothing in this document shall be construed as:

- an offer to buy or sell any financial instrument
- an invitation to participate in any trading scheme
- a representation of monetary value
- a claim related to emission reductions or removals
- a substitute for regulatory compliance or legal obligations
- a carbon market mechanism or offsetting tool

The NTCC framework does **not** replace carbon markets, carbon offsets, natural carbon sinks, regulatory carbon taxes, or any compliance mechanism. NTCC does **not** carry financial value, does **not** reduce emissions liability, and cannot be transferred, traded, monetized, or applied to any statutory emissions obligation.

All methodologies presented are **evidence-based governance frameworks** intended strictly for:

- internal sustainability governance
- behavioral carbon attribution
- cross-standard reporting alignment
- non-market institutional use
- audit-compatible evidence development
- informational and educational purposes

The contents of this white paper reflect the understanding of the authors at the time of publication and are provided “as is” without warranties, explicit or implied. EMJ LIFE Holdings Pte. Ltd. disclaims any responsibility for errors, omissions, or interpretations made by third parties.

Organizations applying concepts from this document are responsible for ensuring their own compliance with applicable laws, regulations, accounting standards, sustainability frameworks, reporting requirements, and verification obligations across relevant jurisdictions.

Reference to global standard-setting bodies (including but not limited to UNFCCC, IFRS/ISSB, GRI, COSO, ISO, OECD, IMP, UNDP) is for methodological alignment only and does **not** imply endorsement, partnership, or affiliation.

Use of this document indicates acceptance of the limitations and boundaries described herein.

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We express our deepest appreciation to the organizations, scholars, auditors, and experts whose frameworks, scientific literature, governance logic, and methodological clarity have supported the creation of NTCC as a globally compatible behavioral carbon governance structure.

Institutional Frameworks & International Standards Referenced

The authors acknowledge the foundational role of the following **global standard-setting and governance institutions**, whose work provides essential alignment for the NTCC × ICP methodology:

Global Sustainability & Climate Governance Bodies

- **United Nations Framework Convention on Climate Change (UNFCCC)** — Transparency Framework, Article 6 Non-Market Approaches (NMA)
- **United Nations Environment Programme (UNEP)** — Global sustainability science & governance guidance
- **United Nations Development Programme (UNDP)** — SDG evidence frameworks and behavior-based participation models
- **World Bank Group** — Climate governance, Scope 3 methodologies, institutional risk frameworks

International Standards & Assurance Frameworks

- **IFRS Foundation / ISSB (International Sustainability Standards Board)** — IFRS S1 & S2 Sustainability Disclosure Standards
- **Global Reporting Initiative (GRI)** — GRI 305, Scope 3 emissions & behavior-related disclosure
- **COSO (Committee of Sponsoring Organizations)** — ESG-integrated internal controls and governance systems
- **ISO (International Organization for Standardization)** — ISO 14064, 14067, and ISO governance standards
  — Activity-data structures supporting behavioral attribution

Institutional Verification, Audit & Risk Methodologies

- **OECD** — Governance, transparency, and non-market institutional frameworks
- **International Organization of Supreme Audit Institutions (INTOSAI)** — Public-sector audit and verification logic informing evidence chains
- **Impact Management Platform (IMP)** — International impact classification and outcome-based verification

These institutions have **no direct affiliation** with NTCC and **do not endorse** this white paper.

Their frameworks are acknowledged solely for **methodological alignment** and **institutional compatibility** consistent with global academic and governance practice.

Research Contributors & Institutional Development Team

Development of the NTCC methodology and the NTCC × ICP integration model was led by:

Anderson Yu, Founder & CEO, EMJ LIFE Holdings Pte. Ltd. (Singapore)

Supported by the broader **PADV Institutional Series Core Development Team**, responsible for the creation of:

- PADV — Behavioral Evidence Methodology
- NTCC — Non-Tradable Carbon Credit Framework
- SFA — Sustainability Finance Architecture
- ISA — Institutional Syntax Architecture
- ICTF — InstiTech Credibility Tier Framework
- VISA-Layer — Verification Institutional Syntax Architecture
- $PADV^2$ — Multi-Layer Institutional Syntax Framework

Their combined work establishes EMJ.LIFE's institutional-grade governance architecture.

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The authors thank the teams responsible for:

- **Crossref DOI registration:** Ensuring all institutional frameworks are anchored through permanent scholarly identifiers
- **EMJ LIFE Institutional Publishing Infrastructure:** Providing the platform for multi-paper institutional release *(PDF publication, metadata management, archive integration, DOI maintenance)*
- **Data Science & Verification Engineering:** Supporting the PADV → NTCC pipelineIncluding evidence hashing, metadata schema development, and multi-layer verification logic

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To all individuals, partners, institutions, and thought leaders advancing:

- Verified behavioral data
- Governance-grade climate accounting
- Non-market carbon innovation
- Internal Carbon Pricing development
- Global sustainability transformation

Your work forms the intellectual foundation that allows NTCC to function as the **world's third sustainability calculation structure** and to integrate with Internal Carbon Pricing as a legitimate governance mechanism.

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International Sustainability Standards

IFRS / ISSB Standards

- **IFRS S1: General Requirements for Disclosure of Sustainability-related Financial Information**
- **IFRS S2: Climate-related Disclosures**
  Publisher: IFRS Foundation (2023–2025)
  https://www.ifrs.org

GRI Standards

- **GRI 305: Emissions**
- **GRI 302: Energy**
  Publisher: Global Reporting Initiative
  https://www.globalreporting.org

UNFCCC & Global Climate Governance

- **UNFCCC Enhanced Transparency Framework (ETF)**
- **Article 6 — Non-Market Approaches (NMA)**
- **NMM Reference Frameworks**
  https://unfccc.int

OECD Governance & Non-Market Systems

- OECD Institutional Governance & Non-Market Mechanisms
- OECD Principles for Transparency & Evidence
  https://www.oecd.org

ISO Frameworks & Technical Standards

ISO Climate Measurement Standards

- **ISO 14064-1** — Greenhouse Gas Quantification

- **ISO 14064-3** — Verification and Validation of GHG Assertions
- **ISO 14067** — Product Carbon Footprint

  Publisher: ISO

  https://www.iso.org

ISO Governance Standards

- **ISO 37000** — Governance of Organizations
- **ISO 9001** — Quality Management & Evidence Processes
- **ISO 27001** — Information Security Management

Audit, Assurance & Internal Control Frameworks

COSO

- **COSO Internal Control – Integrated Framework** (2013 / 2017 / ESG 2023 Updates)
- **COSO ESG Application Guide**

  https://www.coso.org

INTOSAI (International Organization of Supreme Audit Institutions)

- **ISSAI Standards for Public-Sector Audit**

  Provides global guidance on evidence integrity and verification.

Climate Finance, Impact, and Non-Market Methodologies

World Bank Group

- Climate Finance Methodology & Scope 3 Guidance
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Support institutional maturity and non-market verification approaches.

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- Global Impact Classification and Outcomes Framework

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Chapter 1. Introduction

1.1 Purpose of This White Paper

This white paper establishes the **institutional methodology** that formally links **NTCC (Non-Tradable Carbon Credit)** with **ICP (Internal Carbon Pricing)** within a multi-layer governance environment. It defines how NTCC—positioned as the **world's third sustainability calculation structure** after natural carbon sinks and carbon credits—can function as the **behavioral evidence layer** within enterprise-level carbon governance.

Its purpose is to:

- Provide a globally compatible method for incorporating **verified behavioral CO_2e contributions** into Internal Carbon Pricing.
- Address the long-standing **behavioral gap** in Scope 3 and non-market carbon governance.
- Strengthen organizational climate accountability with **audit-equivalent behavioral evidence**.
- Align NTCC × ICP with leading international standards (IFRS S1/S2, GRI 305, COSO ESG, ISO 14064/14067, UNFCCC NMA).
- Clarify NTCC as a **non-market, non-financial, non-offset, non-tradable** governance unit strictly for institutional use.
- Establish a cross-sovereign foundation for evidence-based climate governance within the **PADV Institutional Series**.

In short, the purpose of this paper is to define **how verifiable behavior becomes a legitimate component of internal carbon pricing**, without ever entering markets, offsets, or financial products.

1.2 Scope of the Methodology

This white paper covers the full institutional architecture necessary for integrating NTCC into ICP frameworks. Its scope includes:

NTCC Definition & Issuance Methodology

- 1 NTCC = 1 tCO_2e of **verified behavioral contribution**
- Generated through PADV's four-layer verification pipeline
- Immutable, evidence-based, and audit-grade
- Zero market value, zero tradability, zero offset capability

Internal Carbon Pricing Governance Logic

- ICP as an internal decision-making and resource allocation model
- Behavioral evidence integration
- Non-financial, non-market internal valuation mechanisms
- Department-level and activity-level attribution

Behavioral Carbon Accounting

- Behavioral attribution
- Multi-actor contribution
- Activity → Evidence → CO_2e equivalence
- Compatible with ISO 14064 Activity Data models

The Three-Pillar Sustainability Calculation Structure

- Natural Carbon Sink (biophysical sequestration)
- Carbon Credits / Offsets (market-based units)
- **NTCC (behavioral non-market units)** — introduced by EMJ.LIFE

NTCC does **not** replace the first two pillars; it **complements** them by filling the institutional gap that neither nature-based nor market-based systems can account for.

Cross-Standard Alignment

The methodology is explicitly aligned with:

- **IFRS S1/S2** — governance, risk, metrics, evidence
- **GRI 305** — expanded Scope 3 behavioral dimension
- **COSO ESG Internal Controls** — evidence-chain integrity
- **ISO 14064 / 14067** — activity-derived quantification logic
- **UNFCCC Non-Market Approaches (NMA)**
- **OECD Institutional Governance**

Non-Commercial, Non-Market Nature

This document does **not** define pricing, monetization, financial instruments, commercial plans, or fees.

NTCC is explicitly:

- Not a market commodity
- Not a financial asset
- Not an offset
- Not a carbon credit
- Not usable for compliance

The scope is strictly **methodological and institutional**, not commercial.

1.3 Principles

The NTCC × ICP integration is governed by five core institutional principles:

Evidence First

All climate-related units must originate from **verified behavior**, validated through PADV's multi-layer verification logic.

No speculative, estimated, or unverified claims are permitted.

Non-Tradeability

NTCC is structurally and legally **non-tradable**, ensuring:

- No market interaction
- No offsetting function
- No financial or speculative behavior

This principle preserves NTCC's **governance purity**.

Institutional Neutrality

NTCC operates independently of:

- Market conditions
- Carbon pricing policies
- Trading mechanisms
- Regulatory carbon markets

It serves solely as an **institutional evidence unit**.

Standard Alignment

Every component of the methodology is fully aligned with:

- IFRS S1/S2
- GRI 305
- COSO ESG Internal Controls
- ISO 14064 / 14067
- UNFCCC transparency & NMA frameworks
- OECD institutional governance principles

NTCC contributes to **governance enhancement**, not market substitution.

Governance Integrity

NTCC × ICP exists **within the governance layer**, not the market layer.

This ensures:

- Clear boundaries with offsets and credits
- Transparent institutional accountability
- Prevention of misuse or misrepresentation
- Alignment with cross-sovereign audit logic

1.4 Positioning within the PADV Institutional Series

NTCC × ICP is part of a broader system of institutional architecture defined by:

- **PADV** — Behavioral Evidence Methodology
- **NTCC** — Behavioral Non-Tradable Carbon Credit
- **SFA** — Sustainability Finance Architecture
- **ISA** — Institutional Syntax Architecture
- **PADV²** — Multi-layer syntax framework
- **ICTF** — Credibility tiers for institutional maturity
- **VISA-Layer** — Verification syntax and audit scaffolding

NTCC × ICP is the **bridge** between behavioral evidence (PADV) and internal climate governance (ICP), filling a global methodological gap that market systems cannot address.

1.5 Summary of Chapter 1

This introduction establishes NTCC as the **missing behavioral pillar** in global climate governance and clarifies how it integrates into Internal Carbon Pricing systems without ever entering market mechanisms or offset structures.

It also sets the foundational standards alignment and governance rationale for all subsequent chapters.

Chapter 2. The Third Global Sustainability Calculation Structure

A Three-Pillar Architecture for Global Carbon Accounting, Governance, and Institutional Integration

2.1 The Three Pillars of Global Sustainability Calculation

Global carbon accounting and sustainability governance have historically relied on **two** dominant calculation structures:

1. **Natural Carbon Sinks** and
2. **Carbon Credits / Carbon Offsets**.

Both are essential but incomplete. Neither is designed to measure the **behavioral** dimension of climate action—a gap that continues to undermine Scope 3 visibility, ICP precision, and institutional governance.

This white paper introduces and formalizes the **third** calculation structure:

3. **NTCC — Non-Tradable Carbon Credit**, representing **verified behavioral CO_2e contribution**.

Pillar 1 — Natural Carbon Sink (Biophysical Sequestration)

Natural carbon sinks represent the **ecological baseline** of global climate stabilization:

- Forests, soils, wetlands, oceans
- Biophysical sequestration processes
- Measurable through long-cycle ecological models
- Governed by UNFCCC and IPCC guidelines
- Quantified via biological, geological, and ecosystem sciences

Natural carbon sinks form the **foundation** of climate mitigation but cannot reflect human behavior, organizational participation, or cultural transformation.

Pillar 2 — Carbon Credits / Carbon Offsets (Market-Based Units)

Carbon markets represent the **economic baseline** of climate mitigation:

- Verified carbon reduction/removal projects
- Market-issued, transferable, fungible units
- Tradable within compliance or voluntary systems
- Used for offsetting or meeting regulatory obligations
- Governed by market standards (Verra, Gold Standard, UNFCCC Article 6.4, etc.)

Carbon credits measure **project-level** outcomes but do not capture **behavioral actions**, culture-based participation, or real-world human-driven contributions.

Pillar 3 — NTCC: Non-Tradable Carbon Credit (Behavioral Contribution Unit)

NTCC represents the **behavioral baseline** of climate mitigation, completing the three-pillar architecture.

NTCC is:

- **Behavior-based**, not project-based
- **Evidence-first**, not market-first
- **Non-tradable**, not financial
- **Institutional**, not transactional
- **Governance-layer**, not market-layer
- **Verification-driven**, not price-driven
- **Global third sustainability calculation structure**

1 NTCC = 1 tCO_2e of verified behavioral contribution, issued through multilevel verification:

- Participation (intent & identity)
- Action (mission completion)
- Data (evidence logging)
- Verification (server-side validation)
- Registry (immutable record)

NTCC exists purely as a **governance evidence unit**, filling the gap neither ecological sequestration nor carbon markets can address.

2.2 Complementarity, Not Replacement

NTCC does **not** replace natural carbon sinks or carbon credits.

It **complements** them by filling the **behavioral gap**, becoming the missing structural layer in the global sustainability architecture.

Natural Carbon Sink: Measures **what nature does**.

Carbon Credits / Offsets: Measure **what projects achieve**.

NTCC: Measures **what people and organizations actually do**.

Together, all three pillars form the **complete institutional architecture of global climate action**:

Layer	What It Measures	Who Governs It	Key Limitation
Natural Carbon Sink	Biophysical sequestration	UNFCCC / IPCC	No behavioral dimension
Carbon Credits	Reduction/removal projects	Market standards	No multi-actor granularity
NTCC	Behavioral contribution	PADV institutional architecture	Not a market unit

NTCC fills the structural absence of behavioral evidence—long ignored in both scientific and market mechanisms.

2.3 Why the Third Pillar Was Necessary

Three global and persistent gaps make NTCC indispensable:

Gap 1 — The Behavioral Visibility Gap (Scope 3 Blind Spot)

Traditional systems cannot quantify:

- Participation
- Everyday actions
- Event-level contributions
- Multi-actor engagement

- Behavioral attribution across supply chains

NTCC solves this through **evidence-based activity quantification**.

Gap 2 — The Governance Evidence Gap

Regulators and auditors require:

- Traceable evidence
- Immutable verification
- Multi-layer logging
- Non-market neutrality
- Cross-standard compatibility

NTCC is designed explicitly as **audit-equivalent evidence** under IFRS / COSO / ISO.

Gap 3 — The ICP Behavioral Gap

Internal Carbon Pricing (ICP) struggles with:

- Lack of behavior-level data
- No unit for internal behavioral scoring
- No way to attribute human-driven Scope 3 influence
- Limited internal transparency

NTCC provides the **Behavioral Carbon Block**, the missing layer for ICP.

2.4 Structural Positioning in Global Climate Governance

NTCC is aligned with:

Scientific Layer

- Supports activity-based quantification (ISO 14064 / 14067)
- Consistent with behavioral science evidence models
- Compatible with emissions attribution frameworks

Governance Layer

- IFRS S1/S2
- COSO internal controls
- Multi-layer verification & traceability

Non-Market UN Governance Layer

- UNFCCC NMA (Article 6 Non-Market Approaches)
- OECD non-market governance principles
- Alignment with institutional transparency frameworks

Institutional Syntax Layer

- PADV 4-Ring behavior system
- $PADV^2$ multi-layer governance grammar
- ISA institutional architecture
- SFA sustainability finance non-market structure
- ICTF institutional credibility maturity model

2.5 Summary of the Third Sustainability Calculation

Structure

The emergence of NTCC defines a new institutional era:

Natural Carbon Sink → Ecological Foundation

Carbon Credit → Market Foundation

NTCC → Behavioral Foundation

NTCC completes the tri-structure of climate accounting and allows global organizations to:

- Integrate behavior into governance
- Strengthen Scope 3 visibility
- Improve ICP accuracy
- Build cross-sovereign evidence systems
- Ensure audit- and verification-ready data
- Align with all major international standards

NTCC is not a replacement.

It is the **missing structural layer** that enables governance to finally recognize the role of human behavior in climate contribution.

Chapter 3. NTCC (Non-Tradable Carbon Credit) — Methodology Overview

A Governance-Grade Behavioral CO_2e Evidence Architecture

3.1 Definition of NTCC

NTCC (Non-Tradable Carbon Credit) is defined as:

A non-market, non-financial, non-offset, non-tradable behavioral CO_2e unit representing 1 ton of verified carbon-equivalent contribution generated through evidence-based participation and action.

Core Definition Components

- **1 NTCC = 1 tCO_2e (verified behavioral contribution)**
- **Evidence-first** (PADV verification pipeline)
- **Non-market** (no price, no trading, no offset value)
- **Non-financial** (not an asset, not a commodity, not a token)
- **Governance-layer** instrument (internal controls, audit evidence)
- **Cross-standard compatibility** (IFRS / GRI / COSO / ISO / UNFCCC NMA)

NTCC **does not** represent avoided emissions, removals, reductions, or offsetting.

It represents **verified, attributable, human-driven participation and action**.

3.2 Verification Layers: The Four-Layer Institutional Pipeline

NTCC is generated through a **four-layer verification architecture**, aligned with **PADV → PADV² → ISA → VISA-Layer** institutional syntax.

Verification layers:

Layer 1 — Participation: Intent & Eligibility Verification

- User identity validation
- Participation intent recording

- Eligibility confirmation (event, activity, role)
- Boundary conditions aligned with **ISO 14064 organizational boundaries**
- PADV-authorized participation protocols apply

Participation establishes **who**, **when**, and **under what governance context** a behavioral event begins.

Layer 2 — Action: Mission Execution & Event-Level Behavior

- Task/mission execution
- QR-based action validation
- Timestamped task completion record
- Required evidence artifacts (photo log, location, metadata)
- Activity category mapped to the **NTCC Methodology Table**

Action establishes **what behavior occurred** and **how it aligns with institutional methodology**.

Layer 3 — Data: Server-Side Verification & Integrity Controls

- Duplicate prevention (anti-double counting)
- Inconsistency checks
- Activity-data confirmation (ISO 14064 compatible)
- Log-integrity validation (COSO control activities)
- Behavioral evidence cryptographic hashing
- Metadata normalization (ISA schema v1.0)

Data verification establishes **the integrity and correctness** of the behavioral record.

Layer 4 — Registry: Immutable Institutional Record Entry

- Registry insertion using immutable logic
- Permanent identifier generation
- Cross-actor traceability (user ↔ event ↔ organization)
- Evidence chain anchoring
- Non-market sealing (NTCC Non-Tradeability Clause)
- Alignment with **UNFCCC Non-Market Approaches (NMA)**

The registry establishes **the final, immutable, institutional-grade evidence**

unit.

3.3 Data Characteristics of NTCC

NTCC units carry a specific set of data characteristics that allow them to function as **audit-equivalent, cross-standard, non-market governance evidence**.

A. Timestamped, Non-Replicable Behavioral Evidence

Each NTCC is linked to:

- Participation timestamp
- Action timestamp
- Verification timestamp
- Registry timestamp

This satisfies IFRS S2 requirements for **timeliness, traceability, and auditability.**

B. Multi-Actor Traceability

NTCC provides actor-level precision:

- Individual → event
- Event → brand
- Brand → organizer
- Organizer → institution

This enables:

- Scope 3 behavioral attribution
- Multi-stakeholder governance
- Cross-sovereign verification

C. Consistent Quantification Model

All NTCC units follow:

- A standardized equivalence methodology (tCO_2e per activity class)
- ISO 14064 activity-data compatibility
- IFRS / GRI “consistency” and “comparability” quality requirements

D. Immutable Evidence Architecture

- Hash-locked evidence
- Log-integrity protection
- Registry immutability
- No backward alteration
- No reclassification
- No post-issuance modification

This satisfies COSO "evidence chain integrity" expectations.

3.4 NTCC vs. Carbon Credits — Methodological Differences

Feature	**NTCC**	**Carbon Credit / Offset**
Nature	Behavioral evidence unit	Market reduction/removal unit
Market role	**Non-market**	Tradable commodity
Transferability	**No**	Yes
Offset capability	**No**	Yes
Quantification	Activity-evidence → CO_2e equivalence	Project-based verifier quantification
Financial value	**None**	Yes
Governance role	Internal carbon governance, ICP support	Regulatory or voluntary offset
Measurement unit	Verified behavior	Emission reduction/removal

NTCC is **not** a less strict carbon credit—It is a **different class of sustainability unit** that fills the behavioral gap.

3.5 Institutional Positioning of NTCC

NTCC is positioned within the **governance layer**, not the market layer:

- **Governance-first** (not finance-first)
- **Evidence-first** (not price-first)
- **Institutional syntax unit** (not commodity unit)
- **Supports ICP and ESG governance**
- **Strengthens internal controls and disclosure accuracy**

NTCC is structurally aligned with:

- **IFRS** (governance & evidence quality)
- **GRI** (Scope 3 behavior-related expansion)
- **COSO** (internal controls & evidence lifecycle)
- **ISO 14064** (activity data compatibility)
- **UNFCCC NMA** (non-market mechanisms)
- **OECD** (institutional governance principles)

3.6 Why NTCC is Required in Modern Carbon Governance

Three global structural failures make NTCC necessary:

Market mechanisms cannot measure human behavior

Carbon credits measure **projects**, not **people**.

NTCC restores the human/institutional dimension.

ICP lacks a behavioral quantification unit

Internal Carbon Pricing can price emissions—but cannot price **behavioral contribution** without NTCC.

Scope 3 remains unverifiable without multi-actor behavioral evidence

NTCC provides:

- Actor-level attribution
- Cross-event comparability
- High-resolution behavioral data

- Governance-grade logs

3.7 Summary of the NTCC Methodology

NTCC is:

- The **world's third sustainability calculation structure**
- A **governance-evidence CO_2e unit**
- Verified through **four-layer institutional verification**
- Fully **non-tradable**, **non-financial**, and **non-offsetting**
- Cross-standard compatible
- Designed for **ICP integration**, not carbon markets
- Aligned with global institutional syntax frameworks (PADV × ISA × $PADV^2$ × SFA × ICTF)

NTCC provides what science, markets, and policy have not yet captured—**a verified behavioral layer that completes global climate accounting.**

Chapter 4. Internal Carbon Pricing (ICP) — Institutional Framework

A Governance-First Architecture for Internal Climate Decision-Making

Internal Carbon Pricing is widely recognized as one of the most powerful internal governance mechanisms for climate risk internalization. Yet, traditional ICP frameworks—designed for financial modeling, capital budgeting, and emissions cost estimation—lack the structural capability to integrate **behavioral evidence**, **multi-actor attribution**, or **institutional-grade data**.

This chapter reframes ICP not as a financial instrument but as a **governance architecture**, defining how it must evolve to incorporate **NTCC**, the world's first **behavioral CO_2e evidence unit**.

4.1 Purpose and Role of Internal Carbon Pricing

ICP exists to **internalize climate impact** into an organization's strategic and operational decision-making.

While carbon markets price emissions externally, ICP prices carbon **internally**, enabling organizations to:

Internalize climate-related financial and operational risk

Including transition risk, resource allocation, capital planning, and long-term exposure.

Guide capital budgeting and project evaluation

Carbon becomes an internal input variable in investment decisions.

Allocate resources toward low-carbon pathways

Uses internal price signals to incentivize departments to reduce climate exposure.

Strengthen climate governance and internal accountability

ICP becomes a structural mechanism that informs:

- performance evaluation
- procurement decisions
- operational efficiency
- sustainability strategy
- executive governance

Support disclosure alignment (IFRS S1/S2)

ICP provides internal justification for:

- climate risk management
- scenario analysis
- transition planning
- governance oversight

ICP is therefore **not** merely a calculation—it is an **institutional instrument** for climate governance.

4.2 ICP Models — Global Institutional Classifications

International practice recognizes four major ICP models, each serving a different governance function.

Model 1 — Shadow Price

An internal "what-if" carbon value applied to planning and scenario analysis.

Used for:

- strategic planning
- long-term investment evaluation
- scenario simulation for IFRS S2

Not used for:

- internal budget deduction
- real transactions

It formalizes **risk visibility**, not financial liability.

Model 2 — Internal Carbon Fee

A structural mechanism that charges internal departments based on carbon intensity.

Used for:

- operational incentives
- cost internalization
- behavior-based optimization

Departments pay a fee into an internal sustainability fund.

Model 3 — Capital Budgeting Integration

Carbon becomes a required variable in capital planning models (NPV, IRR, WACC).

Used for:

- capital investment approval
- technology selection
- asset lifecycle cost modeling

Strengthens investment redirection toward sustainable assets.

Model 4 — Performance Metric Integration

Carbon intensity becomes a part of:

- KPIs
- executive incentives
- procurement scorecards
- supplier performance evaluation

Transforms ICP from an accounting tool into a **governance mechanism**.

4.3 Limitations of Traditional ICP (Before NTCC)

Despite its wide adoption, traditional ICP frameworks suffer from structural limitations that prevent full governance effectiveness.

Limitation 1 — No Behavioral Layer

ICP can price emissions but cannot price **actions**.

Questions ICP cannot answer:

- "How much behavior contributed to this outcome?"
- "Which departments created positive climate impact?"
- "Which events mobilized measurable contributions?"

Traditional ICP is **blind to human behavior**.

Limitation 2 — No Multi-Actor Attribution

ICP cannot allocate climate-related value across:

- individuals
- business units
- events
- suppliers
- cross-organizational partners

Traditional systems aggregate data into a single emission figure, losing granularity.

Limitation 3 — No Evidence-Based Participation Data

Without NTCC, ICP lacks:

- participation-level evidence
- action-level logs
- behavioral metadata
- event-based attribution

This violates COSO's requirement for **evidence-chain integrity**.

Limitation 4 — No Support for Scope 3 Behavioral Impact

Traditional ICP cannot quantify:

- community engagement
- customer action
- participant behaviors
- supply chain behavioral signals
- activity-level Scope 3 contribution

NTCC provides the missing evidence.

Limitation 5 — Vulnerable to Estimation and Model Bias

ICP often relies on:

- proxy data
- average emissions
- assumptions
- hypothetical scenarios

This contradicts ISO 14064's requirement for **activity-based data**.

4.4 The Institutional Reframing of ICP

ICP must evolve from a **financial approximation tool** into a **governance architecture**.

Governance-first ICP supports:

- verified evidence (IFRS)
- structured internal controls (COSO)
- behavior-level integrity (PADV)
- multi-actor traceability (ISA)

- non-market carbon contribution (NTCC)

ICP becomes part of:

(1) Governance Layer

— Not finance layer
— Not market layer
— Not offset layer

(2) Evidence & Internal Control Layer

Aligned with COSO Functioning as an extension of sustainability internal controls

(3) Strategy & Allocation Layer

Integrating verified behavior into long-term planning

(4) Cross-Standard Reporting Layer

Providing organizations with a defensible, auditable evidence trail

4.5 Why ICP Requires NTCC

NTCC introduces the world's first **behavioral CO_2e evidence unit**, enabling ICP to:

- integrate measurable behavior
- price internal participation
- include multi-actor attribution
- incorporate event and mission-based data
- support Scope 3 behavioral accounting
- correct for estimation bias
- build audit-grade carbon governance

NTCC becomes the **Behavioral Carbon Block** in ICP—a structural missing piece the world has not previously possessed.

4.6 Summary of Chapter 4

ICP has historically operated without the ability to quantify or price human behavior. By embedding NTCC as a governance-first behavioral evidence unit, ICP evolves into a **complete internal governance mechanism** aligned with international standards, audit logic, and cross-sovereign institutional syntax.

Traditional ICP = financial approximation NTCC × ICP = governance architecture grounded in verified evidence.

This transformation is essential for modern climate governance, disclosure integrity, and multi-actor attribution.

Chapter 5. NTCC × ICP — Institutional Integration Model

A Unified Governance Architecture Connecting Behavioral Evidence and Internal Carbon Pricing

NTCC (Non-Tradable Carbon Credit) provides the world's first **behavioral CO_2e evidence unit**, while ICP (Internal Carbon Pricing) provides the enterprise-level mechanism for internalizing climate impact.

Their integration creates a **new institutional layer** enabling organizations to incorporate **verified human behavior** into climate governance, internal controls, and risk management.

NTCC × ICP is not a financial model; it is an **institutional integration architecture**.

5.1 Integration Principle — The Behavioral Carbon Block

The core principle of NTCC × ICP integration is:

NTCC acts as the Behavioral Carbon Block inside Internal Carbon Pricing systems.

This means ICP no longer prices only **emissions** or **assets**, but can now price

behavioral contribution, creating a **three-layer governance structure**:

Traditional ICP

1. **Emissions layer** (Scope 1/2/3)
2. **Financial layer** (shadow price, fee, budgeting)

ICP with NTCC

1. **Emissions layer**
2. **Behavioral layer (NTCC) ← new institutional layer**
3. **Financial/governance layer**

NTCC introduces a **non-market behavioral dimension**, allowing ICP to quantify and govern:

- participation
- mission actions
- cross-department engagement
- publicly observable actions
- Scope 3 influence
- community and customer activation

No existing carbon credit system delivers this function.

5.2 How NTCC Supports ICP (Mechanistic Integration)

NTCC supports ICP across four institutional mechanisms:

Mechanism 1 — Behavioral CO_2e Attribution

NTCC provides **verified, attributable CO_2e units** for:

- department contributions
- supply chain segments
- event-level participation
- consumer/community behaviors
- public engagement
- internal mission actions

This allows ICP to operate with **behaviorally granular data**, not only emissions

aggregates.

Mechanism 2 — Filling the Scope 3 Governance Gap

Scope 3 is the **least controllable**, least measurable, and least verified domain in sustainability.

NTCC fills this gap by providing:

- multi-actor verified evidence
- event-based behavioral quantification
- activity-level metadata
- participation-driven attribution

ICP can now truly internalize Scope 3 **behavioral** dynamics.

Mechanism 3 — Strengthening Internal Controls (COSO-Compatible)

NTCC creates:

- audit-equivalent evidence
- integrity-protected logs
- multi-layer verification
- cross-entity traceability

ICP now has a **governance-ready input**, enabling:

- control activities
- monitoring mechanisms
- risk mitigation
- governance oversight
- assurance readiness

This ensures consistency with **COSO Internal Control – ESG Guidance**.

Mechanism 4 — Creating a Behavioral Pricing Channel

ICP assigns an internal carbon value to NTCC-derived behavioral evidence.

Examples:

- A department generating 10 NTCC may receive an “internal governance credit”

- Leadership KPIs can use NTCC generation as an internal performance indicator
- Events may produce NTCC-linked governance scoring
- Supplier evaluation may apply NTCC-derived "behavioral governance weighting"

This creates the world's first **behavioral carbon valuation channel**, entirely separate from markets.

5.3 Governance Logic — Where NTCC × ICP Converge

NTCC is **evidence-first**.

ICP is **finance-first**.

Their intersection occurs in the **governance layer**.

The Three Governance Convergence Zones

Zone 1 — Evidence → Decision Making

NTCC provides auditable evidence.

ICP transforms that evidence into internal decision variables.

Examples:

- Adjusted department carbon scores
- Behavior-weighted capital allocation
- Supplier behavior scoring
- ESG-linked remuneration metrics

Zone 2 — Action → Internal Pricing

NTCC measures action.

ICP assigns internal value to action outcomes.

Not a financial instrument → a **governance instrument**.

Zone 3 — Participation → Internal Incentive Architecture

NTCC quantifies participation.

ICP uses that participation to structure:

- engagement incentives
- internal governance rules
- sustainability program adoption
- climate maturity pathways

Thus creating a **Unified Behavioral Governance System**.

5.4 Integration Model Architecture

The NTCC × ICP integration model forms a **four-layer institutional architecture**.

Layer 1 — Behavioral Input Layer (PADV)

- Participation
- Action
- Mission completion
- Activity evidence
- Action metadata

Layer 2 — Verification Layer (VISA-Layer)

- Duplicate prevention
- Log integrity
- Evidence validation
- ISO-aligned activity data
- Immutable registry anchoring

Layer 3 — ICP Processing Layer

ICP uses NTCC outputs for:

- behavioral valuation
- internal pricing
- scenario analysis
- performance metrics
- resource allocation
- internal incentives

Layer 4 — Governance Output Layer (SFA × ISA × ICTF)

Integration results include:

- strengthened Scope 3 reporting
- enhanced governance maturity
- cross-standard disclosure
- improved institutional credibility tiers
- audit-ready internal controls

This is the first unified architecture connecting **behavior → verification → pricing → governance**.

5.5 Behavioral Carbon Block — Formal Definition

To formalize integration, the Behavioral Carbon Block is defined as:

"A non-market, governance-only CO_2e evidence layer derived from verified human behavior, inserted into internal carbon pricing systems for corporate decision-making and governance evaluation."

This block must satisfy:

- non-tradability
- non-offset
- non-financial
- cross-standard compatibility
- evidence-chain integrity
- multi-actor attribution
- institutional neutrality

It is an **institutional construct**, not a commodity.

5.6 Institutional Use Scenarios for NTCC × ICP

Scenario 1 — Department-Level Carbon Governance

Departments gain NTCC for activating climate-positive behavior.

ICP assigns internal value.

Scenario 2 — Event-Level Behavior Governance

Exhibitions, retail events, and mass activities produce NTCC.

ICP interprets these as behavioral contributions.

Scenario 3 — Supplier & Partner Governance

Suppliers can be evaluated by their NTCC-linked behavioral engagement.

Scenario 4 — Internal Remuneration & KPIs

ICP can reward behavior (NTCC) rather than only emissions reductions.

Scenario 5 — Scope 3 Behavioral Evidence for Reporting

Reportable in:

- IFRS Governance
- GRI 305
- COSO ESG evidence chains

Scenario 6 — Strategic Capital Planning

Projects with strong NTCC generation may be prioritized under ICP.

5.7 Summary of Chapter 5

NTCC × ICP establishes the world's first integration between behavioral evidence and internal carbon governance.

It enables organizations to:

- quantify participation
- verify action
- price behavior internally
- govern behavior institutionally
- strengthen Scope 3 disclosure
- modernize sustainability governance
- satisfy international audit and disclosure standards

NTCC does **not** enter markets.

NTCC does **not** offset emissions.

NTCC does **not** replace carbon credits.

Its role is to **complete ICP** by filling the missing **behavioral layer** within global

sustainability governance.

Chapter 6. Behavioral Carbon Accounting

A Verified Evidence Framework for Attributing CO_2e to Human Behavior within Institutional Governance

Behavioral Carbon Accounting (BCA) is the methodological foundation that enables NTCC to represent **1 tCO_2e of verified behavioral contribution**.

While traditional carbon accounting quantifies **emissions**, Behavioral Carbon Accounting quantifies **actions**—the human, institutional, and participatory behaviors that influence climate impact but have historically never been measurable, attributable, or auditable.

This chapter defines the full architecture of Behavioral Carbon Accounting within the PADV institutional syntax.

6.1 PADV → NTCC Pipeline (Participation → Action → Data → Value)

The Behavioral Carbon Accounting system is structured as a **four-stage evidence pipeline**, aligning with PADV's original methodology and further formalized in PADV[2] and ISA.

Stage 1 — Participation (Intent & Eligibility Evidence)

Behavioral carbon accounting begins with **intent**:

- Participant identity is validated
- Eligibility criteria are checked (event, department, stakeholder role)
- Governance boundaries are defined (ISO 14064 organizational boundary alignment)
- Participation timestamp is recorded
- PADV "initiated behavior" syntax is triggered

Participation transforms a potential action into a **governable event**.

Stage 2 — Action (Mission Execution & Behavioral Completion)

Action is the **functional kernel** of behavioral carbon accounting:

- The participant executes a PADV mission or action
- Evidence artifacts are captured (QR scan, geolocation, photo, metadata)
- Activity type is linked to the **NTCC Quantification Table**
- Verification rules (VISA-Layer) check:
    - authenticity
    - mission integrity
    - action completeness

Action transforms human behavior into **quantifiable evidence**.

Stage 3 — Data (Verification, Integrity & Institutional Logging)

Data verification is performed by server-side systems under ISA governance:

- Deduplication (anti-double counting)
- Log integrity checks (hashing, cryptographic validation)
- Time-sequence validation (ISO 14064 activity-data logic)
- Cross-actor consistency checks
- Metadata normalization (NTCC Metadata Schema v1.0)
- Institutional validity checks (COSO internal controls)

Data transforms action into **audit-equivalent evidence**.

Stage 4 — Value (NTCC Issuance & CO_2e Attribution)

Finally, evidence is converted into NTCC (1 NTCC = 1 tCO_2e) through:

- Quantification logic
- Attribution rules
- Registry insertion
- Immutable, non-market issuance
- Cross-standard compliance sealing

Value transforms verified evidence into a **governance-grade CO_2e attribution unit**.

6.2 Behavioral Attribution

Behavioral Carbon Accounting requires a **scientifically defensible, institutionally neutral attribution model**.

This model is based on:

- **Activity Data** (ISO 14064, ISO 14067)
- **Behavioral Evidence** (PADV)
- **Institutional Syntax** (ISA, PADV^2)
- **Verification Layer** (VISA-Layer)

Attribution Logic

Each NTCC unit is based on:

(1) Action Event Metadata

- timestamp
- actor identity
- event ID
- mission ID
- category of behavior
- evidence type

(2) Verification Records

- server-side logs
- integrity checks
- validation markers
- anti-duplication
- institutional signatures

(3) NTCC Methodology Table

This contains:

- Activity → CO_2e equivalence
- Scope 3 relevance
- Behavioral intensity weighting

- Institutional adjustment factors

(4) Organizational Boundary Alignment

Mapping to:

- corporate division
- event operator
- supply chain segment

This enables **multi-level attribution** compatible with IFRS & GRI disclosure requirements.

ISO-Compatible Activity Data Model

Behavioral carbon accounting must align with:

- ISO 14064 (GHG quantification)
- ISO 14067 (product carbon footprinting)
- UNFCCC NMA transparency principles

Thus, activity data are classified as:

A. Direct Behavioral Evidence

Captured through PADV missions.

B. Indirect Behavioral Influence

Participation that alters organizational climate behavior.

C. Systemic Behavioral Effects

Aggregated behavioral datasets that reveal climate-related patterns.

Each contributes to the NTCC methodology at different weighting levels.

6.3 Multi-Actor Contribution

Behavioral carbon accounting must accommodate **multi-actor dynamics**, since climate behavior is not isolated to single individuals or departments.

NTCC supports four attribution layers:

Individual-Level Attribution

Based on actions performed by:

- employees
- consumers
- visitors
- participants
- community members

This enables:

- micro-level governance
- behavioral insight
- internal ICP scoring

Departmental & Organizational Attribution

Behavior aggregated by:

- business unit
- functional team
- project group
- operating division

Supports:

- internal controls
- KPI alignment
- ICP performance metric integration

Event-Level Attribution

Critical for large-scale behavioral data:

- exhibitions
- conferences
- festivals
- corporate activations
- on-site sustainability missions

Supports:

- multi-actor synchronization
- behavior-intensive governance
- high-density evidence generation

Supply Chain & Cross-Entity Attribution

Behavior credited to:

- suppliers
- vendors
- logistics partners
- franchise networks
- collaborating institutions

Enables:

- Scope 3 behavioral quantification
- supplier governance scoring
- non-market institutional coordination

6.4 Key Characteristics of Behavioral Carbon Accounting

1. **Human-Centered**

   Behavior, not emissions, becomes the quantification unit.
2. **Evidence-Based**

   All behaviors must be verified before being quantified.
3. **Immutable**

   Records cannot be altered post-verification.
4. **Non-Market**

   No trading, pricing, or offsetting.
5. **Multi-Actor**

   Attribution reflects complex real-world institutional interactions.
6. **Audit-Compatible**

   Consistent with IFRS S2, COSO, ISO 14064, UNFCCC NMA.
7. **Syntax-Governed**

   Aligned with PADV^2 and ISA institutional grammar.

6.5 Summary of Chapter 6

Behavioral Carbon Accounting:

- Converts behavior into institutional evidence
- Uses PADV verification to ensure integrity
- Produces NTCC as a governance-grade CO_2e unit
- Aligns with the world's major sustainability standards
- Enables ICP to quantify behavior
- Strengthens Scope 3, governance, and internal controls
- Completes the missing behavioral layer in global sustainability accounting

NTCC is not a replacement for emissions accounting—it is the **behavioral complement** that finally allows organizations to measure what people and institutions *actually do* for climate action.

Chapter 7. SFA Framework Integration

How NTCC Functions as a Behavioral Credit Within the Sustainability Finance Architecture (SFA)

The Sustainability Finance Architecture (SFA) establishes a **non-market institutional structure** for integrating verified behavioral contribution (NTCC), organizational governance, and internal climate finance mechanisms such as ICP.

SFA is the foundation that ensures NTCC remains:

- **non-financial**
- **non-tradable**
- **non-offsetting**
- **governance-purposed**
- **cross-standard compatible**

This chapter explains how NTCC is embedded within SFA's multi-layer architecture.

7.1 The Role of SFA in Institutional Carbon Governance

SFA is designed to address a core global challenge:

Sustainability systems have financial structures, but no non-market institutional structure for behavioral contribution.

Markets have carbon credits. Nature has carbon sinks.

Institutions did not have a **behavioral carbon governance unit**—until NTCC.

SFA establishes this missing governance foundation by defining four institutional layers:

1. **Credit Layer**
2. **Registry Layer**
3. **Governance Layer**
4. **Non-Market Finance Layer**

NTCC occupies the **Credit Layer** as the world's first **Behavioral Credit**.

7.2 Credit Layer — NTCC as a Behavioral Credit

Within SFA, NTCC is defined as:

A governance-only, non-tradable behavioral carbon evidence credit representing 1 tCO_2e of verified human/institutional action.

Characteristics within the Credit Layer:

- Not tradeable
- Not transferrable
- Not offsettable
- Not a financial instrument
- Not a market commodity
- Not eligible for carbon accounting substitution

NTCC functions as: **A new category of credit: Behavioral Credit (BCU – Behavioral Contribution Unit)**

BCUs differ fundamentally from carbon credits (offsets):

Feature	NTCC (Behavioral Credit)	Carbon Credit (Offset)
Tradability	No	Yes
Financial value	None	Yes
Purpose	Governance	Compensation/offset
Measurement	Verified behavior	Emission reduction/removal
Layer	Institutional	Market

SFA formalizes NTCC as a **non-market credit**, ensuring full compliance with:

- IFRS S1/S2
- UNFCCC NMA (Article 6)
- COSO Internal Controls
- OECD non-market governance principles

7.3 Registry Layer — NTCC as an Immutable Institutional Record

The SFA Registry Layer ensures NTCC is anchored as a **permanent institutional record**, not a financial asset.

NTCC Registry Characteristics:

- Immutable
- Non-transferable
- Evidence-linked
- Actor-specific
- Timestamped
- Integrity-verified
- Non-market sealed

The registry structure aligns with:

- ISA institutional syntax
- VISA-Layer verification

- PADV evidence lifecycle
- ICTF credibility-tier requirements

The registry serves **institutional traceability**, not trading or settlement.

7.4 Governance Layer — NTCC as Evidence for Internal Controls

The Governance Layer is where NTCC's institutional purpose becomes functional.

NTCC supports:

Governance

- Board-level climate oversight
- ESG governance committees
- Sustainability reporting structures

Risk Management

- Internal control evidence (COSO)
- Climate-related governance risk
- Integrity of Scope 3 behavioral disclosures

Internal Audit

- Evidence-chain validation
- Behavioral verification logs
- Cross-department attribution

NTCC is therefore not a carbon product—It is a **governance asset**.

7.5 Non-Market Finance Layer — ICP Integration

The Non-Market Finance Layer is where NTCC integrates most directly with Internal Carbon Pricing (ICP).

NTCC supports ICP by:

- providing behavior-based CO_2e units

- enabling internal behavioral valuation
- allowing governance-based pricing frameworks
- enhancing internal incentives and allocations
- strengthening non-market climate finance models

SFA ensures **NTCC × ICP** is:

- governance-first
- evidence-based
- non-monetary
- non-offsetting
- cross-standard aligned

NTCC never becomes:

- a carbon price
- a monetary unit
- a credit for sale
- a substitution for emissions

NTCC participates only as a **Behavioral Carbon Block** inside the ICP system (as defined in CH5).

7.6 Cross-Standard Alignment Within SFA

SFA ensures NTCC remains aligned with:

IFRS S1/S2

- Governance
- Risk management
- Internal controls
- Data integrity

GRI 305

- Behavior-based Scope 3 enhancement
- Participation-level transparency

COSO

- Control activities
- Monitoring mechanisms
- Evidence-chain integrity

ISO 14064 / 14067

- Activity data classification
- Quantification consistency

UNFCCC NMA (Non-Market Approaches)

- Non-market governance
- Transparency
- Multi-actor coordination

SFA is the **alignment architecture** ensuring NTCC remains compliant with global non-market governance logic.

7.7 Why NTCC Requires SFA

Without SFA, NTCC could be misinterpreted as:

- a carbon credit
- a market instrument
- a quasi-financial product
- an offset
- a pseudo-commodity

SFA protects NTCC by enforcing:

- **non-market boundaries**
- **non-financial identity**
- **institutional neutrality**
- **governance integrity**
- **cross-standard compliance**

SFA is the institutional safeguard ensuring NTCC remains purely a **Behavioral Credit**—not a tradable or financial unit.

7.8 Summary of Chapter 7

NTCC integrates into the Sustainability Finance Architecture not as a market instrument but as a **governance instrument**.

Its institutional functions within SFA are:

- **Credit Layer:**
  NTCC becomes the world's first **Behavioral Credit**.
- **Registry Layer:**
  NTCC becomes an immutable, non-market institutional record.
- **Governance Layer:**
  NTCC becomes a governance and internal control evidence unit.
- **Non-Market Finance Layer:**
  NTCC integrates into Internal Carbon Pricing as the **Behavioral Carbon Block**.

SFA ensures NTCC stays pure, compliant, non-market, and institutionally governed—exactly as defined in **PADV–NTCC–SFA White Paper (DOI: 10.64969/padv.ntcc.sfa.2025.v1)**.

Chapter 8. Cross-Standard Mapping

A Comprehensive Alignment of NTCC and ICP with Global Sustainability, Assurance, and Governance Frameworks

NTCC × ICP operates strictly within the **governance layer**, not the market layer.

This chapter demonstrates how NTCC functions as a **non-market, audit-equivalent behavioral evidence system** compatible with all major international sustainability standards.

This mapping ensures NTCC can be safely referenced by multinational corporations, auditors, and regulators without regulatory conflict or market substitution.

8.1 IFRS S1 / S2 Alignment

International Sustainability Standards Board (ISSB)

IFRS S1 — General Requirements

IFRS S2 — Climate-Related Disclosures

How NTCC Aligns With IFRS

IFRS Requirement	NTCC Contribution	Alignment Type
Governance	NTCC provides board-usable, verifiable behavioral datasets; supports oversight functions	Governance-aligned
Risk Management	NTCC fills Scope 3 behavioral risk blind spots with verified evidence	Evidence-aligned
Metrics & Targets	NTCC supports internal behavioral metrics (not financial metrics)	Non-market alignment
Data Quality	NTCC uses four-layer verification (PADV → Action → Data → Registry)	Audit-equivalent
Internal Controls	NTCC integrates with COSO and ISA internal controls	Control-aligned

IFRS S2: Climate-Specific Elements

NTCC supports:

- transition planning evidence
- internal carbon governance
- behavioral signals for scenario analysis
- non-financial evidence supporting ICP

NTCC DOES NOT:

- replace emissions data

- represent reductions/removals
- function as a financial carbon unit

Result: NTCC is fully IFRS-compatible because it strengthens **governance**, not carbon accounting substitution.

8.2 GRI 305 — Emissions (Scope 1/2/3)

NTCC expands the **Scope 3 behavioral dimension**, a long-standing global blind spot.

Key Alignment Points

GRI Category	NTCC Enhancement
Scope 1 / 2	No direct overlap — NTCC does not quantify emissions
Scope 3 Behavioral Evidence	NTCC provides participation-, action-, and event-level behavioral attribution
Transparency	Immutable evidence logs strengthen organizational disclosure credibility
Comparability	NTCC uses standardized CO_2e equivalence tables validated through PADV

GRI-Compatible, but Non-Substitutive

NTCC **supports disclosure**, but never replaces emissions reporting.

8.3 COSO ESG Internal Controls Alignment

COSO provides the global standard for governance, control, monitoring, and evidence reliability.

NTCC delivers **internal control-strengthening data**, including:

1. **Control Environment**
   NTCC provides evidence for sustainability governance structures.

1. **Risk Assessment**

   NTCC supports behavioral-risk identification within Scope 3.
2. **Control Activities**
   - Anti-double counting
   - Verification checks
   - Immutable registry protections
   - Boundary validation
3. **Information & Communication**

   Transparent behavioral datasets that satisfy COSO information-quality criteria.
4. **Monitoring Activities**

   NTCC enables continuous governance assurance.

Outcome: NTCC is **COSO-congruent**, making it usable in Big 4 ESG audits without regulatory or market conflict.

8.4 ISO 14064 / ISO 14067 Mapping

Activity-Based Carbon Quantification Standards

How NTCC Aligns

ISO Standard	Relevance to NTCC
ISO 14064-1	NTCC uses activity-level classification aligned with ISO's activity-data approach
ISO 14064-3	NTCC uses multi-layer verification compatible with ISO verification principles
ISO 14067	Supports product/service carbon footprinting by offering behavior impact data

Boundary Management

NTCC boundaries conform to ISO organizational boundary concepts but remain **non-emission, non-offset units**.

8.5 UNFCCC Alignment — Non-Market Approaches (NMA)

NTCC aligns structurally with:

- **UNFCCC Article 6.8 (NMA)**
- **Transparency Framework (ETF)**
- **Behavioral participation models (UNDP/UNFCCC programs)**

UNFCCC-Consistent Characteristics of NTCC

- Non-market
- Non-transferable
- No offsetting
- No carbon reduction/removal claims
- Supports voluntary behavioral governance
- Multi-actor involvement
- Evidence-chain transparency

NTCC is not eligible for:

- Article 6.2 ITMOs
- Article 6.4 carbon trading
- CORSIA
- Any compliance mechanism

Conclusion: NTCC is **structurally compatible** with UNFCCC NMA and transparency principles.

8.6 OECD Institutional Governance Alignment

OECD provides the foundation for **non-market governance, transparency, and institutional accountability**.

NTCC aligns with OECD principles via:

- behavioral participation measurement
- evidence-based governance
- non-market institutional design
- cross-sovereign interoperability

- transparency & integrity principles

NTCC can be referenced as:

- an institutional transparency instrument
- a governance-data enhancement tool
- a behavioral evidence system for ESG strategy

8.7 Cross-Standard Synthesis Table

Global Standard	NTCC Role	Compliance Category
IFRS S1/S2	Governance, evidence, internal controls	Fully aligned (Non-market)
GRI 305	Scope 3 behavioral evidence	Supportive alignment
COSO	Evidence-chain, monitoring, internal control	Strong alignment
ISO 14064/14067	Activity data & verification compatibility	Technical alignment
UNFCCC NMA	Non-market governance	Structural alignment
OECD Governance	Transparency & institutional accountability	Conceptual alignment

8.8 Summary of Chapter 8

NTCC is compatible with all major international sustainability, audit, assurance, and governance frameworks **because it operates entirely within the non-market governance layer**.

NTCC:

- does **not** replace emissions data
- does **not** substitute for carbon credits
- does **not** interfere with offset markets

- does **not** conflict with IFRS/GRI/ISO reporting rules

NTCC **strengthens** global governance compliance by adding:

- verified behavior
- audit-equivalent evidence
- multi-actor attribution
- internal control reinforcement
- Scope 3 transparency
- ICP integration compatibility

This cross-standard alignment makes NTCC the first **globally interoperable behavioral CO_2e evidence unit**.

Chapter 9. Institutional Use Case — Exhibition Demonstration Dataset

A Global-Scale, High-Density Behavioral Evidence Case for Non-Market Carbon Governance and ICP Integration

This chapter presents the **Exhibition Behavioral Demonstration Dataset**—currently the world's most comprehensive institutional dataset for **verified behavior → CO_2e attribution** using NTCC.
It is retained as the **sole case study** in this white paper because of its unmatched:

- **scale**
- **behavioral density**
- **multi-actor complexity**
- **institutional traceability**
- **governance relevance**

This dataset is not a commercial example.

It is a **global non-market demonstration of NTCC methodology in real-world conditions**, providing a full-scale validation for the NTCC × ICP integration model.

9.1 Overview of the Demonstration Dataset

Across four major exhibitions (2024–2025), the NTCC framework recorded:

11,855 verified behavioral events

(events = mission completions with verified PADV evidence)

5,250,000 public welfare points

(points → represent behavioral intent intensity, not financial value)

15,090.99 $kgCO_2e$ (15.1 tons) NTCC behavioral contribution

(all non-market, non-offset, non-tradable)

72 participating brands

(multi-actor institutional structure)

35,000+ unique participants

(verifiable population-level behavioral response)

These numbers represent **governance-grade data**, not marketing statistics.

All behavioral records were:

- timestamped
- identity-linked
- action-verified
- server-validated
- cross-actor mapped
- immutable in registry

This makes the dataset **institutionally auditable** under IFRS/COSO/ISO governance rules.

9.2 Why Exhibitions Are the Ideal Demonstration Environment

Exhibitions create a rare governance environment combining:

High Density of Actions

Thousands of actions performed in compressed time and space.

Multi-Actor Synchronization

- Participants
- Brands
- Organizers
- Vendors
- Institutions

All acting within the same boundary.

Verifiable On-Site Missions

PADV missions ensure:

- single-point validation
- singular actor identity
- immediate verification
- no possibility of double counting

Cross-Boundary Behavioral Transmission

Exhibitions integrate:

- consumers → brands
- brands → organizers
- organizers → institutional systems

This forms a **multi-node evidence web**, impossible to replicate in digital-only environments.

Ideal for Scope 3 Behavioral Visibility

Traditional accounting cannot measure:

- foot traffic behavior
- sustainability engagement
- micro-actions
- real-world participation
- action-to-impact relationships

Exhibitions make these measurable.

9.3 Institutional Relevance of the Dataset

This dataset exemplifies all six global governance requirements:

IFRS S2 — Governance and Risk Management Evidence

Exhibitions generate:

- action-level climate governance data
- verified behavioral responses
- multi-actor evidence clusters
- ICP-relevant participation signals

GRI 305 — Scope 3 Behavioral Enhancement

Provides a unique:

- participant-level
- activity-based
- behavior-derived

expansion to Scope 3 reporting frameworks.

COSO Internal Controls

Exhibitions are ideal for:

- control activities
- evidence logging
- monitoring mechanisms
- validation procedures

ISO 14064 Activity Data

Exhibitions provide activity datasets directly convertible into NTCC.

UNFCCC NMA (Non-Market Approaches)

Exhibitions demonstrate:

- non-market behavioral contributions
- multi-actor transparency
- voluntary participation

- non-tradable, non-offset systems

OECD Governance Principles

Exhibitions generate:

- transparency
- institutional accountability
- cross-actor coordination
- evidence integrity

The dataset is a **model environment for global non-market governance systems**.

9.4 Behavioral Evidence Architecture of the Dataset

The Exhibition Dataset demonstrates the full **PADV → NTCC pipeline**, including:

A. Participation Layer

35,000+ participants

verified across:

- event gates
- mission QR
- official identity protocols

B. Action Layer

Mission categories included:

- sustainability learning
- vendor engagement
- recycling missions
- educational tasks
- brand interactions
- welfare participation

Each mission produced:

- timestamp
- actor ID

- action metadata
- environmental category

C. Data Layer

Verification included:

- duplicated-event prevention
- integrity checks
- metadata normalization
- fraud-resistant validation

D. Registry Layer

Each verified action contributed to:

- an NTCC-equivalent CO_2e value
- immutable registry inclusion
- governance traceability

9.5 ICP Integration Relevance

The dataset demonstrates why NTCC is essential for **Internal Carbon Pricing**:

Multi-Point Evidence

Actions performed across:

- booths
- zones
- activities
- brand stations

Each point becomes a **behavior node** for ICP valuation.

High-Density Behavioral Data

ICP models require:

- fine-grained attribution
- participation-level inputs
- verifiable evidence

The exhibition dataset satisfies all three.

Real-World Behavioral Impact

Unlike surveys, predictions, or assumptions:

- these actions *actually occurred*
- under controlled institutional boundaries
- with verifiable evidence chains

Multi-Actor Attribution

ICP can allocate behavioral contribution to:

- departments
- suppliers
- partners
- event units

Governance-Grade Data

Meets requirements for:

- internal audit
- governance committees
- sustainability oversight
- cross-functional decision-making

9.6 Why This Dataset Is Globally Significant

This dataset is the world's first to achieve:

- ✓ **Population-scale verified sustainability behavior**
- ✓ **Full PADV verification across 35,000+ actors**
- ✓ **Multi-actor institutional coordination across 72 brands**
- ✓ **Real-world behavioral CO_2e contribution = 15.1 tons NTCC**
- ✓ **Immutable record chain for every action (11,855 events)**
- ✓ **Evidence-first governance architecture**
- ✓ **Direct applicability to Scope 3 expansion, ICP, and ESG governance**

This makes the dataset a **global reference model** for:

- governments

- auditors
- ESG rating agencies
- verification bodies
- academic institutions
- corporate governance leaders

9.7 Summary of Chapter 9

The Exhibition Behavioral Demonstration Dataset serves as:

- the **primary global demonstration** of NTCC methodology
- a **population-scale validation** of PADV behavioral verification
- a **real-world evidence base** for ICP integration
- a **model case** for non-market governance frameworks
- a **reference dataset** for global institutions

It is retained as the sole case study because no other environment currently delivers: **this scale, complexity, evidence integrity, multi-actor structure, and governance relevance.**

This dataset confirms that NTCC is not theoretical—it is **operational, governable, measurable, verifiable, and institutionally deployable**.

Chapter 10. Governance Boundary Conditions

Legal, regulatory, and institutional boundaries governing the use, interpretation, and application of NTCC within ICP and sustainability disclosure systems.

The NTCC framework operates strictly within a **non-market, non-financial, non-offset** institutional boundary.

This chapter defines the **governance perimeter**, ensuring clarity, regulatory consistency, and global interpretive safety when integrating NTCC with Internal Carbon Pricing (ICP), Scope 3 reporting, or broader sustainability governance systems.

10.1 Non-Tradeability Boundary

NTCC is intentionally designed as a non-financial, non-market, non-transferable evidence unit.

It must **not** be interpreted as:

- a carbon credit
- a carbon offset
- a carbon removal certificate
- a financial asset or derivative
- a tradable instrument
- a compliance mechanism
- a market commodity
- an emissions reduction claim
- monetary value of any kind

Governance Statement: NTCC is a *verification artifact*, not a *market claim*.

This ensures alignment with UNFCCC Non-Market Approaches (NMA) and IFRS prohibition against misrepresenting non-financial metrics as financial outcomes.

10.2 Legal Boundary — Separation from Carbon Markets

NTCC must remain fully separated from:

A. Regulatory Carbon Pricing

- Carbon taxes
- Carbon fees
- Mandatory government pricing schemes

B. Market-Based Carbon Instruments

- Voluntary carbon markets (VCM)
- Compliance carbon markets (ETS)
- Certified offset programs (VVB/Verra/Gold Standard/ACR)

C. Legal Rights Associated with Carbon Assets

NTCC conveys **no**:

- property right
- ownership right
- offsetting right
- tradable claim
- emissions reduction entitlement

D. Non-Substitution Rule

NTCC **cannot**:

- reduce emissions liability
- satisfy a regulatory obligation
- replace carbon credits or offsets
- be used for "net-zero" claims
- be monetized or securitized

Legal Positioning:

NTCC exists in a separate legal category: **"Behavioral Non-Tradeable Evidence Units"** analogous to non-monetary audit evidence under COSO.

10.3 Risk Control Boundary — Evidence Integrity

The NTCC system implements a multi-layer governance structure to prevent misuse, misinterpretation, or misrepresentation.

A. Anti–Double Counting

- Single verified action → one data record
- Cryptographic uniqueness
- Time-bound and actor-bound
- Registry-level duplication prevention

B. Data Integrity Controls

- immutable registry hash
- timestamp integrity
- audit trail preservation
- identity-linked verification
- server-side validation logic

C. Governance Controls

Relevant for:

- sustainability committees
- internal audit
- risk management
- ESG reporting committees

Controls include:

- documentation standards
- attribution boundaries
- control activity mapping
- cross-standard validation

D. Misrepresentation Prevention

Organizations must **not**:

- claim NTCC as emission reduction
- convert NTCC into financial value
- market NTCC as a credit or product
- imply regulatory substitution
- bundle NTCC as a financial instrument

These controls ensure alignment with:

- IFRS S1/S2
- ISO 37301 governance compliance
- COSO ESG internal control standards
- OECD Governance Principles

10.4 Institutional Boundary — Intended Use Cases Only

NTCC is valid only for **institutional, non-market** applications, such as:

Internal Carbon Pricing (ICP) Behavioral Layer

Supplementing ICP with verifiable behavior (not financial valuation).

Scope 3 Transparency Enhancement

Providing high-resolution behavioral contribution (not emissions avoidance).

Sustainability Governance

Providing evidence for:

- board oversight
- audit trails
- risk management
- internal governance

Non-Market Approaches (NMA) under UNFCCC

Documenting participation-based climate contribution.

Institutional Behavioral Accounting

Documented via PADV → NTCC methodology.

Educational, analytical, methodological use

For:

- institutions
- auditors
- researchers
- verification bodies

NTCC must never be used as a market instrument.

10.5 Boundary Summary Table

Boundary Category	**NTCC Status**	**Notes**
Financial Instrument	**Not allowed**	Not a commodity, asset, or derivative
Offset / Credit	**Not allowed**	Cannot claim emissions reduction
Regulatory Compliance	**Not allowed**	Cannot replace taxes or obligations
ICP Integration	**Allowed**	Behavioral evidence layer only

Boundary Category	NTCC Status	Notes
Scope 3 Expansion	**Allowed**	Non-market behavioral attribution
Governance Systems	**Allowed**	Internal audit, COSO, IFRS S2
UNFCCC NMA Alignment	**Allowed**	Non-market climate contribution
Trading / Transfer	**Prohibited**	Non-transferable evidence records

10.6 Boundary Rationale — Why These Limits Exist

The strict boundary conditions serve four purposes:

Prevent Market Confusion

Ensures NTCC is never mistaken for a carbon credit.

Maintain Methodological Purity

NTCC is about **behavior**, not **market reduction claims**.

Enable Global Institutional Acceptance

Regulators, auditors, and standard setters require:

- non-financial categorization
- governance clarity
- evidence integrity

NTCC meets these requirements only under strict boundaries.

Ensure Cross-Sovereign Compatibility

NTCC must operate safely across:

- different carbon market systems
- legal jurisdictions
- governance regimes

A non-market, non-financial boundary ensures universal applicability.

10.7 Closing Statement on Governance Boundary

The NTCC governance boundary is intentionally conservative.

This design:

- protects institutional credibility
- preserves non-market integrity
- enables global interoperability
- avoids legal and regulatory conflict
- ensures long-term institutional trust

NTCC must always remain:

evidence-first, non-tradable, non-financial, governance-native.

Chapter 11. Institutional Readiness & Implementation Conditions

A governance-oriented assessment framework defining the prerequisites, maturity requirements, system boundaries, and deployment conditions necessary for organizations adopting the NTCC × ICP integration model.

The integration of NTCC (Non-Tradable Carbon Credit) with Internal Carbon Pricing (ICP) introduces a new governance layer into corporate sustainability architecture: **Behavioral Carbon Accounting**.

Because NTCC operates as a **non-market, evidence-first, verification-native system**, enterprises must satisfy specific institutional conditions before integrating NTCC within governance, Scope 3 accounting, or ICP models.

This chapter defines the **readiness standards**, **institutional maturity thresholds**, and **deployment conditions** aligned with global frameworks such as:

- **IFRS S1/S2**
- **GRI 305**
- **ISO 14064 / 37301 / 14067**

- **COSO ESG Internal Controls**
- **OECD Governance Principles**
- **UNFCCC Non-Market Approaches (NMA)**
- **ICTF — Institutional Credibility Tier Framework**
- **ISA — Institutional Syntax Architecture**

11.1 Governance Preconditions

Before adopting NTCC × ICP, organizations must demonstrate baseline governance capacity.

These governance preconditions ensure that behavioral carbon evidence is correctly interpreted, safely used, and properly embedded in corporate structures.

Board-Level Sustainability Oversight

Organizations must have:

- a sustainability committee or ESG governance mechanism
- annual board-level review of climate governance
- documented roles and responsibilities

NTCC requires governance structures capable of interpreting **non-financial evidence** within broader climate strategy.

Internal Control Environment (COSO-Aligned)

Minimum conditions include:

- integrity controls
- monitoring mechanisms
- documentation standards
- policy consistency
- risk management integration

NTCC contributes verifiable evidence; however, **enterprises must maintain governance integrity over interpretation**.

Ethical Use & Non-Market Compliance

Enterprises must agree that NTCC:

- cannot be traded
- cannot be monetized
- cannot be used to claim emission reductions
- cannot be substituted for regulatory obligations

These governance commitments must be documented internally prior to deployment.

11.2 Data Infrastructure Preconditions

Because NTCC is evidence-based, organizations must maintain a minimum data readiness capability.

Identity & Participation Systems

Organizations need systems capable of supporting:

- participant identification
- engagement tracking
- activity-level attribution

These may include:

- event systems
- CRM systems
- supply-chain identity systems
- workforce participation records

Action & Activity Data Logging

Enterprises must maintain:

- event logs
- action verification protocols
- metadata pipelines
- timestamp integrity

Regression or incomplete data systems may compromise governance validity.

Evidence Preservation Requirements

Aligned with ISO and COSO:

- immutable logs
- hashed or versioned records
- audit trails
- data retention policy

NTCC integration requires **proof of action**, not aggregated or estimated datasets.

11.3 Verification Preconditions

NTCC is built on a multi-layer verification model.

Organizations must align with the following preconditions before issuing NTCC-equivalent behavioral attribution:

PADV Compliance

Organizations must implement PADV's four-stage logic:

1. **Participation** — eligibility, identity
2. **Action** — mission execution
3. **Data** — verification
4. **Value** — contribution attribution

Without PADV compliance, NTCC cannot be generated.

Internal Validation Capacity

Organizations must be capable of verifying:

- mission completion
- action integrity
- data consistency
- boundary definitions
- actor legitimacy

Cross-Actor Coordination

NTCC requires multi-actor verification when deployed in:

- events
- supply chains

- enterprise ecosystems

Thus, organizations must demonstrate operational readiness to coordinate among internal and external stakeholders.

11.4 Interpretation Boundaries for Enterprises

To avoid misrepresentation, misuse, or inaccurate reporting, enterprises must adopt the following interpretation boundaries.

NTCC is Not a Financial Instrument

Organizations may not:

- assign monetary value
- represent NTCC as an asset
- integrate NTCC into financial statements

NTCC is Not an Offset or Emission Reduction

Organizations may not claim:

- avoided emissions
- reduced emissions
- carbon neutrality
- offsetting

NTCC only represents **verified behavioral contribution**.

NTCC Cannot Influence Regulatory Obligations

Organizations must not use NTCC to:

- reduce carbon tax liabilities
- meet ETS or cap-and-trade requirements
- substitute for carbon credits

NTCC is Not Transferable or Tradable

Organizations must agree that:

- NTCC cannot be transferred
- NTCC cannot be sold

- NTCC cannot be bundled or securitized

11.5 Institutional Maturity Levels (ICTF-Aligned)

The Institutional Credibility Tier Framework (ICTF) defines five maturity tiers.

Organizations must meet **Tier 2** minimum readiness for NTCC × ICP integration.

Tier 0 — Non-Compliant

No governance, no verification, no data infrastructure

→ Cannot adopt NTCC

Tier 1 — Basic Governance

Initial ESG structure, limited data

→ Observation only; not eligible for NTCC issuance

Tier 2 — Evidence-Ready

Meets:

- governance minimum
- PADV compliance
- data integrity
- internal controls

→ Eligible for NTCC behavioral attribution

Tier 3 — Institutional-Grade

Meets:

- cross-standard alignment
- audit-ready datasets
- ICP integration
- internal climate governance

→ Strong NTCC × ICP integration candidate

Tier 4 — Cross-Sovereign Alignment

Meets:

- multi-jurisdictional reporting
- institutional syntax governance

- non-market approaches (UNFCCC)

→ Ideal for cross-border NTCC governance

Tier 5 — Institutional Clearing Infrastructure

Meets:

- ISA-layer implementation
- PADV^2 syntax maturity
- SFA-level governance

→ Full institutional integration environment

11.6 Conditions for Safe Deployment

NTCC must be deployed only under conditions that ensure **integrity, neutrality, and non-financial use**.

Governance Safeguards

Organizations must maintain:

- clear internal interpretation guidelines
- anti-misrepresentation protocols
- standard operating procedures
- documented roles and responsibilities

Risk Controls

Organizations must enforce:

- anti–double counting
- anti-fraud validation
- data integrity checks
- registry accuracy audits

Institutional Transparency

Organizations must disclose:

- boundaries of NTCC usage
- non-offset nature
- non-market positioning

- behavioral attribution scope

Periodic Review

Under IFRS/COSO-style governance, organizations should perform:

- quarterly data reviews
- annual governance audits
- methodology updates
- system integrity assessments

11.7 Summary of Readiness Requirements

To adopt NTCC × ICP, organizations must demonstrate:

✓ Board-level climate governance
✓ Evidence-ready data infrastructure
✓ PADV-compliant verification capability
✓ Non-market, non-financial interpretation
✓ Alignment with ICTF Tier 2 or above
✓ Internal control environment consistent with COSO
✓ Readiness for cross-standard mapping (IFRS / GRI / ISO / OECD)

Only under these conditions does NTCC × ICP become:

- safe
- governable
- auditable
- institutionally credible

Chapter 12. Institutional Extensions

Expanding NTCC beyond methodological definitions into cross-domain, cross-actor, and cross-sovereign institutional applications.

NTCC × ICP is not merely a carbon-related methodological addition.

It represents the emergence of a **third sustainability calculation structure**—one rooted in verified behavior, multi-layer governance, and institutional syntax.

This chapter outlines **three major extension pathways** that enable NTCC to function across:

- enterprise governance
- supply chain ecosystems
- cross-sector alliances
- national/international non-market mechanisms
- emerging verification infrastructures

These extensions demonstrate that NTCC is **institutionally expandable**, while remaining **non-market, non-financial, non-offset**, and fully aligned with global governance principles.

12.1 Extension I — Cross-Enterprise Governance Integration

NTCC can be deployed as an institutional evidence layer within:

Internal Carbon Pricing (ICP) Expansion

NTCC supplements ICP by adding:

- verified behavioral contribution
- high-resolution micro-attribution
- participation-based governance signals

NTCC does not replace existing financial carbon pricing models.

It strengthens them by incorporating **behavioral evidence**—the missing dimension in traditional ICP.

Scope 3 Behavioral Reinforcement

Traditional Scope 3 accounting faces:

- low-resolution data
- estimation-based uncertainties
- indirect attribution
- lack of behavioral traceability

NTCC introduces:

- actor-level data granularity

- verified action-to-impact mapping
- institutional traceability
- multi-node attribution
- audit-grade verification

Board-Level Sustainability Governance

NTCC enables new modes of governance reporting:

- behavioral KPIs
- mission-oriented contribution metrics
- department-level climate engagement indicators
- non-financial risk metrics

This enhances IFRS S2 and COSO compliance through **evidence-first climate governance**.

12.2 Extension II — Supply Chain & Multi-Actor Ecosystem Integration

Supply chains produce the majority of global Scope 3 emissions.

But they lack:

- behavioral visibility
- granular participation data
- consistent attribution standards
- cross-actor verification mechanisms

NTCC fills these gaps by enabling:

Supplier-Level Behavioral Attribution

Suppliers can generate NTCC-aligned evidence through:

- workforce participation
- low-carbon actions
- process-based missions
- operational behavior change

This enables **new categories of Scope 3 transparency** not achievable through

LCA alone.

Multi-Tier Supply Chain Evidence Chains

NTCC supports evidence transfer across:

- Tier 1 suppliers
- Tier 2 midstream actors
- Tier 3 upstream producers
- downstream retailers

Each actor adds their behavioral evidence to a **linked institutional chain**, aligning with ISA's multi-layer syntax.

Ecosystem-Level Governance Models

Industries can adopt NTCC to create:

- non-market verification networks
- shared sustainability missions
- cross-actor behavior-driven coalitions
- actionable climate participation frameworks

This enables ecosystem governance analogous to UNFCCC NMA (Non-Market Approaches).

12.3 Extension III — Cross-Sovereign and Global Institutional Alignment

NTCC is designed within the PADV × SFA × ISA × ICTF architecture, enabling compatibility with global governance systems.

Alignment with UNFCCC Non-Market Approaches (NMA)

NTCC satisfies NMA requirements:

- non-tradable
- non-offsetting
- multi-actor participation
- evidence-based contribution
- transparency and traceability

NTCC can serve as a **behavioral evidence mechanism** within future NMA frameworks.

Alignment with OECD Governance Principles

NTCC introduces:

- actor transparency
- participation-based accountability
- multi-level governance mechanisms
- evidence integrity systems

These map directly to OECD's principles of ethical, transparent, accountable governance.

Alignment with ISSB (IFRS S1/S2)

NTCC can support:

- governance disclosures
- risk management systems
- non-financial metrics
- behavioral contribution reporting
- climate governance structures

This strengthens organizational readiness for globally mandatory sustainability reporting.

Institutional Clearing Layer (ISA Expansion)

NTCC aligns with ISA's structure across:

- Participation Syntax
- Action Syntax
- Data Syntax
- Verification Syntax
- Value Syntax

Providing the behavioral layer for global institutional clearing infrastructures.

12.4 Extension IV — Verification Ecosystems & Assurance Models

NTCC enables new forms of verification that were previously impossible.

Multi-Layer Verification (PADV^2)

PADV^2 syntax allows:

- micro-event verification
- behavioral chain-of-custody
- cross-node validation
- mission-level integrity
- registry-level accuracy

Independent Assurance Models

NTCC provides evidence suitable for third-party assurance:

- audit trails
- activity logs
- attribution metadata
- immutable verification records
- standardized conversion methodology

This allows NTCC-aligned data to be reviewed under:

- ISAE 3000
- ISO 14064-3
- OECD assurance frameworks

Institutional Credential Systems

NTCC enables creation of:

- organizational contribution profiles
- behavioral climate credentials
- ecosystem participation indexes
- actor-level governance maturity models

These models will support:

- national sustainability programs
- supply-chain governance
- global ESG data interoperability

12.5 Extension V — Educational, Civic, and Social-Level Systems

NTCC is not limited to enterprises.

Youth & Educational Systems

NTCC supports:

- sustainability literacy missions
- behavior-based SDG learning
- verifiable participation systems
- public benefit engagement

Aligned with UN SDG4 (quality education).

National or Municipal Participation Systems

NTCC can enable:

- city-wide behavioral governance
- public sustainability missions
- cross-community participation layers
- non-market climate engagement programs

Aligned with OECD local governance principles.

Civic & Community Governance

NTCC introduces:

- transparent participation evidence
- community climate contribution metrics
- verifiable mission engagement
- local institutional trust architectures

12.6 Summary of Institutional Extensions

NTCC is extendable across four institutional kernels:

Kernel	Description
Enterprise Governance	ICP reinforcement, Scope 3 visibility, internal climate governance
Supply Chain Ecosystems	multi-tier behavioral attribution, cross-actor evidence chains
Cross-Sovereign Systems	alignment with UNFCCC, OECD, IFRS, ISO; ISA-layer integration
Verification & Assurance Networks	audit-ready behavioral evidence, PADV^2 syntax, SFA governance

These extensions demonstrate that **NTCC is not a market instrument**, but a **global institutional mechanism** for:

- verified behavior
- multi-layer governance
- cross-standard reporting
- cross-sovereign compatibility

Chapter 13. Global Institutional Outlook

The emerging role of NTCC as a global non-market mechanism for verified behavior, institutional trust, and cross-sovereign sustainability governance.

The world is transitioning from a carbon-accounting era defined by **inventories, markets, and offsets**

into a new era defined by **governance, evidence, participation, and multi-actor verification**.

This chapter outlines why NTCC—rooted in PADV, SFA, ISA, and ICTF—is positioned to become a central component of **next-generation global**

sustainability governance, not as a market instrument, but as a **behavioral evidence mechanism** within future institutional architectures.

13.1 The Global Shift Toward Non-Market Governance

Traditional sustainability mechanisms rely heavily on:

- carbon markets
- offsetting programs
- financialized climate instruments
- high-level estimation models

However, these systems face structural limitations:

- lack of behavioral attribution
- insufficient evidence chain
- supply-constrained offset markets
- heterogenous verification regimes
- risk of double counting
- rising concerns of greenwashing

Global governance institutions are now moving toward **evidence-based, non-market mechanisms** that complement regulated markets.

Examples of this shift include:

- **UNFCCC Non-Market Approaches (Article 6.8/6.9)**
- **OECD governance-based climate frameworks**
- **ISSB IFRS S2 emphasis on governance & evidence**
- **ISO 14064 activity data focus**
- **EU Corporate Sustainability Due Diligence Directive (CSDDD)**

NTCC directly aligns with this trajectory by introducing a **verified behavioral evidence unit** that fills the gap left by markets and inventories.

13.2 The Next Frontier: Behavioral Evidence in Global Governance

The next decade of sustainability governance will require:

(1) Micro-level attribution

Understanding *who* contributed *what* at *which point of action*.

(2) Multi-actor verification

Corporations
Suppliers
Communities
Institutions
Participants
Events
Governments

behaving within the same system boundary.

(3) Traceable participation layers

Participation → Action → Data → Verification → Institutional Value.

(4) High-resolution Scope 3 inputs

Replacing estimation-based accounting with verified behavioral data.

(5) Governance-native evidence infrastructure

Institution-level, not market-driven.

Traditional systems cannot satisfy these requirements—but NTCC can.

NTCC provides **the world's first scalable, population-ready, multi-actor behavioral evidence mechanism** designed for institutional governance.

13.3 Cross-Sovereign Convergence: Why NTCC Is Universally Deployable

NTCC is uniquely suited for cross-sovereign application because it is:

- **non-market**
- **non-financial**
- **non-offsetting**
- **behavioral-based**
- **evidence-first**
- **framework-neutral**

These properties allow NTCC to operate:

across jurisdictions
across policy regimes
across disclosure environments
across verification cultures

without creating regulatory conflict.

Compatibility Across Regulatory Regimes

NTCC can coexist with:

- ETS systems (EU ETS, Korea ETS, California Cap-and-Trade)
- carbon tax regimes (Singapore, Canada, Japan, Taiwan)
- voluntary carbon markets
- SBTi reduction pathways
- national MRV systems

Because NTCC **never claims emission reduction or offset equivalence**, it cannot distort market integrity.

13.4 The Role of Institutions in Future Sustainability Architecture

Future global governance will not be driven by:

- apps
- platforms

- companies
- markets

Instead, it will be driven by:

Institutions — bodies capable of structuring trust, rules, verification, and multi-actor coordination.

NTCC is designed not as a product, but as a **governance primitive**—a foundational building block for next-generation institutional systems.

Aligned with:

- ISA (Institutional Syntax Architecture)
- PADV^2 (Institutional Syntax Framework)
- SFA (Sustainable Finance Architecture)
- ICTF (Credibility Tier Framework)

NTCC enables institutions to build new:

- non-market governance systems
- evidence clearing infrastructures
- cross-sovereign verification networks
- behavioral attribution standards

13.5 Global Integration Pathways for NTCC

NTCC can integrate into future global systems via four pathways:

International Governance Systems

Potential alignment with:

- UNFCCC NMA (Non-Market Approaches)
- UNDP SDG Evidence Framework
- OECD Governance Principles
- IMF structural climate frameworks
- EU sustainability architecture

NTCC can serve as a **behavioral contribution mechanism** complementing national climate policy.

Enterprise & Supply Chain Systems

Future supply chains will require:

- granular actor data
- traceable participation evidence
- multi-tier verification

NTCC becomes the behavioral backbone of emerging global supply chain disclosure rules (e.g., CSDDD, CBAM).

Verification & Assurance Bodies

NTCC enables verification institutions (SGS, BSI, DNV, TÜV, Bureau Veritas, LRQA, ARES-CERT) to adopt:

- behavior-based audit trails
- institutional verification schemas
- non-market assurance models

This unlocks a new category of global third-party assurance.

Cross-Sovereign Digital Trust Systems

NTCC aligns with emerging digital governance infrastructures:

- verifiable credential systems
- digital public infrastructure
- national identity & participation systems
- cross-border trust frameworks

This allows NTCC to function as a **digital governance primitive**.

13.6 The Emergence of Behavioral Climate Contribution

Over the next decade, nations and institutions will require:

A new class of climate evidence

one that is:

- behavioral
- verifiable

- actor-specific
- scalable
- non-market
- non-financial
- governance-native

NTCC represents the first global methodology capable of meeting this requirement.

It enables societies, companies, and supply chains to quantify:

“How people and organizations behave in ways that advance sustainability.”

This creates a new institutional category:

Behavioral Climate Contribution (BCC)

distinct from:

- carbon markets
- offsets
- inventories
- LCAs
- carbon pricing

BCC will become a core component of:

- ESG reporting
- policy development
- national climate participation programs
- sustainability education & civic missions
- non-market climate collaboration

NTCC is the world’s first operational model for BCC.

13.7 NTCC’s Long-Term Global Role

Looking forward, NTCC is positioned to become:

1. **A global behavioral evidence standard**
   for enterprises, governments, and institutions.

2. **The third pillar of sustainability measurement**
   beside natural carbon sinks and carbon markets.
3. **A universal behavioral block for ICP**
   allowing enterprises to price the behavioral dimension of climate governance.
4. **A cross-sovereign verification mechanism**
   compatible with UNFCCC, OECD, ISO, IFRS, GRI.
5. **A foundation for future global governance infrastructures**
   via ISA / PADV^2 / SFA / ICTF.
6. **A population-scale sustainability participation architecture**
   enabling contribution-based climate engagement.

13.8 Summary

NTCC provides a globally compatible, cross-sovereign, institution-native behavior verification architecture.

As the world seeks new governance models beyond markets and offsets, NTCC stands as the foundation for:

- verified behavior
- institutional trust
- multi-layer governance
- cross-standard reporting
- non-market climate contribution

In the emerging global sustainability era, NTCC will not compete with traditional carbon instruments—it will **complete** the institutional architecture they cannot reach.

Chapter 14. Conclusion — The Institutional Emergence of NTCC

The establishment of a third global sustainability calculation structure and its role in next-generation governance.

The integration of NTCC with Internal Carbon Pricing (ICP) completes a missing layer in global sustainability architecture:

the behavioral dimension of climate contribution.

For decades, sustainability governance has relied on two primary structures:

1. **Natural Carbon Sinks** — ecological absorption and biophysical sequestration
2. **Carbon Markets & Offsets** — financialized emissions reduction and trading mechanisms

Both remain essential.

But neither is designed to quantify **how human systems behave** in ways that advance sustainability.

NTCC introduces the world's **third sustainability calculation structure**, uniquely designed to quantify:

- verified behaviors
- multi-actor actions
- participation-driven contributions
- evidence-based engagement
- non-market climate value

This structure fills the governance blind spot in traditional accounting systems, enabling organizations to measure **what carbon markets and LCAs cannot capture**: **the actions of people, institutions, and ecosystems of practice.**

14.1 What NTCC Contributes to Global Governance

NTCC's institutional design establishes a new paradigm:

A. Behavior as a Governable Unit

CO_2e is no longer only a physical or financial quantity; it becomes a **behavioral quantity backed by evidence**.

B. Verification as a Native Layer

PADV and $PADV^2$ provide the blueprint for:

- evidence acquisition
- multi-node chain-of-custody
- action-level verification
- institutional audit equivalence

This creates a **verification-first climate governance system**.

C. Institutional Compatibility

NTCC aligns with:

- UNFCCC Non-Market Approaches
- OECD Governance Principles
- IFRS S1/S2 disclosure structures
- GRI 305 reporting frameworks
- ISO 14064 / 14067 / 37301 verification regimes
- COSO ESG internal controls
- ISSB's emphasis on governance integrity

This makes NTCC **globally deployable** without regulatory conflict.

D. Completion of the Sustainability Architecture

NTCC does not replace carbon markets, carbon offsets, or natural carbon sinks.

It completes them by addressing the **behavioral gap** that no existing mechanism measures.

14.2 The Institutional Implications of NTCC × ICP

By integrating NTCC into Internal Carbon Pricing, organizations gain:

- a verified behavioral evidence block
- high-resolution Scope 3 attribution
- governance-native participation records
- actor-level contribution mapping
- ICP models enhanced with non-financial evidence

This transforms ICP from a purely financial internal tool into a **behavioral governance instrument**.

Enterprises can now see:

- which actions led to sustainability gains
- which departments contributed verifiable value
- how participation patterns shape climate governance
- how behavior can be priced institutionally, not financially

This marks a shift from:

"Pricing Carbon" → "Understanding Behavior."

14.3 Cross-Sovereign Significance

NTCC's architecture is intentionally:

- non-tradable
- non-offsetting
- non-financial
- non-market
- jurisdiction-neutral

These properties enable it to function:

- across countries
- across regulatory systems
- across verification cultures
- across supply chains
- across corporate and civic actors

NTCC becomes a **governance primitive** that different nations and institutions can adopt without creating market distortions or legal conflicts.

It is the first climate-related mechanism purpose-built for **global interoperability**.

14.4 A New Institutional Grammar for Sustainability

NTCC is not only a unit of behavioral CO_2e.

It is a part of a much larger institutional transformation.

Together with:

- **PADV (Participation–Action–Data–Value)**
- **PADV^2 Syntax**
- **ISA (Institutional Syntax Architecture)**
- **VISA-Layer (Verification Layer Architecture)**
- **SFA (Sustainable Finance Architecture)**
- **ICTF (Institutional Credibility Tier Framework)**

NTCC contributes to a new governance grammar:

- where actions can be verified
- where participation is measurable
- where behavior becomes institutional evidence
- where climate contribution is transparent
- where systems govern themselves via syntax

This is the emergence of the **Institutional Sustainability Era**—a period in which institutions, not markets, define global climate contribution frameworks.

14.5 The Road Ahead

The global sustainability landscape will require:

- new evidence systems
- new governance architectures
- new verification infrastructures
- new cross-sovereign standards

NTCC stands ready to serve as:

- a **behavioral evidence engine**
- a **Scope 3 enhancement mechanism**
- an **institution-level contribution schema**
- a **non-market governance tool**
- a **global institutional building block**

The NTCC × ICP methodology presented in this white paper is not the end of a development process—it is **the beginning of a new institutional architecture**.

14.6 Final Declaration

NTCC represents a new class of climate governance mechanism:

evidence-first,

behavior-driven,

verification-native,

non-market,

cross-sovereign,

institutionally governed.

It completes the global sustainability architecture by adding the one dimension no existing mechanism can quantify:

the actions of people, organizations, and ecosystems of practice.

In doing so, NTCC establishes the foundation for a future in which:

- behavior becomes measurable,
- institutions become verifiable,
- governance becomes multi-layered, and
- sustainability becomes a shared, evidence-based global language.

This is the beginning of a new institutional era—**the era of behavioral climate contribution.**

Appendix A — Technical Foundations

(All tables formatted for audit-grade readability)

A1. NTCC Quantification Framework

Table A1-1. NTCC Behavioral → CO_2e Quantification Structure

Layer	Description	Methodological Basis	Standard Alignment
Behavior Unit	Verified user/participant action	PADV Participation–Action Model	PADV v2.0
Activity Category	Mission-type hierarchy (e.g., education, mobility, circularity)	Structured Activity Table	GRI 305, ISO 14064
Activity Data	Evidence logs, timestamps, actor ID	Server-side verification	ISO 14064-1:2018
Emission Factor	CO_2e equivalent assigned to mission type	Category-specific EF table	IPCC 2006, ISO 14067
NTCC Unit	**1 NTCC = 1 tCO_2e**	Verified behavioral CO_2e	Non-Tradeable Credit Standard
Registry Entry	Immutable record stored in NTCC ledger	Evidence hashing, event signature	VISA-Layer Verification

A1.2 Activity Category Hierarchy (Mission-Type Taxonomy)

Tier	Category Type	Example Missions	Notes
T1	Core Environmental Behavior	Waste reduction, mobility shifts	Highest evidence density
T2	Educational & Awareness	SDGS PASS quizzes, workshops	Converts knowledge → action
T3	Participation-Based Actions	Festival/exhibition participation	Multi-actor verification

Tier	Category Type	Example Missions	Notes
T4	Community & Social Actions	Volunteer tasks, local engagement	Requires multi-point proof
T5	Organizational Behavior	Department-level actions	Used in ICP layering

A2. ICP Integration Formulas

Table A2-1. ICP Model × NTCC Integration

ICP Model	Traditional Input	Missing Component	NTCC Contribution	Institutional Outcome
Shadow Price	Estimated CO_2 impact	Behavioral evidence	NTCC behavioral CO_2e units	More accurate internal cost
Internal Carbon Fee	Production emissions	Activity-based granularity	NTCC micro-behavior attribution	Fee reflects human behavior impact
Capital Budgeting	Financial ROI	Non-financial externalities	NTCC behavior-adjusted indicators	Better low-carbon investment decisions
Performance Metrics	KPI index	Behavior contribution	NTCC per department/unit	Adds behavioral governance layer

A2.2 NTCC × ICP Interoperability Formulas

Component	Formula	Output
Behavioral CO_2e	Σ (Activity Amount × EF)	Total behavior-derived

Component	Formula	Output
Attribution		CO_2e
NTCC Unit Conversion	CO_2e_total ÷ 1,000 kg	NTCC units
ICP Behavior Input Value	NTCC_units × ICP_UnitPrice	Internal behavior cost value
Governance Weighting	ICP_behavior_value × W_gov	Departmental governance score

A3. Verification Pipeline (PADV → VISA → Registry)

Table A3-1. Verification Pipeline Overview

Stage	Description	Verification Logic	Output
P — Participation	User identity, eligibility	Account & device verification	Behavioral session anchor
A — Action Completion	Task execution, mission QR	Dual-point confirmation	Action proof
D — Data Validation	Server-side checks	Anti-replay, anti-fraud	Clean evidence packet
V — Verification Layer (VISA)	Evidence signing	Hashing, cryptographic sealing	Verified evidence block
Registry Entry	Final storage	Immutable ledger	NTCC Unit Record

A3-2 Verification Controls Matrix

Control Type	Mechanism	Purpose
Anti-Double Counting	Mission-ID + Actor-ID hashing	Avoid duplicate credits
Anti-Gaming	Behavior pattern risk engine	Detect anomalies
Time Integrity	Time-stamped signatures	Prevent manipulation
Actor Integrity	Device & account binding	Ensure human-based action
Evidence Chain Integrity	Multi-point confirmation	Prevent fake events

A4. NTCC Metadata Schema (JSON Schema v1.0)

(Table format + formal key definitions)

Table A4-1. NTCC Metadata Fields

Field	Description	Type	Required
unit_id	Unique NTCC identifier	String	Yes
co2e_value	Always “1 tCO_2e”	Number	Yes
activity_type	Mission category	String	Yes
evidence_hash	SHA-256 derived	String	Yes
actor_id	Pseudonymized participant ID	String	Yes
timestamp	ISO 8601 time	String	Yes
verification_level	VISA-Layer tier	Number	Yes

Field	Description	Type	Required
registry_location	Ledger storage reference	String	Yes
metadata_version	Schema version	String	Yes

A5. Institutional Architecture Mapping

(Links NTCC → PADV² → ISA → ICP)

Table A5-1. Syntax Mapping

ISA Layer	NTCC Component	PADV² Syntax	ICP Integration Role
Layer 1 — Participation Syntax	Actor identity	P-Syntax	ICP stakeholder mapping
Layer 2 — Action Syntax	Mission evidence	A-Syntax	Behavioral event input
Layer 3 — Data Syntax	Evidence chain	D-Syntax	Integrity layer for ICP
Layer 4 — Verification Syntax	VISA sealing	V-Syntax	Audit layer for ICP
Layer 5 — Institutional Value Syntax	1 NTCC = 1 tCO_2e	Value-Syntax	CO_2e unit for ICP pricing

Appendix B — Governance & Compliance

(All content presented in tables for audit-grade clarity)

B1. Governance Boundary Matrix

(Defines what NTCC is, is not, and must not be used for)

Boundary Category	What is Allowed	What is Not Allowed	Institutional Rationale
Market Behavior	Behavioral CO_2e quantification	Trading, exchange, offsetting	Preserves non-financial nature of NTCC
Regulatory Use	ESG disclosure support	Replacement of statutory carbon credits or taxes	Avoids legal conflict with carbon pricing laws
Accounting Use	Internal governance inputs	Balance sheet asset/liability classification	Non-financial credit; not a financial instrument
ICP Integration	Behavioral CO_2e input for ICP	Setting external market prices	Internal-use-only methodology
Organizational Reporting	Scope 3 behavioral enhancement	Alteration of Scope 1/2 inventories	Integrity of traditional GHG accounting preserved

B2. Legal Boundary Conditions

(Clear separation from carbon offset, tax, and market instruments)

Legal Boundary	NTCC Position	Explanation
Non-tradability	Required	NTCC cannot be bought, sold, exchanged, or monetized
Non-offsetting	Required	NTCC cannot be used to offset emissions obligations

Legal Boundary	NTCC Position	Explanation
Non-financial classification	Required	NTCC not classified as a financial instrument under IFRS or MAS/SFC rules
Non-tax interaction	Required	NTCC does not reduce carbon tax, fee, or ETS obligations
Attribution Restriction	Strict	NTCC attribution tied to verified behavior only

B3. COSO Internal Control Mapping

(NTCC governance mapped to COSO's five components)

COSO Component	NTCC Governance Controls	Purpose
Control Environment	Non-tradability rules; evidence-first principles	Establish integrity and governance tone
Risk Assessment	Behavioral fraud detection; evidence anomaly monitoring	Identify & mitigate gaming risks
Control Activities	Multi-point verification; registry hashing	Ensure validity of NTCC creation
Information & Communication	Reporting schema; metadata standards	Support transparent ESG & ICP reporting
Monitoring Activities	Periodic audit logs; ledger reviews	Maintain long-term trust and reliability

B4. Internal Audit Checklist (NTCC Edition)

(Designed for Big Four audit compatibility)

Audit Item	Audit Question	Expected Evidence
Identity Integrity	Is the actor uniquely identifiable?	User-ID, device binding, hashed credentials
Action Verification	Was the action completed and validated?	Mission logs, QR verification records
Time Integrity	Is the timestamp unaltered?	Time-signed evidence packet
Double-Counting Prevention	Is each NTCC uniquely assigned?	Mission-ID + Actor-ID hash
Methodology Consistency	Was the correct EF applied?	Activity → EF table cross-reference
Registry Integrity	Is the NTCC immutably stored?	Ledger hash, registry entry

B5. Governance Artifacts

(Formal documents for enterprise adoption)

Governance Artifact	Purpose	Format
Board Governance Template	Approve NTCC usage for ICP & ESG	Board resolution / policy memo
Internal Carbon Pricing Memo	Define integration of behavioral CO_2e	Internal governance document
Verification Protocol Manual	Standardize evidence validation	Operational manual
Data Protection Addendum	Handle NTCC-related personal data	Compliance addendum (GDPR/PDPA)

Governance Artifact	Purpose	Format
Sustainability Disclosure Mapping	Map NTCC to ESG reports	Reporting table for GRI/IFRS

B6. Risk Management Framework

(Aligned with ISO 31000 & COSO risk logic)

Risk Category	NTCC Risk	Control Mechanism
Operational Risk	Incorrect activity data	Multi-point verification; automated checks
Fraud / Gaming Risk	Fake or repeated actions	Behavior anomaly detection engine
Data Integrity Risk	Evidence tampering	Cryptographic verification; sealed logs
Legal Risk	Misclassification as carbon offset	Legal boundary statements; disclaimers
Reputational Risk	Misuse by organizations	Governance oversight; non-tradability enforcement

B7. Data Protection & Privacy Governance

(Aligned with GDPR / PDPA / ISO 27701)

Data Type	Handling Requirement	Control
Actor Identity	Pseudonymization	Hashed user ID
Behavior Records	Purpose limitation (NTCC only)	Scope-restricted storage
Metadata	Minimal retention	Versioned schema

Data Type	Handling Requirement	Control
Cross-Border Transfers	Legal compliance	Standard contractual clauses (SCCs)
Right to Erasure	Allowed where not breaking registry	Partitioned identity-space design

B8. Governance Summary Table

(One-page governance snapshot)

Domain	Requirement	NTCC Compliance
Financial Classification	Not a financial instrument	✓ Fully compliant
Carbon Accounting Integrity	Does not alter S1/S2	✓ Preserved
Scope 3 Enhancement	Behavioral granularity only	✓ Provided
Regulatory Alignment	No conflict with ETS/tax	✓ Compliant
Auditability	Evidence chain, metadata, registry	✓ Big Four compatible

Appendix C — Cross-Standard Mapping

(All content formatted in tables for audit-ready disclosure)

C1. IFRS S1 / S2 Mapping Table

How NTCC strengthens IFRS-compliant governance, evidence, and disclosure

IFRS Requirement	Description	NTCC Contribution	Evidence Type
S1 – Governance	Governance of sustainability-related risks & opportunities	NTCC provides audit-grade behavioral records for governance oversight	Verified evidence chain
S1 – Data Quality	High-quality, decision-useful data	NTCC registry ensures immutable, timestamped data	Ledger-backed metadata
S1 – Controls	Controls over sustainability reporting	VISA-Layer verification fulfills control integrity	Cryptographic signatures
S2 – Climate Risk Management	Identifying & managing climate-related risks	NTCC gives organizations behavior-based climate engagement metrics	Multi-actor behavior logs
S2 – Metrics & Targets	Emissions disclosures (Scopes 1–3)	NTCC acts as **behavioral Scope 3 enhancer**	CO_2e behavioral attribution
S2 – Strategy Integration	Integrating climate considerations into strategy	NTCC integrates into ICP for internal carbon governance	NTCC × ICP integration

C2. GRI 305 — Emissions Mapping

GRI 305 Category	Description	NTCC Enhancement	Alignment Type
305-1	Direct (Scope 1)	No substitution	Governed boundary preserved
305-2	Indirect (Scope 2)	No substitution	Governed boundary preserved
305-3	Other Indirect (Scope 3)	**NTCC adds behavioral granularity**	High-resolution behavioral attribution
305-4	GHG Intensity	NTCC provides department-level behavioral intensity	Quantitative input
305-5	Reduction of GHG emissions	NTCC demonstrates behavior-driven reductions	Verified CO_2e units
305-6	ODS emissions	N/A	—
305-7	NOx, SOx, other emissions	N/A	—

GRI 305-3 is where NTCC creates **global differentiation**—it is the *only* structure capable of providing verified micro-behavioral scope.

C3. COSO Internal Controls Mapping

COSO Component	Requirement	NTCC Reinforcement	Evidence
Control Environment	Ethical foundation & governance tone	Non-tradability ensures neutrality	Governance policy

COSO Component	Requirement	NTCC Reinforcement	Evidence
Risk Assessment	Identify sustainability reporting risks	NTCC fraud-detection & behavioral anomaly engine	Log-based analytics
Control Activities	Preventive & detective controls	Multi-point verification, anti-double-counting	Verification logs
Information & Communication	Reliable internal & external reporting	NTCC registry & metadata schema	Reporting interface
Monitoring	Ongoing evaluation	Ledger review, timestamp integrity	Audit logs

NTCC effectively adds a **Behavioral Control Layer** to COSO.

C4. ISO 14064 / 14067 Mapping

Activity-based quantification alignment

ISO Standard	Requirement	NTCC Method	Alignment Level
ISO 14064-1	GHG inventory — organizational level	NTCC behavioral CO_2e integrates into Scope 3	Compatible
ISO 14064-2	GHG reductions — project level	NTCC ensures non-offset, behavior-only evidence	Compatible (non-offset class)
ISO 14064-3	Verification & validation	VISA-Layer cryptographic verification	Fully aligned
ISO 14067	Product carbon footprint	NTCC adds user behavior impact for product use-phase	Supplemental alignment

Note: NTCC **does not** attempt to be a carbon offset or footprint mechanism —it provides the *behavioral evidence* other standards lack.

C5. UNFCCC MRV (Measurement, Reporting, Verification)

Mapping

MRV Component	UNFCCC Requirement	NTCC Support	Output
Measurement	Transparent, quantifiable CO_2 data	NTCC quantification table & EF model	CO_2e attribution
Reporting	Comparable, consistent disclosure	NTCC metadata schema	Standardized JSON
Verification	Accurate, robust, tamper-proof	VISA-Layer multi-tier verification	Immutable registry record

NTCC is fully aligned with MRV as a **behavioral verification protocol** (non-market category).

C6. OECD & International Governance Expectations

Governance Principle	OECD Requirement	NTCC Response
Transparency	Open, verifiable sustainability data	Ledger-backed NTCC registry
Accountability	Organizations must justify ESG claims	NTCC provides evidence packets
Integrity	Avoid misleading climate claims	NTCC non-tradability eliminates greenwashing
Inclusivity	Multi-actor participation	PADV × NTCC multi-stakeholder model

Governance Principle	OECD Requirement	NTCC Response
Data Governance	High-quality, secure data	ISA × VISA-Layer framework

C7. Big Four Audit Mapping Table

Audit Domain	Big Four Requirement	NTCC Coverage
Evidence Reliability	Provenance, timestamp, immutability	✓ Full
Chain of Custody	No breaks in evidence flow	✓ Ledger-based
Control Testing	Preventive/detective controls	✓ Anti-double-counting
Risk Assessment	Materiality & misstatement risk	✓ Behavior anomaly engine
Assurance Readiness	Data integrity, governance clarity	✓ Audit-ready metadata

NTCC provides a level of **verifiability** comparable to financial audit systems.

C8. Integrated Cross-Standard Summary Table

Standard	What It Requires	What NTCC Adds	Why It Matters
IFRS S1/S2	Governance, risk, metrics	Behavior evidence	Strategy-level integration
GRI 305	Emissions transparency	Behavior Scope 3	Eliminates blind spots
COSO	Controls & governance	Behavior control	Reduces

Standard	What It Requires	What NTCC Adds	Why It Matters
		layer	compliance risk
ISO 14064	Activity quantification	Verified behavior units	Strengthens integrity
UNFCCC MRV	Measurement & verification	Immutable evidence	Global alignment
OECD Governance	Transparency & accountability	Multi-actor evidence	Institutional legitimacy

Appendix D — Institutional Syntax Layer

(All components presented as audit-grade tables)

D1. Overview — The Institutional Syntax Stack

Table D1-1. The EMJ Institutional Syntax Architecture (ISA Stack)

Layer	Name	Purpose	Output
L1	Participation Syntax (P-Syntax)	Establish eligibility, identity, and entry points	Verified participant anchor
L2	Action Syntax (A-Syntax)	Standardize action units & mission execution	Standardized action events
L3	Data Syntax (D-Syntax)	Normalize evidence, metadata & CO_2e attribution	Evidence packet (pre-verification)
L4	Verification Syntax (V-Syntax)	Seal, validate, and hash behavioral evidence	Verified Evidence Block (VEB)

Layer	Name	Purpose	Output
L5	Institutional Value Syntax (Value-Syntax)	Convert verified behavior → institutional-readable units	NTCC (1 tCO_2e), ICP-ready data

D2. PADV → PADV^2 Syntax Mapping

Table D2-1. PADV Core Syntax vs. PADV^2 Institutional Syntax

PADV Element	Definition	PADV^2 Institutional Extension	Output
Participation	Entry, identity, eligibility	P-Syntax (institutional eligibility grammar)	Actor anchor + governance identity
Action	User task execution	A-Syntax (fully standardized action grammar)	Mission execution unit
Data	Evidence and logs	D-Syntax (institutional evidence schema)	Evidence packet
Verification	Confirmation, anti-fraud	V-Syntax & VISA-Layer sealing	Verified evidence block
Value	Points, rewards	Institutional Value Syntax	NTCC units / governance metrics

D3. Syntax-to-Unit Conversion Chain

Table D3-1. Syntax Flow → Institutional Output

Syntax Stage	Output	Higher-Level Function
P-Syntax	Participant anchor	Governance identity
A-Syntax	Action event	Climate-relevant activity

Syntax Stage	Output	Higher-Level Function
D-Syntax	Evidence record	Audit-ready evidence
V-Syntax	Verified block	Trust layer / MRV layer
Value-Syntax	NTCC (1 tCO_2e)	ICP behavioral carbon block

D4. VISA-Layer Integration (Verification Layer Syntax)

The formal verification grammar behind NTCC issuance

Table D4-1. VISA-Layer Syntax Components

Component	Syntax Function	Institutional Purpose
V1 — Identity Verification	Verify actor legitimacy	Prevent identity-based fraud
V2 — Action Verification	Confirm mission execution	Validate behavior authenticity
V3 — Data Integrity Check	Validate metadata + EF	Ensure CO_2e attribution correctness
V4 — Evidence Signing	Hashing + signature	Create immutable evidence
V5 — Ledger Registration	Insert into NTCC registry	Anchor evidence to governance ledger

D5. SFA (Sustainability Finance Architecture) Syntax Mapping

Table D5-1. NTCC Position Inside the SFA Architecture

SFA Layer	Description	Syntax Mapping	NTCC Role
Layer 1 — Behavioral Credit Layer	Non-market sustainability credit	Value-Syntax	NTCC = behavioral credit
Layer 2 — Governance Layer	Ensure verifiability & internal controls	V-Syntax	Verified governance evidence
Layer 3 — Institutional Layer	System-level adoption	PADV^2 / ISA	Regulatory-compatible
Layer 4 — Finance Layer	ICP, budgeting, internal signals	NTCC × ICP	Internal non-financial valuation

D6. ICTF (InstiTech Credibility Tier Framework) Syntax Mapping

Table D6-1. NTCC × ICTF Tier Integration

ICTF Tier Domain	Requirement	Syntax Contribution
Tier 1 — Evidence Integrity	Verified, immutable, timestamped data	VISA-Layer + D-Syntax
Tier 2 — Institutional Alignment	Compatibility with global standards	IFRS/ISO/GRI → ISA Mapping
Tier 3 — Governance Maturity	Multi-layer controls	COSO × PADV^2 Syntax
Tier 4 — Cross-Sovereign Readiness	Usability in multi-jurisdiction systems	Non-tradability + registry neutrality

D7. ICP Syntax Mapping — Behavioral Carbon Layer

Table D7-1. Syntax → ICP Integration Pathway

ICP Component	Required Input	Syntax Source	Output
Shadow Pricing	CO_2e unit	Value-Syntax	Behavior carbon cost
Internal Carbon Fee	Activity attribution	A-Syntax + D-Syntax	Behavior-specific cost signals
Capital Budgeting	Carbon intensity	D-Syntax	Low-carbon decision support
Performance Evaluation	Behavioral metrics	$PADV^2$ syntax	Governance performance signals

D8. Institutional Syntax Summary Table

Table D8-1. One-page institutional syntax overview

Syntax Layer	What It Does	What NTCC Uses It For	What ICP Uses It For
Participation Syntax	Defines legitimate actors	Anchor user identity	Map actors to governance units
Action Syntax	Standardizes behavior	Create uniform behavioral events	Identify carbon-relevant actions
Data Syntax	Structures evidence	Prepare CO_2e attribution	Integrate into ICP datasets
Verification Syntax	Ensures truth & integrity	Issue NTCC	Guarantee audit reliability
Institutional	Converts into	NTCC (1 tCO_2e)	Behavior block in

Syntax Layer	What It Does	What NTCC Uses It For	What ICP Uses It For
Value Syntax	units		ICP

Appendix E — Use Case & Evidence Dataset-Public Disclosure Version

All data aggregated, anonymized, and publication-safe.

E1. Overview — Exhibition Demonstration Case (Global Behavioral Dataset)

Table E1-1. Dataset Summary (Public Version)

Item	Value	Disclosure Status	Notes
Total Behavioral Records	**11,855**	Public	All records aggregated
Total Points Generated	**5,250,000+**	Public	No individual attribution
Total NTCC (Behavioral CO_2e)	**15,090.99 kgCO_2e (15.1 tons)**	Public	Verified, anonymized
Total Participating Brands	**72**	Public	No brand-specific NTCC breakdown
Total Participants	**35,000+**	Public	Population-level, no personal data
Event Types	Pet Expo, Sustainability	Public	General description only

Item	Value	Disclosure Status	Notes
	Missions		

This dataset is **safe for publication** because:

- No personal data
- No brand-specific sensitive CO_2e distribution
- No commercial information
- No internal operational details
- All numbers aggregated & verified

E2. Behavioral Dataset Classification (Aggregated Public Version)

Table E2-1. Behavior Category Distribution (Aggregated)

Behavioral Category	% of Total Actions	CO_2e Contribution Share	Disclosure Status
Education Missions (SDGS PASS Learning)	41%	31%	Public
Exhibition Participation Tasks	28%	38%	Public
Sustainability Interaction (Green Booth Tasks)	19%	17%	Public
Circularity & Waste Reduction Tasks	7%	9%	Public
Community & Social Impact Actions	5%	5%	Public

E3. Verification Pipeline Evidence (Publication-Safe Extract)

Table E3-1. Evidence Pipeline — Public Layer Extract

Verification Stage	**Public Output**	**Internal Data Removed?**	**Notes**
Participation	Count only	✓ Identity removed	No device/user data exposed
Action Completion	Action type totals	✓ Action-source hidden	Only mission category exposed
Data Validation	Category-level success/failure rate	✓ Logs removed	Shows verification integrity
Verification Layer	Verified block total count	✓ Hashes removed	Only aggregate NTCC shown
Registry Entry	Total NTCC issued	✓ Registry details omitted	No ledger path, no signature

Everything below is **safe to share internationally**.

E4. NTCC Outcome Summary (Behavior-Derived CO_2e, Public Version)

Table E4-1. NTCC Output Summary

Metric	**Value**	**Disclosure Status**
Behavioral CO_2e Verified	15.1 tCO_2e	Public
Total NTCC Issued	15.1 Units	Public
Verification Error Rate	<0.02%	Public (statistical only)
Multi-Actor Validation	100% events	Public

Sensitive items removed include:

- Mission-level CO_2e factors
- Brand-level attribution
- Timestamp logs
- Hash-signature blocks
- Device/session IDs

E5. ICP Integration Relevance (Public Version)

Table E5-1. ICP-Relevant Outputs

ICP Requirement	**Public NTCC Dataset Contribution**	**Sensitivity Level**
Behavior-based CO_2e Units	✓ 15.1 tCO_2e	Public
Micro-level Attribution	✗ Removed	Sensitive
Department/Actor Mapping	✗ Removed	Sensitive
Action Category Weighting	✓ Category distribution	Public
Governance Controls	✓ Verification summary	Public

This ensures the dataset is **compatible with corporate ICP simulation** without exposing any governed, personal, or commercial data.

E6. Multi-Actor Evidence Summary (Aggregated & Anonymous)

Table E6-1. Actors Involved in Verified Behavior

Actor Type	**Participation Level**	**Data Status**
General Public / Consumers	High	Aggregated only

Actor Type	Participation Level	Data Status
Exhibitors (72 brands)	High	Brand ID removed
Event Organizers	Medium	Anonymous
SDGS PASS System	System-level	Fully public
Verification Server Layer	System-level	Fully public (no logs)

E7. Dataset Governance & Privacy Controls

Table E7-1. Public Data Governance Assessment

Governance Risk	Exposure Risk	Mitigation	Result
Personal Data	None	No PII stored	✓ Safe
Commercial Sensitivity	Low	All brand-level data removed	✓ Safe
Timestamp/Identity Inference	None	Time + identity fully stripped	✓ Safe
Re-identification Possibility	Extremely Low	Aggregated >35k participants	✓ Safe
Verification Metadata Leakage	None	Hashes & logs removed	✓ Safe

This appendix meets:

- GDPR
- PDPA
- ISO 27701
- Big Four "safe dataset" requirements

E8. Public Transparency Snapshot (One-Page Summary)

Item	Status
Dataset Aggregation	✓ Complete
PII Exposure	✗ None
Brand-Level Details	✗ Removed
Hash Signatures	✗ Removed
Verification Summary	✓ Public
NTCC Summary	✓ Public
Alignment with IFRS/GRI	✓ Fully aligned
Suitable for International Publication	✓ **Yes**

Appendix F — Data Governance

(All content anonymized, standardized, and suitable for publication)

F1. Data Governance Framework Overview

Table F1-1. NTCC Institutional Data Governance Layers

Layer	Governance Focus	Institutional Purpose	Standards Alignment
L1 — Data Collection Governance	Evidence quality & eligibility	Ensure only valid actions are captured	PADV, GDPR (lawfulness), ISO 14064
L2 — Data Validation Governance	Integrity, anti-fraud, correctness	Produce clean, tamper-resistant evidence packets	VISA-Layer, COSO

Layer	Governance Focus	Institutional Purpose	Standards Alignment
L3 — Data Protection Governance	Privacy, pseudonymization, minimization	Protect identity & prevent misuse	GDPR/PDPA, ISO 27701
L4 — Data Storage Governance	Secure storage, immutability	Ensure long-term audit reliability	ISO 27001, MRV
L5 — Data Usage Governance	Purpose limitation, ICP integration	Use data only for NTCC & governance	IFRS S1, OECD guidelines

F2. Data Classification Model

Table F2-1. NTCC Data Classification Matrix

Data Category	Description	Sensitivity Level	Governance Controls
Behavioral Evidence Data	Mission/Action verification logs	Medium	Pseudonymization, integrity checks
Metadata (CO_2e Attribution)	Activity → EF mapping	Low	Standard schema, versioning
Actor Identity Data	User ID (hashed)	High	Pseudonymization, access restrictions
System Verification Data	Hash signatures, verification results	Medium	Secure hashing, no raw logs exposed
Registry Data	NTCC issuance,	Low	Ledger immutability

Data Category	Description	Sensitivity Level	Governance Controls
	immutable entries		

F3. Data Lifecycle Governance

Table F3-1. Data Lifecycle Control Framework

Lifecycle Stage	Governance Requirement	NTCC Implementation	Compliance Alignment
1. Collection	Lawful, minimal, purposeful	Mission data only, no PII stored	GDPR Art.5, PDPA
2. Processing	Integrity, accuracy	Verification pipeline (PADV → VISA)	ISO 14064-3
3. Storage	Security, immutability	Ledger-based evidence storage	ISO 27001
4. Usage	Purpose limitation	NTCC, ICP governance use only	GDPR Art.5(1)(b)
5. Transfer	Lawful cross-border movement	SCCs, pseudonymization	GDPR Chapter V
6. Deletion	Erasure upon request (when possible)	Partitioned identity-space	ISO 27701

F4. Data Integrity & Anti-Fraud Controls

Table F4-1. NTCC Integrity Control Matrix

Control Area	Mechanism	Purpose
Anti-Double Counting	Mission-ID + Actor-ID	Prevent duplicate NTCC

Control Area	Mechanism	Purpose
	hashing	issuance
Proof-of-Action Controls	Multi-point verification	Ensure action authenticity
Timestamp Integrity	Time-signed evidence packets	Prevent manipulation
Anomaly Detection	Behavior-pattern risk engine	Detect fraud or gaming
Data Consistency Checks	EF-table consistency	Ensure correct CO_2e attribution

F5. Privacy & Identity Protection Framework

Table F5-1. Identity Governance Matrix

Privacy Requirement	NTCC Implementation	Compliance Basis
Pseudonymization	Actor-ID hashed, irreversible	GDPR Art.4(5)
Data Minimization	No names, emails, or PII captured	GDPR Art.5(1)(c)
Purpose Limitation	NTCC issuance only	GDPR Art.5(1)(b)
Right to Erasure	Actor ID pseudonym layer deletable	GDPR Art.17
Cross-border Transfer	SCCs + no PII	GDPR Chapter V

F6. Access Control & Authorization

Table F6-1. Role-Based Access Control (RBAC)

Role	Access Level	Data Allowed	Restrictions
User (Participant)	Low	Own behavioral summary	No registry-level access
Brand/Corporate Partner	Medium	Aggregated NTCC stats	No actor identity
Event Organizer	Medium	Action-volume dashboards	No identity data
Auditors / Big Four	High	Evidence chains (anonymized)	No PII exposure
EMJ.LIFE Governance Team	Highest	System-wide oversight	Cannot alter ledger entries

F7. Data Retention Policy

Table F7-1. NTCC Retention Framework

Data Type	Retention Time	Justification	Erasure Possible?
NTCC Registry Entries	Permanent	Required for governance verification	✗ No (immutable)
Verification Evidence Packets	7–10 years	Audit & compliance	✓ Yes (hashed)
Actor-Pseudonym Mapping	Rotating (2–3 years)	Privacy protection	✓ Yes
Organizational Reports	5–7 years	ESG disclosure policies	✓ Yes

Note: **The NTCC registry must remain immutable** to satisfy auditability and

MRV principles.

F8. Data Security Controls

Table F8-1. Security Framework (ISO 27001-aligned)

Control Category	NTCC Control	Standard Alignment
Encryption	AES-256 server-side encryption	ISO 27001 A.10
Hashing & Signatures	SHA-256 evidence hashing	MRV requirements
Access Control	RBAC, MFA for staff	ISO 27001 A.9
Network Security	Firewall + IDS/IPS	ISO 27001 A.13
Logging & Monitoring	Immutable audit logs	ISO 27001 A.12

F9. Purpose-Limited Data Usage

Table F9-1. Authorized Usage Categories

Use Case	Allowed?	Notes
NTCC Issuance	✓ Yes	Primary purpose
ICP Behavioral Integration	✓ Yes	Governance use only
ESG Disclosure Enhancement	✓ Yes	Scope 3 behavior
Marketing / Ads	✗ No	Explicitly prohibited
User Profiling	✗ No	Not compatible with privacy principles
Carbon Trading / Financial Use	✗ No	NTCC is non-tradable

F10. Data Governance Risk Assessment

Table F10-1. Residual Risk Evaluation

Risk	Likelihood	Impact	Controls	Residual Risk
Identity Exposure	Very Low	High	Pseudonymization	Low
Data Manipulation	Very Low	High	Verification + ledger	Very Low
Fraudulent Actions	Low	Medium	Multi-point verification	Low
Misinterpretation of NTCC	Medium	Medium	Clear legal boundaries	Low
Unauthorized Access	Low	High	RBAC + MFA	Very Low

F11. Data Governance Summary (One-Page Institutional View)

Governance Domain	NTCC Compliance
GDPR/PDPA	✓ Fully compliant (PII-free)
ISO 27001	✓ Aligned (encryption, access, storage)
ISO 27701	✓ Aligned (privacy controls)
UNFCCC MRV	✓ Aligned (measurement & verification)
IFRS S1 Data Governance	✓ Fully aligned
COSO Internal Controls	✓ Reinforced via verification syntax
Big Four Audit Readiness	✓ Complete evidence chain

Appendix G — Visual Architecture

(Diagram descriptions rendered in table format)

G1. NTCC End-to-End Flow Diagram (Textual Architecture)

Table G1-1. NTCC System Flow (Mission → Evidence → Verification → Registry)

Stage	Institutional Function	Syntax Layer	Output
1. Mission Creation	Define action category	A-Syntax	Mission blueprint
2. User Participation	Eligibility, identity, entry	P-Syntax	Participant anchor
3. Action Execution	User completes mission steps	A-Syntax	Action event
4. Evidence Capture	System records & validates	D-Syntax	Evidence packet
5. Server-Side Verification	Anti-fraud, integrity checks	V-Syntax	Verified evidence block
6. CO_2e Attribution	Apply EF table	Value-Syntax	Behavioral CO_2e
7. NTCC Issuance	1 NTCC = 1 ton CO_2e	Value-Syntax	NTCC unit
8. Ledger Registration	Immutable entry	VISA-Layer	Registry record

Use: Replaces visual flowchart for publication.

G2. ICP Integration Diagram (Behavior → CO_2e → Internal Pricing)

Table G2-1. NTCC–ICP Integration Schema

Component	Input	NTCC Contribution	ICP Output
Behavior Layer	Participation & Action	Verified actions	Behavioral units
Attribution Layer	Activity data	CO_2e attribution	CO_2e totals
Pricing Layer	Internal carbon price	1 NTCC → ICP multiplier	Internal cost impact
Governance Layer	Policies, controls	Verified evidence	Internal carbon evaluation
Disclosure Layer	ESG reporting	Behavioral Scope 3 enhancement	IFRS/GRI ready data

This table replaces a typical "layered ICP integration diagram."

G3. The "Three Sustainability Calculation Structures" Diagram

Table G3-1. Global Sustainability Calculation Structures (3-Pillar Model)

Structure	Definition	Mechanism	Limitation	NTCC Complement
1. Natural Carbon Sink	Nature-based sequestration	Biophysical absorption	Slow cycle	Adds human behavior dimension
2. Market	Offset/credit	Third-party	Market	NTCC avoids

Structure	Definition	Mechanism	Limitation	NTCC Complement
Carbon Credit	trading	verification	distortion	trading
3. NTCC — Behavioral CO_2e	Verified human action	PADV × VISA syntax	Non-offset only	Fills behavior gap

This table serves as the diagram for the "three-pillar model."

G4. ISA × NTCC × ICP Global Architecture Map

Table G4-1. Institutional Architecture Integration Map

ISA Layer	Role	NTCC Contribution	ICP Interaction
Layer 1 — Participation Syntax	Define actors	Actor anchor	Department/unit mapping
Layer 2 — Action Syntax	Normalize behavior	Action events	Identify ICP-relevant actions
Layer 3 — Data Syntax	Structure evidence	Evidence packets	Support accurate attribution
Layer 4 — Verification Syntax	Seal evidence	Verified blocks	Enhance governance controls
Layer 5 — Value Syntax	Convert to units	1 NTCC = 1 tCO_2e	Internal pricing system

This replaces the "ISA Pyramid Diagram."

G5. $PADV^2$ Institutional Syntax (Five-Layer Model)

Table G5-1. $PADV^2$ Syntax Layers

Syntax Layer	Institutional Role	Output	Use in NTCC	Use in ICP
P — Participation	Actor eligibility	Participant anchor	Actor ID	Unit mapping
A — Action	Standardized actions	Action event	Mission data	Behavior factor
D — Data	Evidence structure	Evidence packet	Verification input	ICP dataset
V — Verification	Integrity protocol	Verified block	NTCC issuance basis	Assurance reliability
Value	CO_2e conversion	NTCC / metrics	Final NTCC	Internal pricing unit

This is the "PADV^2 5-layer diagram" in table form.

G6. VISA-Layer Verification Diagram

Table G6-1. VISA Verification Mechanism

VISA Stage	Function	Output
V1 — Identity Verification	Actor legitimacy check	Verified user anchor
V2 — Action Verification	Confirm action authenticity	Valid action proof
V3 — Data Integrity	Anti-tamper, consistency	Evidence integrity pass
V4 — Signature & Hashing	Seal evidence	Cryptographic block
V5 — Ledger Registration	Immutable storage	Final NTCC record

This table replaces a "verification pipeline diagram."

G7. SFA (Sustainability Finance Architecture) + NTCC Diagram

Table G7-1. SFA × NTCC Value Stack

SFA Layer	Description	NTCC's Position
1. Behavioral Credit Layer	Evidence-driven non-market credit	NTCC = Behavioral Credit
2. Governance Layer	Controls, verification	V-Syntax reinforcement
3. Institutional Layer	Policy, reporting, alignment	ISA integration
4. Finance Layer	ICP, budgeting, internal signals	NTCC × ICP model

This substitutes for the "SFA vertical stack" diagram.

G8. Cross-Standard Alignment Diagram (IFRS / GRI / COSO / ISO)

Table G8-1. Cross-Standard Mapping Visual Table

Standard	Requirement	NTCC Provides	Integration Outcome
IFRS S1/S2	Governance, metrics, risk	Behavioral data + evidence	Full climate reporting enhancement
GRI 305	Emissions transparency	Behavioral Scope 3	Closes Scope 3 blind spot
COSO	Controls, monitoring	Verification syntax	Strengthened governance
ISO	Activity attribution	CO_2e conversion	Activity-based

Standard	Requirement	NTCC Provides	Integration Outcome
14064/67			quantification
UNFCCC MRV	Measurement & verification	Evidence chain	MRV compatible

This is your "five-standard integration diagram."

G9. Registry Architecture Diagram

Table G9-1. NTCC Registry Architecture

Component	Function	Governance Feature
Evidence Layer	Stores verified blocks	Immutable
Hash Index	Links evidence → ledger	Anti-tamper
Registry Ledger	Stores NTCC units	Permanent record
Access Layer	Provides verified queries	Read-only, audit-safe

This table replaces a "ledger architecture schematic."

G10. One-Page Global Institutional Architecture Diagram

Table G10-1. Universal Integration Schema

Domain	Framework	NTCC Role
Behavior Layer	PADV / PADV^2	Behavioral evidence
Verification Layer	VISA-Layer	Proof integrity
Institutional Layer	ISA	Syntax governance
Finance Layer	SFA × ICP	Internal carbon pricing
Reporting Layer	IFRS / GRI / COSO / ISO	Disclosure enhancement

This table becomes your "global architecture overview diagram."

Appendix H — Glossary

Full Institutional Terminology for NTCC × ICP × PADV × ISA Frameworks

(All entries in table format)

H1. Behavioral & Participation Terminology (PADV Core)

Table H1-1. PADV Behavioral System Terms

Term	Definition	Category
PADV	Participation–Action–Data–Value methodology for verified behavioral data.	Behavioral Framework
Participation (P)	User identity, eligibility, and entry into the action system.	PADV Component
Action (A)	Verified mission/task execution performed by a human actor.	PADV Component
Data (D)	Evidence records generated from action; pre-verification.	PADV Component
Value (V)	Institutional outcome produced after verification (e.g., points, NTCC).	PADV Component
Behavioral Evidence	A verifiable action log linked to CO_2e attribution.	Evidence Term
Mission	A structured, rule-defined activity that produces evidence.	Behavioral Unit
Task QR Code	Action trigger validating mission-specific behavior.	Verification Mechanism

H2. Institutional Syntax Terminology ($PADV^2$ / ISA)

Table H2-1. Institutional Syntax Layers

Term	Definition	Category
PADV²	Multi-layer institutional syntax expanding PADV into a five-layer grammar.	Institutional Framework
Institutional Syntax Architecture (ISA)	Governing architecture converting behavior → evidence → institutional units.	Architecture
Participation Syntax (P-Syntax)	Grammar defining eligible actors and identity integrity.	Syntax Layer
Action Syntax (A-Syntax)	Standardized representation of mission behaviors.	Syntax Layer
Data Syntax (D-Syntax)	Evidence structuring rules and metadata schema.	Syntax Layer
Verification Syntax (V-Syntax)	Multi-level verification grammar ensuring integrity.	Syntax Layer
Value Syntax	Rules converting verified behavior into institutional-readable units.	Syntax Layer
Syntax Maturity Index	Degree to which a system implements institutional grammar.	ISA Metric

H3. Verification Terminology (VISA-Layer)

Table H3-1. VISA-Layer Verification Terms

Term	Definition	Category
VISA-Layer	Verification Infrastructure for Syntax Assurance; multi-tier verification system.	Verification Framework

Term	Definition	Category
Identity Verification (V1)	Confirms legitimacy and uniqueness of the actor.	Verification Tier
Action Verification (V2)	Confirms mission execution and prevents fraud.	Verification Tier
Data Integrity Check (V3)	Ensures metadata, CO_2e factors, and logs are correct.	Verification Tier
Evidence Hashing (V4)	Cryptographically seals evidence packets.	Verification Tier
Ledger Registration (V5)	Writes verified data into immutable registry.	Verification Tier
Verified Evidence Block (VEB)	Final sealed unit produced after passing VISA-Layer.	Verification Output

H4. NTCC Terminology (Non-Tradable Carbon Credit)

Table H4-1. NTCC Definitions

Term	Definition	Category
NTCC	Non-Tradable Carbon Credit; 1 NTCC = 1 tCO_2e verified behavioral contribution.	Core Term
Behavioral CO_2e	CO_2e derived from validated human actions, not market projects.	Carbon Term
Non-Tradability	NTCC cannot be bought, sold, exchanged, or offset.	Governance Principle
Behavioral Credit	NTCC's classification within SFA — credit derived from verified behavior only.	Financial Classification

Term	Definition	Category
Registry Entry	Immutable ledger record storing NTCC issuance data.	Verification Output
CO_2e Attribution Table	Methodology mapping mission types → emission factors → NTCC.	Methodology

H5. ICP Terminology (Internal Carbon Pricing)

Table H5-1. ICP Terms

Term	Definition	Category
Internal Carbon Pricing (ICP)	Internal governance mechanism assigning monetary value to carbon impact.	Governance Framework
Shadow Price	Estimated carbon price for planning scenarios.	ICP Model
Internal Carbon Fee	Charge applied internally per unit of CO_2e.	ICP Model
Capital Budgeting Carbon Factor	Adjusting financial evaluation using CO_2e intensity.	ICP Model
Behavioral Carbon Block (BCB)	NTCC-based behavioral evidence inserted into ICP models.	NTCC × ICP
Non-Financial Unit	NTCC is non-financial; used only for governance inputs.	Governance

H6. SFA Terminology (Sustainability Finance Architecture)

Table H6-1. SFA Terms

Term	Definition	Category
SFA	Sustainability Finance Architecture; EMJ's governance-first financial framework.	Financial Architecture
Behavioral Credit Layer	NTCC classification layer — evidence-based sustainability credits.	SFA Layer
Governance Layer	Ensures integrity of NTCC and evidence.	SFA Layer
Institutional Layer	System-wide alignment with standards & governance.	SFA Layer
Finance Layer	ICP, internal metrics, non-market valuation.	SFA Layer

H7. ICTF Terminology (InstiTech Credibility Tier Framework)

Table H7-1. ICTF Terms

Term	Definition	Category
ICTF	Framework measuring institutional trust maturity across evidence, governance, and alignment.	Trust Framework
Tier 1 — Evidence Integrity	Verified, consistent, tamper-proof evidence.	ICTF Tier
Tier 2 — Institutional Alignment	Alignment with IFRS/GRI/ISO/UNFCCC.	ICTF Tier
Tier 3 — Governance Maturity	Internal controls, auditability, non-tradability.	ICTF Tier

Term	Definition	Category
Tier 4 — Cross-Sovereign Readiness	Suitability for multi-jurisdictional governance.	ICTF Tier

H8. SDGS PASS Terminology

Table H8-1. SDGS PASS Terms

Term	Definition	Category
SDGS PASS	Behavior-based sustainability participation system built by EMJ.LIFE.	Engagement Framework
Green Ticket	Action credential enabling mission participation.	Mission Mechanism
公益積分 **(Public Welfare Points)**	Points earned from completing sustainability actions.	Incentive System
Mission QR	Code used to verify action occurrence.	Verification Mechanism
Redemption Flow	Exchange actions that produce verified evidence.	Behavioral Loop

H9. Carbon Accounting Terminology

Table H9-1. Carbon Accounting Terms

Term	Definition	Category
Scope 1	Direct emissions from company-owned sources.	GHG Protocol

Term	Definition	Category
Scope 2	Indirect emissions from purchased energy.	GHG Protocol
Scope 3	All other indirect emissions (value chain).	GHG Protocol
Behavioral Scope 3	NTCC-enhanced behavioral segment of Scope 3.	NTCC × Scope 3
Emission Factor (EF)	Rate converting activity → CO_2e.	Carbon Metric
Activity Data	Quantified behavioral input for CO_2e calculation.	Carbon Metric

H10. Verification & Governance Terminology

Table H10-1. Verification & Governance Terms

Term	Definition	Category
MRV (Measurement, Reporting, Verification)	UNFCCC's climate accountability standard.	Governance
Audit Trail	Evidence chain used in review/assurance.	Audit
Governance Boundary	Legal and institutional limits defining NTCC usage.	Governance
Data Minimization	Privacy principle that only necessary data is retained.	Privacy
Immutability	Registry entries cannot be altered.	Verification

H11. Reporting & Standards Terminology

Table H11-1. ESG Reporting Terms

Term	Definition	Category
IFRS S1	General sustainability disclosure standard.	Reporting
IFRS S2	Climate-related disclosure standard.	Reporting
GRI 305	Greenhouse gas emissions standard.	Reporting
ISO 14064	GHG quantification & verification standard.	Reporting
ISO 14067	Product carbon footprint standard.	Reporting
OECD Principles	Transparency & accountability governance standards.	Governance