Impact Tokenization and Innovative Financial Models for Responsible Agricultural Supply Chains

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Agenda

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01 – Key Research Findings from Expert Interviews

02 – Event Tokenization & Impact Measurement & Verification in the Agricultural Supply Chain

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05 – Recommendations

06 – Questions & Answers
Purpose of Paper
Purpose of Research Paper

This research paper examines how new forms of impact measurement, verification, and tokenization can be leveraged to test innovative financial models that incentivize more responsible agricultural supply chains.
Key Research Findings from Expert interviews
Key Research Findings from Expert Interviews

1. **Performance-based financial models** -- where payments are dependent on measurable impact targets -- provide significant opportunity to generate both impact and financial return for investors and can attract a larger pool of impact-first investors.

2. Advancements in technology have allowed for **real-time, scalable impact measurement and verification** in agricultural supply chains, which can unlock innovative performance-based financial models.

3. Ideal blockchain-based agricultural supply chain solutions are those that **fit into existing financial frameworks**, complimenting current free market incentive structures, and are managed with strong governance practices.
Event Tokenization & Impact Measurement & Verification in the Agricultural Supply Chain
Event Tokenization & Impact Measurement & Verification in the Agricultural Supply Chain

DLT and blockchain provide the technical foundation for tokenization of singular events

Distributed ledger technologies (DLT) and blockchain allow for:

- data tokenization
- storage of verified impact data
- securitization and new business and financing models

Figure: Traditional centralized ledger and a distributed ledger

Tokenization on individual event level provides the foundation for innovative financing models.

**Figure:** The minting of impact tokens: Each event has a custom verification model

**Source:** Proof of Impact Whitepaper (2019)
Event triggered performance based token function on smart contracts

Source: Proof of Impact Whitepaper (2019)
DLT allows for new forms of impact investing, linking directly to outcome

Source: Proof of Impact Whitepaper (2019)
Blockchain as a Tool for Tracking & Verification

**Transparency:** All relevant data (e.g., location, date, photos, confirmation codes) are publicly available.

**Immutability:** The data cannot be manipulated unless the community agrees and the change is made public.

**Attribution:** Each token with the associated data is assigned to one owner -- the person or organization who funded it.
Meaningful Output Measures for Impact

IRIS Catalog of Metrics

IRIS metrics are designed to measure the social, environmental and financial performance of an investment.

To use IRIS metrics—and the resulting data—as part of the investment management process, IRIS metrics should be used and analyzed in generally accepted sets and according to well-defined objectives. To access generally accepted Core Metrics Sets by Theme or Sustainable Development Goal (SDG), set up a profile.

Average Client Agricultural Yield: Total (PI3468)
Average agricultural yield per hectare of clients (who were farmers) of the organization during the reporting period.

Average Client Agriculture Yield: Smallholder (PI9421)
Average agricultural yield per hectare, of clients (who were smallholder farmers) of the organization during the reporting period.
Data as Proof of Impact

**Over-humanized data** is data coming from multiple human-controlled mobile devices or consensus among multiple participants on the ground. An example of this is mobile app data pulled in real time from multiple workers to confirm location.

**Dehumanized data**

Is objective data coming directly from non-human sources. Examples include IoT data, satellite imagery of farms, and automated sensor data.
Methods for Technology-Based Data Collection

Spectrum from basic technology to advanced technology (especially with regards to agricultural supply chain)
- Photos/videos from smartphones
- Drones
- Satellites
- IOT/ Machine generated data
- Cross referencing different data sources
Technology-Based Data Collection

IoT Supply Chain – Farm to Shelf

Farm to Warehouse
- Temperature monitoring
- Humidity monitoring
- Light exposure
- Location of truck

Optimising Distribution
- Route optimisation
- Temperature monitoring
- Location of produce
- On-time delivery notification

On the farm
- Soil moisture monitoring
- Water consumption
- Leak detection
- Tracking of farm equipment
- Live stock tracking

Smart Warehousing
- Tracking of equipment
- Water metering
- Service buttons
- Temperature and humidity
- Motion detection

A Satisfied Customer
- Less empty shelves due to late stock
- Maintain optimal temperature
- Monitor fridge power
- Customer satisfaction buttons
## Technology-Based Data Collection (cont’d)

### Key Opportunities

- Real-time information
- More granular data
- Increased reliability and validity of data
- Can lower costs over time and increase efficiency

### Key Challenges

- Expensive (in the short-run)
- Requires training
- Requires workflow adjustments
- May require existing infrastructure (e.g., Internet access)
Impact Verification

Completeness & Uniqueness: Tailored cross-sectional and longitudinal validation checks

Third Party Human Confirmation: Independent random sampling confirmation conducted manually by human verifiers

Exclusion criteria: Does not pass due diligence and vetting criteria
- Data only contains text from manual data collection
- Data fails verification checks

Enhanced Validation: Self-reported data cross-checked against independent external online sources

Third Party Machine-Based Confirmation: Third party administered machine for data collection and verification
# Impact Validation Examples

<table>
<thead>
<tr>
<th>Validation Check</th>
<th>Example Data Point</th>
<th>Validation Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Background in photo matches landscape of location on Google Maps</td>
<td>Image with supporting background that matches Google map:</td>
<td>Google map zoom in on the matching background:</td>
</tr>
<tr>
<td></td>
<td><img src="image1.jpg" alt="Image" /></td>
<td><img src="google_map.png" alt="Google Map" /></td>
</tr>
<tr>
<td>EXIF metadata of the photo matches date of the impact occurrence</td>
<td>Date of impact in image (Nov. 17, 2019):</td>
<td>Screenshot of EXIF metadata:</td>
</tr>
<tr>
<td></td>
<td><img src="date_image.jpg" alt="Date" /></td>
<td><img src="exif_metadata.png" alt="EXIF Metadata" /></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Field</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>create</td>
<td>2020-06-25T14:33:20+00:00</td>
</tr>
<tr>
<td>ApertureValue</td>
<td>126503/50079</td>
</tr>
<tr>
<td>BrightnessValue</td>
<td>24697/4332</td>
</tr>
<tr>
<td>ColorSpace</td>
<td>65535</td>
</tr>
<tr>
<td>ComponentsConfiguration</td>
<td>1, 2, 3, 0</td>
</tr>
<tr>
<td>CustomRendered</td>
<td>7</td>
</tr>
<tr>
<td>DateTime</td>
<td>2019/11/17 15:12:20</td>
</tr>
<tr>
<td>DateTimeDigitized</td>
<td>2019/11/17 15:12:20</td>
</tr>
<tr>
<td>DateTimeOriginal</td>
<td>2019/11/17 15:12:20</td>
</tr>
</tbody>
</table>
Impact Verification Confidence Scoring

1. Number of Supporting Data Points
   - Score 1: 5-9 supporting data points
   - Score 2: 10-14 supporting data points
   - Score 3: 15+ supporting data points

2. Quality of Supporting Data Points
   - Score 1: 1 self-evident data point
   - Score 2: 2 self-evident data points
   - Score 3: 3+ self-evident data points

3. Completeness and Consistency of Data
   - Score 1: 16%+ excluded data errors
   - Score 2: 15-5% excluded data errors
   - Score 3: <5% excluded data errors

4. Machine-Based Data Collection
   - Score 1: Fully manual human collection
   - Score 2: Hybrid data collection
   - Score 3: Fully machine-based collection

5. Third-Party Human Confirmation
   - Score 1: No human third party
   - Score 2: Third party basic audit
   - Score 3: Third party enhanced review

6. Third-Party Machine Confirmation
   - Score 1: No machine third party
   - Score 2: Machine confirms support data
   - Score 3: Machine confirms outputs

Final sum score: 210
Case Study: Incentivized Sustainable Supply Chain

Three stakeholders:

1. **Bamboozled**: Furniture brand, specializes in the retail sale of sustainably produced bamboo furniture

2. **Sustain Chain**: Bamboo furniture supplier, needs upfront investment (i.e., loans) for working capital

3. **Sustainable Agrifund**: Impact investor, provides upfront investment capital to Sustain Chain at 7% interest

**Goal**: Sustain Chain gets rewarded for sustainable production, Bamboozled promotes impact to customers and minimizes risk in supply chain, and Sustainable Agrifund makes financial return while investing in impact
Case Study: Incentivized Sustainable Supply Chain

**Incentives for Impact**
Sustain Chain hits its targets, Bamboozled continues its purchase orders, and Sustainable Agrifund reduces the interest rate on the loan.

**Impact Verification**
A third party verifier vets the data to verify achievement of impact targets, then tokenizing the data on a blockchain.

**Impact Metric Selection**
Sustain Chain identifies meaningful output metrics: fair wages, work hours, work conditions, sustainable packaging, etc.

**Data as Proof of Impact**
For each metric, Sustain Chain collects proof data: dates, locations, photos, receipts, contracts, HR/payroll records, etc.

**Collection via Technology**
Sustain Chain pulls data from an its payroll system, CRM, security cameras, bank statements, and utilities for verification.
Monetizing Tokenized Impact as an Investment
Different financial models exist and impact investment is suitable for this use-case

Figure: Examples of agricultural investments along the spectrum of investment options

Monetizing Tokenized Impact as an Investment

The analysis focuses specifically on performance-based financial models in which some financial return is based on the achievement of measurable, verified impact results.

<table>
<thead>
<tr>
<th>Performance-based</th>
<th>Not performance-based</th>
</tr>
</thead>
</table>
| **Interest-bearing** | - Pay for Success (PFS) models (e.g., Impact Security, social impact guarantee)  
- Interest-bearing loan |
|                   | - Equity investments in impact-focused companies  
- ESG fund investments  
- Fixed income bonds  
- Loan guarantee or loan insurance  
- Crop or price insurance |
| **Non-interest bearing** | - Performance-based donations  
- Principal-only PFS models |
|                   | - Principal-only loan  
- Traditional grants and donations |
Financial Models

- Interest-Bearing Pay for Success Model
Interest-Bearing Pay for Success
## Interest-Bearing Pay for Success Model

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Payer(s) agree to fund verified impact if impact targets are achieved</td>
</tr>
<tr>
<td>2.</td>
<td>Investors pay upfront to fund impact delivery</td>
</tr>
<tr>
<td>3.</td>
<td>Implementer uses upfront funds to deliver impact within time period</td>
</tr>
<tr>
<td>4.</td>
<td>Verifier verifies data to ensure impact was achieved</td>
</tr>
<tr>
<td>5.</td>
<td>Investors and payer(s) receive impact data</td>
</tr>
<tr>
<td>6.</td>
<td>Payer(s) pay back investors (principal + interest)</td>
</tr>
</tbody>
</table>

**Diagram:**
- **Payer(s) commit contingent funding**
- **Verifier**
- **Payer(s) pay if impact achieved**

The diagram illustrates the flow of funds and impact verification processes.
Sub-Model: Social Impact Guarantee

- Operates like “impact insurance”
- Investors commit to pay back the payers (i.e., government or philanthropy) if impact targets are not achieved.
- Eliminates “double capitalization” problem
Results
# Results

<table>
<thead>
<tr>
<th></th>
<th>Financial Return (30%)</th>
<th>Accessibility (20%)</th>
<th>Replicability (20%)</th>
<th>Regulatory Feasibility (30%)</th>
<th>Final Score (Average Weighted)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance Based Donation</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>2.4</td>
</tr>
<tr>
<td>Principal-Only Pay for Success Model</td>
<td>1</td>
<td>3</td>
<td>2.5</td>
<td>3</td>
<td>2.3</td>
</tr>
<tr>
<td>Impact-Based Loan</td>
<td>3</td>
<td>2.5</td>
<td>2.5</td>
<td>3</td>
<td>2.8</td>
</tr>
<tr>
<td>Interest-Bearing Pay for Success Model</td>
<td>4</td>
<td>3</td>
<td>1.5</td>
<td>3</td>
<td>3.0</td>
</tr>
</tbody>
</table>
Recommendations
Recommendations

- **Recommendation #1**: Support the Development of a Democratized Pay for Success Investment Platform
- **Recommendation #2**: Promote the Piloting of Impact-Based Loans
Questions?