Soy - Customer Value Gap

Team 1: Angelika S. Utagawa, Phuong Anh (Alicent) Nguyen, Mattia Cavenaghi, Michelle Barski, Rick van Rijn

Introduction

Target Audience & Scope

Target Audience: This report is intended for stakeholders navigating the intersection of agricultural supply chains, geospatial technology, and regulatory compliance. Key audiences include European National Competent Authorities (NCAs) responsible for enforcement (such as the Dutch NVWA) , environmental NGOs , voluntary certification bodies (like the Round Table on Responsible Soy) , and supply chain sustainability leaders.

Scope: The project analyzes the commercial and regulatory viability of using Earth Observation (EO) technologies to enforce the EU Deforestation Regulation (EUDR). It specifically focuses on the highly complex and opaque global soy commodity industry and evaluates proposed tech-enabled solutions for both public regulators and civil society watchdogs.

Executive Summary | Introduction

The Challenge: The EU Deforestation Regulation (EUDR)

The European Union has introduced the EUDR to ensure that products consumed within or exported from the EU do not contribute to global deforestation. For seven core commodities, including soy, companies must prove their products are deforestation-free by providing precise GPS coordinates of the specific plots of land where the commodities were produced. While the environmental goal is clear, the implementation is highly contentious and complex, prompting a delay in enforcement until December 2026 for large enterprises.

The Core Problem: The Opaque Soy Supply Chain

The fundamental challenge in enforcing the EUDR lies in the physical reality of the global soy industry. After harvest, soybeans from thousands of different farms are mixed together at local aggregation points and massive storage silos. Once this mixing occurs, tracing a specific batch of soy back to an individual plot of land is nearly impossible. The industry warns that building separate physical silos for compliant versus non-compliant beans is prohibitively expensive and impractical. Ultimately, the primary constraint is a structural lack of farm-level geolocation data being captured early in the supply chain.

The Role of Technology: Earth Observation (EO) as an Enabler

Earth Observation (EO) technology, which utilizes satellites and artificial intelligence to monitor land-use changes, is a critical tool for tracking deforestation. However, EO is not a magic solution. While satellites can identify deforestation risks and verify if land has been cleared, they require an initial set of GPS coordinates to analyze. Satellites can verify existing data, but they cannot create missing supply chain data. Therefore, technology serves as an enabler for accountability, but it must be combined with reliable on-the-ground supplier information to be effective.

The Role of Technology: Earth Observation (EO) as an Enabler

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Strategic Pathways: Proposed Solutions To address the massive enforcement and compliance bottlenecks created by the EUDR, the report outlines two strategic solutions targeting different stakeholders:

- **Solution 1: EUDR Enforcement Support Layer (For Regulators)** National authorities face the overwhelming task of reviewing massive volumes of corporate due diligence submissions. This solution proposes a "human-in-the-loop" screening system designed for authorities like the Dutch NVWA. Rather than making automated legal judgments, this tool uses data to flag high-risk shipments, helping human inspectors prioritize their time and focus on cases that require closer investigation.
- **Solution 2: EO Monitoring for Substantiated Concerns (For Watchdogs)** The EUDR contains a provision allowing third parties, such as NGOs, to submit formal complaints, known as "substantiated concerns", if they suspect a company is violating the rules. This solution provides NGOs with the analytical tools necessary to turn raw satellite data into credible, regulatory-grade evidence dossiers. This empowers civil society to hold companies accountable by triggering official government investigations.

Conclusion: The transition to deforestation-free soy supply chains requires more than ambitious legislation; it requires functional enforcement infrastructure. By equipping both government regulators and environmental watchdogs with targeted, data-driven tools, the industry can move from opaque, voluntary sustainability pledges toward a system of enforceable, verifiable accountability.

Can EO create economic value, and if so, *where* and *for whom*?

Our main research question informs the structure of our discussion.

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The EUDR

The EUDR

The EO Ecosystem: Hardware vs Software

Data providers (Hardware)

What they do: Operate the physical satellite constellations (ESA/Copernicus, Planet Labs, Maxar, Airbus) that capture raw optical and radar imagery of the Earth.

The Output: They provide the foundational layer of visual data, offering extremely high-resolution imagery and frequent, daily updates.

The Challenge: They generate petabytes of raw, unstructured pixel data. This imagery is highly detailed but requires massive computational power to translate into legal compliance evidence.

Analytics & Integration (Software)

What they do: Ingest massive streams of raw space pixels and transform them into automated, audit-ready compliance tools (CGI, TraceX, LiveEO, Satelligence).

The Value: They apply artificial intelligence to the raw data to successfully differentiate between illegal deforestation and normal agricultural harvesting.

The Output: They serve as the operating system for EUDR. They provide dashboards that integrate with corporate ERPs to map supply chains, cross-reference GPS data with 2020 baselines, and automatically generate Due Diligence Statements (DDS).

What is the EUDR?

The EU Deforestation Regulation ensures products consumed in or exported from the EU do not contribute to global forest loss.

The Law: Products must be verifiably **deforestation-free** (produced on land not subject to deforestation or forest degradation after **December 31, 2020**) and legally produced according to the country of origin.

The Deliverable: Companies must submit a Due Diligence Statement (DDS) containing precise geolocation data (GPS points or polygons) of the exact plots of land where the commodities were produced.

Critical Timeline Update: Implementation was officially delayed to ease administrative burdens. Large/Medium enterprises must now comply by **December 30, 2026**, and Micro/Small enterprises by **June 30, 2027**.

The EUDR

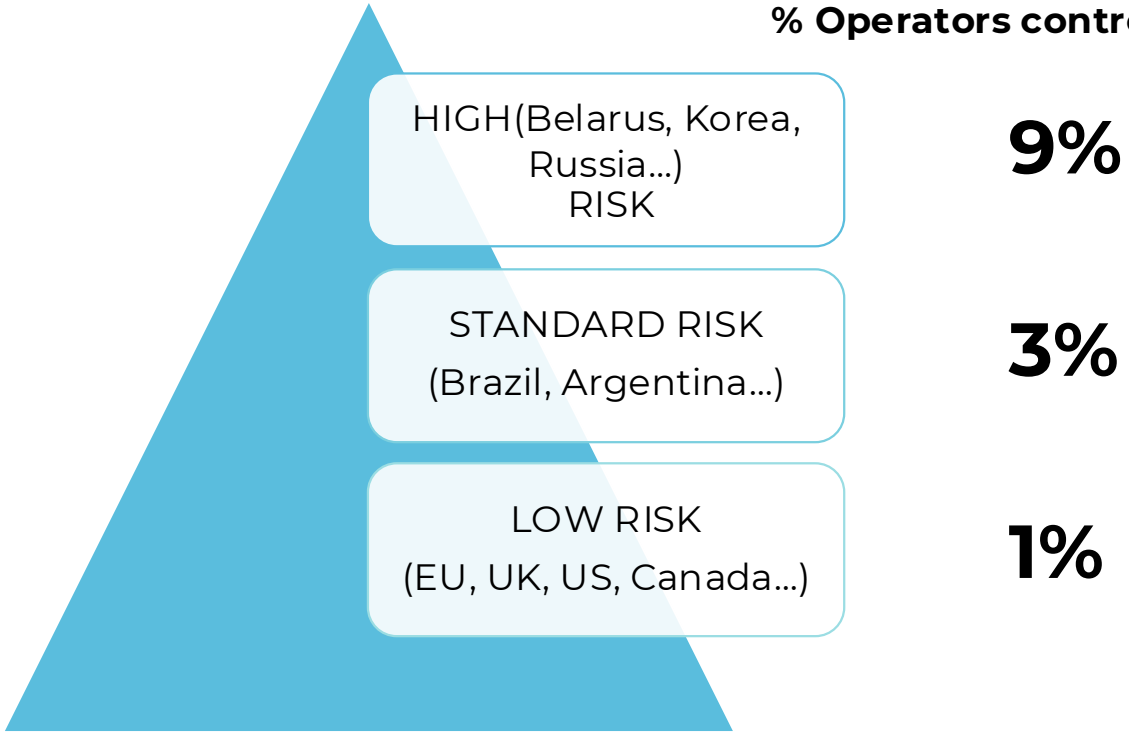
Who is Affected?

The regulation strictly targets seven core commodities and their downstream derivatives.

The 7 Commodities: Cattle, Cocoa, Coffee, Oil Palm, Rubber, Soy, and Wood.

Derivatives: This extends to products made from these materials, such as chocolate, leather, furniture, tires, and printed paper.

The Actors: Any "Operator" (who first places the product on the EU market or exports it) and "Trader" (who commercializes it further down the supply chain).



Risk tiers determines the level of mandatory checks for operators placing relevant commodities in the EU market

The EUDR

What Potential Politics are at Play?

The EUDR is highly contentious on the global stage, which directly drove the recent 12-month implementation delay.

Producer Pushback: Major exporting countries (e.g., Brazil, Indonesia, Malaysia) view the law as protectionist and a violation of WTO rules, arguing it ignores local sustainability efforts.

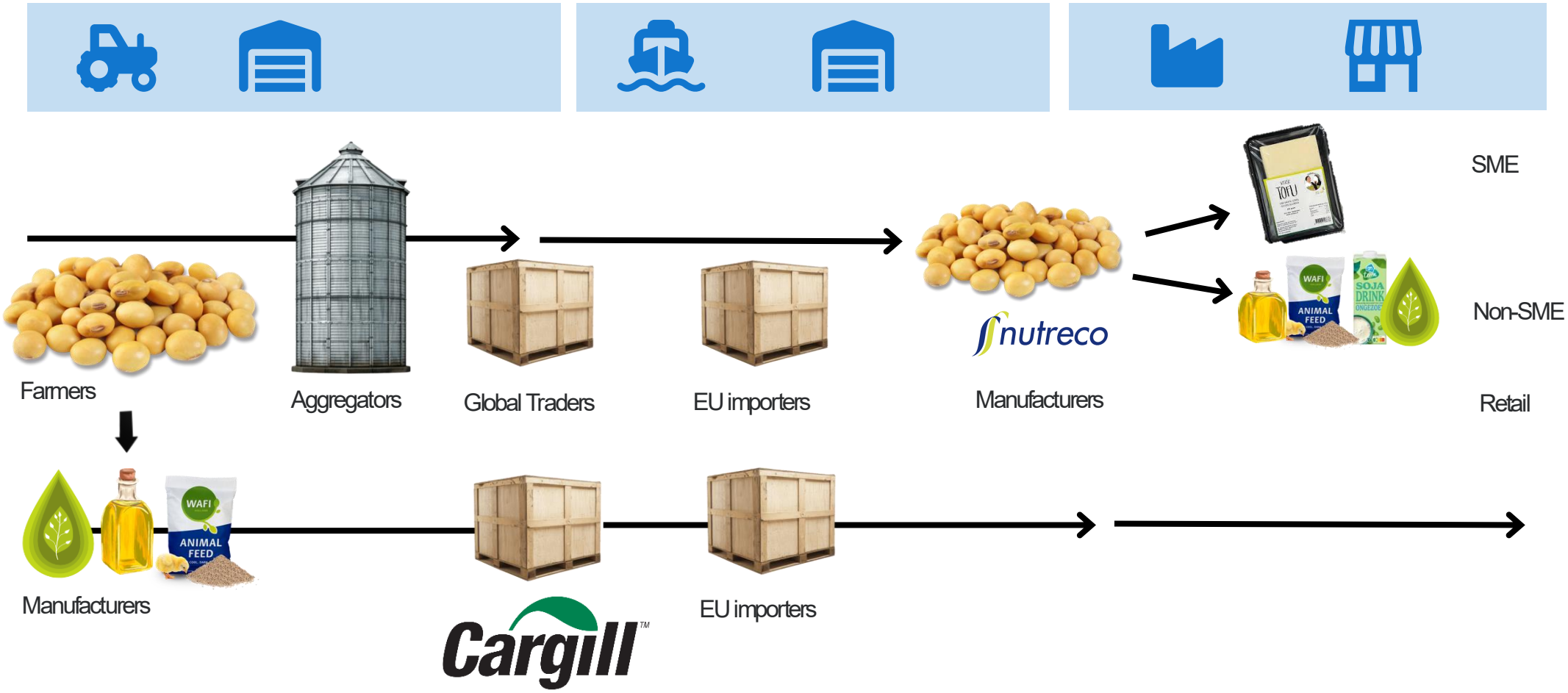
SME Burden: European trade groups lobbied heavily about the massive IT and administrative burden the law places on smaller businesses, triggering an upcoming EU "simplification review" by April 2026.

Data Privacy & Sovereignty: Sharing precise farm-level GPS polygons raises national security and data privacy concerns in certain jurisdictions.

Soy Commodity Industry

2

Soy Commodity Industry | Visual Overview



Soy Commodity Industry

The Long and Opaque Soy Supply Chain

1

Farm production

Soybeans are cultivated in large commercial farms and by smaller producers across major exporting regions such as Brazil, the United States, and Argentina. These producers plant, grow, and harvest soybeans as raw agricultural commodities.

According to USDA data for the 2024 marketing year (October-September), Brazil accounted for roughly 40% of global soybean production (171.5 Million metric tons), followed by the United (119.05 million mt), and Argentina (51.11 million). (Foreign Agricultural Service U.S. Department of Agriculture, 2025)

2

First aggregation

After harvest, farmers typically sell soybeans to local aggregators, cooperatives, traders or grain elevators. At these collection points, beans undergo basic post-harvest handling: drying, cleaning, sorting, grading, and storage in bulk silos. These aggregators mix beans from thousands of small farms into a single silo. Once that mixing happens, the link to the specific plot of land is physically lost. If just one farm in that mix is deforested, the entire silo becomes "contaminated" and non-compliant with EUDR standards.

“The storage phase is a key control point in the soy supply chain. Once the beans are mixed, it is nearly impossible to trace back to the individual source if no chain-of custody process is in place.”(European Bank for Reconstruction and Development, 2024)

“This is particularly challenging as many small farmers and intermediaries lack the technical capabilities to collect and provide this data.” (Hollfelder, 2024)

3

Crushing facilities

Aggregated soybeans move by truck, rail or barge from inland collection points to crushing plants or export terminals in origin countries.

The majority of soybean crushing occurs “on-shore", in producing countries to minimize transport costs of the raw grain. Soybeans are cleaned, cracked and processed into meal and oil. These forms are still under EUDR scope.

4

Traders: Domestic transport, export and international shipping

Large traders like Cargill or Bunge can purchase soy directly from producers, which allows for traceability to the farm level. However, this becomes more challenging for indirect sourcing when traders buy from silos, grain elevators or ports, wherein soy has been mixed from multiple farms.

Exporters load soybeans (or sometimes soymeal and oil) onto bulk vessels and ship them to European ports, forming long, international supply routes that complicate traceability and segregation under regulations such as the EU Deforestation Regulation.

To solve this, the industry assumes they need to build separate physical silos for compliant versus non-compliant beans. Major associations like COCERAL have explicitly stated that building new storage at ports is "prohibitively expensive and impractical". They warn that trying to physically segregate soy will lead to "reduced throughput" and supply chain disruptions. (COCERAL, 2025)

The Long and Opaque Soy Supply Chain

5

Import into Europe

China is the biggest importer of soybeans, accounting for 60% of global soy imports in 2023. After China, the EU27+ is the biggest importer of soybeans, and the largest importer of soybean meal (IDH et al, 2025). The EU's total requirement of soybeans and derived products is ~28-29 million mt; domestic soy production is tiny, with only around 2 million mt of EU-grown soybeans contributed to crushing in 2024 (Owoeye, 2025) In Europe, main entry points are ports such as in the Netherlands, which receives almost 6 million tones of soybean equivalents (or nearly 20% of total EU27+ imports)(IDH et al, 2025).

Germany, Spain, and Italy follow the Netherlands in import volume.
Note on the importance of NL: It is the largest importer of soy in the EU27+, yet domestic soybean consumption is modest. Most of the import volume is transformed, and exported as soybean meal equivalents, either in direct form or embedded in animal-based products. NL is the key gateway into Europe, and has consistently led promoting sustainable practices, especially for sourcing soy meant for Dutch markets.

100% of domestic soybean meal consumption is compliant with FEFAC Soy Sourcing Guidelines. (FEFAC, 2021) Many Dutch companies are the first to place soy products into the European market, therefore, they bear the compliance responsibilities of traceability due diligence, submission of documentation, as the "operator".

6

Processors

European oilseed crushing plants process imported soybeans into soybean meal (used primarily in animal feed) and soybean oil (used in food and industrial applications), often under contracts with feed manufacturers and food companies. Pre-processed forms are transformed further as an ingredient in another product.

7

Manufacturing: Feed and livestock production

34% of soybean oil goes to food, 29% for animal feed, 29% to biodiesel.
Soybean meal is the primary choice for animal feed components, accounting for 55% of oilseeds (FEFAC, 2019).

Compound feed mills purchase soybean meal (and sometimes full-fat soy) and blend it with cereals, minerals and additives to produce formulated feeds tailored to species such as poultry, pigs, dairy cattle and aquaculture.
Livestock farmers buy these feeds under forward contracts or spot purchases, and soy thus enters the supply chain as an embedded protein input in meat, milk and egg production rather than as a consumer-facing ingredient.

8

Food processing, retail and final consumption

A smaller share of soy is processed directly into human foods such as tofu, drinks and plant-based meat analogues.
In 2025, the plant-based food market in Europe was valued at 6.64 billion euros , with soy-based products accounting for 28% of total sales. By ingredient, soy commanded 45.05% of the Europe plant-based food and beverage market size in 2025(mordorintelligence, 2026).
Retailers and foodservice operators then purchase these products and offer them to consumers, who typically encounter soy indirectly via animal products and processed foods.

"a European consumes approximately 60.6 kg of soy per year . If we include the use of soybean meal in livestock feed, the majority of soy consumed comes indirectly from animal products (meat, eggs, dairy products, and farmed fish), amounting to 54.9 kg per capita per year . Direct consumption of soybeans for human food represents only 3.5 kg per capita per year . The use of soy as fuel is estimated at 2.3 kg per capita per year." (Vyashini Chokupermal, 2022)
The visibility to soy origin is the weakest in this final stage. Traceability relies on certifications and supply chain documentation to demonstrate compliance with sustainability standards.

Earth Observation Industry

EO as an Industry

Data → Processing → Insight → Decision

Industry Value Chain

Satellites/EO Data → AI/Analytics → Platforms/Dashboard

Technology Stack

Application Platforms

AI & Analytics

Machine learning models, classifications & risk detection

Platforms/ Dashboard

Satellite Missions

(e.g. Sentinel-1, Sentinel-2)

Industry Ecosystem

EO data Providers	Integrators & Compliance Vendors	Advisory / Risk & Sustainability
	- Airbus - CGI	

“The EU explicitly identifies the role of geospatial data as an essential asset for achieving EUDR objectives.”

Earth observation has evolved into an enabling layer for public policy implementation, especially where regulations require proof tied to geography. The EU’s Copernicus programme is designed for public bodies and policy-makers and provides open access to data for any user, making it uniquely suited as a shared evidence base in regulation-heavy contexts.

Politics at Play

EUDR turns deforestation into a trade governance issue: the EU must implement consistent checks while balancing administrative burden, geopolitics with producer countries, and industry lobbying. Traceability to plot-level geography is central because deforestation risk is spatial: the EU explicitly frames traceability to the plot of land as necessary to show “no deforestation occurring on a specific location.” (European External Action Service, 2024)

This increases demand for standardized geospatial evidence that is credible across member states and defensible in contested compliance decisions, driving EO from “nice-to-have sustainability data” toward “evidence infrastructure.”

European Commission messaging around **free access** underscores the policy intent to create broad societal/economic benefit from EO data. (European Commission, 2013)

Earth Observation Industry

What Technologies Exist?

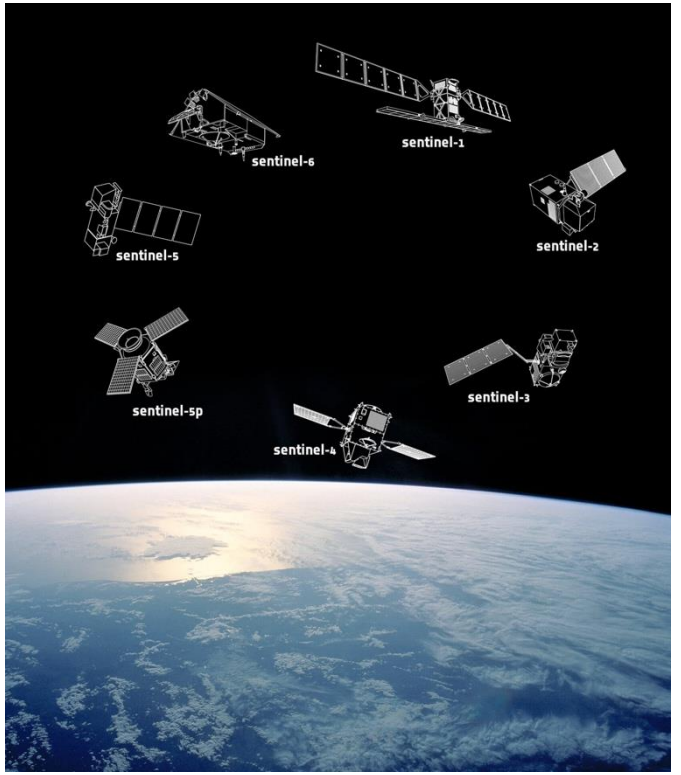
Copernicus/Sentinel baseline: ESA develops/operates Sentinel missions for Copernicus to meet revisit and coverage requirements, producing robust datasets for operational services.

Open data model: Copernicus operates a “full, free and open” data policy, which supports scaling EO into public-sector workflows. (European Space Agency , 2013)

Data: Sentinel-1 radar, Sentinel-2 multispectral, contributing missions

Processing: classification, change detection, alerting, risk scoring

Products: deforestation alerts, land-use history, risk dashboards, compliance evidence packs



EU Forest Observatory: Official Tools Supporting EUDR

Tool/Dataset	Description	Purpose for EUDR Compliance
Global Forest Cover 2020	A spatial map showing forest presence as of the EUDR cut-off date of Dec 31, 2020.	Provides the baseline forest extent for risk assessments under the regulation.
Forest Attributes Dataset	Spatial information on key forest landscape features relevant to degradation.	Helps distinguish forest types and supports assessments of forest degradation tied to commodity sourcing.
Forest Cover Change & Drivers	Global spatial datasets of forest disturbances (deforestation, logging, fires, etc.) over recent years.	Offers insight into recent forest change trends and drivers, informing supply-chain risk.
Production & Trade Commodity Visualizations	Interactive visualizations linking national-level commodity production and trade flows.	Helps analyze EUDR-relevant commodities' production and trade exposure.

EO Industry Landscape: Actors Relevant to EUDR Implementation

The Earth Observation (EO) industry relevant to the EU Deforestation Regulation (EUDR) consists of multiple layers of actors providing different forms of geospatial intelligence. Rather than framing these actors as competitors, it is more accurate to view them as components of a broader compliance ecosystem, each addressing different stages of monitoring, risk assessment, and due diligence.

The layered structure of the EO ecosystem also reveals important functional boundaries and gaps relevant to EUDR implementation. Public monitoring platforms provide transparency but lack legal defensibility and integration into customs workflows. Commercial compliance vendors offer operational solutions, yet their services remain fragmented and proprietary, potentially limiting standardization across EU member states. Trade analytics platforms add exposure mapping but depend on underlying geospatial datasets for accuracy.

This fragmentation highlights a broader governance challenge: while EO capabilities exist across the ecosystem, coordination and harmonization remain limited. As a result, the transition from environmental monitoring to enforceable regulatory infrastructure is not purely technical, but institutional.

EO Industry Landscape

A. Public/multilateral platforms — Transparency & Monitoring Layer

Global Forest Watch

Provides open-access forest monitoring and near-real-time disturbance alerts. Used by governments, NGOs, and companies for broad transparency

B. Commercial EO Compliance Vendors — Operational compliance Enablement Layer

AIRBUS

- Offers deforestation monitoring tailored to supply-chain due diligence and EUDR

Satelligence

- Provides deforestation- and conversion-free (DCF) monitoring services and APi-based compliance tools

TraceX

- Focuses on satellite-based deforestation and land-use risk screening for supply chains

C. Supply-chain transparency & Trade analytics — Risk Exposure & Trade Mapping Layer

- Key Actors: Trase (SEI & partners)
- EU Forest Observatory

Insights & Case Studies

Interview | About our Interviewee

Antonie C. Fountain

Organisation Name: VOICE Network (cocoa), VOCAL Alliance (coffee)

Designation: Public Speaker, Sustainability Leader.

LinkedIn URL:
https://www.linkedin.com/in/antonie/

Antonie C. Fountain is a leading sustainability expert and NGO strategist with over 15 years of experience in the cocoa sector and growing influence across coffee, palm oil, soy, rubber, and timber. He serves as the Managing Director and Co-Founder of the VOICE Network, an association of NGOs and trade unions addressing sustainability challenges in the global cocoa supply chain, and more recently as Co-Founder and Managing Director of VOCAL, a parallel initiative in the coffee sector. Recognized as a Knight in the National Order of the Republic of Côte d'Ivoire and a sought-after keynote speaker, Fountain is deeply embedded in EU regulatory advocacy, corporate accountability, and the empowerment of rights holders across global commodity chains.

Photo by The Alembics Lab

Interview | Antonie C. Fountain

Learnings from an Expert of the Premium Commodities

Why we chose Antonie, an Expert in Cacao?

Our team identified the Cacao commodity industry as a leader in adoption of traceability systems. By seeking out the success factors of cacao, though it is a fundamentally different commodity, we hoped to gain an understanding of which techniques may work for the Soy commodity. Antonie Fountain was identified as a uniquely valuable knowledge partner for this research due to his rare combination of on-the-ground NGO experience, regulatory advocacy expertise, and cross-commodity perspective. Having been centrally involved in shaping the EU's approach to deforestation and due diligence regulations (including co-founding one of the first business-civil society coalitions in Brussels to actively lobby for binding EUDR legislation !) Fountain offered a critical vantage point on both the promise and the limitations of compliance-driven sustainability efforts. His experience bridging the gap between more mature commodity sectors like cocoa and emerging regulatory challenges in soy made him particularly well-positioned to help contextualize the business case for Earth Observation technologies in the soy supply chain.

About VOICE & VOCAL

The VOICE Network, co-founded by Fountain in 2010, is a Brussels-based association of NGOs and trade unions united around driving meaningful sustainability progress in the global cocoa supply chain. Over its 15-year history, VOICE has become one of the most prominent civil society voices in cocoa, conducting research, leading global advocacy, building the capacity of rights holders in origin countries, and holding both the private sector and governments accountable through what Fountain describes as organized "countervailing pressure." This model is credited as a key factor in cocoa's evolution into one of the more progressive commodity sectors on sustainability. Building directly on this foundation, Fountain co-founded VOCAL in 2024 to replicate and apply this civil society organizing model to the coffee sector, addressing gaps in accountability around social, environmental, and economic conditions across the coffee value chain. Together, VOICE and VOCAL represent a deliberate, replicable strategy for driving systemic change in global commodity markets, one grounded in the organized pressure of rights holders backed by enforceable regulation.

Interview | Antonie C. Fountain

Insights 1/3

NGO Insights on Market Dynamics and Regulation

Drawing on decades of advocacy and research, Fountain traced the evolution of sustainability efforts across commodities. Early progress, he explained, was often driven by media exposés and voluntary corporate commitments, which generated effort but rarely systemic impact. Certification schemes and roundtables were described as **initial defensive mechanisms**, allowing companies to respond collectively to criticism while shielding laggards from deeper accountability.

"The first strategy of defense of companies faced with sustainability criticism is to set up an institution that speaks on their collective behalf... NGOs participate in these roundtables not because they are perfect, but because they have struggled to have any meaningful dialogue with the companies at all."

According to Fountain, the most significant shift occurred only in the past 6–7 years with the introduction of **binding EU regulations**, including EUDR and broader human rights due diligence frameworks. These regulations fundamentally changed internal corporate dynamics, elevating sustainability from a peripheral concern to a C-suite reporting priority.

"We have done more in the last two years than we did in the twenty years before—because of regulation."

However, he also cautioned that repeated delays and political backtracking around EUDR have damaged the EU's regulatory credibility, weakening companies' willingness to invest and undermining long-term planning.

Interview | Antonie C. Fountain

Insights 2/3

Earth Observation: Potential, Limits, and the Need for Hybrid Models

On the role of EO technologies, Fountain acknowledged significant progress in satellite monitoring, particularly in cocoa-producing regions where EO is increasingly used for **near–real-time deforestation alerts**. Advances in image resolution, radar, infrared sensing, and AI-driven change detection were highlighted as promising tools for monitoring land-use change at scale.

At the same time, he stressed the **limits of purely technological approaches**, especially in complex agricultural landscapes such as agroforestry systems, where distinguishing between forest, tree crops, and degraded land remains challenging.

"Purely basing monitoring on satellite imagery without boots on the ground will always create false positives and false negatives."

For soy, while some of these agroforestry nuances may be less relevant, Fountain emphasized that EO can only function effectively as part of a **hybrid system**, combining satellite data with ground-level verification and reliable supplier information.

Regulatory Climate

Finally, Fountain's commentary on the current regulatory climate served as an important caveat for our research and led our team to exploring the geopolitics surrounding the regulation.

"People now see the EU increasingly as the little boy who cried wolf."

The repeated delays and political backtracking around the EUDR have, in his view, severely damaged the EU's credibility as a regulatory actor, weakening corporate willingness to invest in compliance infrastructure and undermining the internal business cases that sustainability managers had built within their organizations. This finding is directly relevant to assessing the commercial viability of EO technology adoption in the soy sector, as market demand for these tools is inextricably linked to the perceived certainty and enforceability of the regulation they are designed to support.

Interview | Antonie C. Fountain

Insights 3/3

Cocoa & Coffee Segment Development

On the role of EO technologies, Fountain acknowledged significant progress in satellite monitoring, particularly in cocoa-producing regions where EO is increasingly land remains challenging.

"When I started in cocoa 20 years ago, cocoa was not a front-runner commodity... It has become a front-runner because of constant pressure, not because companies suddenly became good."

"Everywhere cocoa and chocolate companies get together, they know they will be asked the same hard questions, year in, year out...That **constant countervailing pressure** is what moves the sector."

The **real inflection point came when constant pressure followed with binding regulation**. For soy, where mixing makes it "very easy to hide" and voluntary frameworks have long dominated, this trajectory offers both a template and a warning about the limits of goodwill without enforcement.

Tech as Enabler, Not Solution

Fountain's perspective on Earth Observation was neutral: while recognizing the importance of EO for transparency and data access, he framed technology as a **supporting instrument**, not a driver of change in itself.

Fountain argues that there are two key forces that truly change the dynamics of the industry: "The first thing is when rights holders unite and speak out... the second thing is when that countervailing power then gets followed up by regulatory compliance."

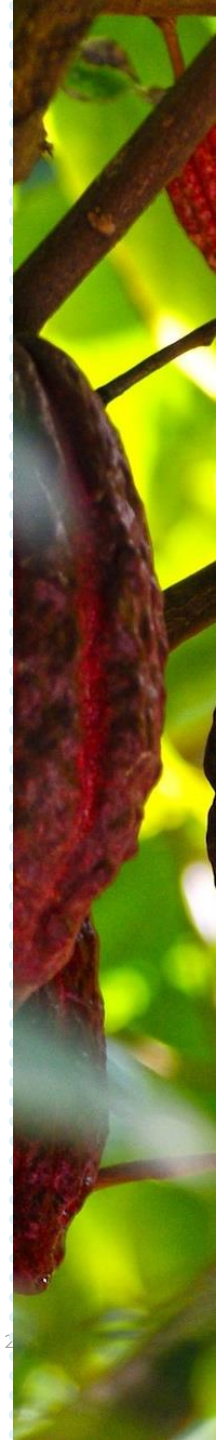
"**Transparency** and **access to information** are key tools to **allow countervailing power** to hold power accountable...There is a role for technology in there... However, and **this is what most tech bros don't want to hear: it is a servant role, not a leader role**...It enables rather than is the answer in and of itself. It's a tool, not a goal."

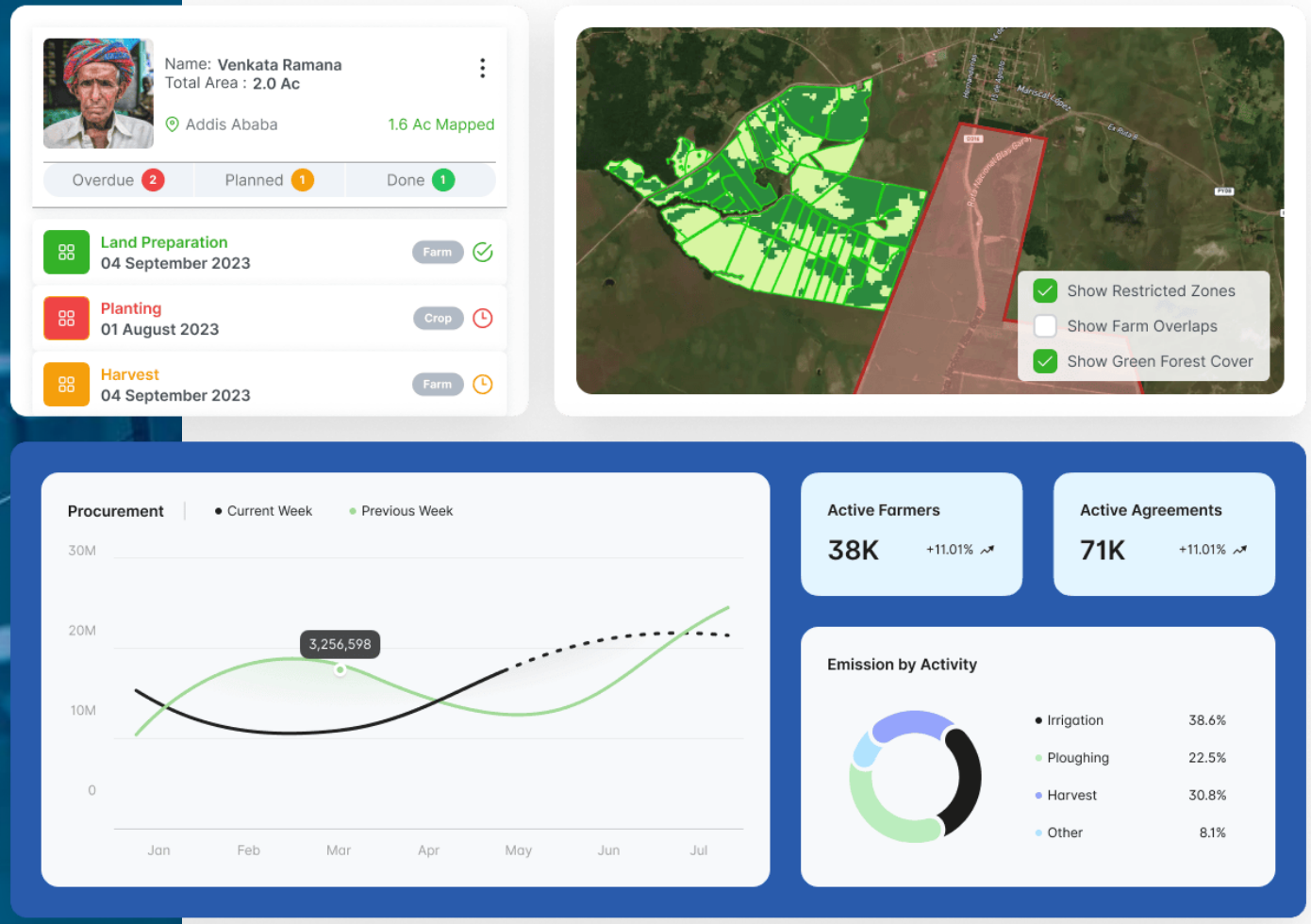
In this context, **EO and data transparency were positioned as critical tools for enabling accountability:** helping NGOs, regulators, and affected communities hold power to account, but insufficient without political will and regulatory enforcement.

Key Learning(s)

Countervailing power *followed by* enforcement is what moves sectors towards sustainability. This countervailing power, however, needs access to information to enforce accountability.

Repeated delays and political backtracking around the EUDR have damage the EU's credibility as a regulatory actor, thus reducing willingness to invest.





Case Study | About our Interviewee

Udit UA

Organisation Name: TraceX Technologies Pvt Ltd, India

Designation: Business Development Manager

LinkedIn URL: https://www.linkedin.com/in/udit-akkihal-93812a212/

Udit Akkihal is a Business Development Manager at TraceX Technologies, a Bangalore-based blockchain-powered supply chain traceability platform, where he has been driving B2B growth across domestic and international markets for nearly three years. He holds both a Bachelor's degree in Agricultural Marketing and Cooperation, a Masters degree from Gkvk, college of Agriculture, Bangalore, and *an MBA in Agribusiness Management from the University of Agricultural Sciences, where his research focused on supply chain analysis of the Alphonso mango. With a background that bridges agribusiness academia and climate tech, Udit specializes in helping companies across the food and agriculture sector achieve end-to-end traceability, sustainability reporting, and compliance with regulations such as the EU Deforestation Regulation.*

Photo from tracextech.

Case Study | TraceXTechnologies

Compliance-driven Traceability in Complex Agricultural Chains

Why TraceX?

Speaking with Udit Akkihal from TraceX Technologies provided a valuable industry perspective on the practical realities of implementing Earth Observation and traceability technology within EUDR compliance frameworks. As a company already actively working across all seven EUDR-regulated commodity value chains — including soy — TraceX offered firsthand insight into the real barriers companies face, particularly around supplier data collection and geolocation formatting, which are especially acute in the soy supply chain given its complexity and the geographic concentration of production in Brazil and the US.

Furthermore, TraceX's hybrid approach of combining proprietary remote sensing using EU-approved datasets with third-party partnerships illustrates the current state of the EO technology landscape and the gap between what is technically possible and what is commercially viable at scale. Their experience with deals stalling due to regulatory delays, budget uncertainty, and low awareness among potential customers directly validates key barriers identified in our research, making this interview a critical data point in assessing the real-world business case for EO technology adoption in the soy supply chain.

About TraceX Technologies

TraceX is a technology provider focused on digitizing agricultural supply chains to support sustainability reporting, nature-based solutions, and, more recently, **EUDR compliance**. The company operates as a **B2B infrastructure layer**, working with agri-commodity companies that already engage with farmers rather than sourcing data independently.

TraceX's core product, *FoodSign*, integrates:

Mobile data collection for farm-level inputs (offline-first to function in low-connectivity regions)

Web-based tools for post-harvest aggregation, supplier management, and reporting

Blockchain-backed data integrity to prevent post-hoc manipulation

Built-in remote sensing, using EU-approved datasets, complemented by third-party EO partners for advanced deforestation insights

.

Interview | Uddit Akkihal

Insights 1/2

Soy Procurement is Structurally Opaque

For soy specifically, TraceX highlights that **technical capability is not the main constraint**. Instead, the challenge lies in **upstream data availability**, particularly:

1. Lack of **farm-level geolocation data**
2. Inconsistent or non-standardized procurement records
3. Multi-tier supplier relationships with limited transparency

Soy supply chains are characterized by **extensive mixing at multiple stages**, making backward traceability significantly harder than in smallholder-driven commodities such as cocoa or coffee. EO tools can identify deforestation risk and verify land-use change, but they require an initial geospatial reference point.

"The backward supply chain for soy is very long. Suppliers source from other suppliers, who source from someone else... Companies work with thousands of farmers, but they don't know the geolocation of those farms."

TraceX structures EUDR compliance around **three supply-chain entry points** (first mile, second mile, EU mile), allowing companies to adopt partial compliance strategies depending on their level of control. This modularity supports scalability but also exposes a fundamental reality: *EO enables **verification**, not **data creation**.*

Interview | Uddit Akkihal

Insights 2/2

Business Case Tensions

Our discussion surfaced a central tension relevant to EO-enabled compliance solutions: while the technology exists and regulatory pressure is increasing, the business case is not yet uniformly clear—especially in soy.

TraceX has worked with a range of clients across sustainability reporting, nature-based solutions, and agri-commodity traceability. Early engagements included **startups, mid-sized agribusinesses, and pilot partnerships** exploring deforestation monitoring, biofuel traceability, and ESG reporting.

Several of these early collaborations, particularly with **Brazilian producers and biofuel-related actors,** failed to progress beyond pilot stages. According to Akkihal, these breakdowns were caused by **external uncertainty**:

1. Evolving and unclear EUDR requirements
2. Limited internal budgets allocated to “non-mandatory” sustainability tools
3. Hesitation from suppliers to share procurement and geolocation data

“Rules were changing, suppliers were not giving data, and budgets were unclear.”

“Because of the delays, many conversations just went cold.”

Nevertheless, TraceX is now observing renewed interest from larger companies as enforcement timelines approach, suggesting that scalability may be driven more by regulation than by immediate operational ROI.

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“If EUDR starts tomorrow, we are ready.”

Udit Akkihal, TraceX Technologies

Key Learning(s)

EO enables verification but cannot create missing data.
The fundamental constraint in soy is not satellite resolution or processing power, it is that farm-level geolocation data was never captured upstream. EO tools can only screen polygons that already exist. Where the data gap is structural, technology is not the solution.

EO-based compliance technology providers exist, but demand for them fluctuates as the EUDR implementation timeline gets delayed.

Case Study | About our Interviewee

Dr. Julia Hörnig

Organisation Name: Cattwyk

Designation: Counsel

LinkedIn URL: https://www.linkedin.com/in/dr-julia-h%C3%B6rnig-lawyer/

Dr. Julia Hörnig is a counsel at Cattwyk based in Brussels, specializing in trade compliance, economic security, and sustainability, with a focus on sustainable and circular supply chains. She advises on foreign trade law, EU regulatory processes, and legislative monitoring for the European Union, drawing on her PhD in international transport law and academic background as a former assistant professor at Erasmus University Rotterdam. Team 1 met with Dr. Hörnig on February 20th, 2026. Key insights gained by students from the meeting follow.

Photo by Blogtrepreneur on flickr

Interview | Dr. Julia Hörnig

Dr.Julia Hörnig: Legal Expert Interview

Why Dr.Hörnig?

To ground the project's analysis in the regulatory architecture that defines both the opportunity and the constraints for Earth Observation technology in EUDR compliance, Team One sought legal expertise from a practitioner operating at the precise intersection of EU trade law, sustainability regulation, and supply chain compliance. Dr. Julia Hörnig is a counsel at Cattwyk, based in Brussels, where she specializes in foreign trade law, economic security, and sustainable supply chains. She holds a PhD in international transport law from the University of Lucerne and brings an academic foundation from her tenure as assistant professor in sustainable maritime trade and transport law at Erasmus University Rotterdam — an institution that shares both geography and intellectual heritage with the team's own institution.

Dr. Hörnig's profile made her an unusually precise fit for the questions this project needed answered. Where commercial operators could speak to market dynamics and certification bodies to industry governance, only a Brussels-based trade compliance lawyer could speak authoritatively to how the EUDR functions as a legal instrument — how liability is allocated, where enforcement authority sits, what evidence standards operators are actually held to, and where the boundaries lie between what private technology can legitimately do in a compliance context and what it cannot. These questions are not academic. They determine whether the business case for EO technology in EUDR enforcement is structurally viable or legally constrained before it begins.

Team One met with Dr. Hörnig on February 20th, 2026. Her insights provided the legal scaffolding within which all other findings — from the NVWA's enforcement approach to RTRS's certification positioning to TraceX's product architecture — must be understood.

Interview | Dr. Julia Hörnig

Key Insights

The EUDR establishes the standard, the basis by which national authorities act.

Deforestation is clearly and uniformly defined in the law. For soy specifically, agroforestry exemptions do not apply, which simplifies compliance assessments. In Dr. Hörnig's framing, **soy is one of the regulation's "easier"** commodities precisely because the legal question of what counts as deforestation is settled

The EUDR is legally centralized but operationally fragmented. NCAs across member states interpret the same regulation but enforce it at different speeds and intensities.

Across member states, the gravity of enforcement may, however, have a different pace and intensity. For example, German authorities are known to be more stringent in enforcement than Greek ones. Enforcement capacity is not harmonized, which may create uneven outcomes despite a single legal standard. *Despite this, it is likely that competent authorities amongst nations will communicate instances of non-compliance to each other, thereby leveling out enforcement outcomes.*

Besides differences in enforcement pace across nations, within a nation, levels of enforcement have different intensity. Customs authorities will stop operators' imports if geolocation data is missing but are unlikely to check the substance of the EUDR. Substance-level enforcement remains with NCAs.

In terms of the use of private technology, **if authorities rely on data sources not equally available to all NCAs, this creates an EU law problem**. Therefore, **the EU Forest Observatory and official FAQs matter**. Moreover, if authorities use private tools, they may give a competitive advantage to the operators also using said platform.

Most importantly, Dr. Hörnig emphasizes that the **burden of proof rests on the operators**. Operators are the actors who must be proactive, conduct their own due diligence, assess and demonstrate negligible risk. Therefore, **the system is operator-driven**. Authorities intervene only if they rebut the operator's assessment.

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“The burden of proof rests with the operator.”

Dr.Julia Hörnig, Cattwyck

Key Learning (s)

Private EO tools are legally precluded from the authority-facing enforcement market.

According to Dr.Hörnig, if NCAs rely on data sources not equally available to all member states, it creates an EU law problem. This structurally separates the operator-facing compliance market from the authority-facing enforcement market.

The system is operator-driven — making legal defensibility, not environmental accuracy, the product.

Operators must proactively prove negligible risk before authorities arrive. The commercial value of EO tools is therefore the construction of a defensible legal record, not independent environmental verification. This reframes what the product actually is.

Case Study | About our Interviewee

Martina Torma

Organisation Name: Roundtable for Responsible Soy

Designation: Regional Manager, Market Development and Stakeholder Affairs (Europe)

LinkedIn URL: https://www.linkedin.com/in/martina-torma/

Martina Torma is a sustainability and stakeholder engagement professional with nearly a decade of experience at the intersection of agribusiness, responsible sourcing, and communications. She has built her career working with leading international organizations: the FAO, RSPO, and most recently the Round Table on Responsible Soy Association developing and driving market transformation strategies across Europe and beyond. Her expertise spans relationship-building with value chain stakeholders, strategic partnerships, and representing organizations in high-level policy and industry forums. With a background that bridges communications and market development, Martina brings a uniquely holistic perspective to advancing sustainability certification and responsible sourcing initiatives on a global scale.

Photo by done!

Case Study | Roundtable for Responsible Soy

Voluntary Certification at Regulatory Crossroads

Why RTRS?

To understand the landscape of voluntary sustainability governance in the soy sector and the degree to which existing mechanisms absorb or complement demands of the EUDR Team One sought insight from The Roundtable on Responsible Soy (RTRS). The RTRS, founded in 2006 and operating as a global multi-stakeholder body, brings together producers, traders, retailers, financial institutions, and civil society organizations under a single governance framework. Unlike any individual company or advocacy group, RTRS engages all constituencies simultaneously, thus making it one of the few institutions capable of offering a system-level view of how the soy industry is collectively responding to regulatory change.

Team One spoke with Martina Torma, RTRS's representative for European stakeholder engagement, on February 23, 2026. The conversation was motivated by a specific analytical question: in a sector where the dominant voluntary sustainability mechanism was under acute pressure (the Amazon Soy Moratorium having collapsed just weeks prior) what role could existing certification infrastructure play in the transition to mandatory EUDR compliance, and where would the gaps remain?

Understanding RTRS's institutional position, its business model constraints, and its strategic response to the regulation was essential for assessing whether the compliance landscape was already adequately served, or whether meaningful space existed for Earth Observation technology to add value at a governance level that purely commercial compliance tools could not reach.

Context

The interview took place on February 23, 2026, this was weeks after ABIOVE's withdrawal from the Amazon Soy Moratorium, and ten months before the EUDR's December 2026 enforcement deadline. Both events bear directly on RTRS's strategic position.

The moratorium's collapse eliminated the primary voluntary deforestation governance mechanism in Brazilian soy, leaving certification schemes as most significant remaining infrastructure in the sector. Simultaneously, the EUDR's approach to compliance of requiring plot-level geolocation traceability and physical supply chain verification is structurally incompatible with the book-and-claim credits model that constitutes the dominant share of RTRS's current market volume.

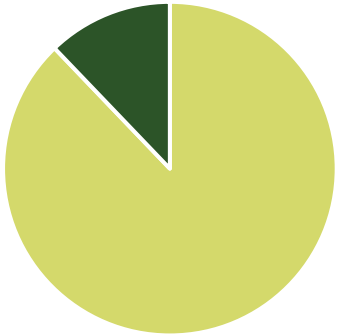
Case Study | Roundtable for Responsible Soy

Insights 1/3

In 2024, RTRS certified 7,440,222 tons of Responsible Soy.

Of these certified volumes, **88%, or 6,535,714 tons** was through the credit system.

2024 Management Report



On the Amazon Soy Moratorium Collapse

Torma acknowledged the moratorium's collapse directly, while carefully avoiding political positioning, a reflection of RTRS's need to maintain relationships with both trader members and civil society simultaneously.

"We do acknowledge the crucial importance that the soy moratorium has played in the past almost 20 years to really drive sustainability and to stop deforestation in the Amazon region."

She framed the collapse as an opportunity for RTRS rather than purely a loss, noting that RTRS's 2009 deforestation cutoff date is only one year after the moratorium's 2008 cutoff, which could position it as a credible successor safeguard.

"Now that it's not there anymore, we do see a very important role RTRS can play in the future because companies do need to have these safeguards — the certainty that the commodities they import to Europe are covered."

On the Credits Model and EUDR Incompatibility

Torma was candid about the market shift underway, acknowledging that the book-and-claim credits model, which represents the vast majority of RTRS's European volume, will lose its primary function in a regulatory compliance context.

"Credits might lose their role for the first period for sure, because all the companies are publicly expressing that EUDR is a priority for them."

However, she resisted framing this as the end of credits entirely, making a producer finance argument for their continued relevance:

"If companies pay a premium for EUDR, they pay for the logistics — the segregation. If they buy credits, it might not directly link to the physical soy, but it does contribute to giving incentives for producers to do good and expand their certified areas. Abandoning credits completely might harm more than do good."

Her strategic response is to reposition credits as a development finance instrument rather than a compliance tool — a distinction that is intellectually sound but will be difficult to communicate to a market conditioned to treat them as sustainability claims.

Case Study | Roundtable for Responsible Soy

Insights 2/3

On Whether RTRS Wants to Be an EUDR Compliance Tool

The most strategically significant exchange of the interview concerned RTRS's reluctance to position itself as a formal EUDR compliance proxy. The reason behind it was liability, not ambition.

"Positioning our certifications as a compliance tool is also a risk for our organisations because it would put the liability on the certification schemes. It's clear by the Commission that certification schemes are not a green light — it does not equal compliance."

"We do see ourselves as a very important tool to gather the necessary information and have audit-verified data for the compliance process — but not necessarily that RTRS is EUDR compliant. That's not something we envisioned."

What RTRS does claim is a role in risk mitigation by providing evidence of due diligence effort rather than proof of compliance outcome:

"If a company identifies that the region they're importing from is a higher risk region, but they can showcase that they have RTRS certification — that could play a role in showcasing that they put effort into mitigating those potential risks of deforestation."

On the Controlled Mass Balance Model

Torma described the specific technical solution RTRS developed in direct response to member consultation, the EUDR-aligned controlled mass balance chain-of-custody model. Critically, she revealed why RTRS chose not to build a full proprietary traceability system:

"Members said that developing another traceability system within RTRS is not something they would really need, because they also have their own systems. It would be a duplication — they'd have to report within two systems."

This is a commercially significant finding. The five or six major traders who dominate the global soy market have already built internal traceability infrastructure and explicitly told RTRS not to duplicate it. This directly constrains the addressable market for any new external traceability platform.

Insights 3/3

On EO Technology and the Data Privacy Barrier

When Earth Observation was raised, Torma volunteered a constraint that is not widely discussed in the compliance technology market:

*"RTRS is already collecting geolocation information through audits — as part of the audit reports, they are available. But there is a big challenge regarding **privacy policy**. This information is protected, and we would need the consent of all the producers to share this information. We cannot share this information as a certification scheme with our traders or with certification bodies."*

She identified RSPO as a model for resolving this:

"RSPO is working on a system — revising their online platform and traceability system — that enables, with the producers' consent, this information to be passed on through the platform. This might be something to explore in the future for us as well."

On Trade Dynamics and Market Restructuring

Torma's closing observations draw directly from conversations with major traders. She offered a forward-looking view of how the market is restructuring in anticipation of EUDR enforcement:

"Last year with all the uncertainty, the whole market was kind of frozen. Nothing happened. Everyone was waiting — and they are still waiting right now because we are waiting for the review that will be finalized in April."

She described an emerging geographical reallocation of trade flows, with higher-risk origins shifting toward non-EU markets:

"We might see shifts for our producing countries — shifting from higher risk regions to lower risk regions in Brazil or Argentina for the EUDR compliance products. And then from the higher risk countries, all the soy would go to different regions like Asia, China — which is a risk."

She identified this leakage dynamic as a specific space where RTRS's presence in higher-risk producing regions remains strategically valuable: maintaining certification infrastructure where commercial incentives alone would not sustain it.

Case Study | Roundtable for Responsible Soy

Strategic Assessment

RTRS enters the EUDR enforcement period in a structurally ambiguous position. Its certification standard is credible and its producer relationships are genuine assets. Its new chain-of-custody module represents a real institutional adaptation. But its dominant revenue-supporting product, the credit, is incompatible with the regulation's core requirement, and its governance structure makes rapid reform difficult. The organization is navigating a transition from voluntary market instrument to regulatory-adjacent infrastructure without yet having resolved what that means for its business model, its member relationships, or its liability exposure.

Two findings from this interview are of particular relevance to the EO business case. First, RTRS holds a geolocation database of certified farm polygons, a foundational asset for satellite-based deforestation verification, but cannot share it without new producer consent infrastructure. The data exists but is legally locked.

Second, the major traders have explicitly told RTRS not to build another traceability system. This means the market for a new external compliance platform targeting large traders is more constrained than it appears, but the market for infrastructure that unlocks existing data, enables consent management, and connects certification polygons to continuous satellite monitoring remains open and unaddressed.

RTRS's long-term value proposition is not compliance equivalence, it explicitly does not want that liability. It is the standard that sits above the regulatory floor, covering the labor, community, and agricultural dimensions that the EUDR does not reach. Whether the market will pay for that distinction, in a regulatory environment that has conditioned buyers to treat deforestation as the only sustainability metric that matters, is the central commercial question RTRS has not yet answered.

Key Learning(s)

Large traders have proprietary internal systems and explicitly do not want external tools.

RTRS holds the most valuable certified farm polygon database in the sector, but it is legally locked without a producer consent infrastructure.

"We might see shifts for our producing countries — shifting from higher risk regions to lower risk regions in Brazil or Argentina for the EUDR compliance products. And then from the higher risk countries, all the soy would go to different regions like Asia, China — which is a risk."

Martina Torma, RTRS

Nederlandse Voedsel- en Warenautoriteit

Ministerie van Landbouw, Natuur en Voedselkwaliteit

Erno Bammens

Organisation Name: NVWA (Dutch Food and Consumer Product Safety Authority)

Designation: Manager of Innovation Lab

LinkedIn URL: https://www.linkedin.com/in/erno-bammens-222881/

Erno Bammens is the Manager of the Innovation Lab (Innovatielab) at the Netherlands Food and Consumer Product Safety Authority (NVWA), where he has been leading digital supervision and technological innovation since 2018. In this role, he oversees the development and application of cutting-edge tools, including satellite data, drones, and sensor technologies, to modernize the NVWA's inspection and enforcement processes. With a background spanning ICT program management and geographic information systems at Enexis, Erno brings a strong foundation in data-driven strategy and cross-organizational collaboration to his work at the intersection of regulatory oversight and emerging technology.

Nederlandse Voedsel- en Warenautoriteit

Ministerie van Landbouw, Natuur en Voedselkwaliteit

Case Study | About our Interviewees

Tieme Wanders

Organisation Name: NVWA (Dutch Food and Consumer Product Safety Authority)

Designation: Senior inspector expertise nature & bee breeder

LinkedIn URL: https://www.linkedin.com/in/tieme-wanders-42436712/

Tieme Wanders is a Senior Inspector at the Netherlands Food and Consumer Product Safety Authority (NVWA), where he specializes in nature expertise and serves as a key figure in the NVWA's preparation as a competent authority for both the EU Timber Regulation and the EU Deforestation Regulation. He brings over two decades of deep forestry expertise to this role, having spent 20 years at FORM International as a senior consultant and research and development manager working across sustainable forest management, FSC certification, and timber legality in countries spanning West and Central Africa, Latin America, and beyond. Trained as a tropical forester at Wageningen University, Tieme combines rigorous on-the-ground field experience with a thorough understanding of the regulatory landscape, making him a particularly valuable voice on the practical realities of EUDR implementation.

Photo by done!

Case Study | NVWA

Voluntary Certification at Regulatory Crossroads

Why NVWA?

To understand the operational realities of competent authorities, Team One spoke with Erno Brammens and Tieme Wanders from the NVWA on February 23, 2026.

Our key inquiries surrounded the working process of the NVWA, their learnings from the dry run, and investigation into whether they, and other competent authorities, have an unmet need.

What the NVWA Does: Inspections, not Audits

The interview opened with an important definitional clarification that has direct implications for how the compliance burden is distributed and where liability sits. Tieme was emphatic on this point:

"We don't do audits. What we do is an inspection — our inspectors can judge something and draw a conclusion on their own. Whereas an auditor evaluates something, makes a report, and then somebody else concludes whether it's OK or not. This process is fundamentally different."

This distinction is not semantic. An inspection carries independent judicial authority, while the NVWA inspector can act on their own conclusions rather than waiting for a third-party determination. Erno reinforced the broader philosophy underpinning this:

"We are not responsible for the quality of the products. We are responsible for checking if the manufacturer is compliant. The manufacturer is in itself responsible — and we check if they take that responsibility."

This framing has significant implications for the EO business case. The NVWA is not in the business of independently determining deforestation status, rather they are in the business of verifying whether the operator's own determination is credible and well-evidenced. Technology tools that help the NVWA cross-reference operator claims against independent satellite data are therefore directly aligned with this core function. The gap they need to close is not "who is deforesting" but rather "is this operator's risk assessment plausible given what we can observe."

Insights 1/4

The Internal System of Inspections

The most operationally significant portion of the interview concerned the NVWA's current and planned internal monitoring system. Tieme provided a candid walk-through of how inspections currently work:

"We ask the company to explain to us how they came to a conclusion that their product is conforming to the regulation. For the EUDR, we ask: how did you check that it's deforestation free? How did you check that it's legally produced? And what evidence did you collect?"

The NVWA does not simply accept the operator's submission at face value. They run their own cross-check using a layered system:

"We do have our own system which uses several map layers — not just JRC but also several other public data layers on deforestation overlaid — to see whether anywhere has a risk of deforestation. If we say there's a risk and they don't talk about it in their evaluation, then we say that's not very well done. And then we hit them with a whip."

On the JRC Global Forest Cover map specifically, Tieme offered a nuanced and important qualification:
"The GRC is improving continuously, but they themselves have indicated: if you have better information, please use that. It's not yet complete and it's only one way of looking at it — it's always good to combine multiple layers."

Crucially, Tieme was candid about the current system's limitations:
"What we would like it to do is use public layers, take all the geolocations that are in the tracer system, put them through the system, and then alert us on places that have a high risk for deforestation so that we can focus our inspections there. But what we have is not robust enough for that."

Erno added that the innovation roadmap is already pointed in this direction:
"We are developing techniques like discontinuity analysis and anomaly analysis. If the data looks right, there can be a second layer of anomalies or discontinuity. But first we have to build some experience with data."

This combination: a stated aspiration, a confirmed insufficiency, and an active development program, constitutes one of the clearest procurement signals in the entire research project. The NVWA knows what it needs, knows it does not yet have it, and is actively building toward it.

Insights 2/4

Enforcement Readiness and the Delay

Perhaps the most candid section of the interview concerned the impact of EUDR's repeated delays on NVWA's internal operations and personnel. Tieme asserted: *"We were ready. The delay doesn't mean anything except a delay. But what it does mean is that people that were prepared to work for it — they wonder if it's ever going to happen. For the inspectors, it's quite difficult to remain very motivated... They specifically applied for a job on combating deforestation. They wanted to work on that and now they have to do other things. It's not really great."*

On compliance rates from the dry runs, Tieme delivered the most striking data point of the interview:

"Among the ones that think they are ready — those that participated in the dry run — less than half of them was actually ready."

Erno's inversion of the conventional compliance narrative added a further layer of analytical depth:

"The companies that are compliant are the ones complaining. So we may look at the ones not complaining... they might be the ones that will not be compliant in the future."

This insight reframes the political noise around EUDR delays. The loudest corporate voices pushing for delays or looser standards are, paradoxically, likely to be among the more prepared actors. The genuinely risky population (those most likely to be non-compliant when enforcement begins) are largely silent in the public debate precisely because they have not invested in preparation

Port Shopping & Leakage Problem

The interview confirmed what our team had theorized, that uneven enforcement across EU member states may create a leakage risk. Tieme articulated the mechanism clearly:

"It's possible that some of the people that have difficulty complying may resort to going through countries that don't have proper enforcement — because when they bring it in for free circulation, that is when they have to comply with the EUDR. And where you do it helps, because once it's in, it's in."

The structural gap is significant:

"There are member states in the EU that don't even have a competent authority named yet. If that situation persists, their enforcement will follow the same lead — because if there's nobody to do it, it will not be done."

The NVWA's partial mitigation strategy relies on cross-NCA coordination through expert working groups, chain-of-responsibility provisions embedded in the EUDR text, and joint dry runs with German, Belgian, and French counterparts. Tieme described the chain responsibility evolution from the EU Timber Regulation to the EUDR as a deliberate attempt to close this gap:

"In the EUDR, they wanted to plug that gap by giving more chain responsibility. If you're a large trader, you still have the same chain responsibility — and because of this, it's now easier to say: we see something happening, and then ask our colleagues in another country to follow up."

This remains a partial solution at best. The leakage problem is structural and cannot be resolved by any single competent authority acting alone. This point reinforces the case for European-level coordination in monitoring infrastructure.

Insights 3/4

Role of Certification Schemes

A direct question about the NVWA's acceptance of private control systems (such as the RPSO) yielded a characteristically precise and honest response from Tieme:

"The acceptance of private control systems — it means something, but it also means nothing. We have not worked out so far what this means for our supervision on the EUDR."

The NVWA's interest in certification schemes is pragmatic and resource-driven rather than ideological. They are checking governance structures as a prerequisite, but formal recognition of compliance equivalence remains undefined. The underlying logic is straightforward:

"We have a limited number of people that can do that work. Private control system certifications have a lot of auditors walking around. It would be great to bundle energy to get to compliance — because that's our main goal."

This is a significant finding for the RTRS angle of this research. Certification schemes are not a shortcut to compliance in the NVWA's current framework, they are an untapped resource the NVWA would like to leverage, but the governance architecture for doing so has not yet been built.

AI and Technology, Where They Are Heading

Erno's statements on AI and technology were forward-looking and commercially significant. On AI integration into the inspection workflow:

"If we are processing larger quantities of data, we are **looking at AI — not to find discrepancies, but to alert the human in the loop of a transportation or a product that might need some attention by the inspector.** So we don't flag it as fraudulent, we flag it as something worth attention."

This framing of AI as a triage and prioritization tool rather than a decision-maker closely mirrors what the research team has identified as the most viable near-term application of EO technology in regulatory contexts.

Insights 4/4

Co-Creation & Trust

On the trajectory of satellite systems specifically:

"We think that in the near future, the development of satellite information systems and remote sensing systems will show a high rate of growth. We think that the information provided by satellites will increase in the coming years. ***We also think it is highly technical and highly specialised work — so no operator, no government operator like us or any country can develop this on its own.*** *We think we will see European cooperation between government and business systems."*

When asked how far in the future this collaboration model would materialize, Erno's answer was the most commercially significant statement of the entire interview:

"Today. Today. We are also doing experiments, proof of concepts with the dairy sector — dairy companies — to work on data owned by the farmers that we can use to establish a form of compliancy."

Erno closed the interview with a vision of multi-stakeholder collaboration that transcended compliance and spoke to a broader institutional philosophy:

"We have to step beyond suspicion against the others. NGOs are not always trying to destroy the business, and business is not always trying to get by with products. We have to learn to have more trust in each other and co-create. We have to do it together."

"Cooperation with the sector, the manufacturers, the consumers, universities, and NGOs — cooperation between the four — will be very important in the future. We can't do it alone."
"We are not looking to bother those who are doing good. We are looking for those who are doing bad and wrong — and we have to do that together."

This **quadruple helix model of government, business, academia, and civil society working in active co-creation is not a distant aspiration**. It is the NVWA's current operating philosophy, already being tested in the dairy sector and explicitly open to expansion into other commodity chains.

Key Learning(s)

Competent authorities share best practices, interpret legal definitions, and have scheduled meetings amongst each other. Their discussions serve as the basis for official documents, such as the FAQs provided publicly and to the NCAs.

Leakage and Waterbed effect: some member states don’t even have a named competent authority, and ”port shopping” is a real concern.

The NVWA uses their own system when conducting inspections, but they acknowledge the critical role of collaboration with highly specialised EO companies to improve their solution.

Proposed Solutions

Proposed Solutions

Solution 1: EUDR Enforcement Support Layer

Strategic Rationale

Under the EUDR, the main enforcement bottleneck sits with **National Competent Authorities (NCAs)**: they must review large volumes of due diligence submissions, decide what deserves attention, and build defensible follow-up actions under limited capacity.

Our solution targets this bottleneck directly. **The EUDR Enforcement Support Layer** is a **human-in-the-loop flagging and inspection-support system** that helps authorities prioritise cases, structure evidence, and improve consistency in enforcement decisions - without replacing inspector judgement.

We propose a **Netherlands-first pilot with the NVWA**. This is strategically strong because Dutch ports (especially Rotterdam) are a major gateway for commodity flows into the EU. A successful pilot can become a reference implementation for scaling to other Member States.

Solution 1

Value Proposition

We help National Competent Authorities turn high volumes of due diligence submissions into inspection-ready priorities through a human-in-the-loop flagging system that improves attention, consistency, and case support (European Union, 2023; European Commission, 2023; The NVWA, 2026).

Specifically, we provide:

1. **Risk-based flagging mechanism:** Screens submissions and geolocation-related inputs to identify cases, flows, or patterns that are worth inspector attention (not automatic fraud labels)

2. **Inspection-support evidence outputs:** Structured evidence summaries and case-support files that help inspectors review flagged cases, request additional evidence, and prioritise follow-up

3. **Human-in-the-loop triage workflow:** A workflow layer that supports analyst/inspector review, escalation, and documentation rather than replacing regulatory judgement

4. **Calibration + learning loop:** Continuous refinement of flags and thresholds based on inspector feedback, improving signal quality and reducing operational noise over time

The core value is not detection alone. The value is enforcement usability.

Competent authorities need support that fits real inspection practice: what deserves attention, why it was flagged, and what evidence is available for follow-up. Our solution improves prioritisation, consistency, and case preparation under limited enforcement capacity (European Union, 2023; European Commission, 2023).

Important limitation: the system does not autonomously determine legal compliance or replace inspections. It supports human judgement by structuring risk signals and evidence. Final decisions remain with the competent authority (European Union, 2023).

Solution 1

Customer Segments and Channels

Primary target customers are National Competent Authorities (NCAs), starting with:

- **NVWA (Netherlands)** as first pilot authority (The NVWA, 2026)
- Later expansion to other EU NCAs with similar enforcement pressures (European Union, 2023; Bayerisches Landesamt für Umwelt, 2023; Masaf, 2023)
- Priority on authorities facing high volumes of EUDR-relevant commodity flows (soy-first scope) (Statistics Netherlands, 2023; Port of Rotterdam, 2025)

Within these authorities, the relevant decision-makers/users are typically:

- Enforcement / inspection leadership
- Risk analysts and screening teams
- Supervisors responsible for triage and case prioritisation
- Policy/implementation coordinators for EUDR rollout
- IT / digital transformation leads (for workflow integration)

Customer acquisition would primarily occur through:

- **Direct engagement with competent authorities** via pilot discussions (NVWA-first) (The NVWA, 2026)
- Public-sector innovation / enforcement modernization programs
- EU and national policy / implementation forums related to EUDR enforcement (European Commission, 2023; European Union, 2023)
- Peer-to-peer diffusion after a successful Dutch reference implementation
- Collaboration with knowledge institutions and technical partners (quadruple-helix entry route) (van den Berg & Slangen, 2024)

Service delivery would occur through:

- A secure **authority-facing flagging and inspection-support platform**
- Structured evidence summaries / case-support outputs for inspector review
- Workflow integration into existing triage and review processes
- Calibration workshops and feedback loops with inspectors/analysts
- Controlled handling of external evidence inputs (e.g., certification-related information) under NCA oversight (European Union, 2023)

Solution 1

Revenue Streams

Willingness to pay is strongest when the solution is framed as **public digital enforcement infrastructure**, not a generic software tool. Therefore, a standard SaaS model is less realistic than a **pilot-to-service public-sector model** (European Union, 2023; European Commission, 2023; The NVWA, 2026).

A staged revenue model is most viable:

1. **Co-funded pilot contract (NVWA-first)**
   Project-based revenue for pilot setup, flagging calibration, workflow design, and operational validation (The NVWA, 2026)

2. **Recurring operational service contract**
   Annual / multi-year authority contract for platform operation, maintenance, support, monitoring, and ongoing calibration

3. **Implementation & integration fees**
   Authority-specific setup, workflow integration, role configuration, and deployment support (pilot and later NCA rollouts)

4. **Training & capability-building services**
   Inspector/analyst onboarding, refresher training, and calibration workshops to maintain quality and trust in flag use

5. **Replication revenue (EU scaling)**
   Rollout of the Dutch reference implementation to other NCAs through packaged deployment + recurring service agreements (European Union, 2023; Bayerisches Landesamt für Umwelt, 2023; Masaf, 2023)

6. **Optional advanced modules**
   Add-on reporting, interoperability connectors, or specialized evidence-handling features (without changing the NCA-first core model)

The most realistic long-term structure is a **blended model** combining recurring public-sector service contracts with implementation revenue and selective co-funded innovation support in early stages.

Solution 1

Key Activities and Resources

Key Activities

Design and operate **the human-in-the-loop flagging mechanism**

Process geolocation and risk-relevant data **for soy-focused screening** (Statistics Netherlands, 2023)

Generate **inspection-support evidence summaries** and case-support outputs

Integrate the system into authority triage and review workflows (NVWA-first) (The NVWA, 2026; European Union, 2023)

Run **flag calibration loops** based on inspector/analyst feedback

Provide training and onboarding for inspectors and risk teams

Maintain explainability, auditability, and version control of flag logic

Codify pilot lessons into a **reference implementation** for other NCAs (European Union, 2023; Bayerisches Landesamt für Umwelt, 2023; Masaf, 2023)

Operational fit and calibration are as important as technical detection performance.

Key Resources

Multidisciplinary team (EO/geospatial, engineering, workflow/product, enforcement-domain expertise)

Flagging methodology + alert taxonomy (thresholds, categories, escalation logic)

Geospatial/data processing infrastructure (storage, compute, pipelines, monitoring)

Workflow integration capability for authority environments

NVWA pilot-based operational learning (what inspectors find useful vs noise) (The NVWA, 2026)

Governance, explainability, and auditability infrastructure

Soy supply-chain context knowledge (aggregation, traceability limitations) (Statistics Netherlands, 2023; Port of Rotterdam, 2025)

Reusable **reference implementation package** for EU scaling (European Union, 2023)

Institutional trust and operational learning become strategic assets over time.

Solution 1

Key Partners and Cost Structure

Key Partners

NVWA (first customer + design/validation partner) (The NVWA, 2026)

Other National Competent Authorities (for later harmonization and scaling) (European Union, 2023; Bayerisches Landesamt für Umwelt, 2023; Masaf, 2023)

EO / geospatial / technical infrastructure partners

Universities and research institutions (validation, calibration, methodology)

Sector actors (operators, traders, industry bodies) for data reality and workflow relevance

Private control systems / certification schemes as evidence contributors (not compliance substitutes) (European Union, 2023)

NGOs / civil-society actors (scrutiny, contextual intelligence, legitimacy)

Integration partners for embedding into operational authority workflows

The quadruple-helix strengthens supervision quality while the NCA remains the final decision-maker (van den Berg & Slangen, 2024; European Union, 2023).

Cost Structure

Major cost components include:

- Specialized personnel (EO/geospatial, engineering, implementation, domain expertise)
- Data and technical infrastructure (compute, storage, geospatial processing, monitoring)
- Integration and deployment into authority workflows
- **Flag calibration, validation, and quality improvement**
- Training, support, and change management
- Governance, explainability, and auditability infrastructure
- Security, access control, and reliability operations
- Ecosystem coordination and partnership management (quadruple helix)

Cost profile implication:

- Pilot phase is more resource-intensive (design, calibration, integration)
- Scalability improves after a validated **reference implementation** is established
- This is a high-trust public enforcement service, not a lightweight compliance dashboard

Business Model Canvas Overview

Solution 1

Key Partners

NVWA (first customer + pilot / validation partner)

S&T (technical / implementation partner)

TNO / research partner (validation, methodology, calibration)

EO / geospatial data and cloud infrastructure partners

Other NCAs (later harmonization and scaling)

Sector actors / trade-data-relevant stakeholders (workflow reality checks)

Integration and training partners for authority deployment

Key Activities

Design and operate human-in-the-loop flagging

Risk screening and triage support (soy-first)

Generate inspection-support evidence summaries

Calibrate flags with inspector / analyst feedback

Integrate into authority review workflows

Maintain QA, explainability, and auditability

Run NVWA pilot and codify reference implementation

Key Resources

Multidisciplinary team (EO, engineering, workflow, enforcement expertise)

Flagging methodology + alert taxonomy

Geospatial/data processing infrastructure

Workflow integration capability for authority environments

Governance / explainability / auditability infrastructure

NVWA pilot-based operational learning

Reusable reference implementation package for EU scaling

Value Propositions

Turn high volumes of EUDR-relevant submissions/data flows into inspection-ready priorities

Improve prioritisation, consistency, and case preparation for National Competent Authorities

Human-in-the-loop flagging that supports inspectors (not automatic compliance judgement)

Structured inspection-support outputs with explainable risk signals and evidence summaries

Reduce manual screening burden under limited enforcement capacity

NVWA-first pilot → Dutch reference implementation for later EU NCA scaling

Customer Relationships

Co-development with NVWA (soy-only pilot)
Dedicated support for analysts / inspectors
Calibration workshops and feedback loops
High-trust public-service relationship
Method transparency and defensibility
Training, onboarding, and workflow adaptation
NCA remains final decision-maker (quadruple-helix support)

Channels

Direct NCA engagement via pilot discussions (NVWA-first)

Public-sector innovation / enforcement modernization routes

EU and national EUDR implementation forums

Peer-to-peer diffusion after Dutch reference pilot

Knowledge + technical partner networks (quadruple-helix entry)

Authority-facing deployment, integration, and training

Customer Segments

Primary target customers: National Competent Authorities (NCAs)

First pilot authority: NVWA (Netherlands)

Later expansion to other EU NCAs with similar enforcement pressures

Priority on authorities handling high volumes of EUDR-relevant commodity flows (soy-first scope)

Key users / decision-makers within NCAs:

Enforcement / inspection leadership

Risk analysts and screening teams

Supervisors responsible for triage and case prioritisation

Policy / implementation coordinators for EUDR rollout

IT / digital transformation leads

Cost Structure

Specialized personnel (EO/geospatial, engineering, implementation, domain expertise)

Data and technical infrastructure (compute, storage, geospatial processing, monitoring)

Integration and deployment into authority workflows

Flag calibration, validation, and quality improvement

Training, support, and change management

Governance, explainability, and auditability infrastructure

Security, access control, and reliability operations

Ecosystem coordination and partnership management (quadruple helix)

Revenue Streams

Co-funded pilot contract (NVWA-first)

Recurring operational service contract (authority-facing platform operation and support)

Implementation and integration fees (authority-specific setup and deployment)

Training and capability-building services (inspectors / analysts)

Replication revenue from rollout of Dutch reference implementation to other NCAs

Optional advanced modules / interoperability connectors

Solution 1

Overall Viability Assessment

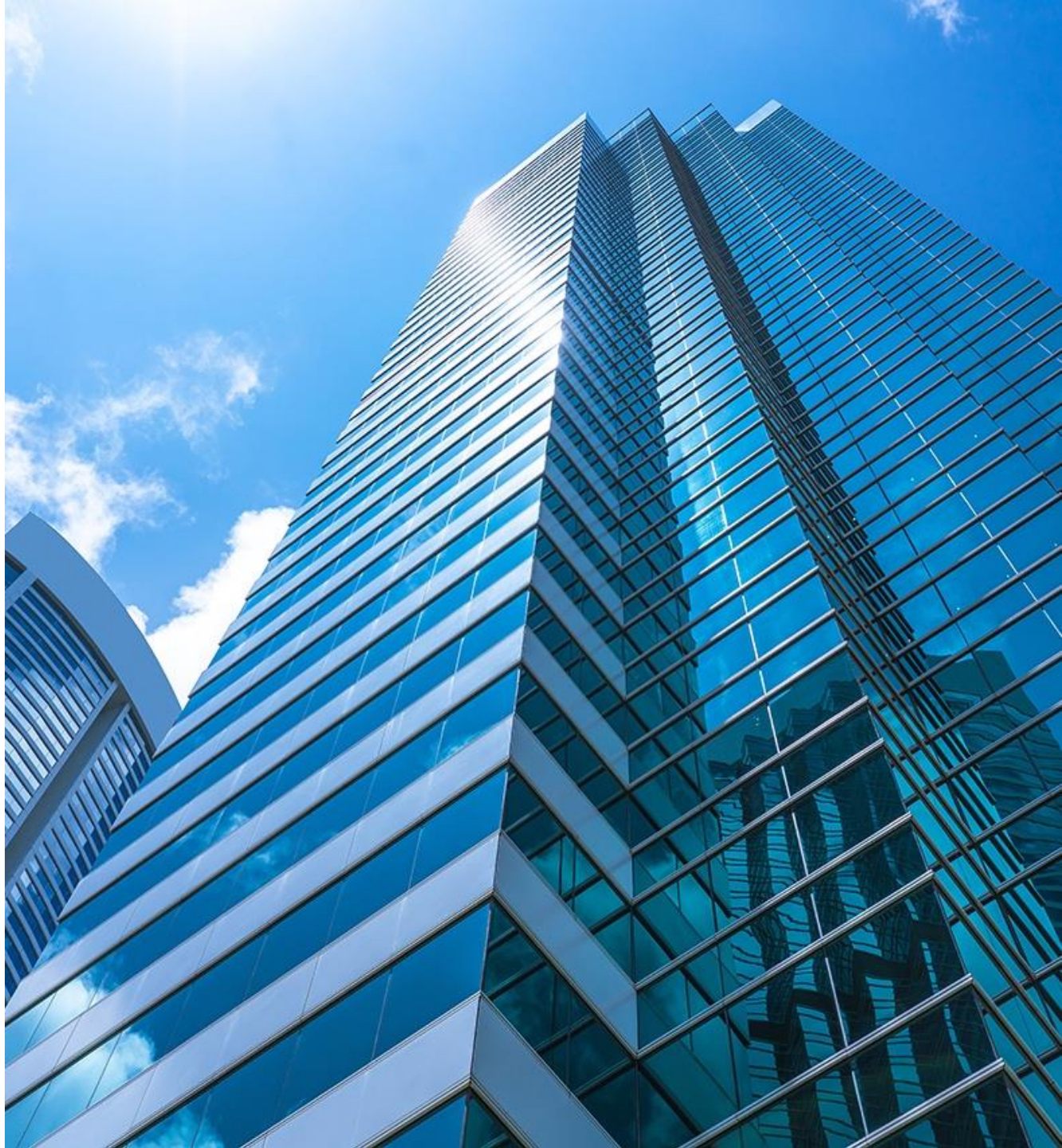
The EUDR creates an operational bottleneck for **National Competent Authorities (NCAs):** they must screen large volumes of due diligence submissions, prioritise checks, and build defensible follow-up actions under limited capacity.

This creates a strong use case for an EUDR Enforcement Support Layer: a human-in-the-loop flagging and inspection-support system that improves prioritisation and case preparation without replacing inspector judgement.

A Netherlands-first NVWA pilot turns the concept from a technical idea into a regulator-tested enforcement workflow that can scale across the EU.

Viability depends on implementation: public procurement timelines, workflow integration, flag calibration (to avoid alert fatigue), and trust/traceability in regulator-facing tools.

Overall, the solution is **viable and strategically strong** when framed as **public digital enforcement infrastructure**. Early phases are resource-intensive, but scalability improves after a validated Dutch reference implementation.



Solution 2: EO Monitoring to Enable Substantiated Concerns

Strategic Rationale

Under the EUDR, any individual, NGO, or organization can submit a substantiated concern to a Member State's Competent Authority. A **substantiated concern** must be a "duly reasoned claim based on objective and verifiable information." ((EEAS, n.d.)

This creates a structural enforcement lever: NGOs no longer need to rely solely on media pressure or advocacy campaigns. They can trigger regulatory investigation, provided they have credible, defensible evidence.

Our solution positions **EO monitoring as an enforcement-enabling infrastructure**: not as a generic mapping tool, but as a system that converts land-use signals into authority-actionable dossiers.

Solution 2

Value Proposition

We help NGOs and third parties turn suspicion into complaint-grade evidence that can plausibly lead to an investigation.

Specifically, we provide:

1. **Satellite-based change detection** (deforestation/land-use change) tied to specific geolocations or production polygons

2. **Risk indicators** (e.g., change after cut-off date, overlaps with protected/Indigenous lands, abnormal expansion patterns, repeated/duplicated polygons, suspicious geometry)

3. **Substantiated Concern Dossier Pack**: time-stamped maps, evidence annex, methods summary, confidence levels, and a structured reasoning chain aligned with EUDR expectations

4. **Ongoing monitoring + alerts for priority** landscapes/commodities so NGOs don't rely on one-off investigations

The core value is not maps. The value is regulatory usability.

Authorities require objective, verifiable information. NGOs require evidence strong enough to withstand scrutiny. Our solution reduces investigation time, increases credibility, and raises the likelihood that authorities open a formal check.

Important limitation: EO monitoring alone cannot prove supply chain linkage. The strongest cases combine EO evidence with sourcing, trade, or corporate information. **Our solution strengthens a claim, it does not independently establish legal liability.**

Solution 2

Customer Segments and Channels

Primary target customers are enforcement-oriented NGOs with:

- Active legal or investigations teams
- A track record of filing regulatory complaints
- Commodity-specific expertise (soy, cocoa, palm oil, cattle, coffee, timber)

Within these organizations, the relevant decision-makers are typically:

- Heads of investigations
- Legal counsel
- Supply chain policy leads
- Program managers for high-risk landscapes

Customer acquisition would primarily occur through:

- Direct engagement with investigative/legal NGO teams
- Participation in EUDR-related policy forums and webinars
- Collaboration with enforcement-focused NGO networks
- Network effects via coalitions and standard-setting bodies (RTRS-type organisations)

Service delivery would occur through:

- A secure web-based platform
- Downloadable evidence packages
- API access for NGOs with internal systems
- Due to the sensitivity of potential complaints, secure data handling and controlled access are essential.

Revenue Streams

Willingness to pay in the NGO sector is structurally limited. Therefore, a pure enterprise SaaS model is unrealistic.

A hybrid model is more viable:

1. Tiered subscription for landscape monitoring and alerts
2. Fixed per-case fees for dossier preparation
3. Grant-funded deployments co-financed by philanthropic foundations
4. Paid training workshops on EO evidence use for enforcement

The most realistic long-term structure is a blended model combining modest subscription income with donor-supported infrastructure funding.

Without external funding, revenue scalability is constrained.

Solution 2

Key Activities, Resources, Partners and Cost Structure

Key Activities

EO data ingestion and preprocessing

Change detection and risk classification

Quality assurance and defensibility validation

Evidence packaging aligned with regulatory requirements

Customer support and analyst interpretation

Continuous refinement based on feedback from authorities

The defensibility of outputs is as important as technical accuracy.

Key Resources

EO datasets and processing infrastructure

Validated change-detection algorithms

Skilled analysts capable of interpreting signals

Legal and regulatory expertise to align outputs with EUDR standards

Secure data management systems

Human expertise is likely to be a major cost driver.

Key Partners

EO data providers and cloud infrastructure partners

Anchor NGOs for pilot validation

Legal clinics or regulatory advisors

Investigative data partners (e.g., trade flow or shipping data providers)

Philanthropic funders

EO evidence is most powerful when combined with supply chain intelligence. Partnerships strengthen that integration.

Cost Structure

Major cost components include:

Data acquisition and cloud computing

Analyst labor (particularly for high-touch support)

Platform development and maintenance

Quality assurance and documentation

Data security and compliance infrastructure

There is a structural tension between scalability and impact:

High-touch services increase case quality but reduce scalability

Fully automated systems scale better but risk weaker enforcement impact

This trade-off directly affects margins.

Business Model Canvas Overview

Solution 2

Key Partners	Key Activities	Value Propositions	Customer Relationships	Customer Segments
EO data providers (Sentinel / commercial imagery) Anchor NGOs & RTRS Legal / regulatory advisors Trade & supply chain data partners Philanthropic funders	Deforestation change detection Risk flagging & QA validation Substantiated concern dossier creation Continuous monitoring & alerts Regulatory alignment	Turn land-use signals into regulatory-grade evidence. Enable NGOs & RTRS to file or respond to substantiated concerns with objective, verifiable data. Strengthen certification credibility without assuming compliance liability	Co-design with anchor partners Transparent, defensible methodology Secure data handling Tiered support (self-serve → assisted → rapid response)	Enforcement-oriented NGOs NGO coalitions Governance bodies (e.g., RTRS) Investigative journalists (secondary)
	Key Resources EO datasets & cloud infrastructure Change-detection models Legal/regulatory expertise Skilled analysts Secure case management platform		**Channels** Direct outreach to investigations/legal teams EUDR policy forums NGO & certification networks Secure web platform + downloadable evidence packs	

Cost Structure	Revenue Streams
EO data & cloud compute, Analyst labor, Platform development, QA & documentation, Data security	Monitoring subscriptions, Per-case dossier fees, Grant co-financing. Training workshops

Solution 2

Overall Viability Assessment

The regulatory mechanism for substantiated concerns creates a clear structural opportunity:

NGOs now have a formal pathway to trigger enforcement action. EO monitoring can materially strengthen their ability to use that pathway.

However, three constraints reduce commercial attractiveness: limited NGO budgets, need for human interpretation and legal alignment, and EO evidence alone is insufficient without supply chain linkage.

Therefore, the business case is strongest under a hybrid funding model that treats EO monitoring partly as public-good enforcement infrastructure rather than purely commercial SaaS.

The solution is viable, but margins are likely moderate unless: coalition-based subscriptions are achieved, or philanthropic funding covers the core monitoring system.

Comparison of Solutions

Comparison of Solutions

Key Performance Indicators (KPIs)

The following KPIs are used to assess the two proposed solutions.

1

Scalability

Can this solution scale across customers/markets without proportionally increasing human effort?

2

Revenue strength

How strong and durable is the paying customer logic (budget strength, recurring revenue potential, payment reliability)?

3

Political risk

How exposed is the solution to political contestation, institutional resistance, or reputational conflict that can block adoption/use?

4

Speed to pilot / market entry

How quickly can the solution be piloted and demonstrate value?

5

Impact at scale

If adopted, how much can the solution influence EUDR enforcement outcomes across the system?

Comparison of Solutions

Ranking across the KPIs

Criteria	A. EUDR Enforcement Support Layer (NCA-first)	B. EO Monitoring for Substantiated Concerns (NGO/RTRS-first)
Scalability	4/5	3/5
Revenue strength	4/5	2/5
Political risk	3/5	2/5
Speed to pilot / market entry	2/5	4/5
Impact at scale	5/5	3/5
Total rating across KPIs	**18/25**	**14/25**

Comparison of Solutions

Rationale

Solution A: EUDR Enforcement Support Layer. Solution B: EO Monitoring for Substantiated Concerns

1 Scalability

A has slower initial adoption (public authorities, integration), but once a reference implementation exists (NVWA-first), it can be replicated to other NCAs with reusable workflows and implementation playbooks.

B has technically scalable EO monitoring elements, but the attached doc explicitly notes a structural tension: high-touch analyst/legal support improves impact but reduces scalability.

2 Revenue strength

A targets public authorities with potential for multi-year operational contracts, integration fees, and recurring service revenue (stronger contract value per customer).

B faces a tougher revenue reality: the attached doc itself says NGO willingness to pay is structurally limited, a pure SaaS model is unrealistic, and a hybrid (subscriptions + per-case + philanthropy) model is more viable. It also notes moderate margins unless coalition subscriptions or philanthropic funding cover core monitoring.

RTRS improves B's commercial profile versus typical NGOs, but it does not fully remove the funding/margin constraint described in the document.

3 Political risk

A is politically sensitive (regulator-facing, fairness, auditability, scrutiny), but the risk is more manageable if positioned as: human-in-the-loop flagging, inspection support, not automated legal judgment, co-developed with an NCA (NVWA-first).

B operates directly in a complaint/escalation pathway. The attached doc explicitly emphasizes political sensitivity, reputational stakes, and the need for strong trust/defensibility because NGOs will not risk weak evidence.

It is also closer to adversarial dynamics (NGO ↔ operator ↔ authority), which tends to increase political and reputational friction.

4 Speed to pilot / market entry

B is faster because it can be launched via: NGO / RTRS partnerships, analyst-supported dossiers, a secure platform + downloadable evidence packs, without waiting for deep public-sector procurement and workflow integration.

A is slower because it depends on: authority buy-in, pilot governance, integration into enforcement workflows, trust/auditability requirements, and likely longer procurement cycles.

5 Impact at scale

A sits at the enforcement bottleneck itself (NCA triage, prioritisation, case support). If adopted by a major authority (e.g., NVWA), it can affect many submissions and create a reusable enforcement workflow.

B can absolutely create impact by enabling substantiated concerns and triggering investigations (the attached doc correctly identifies this as a structural enforcement lever), but impact is more case-triggered and episodic than system-wide process transformation.

EO evidence alone is insufficient without supply-chain linkage, which limits standalone impact in some cases.

Conclusions

“Solution B (EO Monitoring for Substantiated Concerns) is faster to launch, but Solution A (EUDR Enforcement Support Layer) is stronger on long-term scalability, revenue quality, and system-level enforcement impact.”

Our comparison shows a clear trade-off between speed and long-term strategic strength.

The NGO/RTRS-facing substantiated concerns solution can likely be piloted faster because requires less direct integration into public enforcement workflows and can operate through analyst-supported evidence services. However, its revenue model is structurally weaker due to limited NGO budgets and reliance on hybrid funding.

By contrast, the EUDR Enforcement Support Layer is slower to implement because it depends on public-sector adoption, integration, and trust-building, but it offers stronger long-term potential in terms of recurring revenue, scalability through reference implementations, and system-wide enforcement leverage at the competent authority level.

EO can create economic & societal value in the inspection process for National Competent Authorities.

Our discussion answers our key research question.

Roadmap of Implementation

6

Roadmap of Implementation

Timeline

Validation
Month 0–3

- Confirm **NVWA problem–solution fit** (soy-only scope)
- Define system boundaries **(flagging support, not legal judgement)**
- Agree pilot KPIs: usefulness, triage time, workflow fit
- Set pilot governance + feedback cadence

Partnerships
Month 2–6

- Build co-development coalition: **NVWA + S&T + TNO**
- Define technical roles, validation roles, and delivery ownership
- Align on data access boundaries and confidentiality
- Explore legal/procurement route for pilot setup

Pilot Design & Build
Month 4–8

- Design **human-in-the-loop flagging mechanism**
- Build soy-focused screening + inspection-support outputs
- Create reviewer feedback loop for flag calibration
- Prepare pilot workflow with NVWA users

Pilot Execution
Month 8–12

- Run limited-scope **NVWA pilot** (soy-only)
- Test flag relevance, explainability, and operational usability
- Calibrate thresholds to reduce noise / alert fatigue
- Evaluate against agreed KPIs and document lessons learned

Scaling
Month 12–24

- Convert pilot into a repeatable **service model**
- Package Dutch pilot into a reference implementation
- Start outreach to next NCAs (highest-fit countries first)
- Prepare commodity expansion after workflow validation

Stakeholder Contact Map

First steps: Who to Talk to at each Stage?

VALIDATION (M0–3)

NVWA
Confirm urgency, timing, and openness to starting now.

NVWA - Erno Bammens (Manager Innovation Lab)
Validate innovation fit, pilot framing, and co-development potential.

NVWA - Tieme Wanders (Senior Inspector expertise)
Define what makes a flag useful in practice (vs. operational noise).

S&T (early technical feasibility check)
Test feasibility of a soy-only pilot and minimum flagging workflow.

PARTNERSHIPS (M2–6)

S&T (technical partner)
Design EO/data pipeline, flagging logic, and pilot architecture.

TNO (knowledge / validation partner)
Strengthen methodology, explainability, and credibility.

NVWA - Erno Bammens + relevant innovation/procurement contacts
Align on co-development structure, governance, and pilot route.

Soy-chain sector contacts / data-relevant stakeholders
Reality-check assumptions and operational constraints.

PILOT (M4–12)

NVWA pilot owner + operational users
Run pilot cycles and test workflow usability in practice.

NVWA - Tieme Wanders + inspector/analyst users
Calibrate thresholds, improve relevance, and reduce alert fatigue.

S&T implementation team
Build, iterate, fix issues, and support pilot execution.

TNO / research support
Document assumptions, limitations, and validation quality.

SCALING (M12–24)

NVWA (reference partner)
Share lessons learned and support peer-to-peer credibility.

Other NCAs
Test transferability of the Dutch reference workflow.

EU / cross-NCA exchange forums
Support harmonization and replication dialogue.

Training / integration partners
Enable onboarding, local adaptation, and rollout support.

Appendix:
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Approach

This project employed a qualitative research design combining systematic desk research with primary data collection through stakeholder interviews. This mixed-source approach was selected to ensure that findings were grounded in both the existing evidence base and the lived experience of those closest to the subject matter.

Desk Research
The desk research phase involved a structured review of relevant secondary sources, including academic literature, policy documents, institutional reports, grey literature, and publicly available data. Sources were identified through targeted database searches and snowball referencing, then assessed for relevance, credibility, and recency. The purpose of this phase was twofold: to establish a baseline understanding of the landscape and to identify key themes, gaps, and contested areas that could be explored further through primary research.

Stakeholder Interviews
Primary data was gathered through a series of semi-structured interviews with a purposively selected group of stakeholders. Participants were identified on the basis of their direct experience, institutional knowledge, or decision-making role in relation to the subject under study. The semi-structured format allowed the research team to pursue a consistent line of inquiry across interviews while remaining responsive to individual perspectives and emerging threads.
Interviews were conducted remotely and lasted approximately 30 minutes on average. With participants' consent, interviews were recorded and transcribed. Transcripts were then analysed thematically, with codes developed both deductively from the existing literature and inductively from the data itself.

Integration of Findings
Insights from the desk research and interviews were analysed in parallel and subsequently triangulated to identify areas of convergence and divergence. Where the literature and stakeholder testimony aligned, this was taken as a strengthening signal. Where tensions emerged, these were treated as analytically significant and explored further in the findings. This iterative process of comparison helped to produce conclusions that are both evidence-informed and practically grounded.

Limitations
The desk research was necessarily selective given the breadth of available material, and the interview sample, while purposive, was not exhaustive. Findings reflect the perspectives of those consulted and should be interpreted accordingly rather than as representative of all relevant actors. Notwithstanding these constraints, research was well-suited to generating the depth of insight required for the project's objectives.

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Alicent Nguyen

Mattia Cavenaghi

Angelika Sakura Utagawa

Rick van Rijn

Michelle Barski