FIBER

FRAMEWORK FOR INCOME BIODIVERSITY & EMISSION REDUCTION

THE JUTE FOUNDATION (TJF) GLOBAL PLASTIC REGISTRY

Methodology for the Quantification of Upstream Polymeric Source Reduction through Serialized Jute Material Displacement and Lifecycle Displacements (JPAC Framework).

METHODOLOGY CODE:	TJF-METH-0002 (Version 1.1)
ASSET CLASS:	Jute Plastic Avoidance Credits (JPACs)
PRIMARY SCOPE:	Upstream Source Reduction & Polymeric Material Displacement
SECONDARY SCOPE:	Sectoral Scope 1 (Agriculture & Supply Chain Safeguards)
ELIGIBLE POLYMERS:	HDPE, LDPE, LLDPE, PP (Polypropylene)

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PART I
INTRODUCTION & STRATEGIC FOUNDATIONS

METHODOLOGY COVER SHEET & EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

Document Reference: **TJF-METH-0002 VERSION 1.1)**

Asset Class: **Upstream Jute Plastic Avoidance Credit (JPAC)**

Unit Equivalence: **1 JPAC = 1.0 Metric Ton of verified pure fossil-fuel plastic prevented from entering the economy**

The Plastic Credit Quality Initiative (PCQI) emphasizes that traditional plastic credits face significant environmental integrity risks because downstream cleanups occur after ecosystems are already harmed [PCQI]. **TJF-METH-0002** directly resolves this issue by switching the market paradigm to **Upstream Source Reduction**. This framework establishes rigorous rules for the intentional, functional replacement of synthetic single-use packaging with high-utility, multi-trip natural jute infrastructure.

The methodology operates across four specialized project modules: Food Grain Sacks, Export Coffee Sacks, Export Cocoa Sacks, and Lifestyle Retail Bags. Rather than assuming a simple 1:1 material substitution by weight, the registry applies a **Functional Equivalence Ratio** that balances the material attributes of both the baseline plastic and the alternative jute. By combining digital tracking (QR/RFID serialization) with localized destination surveys, the framework tracks every distributed bag from raw agricultural sourcing to final deployment. This approach guarantees that credits are only generated when a verifiable mass of virgin fossil-fuel polymer (HDPE, LDPE, LLDPE, PP) is successfully prevented from entering the global economy.

A PCQI ALIGNED FRAMEWORK

The **Plastic Credit Quality Initiative (PCQI)**—led by WWF, Environmental Progress, and stakeholders like SYSTEMIQ—proactively critiques voluntary plastic markets for loose additionality rules, over-crediting, and weak local safeguards [PCQI]. The technical architecture of **TJF-METH-0002** was specifically designed to directly address the primary pillars of the PCQI framework:

Pillar 1: Additionality Assurance (PCQI Core Standard)

- **The PCQI Critique:** Many credit projects issue credits for actions that would have occurred anyway due to changing economic trends or existing single-use plastic regulations [PCQI].

- **The TJF-METH-0002 Defence:** Section 4 closes this loophole by enforcing a strict two-stage additionality barrier. First, a **Regulatory Surplus Test** denies credit eligibility if a local single-use plastic ban is legally active and actively enforced. Second, a **Common Practice Analysis** mandates that if natural fibre alternatives surpass a 15% market share in the specific commercial application corridor, the project is disqualified. This guarantees that credit revenues only finance projects facing critical cash-flow and capital constraints.

Pillar 2: Conservative Quantification (PCQI Core Standard)

- **The PCQI Critique:** Registry methodologies frequently inflate baselines by over-estimating the volume of plastic displaced and ignoring alternative material lifespans [PCQI].

- **The TJF-METH-0002 Defence:** Sections 5 and 6 implement the **Functional Equivalence Ratio**. Credits are calculated based on the precise mass of plastic avoided, not the weight of the jute distributed. Furthermore, Section 12 features a **Conservativeness Discount Matrix**. If field data surveys exhibit a statistical error margin greater than 5%, credit volumes are automatically penalized by a tiered discount (up to 10%), and datasets with errors over 15% are rejected out of hand. Section 13 applies a mandatory **14% Moisture Regain Baseline (ISO 287)** to mathematically subtract environmental humidity from truck scale weights, completely blocking weight-inflation fraud.

Pillar 3: Permanence and Net Environmental Benefit (PCQI Core Standard)

- **The PCQI Critique:** Projects often overlook the environmental or carbon footprint generated by producing and shipping the alternative material, resulting in carbon leakage [PCQI].

- **The TJF-METH-0002 Defence:** Section 7 requires a comprehensive **Cradle-to-Grave Lifecycle Assessment (LCA)**. The raw agricultural sourcing emission factor is set to a strict floor of 0.00 kg CO_2e/kg, preventing developers from claiming temporary biogenic carbon sinks. If heavy ocean shipping or mill processing causes project emissions to exceed the plastic baseline, the difference is directly deducted from final JPAC minting volumes, ensuring the framework remains strictly net-climate positive.

Pillar 4: Robust Social and Environmental Safeguards (PCQI Core Standard)

- **The PCQI Critique:** Upstream alternative manufacturing can cause local water pollution, use child labor, or economically harm vulnerable downstream waste pickers [PCQI].

- **The TJF-METH-0002 Defence:** Section 8 introduces explicit safeguards to manage these risks. Section 8.1 establishes mandatory, semi-annual water sampling upstream and downstream of jute retting sites, enforcing strict BOD and COD compliance limits. Section 8.3 requires **SA8000 or SEDEX SMETA certifications** at the mill phase to guarantee fair wages, safety gear, and human rights compliance. Crucially, Section 8.4 addresses the informal economy through a **"Just Transition" protocol**, requiring urban projects to verify that source reduction does not destroy the daily sorting livelihood of informal waste pickers without offering them formal sorting or logistics employment inside the new alternative supply chain network.

SECTION 0
GLOSSARY OF TERMS AND DEFINITIONS

- **Additionality**

  The principle ensuring that a project activity's environmental benefits would not have occurred in the absence of the credit incentive [PCQI]. To achieve additionality, a project must prove it surmounts significant financial or technological barriers and is not common market practice.

- **Anker Methodology**

  A globally recognized, peer-reviewed framework used to calculate localized, socio-economically accurate living wages. It factors in the real-world costs of decent housing, food, healthcare, utilities, education, and unexpected emergencies for a typical family size within a specific manufacturing or farming region.

- **Baseline Scenario**

  The business-as-usual reference case that represents what would have happened to the environment if the project activity had not been implemented. In this methodology, the baseline is the mass of single-use, fossil-fuel plastic packaging that would have been produced, distributed, and subsequently mismanaged.

- **Chain of Custody (CoC)**

The sequential, legally documented path of custody, ownership, and control of a material or asset through every stage of the supply chain—from raw agricultural sourcing and milling to final consumer or industrial deployment.

- **Common Practice Analysis**

  An assessment used to determine if a project's core activity is already widely adopted within the targeted geographic boundary. Under this methodology, if the alternative material's market penetration exceeds 15% in a specific sub-sector, it is deemed common practice and loses credit eligibility.

- **Displacement Factor (DF)**

  The mathematical fraction (ranging from 0.0 to 1.0) that measures the true effectiveness of the alternative material in replacing the baseline plastic. A factor of 1.0 indicates perfect substitution, whereas a lower factor accounts for "dual-use" leakage where consumers continue to use plastic alongside the alternative.

- **Double-Counting**

  The fraudulent or erroneous allocation of a single environmental benefit to multiple entities, frameworks, or registries. This includes "double-issuance" (minting two credits for the same mass) and "double-use" (selling or retiring the same credit serial number twice) [PCQI].

- **Extended Producer Responsibility (EPR)**

  A regulatory policy framework under which product manufacturers and brand owners are held financially and operationally accountable for the collection, sorting, and end-of-life processing of their packaging materials.

- **Fourier-Transform Infrared Spectroscopy (FTIR)**

  An analytical laboratory testing technique used to identify organic, polymeric, and chemical compound molecular structures. In this framework, it is mandated to definitively verify the exact baseline polymer composition (e.g., HDPE vs. PP) when manufacturer labels are absent.

- **Functional Equivalence**

  The operational ratio establishing how much alternative material infrastructure is required to deliver the exact same utility lifespan as the baseline material. It prevents 1:1 mass weight errors by balancing the durability and reuse cycles of the materials against one another.

- **Jute Moisture Regain Baseline**

  The standardized commercial moisture standard (fixed at 14% under ISO 287) used to normalize raw fibre weights. It prevents credit inflation fraud by

mathematically subtracting ambient water weight absorbed by the hygroscopic jute fibre during storage and shipping.

- **Jute Reuse Factor (T_jute)**

  The total number of functional deployment or transport cycles an alternative jute bag successfully completes in the field before it wears out, tears, or is permanently retired from operations.

- **Polymer Fraction Factor (PF)**

  The exact weight percentage of pure, hydrocarbon-derived synthetic polymer contained within a packaging element. This metric ensures that composite or multi-layer baseline materials are only credited for their actual plastic mass, completely excluding non-plastic coatings, adhesives, or foil linings.

- **Regulatory Surplus**

  The requirement that a project activity must not be legally mandated by existing municipal, national, or international laws. If a single-use plastic ban covers the target polymers and is actively enforced in the project area, the activity lacks regulatory surplus and is ineligible for crediting.

- **Retting**

  The biological and chemical extraction process of submerging raw jute plant stems in water to loosen and separate the structural fibres from the inner woody stalk. This process requires strict water quality monitoring (BOD/COD thresholds) to protect surrounding aquatic ecosystems.

- **Systemic Leakage**

  The unintentional shifting of environmental burdens, plastic production, or waste mismanagement from within the designated project boundary to an unmonitored area outside the project limits as a direct result of the project's activities.

- **Uncertainty Deduction Factor (UDF)**

  A conservative mathematical discount applied directly to final credit volumes or individual survey parameters to penalize statistical data variance (margin of error). It scales progressively higher as survey precision degrades to preserve the environmental integrity of the registry.

- **Upstream Plastic Avoidance Credit (JPAC)**

  The proprietary, non-fungible environmental asset generated under this framework, where exactly 1.0 issued JPAC strictly represents 1.0 Metric Ton of net-verified, fossil-fuel baseline plastic safely prevented from entering the global economy.

- **Validation and Verification Body (VVB)**

An independent, accredited third-party auditing institution (compliant with ISO 14065 standards) responsible for rigorously inspecting project design assumptions (Validation) and post-implementation distribution data trails (Verification).

PART II
REGULATORY APPLICABILITY AND ELIGIBILITY

SECTION 1
OBJECTIVE, SCOPE & APPLICABILITY CONDITIONS

1.1 Objective of the Methodology

The primary objective of this methodology is to incentivize a structural market shift away from single-use synthetic plastic packaging and toward renewable, biodegradable natural fibre alternatives.

This methodology establishes a rigorous, conservative, and verifiable scientific framework for quantifying the **net equivalent mass** of specific virgin fossil-fuel polymers (HDPE, LDPE, PP) safely displaced plastic prevented from entering the global economy through the intentional substitution of natural jute fibre products.

By prioritizing **Upstream Source Reduction**, this methodology incentivizes supply chain interventions that minimize the production of woven polypropylene sacks replaced by jute sacks before they are manufactured, avoiding downstream waste, energy consumption, and environmental degradation.

Project activities designed under this methodology are eligible to receive JPACs **subject to a verified baseline displacement contract and a Net-Impact Lifecycle deduction**, where:

1.2 Upstream Prevention vs. Downstream Mitigation

Traditional plastic waste mitigation focuses heavily on collection, sorting, and downstream recycling. While critical, these pathways suffer from significant structural limitations:

- **Thermal Degradation:** Polymers like High-Density Polyethylene (HDPE), Low-Density Polyethylene (LDPE), and Polypropylene (PP) can only be mechanically recycled a limited number of times before polymer chains shear, rendering the material brittle and forcing downcycling into lower-value, unrecyclable products.
- **Low Recycling Efficiencies:** Global municipal collection systems leak millions of tons of plastic annually into marine and terrestrial ecosystems.

- **Energy and Water Intensity:** Downstream processing of contaminated plastic waste requires significant washing, chemical treatment, and high-temperature extrusion, creating localized pollution and greenhouse gas emissions.

This methodology bypasses these failures by intervening at the **procurement stage and enabling** *Net* **Avoidance**, accounting for any lifecycle impacts introduced by the jute supply chain.. By replacing plastic packaging with biodegradable jute alternatives, the physical demand for virgin resin is reduced, limiting extraction, refining, polymerization, and transport emissions associated with that plastic packaging unit.

Energy Intensive
Downstream Focus —▶ Accumulation —▶ Collection —▶ Sorting —▶ Recycling/Downcycling

Source Reduction
Upstream Focus —▶ Material Substitution (Jute) —▶ Zero Polymer Production

By intervening before manufacturing, the project permanently eliminates the need for fossil fuel extraction and refining for that unit of packaging.

SECTION 2
ELIGIBILITY AND STRUCTURAL MATERIAL PATHWAYS

This methodology explicitly enforce that the *jute mass* is completely disconnected from the crediting formula. Credits must be calculated using a **Functional Displaced Unit (FDU)** based entirely on the baseline 120g–200g or relevant plastic mass values provided below.

2.1 Pathway A: Industrial Commodity Packaging Substitution (HDPE & Woven PP Substitution)

This pathway applies to commercial and industrial projects where heavy-duty woven plastic packaging (primarily High-Density Polyethylene [HDPE] and Woven Polypropylene [PP]) is systematically replaced with natural jute sacks for bulk logistics.

2.1.1 Target Applications

- **Grains and Seeds:** Rice, wheat, maize, lentils, and pulses.

- **Dry Industrial Minerals:** Sand, dry clay, agricultural lime, and non-corrosive chemicals.
- **Global Export Commodities:** Green coffee beans and raw cocoa beans transported from tropical origin countries to international processing hubs.

Geographic Destination Discount. The baseline calculations must reflect the end-of-life waste management realities of the destination country where the bag is decommissioned, considering the biodegradable decomposition value of the discarded waste.

2.1.2 Baseline Industrial Packaging Specifications

Eligible baseline industrial packaging must be single-trip or low-reuse woven HDPE or PP sacks designed for a carrying capacity between 25 kg and 100 kg. Due to grain dust, moisture, and operational wear, these sacks are almost exclusively single-use in global commodity supply chains and are discarded, landfilled, or incinerated upon arrival.

This methodology mandates **Trippage Tracking Protocol**. Project developer cannot mint credits upfront upon the sale of the jute bag. Credits will be tied to verified logistics trip logs or adjusted by a conservative **Discount Factor** reflecting actual reuse cycles in the field

Pathway A: Industrial Sack Substitution	
Baseline Plastic Sack	**Project Jute Sack**
Material: Woven PP/HDPE	Material: 100% Natural Jute
Average Mass: 120g - 200g	Average Mass: 580g – 1020g
Durability: Single-Trip	Durability: Multi-trip (8-10 cycles)

Mandatory Provision:
Project Jute Sack mass shall be used exclusively for Lifecycle Assessment (LCA) tracking and is strictly excluded from credit volume calculation formulas.

Durability: Multi-trip (8-10 cycles). A conservative baseline multiplier of 1.0 shall be applied only if a closed-loop return log is verified; otherwise, a 0.125 default fraction applies

2.1.3 Project Jute Sack Specifications

To claim credits under Pathway A, project jute sacks must meet the following structural guidelines:

- **Fabric Composition:** Made from 100% natural Corchorus capsularis (jute) fibres.
- **Weave Density:** Minimum weave configuration of 6 porter (warp threads per inch) and 8 shots (weft threads per inch) to prevent structural leakage.
- **Hydrocarbon-Free Certification:** For food-contact commodities (coffee, cocoa, and grains), the jute sacks must be manufactured using exclusively vegetable oil-based batching agents, ensuring unsaponifiable matter remains below 1250 mg/kg of dry fibre (tested via ISO 15119).
- **Load Rating:** Structurally rated to carry a static load of up to 70 kg without tearing.

2.2 Pathway B: Consumer Retail Carrier Bags Substitution ((LDPE, HDPE, & LLDPE < 50 Microns))

This pathway applies to projects that distribute durable, reusable jute retail bags to replace thin, single-use plastic carrier bags at commercial points of sale, supermarket checkouts, and lifestyle retail stores.

2.2.1 Baseline Retail Bag Specifications

Eligible baseline carrier bags under Pathway B are single-use plastic bags with integrated handles, manufactured from Low-Density Polyethylene (LDPE), High-Density Polyethylene (HDPE), or Linear Low-Density Polyethylene (LLDPE). The baseline bags must have a wall thickness of less than 50 microns. Bags within this range are highly prone to environmental dispersion, wind-blown littering, and stormwater system clogging.

Pathway B: Retail Carrier Substitution	
Baseline Plastic Bag	**Project Jute Bag**
Material: Thin HDPE/LDPE	Material: 100% Natural Jute
Thickness: < 50 Microns	Average Mass: Lifespan: >= 100 Use Cycles

Lifetime: Single Use (1 Use)	Durability: Multi-year Reusable

2.2.2 Project Jute Retail Bag Specifications

To qualify for crediting under Pathway B, the distributed jute bags must be designed for long-term reuse. Distributed retail jute bags must be built for heavy reuse and meet these minimum quality metrics:

- **Fabric Weight:** Minimum of 300 grams per square meter (g/m^2).
- **Tensile Strength:** Minimum warp breaking load of **800 N** and weft breaking load of **900 N**, tested under ISO 13934-1.
- **Handle Assembly:** Reinforced double-cross-stitch handles capable of repeatedly carrying a static weight of 12 kg.
- **Lifespan Capacity:** Built to withstand at least 85 cycles. **An empirical Consumer Rebound Discount of 75% shall be deducted from upfront credit generation unless point-of-sale reuse tracking data is actively provided.**
- **Chemical Safety:** Natural fibre dyes must be non-toxic, lead-free, and comply with OEKO-TEX Standard 100 or equivalent global consumer safety standards.

PART III
BASELINE METROLOGY AND ADDITIONALITY

SECTION 3
BASELINE SCENARIO DETERMINATION

3.1 Establishing Geographic and Sectoral Boundaries

Before initiating any baseline assessment, the project developer must establish a clear geographic and sectoral boundary. This boundary defines the physical and commercial limits of the project activity and must be verified by an independent Validation and Verification Body (VVB).

- **Geographic Boundary:** Must be defined at the municipal, state, or national level. All retail points of sale (for consumer bags) or industrial distribution facilities (for industrial sacks) must operate within this specified boundary.
- **Sectoral Boundary:** Must be limited to either **Pathway A (Industrial HDPE and LDPE Bags/Sacks)** or **Pathway B (Consumer Retail Carrier Bags)**. A single project may apply both pathways, but the baseline data, sampling pools, and calculations must be kept entirely separate.

The project developer must systematically define the baseline plastic usage through the following four-stage protocol. This protocol is subject to audit by an accredited Validation and Verification Body (VVB).

Step-by-Step Baseline Assessment Methodology

Step-by-Step Baseline Assessment Methodology		
Step 1	HISTORICAL DATA AUDITING	Gather the consecutive 24 months of historical procurement records immediately preceding the official project start date from target users
Step 2	REPRESENTATIVE PHYSICAL SAMPLING	Establish a randomized sample size calculated to achieve a 95% confidence level and a 5% margin of error based on total annual distribution volume
Step 3	MATERIAL CHARACTERIZATION & WEIGHT VERIFICATION	Weigh samples using calibrated scales to find Average Plastic Weight.
Step 4	WASTE DESTINATION MAPPING	Run localized surveys to map disposal routes (landfill, burn, litter).

3.2 Physical Baseline Bag Characterization Protocol

During baseline validation, the project developer must execute physical weighing campaigns. Each sample must be clean and weighed on an analytical balance calibrated to a precision of +/- 0.1 grams. The developer must document the polymer type using Fourier-Transform Infrared Spectroscopy (FTIR) if the material composition is not declared by the manufacturer.

3.3 Path-Specific Baseline Determination Protocols

3.3.1 Pathway A (Industrial HDPE and Woven PP Sacks

For industrial projects (e.g., replacing plastic chemical bags, agricultural fertilizer sacks, or heavy construction material packaging), the baseline is determined as follows:

- **Historical Procurement Audit:** The project developer must collect at least two years of purchasing invoices from the participating industrial facilities. This data must confirm the total volume of plastic bags purchased, their technical specifications, and their average purchase price.
- **Physical Sampling Protocol:** A random sample of at least 100 unused baseline plastic sacks must be collected from the target facilities. Each sack must be measured for:
    - Length, width, and thickness (measured in microns using a calibrated digital micrometer).
    - Gross individual weight (measured in grams on a scale with a precision of **+/-0.1 grams**).
- **Baseline Calculation Basis:** The average weight of these samples establishes the **Replaced Plastic Bag Weight** variable used in the core credit equation.

3.3.2 Pathway B: Consumer Retail Carrier Bags

For consumer-focused projects (e.g., check-out shopping bags distributed at supermarkets or shopping malls), the baseline is determined as follows:

- **Point-of-Sale Data Collection:** The developer must partner with participating retail chains to extract historical sales and distribution data for thin single-use plastic carrier bags. This data must cover a minimum continuous period of 24 months prior to project implementation.
- **Physical Weight Audits:** Retail bags must be sampled directly from retail cash registers. Because thin carrier bags can vary in thickness and raw material quality, a minimum sample size of 250 bags must be weighed to determine the standard **Replaced Plastic Bag Weight** for the retail partner.

3.4 Waste-Stream Destination Mapping

The project developer must provide empirical evidence of the local end-of-life pathways for the baseline plastic packaging. This is done through through localized disposal surveys. **In the absence of field data, municipal records may be used, provided they are updated within the last 36 months.**

Disposal Route	Impact on Baseline Assessment	Requirement for Crediting
Municipal Landfill	High Persistence	Eligible. A 25% structural discount applies if the destination is a certified, fully contained sanitary landfill. (reward for projects)
Open Air Burning / Incineration	Toxic Atmospheric Releases	Eligible. Mandatory 50% discounted from the avoided volume.
Terrestrial & Marine Litter	Microplastic Fragmentation	Eligible Mandatory Pro-Rata Deduction. The baselines mass shall be multiplied by **(1 - R)**, where R s the exact regional recycling rate for that polymer
Industrial Closed-Loop Recycling	Displaces Virgin Material	Must be discounted from the baseline if recycling rates exceed 20% in the region.

3.5 Standardized Baseline Questionnaire Format

The baseline survey must include the following standardized data points to be verified by the VVB:

TJF BASELINE SURVEY SHEET - VERSION 1.0		
1	Respondent ID / Location Code	
2	Sector Classification	[ ] Pathway A (Industrial) [ ] Pathway B (Retail)

3	Primary Plastic Polymer Used	[ ] HDPE [ ] LDPE [ ] LLDPE [ ] PP [ ] Other
4	Average Monthly Bag/Sack Consumption (Units)	_____ *Required Verification Document Reference Number
5	Physical Dimensions of Plastic Bag	Length (cm): _____ Width (cm): _____ Gusset (cm): _____
6	Measured Thickness (Microns, average of 5 points)	
7	Measured Weight of Sample (grams, precision +/-0.1g)	
8	Primary End-of-Life Route	[ ] Municipal Landfill [ ] Open Burning [ ] Informal Litter [ ] Recycling
9	Baseline Reusability Multiplier: Is the plastic bag reused within operations?	[ ] No (1.0) [ ] Yes, Average _____ Trips

SECTION 4
SYSTEMIC ADDITIONALITY DEMONSTRATION

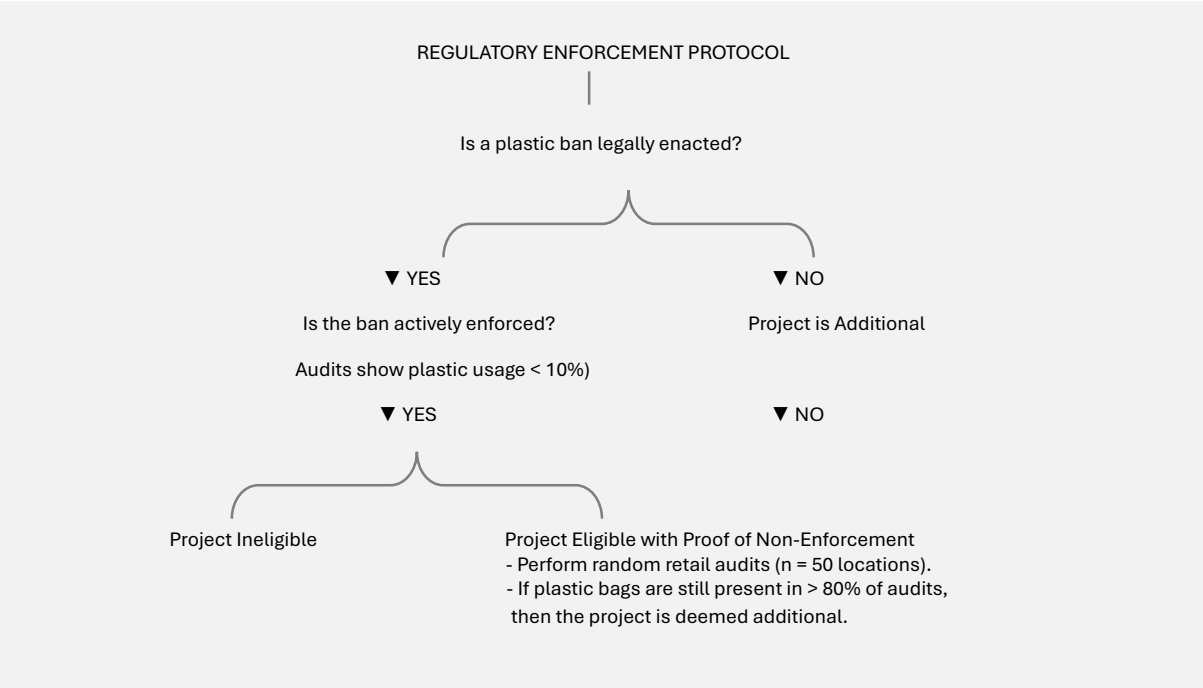
4.1 Regulatory Surplus Assessment and the 'Paper Ban' Protocol

The developer must prove that the replacement of plastic packaging with jute is not legally mandated by local environmental regulations. If a legal plastic ban is active in the project boundary, the project developer must apply the **Regulatory Enforcement Protocol**.

4.1 Step 1: Regulatory Surplus Assessment

The project must not be required by any existing local, regional, or national laws, regulations, or legally binding agreements.

- **The Paper Ban Rule:** If a legally binding regulation or ban has been enacted, **regulatory surplus is terminated 12 months after the official law enactment date,** regardless of local non-enforcement rates.”.
- **Empirical Proof of Non-Enforcement:** The developer must conduct unannounced physical audits using a sample size **statistically calculated to capture regional compliance with a 5% margin of error** in the region. If more than 80% of these audited facilities continue to distribute or use the baseline plastic packaging, the market is classified as "non-compliant," and the project remains eligible for crediting.



This methodology requires to establish if the plastic market penetration is greater than **50%** across a statistically significant sample pool.

The project developer must also prove that the transition from plastic packaging to jute is a direct result of the incentive provided by Upstream Plastic Avoidance Credits (JPAC) and would not have occurred under a business-as-usual scenario.

4.2 Financial Barrier Analysis

The cost barrier of natural fibres is the primary factor preventing widespread market adoption. Jute bags require a significantly higher initial capital investment compared to fossil-fuel packaging. The developer must provide a clear financial analysis proving that the high cost of jute prevents its adoption without credit financing.

The table below illustrates the significant cost gap between baseline single-use plastic bags and reusable jute bags:

Comparative Sourcing Cost Model		
Metric	**Single-Use HDPE Bag**	**Reusable Jute Retail Bag**
Unit Production Cost	$0.015	$1.200
Purchasing Cost Multiple	Baseline (1x)	80x higher upfront cost
Operational Lifespan	1 Trip	85+ Trips
Amortized Cost per 10,000 Uses	$150.00	$141.17 (reflecting a real world operational loss and soilage rate)

Although jute is cost-competitive when evaluated across its full reuse life, the **80-fold increase in upfront cost** represents an immediate cash-flow barrier for retailers and industrial users.

JPAC credit sales provide the necessary forward-funding to subsidize these high initial wholesale purchases, directly overcoming this financial barrier. By utilizing credit finance through forward-funding or ongoing credit sales, the project developer can subsidize the upfront wholesale cost of the jute products, enabling target businesses to shift their packaging supply chains without increasing initial capital expenditures.

4.3 Step 3: Technological and Operational Barriers

Replacing synthetic plastics with natural jute fibres introduces operational challenges that must be addressed:

- **Packaging Machinery Modifications:** High-speed automated packaging lines designed for plastic film rolls or synthetic woven bags cannot run natural jute fibres without modifications. Jute is thicker, has less elasticity, and generates natural fibre dust that can clog precision machinery. The project developer must provide **an independent mechanical engineering certification and certified CapEx invoices** detailing the retrofits required to adapt existing bagging lines to jute.

- **Storage and Moisture Barriers:** Unlike plastic, raw jute is breathable and absorbs environmental moisture. To protect sensitive contents (like sugar or cement), specialized vegetable-oil based moisture barrier laminations are required. Developing these food-grade, biodegradable moisture barriers requires specialized engineering, which represents a significant technological barrier.

4.4 Step 4: Common Practice Analysis

The developer must analyze the penetration rate of jute packaging within the defined geographic and sectoral boundary.

- **The 15% Market Penetration Threshold:** If a market analysis shows that natural fibre products account for more than 15% of the total packaging market within the **specific sub-sector and functional application (e.g., B2B chemical storage vs. retail grocery transport)**, the project activity is considered "common practice" and is ineligible for crediting.
- **Proving Non-Common Practice:** The developer must submit commercial market reports, industry trade logs, or municipal purchasing data **published within the 12 months immediately preceding the project submission date** to prove that jute usage remains a niche option, representing less than 15% of active operations in the target region.
- **Market penetration must be re-evaluated every 5 years.** If the threshold exceeds 15% during a renewal audit, future credit issuance shall be capped or frozen.

PART IV
CORE ASSET MATHEMATICS AND QUANTIFICATION

SECTION 5
CORE CREDIT QUANTIFICATION MATHEMATICS

To establish a highly precise, auditable, and transparent accounting framework, this methodology eliminates the use of abstract mathematical variables. Instead, all calculations are expressed through a standard, text-based, step-by-step formula.

This structural approach ensures that all regional authorities, registry auditors, and project developers can perform, verify, and reproduce the mathematical results with absolute precision.

5.1 The Core Upstream Avoided Credit Formula

To determine the total net mass of physical plastic prevented from entering the supply chain in a year, the project developer must apply the following formula:

The net mass of upstream plastic avoided is calculated using the standard formula below:

CORE PLASTIC AVOIDANCE EQUATION

Total Avoided Plastic Mass (Metric Tons) =

Number of Distributed Jute Bags **(×)**

Jute Reuse Factor **(×)**

Replaced Plastic Bag Weight (kg) **(×)**

Displacement Factor **(×)**

(1 - Leakage Factor) **(×)**

Metric Ton Conversion Factor (0.001)

Detailed Description of Factors:

- **Number of Distributed Jute Bags (units):** The total quantity of jute bags verified as manufactured, distributed, and active within the target supply chains during the monitoring period.
- **Jute Reuse Factor (dimensionless):** The average number of times a single jute bag is used over its operational lifespan.
- **Replaced Plastic Bag Weight (kg):** The average physical weight of the specific single-use baseline plastic bag being replaced.
- **Displacement Factor (fraction):** A percentage value (expressed as a decimal between 0 and 1) representing the portion of distributed jute bags that actively replace a plastic alternative, accounting for bags that are misplaced, kept in storage, or underutilized.
- **Leakage Factor (fraction):** A percentage value (expressed as a decimal between 0 and 1) representing indirect increases in plastic use elsewhere due to the project activity (e.g., consumers purchasing plastic trash bags because single-use retail bags are no longer available).
- **Metric Ton Conversion Factor (0.001):** The standard constant used to convert kilograms into metric tons.

5.2 The Standardized Jute Equivalence Formula

To determine the exact volume of raw jute fabric required to offset plastic packaging and generate exactly one Upstream Plastic Avoidance Credit, developers must apply the following formula:

Number of Distributed Jute Bags **(×)**

(Jute Reuse Factor /Baseline Plastic Reuse Factor) **(×)**

Replaced Plastic Bag Weight(kg) **(-)**

Upstream Material Processing & Waste Deduction (Metric Tons)

Where:

- **Mass of Jute Needed: JPAC Unit Equivalence**: One Upstream Plastic Avoidance Credit (JPAC) shall strictly represent exactly 1.0 Metric Ton of net verified baseline plastic mass avoided.
- **Jute Bag Weight:** The individual physical weight of the project's jute bag (kg).
- **Plastic Bag Weight:** The individual physical weight of the single-use plastic bag being replaced (kg).
- **Jute Reuse Factor:** The average number of times the jute bag is reused over its entire operational lifespan.
- **DF (Displacement Factor):** The fraction of active plastic displacement achieved in practice. **This value shall be determined using one of two options:**
    - **Default Conservative Approach**: Apply a fixed default value of **0.80** for Pathway A (Industrial B2B) or **0.50** for Pathway B (Retail Consumer).
    - **Empirical Monitoring Approach**: Calculate dynamically using the formula:
      DF = 1 – {Residual Plastic Purchased Post-Project / Historical Baseline Plastic Purchased} verified by consecutive procurement invoices."
- **Leakage: A mandatory minimum default value of 0.15 (15%) shall be applied in the absence of dynamic supply chain tracer audits**

SECTION 6
CATEGORY-SPECIFIC QUANTIFICATION MODULES & SCALING PROTOCOL

The following subsections outline the exact specifications, baseline variables, and the final quantity of jute bags required to replace 1 million single-use plastic bags across major global use cases.

OPTION A:
The Supply Chain View (For Logistics & Inventory Tracking)
Use this table to audit physical warehouses, manufacturing outputs, and shipping manifests.

MASTER SUMMARY VIEW Per 1 million Jute Bags Distributed		
Target Application / Use Case	**Physical Jute Weight**	**Total Lifetime Asset Yield**
Module 1: Food Grain Sacks	580.0 Metric Tons	1,117.2 JPACs
Module 2: Export Coffee Sacks	907.0 Metric Tons	1,283.0 JPACs
Module 3: Export Cocoa Sacks	1,020.0 Metric Tons	1,457.3 JPACs
Module 4: Lifestyle Retail Bags	300.0 Metric Tons	891.5 JPACs

OPTION B:
The Environmental Impact View (For Public Markets & Credit Buyers)
Use this table for public registry dashboard, marketing materials, and corporate buyer reports.

MASTER SUMMARY VIEW Per 1 million Single-Use Plastic Bags Displaced		
Target Application / Use Case	**Required Jute Weight**	**Total Environmental Yield**
Module 1: Food Grain Sacks	51.9 Metric Tons	100.0 JPACs
Module 2: Export Coffee Sacks	707.0 Metric Tons	1,000.0 JPACs
Module 3: Export Cocoa Sacks	700.0 Metric Tons	1,000.0 JPACs

Module 4: Lifestyle Retail Bags	3.5 Metric Tons	10.5 JPACs

Unified Cross-Scale Verification Protocol

To prevent data misalignment during independent audits, project developers and Validation and Verification Bodies (VVBs) must utilize the core module ratios to seamlessly convert tracking metrics between the **Supply Chain View (Table 1)** and the **Environmental Impact View (Table 2)**.

The two scales are mathematically reconciled using the following standardized formulas:

1. Converting Supply Chain Volume to Credit Yield

When auditing a project based on physical manufacturing or shipping manifests, the total volume of credits generated is derived directly from the individual unit count:

Total JPACs Generated =

Total Jute Units Distributed **(x)**

Effective Plastic Replaced per Bag **(/)** 1,000

Example (Module 4):
1,000,000 x 0.8915 kg / 1,000 = 891.5 JPACs
(matches Table 1)

2. Converting Plastic Displacement to Required Material Infrastructure

When calculating market-level plastic displacement (e.g., matching a corporate buyer's specific offset target), the physical jute infrastructure required to achieve that target is scaled using the module ratio:

Required Jute Infrastructure (Metric Tons) =

Target JPAC **(x)**

Jute Mass Needed per Credit

Example (Module 4):

10.488 JPACs = 1million plastic bags x 0.337 kg ratio = 3.53 Metric Tons of Jute *(matches Table 2)*.

6.1 Module 1: Heavy-Duty Food Grain Sacks (B-Twill)

6.1.1 Target Application

This module is tailored for regional agricultural distribution, specifically the bulk storage, transport, and commercial handling of essential staple crops, including wheat, rice, corn, pulses, and barley.

6.1.2 Specifications and Operational Variables

- **Jute Sack Type:** Standard B-Twill double warp jute sack.
- **Individual Jute Bag Weight:** 0.580 kg (580 grams).
- **Carrying Capacity:** 50 kg of raw grain.
- **Replaced Baseline Plastic**: Woven PP sack. A baseline reuse factor of 2.0 trips shall be applied as a denominator to the equation unless a strict regional single-trip logistics loop is explicitly proven via VVB audits.
- **Baseline Plastic Sack Weight:** 0.120 kg (120 grams).
- **Jute Reuse Factor:** 10 trips (standard rotation in national agricultural grain agencies).
- **Displacement Factor (DF):** 0.95 (95% active utilization within regulated cooperatives).
- **Leakage Factor (LK):** 0.02 (2% tracking loss).

6.1.3 Step-by-Step Quantification (Net Plastic Avoided in Metric Tons)

To find the mass of jute required to generate exactly 1 Credit, apply the Jute Equivalence Formula:

1. Calculate the denominator (effective plastic replaced per bag):

= Jute Reuse Factor (×) Plastic Bag Weight (×) DF (×) (1 - Leakage)
= 10 × 0.120 kg × 0.95 × (1 - 0.02)

= 10 × 0.120 kg × 0.95 × 0.98

= 1.1172 kg of plastic avoided per jute bag.

2. Calculate Total JPACs Issued:

JPACs = Total Jute Sacks Distributed x 1.1172 kg / 1000

To convert this value into a clear, operational ratio:

For Heavy-Duty Food Grain Sacks, deploying **0.519 Metric Tons of dry-basis natural jute (or a verified equivalent count of 895 individual B-Twill units)** replaces enough woven PP sacks to generate exactly 1 Upstream Plastic Avoidance Credit (JPAC).

6.1.4 Total Weight of Jute Needed to Replace 1 million Plastic Bags

To calculate the total weight of jute needed to displace 1 million woven PP grain bags:

Total Jute Weight = 1,000,000 bags (×) Jute Bag Weight (0.580 kg) = 580,000 kg = 580.0 Metric Tons of Jute

Yielding 1,117.2 JPACs, to be issued ex-post in annual tranches based on verified multi-trip log reviews).

6.2 Module 2: Premium Export Coffee Sacks

6.2.1 Target Application

This module applies to international agricultural logistics, focusing on raw, green coffee bean storage, long-haul sea freight, and export operations.

6.2.2 Specifications and Operational Variables

- **Jute Sack Type:** Hydrocarbon-free, natural vegetable oil-treated Hessian export sack.
- **Individual Jute Bag Weight:** 0.907 kg (907 grams).

- **Carrying Capacity:** 60 kg of raw green coffee beans.
- **Replaced Baseline Plastic:** Multi-layer low-density polyethylene (LDPE) bulk bag liners or heavy single-use woven PP sacks.
- **Baseline Plastic Sack Weight:** 0.180 kg (180 grams).
- **Jute Reuse Factor:** 8 trips (limited due to overseas freight, with domestic reuse post-import).
- **Displacement Factor (DF):** 0.90 (90% utilization).
- **Leakage Factor (LK):** 0.01 (1% handling leakage).

6.2.3 Step-by-Step Quantification (Mass of Jute Needed for 1 Credit)

Apply the Jute Equivalence Formula to calculate the target coffee shipping metrics:

1.Calculate the denominator (effective plastic replaced per bag):

= Jute Reuse Factor × Plastic Bag Weight × DF × (1 - Leakage)

= 8 × 0.180 kg × 0.90 × (1 - 0.01)

= 8 × 0.180 kg × 0.90 × 0.99

= 1.2830 kg of plastic avoided per jute bag.

2. Calculate the Jute Mass Needed:

= Jute Bag Weight / Denominator

= 0.907 kg / 1.2830 kg

= 0.707 kg of jute per credit.

Converting this ratio:

For Premium Export Coffee Sacks, deploying 0.707 Metric Tons of natural jute replaces enough multi-layer LDPE liners **(accounting strictly for the verified pure polymer mass fraction, excluding non-plastic barriers)** to generate exactly 1 Upstream Plastic Avoidance Credit (JPAC).

6.2.4 Total Weight of Jute Needed to Replace 1 million Plastic Bags

To calculate the total weight of jute needed to displace 1 million premium plastic liners:

Total Jute Weight = 1,000,000 bags (×) Jute Bag Weight (0.907 kg) = 907,000 kg = 907.0 Metric Tons of Jute

Yielding 1,283.0 JPACs over its lifespan).

6.3 Module 3: Premium Export Cocoa Sacks

6.3.1 Target Application

This module is tailored for tropical agricultural export systems, specifically designed for the high-volume bulk transport of fermented cocoa beans.

6.3.2 Specifications and Operational Variables

- **Jute Sack Type:** Grade-A heavy-duty sacking fabric (odorless and hydrocarbon-free).
- **Individual Jute Bag Weight:** 1.020 kg (1020 grams).
- **Carrying Capacity:** 65 to 70 kg of raw cocoa beans.
- **Replaced Baseline Plastic:** High-Density Polyethylene (HDPE) bulk liners or high-weight woven synthetic sacks.
- **Baseline Plastic Sack Weight:** 0.200 kg (200 grams).
- **Jute Reuse Factor:** 8 trips. **To claim reuse beyond Trip 1, an electronic Chain-of-Custody (CoC) log must verify arrival and reuse at the importing destination; otherwise, a default of 1.0 trip applies.".**
- **Displacement Factor (DF):** 0.92 (92% utilization).
- **Leakage Factor (LK):** 0.01 (1% loss).

6.3.3 Step-by-Step Quantification (Mass of Jute Needed for 1 Credit)

Apply the Jute Equivalence Formula to define the cocoa shipping baseline:

1.Calculate the denominator (effective plastic replaced per bag):

= Jute Reuse Factor (×) Plastic Bag Weight (×) DF (×) (1 - Leakage)

= 8 × 0.200 kg × 0.92 × (1 - 0.01)

= 8 × 0.200 kg × 0.92 × 0.99

= 1.4573 kg of plastic avoided per jute bag.

2. Calculate the Jute Mass Needed:

= Jute Bag Weight / Denominator

= 1.020 kg / 1.4573 kg

= 0.700 kg of jute per credit.

Converting this ratio:

For Premium Export Cocoa Sacks, deploying 0.69992 Metric Tons of natural jute replaces enough synthetic liners to generate exactly 1 Upstream Plastic Avoidance Credit (JPAC).

6.3.4 Total Weight of Jute Needed to Replace 1 million Plastic Bags

To calculate the total weight of jute needed to displace 1 million heavy-duty plastic cocoa sacks:

Total Jute Weight = 1,000,000 bags (×) Jute Bag Weight (1.020 kg) = 1,020,000 kg = 1,020.0 Metric Tons of Jute

Yielding 1,457.3 JPACs over its lifespan.

6.4 Module 4: Lifestyle Retail and Consumer Shopping Bags

6.4.1 Target Application

This module is designed for commercial consumer sectors, replacing thin, single-use retail carrier bags at grocery checkouts, apparel stores, and consumer goods points of sale.

6.4.2 Specifications and Operational Variables

- **Jute Bag Type:** Standard reusable consumer shopping bag (laminated structure with integrated cotton or jute handles).
- **Individual Jute Bag Weight:** 0.300 kg (300 grams).
- **Carrying Capacity:** 12 kg of dry consumer goods.
- **Replaced Baseline Plastic:** Single-use LDPE retail carrier bags.
- **Baseline Plastic Bag Weight:** 0.012 kg (12 grams).
- **Jute Reuse Factor:** 85 trips (long-term household utility).
- **Displacement Factor (DF):** 0.92 (92% active substitution rate).
- **Leakage Factor (LK):** 0.05 (5% leakage, accounting for purchased plastic trash liners).

6.4.3 Step-by-Step Quantification (Mass of Jute Needed for 1 Credit)

Apply the Jute Equivalence Formula to calculate retail substitution efficiency:

1.Calculate the denominator (effective plastic replaced per bag):

= Jute Reuse Factor (×) Plastic Bag Weight (×) DF (×) (1 - Leakage)

= 85 × 0.012 kg × 0.92 × (1 - 0.05)

= 85 × 0.012 kg × 0.92 × 0.95

= 0.8915 kg of plastic avoided per jute bag.

2. Calculate the Jute Mass Needed:

= Jute Bag Weight / Denominator

= 0.300 kg / 0.8915 kg

= 0.337 kg of jute per credit

Converting this ratio:

For Consumer Lifestyle Bags, deploying 0.337 Metric Tons of natural jute replaces enough thin single-use plastic carrier bags to generate exactly 1 Upstream Plastic Avoidance Credit (JPAC).

6.4.4 Total Weight of Jute Needed to Replace 1 million Plastic Bags

To calculate the total weight of jute needed to displace 1 million thin single-use plastic grocery bags:

Total Jute Weight = 1,000,000 bags (×) Jute Bag Weight (0.300 kg) = 300,000 kg = 300.0 Metric Tons of Jute

Yielding 891.5 JPACs over its lifespan.

SECTION 7: LIFE CYCLE ASSESSMENT (LCA) AND CARBON NEUTRALITY NESTING

To safeguard environmental integrity and verify that the project does not lead to a net increase in greenhouse gas emissions, the project developer must conduct a cradle-to-grave comparative carbon assessment.

The project is eligible... if and only if the **total mass-adjusted lifecycle emissions** of the jute products **(calculated as Total Jute Mass × Jute Factor)** are less than or equal to the baseline plastic emissions **(Baseline Plastic Mass × Plastic Factor).**

	LIFECYCLE EMISSIONS (kg CO_{2e} per kg)
Virgin Polypropylene (PP)	1.95

High-Density Plastic (HDPE)	1.85
Low-Density Plastic (LDPE)	1.80
Natural Jute Fibre	0.00 CO_2 / kg

7.1 Standardized Emission Factors for Comparative Lifecycle Assessments

If local, project-specific lifecycle data is not available, the developer must utilize the following peer-reviewed, internationally recognized default factors:

Phase	Jute Fibre Pathway	HDPE/LDPE Plastic Pathway	PP Plastic Pathway
Material Sourcing & Extraction	0.00 kg CO_2e / kg *(Net Carbon sequestered after adjusting process emissions)*	1.85 kg CO_2e / kg *(Fossil fuel extraction and refining)*	1.95 kg CO_2e / kg *(Propylene monomer synthesis)*
Manufacturing & Weaving	0.30 kg CO_2e / kg *(Mechanical fibre carding and weaving)*	0.40 kg CO_2e / kg *(Extrusions and bag cutting)*	0.45 kg CO_2e / kg *(Extrusion and structural weaving)*
Transport & Distribution	0.22 kg CO_2e / kg *(Ocean shipping to target markets)*	0.12 kg CO_2e / kg *(Typically closer regional transport)*	0.14 kg CO_2e / kg *(Regional supply networks)*
End-of-Life Disposal	0.05 kg CO_2e / kg *(Aerobic biodegradation and soil enrichment)*	1.20 kg CO_2e / kg *(High municipal incineration rates)*	1.30 kg CO_2e / kg *(Waste combustion and decomposition)*

All emission factors in Table 7.1 must be mass-adjusted by multiplying the factors by the total physical weight of material required to satisfy the functional lifecycle trips before computing final project eligibility.

7.1.2 Mandatory Net Lifecycle Emissions Alignment Equation

To qualify for JPAC issuance, the project developer must prove that the total mass-adjusted emissions of the alternative material do not exceed the baseline plastic footprint. Project developers must calculate this boundary using the following formula:

$$\text{Net Project Emissions} = (M_{jute} \times EF_{sourcing}) + (M_{jute} \times EF_{mfg}) + (M_{jute} \times EF_{trans}) + (M_{jute} \times EF_{eol})$$

Where:

- M_{jute} = The total physical metric tonnage of jute distributed by the project.
- $EF_{sourcing}$ = Raw material sourcing factor. This value must be set to a conservative floor of 0.00 kg CO_2e/kg to eliminate temporary biogenic carbon storage claims.
- EF_{mfg}, EF_{trans}, EF_{eol} = The respective table factors from Section 7.1.

If Net Project Emissions exceed the calculated total Baseline Plastic Emissions, the difference must be mathematically deducted from the final JPAC credit volume at a rate of 1 JPAC per 1 Metric Ton of excess CO_2e generated.

PART V
ENVIRONMENTAL, SOCIAL, AND LABOUR SAFEGUARDS

SECTION 8
ENVIRONMENTAL AND SOCIAL SAFEGUARDS

8.1 Environmental Protection and Water Quality: Agricultural Sourcing Safeguards

Because jute is an agricultural product, its cultivation must be managed responsibly to avoid localized ecological damage:

8.1.1 Retting Water Quality Standards and Compliance Thresholds To ensure that upstream agricultural sourcing does not degrade local aquatic ecosystems, all project developers must verify that jute retting activities do not discharge untreated effluents into public water bodies.

- Mandatory Water Testing: Project developers must conduct semi-annual water sampling at active retting sites, measured 50 meters upstream and 50 meters downstream of the discharge zone.
- Compliance Thresholds: Testing must prove that local water bodies do not exceed a Biochemical Oxygen Demand (BOD) increase of more than 10% relative to the upstream baseline or must comply with national surface water quality standards (e.g., Central Pollution Control Board standards in production regions).
- Corrective Action: If downstream sampling reveals critical hypoxic conditions (Dissolved Oxygen < 4.0 mg/L), credit issuance for that specific agricultural batch shall be frozen until biological remediation or proper water filtration systems are verified.

8.1.2 Prohibited Chemical Sourcing Restrictions Project activities must completely ban the use of non-biodegradable synthetic retting accelerators, heavy-metal-based microbial starters, or WHO Hazard Class I/II pesticides during the cultivation and fibre extraction phases. Only mechanical, natural microbial, or certified organic enzymes may be utilized to assist fibre separation.

8.2 Social Equity, and Labor and Mill Safety Safeguards

The manufacturing of jute fibre products is a labour-intensive process. Therefore, project activities must prove strict adherence to the following social protections:

8.2.1 Fair Living Wage and Safety Verification Protocol

Compliance with the social protections outlined in Section 8.2 shall be verified annually by an independent third-party VVB through the following data collection channels:

- Wage Auditing Framework: Employee payroll ledgers must prove that wages meet or exceed the benchmarks defined by the Global Living Wage Coalition (GLWC) or the Anker Methodology for the specific processing region.
- Safety Equipment Verification: On-site auditors must visually verify and document a minimum 95% active workforce deployment rate of organic dust respirators/masks and industrial ear protection within high-noise mechanical loom environments.

8.2.2 Informal Waste Sector Livelihood Safeguard (Just Transition)

Because upstream source-reduction activities structurally lower the aggregate volume of municipal single-use plastic waste, project developers utilizing Pathway B (Consumer Retail Bags) must perform a local Livelihood Impact Assessment.

- No-Harm Metric: Developers must confirm that the localized source reduction does not systematically displace or financially destabilize the baseline daily sorting income of the informal waste-picking community within the project boundary.
- Mitigation Strategy: In the event of documented structural income loss within local waste picker groups, the project developer must implement a Just Transition strategy (e.g., offering formal collection, sorting, or logistics employment opportunities within the alternative jute network).

PART VI
CONTINUOUS MONITORING AND UNCERTAINTY MANAGEMENT

SECTION 9
DIGITAL TRACEABILITY AND LOGISTICS DATA TRACKING (MRV)

To ensure that only genuine, high-quality jute bags are counted toward credit generation, developers must implement a digital tracking and validation system.

9.1 CONTINUOUS SUPPLY CHAIN TRACKING

DIGITAL-TO-PHYSICAL AUDIT PATHWAY		
1	Spinning & Weaving	• Mill records batch production weights. • Unique serial numbers generated.
2	Barcode/RFID Tagging	• Every bag gets a durable, scannable tag. • Scan logged during shipment dispatch.
3	Deployment Scanning	• Sacks scanned at agricultural hubs. • Retail bags registered at checkout.
4	Consumer Surveys	• Annual surveys run to track reuse cycles. • Physical durability checked on site.

9.1.2 Automated Serialization and Double-Counting Locks:

To ensure absolute asset integrity and satisfy PCQI anti-double-counting criteria, the registry platform must execute an automated validation check on all uploaded Barcode/RFID data:

- Double-Claiming Interlock: The registry database shall automatically reject any batch or individual serial number that has been previously uploaded, registered, or cleared for credit minting within any other project boundary or geographic jurisdiction.
- Cross-Registry Check: Project developers must legally attest that the physical mass tracked under this project has not been synchronized with carbon offset protocols (e.g., biogenic sequestration claims) or regional compliance EPR schemes.

9.1.3 Empirical Survey Sampling Rules (Lifespan Calibration):

When consumer or facility surveys are deployed under Step 4 to calibrate the active Jute Reuse Factor (T_jute), the following data standards apply:

- Statistical Confidence Pool: Survey sampling pools must be randomized and sized to mathematically satisfy a 95% confidence level with a maximum 5% margin of error based on the total annual distributed bag volume.
- Asymmetric Discounting: If empirical field surveys reveal that the real-world reuse cycle mean is lower than the default methodology pathway baseline by more than 10%, the quantification engine must dynamically adjust downward to reflect the field-verified lifespan for all future credit tranches.

9.2 Data Points to Be Continuously Monitored

To comply with this methodology, the project developer must monitor, record, and archive the following parameters during every crediting period:

Parameter Name	Method of Measurement	Minimum Frequency	Archive Period
Quantity of Distributed Jute Bags	Digital sales ledger entries, factory shipment logs, and point-of-sale scanning records.	Continuous tracking of every transaction.	10 years after credit issuance.
Individual Jute Bag Weight	Direct physical weighing of a randomized sample size **calculated to achieve a 95% confidence level and a 5% margin of error based on total production run volume**.	Measured per manufacturing run.	10 years after credit issuance.
Replaced Plastic Bag Weight	Direct physical weighing of a randomized sample size **calculated to achieve a 95% confidence level and a 5% margin of error based on target market annual distribution estimates**.	Updated annually.	10 years after credit issuance.

Jute Reuse Factor	For consumer retail bags: verified through random digital consumer surveys. For industrial sacks: determined by tracking distribution and return cycles.	Measured and calculated annually.	10 years after credit issuance.
Displacement Factor	Verified through retail spot-checks and industrial audits to confirm that jute is actively replacing plastic rather than being stored or discarded.	Measured and calculated annually.	10 years after credit issuance.
Leakage Factor	Verified through consumer surveys, monitoring whether consumers have purchased plastic trash liners to replace thin shopping bags.	Measured and calculated annually.	10 years after credit issuance.
Jute Moisture Content / Dry-Matter Fraction	Direct testing using calibrated digital pin/insertion moisture meters on a randomized batch sample prior to final dispatch. All weights must be mathematically adjusted to a **standard 14% commercial moisture regain baseline under ISO 287.**	Measured per manufacturing run and warehouse dispatch event..	10 years after credit issuance.

SECTION 10
STATISTICAL UNCERTAINTY MANAGEMENT AND DISCOUNT MATRIX

10.1 Scale Calibration Protocol

- All physical scales used at the manufacturing mills or in baseline characterization campaigns must be calibrated annually by an accredited third-party metrology laboratory holding a valid ISO/IEC 17025 certification.
- Calibration certificates must be archived digitally and made available to the VVB during verification audits.

10.2 Double-Counting Prevention Protocol

- Each distributed jute bag must have a unique identifier (a QR code or an RFID tag) woven into its structure.
- This identifier must be logged in a centralized registry system when the bag is shipped from the factory.
- If a unique ID is scanned more than once during the initial distribution phase, the registry will flag the entry and exclude the duplicate unit from the final credit calculations.

10.3 Independent Third-Party Verification

At the end of each monitoring period, an independent, accredited Validation and Verification Body (VVB) shall conduct a formal audit. This audit consists of three mandatory physical and digital components:

- Manufacturing Mill Audits
  The VVB must audit a random sample of the data from manufacturing mills, and shall conduct on-site physical verifications to:
  - Inspect raw material procurement invoices and verify jute yarn purchases.
  - Confirm that batch weights match the values recorded in the digital ledger.
    –
  - Verify that the mills comply with the social and environmental safeguards outlined in Section 8 (e.g., verifying fair wages, safe working conditions, and the complete absence of child labor).
- Distribution and Retail Site Audits For consumer-focused projects, the VVB shall visit randomized retail points of sale to:
  - Observe and verify the active distribution of jute bags at cash registers.
  - Inspect point-of-sale systems to confirm that retail transaction logs accurately match the digital deployment records.
- Household and Operator Surveys
  To verify the Jute Reuse Factor and Displacement Factor, the VVB must review and validate the annual survey logs. The VVB will:
  - Check that the survey sample size meets a statistically valid 95% confidence level and 5% margin of error based on total annual distribution volume.

10.4 Statistical Precision and Uncertainty Deductions

Any variable determined through sample monitoring (such as the consumer retail reuse factor or localized displacement factors) must meet strict statistical thresholds to minimize quantification uncertainty.

10.4.1 Target Thresholds Surveys

Field sampling campaigns must be designed to achieve a 95% confidence interval with a precision equal to or better than 5%.

10.5 Conservativeness Discount Matrix

To maintain absolute environmental integrity, a tiered conservativeness discount must be applied to the final calculated credits based on the statistical uncertainty of the monitored survey parameters:

CONSERVATIVENESS DISCOUNTS	
Uncertainty <= 5%	0% Discount (Maximum Crediting)
Uncertainty 5.1%-10%	5% Discount
Uncertainty 10.1%-15%	10% Discount (Maximum Allowed)
Uncertainty > 15%	Ineligible for Credit Generation

The quantification engine and third-party Validation and Verification Bodies (VVBs) must apply the following structural discount tiers at the end of each monitoring period:

- Tier 1 (Low Uncertainty): If uncertainty is <= 5% at a 95% confidence interval, no deduction applies. The Uncertainty Deduction Factor (UDF) is 1.00 (0% discount; maximum crediting).
- Tier 2 (Moderate Uncertainty): If uncertainty is > 5% and <= 10% at a 95% confidence interval, a mandatory 5% discount is applied to the final credit volume (UDF = 0.95).
- Tier 3 (High Uncertainty): If uncertainty is > 10% and <= 15% at a 95% confidence interval, a mandatory 10% discount is applied to the final credit volume (UDF = 0.90). This represents the maximum allowable threshold for credit generation.

- Tier 4 (Unacceptable Uncertainty): If uncertainty exceeds 15% at a 95% confidence interval, the target monitoring dataset is declared structurally invalid. Zero credits shall be issued for the impacted parameters during that specific monitoring period.

SECTION 11
CORE PARAMETER MONITORING MATRIX TABLE

11.1 Overview of Monitored Variables

To ensure continuous data quality and verification accuracy, all project activities registered under TJF-METH-0002 must systematically log, track, and archive the core variables defined in the matrix below. No Upstream Plastic Avoidance Credits (JPACs) shall be issued without a verified, complete monitoring dataset for the corresponding compliance period [PCQI].

11.2 Core Parameter Monitoring Matrix

Parameter Name & Symbol	Method of Measurement & Calibration Standards	Minimum Frequency	Mandatory Archive Period
Distributed Material Mass (M_jute)	Warehouse weight scale tickets and dispatch logs. All hardware used must hold active certifications under ISO/IEC 17025 or valid national weights-and-measures laws updated within the trailing 12 months.	Recorded per manufacturing run and bulk warehouse dispatch event.	10 Years post credit issuance.
Individual Jute Bag Weight	Direct physical weighing. Sample sizes must be randomized and dynamically calculated to achieve a 95% confidence level and a 5%	Measured per manufacturing run batch.	10 Years post credit issuance.

	margin of error based on total production run volume.		
Jute Moisture Content / Dry-Matter Fraction	Direct testing using calibrated digital pin/insertion moisture meters on randomized batch samples. All physical weights must be mathematically adjusted to a standard 14% commercial moisture regain baseline under ISO 287.	Measured per manufacturing run and dispatch event.	10 Years post credit issuance.
Expected Lifespan / Trippage (T_jute)	Centralized Barcode/RFID tracer system logs. Data must be supplemented by mandatory annual random-sample end-user audits to verify real-world operational durability and active discard rates in the field.	Continuous digital logging; audited annually.	10 Years post credit issuance.
Replaced Plastic Bag Weight	Direct physical weighing of baseline single-use plastic alternatives. Randomized sample sizes must be calculated to achieve a 95% confidence level and a 5% margin of error based on target market annual distribution estimates.	Updated and verified annually prior to verification.	10 Years post credit issuance.
Systemic Leakage Fraction (L_factor)	Field data collected via randomized regional merchant and facility surveys. Any supporting regional municipal waste audits or literature used must be updated or published within the trailing 24 months.	Re-evaluated and updated every 24 continuous months.	10 Years post credit issuance.

11.3 Data Retention and Accessibility

All digital ledger data, transaction receipts, scale tickets, calibration certificates, and raw survey responses associated with the parameters listed in Section 13.2 must be

stored in a centralized, secure cloud database. This data must remain fully accessible to the registry platform and third-party Validation and Verification Bodies (VVBs) for a minimum of 10 years following the official retirement or sale of the corresponding credit tranches.

PART VII
AUDITING & REGULATORY GOVERNANCE

SECTION 12
VALIDATION AND VERIFICATION PROTOCOLS

12.1 Independent Auditing Requirements

To ensure the environmental integrity of all Upstream Plastic Avoidance Credits (JPACs) minted under this methodology, project activities must undergo a distinct two-step independent audit process conducted by an accredited third-party Validation and Verification Body (VVB). The registry shall only recognize VVBs that maintain active accreditation under ISO 14065 or are formally approved under major international standards (e.g., Verra, Gold Standard, or the UN Framework Convention on Climate Change).

12.2 The Validation Sequence (Pre-Project Approval)

Before any project activity can officially register or begin generating credit baselines, the designated VVB must conduct a comprehensive validation review to verify that the project design conforms to the parameters of TJF-METH-0002.

- **Additionality Audit**: The VVB must stress-test the project's Additionality Systematic Demonstration (Section 4). This includes inspecting audited financial logs to confirm the Capital Expenditure barrier and independently verifying that the regional common practice threshold remains strictly below 15%.
- **Regulatory Surplus Check**: The VVB must review national, state, and municipal environmental laws within the project boundary. If a statutory single-use plastic ban covering the target polymers is actively in force and formally enforced, the validation must be denied.
- **Ex-Ante Calculation Stress-Test**: The VVB must independently audit the math models used to establish the pre-project baseline parameters.

12.3 The Verification Sequence (Post-Distribution Auditing)

Verification occurs periodically post-project implementation and is the mandatory trigger for credit issuance. No JPACs shall ever be minted based on forecasts or projections.

- **Physical Manifest and Serialization Audit**: The VVB must conduct an on-site audit of the manufacturing facilities and regional distribution warehouses. Auditors must cross-verify the digital Barcode/RFID logs against physical shipping manifests, truck scale records, and corporate B2B sales invoices.

- **Moisture-Regain Calibration Check**: The VVB must confirm that all physical jute weights logged by warehouse scales have been adjusted downward using the mandatory 14% moisture-regain baseline under ISO 287 to prevent over-crediting for ambient water weight.
- **Dynamic Lifespan Survey Verification**: For all ongoing credit tranches, the VVB must review the randomized annual end-user surveys tracking the actual Jute Reuse Factor (\(T_{jute}\)). If field data shows the real-world reuse mean has dropped below the default pathway baseline by more than 10%, the verification body must dynamically scale down the credit yield calculations for that monitoring period.

12.4 Auditing Frequencies and Tranche Schedules

- **Initial Verification**: The first project verification audit must occur within 12 months of the official project start date.
- **Subsequent Verifications**: Verification audits must be executed at a minimum frequency of once every 12 continuous months. A project developer may choose to execute verification on a semi-annual basis (every 6 months) provided that data collection achieves the same statistical confidence pools.
- **Crediting Period Limits**: Projects registered under this methodology shall be granted a fixed crediting period of 5 years. At the conclusion of the 5-year cycle, the project must undergo a comprehensive Baseline Re-Assessment and Common Practice analysis to qualify for a maximum of one 5-year renewal.

SECTION 13
CONCLUDING REGISTRY TERMS AND LEGAL CONSTRAINTS

13.1 Anti-Double-Counting and Asset Integrity Policy

To satisfy the highest-level asset purity requirements of the PCQI, the registry enforces an absolute, automated double-counting lock across all operational layers:

- **Exclusive Material Tracking**: The physical mass of natural jute fibre utilized to claim JPACs under this framework cannot be concurrently used to claim credits under any carbon offset program (such as agricultural biogenic soil sequestration or biofuel incentives). Any project found to be stack-claiming carbon and plastic

credits on the exact same material volume shall face immediate registry termination.

- **Extended Producer Responsibility (EPR) Interlock**: If a project developer sells credits into a mandatory national compliance registry (such as the Central Pollution Control Board EPR system in India), those specific credit serial numbers must be instantly and permanently marked as "Retired for Compliance" within the global voluntary ledger to prevent duplicate commercial trading.

13.2 Credit Ownership and Chain of Custody

- **Primary Title Rights**: The legal title and ownership of a generated JPAC belong strictly to the entity that finances and executes the intentional substitution at the procurement or distribution stage, unless explicit contractual transfer agreements are filed with the registry platform during initial project validation.
- **The Serialization Protocol**: Every issued JPAC must be assigned a permanent, non-fungible digital serial number tracking the country of origin, target application module (Modules 1–4), validation year, and the unique digital batch IDs of the underlying Barcode/RFID tags.

13.3 Registry Revocation and Permanence Rules

- **Material Reversal Adjustments**: If a post-project audit reveals that a major batch of distributed retail consumer bags (Pathway B) experienced premature structural failure or widespread consumer discard resulting in real-world reuse cycles falling below 50% of the default pathway calculation, the registry platform shall deduct the equivalent volume from the developer's unissued buffer pool accounts.

13.4 Fraud and De-listing Penalties

- If a project developer is found to have falsified baseline procurement data, manipulated warehouse scale readings, or recycled duplicate serial number logs across multiple project sites, the registry shall immediately freeze all associated accounts, invalidate all active un-retired serial numbers, and publicly publish a non-compliance notice on the registry dashboard.

SECTION 14
REGISTRY ACCOUNT ONBOARDING TERMS AND CONDITIONS

14.1 Onboarding Terms For Project Developers

14.1.1 Account Eligibility, Legal Representation, and Identity Verification (KYC/KYB)

To qualify for an active project developer account on **The Jute Foundation (TJF) Global Plastic Registry**, an applicant must be a legally incorporated entity in good standing within its country of domicile.

- **Know Your Business (KYB) Mandate:** Applicants must upload certified copies of corporate registration, ultimate beneficial ownership (UBO) structures, valid corporate tax identity documents, and an authorized corporate resolution designating the account manager.
- **Prohibited Jurisdictions:** Accounts shall be denied to entities or corporate officers designated on any active international sanctions lists (e.g., OFAC, UN, EU).
- **Single Account Limit:** A project developer is permitted exactly one master corporate registry account. Sub-accounts may be created for localized subsidiary management, but the primary master account holder remains strictly liable for all actions, filings, and legal claims tied to all projects.

14.1.2 Ongoing Operational Compliance, Metric Accuracy, and Fees

- **Execution of Methodology Requirements:** Project developers legally bind themselves to the operational, metrological, and monitoring requirements of **TJF-METH-0002** upon account activation [PCQI].
- **The Dry-Basis Data Mandate:** Developers agree that any bulk warehouse weight or scale log entered into the platform must be pre-adjusted to the standard **14% moisture-regain baseline under ISO 287** using calibrated hardware. Entering raw, unadjusted wet weights shall be flagged as an immediate account infraction.
- **Fee Structure Framework:** Developers agree to abide by the registry's fixed administrative fee structure:
    - **Project Intake & Screening Fee:** ..... per PDD submission.
    - **VVB Fees:**..... paid by the project developer to the registry to provide the VVB service
    - **Registry Issuance Fee:** ..... USD per Upstream Plastic Avoidance Credit (JPAC).
    - **Credit Transfer Fee:** ..... %of the asset volume per cross-account transaction.

- **Tokenization Fee:** ..... this is for information only and the contractual liabilities rest between the Project developer / Seller of JPACs and the VDA platform.

14.1.3 Liability for Falsification, Account Suspension, and Token Revocation

- **Zero-Tolerance Fraud Policy:** If a project developer is found by an independent VVB or the registry board to have intentionally falsified historical baseline procurement data, recycled duplicate digital serial numbers, or altered moisture meter scale logs, the registry shall execute immediate enforcement actions.
- **Suspension and De-listing Protocols:** The developer's registry account shall be permanently frozen, and all active projects under review or implementation shall be de-listed from the public portal.
- **Asset Cancellation and Legal Redress:** All unretired or available UPAC serial numbers associated with the fraudulent developer shall be permanently marked as **"Cancelled/Void"** on the public voluntary ledger. The registry reserves the right to pursue civil and criminal litigation for environmental asset fraud and to recover damages to the platform's market reputation.

14.2 Onboarding Terms for Validation and Verification Bodies (VVBs)

14.2.1 Mandatory ISO Accreditation and Technical Expertise

An independent auditing entity seeking formal onboarding as an approved VVB on the TJF platform must provide clear proof of structural competence:

- **Active ISO Credentials:** The VVB must present an active, unexpired accreditation under **ISO 14065** or show valid designation as an approved third-party auditor under major international standards (e.g., Verra or Gold Standard).
- **Auditor Qualification Logs:** The VVB must upload CVs and official competence logs for the assigned lead auditors, proving specific expertise in agricultural/textile engineering (ISO 287 compliance) and polymer chemistry (FTIR analysis).
- **Mandatory Training:** Assigned personnel must complete the registry's proprietary training curriculum on the technical conversion mechanics of the **Functional Equivalence Ratio**.

14.2.2 Conflict of Interest Limitations and Impartiality Declarations

- **The 36-Month Consulting Ban:** A VVB is completely barred from validating or verifying any project activity if the VVB, its parent corporation, or its individual team members have provided consulting or PDD-drafting services to that specific developer within the **trailing 36 months**.

- **Zero Commercial Interest:** The VVB must legally swear that it holds zero financial stake in the target project, the underlying technology, or the secondary pricing and sale of the resulting UPAC tokens.

- **Independent Selection Loop:** While project developers pay for third-party validation and verification services, the VVB must remain completely autonomous. Any attempt by a developer to condition payment upon a favorable auditing verdict must be reported to the registry within 48 hours.

14.2.3 Performance Review Cycles and Revocation of Auditing Status

- **Annual Performance Reviews:** All onboarded VVBs are subject to an annual performance review by the TJF Registry Quality Assurance Committee. The registry will spot-audit at least 10% of the VVB's signed verification reports against the raw database metrics to evaluate compliance with Section 12 precision controls.

- **Desktop Audit Violations:** If a VVB issues a clean validation or verification report without conducting the required on-site physical field visits (spinning mills, retail checkouts, or agricultural retting zones), the audit shall be declared null and void.

- **Revocation of Status:** Failure to identify major non-conformances, collusion with a developer, or a pattern of sloppy data validation will lead to the immediate **revocation of the VVB's registry auditing status**. The VVB will be blacklisted from future platform actions, and a formal notification of professional misconduct will be sent to their respective ISO accreditation body.

SECTION 15
REGISTRY ONBOARDING ACKNOWLEDGEMENT AND LEGAL SIGN-OFF

LEGAL ATTESTATION SHEET FOR SYSTEM ACCESS

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THE JUTE FOUNDATION (TJF) GLOBAL PLASTIC REGISTRY

MANDATORY REGISTRY ACCOUNT ONBOARDING AGREEMENT

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REGISTRY ACCOUNT TYPE SELECTION:

PRIMARY PROJECT DEVELOPER (ACCOUNT CODE: TJF-DEV-NEW)

ACCREDITED VALIDATION & VERIFICATION BODY (ACCOUNT CODE: TJF-VVB-NEW)

LEGAL REPRESENTATIVE DECLARATION:

"By checking the selection box above and appending an authorized digital or physical signature below, the onboarding entity legally binds itself, its parent corporations, employees, and designated project teams to the full operational mandates, metrological parameters, and legal liabilities defined within Sections 1 to 15 of the TJF-METH-0002 methodology framework.

The entity acknowledges that any data manipulation, moisture metric inflation, double-counting of environmental assets, or breach of impartiality guidelines shall cause the immediate, irreversible termination of registry system access, the cancellation of underlying UPAC assets, and the initiation of formal legal proceedings under international environmental asset fraud jurisdictions."

Authorized Legal Representative Signature: _____ Date: [DD/MM/YYYY]

Printed Name & Official Corporate Title: _____

Legal Corporation Name / Auditing Firm Name: _____

Corporate Identity Seal / Professional Notary Stamp:

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