

# Traceability Guide for Deforestation- and Conversion-Free (DCF) Leather



Made possible in part by generous  
funding from the Tapestry Foundation.

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# Contents

<b>I</b>	<b>Introduction</b>	<b>3</b>
	<b>1. Purpose of the Guide</b>	<b>3</b>
	<b>2. Cattle Production and Leather Supply Chains</b>	<b>4</b>
<b>II</b>	<b>Fundamentals of Traceability and Related Supply Chain Approaches</b>	<b>6</b>
	<b>1. Traceability</b>	<b>6</b>
	<b>2. Certification Programs</b>	<b>6</b>
	Certification Programs and Traceability	7
	Complementing Certification with Traceability in the Leather Sector	7
	<b>3. Chain of Custody Approaches</b>	<b>8</b>
	Chain of Custody and Traceability	8
	Complementing Chain of Custody with Traceability in the Leather Sector	9
	<b>4. Supply Chain Mapping</b>	<b>9</b>
	Product Backward Tracing	9
	Mapping and Traceability	10
	Complementing Supply Chain Mapping with Traceability in the Leather Sector	10
	<b>5. Monitoring and Geospatial Analysis</b>	<b>11</b>
	Monitoring and Geospatial Analysis and Traceability	11
	Challenges of Monitoring and Geospatial Analysis in the Leather Sector	11
	<b>6. Material Forward Tracking</b>	<b>12</b>
<b>III</b>	<b>Standards-Based Traceability</b>	<b>13</b>
	<b>1. Global Traceability Framework for Beef and Leather</b>	<b>14</b>
	Serialized and Lot-Based Traceability	16
	Core Traceability and a Modular Approach	16
	<b>2. DCF and Traceability Requirements</b>	<b>17</b>
<b>IV</b>	<b>Implementation Roadmap</b>	<b>18</b>
	<b>1. Steps to Achieve Full Traceability</b>	<b>18</b>
	Organizing Internal Roles and Responsibilities	18
	<b>STEP 1:</b> Assessing Your Company's Current Traceability Practices	20
	<b>STEP 2:</b> Understand the Value Chain and Identify Trusted Partners	20
	<b>STEP 3:</b> Initiate a Standardized Traceability Data Request	21
	<b>STEP 4:</b> Conduct a Gap Analysis	22
	<b>STEP 5:</b> Validate Feasibility and Demonstrate Success	23
	<b>STEP 6:</b> Incorporate Traceability into Purchasing Specifications	24
	<b>STEP 7:</b> Roll-out Traceability Across Operations	25
	<b>STEP 8:</b> Enable System Integrations and Enhance Technological Innovation	25
	<b>STEP 9:</b> Implement Data Analytics and Verification	26
	<b>STEP 10:</b> Foster Industry-Wide Collaboration to Increase Volumes	27
	<b>STEP 11:</b> Incorporate Incentives (optional)	29
	<b>2. Financial Investments and Capacity Building</b>	<b>29</b>
<b>V</b>	<b>Tracking, Reporting, and Strengthening Traceability Progress</b>	<b>30</b>
	Strengthening Internal Monitoring Systems	30
	Continuous Improvement	30
<b>VI</b>	<b>Transparency, Communication, and Stakeholder Engagement</b>	<b>31</b>
	<b>1. Communicating Traceability Commitments to Stakeholders</b>	<b>31</b>
	<b>2. Educating Consumers on Traceability and Sustainability Impact</b>	<b>32</b>
<b>VII</b>	<b>Annex: Additional Resources and Tools</b>	<b>33</b>
	<b>1. Leather Taxonomy: Processes and Key Terms in Leather Production</b>	<b>33</b>
	<b>2. Glossary of Terms Used in this Guide</b>	<b>34</b>
	<b>3. Traceability Assessment Tool</b>	<b>35</b>
	<b>4. Trusted Partners Identification tool</b>	<b>36</b>
	<b>5. Data Request Template</b>	<b>37</b>
	<b>Endnotes</b>	<b>40</b>



Nelore cattle in the state of Paraná, Brazil. © Anderson Coelho/iStock; Leather automotive seat. © gargantiopa/iStock; Fine leather armchair. © asbe/iStock; Luxury handbags in boutique showcase. © stock\_colors/iStock; Leather athletic shoes. © Armastas/iStock

# I Introduction

## 1 Purpose of the Guide

The Traceability Guide for Deforestation- and Conversion-Free (DCF) Leather provides a practical roadmap to help companies achieve full supply chain traceability for leather products. Its purpose is to support any company committed to building transparent, responsible, and regulation-ready supply chains, with the overarching goal of eliminating deforestation and ecosystem conversion from sourcing practices. The guide aligns with international frameworks and provides practical direction to support compliance with emerging regulations, including the EU Deforestation Regulation (EUDR), the EU Corporate Sustainability Due Diligence Directive (CSDDD), and similar laws worldwide.

This guide also recognizes and builds upon the leadership of companies engaged in the [Deforestation-Free Call to Action for Leather](#), an initiative co-led by Textile Exchange, WWF, and the Leather Working Group. While the Call to Action serves as

an important reference for ambition and collaboration, the guidance presented here is designed for achieving goals and is relevant to all companies seeking to implement credible DCF commitments across their leather supply chains.

This Traceability Guide provides a **structured implementation approach, offering practical guidance on supplier engagement, data standardization consistent with global traceability standards such as GS1 EPCIS standards, and integration of traceability into procurement policies.** Additionally, it covers key fundamentals of traceability and certification, presents global standards and modular approaches, and provides a step-by-step Implementation Roadmap. Later chapters address progress tracking, transparency, stakeholder engagement, and a comprehensive Glossary to support effective application.

## 2 Cattle Production and Leather Supply Chains

The global leather supply chain is complex and highly fragmented, involving a multitude of actors across regions with varying regulatory environments and production practices. Latin America, particularly Brazil, Argentina, and Paraguay, accounts for a significant portion of global leather exports. Latin American countries also present the highest risks for deforestation and ecosystem conversion, notably in sensitive biomes such as the Amazon and Cerrado in Brazil, and the Gran Chaco in Argentina and Paraguay<sup>1</sup>. Supply chains in this region are often opaque due to the widespread practice of indirect cattle sourcing, where animals are frequently traded through intermediary farms, including breeding and rearing operations, before reaching slaughterhouses.

In Asia, countries such as India, China, and Vietnam play a crucial role in leather processing and manufacturing. India is a major producer of bovine leather and the second-largest producer of footwear after China, with an annual production of 2.58 billion pairs (2018)<sup>2</sup>. However, it faces significant traceability challenges, primarily due to the large number of smallholders and the prevalence of informal sector operators. Meanwhile, China and Vietnam are key destinations for tanning and finishing operations, frequently importing raw hides from Latin America, Australia, and the United States to meet global demand<sup>3,4</sup>.

Europe, particularly Italy, Spain, and Portugal, is renowned for high-end leather production. Italy, and more specifically the Tuscany region, specializes in the manufacture of luxury leather goods. European producers are typically subject to more stringent regulations concerning animal welfare and environmental protection. However, their reliance on imported raw materials adds complexity to ensuring traceability throughout the supply chain<sup>5</sup>.

The structure of the leather supply chain itself poses inherent traceability challenges due to its multi-stage processes. This includes cattle breeding, raising, and slaughtering; hide collection and trading – often involving multiple intermediaries; tanning and finishing processes such as wet-blue, crust, and finished leather; and finally, the manufacturing and assembly of finished goods (see Image 1, next page).

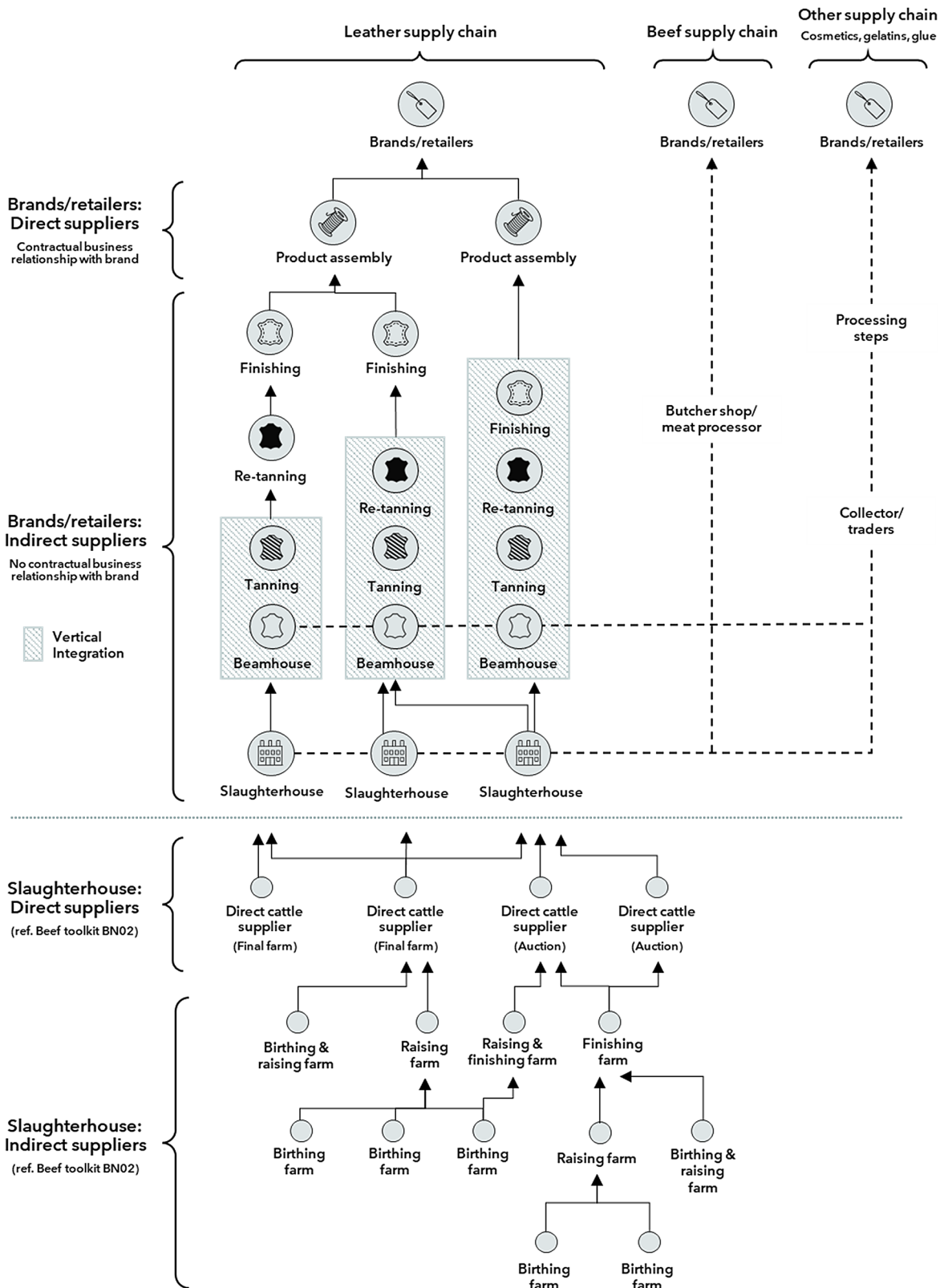
Image 1 illustrates the complexity and fragmentation of the beef and leather supply chains, from farm-level production to final product assembly. One of the most significant challenges in achieving full traceability is the prevalence of indirect sourcing, where animals often pass through multiple intermediaries before reaching slaughterhouses. This makes it difficult to trace materials back to their farm of origin – particularly in regions with a high risk of deforestation and ecosystem conversion.

The supply chain's fragmented structure, with a large number of smallholder farms and intermediary actors, further complicates data collection and verification. In many cases, there is limited visibility beyond direct suppliers, posing risks of non-compliant sourcing practices. Moreover, the absence of standardized data systems across different regions leads to inconsistent information, impeding interoperability and the effective implementation of traceability standards. These factors combined create significant barriers to establishing robust, transparent, deforestation-free leather supply chains. Overcoming these barriers requires coordinated action, standardized traceability frameworks, and strengthened supplier engagement at every stage of the value chain.



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Image 1: Example of Beef and Leather Supply Chains



**Note:** This is a simplified version of the supply chain – there are many more complex iterations possible, including the potential for traders to be involved between stages and for processes to be sub-contracted to other actors.



A drone image of Nelore cattle as they move from one paddock to another on a high intensive grass system project in Brazil. © *shiota/iStock*

## II Fundamentals of Traceability and Related Supply Chain Approaches

### 1 Traceability

According to [GS1](#), traceability is the ability to trace the history, application, or location of an object. When considering a product or a service, traceability can relate to origin of materials and parts; processing history; and distribution and location of the product or service after delivery. It also allows companies to link product volumes to specific attributes of suppliers and/or production sites.

Rather than relying solely on static product information, a robust traceability system documents every action – such as shipping, receiving, transforming, or storing materials – linked with accurate timestamps, locations, and actors involved<sup>6</sup>. This enables real-time visibility and supports more robust risk management, compliance, and product authenticity claims.

There are other common supply chain management practices that complement the transparency enabled by traceability. Below are some of the most common ones and how they relate to traceability.

### 2 Certification Programs

Certification programs are formalized practices to verify compliance with pre-defined standards, typically focusing on sustainability, environmental protection, and ethical labor practices. According to [ISEAL](#), a certification system may apply to different scopes – such as a sector, a geography, a segment of the supply chain, or a life-cycle stage – depending on its design and intended outcomes.

Certifications function through a multi-step process, according with [ISEAL](#).

- **Standard Development:** Establishing measurable criteria within the scope of the certification (sustainability, labor, quality, etc.)
- **Auditing and Verification:** Independent assessments of adherence to these criteria
- **Issuance and Labeling:** Granting certification and allowing claims about sustainability, etc.
- **Surveillance and Recertification:** Ongoing monitoring to ensure continuous compliance

In the leather sector, some certification programs assess environmental and social performance, each with varying approaches to supply chain practices. Examples include certification from the [Leather Working Group \(LWG\)](#); [ICEC \(Institute of Quality Certification for the Leather Sector\) certification](#), widely recognized in Italy; [CSCB \(Brazilian Leather Certification of Sustainability\)](#), developed in Brazil; [Sustainable Leather Foundation](#); and [Oeko-Tex](#). According to the [Beef on Track technical report](#), while these certifications represent important progress for sustainable leather production, none fully address the demands for traceability to the point of origin of the animal, which is increasingly necessary for compliance with zero-deforestation regulations.

## Certification Programs and Traceability

Certification and traceability are complementary components of a robust sustainability strategy. While certification schemes typically focus on verifying compliance with environmental and social criteria at specific sites, traceability focuses on tracking material as it flows through the supply chain. Increasingly, traceability is embedded within certification programs to support the validation of sustainability claims and to ensure that certified volumes are properly accounted for. Conversely, stand-alone traceability systems can enhance certification by offering more granular, real-time data on the origin and flow of materials – offering added transparency and reinforcing certified outcomes.

A useful parallel is found in the soy industry. As an example, the [Profundo 2023](#) report (commissioned by WWF Germany and IUCN NL) highlights how traceability is assessed within voluntary sustainability standards (VSS) for soy. While many VSS provide strong frameworks for deforestation, biodiversity, and social safeguards, traceability often remains a gap. Some standards received low scores due to the lack of robust systems for tracking material origin and movement.

This analysis is highly relevant to leather. Different certification systems differ widely in their environmental and social requirements and the degree of traceability and oversight throughout the supply chain<sup>7</sup>. In most cases they need to be complemented by traceability tools to provide visibility to the point of origin – a critical requirement under emerging regulations like the EUDR.

Some certification programs are evolving to integrate traceability more deeply into their systems. The Leather Traceability Cluster is developing a standard that aims to provide the requirements agreed by the sector's certification bodies and scheme owners setting the minimum essential elements for leather traceability and minimum data or information to be kept as evidence<sup>8</sup>. Other example from the seafood sector incorporates environmental and social criteria across multiple operations in the supply chain – such as feed mills, hatcheries, farms, and processing plants. Programs can use batch-level coding and documentation to assign unique identifiers to production lots or harvest groups. This enables

the certified product to be traced through the production process and supports verification that each upstream stage has met the program's requirements and undergone proper audit or assessment.

## Complementing Certification with Traceability in the Leather Sector

Certification systems validate environmental and social practices at specific locations and points in time – typically through audits and supporting documentation. Some certifications include chain of custody (ChoC) requirements to track certified materials as they move through the supply chain. However, ChoC documentation is generally collected for periodic audits, not for real-time oversight. It often tracks volumes or percentages rather than specific batches and is rarely integrated across supply chain actors in a way that allows continuous data exchange.

Traceability systems go beyond this by capturing and sharing data on the actual movement of materials – often in near real-time. These systems are designed for operational use, enabling day-to-day risk management, detection of laundering or non-compliant material, and alignment with emerging regulatory requirements and market demands.

When paired with certification, traceability adds a technical layer that strengthens the credibility of sustainability claims. It provides a mechanism for identifying and verifying the entry of non-compliant materials into the supply chain – enhancing overall assurance that certified practices are upheld throughout the product's journey.

- **Integrated Coverage Across the Supply Chain:** Most existing certifications focus on leather processing stages – such as tanning or chemical management – without addressing full upstream traceability. In contrast, traceability systems are designed to connect data across all tiers, including upstream and downstream actors. By integrating traceability, certification programs can expand their scope to encompass the entire supply chain, including environmental and social performance at origin.
- **Access to Point-of-Origin Data:** Certification programs like LWG and ICEC typically do not trace hides to the georeferenced farm of origin. Traceability systems, particularly those designed with geolocation capabilities, can fill this gap – supporting compliance with deforestation-free regulations like the EUDR or farm-level claims such as emissions or Science-Based Targets for Nature, which require point-of-origin data. When embedded into certification frameworks, traceability enables more reliable sourcing assessments and risk mitigation.
- **Integrity Risks:** The fragmented nature of the leather supply chain reduces the visibility of upstream practices and increases the risk of fraud. Traceability systems can strengthen certification by providing granular, real-time

data on product flows and custody changes, helping to detect inconsistencies and prevent laundering of materials. Similar approaches are already being explored in sectors like cotton, where traceability is used to reinforce certified claims.

### 3 Chain of Custody Approaches

While certification was originally designed to verify practices at individual sites of commodity production (e.g., farms or forests), Chain of Custody (ChoC) systems were later developed to enable the transfer of communications and validation of claims made about products, processes, businesses, or services.

The ChoC system is the set of documents used to establish, manage, and verify the transfer of materials and associated attributes through the supply chain. The system normally includes normative requirements (a ChoC Standard), a means of identifying sites and entities participating in the chain of custody, a monitoring and verification mechanism, and often a centralized system that tracks the transfer and reconciliation of volumes through the supply chain.

It is through a robust ChoC system that it becomes possible to ensure that the volumes of certified material sold do not exceed the volumes of certified material produced or purchased by a supply chain actor.

According to [ISEAL](#), there are multiple ChoC models, each offering different levels of visibility in the supply chain. The choice of model impacts the level of assurance and claims that brands can make regarding socio-environmental impacts as well as other aspects of the product, including deforestation-free materials.

- 1. Identity Preservation:** Materials with specified characteristics from a single source are kept physically separate from materials without specified characteristics and different origins.
- 2. Segregation:** Materials with specified characteristics are kept physically separate from materials without the same specified characteristics from initial input to the final output.
- 3. Controlled Blending:** Materials with a set of specified characteristics are mixed according to certain criteria with materials or product without that set of characteristics resulting in a known proportion of the specified characteristics in the final output.
- 4. Mass Balance:** Materials with a set of specified characteristics are mixed according to defined criteria with materials without that set of characteristics, and the transfer of characteristics may be free / non-proportional.
- 5. Book and Claim (B&C):** The transfer of specified characteristics are decoupled from the physical flow of material or product through the supply chain.

According to [Textile Exchange](#) and [ISEAL](#), ChoC systems offer documentation and control mechanisms needed to validate claims such as “recycled,” “organic,” or “deforestation-free.” They do this by defining how materials are identified, kept separate or blended, and documented at every step in the chain. For example, [Textile Exchange’s Content Claim Standard](#) (CCS) establishes clear requirements for ChoC systems to control and document each stage of material handling.

#### Chain of Custody and Traceability

ChoC and traceability are closely related but serve distinct purposes within supply chain management.

ChoC is a documentation system based on records – such as purchase logs, batch reconciliation ChoC, and certificates – that show claimed materials (like deforestation-free or certified inputs) were handled according to defined rules.

Traceability, on the other hand, is a data system focused on tracking the actual movement and transformation of specific lots of material through each step of the supply chain. Traceability uses event-based data through specified stages of production, processing, and distribution, identifying the when, where, what, and how of the physical flow of materials from source to final product. It enables organizations to access key information – such as geolocation data, farm or facility of origin, and critical tracking events – providing visibility and transparency across the entire supply chain. In simple terms:

- **ChoC answers the question:** *Can we prove that this material was handled according to specific requirements?*
- **Traceability answers the question:** *Can we follow the actual journey of this material – where it originated, how it moved, and where it ended up – based on real-world events and timely data?*

ChoC documentation can support a certification claim by describing how material was kept separate from non-compliant sources, and ChoC audits can check that companies are implementing their procedures. Complementarily, traceability provides additional verifiable data – such as farm-level origin and geospatial coordinates – which may be required to demonstrate compliance with regulations and to substantiate some sustainability claims from brands.

Critically, ChoC systems often fall short when materials are transformed or disaggregated – such as when a single animal becomes multiple products – because the system tracks custody, not identity. Without event-based traceability, it becomes challenging to verify that a specific material in a product originated from a specific source.

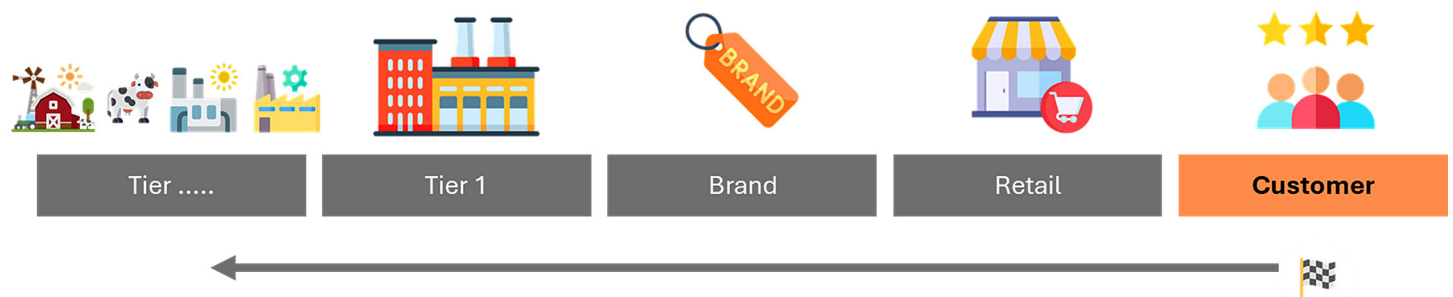
While ChoC provides useful documentation for sustainability claims, it is not a substitute for traceability. Traceability systems are increasingly essential to meet emerging regulations, manage risk, and demonstrate supply chain transparency in a verifiable, granular way.

## Complementing Chain of Custody with Traceability in the Leather Sector

ChoC systems are useful for validating sustainability claims by documenting how materials and their attributes are managed through the supply chain. In the leather sector, however, the effectiveness of ChoC can be constrained by inherent features of the supply chain. In this context, traceability systems can play a crucial complementary role, providing the granularity and visibility needed to overcome key operational challenges and reduce integrity risks.

- Dependency on Upstream Supply Chains with Limited Integration:** The leather sector inherits much of its sourcing data from the beef industry, which often lacks seamless integration with leather-specific ChoC systems. As a result, critical upstream data – such as geolocation of farms, deforestation risk, or animal movement – may not be captured or linked to the final product. Without this linkage, ChoC alone may be insufficient to validate deforestation-free claims. Traceability tools designed to bridge sectoral gaps can support more complete and auditable documentation.
- Fragmentation and Laundering Risk Across Supply Chain Nodes:** Leather supply chains involve numerous intermediaries, as illustrated in Image 1, where information may be lost or altered. This fragmentation increases the risk of *laundering*, where non-compliant hides are introduced into documented or certified flows, especially when material movements are not tracked in real time. Traceability enhances ChoC systems by capturing actual product flows, identifying inconsistencies in volumes or timelines, and reinforcing the chain's integrity.
- Limited Oversight Near the Point of Origin:** The beginning of the supply chain is often the most opaque, with weak documentation and monitoring. ChoC systems may reflect the last recorded actor, but without upstream traceability, it is difficult to determine whether that actor is the actual source, especially in complex supply chains such as leather. Traceability provides tools to link hides back to origin farms, verify compliance with land-use regulations, and ensure that no material from deforested areas enters certified supply chains.

**Image 2:** Product Backward Tracing Model



## 4 Supply Chain Mapping

Supply Chain Mapping is the process of documenting and visualizing the network of suppliers, facilities, and processes **potentially** involved in the production of goods across different tiers of the supply chain. It typically involves mapping suppliers tier by tier – both upstream and downstream – without necessarily linking the data to a specific product. As defined by [Textile Exchange](#), a supply chain map is a visual representation of goods, information, processes, and financial flows that occur throughout a supply chain. Mapping the supply chains of fibers and materials, in particular, enables companies to advance broader transparency efforts and align supply chain management with their corporate strategies.

### Product Backward Tracing

Product Backward Tracing (also known as “garment mapping”) refers to tracing a specific product’s journey backward through the supply chain – from the point of sale to the point of origin. It typically begins with the finished goods manufacturer and moves upstream to identify prior processing steps and material sources.

This approach can surface a list of potential supply chain actors and provide a **picture** in simple, highly integrated supply chains with few actors, such as traders or sourcing sites.

However, there are significant limitations:

- It often relies on **self-reporting** by suppliers using existing supplier databases.
- Suppliers may include upstream companies that were **inactive** during the production period, resulting in a list of potential – but unverified – participants.
- Without a material-level traceability system, there is **no evidence** that the listed suppliers were actually involved in the material used for the product.

Given that this product-backward approach identifies potential rather than actual suppliers, brands should be cautious about relying on it – or investing heavily in it – as a standalone solution.

## Mapping and Traceability

While often discussed in similar contexts, supply chain mapping and traceability serve distinct functions in building transparency and compliance across value chains. Recognizing their differences is essential – particularly in complex supply chains such as leather, where both tools must be strategically combined.

Supply chain mapping provides a network-level view of **all potential suppliers** and facilities involved in the production of a material or product – including indirect or upstream entities. In contrast, traceability links specific product volumes to individual suppliers and events, enabling companies to follow the actual journey of a batch or product through key events – from origin to final product. This is essential for meeting regulatory requirements such as the EU Deforestation Regulation (EUDR), which demands product-specific, geolocated sourcing data<sup>9</sup>.

In short, mapping shows who could have touched it. Traceability shows who did.

As emphasized in the Supply Chain Mapping Guide, part of the Deforestation-Free Call to Action Leather toolkit, supply chain mapping without tracing specific products is a theoretical exercise and should be viewed as context building about potential routes of supply. A level of verification is required to take the exercise to the next stage and link specific materials to products being sourced.

## Complementing Supply Chain Mapping with Traceability in the Leather Sector

Mapping is a fundamental first step in building understanding of the leather supply chain. It enables brands to identify and prioritize suppliers for further engagement, laying the groundwork for traceability. As noted in the Supply Chain Mapping Guide of the



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Deforestation-Free Call to Action for Leather, “mapping should be used to build information and engagement with suppliers within the initial phase. It acts as a steppingstone towards the product/material level traceability needed to verify deforestation/ conversion-free leather sourcing.” The two processes are **complementary**: mapping focuses on actors and relationships, while traceability links specific materials to transactions and geolocated origin.

- Mapping Enables Strategic Prioritization:** In highly fragmented leather supply chains, mapping exercises reveal thousands of potential upstream actors – many of whom may never supply materials to the final product. Mapping can serve as a useful starting point to identify and prioritize suppliers for engagement. However, mapping alone does not generate traceability. Even exhaustive mapping exercises that identify many possible upstream actors do so without establishing clear, verifiable links between specific materials and the products they end up in. Its greatest value lies in guiding targeted supplier engagement. For example, a leather brand attempted to map its bovine leather supply chain and identified over 50,000 farms as potential sources. However, few of these farms directly supplied the animals from which the leather was generated to be used in their final products. This demonstrates the high cost and effort involved in mapping, which may not always yield actionable product-specific insights.
- Reducing Risk Through Traceability Data:** Mapping helps identify supply chain actors, but it is not sufficient to track how materials move between them. As noted in the Supply Chain Mapping Guide, “supply chain mapping without tracing specific products is a theoretical exercise” and must be accompanied by verification to link products to origin. Without traceability of actual movements and transactions, there is a risk that materials from non-compliant or unknown sources are introduced undetected – a laundering risk that mapping alone cannot address.
- Traceability Enhances Mapping by Connecting Data Across Tiers:** Because leather supply chains depend heavily on upstream information from the beef sector, data quality diminishes as it flows downstream. Mapping may identify potential actors such as slaughterhouses and tanneries, but traceability is required to link material to product and to validate whether hides originated from deforestation-free farms. Integrating both tools is key: mapping provides the structure for supplier engagement, while traceability adds the transaction-level evidence needed to make farm level claims such as deforestation free.
- Compliance and Traceability Gaps:** For companies aiming to comply with regulations like the EU Deforestation Regulation (EUDR), traceability to geolocated farms is required. In leather, this level of detail is rarely available without first mile digitization and integration of farm-level data into traceability systems, which many existing certifications and ChoC models do not currently provide.

## 5 Monitoring and Geospatial Analysis

The goal of monitoring is to systematically track progress against a company's action plan or strategy, with a focus on improving current and future management of outputs, outcomes, and impacts. In the context of leather supply chains, monitoring involves regularly assessing environmental, social, and ethical practices across all stages – from raw material sourcing to finished goods. For deforestation, Geospatial Analysis is essential and involves collecting, processing, and visualizing data associated with specific geographic locations. This analytical approach utilizes Geographic Information Systems (GIS), satellite imagery, GPS data, and other location-based information to interpret spatial patterns and relationships. By examining the geographic context of data, geospatial analysis provides valuable insights into how entities interact within a given space.

### Monitoring & Geospatial Analysis and Traceability

Beyond verification, traceability data with location identifiers enables powerful geospatial analysis by providing precise supply chain information needed to assess geographic regions, monitor risks, and validate sourcing practices. With comprehensive traceability data, brands can integrate geospatial analysis into their systems to go beyond basic compliance and actively monitor and validate their deforestation- and conversion- free (DCF) commitments. This combination allows for proactive risk management, continuous verification, and more informed decision-making, giving brands the ability to track the geographic origin of raw materials, verify sustainability claims, and strengthen their environmental and ethical commitments through transparent, data-driven substantiation of sourcing claims.

The [Beef on Track](#) initiative is a prime example of using geospatial analysis in the livestock sector to ensure sourcing compliance. Through its Voluntary Monitoring Protocol for Cattle Suppliers in the Amazon and Cerrado biomes, this initiative guides companies to integrate satellite monitoring with traceability data to assess cattle properties and verify compliance with deforestation-free sourcing claims. By combining supply chain traceability with geospatial monitoring, it becomes possible to authenticate sustainability claims and ensure that suppliers consistently meet environmental commitments.

### Challenges of Monitoring & Geospatial Analysis in the Leather Sector

- Laundering Risk at the Beginning of the Supply Chain:** In the early stages of leather production, particularly in regions with fragmented supply bases, there is a significant risk of laundering non-compliant materials. This occurs when materials from non-compliant sources are mixed with those from compliant sources, making it difficult to distinguish and verify the origin of the materials. Such practices undermine sustainability efforts and pose reputational risks to brands.



Satellite collecting data. © 3DSculptor / iStock; Mapping locations using geospatial data. © WWF-Indonesia / Sunarto

- Limited Scope for Upstream Farms:** Monitoring & Geospatial analysis is often conducted only for the farm directly supplying the slaughterhouse, leaving upstream farms and intermediaries unmonitored. This limited scope means that key areas of the supply chain, such as birth farms and intermediaries, remain outside the purview of geospatial monitoring, undermining the ability to ensure full traceability and compliance with sustainability claims.
- Data Accuracy and Resolution:** High-quality geospatial analysis relies on accurate and detailed data. Obtaining precise geographic information, especially in remote or rural areas where raw materials originate, can be challenging. Inaccurate or low-resolution data may lead to erroneous conclusions and ineffective monitoring strategies.
- Integration with Existing Systems:** Incorporating geospatial analysis into current supply chain management systems requires automated integration. This process can be complex, necessitating specialized software and expertise in the absence of data standards. Ensuring that geospatial data aligns with other operational data is crucial for coherent analysis and decision-making.
- Cost Implications:** Implementing geospatial analysis involves costs related to data acquisition, software, and personnel training. For companies with limited resources, these expenses can be a barrier. However, the long-term benefits, such as improved supply chain efficiency and sustainability, may outweigh the initial investments.

## 6 Material Forward Tracking

A core component of traceability is **material forward tracking**, which is the capability to locate or follow the path of a particular traceable object downstream (through later observations) based on data recorded at defined points of the supply chain according to [GS1](#). This method involves tracking the material's journey from its origin – such as the birth farm or sourcing region – through every stage of processing and manufacturing, all the way to the final product.

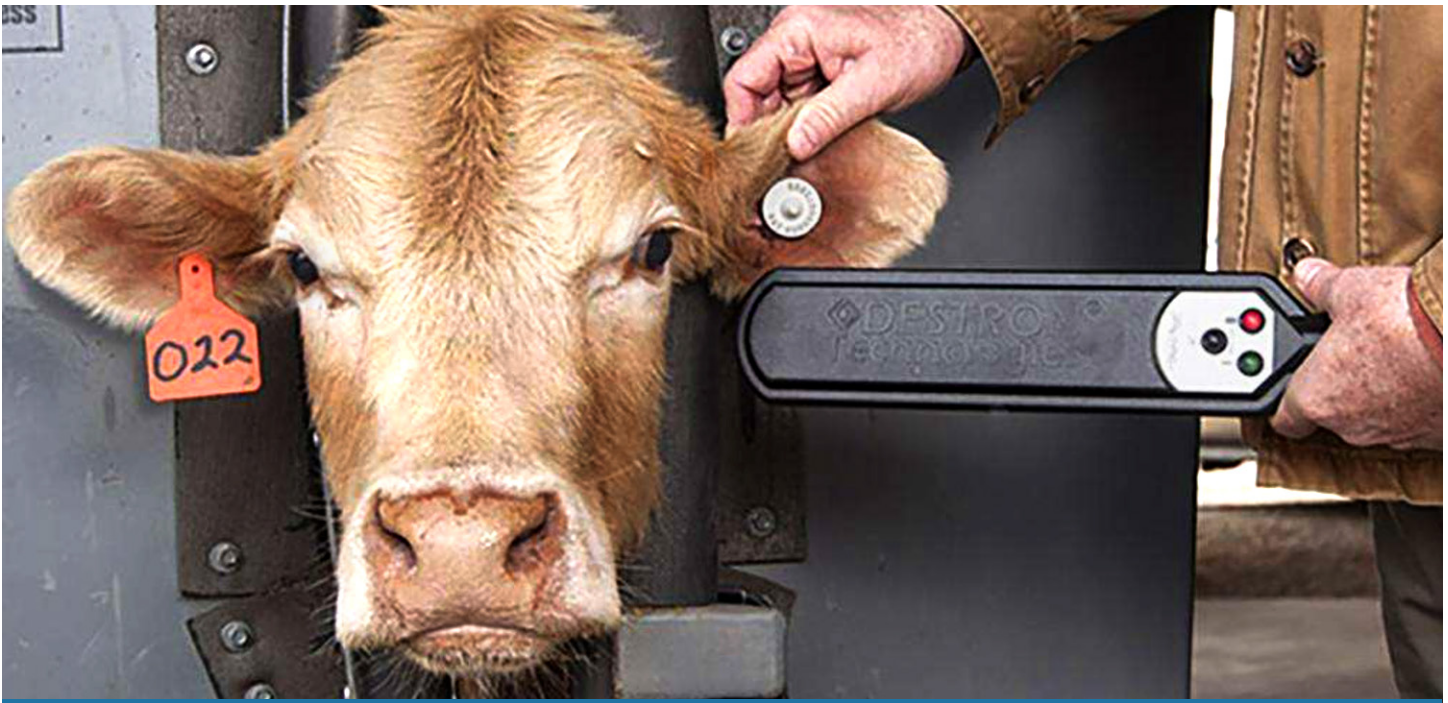
By systematically recording Critical Tracking Events (CTEs) and Key Data Elements (KDEs) at each point of transfer along the

supply chain, this forward-looking model ensures data integrity and supports compliance with deforestation-free sourcing requirements and other regulatory frameworks. It also enables brands to:

- Support accurate sourcing verification in line with EUDR and similar regulations
- Reduce the risk of laundering non-compliant materials
- Provide consumers and stakeholders with verifiable, validated sustainability claims

**Image 3:** Material Forward Tracking Model





Scanning a radio frequency identification (RFID) ear tag. © USDA Animal and Plant Health Inspection Service

## III Standards-Based Traceability

Traceability is the ability to systematically identify and track the history, application, and location of a product or material using recorded data. This is closely related to the concept of **event-based traceability**, which focuses on capturing and recording two essential components:

- **Critical Tracking Events (CTEs):** These are specific events that occur during the product's journey through the supply chain, such as receiving, transforming, packing, shipping, and transporting materials. In the leather industry, key CTEs might include processing at tanneries, movement from tanneries to manufacturers, and final distribution to retailers.
- **Key Data Elements (KDEs):** These are specific data points that describe the movement, handling, and transformation of a product throughout its supply chain journey. For example, KDEs might include the what, when, where, and why of each supply chain step – such as the date and time of a transformation event, the origin location of the cattle used for leather, supplier information, and other critical details.

Robust event-based traceability is grounded in **standards**, meaning the adoption of globally recognized protocols that enable consistent data capture, sharing, and interpretation across all actors in a supply chain. This approach supports interoperability, reduces data fragmentation, and strengthens transparency – key enablers for regulatory compliance, risk mitigation, and credible sustainability claims.

In the context of increasing regulatory pressure, notably the EU Deforestation Regulation (EUDR), standards-based traceability has become a critical tool. The [GS1 in Europe White Paper on Deforestation](#) highlights how global standards – such as [EPCIS \(Electronic Product Code Information Services\)](#) and the [Data Framework for Interoperable Electronic Traceability for Deforestation-Free Cattle In Brazil](#) – can directly support companies in meeting EUDR requirements. These standards enable the linking of physical goods with digital records, ensure the verifiability of geolocation data, and facilitate the secure and structured flow of traceability information throughout complex supply chains.

By implementing such standards, companies are better positioned to collect and communicate the Key Data Elements (KDEs) and Critical Tracking Events (CTEs), including geolocation at plot level, timestamps, actors involved, and transformation or aggregation points along the chain. The [Data Framework for Interoperable Electronic Traceability for Deforestation-Free Cattle In Brazil](#) published by GS1 is a recognized publication which establishes KDEs and CTEs for the cattle supply chain. These structured and interoperable systems provide a foundation for building traceability that is scalable, auditable, and regulation ready.



## Data Standard in the Seafood Sector Case Study

In the seafood industry, where multi-stage supply chains also complicate traceability, the [Global Dialogue on Seafood Traceability \(GDST\)](#) framework has played a pivotal role in scaling traceability efforts. Launched in March 2020 after three years of collaboration among over 60 global companies, the GDST established the first international standards for interoperable seafood traceability systems.

These standards aim to:

- Enhance the reliability of seafood information
- Reduce traceability costs
- Minimize supply chain risks by eliminating IUU (Illegal, Unreported, and Unregulated) products
- Secure long-term social and environmental sustainability in the sector

The GDST framework defines:

- Internationally agreed-upon Key Data Elements (KDEs) linked to seafood products
- Technical specifications for traceability systems that are vendor-neutral and applicable across the entire seafood supply chain

This standardized approach makes traceability scalable, fostering industry-wide collaboration and providing robust proof of sustainability from production to consumption<sup>10</sup>.

## 1 Global Traceability Framework for Beef and Leather

The beef and leather industry, also characterized by long, multi-tiered, and often opaque supply chains – from cattle farms through slaughterhouses, tanneries and manufacturers to brands – faces significant challenges in traceability. Historically, the lack of unified documentation and system integration has made it difficult to trace materials back to their origin, and even more so to trace the animal which provided the hide back to its origin.

To address these challenges, the [Global Traceability Framework for Beef and Leather](#) is being developed through a cross-sector collaboration among multiple stakeholders to establish a clear and standardized approach tailored to the specific needs of the leather sector. According to [GS1 Global Traceability Standard](#), a Data Standard is a set of agreed-upon requirements for

capturing, sharing, and managing data across various actors within a supply chain. In traceability, a data standard ensures that data collected from different systems are compatible and interoperable, allowing seamless information flow across the value chain.

The Global Traceability Framework for Beef and Leather focus on end-to-end traceability, defining the CTEs and KDEs applicable to each actor in the supply chain, from the origin (e.g., birth farms) to the final brand (see Table 1 on next page). It enables the industry to align on the type of data that must be collected, when, and by whom – thus promoting traceability that is both actionable and compliant with emerging legal frameworks.

**Table 1:** Example of Critical Tracking Events (CTE) and Key Data Elements (KDE) matrix for the beef supply chain

		CTEs and Supply Chain Steps					
		Commission	Ship	Receive	Transform	Decommission	Aggregate/ Disaggregate
KDEs		Birthing	Shipping of livestock, raw materials, or finished products	Receiving livestock, raw materials, or finished products	Slaughtering, processing, commingling, packaging	Consumption or disposal of raw materials or finished goods	Aggregation or disaggregation of goods
Who	Organization (Entity that owns event location)	X	X	X	X	X	X
What	Product Identification (UUID)	X	X	X	X (*)	X	X
	Quantity	X	X	X	X (*)	X	X
	Unit of Measurement	X	X	X	X (*)	X	X
	Linking KDE (Lot/Batch/Serial)	X	X	X	X (*)	X	X
Where	Event Location ID (UUID)	X	X (**)	X (**)	X	X	X
	Event Location Address	X	X (**)	X (**)	X	X	X
	Event Location Name	X	X (**)	X (**)	X	X	X
When	Event Date & Time	X	X	X	X	X	X
Why	Business Step	X	X	X	X	X	X
Technical	Event Read Point	X	X	X	X	X	X
	Event ID	X	X	X	X	X	X

(\*) Collect KDE for Inputs & Outputs | (\*\*) Collect KDE for Source and Destination Locations

The Global Traceability Framework for Beef and Leather is aligned with the broader principles of the GS1 EPCIS, reinforcing global efforts to enhance supply chain visibility and product integrity. Similar to how the Global Dialogue on Seafood Traceability (GDST) has advanced interoperable data sharing in the seafood industry, the Beef and Leather Framework aims to harmonize data practices in the beef and leather sectors – providing a replicable and scalable model for other complex supply chains.

Key Benefits of Standards-Based Traceability in Leather:

- **Improved Data Quality:** Ensures data is consistent, accurate, and timely, reducing the risk of errors and enhancing trust across the supply chain.
- **Stakeholder Alignment:** Standard definitions of KDEs and CTEs facilitate seamless collaboration among upstream and downstream actors.
- **Regulatory Compliance:** Prepares companies to meet rigorous disclosure and due diligence obligations, such as those set out by the EUDR.
- **Fraud Prevention:** Reduces the risk of false claims by enabling transparent and verifiable traceability across the entire chain of custody.

## Serialized and Lot-Based Traceability

Within the first mile approach proposed in this guide, two primary methods of tracking products are recognized: **serialized and lot-based traceability**. Both methods can be integrated within a single supply chain<sup>11</sup>, and the Global Traceability Framework for Beef and Leather aims to define the conditions and necessary data requirements for each stage of the supply chain to ensure effective traceability.

- **Serialized Traceability:** This method tracks each individual item (e.g., a single cow or a single hide), typically using unique identifiers such as barcodes or RFID tags. Serialized traceability offers a high level of precision, enabling brands to track each leather product from its origin to the final consumer. This ensures that every item's journey is fully traceable, providing enhanced granularity for risk assessment and sustainability verification. However, implementing serialized traceability across the entire leather supply chain can be costly and data-intensive, particularly beyond the slaughterhouse level, due to the massive volume of hides being traded. Therefore, serialized traceability is often used to track cattle until slaughter, which ensures greater granularity for assessing risks in high-risk regions of the supply chain. Deforestation, for instance, typically occurs in the earlier stages of the cattle supply chain, particularly at birth and rearing farms, making it crucial to capture detailed data at these stages for deforestation-free sourcing.
- **Lot-Based Traceability:** This approach tracks groups of products, or "lots," that share common attributes, such as being processed in the same batch at a tannery. Lot-based

traceability is more cost-effective and is often used for materials that undergo similar processing steps. In the leather supply chain, lot-based traceability is commonly adopted post-slaughter, through to the manufacturing of the final product. Hides can be aggregated into lots based on shared quality attributes or sustainability claims, which simplifies data collection while still ensuring that products meet sustainability standards.

By integrating both serialized and lot-based traceability, the Global Traceability Framework for Beef and Leather ensures a cost-effective, feasible, and data-accurate approach to supply chain management. This dual-method approach balances precision and practicality, making it possible to trace products at the necessary levels of detail while minimizing costs and data complexity.

## Core Traceability and a Modular Approach

Within the Global Traceability Framework for Beef and Leather, a modular approach to traceability is proposed, designed to create systems that can be adapted to different needs throughout the value chain. As outlined in Chapter II, traceability at its core relies on two essential components – Critical Tracking Events (CTEs) and Key Data Elements (KDEs).

To ensure consistency and transparency, CTEs and KDEs must be standardized as the core elements of leather traceability, including data related to geolocation (in the form of an address or geocoordinates), allowing uniform data capture across the entire supply chain.

Additionally, the modular approach enables the inclusion of specific modules tailored to address environmental and human rights concerns that brands may have as part of their commitments. For example:

- **Environmental Modules:** These could track the environmental impact of production practices, such as water usage, carbon emissions, and deforestation risks. A module dedicated to environmental data can help verify sustainability claims, such as deforestation-free leather.
- **Human Rights Modules:** These modules could help to collect data in support of ensuring that labor conditions and human rights are respected throughout the supply chain. Data might include compliance with labor standards, fair wages, and working conditions.

By adopting this approach, brands can capture all data relevant to core traceability, from raw material origin to the final product, while simultaneously gathering the necessary data to substantiate their sustainability claims or other business commitments.



## Operationalizing Certification Requirements Through a Modular Traceability Approach

### Case Study

[PRISM](#) (Platform for Responsible Industry Sourcing and Monitoring), a digital platform developed by the [Global Seafood Alliance](#) (GSA), exemplifies how a modular approach to traceability can operationalize certification requirements. Built on GS1-aligned data standards, Prism integrates certification-relevant data – such as audit results, non-conformities, and farm locations – into a shared digital platform.

Structured around core traceability elements (CTEs and KDEs), Prism enables the integration of audit data modules related to environmental, human rights, animal welfare, and food safety claims. Suppliers and producers can upload, manage, and validate data in real time, while retailers and importers benefit from dashboards that flag risk, visualize supply chain geography, and enable proactive audit oversight.

This case illustrates how a modular approach to traceability can extend the value of certification beyond annual audits – transforming compliance into continuous, data-driven assurance that supports brand commitments to transparency, sustainability, and ethical sourcing.

## 2 DCF and Traceability Requirements

Deforestation- and Conversion-Free (DCF) sourcing claims require traceability systems that can link materials directly to their farm-level origins. Without this level of traceability, it is challenging to confirm that a product or material genuinely originates from DCF-compliant sources. As more companies commit to sourcing leather free from deforestation, it becomes essential to define clear, verifiable traceability and data requirements for suppliers at every stage of the supply chain. These requirements should align with established frameworks and market expectations, including the Accountability Framework (AFI), the EU Deforestation Regulation (EUDR), LWG Deforestation Due Diligence requirements, and regional initiatives such as Beef on Track in Brazil. These initiatives provide practical guidance for structuring supplier expectations and verifying origin-linked compliance. To enhance traceability and verify DCF sourcing, these requirements should include:

- Establishing a DCF commitment with a clear cut-off date for critical regions, such as the Amazon and Cerrado in South America.
- Collecting, storing, and sharing relevant traceability data (referred to in the Global Traceability Framework for Beef and Leather as the Key Data Elements (KDEs) of each Critical Tracking Event (CTE)) to track the flow of products through the supply chain.
- Implementing a monitoring system to manage supply chain compliance and ensure that all stakeholders adhere to DCF criteria.



## IV Implementation Roadmap

The Implementation Roadmap is designed to guide companies through a clear, practical process for achieving full traceability in deforestation-free leather supply chains. Recognizing the complexity and challenges inherent in leather sourcing, this step-by-step framework helps organizations build their traceability capabilities incrementally, starting with foundational actions and advancing toward comprehensive system integration.

By utilizing a **pilot approach** in collaboration with trusted partners, as described below, companies can prioritize practical applications before scaling traceability solutions. This ensures effective and informed decision-making based on prior testing and evaluation of the most suitable approach for the brand.

### 1 Steps to Achieve Full Traceability

Experience has shown that the following 11 steps can effectively guide companies toward achieving end-to-end traceability for deforestation-free leather. Breaking the process into manageable steps helps organizations gain a deeper understanding of supply chains, engage suppliers effectively, and implement traceability technologies with confidence.

In addition to guiding operational implementation, the roadmap encourages companies to reflect on their broader strategic ambition regarding deforestation- and conversion-free (DCF) sourcing. Drawing from the **DCF Implementation Toolkit**, it highlights the importance of understanding both the current state and the aspiration – not just “*Where are we today?*” but also “*Where do we want to go?*” While many brands share a common DCF goal, each may define their own pathway, pace, and scale of action. This reflection supports aligning implementation steps with corporate strategy and long-term supply chain governance.

### Organizing Internal Roles and Responsibilities

Before engaging with external partners, it is essential to establish internal alignment. The matrix below provides a suggested RACI (Responsible, Accountable, Consulted, Informed) framework for key roles typically involved in implementing leather traceability. Each organization should adapt this structure based on their internal setup, regional operations, and sourcing strategies.

**Table 2:** Suggested RACI Matrix – Internal Roles and Responsibilities for Traceability Implementation

Key Activities	Sustainability	Procurement	Compliance / Legal	IT / Data Management	Supply Chain	Executive Sponsor
Conduct internal traceability assessment	R	C	C	C	R	I
Define traceability objectives and roadmap	R	C	C	C	R	I
Identify priority sourcing regions and key suppliers	C	R	I	I	A	I
Align on traceability requirements and standards (e.g., GS1 EPCIS)	R	C	A	A	R	I
Develop and send data request template	R	A	C	A	C	I
Support suppliers in traceability data submission	A	R	I	C	R	I
Review and verify supplier data	R	C	C	C	A	I
Define contractual clauses or specifications on traceability	C	R	R	I	C	I
Present pilot results internally and align on scaling strategy	R	C	C	C	C	A

**R** = Responsible (Executes the task)

**A** = Accountable (Owns the result and decision)

**C** = Consulted (Provides input or expertise)

**I** = Informed (Kept in the loop)

## STEP 1: Assessing Your Company's Current Traceability Practices

The assessment evaluates current capabilities and progress toward leather traceability. This step identifies achievements, gaps, and provides a clear starting point for advancing a company's traceability efforts focusing on internal practices.

**Goal:** To establish a clear understanding of the company's traceability readiness, enabling companies to address specific challenges and leverage prior progress effectively by determining the optimal starting point for achieving full traceability.

### How to:

- 1. Gather Relevant Documentation:** Collect all existing traceability and supply chain-related documents, policies, and records – such as supplier agreements, procurement processes, traceability reports, mapping data, and logistics/transportation documents. This information helps companies understand their current traceability setup, map their internal systems, and identify areas for improvement. Consolidating these documents ensures a comprehensive assessment, allowing companies to determine the appropriate starting point within the 10-step approach.
- 2. Engage Key Stakeholders:** Alongside gathering documentation, consulting with internal teams (e.g., procurement, traceability, sustainability, compliance) and external stakeholders (e.g., suppliers, auditors) to gain deeper insight into current traceability practices. Their input is essential for achieving a complete understanding of the company's traceability maturity.
- 3. Use the Traceability Assessment Tool:** Apply the Traceability Assessment Tool (Annex 3) to evaluate the current state of traceability systems, processes, and supplier engagement. This step helps pinpoint gaps and strengths based on predefined criteria.
- 4. Determine Next Steps:** Based on the assessment results, identify the appropriate starting point in the guide's 10-step approach. Direct companies to the most relevant next step, building on prior progress and ensuring efficient use of resources.

## STEP 2: Understand the Value Chain and Identify Trusted Partners

Many companies try to implement a reverse tracking approach – often referred to as product backward traceability – by starting from a finished leather product and tracing it back to the cattle farm. While this method works in vertically integrated supply chains, it is less feasible for the leather sector due to its fragmented nature and the varied production characteristics of numerous suppliers (see Chapter I).

To build a reliable traceability system, product-backward efforts should be complemented by a first mile approach that engages producers in a specific sourcing region and establishes real-

time traceability at the origin. As traceability initiatives evolve, it becomes crucial to link this first mile data with subsequent production stages – such as tanning, manufacturing, and finishing. Typically, this integration begins at a small scale as a **pilot** with a select group of trusted partners, allowing brands to refine and scale their approach. Over time, these efforts lead to genuine traceability of the materials the brand is using detailing the point of origin and the full chain of custody – so every link is verifiably tied to the brand's products rather than a broad network of actors who may or may not be part of your operation.

Many companies have already conducted assessments or possess chain of custody information, enabling them to identify key material suppliers in high-risk areas. Leveraging these existing assessments can further enhance the understanding of the value chain and help identify the most reliable partners to pilot a traceability process.

## Mapping vs. Traceability

As detailed in Chapter II, mapping is the process of identifying the **universe of potential suppliers** linked to a company's operations. However, this does not imply a direct material flow or linkage to a specific lot of material. In contrast, traceability establishes a *verifiable connection* between specific batches or lots and the suppliers involved in their production and handling.

A brand may map 50,000 cattle farms as potential sources in its supply base, but only 500 are actually tied to the wet-blue used in current production. Mapping is a diagnostic tool – traceability is the operational proof.



**Goal:** To build a foundational understanding of the value chain and engage a small group of trusted partners to pilot and refine traceability solutions, enabling companies to confidently scale effective practices.

**How to:**

**1. Conduct targeted mapping to identify key suppliers:**

Start by leveraging existing procurement data to pinpoint priority Tier 1 suppliers (e.g., product manufacturers) – those providing significant volumes and/or with longstanding relationships. Determine their primary trading partners and the regions in which they operate. Cascade this inquiry from tier to tier, focusing on the next set of major suppliers at each level.

An alternative approach is to start with the country of origin. If the company knows which country supplies raw material, it can focus on that country's major exporters from the region in question. The brand can focus inquiry with supply chain actors whether it sources from one of these dominant exporters. If so, that supplier is a strong starting point, as it likely represents a significant share of the company's volume from that geography.

Remember that the goal is not to catalog every account in supplier databases, whether active or inactive – as it can be both expensive and time consuming without revealing actual material flows. Instead, aim to identify a subset of entities and trusted partners where material is most likely moving. Ideally, mapping extends to identifying several wet-blue suppliers or slaughterhouse candidates in priority regions. However, once finished tanneries are identified, issuing a traceability data request (see Step 3 for more details) can map to material providers based on actual traceability transaction data.

See the Trusted Partners Identification tool (Annex 4). If the brand is already using – or has previously applied – the Supplier Questionnaire provided by the Leather Working Group (LWG), it may extract information about trusted partners directly from the results of that mapping.

**2. Vet Supply Chain Potential Partners:** After identifying key wet-blue suppliers, ideally from diverse sourcing regions, companies should gauge each supplier's current engagement and willingness to support traceability initiatives. To build or strengthen these relationships, companies can:

- Discuss opportunities, challenges, and traceability goals
- Share informational resources on traceability, sustainability claims, and best practices
- Provide tools and guidance to help suppliers meet brand expectations
- Offer incentives, training, and education on traceability topics

This collaborative approach nurtures strong, mutually beneficial partnerships with suppliers who are committed to advancing traceability.

## Principles for Engaging Trusted Partners

Engaging trusted partners in traceability is not just a technical task – it is a strategic relationship-building effort. Successful engagement is rooted in mutual value recognition, trust, and a shared long-term vision. To foster this, brands should:

- **Demonstrate long-term commitment:** Suppliers are more likely to engage when they see consistent investment and genuine interest beyond short-term objectives.
- **Co-create objectives:** Involving partners in the design of traceability solutions from the outset fosters ownership and enhances the quality of collaboration.
- **Acknowledge local capacities and limitations:** Calibrating expectations and timelines to the real operational context of suppliers shows respect and improves feasibility.
- **Align commercial interests with traceability goals:** Clearly communicating how traceability can unlock business benefits – such as market access or reputation – helps build buy-in.

**3. Prioritize Trusted Partners:** Based on the engagement activity results, companies should prioritize one-to-three tannery partners or leather supply chains that have direct sourcing relationships with wet blue or raw hides. When selecting these trusted partners, consider those with significant volume, risk profile (suppliers from high-risk geographies), long-standing partnerships with the brand, and a demonstrated interest or readiness to collaborate on traceability initiatives. It is crucial that these early collaborations emphasize interoperability, ensuring that the systems developed during initial trials can seamlessly integrate with later-stage production processes. Their active involvement is key to testing, refining, and standardizing solutions – avoiding siloed systems that could impede broader scalability.

### STEP 3: Initiate a Standardized Traceability Data Request

Once trusted partners are identified, the next step is to issue a clear and structured data request to align on traceability definitions and material-specific data requirements. Using GS1 standards<sup>1</sup> ensures that the collected data is interoperable and scalable for future traceability solutions. An example is the Global Traceability Framework for Beef and Leather, which ensures that

<sup>1</sup> As mentioned in Chapter III, the most widely recognized GS1 standard for event-based traceability is GS1 EPCIS (Electronic Product Code Information Services). For further details, please refer to Chapter III.

data adheres to a consistent framework, facilitating seamless integration with existing systems and reinforcing industry-wide best practices. For further details on the Global Traceability Framework for Beef and Leather, please refer to Chapter III.

**Goal:** To ensure alignment and clarity in data-sharing expectations while leveraging standardized formats to promote system interoperability and scalability.

**How to:**

**1. Align with Trusted Suppliers:** This preparatory activity focuses on aligning expectations, identifying roles, and outlining clear next steps – ensuring both the company and supplier are ready to implement traceability effectively. Clarify the data request and highlight potential benefits – such as efficiency gains, reduced compliance risks, and competitive advantage. Address concerns regarding data privacy, integration costs, and regulatory requirements to secure early buy-in and ensure clearly defined adoption roles.

**Note:** Similar requests have already been initiated with high-volume suppliers in key export markets. This step builds on those efforts and sets the stage for broader verification – see Step 9 for details on data validation and assurance mechanisms.

**2. Send a Formal Written Request:** Distribute a formal data request that sets clear expectations on data format, submission process, and deadlines to the trusted suppliers. To facilitate data collection, the brand should share a standardized data request template. These materials, along with supplier orientation, should evolve in step with the development and revision of data standards. See the Data Request Template in Annex 5.

**3. Support Suppliers in Data Submission:** Walk suppliers through the template to clarify its structure, requirements, and to align on specific data points. Support suppliers in data submission by addressing questions related to the structure of the data standard, its application, terminology, IT requirements, or on-the-ground analysis of traceability in practice, in order to ensure compliance and enhance data quality.

**4. Collect and Analyze:** Review the submitted data for accuracy, completeness, and adherence to the Data Request. Identify missing data, determine availability, and outline steps to obtain it.

## STEP 4: Conduct a Gap Analysis

With supplier data in hand, the brand can assess the supplier's traceability efforts, the data available, and the gaps that need to be addressed to meet thorough traceability standards that allow interoperability and scale. By evaluating their current practices, companies can provide targeted feedback to partners and define realistic improvement timelines, ensuring traceability goals are achievable and accomplished collaboratively.

**Goal:** To evaluate supplier traceability capabilities, identify data gaps, and provide actionable feedback to align their efforts with the company-specific traceability objectives.

**How to:**

**1. Analyze Traceability Data & Assess Supplier Capabilities:**

Analyze the traceability data received from the suppliers, focusing on practices and data quality. Identify where suppliers' capabilities align with or diverge from your traceability requirements.

**2. Identify Alignment Points and Gaps:** Based on the Data Sheet received from suppliers and analyzed in previous steps, brands can quickly identify data gaps. Highlight areas where supplier data meets expectations and identify any gaps or inconsistencies in their traceability information. This assessment provides a clear roadmap for targeted improvements.

**3. Engage in Supplier Feedback Session:** Organize feedback session with suppliers to discuss the findings of the gap analysis. Clearly communicate necessary data adjustments, areas for development, and the reasons behind these recommendations.

**4. Define Realistic Timelines for Improvement:** Collaborate with your suppliers to establish practical timelines for addressing identified data gaps and enhancing data quality. Use the Supplier Action Plan example to provide clear guidance and allocate the necessary resources to support their progress.

**5. Document Findings and Next Steps:** Record the results of the gap analysis and the improvement plans agreed upon detailing specific measures and time frames for each supplier to meet the requirements. Use this documentation to track progress and ensure alignment in subsequent steps of the traceability implementation process.





## Supplier Feedback Session and Timelines for Improvement

### Case Study

As part of a pilot project to test traceability integration in the leather sector, one international brand worked closely with one key wet-blue supplier to evaluate current traceability capabilities and identify data gaps. After sharing the standardized data request (see Step 3), the supplier raised questions about the structure and format of the requested information.

To address these challenges, the brand held two clarification sessions with the supplier, focusing on how to interpret the requirements and populate the templates correctly. These sessions enabled a shared understanding of expectations and clarified the rationale behind each data field.

As a result, both sides aligned on a final data format and established a stepwise plan for data submission. A timeline was agreed upon to allow the supplier to gradually enhance their data collection and reporting systems.

## STEP 5: Validate Feasibility and Demonstrate Success

As this approach is rolled out, the brand will uncover both valuable insights and data gaps. Rather than waiting years for complete data, solutions can be modeled using available data and historical records to develop a functional traceability prototype. Using existing information, validated assumptions and reporting mechanisms, companies will develop a working model that demonstrates the feasibility of their traceability solution.

**Goal:** To test and validate a traceability prototype using historical data from trusted suppliers, validated assumptions, and reporting systems; to identify challenges and opportunities for refinement, build confidence in the solution, and lay the foundation for full-scale implementation.

### How to:

**1. Leverage Supplier Data:** Start with traceability data from finished goods or tannery operations to establish an initial model and demonstrate early success. Where upstream data is not yet available, companies may use historical purchase order data or indicative inputs as placeholders to simulate likely traceability flows for demonstration purposes. This stepwise approach enables immediate action and analysis of systems while progressively integrating more granular data – wet-blue, meatpacker, and farm level – refining the solution over time.

**2. Assess Digital Traceability Solutions:** Scaling traceability across large volumes, transactions, and geographies requires a digital approach. Manual reporting is time consuming, error-prone, costly, and lacks the operational benefits of real-time data.

Whether developing in-house solutions or using third-party providers, certain factors must be considered when evaluating tools. While interoperability (e.g., GS1 EPCIS compliance) is foundational, it is equally important to assess:

- **System architecture and scalability:** Can the platform support growing transaction volumes and supplier onboarding across regions?
- **Data privacy and access controls:** How are supplier data and commercial sensitivities protected?
- **Auditability and verification mechanisms:** Can the system support third-party verification or integrate with assurance tools?
- **User interface and ease of use:** Is the system practical for daily use by suppliers with different levels of digital maturity?
- **Integration with internal systems:** Can the platform interface with existing PLM, ERP, or procurement platforms?
- **Analytics and reporting capabilities:** Does it offer dashboards, alerts, or tools to support compliance and decision-making?

Examples like the **GDST Tool Tester** illustrate how to verify provider alignment with GS1 standards.

- 3. Develop a Prototype<sup>2</sup>:** Combine the historical data from trusted suppliers with validated assumptions to create a working prototype within the selected traceability system. Use this model to project results, refine its application, and align with the brand's traceability priorities at scale.
- 4. Configure Reporting Systems:** Set up the system for collecting, analyzing, and reporting traceability data. Ensure the system aligns with traceability goals and provides support for decision-making and future scalability.
- 5. Showcase the Prototype and Demonstrate Success:** Present the working prototype to stakeholders, including supply chain partners, leadership, and other relevant parties. Highlight the model's success in addressing traceability objectives and its potential for scalability.

## STEP 6: Incorporate Traceability into Purchasing Specifications

Suppliers are familiar with quality specifications; traceability data extends this to ensure due diligence and material origin verification. Embed traceability requirements into procurement to standardize expectations, ensure compliance, and classify sourcing regions. Integrating these into purchasing specifications creates a consistent framework with stepwise guidelines for preferred, required, and banned regions or suppliers.

**Goal:** To formalize traceability requirements within purchasing specifications while establishing clear sourcing criteria, ensuring alignment, compliance, and consistency across all suppliers.

### How to:

#### 1. Develop Traceability-Integrated Procurement Policies:

Update purchasing policies to include traceability requirements – focusing on data quality, standards, and DCF product criteria – and define sourcing materials and suppliers by categorizing them as:

- **Preferred:** Materials or suppliers that meet the highest standards of sustainability and responsibility, prioritized in procurement whenever possible.
- **Required:** Minimum mandatory criteria that all suppliers and materials must meet to be eligible for procurement.
- **Non-compliant:** Materials or practices that do not comply with the company's ethical, environmental, or regulatory standards and are therefore prohibited from procurement.

**2. Standardize Supplier Agreements:** Incorporate traceability and sourcing region requirements into supplier contracts to formalize expectations and promote accountability.

**3. Communicate Requirements to Suppliers:** Share the updated purchasing specifications and sourcing region guidelines with suppliers, providing clear instructions and timelines for compliance.



## Embedding Traceability into Purchasing Specifications

### Case Study

In the seafood sector, one company revised its purchasing specifications to formally require traceability as a condition for procurement. The updated terms mandated that all suppliers adopt traceability platforms compatible with the Global Dialogue on Seafood Traceability (GDST) standards and electronically report key data elements (KDEs) for each product.

Suppliers were also required to implement GS1-compliant barcodes and maintain documentation aligned with the U.S. Food Safety Modernization Act (FSMA) Section 204 Traceability Rule. These specifications were integrated directly into procurement policies, contracts, and onboarding procedures, making traceability a non-negotiable aspect of supplier compliance.

By embedding clear and standardized traceability requirements into its purchasing process, the company is better positioned to ensure interoperability, improved supply chain transparency, and sourcing practices aligned with regulatory and sustainability commitments.

## STEP 7: Roll-out Traceability Across Operations

With traceability requirements already embedded into purchasing specifications and supplier agreements, the brand is now prepared to extend the traceability model beyond the initial pilot. Begin by enhancing traceability with the suppliers already engaged, then gradually extend the same requirements to additional key suppliers handling significant volumes. This stepwise expansion should be managed across suppliers, facilities, and geographies, with a focus on Deforestation and Conversion-Free (DCF) products to ensure a sustainable, manageable rollout.

**Goal:** To gradually scale the traceability model across the value chain while increasing the availability of DCF products in individual facilities and broader operations.

### How to:

- 1. Scale Volume with Current Suppliers:** Leverage established supplier relationships to scale traceability efforts, expanding volumes in facilities adopting these practices.
- 2. Pilot in Select Geographies or Facilities:** Align requirements across suppliers in the same region to standardize DCF product traceability. Focus on geographies with the highest volume potential.
- 3. Communicate Demand for DCF Products:** Clear market signals mobilize suppliers and partners to meet requirements. Communicating specific, long-term commitments builds supplier confidence for necessary investments. Collaboration with others interested in DCF products (Step 10) helps channel demand for all products from compliant facilities.
- 4. Define the Right Data Access Model:** As traceability scales, it becomes essential to determine how traceability data will be exchanged between suppliers and the brand. Two main approaches are commonly used:
  - **Push Model (Per-Transaction Submission):** Suppliers submit traceability data for each order or batch. This allows greater control over data flow, aligns well with event-based traceability, and allows real-time integration. However, it requires higher supplier capacity and strong systems integration; it may lead to data duplication or inefficiencies if not automated.
  - **Pull Model (On-Demand Access):** Suppliers maintain traceability data in their systems or on a shared platform, and the brand retrieves it when needed. This reduces supplier burden, offers flexibility for internal auditing and reporting, and allows for staggered system upgrades. However, it represents a risk of data fragmentation or outdated records if access protocols are not well defined or regularly tested.

Both models have been explored in early discussions with leather brands. Brands should evaluate which approach best suits their supplier base and digital infrastructure. In practice, hybrid models

– where critical data points are pushed automatically while full datasets remain accessible on demand – can offer a balanced solution.

## STEP 8: Enable System Integrations and Enhance Technological Innovation

To rapidly scale traceability data and DCF products, integrate traceability systems with existing databases and enterprise management systems for more automated data flow. Using a global data standard, such as GS1 EPCIS, enables interoperability, allowing multiple systems and databases to connect efficiently.

Some companies may not have enterprise-level systems in place. For these companies, system integration may still be a future step – hence its classification here as optional. This step explores two complementary pathways:

- 1. Foundational integration:** connecting traceability systems to existing internal systems (e.g., ERP, PLM, procurement), which is crucial for operational efficiency at scale.
- 2. Advanced integration (optional):** exploring emerging technologies to future-proof systems and enhance traceability capabilities.

**Goal:** To ensure traceability data is integrated into broader operational systems, enhancing usability and decision-making while aligning innovations with the company's existing systems and databases to improve efficiency and scalability in traceability efforts.

### How to:

- 1. Integrate with Core Enterprise Systems (Foundational Integration):** Review existing enterprise platforms (e.g., ERP, PLM, procurement systems) and assess their compatibility with traceability data structures. Integration with these systems reduces reliance on manual data entry and enables traceability to operate at scale. This includes API-based connections, shared databases, and cloud-based solutions.

This foundational integration is essential for brands aiming to automate reporting and manage growing volumes of traceability data efficiently.

- 2. Connect with Supplier Traceability Platforms:** For suppliers using their own platforms, align with the providers to automate data exchange. This roll-out should be part of the broader operational scale-up described in Step 7.
- 3. Explore Optional Emerging Technologies (Advanced Integration):** Brands interested in enhancing traceability capabilities may assess the feasibility of optional emerging tools – such as satellite monitoring, RFID, QR codes, barcodes, or DNA marking. These technologies can support material authentication and risk monitoring, particularly in high-risk sourcing geographies.

While technologies like blockchain, AI, and IoT receive frequent attention, they should only be considered if they address

concrete use cases within the company's traceability goals and infrastructure readiness.

- 4. Pilot and Refine System Integrations:** For any system integration – whether foundational or advanced – pilot the approach in selected operations to validate real-time data exchange, user experience, and system responsiveness. Collect feedback from IT, procurement, and end users to fine-tune configurations and develop a roadmap for broader deployment.
- 5. Participate in Cross-Sector Collaborations:** Partner with technology providers, research institutions, and industry experts to continuously identify traceability trends and innovations and contribute to the development and adoption of global traceability standards.

## STEP 9: Implement Data Analytics and Verification

Ensuring the reliability of traceability data is essential for building trust and mitigating supply chain risks. This step focuses on validating traceability information through rigorous internal controls, data analytics, and independent third-party verification. By integrating data standards and interoperable frameworks such as GS1 EPCIS, companies can strengthen data integrity, enhance transparency, and pinpoint high-risk suppliers or supply chain vulnerabilities.

Verification processes can draw from principles used in financial auditing, emphasizing consistency, transparency, and accountability. Just as financial data is reported under frameworks like Generally Accepted Accounting Principles (GAAP), traceability data should follow clearly defined standards and guidelines to ensure it is credible, comparable, and auditable.

Beyond verification, traceability data enables geospatial analysis. With accurate, granular supply chain data, brands can integrate geospatial analysis into traceability systems to sourcing regions, monitor risks, and verify DCF claims. This allows brands to go beyond compliance – actively monitoring and validating DCF commitments, making informed sourcing decisions, and strengthening sustainability claims (see Chapter II for details).

In addition to verifying self-declared data, this step also incorporates **continuous monitoring of traceability flows** to detect anomalies, track supplier behavior, and flag risks proactively. High-quality, event-based data allows companies to move from periodic verification to ongoing oversight.

This step takes into consideration the three main models of verification according to the [Accountability Framework \(AFi\) Operational Guidance on Monitoring and Verification](#):

- 1. First-party verification:** Internal checks or supplier self-declarations, common in early stages of traceability efforts. Performed by a different team within the company itself.
- 2. Second-party verification:** Performed by an entity with an interest in the company being assessed, which can be

## Verification Beyond Deforestation

While this step emphasizes traceability data and DCF verification, the traceability system should also enable modular verification of other sustainability claims, such as animal welfare, chemical usage, and other ESG priorities. These functional “modules approach” are described in Chapter III (Global Traceability Framework for Beef and Leather), allowing companies to layer multiple criteria into the same traceability framework.

evaluations conducted by customers or buyers within the supply chain.

- 3. Third-party verification:** Performed by an entity that does not have an interest in the company nor provide other services to it, which encompass independent assessments by external organizations, offering the highest level of credibility. Third-party verification should be used when a high level of confidence and credibility is needed, such as high-risk sourcing regions.

**Goal:** To ensure the accuracy and reliability of traceability data through a standardized reporting framework, rigorous internal controls and data analytics, and independent third-party verification, strengthening credibility and risk management.

### How to:

- 1. Standardized Reporting Framework:** Companies would report traceability data using a standardized framework, such as Global Traceability Framework for Beef and Leather following GS1 EPCIS. This framework would define key data elements (KDEs) and critical tracking events (CTEs) for consistent data collection and reporting.
- 2. Internal Controls and Data Analytics:** Similar to financial internal controls, companies should establish robust processes for recording and verifying traceability data using data analytics tools. This includes documenting supplier inputs, tracking product movement, and validating certifications at each stage of the supply chain.
- 3. Leverage Third-Party Verification (Auditing):** Independent third parties would perform verification audits of the self-reported data. These audits would ensure the data is accurate, complete, and aligned with the standardized framework. The auditors would examine source documents, conduct supplier interviews, and cross-check data for inconsistencies.
- 4. Identify and Address Critical Points:** Auditors would assess materiality to focus on high-risk areas of the supply chain where discrepancies are more likely. This mirrors the financial auditing process, where the focus is on areas with the greatest impact on financial statements. In the environmental context, a risk-based approach enables companies to focus verification efforts on areas of higher vulnerability, such as



## Technology-Enabled Verification Case Study

Digital tools are revolutionizing verification by automating data capture and validation. Platforms such as PRISM by the [Global Seafood Alliance](#) demonstrate how real-time data, blockchain records, and AI can enhance transparency and reduce fraud.

PRISM (Platform for Responsible Industry Sourcing and Monitoring) leverages digital verification and certification data in the seafood industry to ensure that claims are accurate and traceable to verified sources. It aggregates audit data from certified entities, flags inconsistencies, and supports continuous compliance with standards. Though developed for seafood, it offers a replicable model for leather and other commodities with complex, fragmented supply chains

sourcing regions with a history of deforestation or facilities lacking prior audits. [AFI Monitoring and Verification Principle](#) recommends assessing risk based on:

- **Geography (e.g., high-deforestation areas)**
- **Supply chain complexity**
- **Supplier performance history**

A reliable source of supplier performance insight is traceability data based on actual purchases and transactions of real material moving through the supply chain. Even more valuable is granular data tied to specific lots, which offers greater visibility, reveals inconsistencies, and helps flag potential supplier risks.

Lot-level traceability can highlight data inconsistencies, identify at-risk suppliers, and provide a clear basis for targeting interventions. This enables buyers to focus improvement efforts where they matter most or take proactive steps to reduce risk and ensure supply chain integrity.

### 5. Define Your Deforestation Verification Strategy:

Brands may adopt different approaches to verifying DCF claims, depending on factors such as geography, product type, supplier profile, or sourcing volumes. These approaches can range from supplier-provided guarantees to more direct verification mechanisms led by the brand. In some cases, companies may implement targeted checks or independent verification efforts in higher-risk areas or for specific products.

Each strategy has implications for cost, feasibility, and credibility, and companies are encouraged to choose the model – or combination of models – that best aligns with their risk profile, operational capacity, and sustainability commitments.

**6. Certification and Assurance:** Following verification, the auditor would issue an assurance statement or certification,

similar to an auditor's opinion in financial reporting. This certification would indicate whether the traceability data is accurate and adheres to the reporting framework.

## STEP 10: Foster Industry-Wide Collaboration to Increase Volumes

Scaling fully traceable DCF products require channeling demand to facilities that meet these standards. Expanding demand across sectors – beef, leather, pharmaceuticals, and cosmetics – creates a larger pool to distribute traceability costs and increases the number of clients seeking products with the same attributes. For leather, pooling buyers across different grades – high fashion, accessories, footwear, furniture, and auto seating – further supports cost-sharing. Industry-wide collaboration with suppliers and sectoral organizations can align efforts and accelerate adoption.

**Goal:** To expand traceability coverage by working collectively with suppliers, peers, and industry bodies, increasing the volume of traceable products and driving sector-wide adoption.

### How to:

- 1. Engage in Multi-Stakeholder Initiatives:** Partner with industry groups and collaborative initiatives to align traceability goals and strategies. Participate in sector-wide discussions to influence policy and regulatory frameworks that support traceability.
- 2. Encourage Peer and Supplier Participation:** Share best practices, cases studies and lessons learned to encourage peers and suppliers to adopt traceability systems.
- 3. Scale Traceable Product Volumes:** Work collectively to address barriers to implementing traceability on a scale and support joint investments in technology and infrastructure to facilitate industry-wide adoption.



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## Better Food Future – Joint Initiatives

### Case Study

[Better Food Future](#) exemplifies how companies can come together to invest in and purchase materials with the same sustainability characteristics. Spearheaded by a collaboration between the UN Global Compact Ocean Stewardship Coalition and Wholechain, this initiative unites diverse UN Global Compact signatories to establish common sustainability standards across their supply chains.

#### Key Elements of the Project:

- **Aligned Sustainability Criteria:** Companies agree on rigorous environmental and social benchmarks – such as deforestation- and conversion-free practices – to ensure every purchased product meets identical sustainability characteristics.
- **Joint Investment in Technology and Capacity Building:** By pooling resources, partners invest in digital traceability systems and capacity building initiatives. This shared investment enables the development of interoperable data frameworks and standardized reporting, reducing costs and mitigating risks across the value chain.
- **Collaborative Approach to Procurement:** The partnership creates a unified purchasing framework that supports alignment on technical and traceability requirements. This joint approach helps scale traceability volumes and enhances market transparency and accountability.
- **Scalability and Impact Acceleration:** Through multi-stakeholder engagement and coordinated pilot programs, the initiative demonstrates how shared investments lead to improved data quality and traceability. As these best practices expand industry-wide, they set new benchmarks for sustainability that are replicable across sectors, including leather, soy, and beyond.

**Outcome:** The Better Food Future Partnership serves as a practical example of industry-wide collaboration where companies collectively drive systemic change. By aligning their investments and purchasing strategies, they achieve higher volumes of traceable products, reduce operational risks, and accelerate the transition toward sustainable supply chains on a global scale.



Hereford calf on a regenerative farm in Scotland. © David Bebbler / WWF-UK

## STEP 11: Incorporate Incentives (optional)

Focuses on motivating suppliers and partners to prioritize traceability by implementing incentive mechanisms, fostering collaboration and scalability throughout the supply chain.

**Goal:** To foster supplier engagement and accelerate traceability adoption by aligning incentives with traceability objectives.

### How to:

- 1. Design Incentive Programs:** Develop financial or non-financial incentives, such as preferential contracts or recognition programs, to reward suppliers for traceability achievements.
- 2. Communicate Benefits to Suppliers:** Explain how incentives align with suppliers' goals and create mutual value through traceability efforts.
- 3. Monitor Impact and Adjust Programs:** Track the effectiveness of incentives and refine them based on supplier feedback and program outcomes.

## 2 Financial Investments and Capacity Building

Achieving end-to-end traceability for deforestation-free leather requires not only clear operational steps but also strategic financial investments, supplier engagement, and capacity building across the value chain. Given the complexity and fragmentation of beef and leather supply chains, companies face technical, financial, and operational barriers – especially when involving upstream suppliers like farms and slaughterhouses or adopting digital tools. Without targeted support and resources, these actors may struggle to implement and sustain effective traceability systems.

Capacity building plays a complementary role by equipping suppliers and procurement teams with the technical skills and tools needed to collect, manage, and report traceability data. This includes training on data standards (such as GS1 EPCIS) and the use of digital platforms.

Several mechanisms are emerging to support companies in overcoming financial barriers and accelerating traceability implementation:

- **Deforestation-Free Leather Fund:** The Deforestation-Free Leather Fund is an initiative led by World Wildlife Fund (WWF), offering companies a platform to financially support strategic projects aimed at enhancing the sustainability of leather supply chains. The fund focuses on regions with ecosystems at high risk of environmental degradation, particularly in Brazil, South America's leading producer of cattle and leather. Its primary objectives include implementing effective end-to-end traceability systems, promoting responsible ranching practices, and assisting farmers in achieving environmental compliance and market access. By pooling resources,

participating companies can collectively drive significant, large-scale change beyond what could be achieved individually, thereby contributing to the reduction of deforestation and greenhouse gas emissions associated with leather production.

- **Incentivizing producers to adopt sustainable practices like DCF production:** WWF has developed a study focusing on the development of an incentive-based model to connect international leather brands with these indirect suppliers, offering direct incentives for adopting sustainable practices like DCF production. By focusing on the early stages of the supply chain, this model ensures that incentives reach birth farms, which are often overlooked but vital to reduce deforestation and foster sustainable development. The model focuses on traceability and transparency, enabling brands to reward sustainable practices and achieve environmental compliance.

To maximize the effectiveness and reach of financial and technical support, the following strategies are encouraged:

- **Cross-sector Collaboration:** Brands should collaborate beyond the fashion and leather industries, engaging with stakeholders in the beef sector, agritech providers, financial institutions, and civil society. These partnerships can align data frameworks, reduce costs through shared infrastructure, and promote harmonization of traceability practices.
- **Collective Approaches and Precompetitive Alliances:** Participating in initiatives such as the Better Food Future pilots or sectoral platforms coordinated by Textile Exchange allows brands to jointly design pilots, aggregate demand for traceable materials, and share lessons learned. These collective actions build trust, improve data interoperability, and de-risk innovation for all actors involved.
- **Public-Private Partnerships:** Engaging with international donors, development finance institutions, and local governments can unlock concessional finance or technical assistance, especially in sourcing regions where regulatory compliance and capacity gaps are most pronounced.



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## V Tracking, Reporting, and Strengthening Traceability Progress

Tracking and communicating brands' traceability progress is essential to ensure accountability, continuous improvement, and alignment with deforestation-free commitments. In general, monitoring and reporting on the progress of the brand in achieving traceability serves two key purposes: i) Internal management and continuous improvement, enabling companies to assess performance against traceability milestones and make informed decisions; and ii) External accountability and transparency, building trust with stakeholders by demonstrating alignment with deforestation-free commitments and international expectations, such as the *Deforestation-Free Call to Action for Leather* and the EU Deforestation Regulation.

Moreover, the [Accountability Framework](#) outlines best practices for public reporting by companies regarding ethical and sustainable supply chains. Key principles include:

- **Timeliness:** Reporting at least annually, aligned with fiscal or programmatic cycles
- **Completeness:** Report on all material sourcing geographies and supply chain stages
- **Accessibility:** Make reports publicly available and ensure they are understandable to key stakeholders

### Strengthening Internal Monitoring Systems

Companies are encouraged to establish internal systems and protocols to ensure consistent data collection and evaluation, serving as the foundation for their reporting activities. Recommended methods include:

- **Third-Party Verification:** Conduct audits of traceability data and systems, in alignment with the practices outlined in Step 8 of the Implementation Roadmap. Where appropriate, adopt financial-style audit standards (e.g., materiality, completeness, consistency) and report audit results accordingly.
- **Standardized Reporting Frameworks:** Report using common data formats, as defined by the Global Traceability Framework for Beef and Leather (see chapter III).
- **Benchmark Participation:** Use [Textile Exchange's Materials Benchmark](#) as the primary annual reporting platform for companies signatories in the Deforestation-Free Call to Action for Leather tracking.

### Continuous Improvement

Monitoring is not just for accountability – it also informs adaptive management. Companies should use results from KPI tracking and reporting to:

- Identify gaps and adjust traceability strategies (e.g., regional focus, supplier support)
- Update procurement specifications (see Step 5 of the Implementation Roadmap)
- Refine supplier engagement and incentive models (see Step 10)
- Improve technology integration and reporting tools over time



## VI Transparency, Communication, and Stakeholder Engagement

Traceability is the foundation of transparency. It generates the credible data that transparency relies on – not just to track supply chains, but to engage stakeholders, build trust, and drive sustainability outcomes. Leading brands go beyond collecting data. They share it clearly, educate consumers, and foster trust across their supply chains and with the public.

### 1 Communicating Traceability Commitments to Stakeholders

Clear and strategic communication around traceability efforts helps brands differentiate themselves, meet regulatory requirements, and manage reputational risks. As regulations like the EU Deforestation Regulation (EUDR) and the [FSMA Traceability Rule](#) come into force, proactive engagement becomes not just a best practice but a necessity. For effective communications, companies are encouraged to:

- **Publish a Traceability Commitment Statement:** Detail your goals (e.g., 100% deforestation- and conversion-free

leather by 20XX), milestones, and implementation timeline. Keep it accessible and visible across your sustainability and sourcing disclosures.

- **Publicly Share Your Journey:** As described in the implementation roadmap, your company's progress through the 10 steps can be shared through annual reports, dashboards, or impact updates. Transparency in gaps and challenges, not just achievements, helps build trust.
- **Leverage Existing Reporting Channels:** Align communication with [Corporate Sustainability Reporting Disclosure \(CSRD\)](#), [GRI](#), and other mandatory disclosures to streamline the message. Use established frameworks to report traceability efforts.
- **Engage Through Multi-Stakeholder Initiatives:** Participating in initiatives like [Better Food Future](#) sends a strong signal to stakeholders and facilitates joint messaging.
- **Train Spokespersons Across Teams:** Ensure procurement, marketing, and sustainability teams are aligned in their messaging and understand the value of traceability.

## 2 Educating Consumers on Traceability and Sustainability Impact

Consumers increasingly seek to understand the origin of materials and the environmental and social footprint behind products. Leather, due to its connection with deforestation, animal welfare, and transparency concerns, is particularly under scrutiny. Key for an effective consumer engagement process are:

- **Simplify the Message Without Oversimplifying Reality:** Use infographics, videos, or “follow the journey” storytelling to show how traceability works in your supply chain, from farm to finished product. Highlight your Proof of Concept (PoC) and supplier partnerships to demonstrate progress.
- **Use Product Labels and QR Codes:** Technologies like QR codes can provide real-time access to traceability data. When paired with user-friendly interfaces, these tools become powerful education platforms.

- **Highlight Co-Benefits of Traceability:** Make clear how traceability links to larger sustainability goals, e.g., protecting forests, reducing emissions, empowering smallholders. This framing helps consumers understand why traceability matters.
- **Partner with Trusted Third Parties:** Collaborations with NGOs, certification schemes, or platforms add credibility to your messaging and provide educational resources for consumers.
- **Create Feedback Loops:** Enable consumers to ask questions or provide feedback on your traceability and sourcing claims. This not only builds engagement but can also inform continuous improvement.

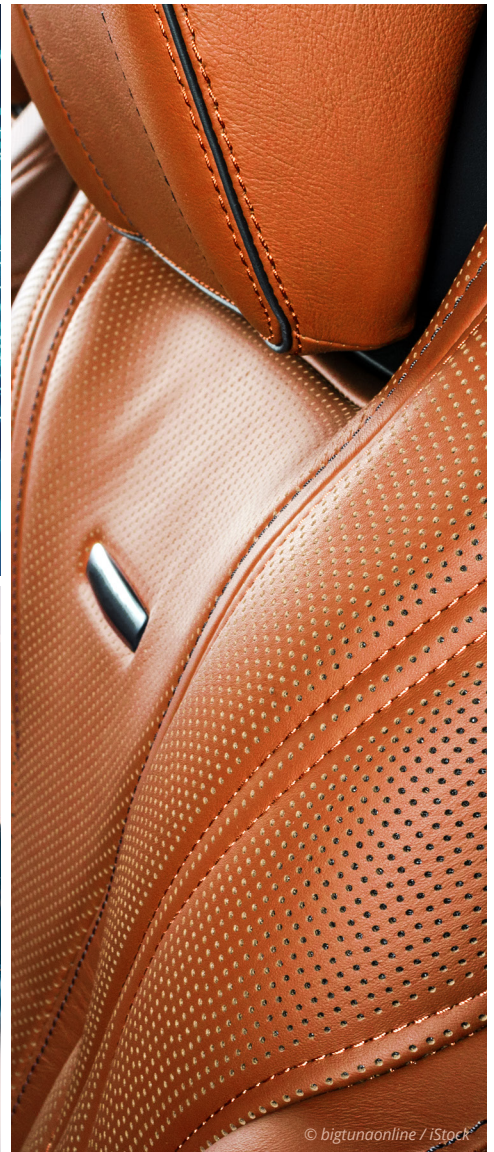
By communicating transparently and educating stakeholders, brands move traceability from a compliance requirement to a tool for transformation. The communication strategy should evolve alongside your traceability journey – starting from early pilots and becoming more robust as your systems scale and mature. ■



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## VII Annex: Additional Resources and Tools

### 1. Leather Taxonomy: Processes and Key Terms in Leather Production

Understanding the stages of leather production and their terminology is essential for traceability. Below is a brief overview of key stages and their relevance across geographies:

**Table 2:** Suggested RACI Matrix – Internal Roles and Responsibilities for Traceability Implementation

Leather Supply Type (based on LWG Standards)		
Leather Supply Type	Description	
Leather Manufacturer	A place (facility) where the process of leather production occurs. (Note: leather manufacturers may perform the whole transformation process from raw hide to finished leather or may perform a part of the process.)	
Leather Trader	A company that buys raw, partly processed or finished leather from one company and sells them to another one. The products remain unchanged.	
Commissioning Manufacturer	A person or company that buys raw or partly processed material and commissions manufacturing work to be carried out by sub-contractors, before selling it on as finished leather.	
Material States		
Material States	Description	
Full Substance Hide	A full substance hide is an unsplit hide that maintains its original full thickness from the grain (outer surface) to the flesh side. It has not been mechanically split into layers.	
Top Grain Split	The upper portion of a hide, separated during the splitting process. It includes the grain surface (the outer side of the hide where the hair was) and has had the lower (flesh) layer removed. Often corrected or finished to enhance appearance.	
Drop/Fresh Split	The portion of the hide that “drops” off or is split away during the splitting process. It generally refers to the flesh split, which is the lower portion separated from the top grain.	
Side	A full hide cut lengthwise into two symmetrical halves. Each half is referred to as a “side.”	
Skin	A general term for the hides of smaller animals (like goats, sheep, pigs, etc.) and sometimes refers to young cattle hides. Skins are thinner and lighter than hides from mature cattle.	
Stages of Leather Hides in the Process		
Stage	Description	Regional Notes
Raw Hide	Freshly removed animal skins, typically salted for preservation.	Commonly collected at slaughterhouses (Brazil, India, USA).
Pickled Hide	Raw hides preserved in acidic brine to prepare for tanning.	Predominantly in Asia and Latin America.
Pre-tanned Hide	Hides that have undergone initial tanning processes (chrome, vegetable, or synthetic), providing basic stability, resistance to putrefaction, and preservation.	Produced in Brazil, Argentina, and India; exported to Europe and Asia for further processing.
Tanned Hide (wet-blue, wet-white)	Chrome-tanned hides that are semi-processed, characterized by their bluish color (wet-blue) or white/cream appearance (wet-white).	Exported from Brazil and Argentina to Asia and Europe for finishing.
Crust Hide	Tanned and dried leather, not yet finished with surface treatments.	Common in European tanneries (Italy, Spain).
Finished Leather	Final leather product with surface coatings, dyeing, and texturing.	Produced in Italy (luxury), China, and Vietnam (volume manufacturing).
Splits and By-products	Layers of hide split during processing; often used in suede or bonded leather products.	Widely used in lower-cost product segments globally.

**Source:** [Leather Naturally Part 1](#); [Leather Naturally Part 2](#); [Leather Working Group Definitions](#);

**Note:** The terminology and processing stages may vary slightly by geography, particularly regarding the chemicals and techniques used in tanning and finishing processes.

## 2. Glossary of Terms Used in this Guide

**Table 3:** Glossary

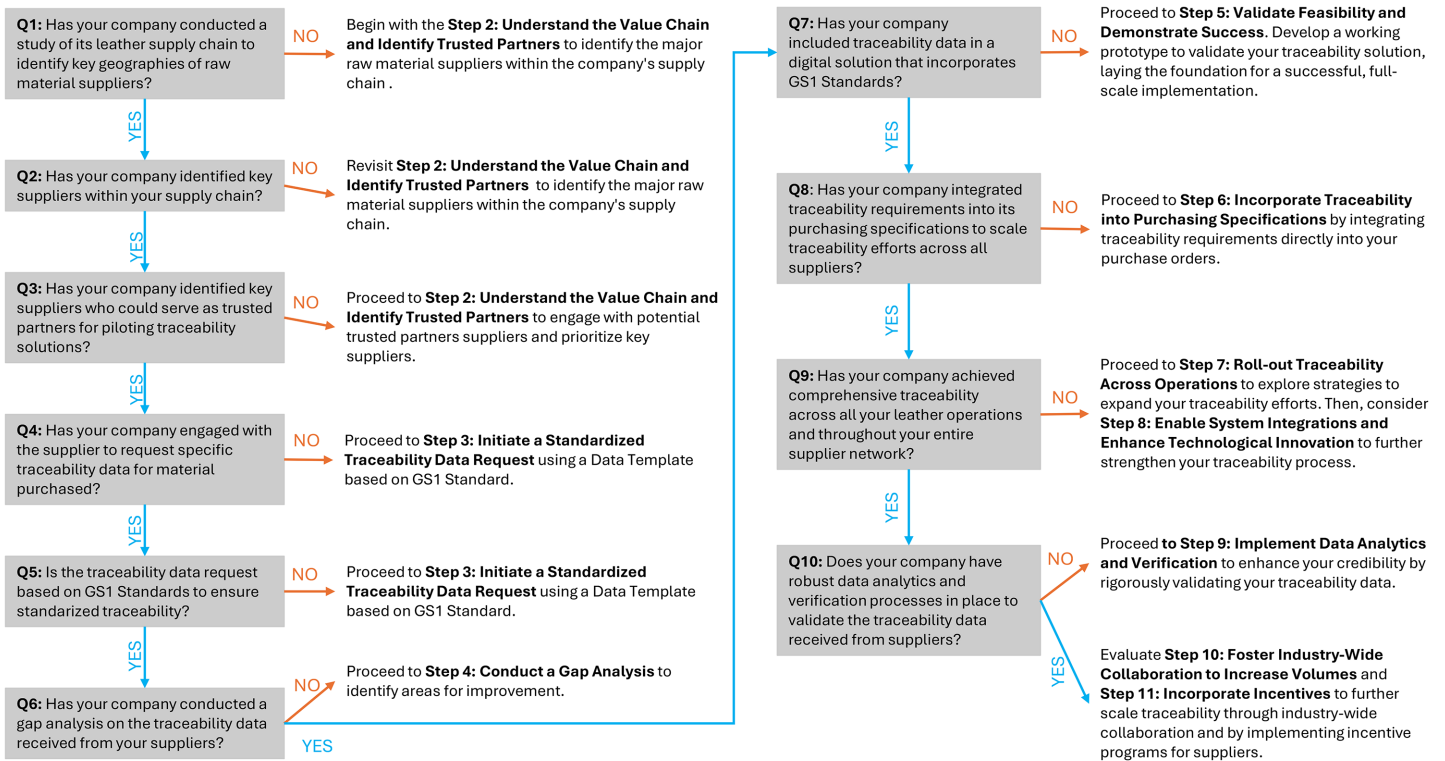
Term	Definition
Brands	A company that purchases processed materials or finished products from a supplier.
Chain of Custody (ChoC)	The ChoC system is the set of documents used to establish, manage, and verify the transfer of materials and associated attributes through the supply chain. The system normally includes normative requirements (a ChoC Standard), a means of identifying sites and entities participating in the chain of custody, a monitoring and verification mechanism, and often a centralized system that tracks the transfer and reconciliation of volumes through the supply chain. [ISEAL]
Conversion	Loss of a natural ecosystem due to its replacement by agriculture, another land use, or a significant, lasting change in its species composition, structure, or function. This includes deforestation and severe degradation, regardless of legality. [AFI]
Deforestation	Loss of natural forest due to its conversion to agriculture, other land uses, tree plantations, or through severe and sustained degradation. This applies regardless of legality and includes any total loss of natural forest cover. [AFI]
Deforestation- and Conversion-Free (DCF)	Products sourced from areas not subject to deforestation or ecosystem conversion after an agreed cutoff date. [AFI]
Downstream	A position in the supply chain further from raw material origin and closer to the stage of final sale and consumption.
GS1	Global organization that develops and maintains standards for supply chain data, including barcodes and traceability systems, to improve efficiency, interoperability, and transparency across industries. [GS1]
GS1 EPICS	A global standard for sharing information about the movement and status of products across supply chains. [GS1]
Manufacturer	A company that manufactures consumer products from raw or processed agricultural or forestry materials.
Producer	The owner or manager of a production unit. This includes smallholders and other individual owners/managers, corporate entities, and communities that own or manage production systems.
Retailer	A company that sells products directly to individual consumers. This includes supermarkets, convenience stores, lumber and home improvement stores, home furnishings stores, online retailers, restaurant chains, and the like.
Sourcing Area	An area or region from which materials in a supply chain originate.
Supplier	A producer or company that supplies raw materials, processed materials, or finished products to a buyer.
Supply Chain Mapping	Process of documenting and visualizing the network of suppliers, facilities, and processes potentially involved in the production of goods across different tiers of the supply chain. [Textile Exchange]
Traceability	Ability to trace the history, application, or location of an object. When considering a product or a service, traceability can relate to origin of materials and parts; processing history; and distribution and location of the product or service after delivery. It also allows companies to link product volumes to specific attributes of suppliers and/or production sites. [GS1]
Upstream	A position in the supply chain closer to the raw material origin.
Verification	Assessment and confirmation of compliance, performance, and/or actions relative to a stated commitment, policy, goal, target, or other obligation. Verification signifies that information is checked and confirmed by persons other than those involved in the operation or entity being assessed. [AFI]

### 3. Traceability Assessment Tool

The Traceability Assessment Tool has the objective of establishing a clear understanding of a company's traceability readiness, enabling companies to address specific challenges and leverage prior progress effectively by determining the optimal starting point for achieving full traceability.

Steps to use the tool:

1. Start at Q1 and answer each question with a simple Yes/No
2. Follow the actions indicated for a "No" answer to address gaps
3. For "Yes" answers, continue to the next question until you reach an action point that directs you to a specific step in the 10-step roadmap.



#### 4. Trusted Partners Identification tool

This tool aims to support companies to identify and prioritize key suppliers who can become trusted partners to pilot and refine traceability solutions, enabling companies to confidently scale effective practices.

Steps to use the tool:

1. Based on information collected from previous mapping exercises, the brand can either answer these questions internally or, if no prior mapping information is available, send these questions to the Tier 1 supplier in order to identify priority material suppliers for each Tier 1 supplier. **Reminder:** Focus on mapping suppliers for volumes or strategic relationships without attempting to catalog the entire supplier base.
2. The brand should complete the Prioritization Summary based on the information presented in the Supplier Identification sheet. Document only those actors who are relevant for building a pilot.

Note that information in purple are purely illustrative examples.

##### Information About Tier 1 Supplier

<b>Supplier Name</b>	Luxe Tannery Group
<b>Site Country</b>	Spain
<b>Contact Name</b>	Javier Morales
<b>Contact Email</b>	<a href="mailto:j.morales@luxetannerygroup.com">j.morales@luxetannerygroup.com</a>
<b>Job Title</b>	Head of Procurement
<b>Does the supplier have a traceability system capable of tracking material inputs and outputs?</b> <b>Include description of the system.</b>	No. They claim to have a system able to provide country of origin for the wet-blue, but it's unclear the results and methodologies used.

##### Information About Suppliers Related to the Tier 1 Supplier

Please provide information about your top five material suppliers, based on sourced volume and/or the strength of your relationship with them. The suppliers can provide raw hide, pickled, wet-blue or wet-white, crust leather, or finished leather.

Supplier Name	Country of Operation	Region (State or Province)	% Volume Sourced	Direct Relationship (Yes/No)	Does the supplier have a traceability system capable of tracking material inputs and outputs?	Comments
Prime Leather Co.	Brazil	Pará	45%	Yes	No	
EcoHide Solutions	Argentina	Santa Fé	20%	Yes	No	
Atlantic Leather	USA	N/A	5%	No	Unsure	
GreenCraft Leather	India	N/A	5%	Yes	Yes, but is not providing data	

## 5. Data Request Template

This template serves as a comprehensive guide for companies committed to achieving end-to-end traceability within their leather supply chains. Aligned with global traceability standards, such as the Global Traceability Framework for Beef and Leather, this document provides a structured framework for gathering and managing traceability data across all supply chain tiers.

Below, you will find step-by-step guidance on data requirements for suppliers, with the aim of connecting data back to the farm level, as well as technical standards and implementation stages tailored to support varying levels of traceability readiness. The template is designed to assist companies in progressing from basic data collection to advanced, automated traceability, ensuring compliance with emerging global standards.

Considering the varying levels of maturity among companies, not all brands will begin data requests from the same starting point. As the company advances toward dynamic traceability, brands are encouraged to select an implementation level suited to their current capabilities, ranging from foundational documentation in physical or digital form to fully automated, real-time traceability systems. This phased approach helps companies progressively build a comprehensive traceability model, enhancing transparency and alignment with global standards and commitments.

### Introduction

*[Company's name] aims to achieve comprehensive end-to-end traceability to meet emerging regulations that require disclosing the point of origin, complete chain of custody, and socio-environmental verification within its leather supply chains, in alignment with the Deforestation-Free Supply Chains goal. [Company's name] is committed to enhancing its efforts in supplier engagement and traceability for leather suppliers and beyond.*

*In this context, [Company's name] aims to enhance transparency, quality control, and regulatory compliance through a robust tracking system. As a result, businesses and consumers gain greater confidence in the origin and handling of products.*

*To advance its commitment to full traceability, [Company's name] is initiating a data request to its suppliers to bridge farm-level data from slaughterhouses and wet-blue suppliers. In addition to other certifications, protocols, and deforestation-free cattle initiatives, [Company's name] aims to gather standardized, event-based data that traces leather products back to the original birth farms of the cattle, thereby supporting deforestation- and conversion-free claims for products originating from cattle supply chains.*

### Standards-Based Traceability

Traceability refers to the systematic ability to identify and track the history, application, and location of a product or material through recorded data. Within the **Global Traceability Framework**, this concept is operationalized through event-based traceability, which emphasizes capturing and recording two core components:

- **Critical Tracking Events (CTEs):** These are key moments in the supply chain – such as receiving, transforming, packing, shipping, and transporting materials – that provide visibility into a product's journey. In the leather industry, CTEs might include cattle processing at tanneries, transport to manufacturing facilities, and final delivery to retail.
- **Key Data Elements (KDEs):** These are the specific data points that describe each CTE. KDEs answer questions such as what happened, when, where, and why – for example, the date and location of a transformation event, supplier identity, and origin of raw materials like cattle.

Event-based traceability ensures that data is not only collected, but also structured and standardized across all supply chain actors. To make this possible, the Global Traceability Framework for Beef and Leather promotes the adoption of interoperable standards, specifically the GS1 EPCIS framework. This unified approach allows consistent data capture, sharing, and interpretation, helping to eliminate silos and improve transparency, regulatory compliance, and sustainability claims verification across international supply chains.

### Data Requirements

*[Company's name] is moving toward a state where the key data elements (KDEs) of each critical tracking event (CTE) listed in Table 5 (next page) must be reported through an interoperable, standards-based traceability system or digital format. See details of data required in the Global Traceability Framework for Beef and Leather.*

## 5. Data Request Template (continued)

**Table 4.** Illustrative description of key data elements (KDEs) for each critical tracking event (CTEs) to describe the traceability information<sup>3</sup>

\*Additional critical tracking events (CTEs) may be needed for intermediary properties (e.g., backgrounding property, feedlot, sale yards)

Breeding Property / Breeder Farm		Fattening Property		Slaughterhouse			Processor / Tannery		
CTE: Birth	CTE: Ship to Fattening Farm*	CTE: Receive at Fattening Farm*	CTE: Ship to Slaughterhouse	CTE: Receive at Slaughterhouse	CTE: Butcher Cattle (Transform)	CTE: Ship to Processor or Tannery	CTE: Receive at Processor / Tannery	CTE: Tanning (Transform)	CTE: Ship to customer
		Serialized traceability		Serialized or lot-based traceability			Serialized or lot-based traceability		Lot-based traceability
<b>Location</b> • Organization • Location Name • Location • Geocoordinates or Address	<b>Location</b> • Organization • Location Name • Location • Geocoordinates or Address	<b>Location</b> • Organization • Location Name • Location • Geocoordinates or Address	<b>Location</b> • Organization • Location Name • Location • Geocoordinates or Address	<b>Location</b> • Organization • Location Name • Location • Geocoordinates or Address	<b>Location</b> • Organization • Location Name • Location • Geocoordinates or Address	<b>Location</b> • Organization • Location Name • Location • Geocoordinates or Address	<b>Location</b> • Organization • Location Name • Location • Geocoordinates or Address	<b>Location</b> • Organization • Location Name • Location • Geocoordinates or Address	<b>Location</b> • Organization • Location Name • Location • Geocoordinates or Address
<b>Traceable Object Information</b> • Serial Number (e.g., NLIS tag) (or lot/mob numbers of animals for mob-based transfers) • Weight (optional) • Unit of measure (optional) • Product description • Product ownership	<b>Traceable Object Information</b> • Serial Number (e.g., NLIS tag) (or lot/mob numbers of animals for mob-based transfers) • Weight (optional) • Unit of measure (optional) • Product description • Product ownership	<b>Traceable Object Information</b> • Serial Number (e.g., NLIS tag) (or lot/mob numbers of animals for mob-based transfers) • Weight (optional) • Unit of measure (optional) • Product description • Product ownership	<b>Traceable Object Information</b> • Serial Number (e.g., NLIS tag) (or lot/mob numbers of animals for mob-based transfers) • Weight (optional) • Unit of measure (optional) • Product description • Product ownership	<b>Traceable Object Information</b> • Serial Number (e.g., NLIS tag) (or lot/mob numbers of animals for mob-based transfers) • Weight (optional) • Unit of measure • Product description • Product ownership	<b>Traceable Object Information</b> • Serial Number (e.g., NLIS tag) (or lot/mob numbers of animals for mob-based transfers) • Weight (optional) • Unit of measure • Product description • Product ownership	<b>Traceable Object Information</b> • Input Linking KDEs (Serial Numbers) • Weight (optional) • Unit of measure • Input Product description • Output Linking KDEs (Serial Numbers) • Output Quantity • Output Unit of measure • Output Product description (raw leather hides) • Product ownership	<b>Traceable Object Information</b> • Serial Number • Quantity • Unit of measure • Product description • Product ownership	<b>Traceable Object Information</b> • Serial Number • Quantity • Unit of measure • Input Product description • Output Linking KDEs (Batch, Lot IDs) • Output Quantity • Output Unit of measure • Output Product description (e.g., bovine leather wet blue) • Purchase order (if applicable) • Product ownership	<b>Traceable Object Information</b> • Lot ID Number • Quantity • Unit of measure • Product description • Purchase order • Product ownership
<b>Technical Data</b> • Event date • Information provider	<b>Technical Data</b> • Event date (Movement date/date of transfer) • Information provider • Ship-to Farm/Company Name • Ship-to Address	<b>Technical Data</b> • Event date (Movement date/date of transfer) • Information provider • Receive-from Farm/Company Name • Receive-from Address	<b>Technical Data</b> • Event date (Movement date/date of transfer) • Information provider • Ship-to Farm/Company Name • Ship-to Address	<b>Technical Data</b> • Event date (Movement date/date of transfer) • Information provider • Receive-from Farm/Company Name • Receive-from Address	<b>Technical Data</b> • Event date and time • Information provider	<b>Technical Data</b> • Event date • Information provider • Ship-to Company • Ship-to Address	<b>Technical Data</b> • Event date • Information provider	<b>Technical Data</b> • Event date and time • Information provider	<b>Technical Data</b> • Event date • Information provider • Ship-to Company • Ship-to Address

### 1. Tagging and Identification

A **primary** requirement for suppliers is the use of a **lot ID schema** that can connect the product to a specific unit of production (transformation event) so that the **lot can be linked to the serialized cattle from that production unit** and therefore traceability can be connected back to the original birth farms to demonstrate the point of origin required by emerging legislation<sup>4</sup>.

One of the core challenges of interoperable electronic traceability is having universally unique identifiers for locations and trade items. In many circumstances, only the serial ID will be present on the tagged animal, or the lot ID on the hides. [Company's name] supports the following approach to identification and tagging across the industry to overcome these challenges:

#### Assigning Serial IDs to Cattle

To establish universally unique serialization (preventing data collisions if multiple farms supplying the same meat packer were to use the same serial numbers), [Company's name] recommends using the official numbering issued by national sanitary or environmental bodies in each supplier country. For example:

- In **Brazil**, use the official number issued by the Agriculture Management Platform (PGA), managed by the Agricultural Defense Secretariat (SDA/MAPA), with the following composition:
  - the first three digits will be represented by the code Brazil - 076;
  - twelve subsequent sequential digits, identifying the animal.

The SISBOV number consists of the fifteen-digit sequence for the identification of individual cattle, by management number, the sequence from the tenth to the fifteenth digit of the SISBOV number.

- In the **United States**, the Animal Disease Traceability (ADT) framework is used for livestock identification and traceability. Under the ADT system managed by the USDA's Animal and Plant Health Inspection Service (APHIS), the following applies: Cattle are identified using official tags that include either an RFID or visual identifier, known as the Animal Identification Number (AIN). The AIN comprises 15 digits, where:
  - the first three digits are the country code (840 for the U.S.);
  - the remaining twelve digits serve as a unique identifier for the individual animal.

APHIS-approved devices include electronic and visual tags, ensuring traceability through each stage of the livestock supply chain.

<sup>3</sup> This framework was developed for the Brazilian context and may not be applicable in all geographic settings.

<sup>4</sup> Traceability – European Commission (europa.eu)

## 5. Data Request Template (continued)

- In **Uruguay**, use the official DICOSE number for livestock identification. DICOSE (Dirección de Contralor de Semovientes) is the institution responsible for assigning these numbers and performing the corresponding controls, operating under the Ministry of Livestock, Agriculture, and Fisheries (MGAP). This number comprises 9 digits:
  - the first two indicate the department where the producer is established;
  - the third and fourth digits indicate the number of the police precinct to which jurisdiction the establishment is subject;
  - the following four digits correspond to the corporate name and the ninth digit is the verifier.
- In **Australia**, the National Livestock Identification System (NLIS) is used to identify and trace livestock. This system combines permanent identifiers, movement documents, and database records to maintain traceability. Cattle are identified using NLIS-approved electronic devices, which can include either an RFID ear tag or a rumen bolus paired with a visual ear tag. These electronic identifiers are mandatory to ensure accurate tracking across the livestock supply chain.

### Assigning Lot IDs to Products

[Company's name] is not requesting a specific lot ID schema across all stakeholders as long as the lot ID provided to the wet-blue customer can connect the product to a specific unit of production (transformation event) so that the lot can be linked to the serialized cattle from that production unit. This means suppliers already using a lot ID schema can implement traceability according to the Framework mentioned without having to change their lotting practices, provided the lot IDs already connect to the specific unit of production.

The need to shift from serialized to **lot-based** traceability as the raw materials move downstream in the supply chain toward finished goods was identified due to operational feasibility of managing and consuming the traceability data and information within the internal systems.

This request acknowledges the importance and necessity of segregating individually identified animals in high-risk regions, such as the Amazon and Cerrado in Brazil, where there is often a mixture of animals from deforested and non-deforested areas. Thus, [Company's name] aims to reach traceability in the leather supply chain by **transitioning from individual animal serialization to lot-based product traceability** at a known point in the supply chain, either in the slaughterhouse or at the wet-blue tannery.

### Data Request

As [Company's name] moves toward a state of real-time data collection from suppliers in alignment with GS1 event-based data standards, we are starting with an **initial data request** to suppliers to establish the connections between farm-level data and [Company's name]'s existing supply chain practices. This data request for suppliers consists of the following:

- Providing all **Key Data Elements** for each **Critical Tracking Event** as shown in Table 4 for a set scope: for the product journey related to invoice XXXXXX, by [date]
- The invoice should be able to be tied back through the supply chain with unique identifiers (linking KDEs) through each Critical Tracking Event to the indirect (birth) farms
- For this request, data may be provided through either an CSV template (to be provided to the suppliers), or EPCIS file, if available

[Company's name] will also gather feedback from suppliers on traceability data requirements and integrations, with the ultimate goal of moving toward a working integrated solution for [Company's name] to scale deforestation-free leather volumes across its supply chains.

### Technical Support

For questions or additional assistance, please contact our support team at [Contact Email or Phone Number].

To address common challenges and technical questions related to traceability data submission, please visit [Company's name]'s website and refer to our traceability guidelines, or contact our team directly for personalized support.

## Endnotes

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- <sup>1</sup> World Wildlife Foundation (WWF) Articles (2024): <https://www.worldwildlife.org/magazine/issues/fall-2024/articles/what-is-the-environmental-impact-of-leather#:~:text=Leather%20is%20a%20byproduct%20of,fire%20risk%2C%20and%20soil%20erosion.>
- <sup>2</sup> Council for Leather Exports (CLE): *Indian Leather Industry* (2019): <https://leatherindia.org/indian-leather-industry/>
- <sup>3</sup> Department of Scientific and Industrial Research (DSIR), Ministry of Science and Technology, Government of India: *Leather & Footwear* (2019): [https://www.dsir.gov.in/sites/default/files/2019-11/3\\_0.pdf](https://www.dsir.gov.in/sites/default/files/2019-11/3_0.pdf)
- <sup>4</sup> The Observatory of Economics (OEC): Tanned Equine and Bovine Hides in China (2023): <https://oec.world/en/profile/bilateral-product/tanned-equine-and-bovine-hides/reporter/chn>
- <sup>5</sup> Ognibene, S., Anzolin, E. and Za, V., Tuscany's Luxury Suppliers Feel Chill from China and Changing Trends. Reuters (2024): <https://www.reuters.com/business/retail-consumer/tuscany-luxury-suppliers-feel-chill-china-changing-trends-2024-04-24/>
- <sup>6</sup> GS1 EPICS. <https://www.gs1.org/standards/epcis>
- <sup>7</sup> Textile Exchange. Materials Market Report. (2025): <https://textileexchange.org/knowledge-center/reports/materials-market-report-2025/>
- <sup>8</sup> <https://www.cotance.com/the-leather-traceability-cluster>
- <sup>9</sup> Deforestation-Free Call to Action for Leather Toolkit. Supply Chain Mapping Guide.
- <sup>10</sup> Global Tuna Alliance. Tuna 2020 Traceability Declaration Traceability Toolkit. (2020): <https://www.globaltunaalliance.com/wp-content/uploads/2020/06/Traceability-toolkit-FINAL.pdf>
- <sup>11</sup> Wholechain. Serial vs Lot Traceability. (2024): <https://support.wholechain.com/article/120-serial-lot-traceability>