
Strategic Traceability Framework

Traceability – throughout the entire supply chain



Document purpose

To provide insights into creating an end-to-end traceability and digitalised supply chain – from raw material to after-sales services

This document is aimed at organisations planning to implement systems and processes for product traceability. The document describes the decisions that need to be made, the business benefits that can be achieved, the stakeholders that need to be involved, and how to get started.

The document is based on GS1 standards and methodologies.



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—Introduction

1. One solution to address different needs
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3. Each company has their own system and makes information available when needed
4. Use global standards and models
5. Share the right information at the right time
6. Introduce event-based traceability
7. Find a balance between transparency and confidentiality

Get Started with Traceability

—Introduction

1. Document the purpose and determine prioritised business needs
2. Describe the physical product flow and identify Critical Tracking Events (CTEs)
3. Create conditions for interoperability
4. Register event-based data
5. Make traceability data available

Strategic Traceability Framework

Introduction

Drivers of traceability

In an increasingly complex global market, traceability is crucial for successful and sustainable supply chains. It is not just a competitive advantage but a necessity driven by several key factors such as:



Legal requirements

European legislation places increasing demands on traceability throughout the supply chain.



Market requirements

Consumer demand for transparency about the origin, manufacturing practices and environmental impact of products is driving the need for traceability.



Product safety

Effective traceability enables rapid identification and action in the event of quality deficiencies, counterfeits and/or recalls.



Resilient supply chains

Supply chains need to be resilient so as to quickly adapt to changes and disruptions. Data-driven insights from traceability systems can support quick adaptations and help identify areas for improvement leading to efficiency and more resilience.

Strategic Traceability Framework

The importance of standards

A standardised way of exchanging digital traceability information locally and globally enables a correct, consistent and efficient flow of products and information throughout the supply chain.

Easier and more efficient sharing of information enables the industry to deliver safety, quality, sustainability, trust and compliance with regulatory requirements. It increases the transparency of information, movements, and the origin of products. It also enables faster and more targeted recalls for increased consumer and patient safety.

Are you ready to take your business to the next level? Join two million other successful companies using established, scalable and future-proof standards from GS1.

Create a **traceable** and **digitalised** **supply chain** from raw material to after-sales



End-to-End supply chain traceability with GS1 standards



This strategic guidance:

- Defines the necessary data that needs to be collected in different parts of the supply chain.
- Shows how GS1 standards and services enable the collecting and sharing of data to achieve traceability.
- Explains what companies need to do in the short and long term to achieve end-to-end traceability in the supply chain.



Agreement on minimum requirements for data sharing

An important step is agreeing on minimum requirements for what data should be shared, what type of data it should be linked to and how it should be shared with other parties to achieve traceability.

Strategic Traceability Framework

End-to-End supply chain traceability with GS1 standards

Short- and long-term traceability

Short term – within 2 years

Today, most companies meet their traceability needs by **sharing product data with their immediate business partners** – "one step back and one step forward" in the supply chain.

In the short term, the current way of sending information will be sufficient, for example by sending traceability information in the despatch advice and/or a delivery note.

Long term – within 5 years

In the long term, several legal requirements will **increase the need for end-to-end traceability** in the whole supply chain. The need to access information from all parties in the chain requires new ways to collect and make data available.

Companies should therefore invest in event-based systems where **information about important events is captured and can be shared with different parties in the supply chain.**

Strategic Traceability Framework

Vision

Vision

Background

In 2018, GS1 Sweden's Industry Council for groceries developed a vision for traceability that defined a common minimum level of traceability in the grocery sector.

Two players in the Industry Council offered to test the vision using the GS1 [TraceWay methodology](#). The pilot ran from 2024–2025

This framework builds on the vision, the pilot, and GS1's guidelines on traceability – Global Traceability Standard – GTS2



Summary

Vision

Each party in the supply chain shares real-time traceability data in a way that supports the business relationship and is based on global GS1 standards.

Guidelines

- Each party chooses how to use traceability data and with whom their own information is shared.
- A minimum common level of traceability is established.
- Traceability should be modular (possible to build on) – which is why GS1 standards is advocated.
[Traceability » GS1 Sweden](#)

Traceability is achieved by answering these questions:

Who?

What?

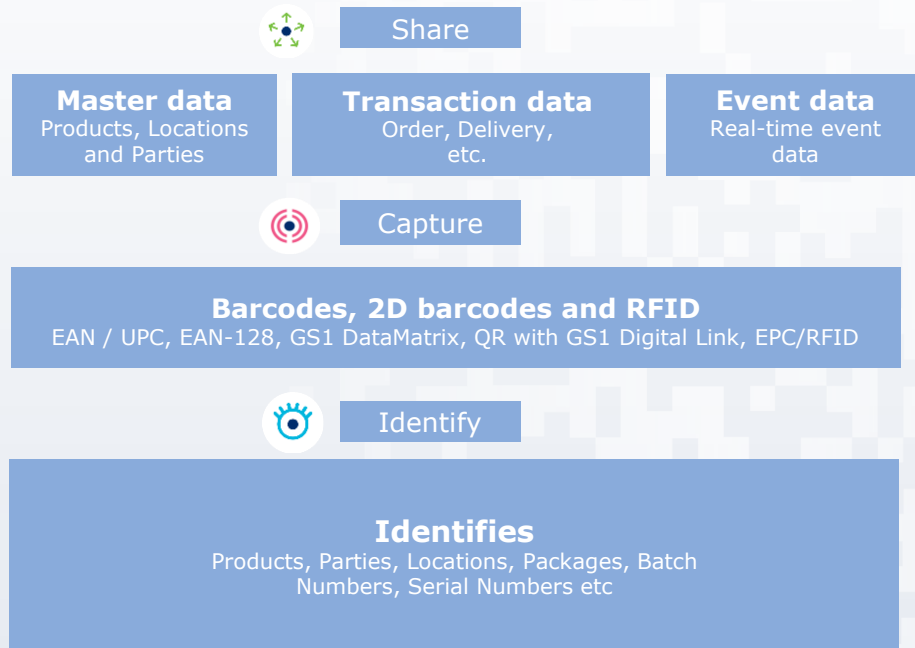
Where?

When?

Why?

GS1 tools that can serve as the foundation for traceability solutions

GS1 enables traceability by providing a **global, standardised business language** to **identify, capture, and share** data throughout the supply chain.



Vision

Developing traceability

Critical Tracking Events	Harvesting	Receiving	Processing	Delivery	Product
					
Key Data Elements	Who What Where When Why	Who What Where When Why	Who What Where When Why	Who What Where When Why	Who What Where When Why

Implement **KDE** and **CTE** to enable end-to-end traceability

Recording Key Data Elements (KDE) at each Critical Tracking Event (CTE) in the supply chain enables traceability throughout the supply chain .

Critical Tracking Events such as:

- Raw material extraction
- Receipt
- Processing
- Shipment

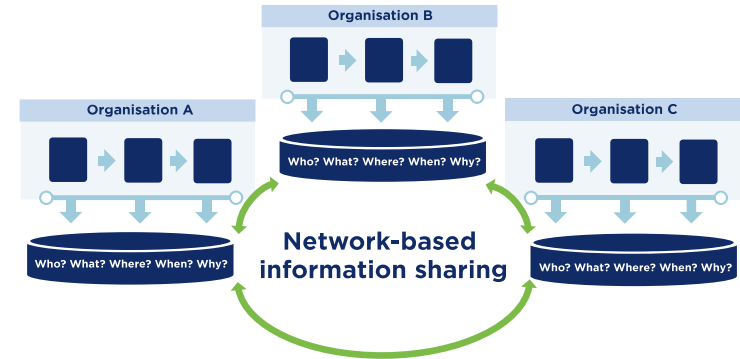
For each CTE, the following (Key Data Elements) should be captured:

- Who – performed or received
- What – product or material
- Where – location of the event
- When – date and time
- Why – reason

Vision

Share real-time or near-real-time traceability data

- Exchange of traceability information should occur in real time or near real-time to enable rapid tracking.
- Each party decides what information to make available and with whom it is shared, so that business-sensitive information can be protected.
- Traceability based on networked model where parties keep traceability data in their own local systems and stages it in a way that enables all supply chain parties to query the data is recommended.

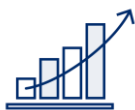


Sharing of real-time or near-real time traceability data can be achieved with different technical solutions, such as **the GS1 standard for sharing event data – EPCIS** (Electronic Product Code Information Services)

Regardless of the technology choice, **traceability data** shared should **comply with the GS1 Traceability Standard**.

Business benefits and driving forces

Benefits of traceability



More efficient flow of goods

Improve your forecasting, inventory management, and logistics processes by gaining control of the supply chain.



Consumer and patient safety

Gain increased trust from patients and consumers through transparent information about products.



Comply with legal and market requirements

Improve your ability to comply with legislation, new information requirements and ensure sustainable supply chains.

More benefits

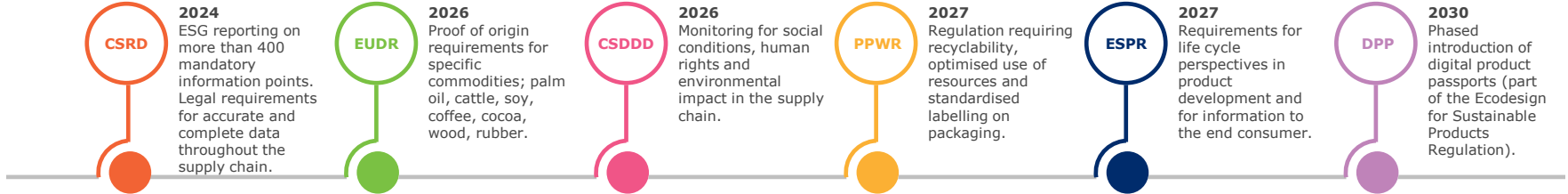
- Conduct targeted recalls of dangerous or defective products
- Identify the origin of raw materials
- Track goods during transport
- Optimize on-shelf availability
- Consumers can confirm the authenticity of products
- Identify counterfeit products
- Create internal traceability
- Improve data quality
- Reduce waste
- Efficient planning of goods receipt
- Resilient supply chain – ability to adapt quickly to unexpected events

Business benefits

Driving forces - Regulations

Several upcoming regulations will require traceability and systematic data management. The regulations affect customers, employees, investors and authorities and can be leveraged strategically to advance traceability initiatives within the organisation.

Examples of regulations that may require traceability:



*CSRD - Corporate Sustainability Reporting Directive, EUDR - European Union Deforestation Regulation, CSDDD - Corporate Sustainability Due Diligence Directive
PPWR - Packaging and Packaging Waste Regulation, ESPR - Ecodesign for Sustainable Products Regulation, DPP - Digital Product Passport,

Guiding principles

Guiding principles

Introduction – Guiding principles for achieving interoperability

To achieve traceability in the supply chain, **interoperability** is required. Interoperability is the ability of systems, organisations, and business processes to interact and communicate seamlessly based on common protocols.

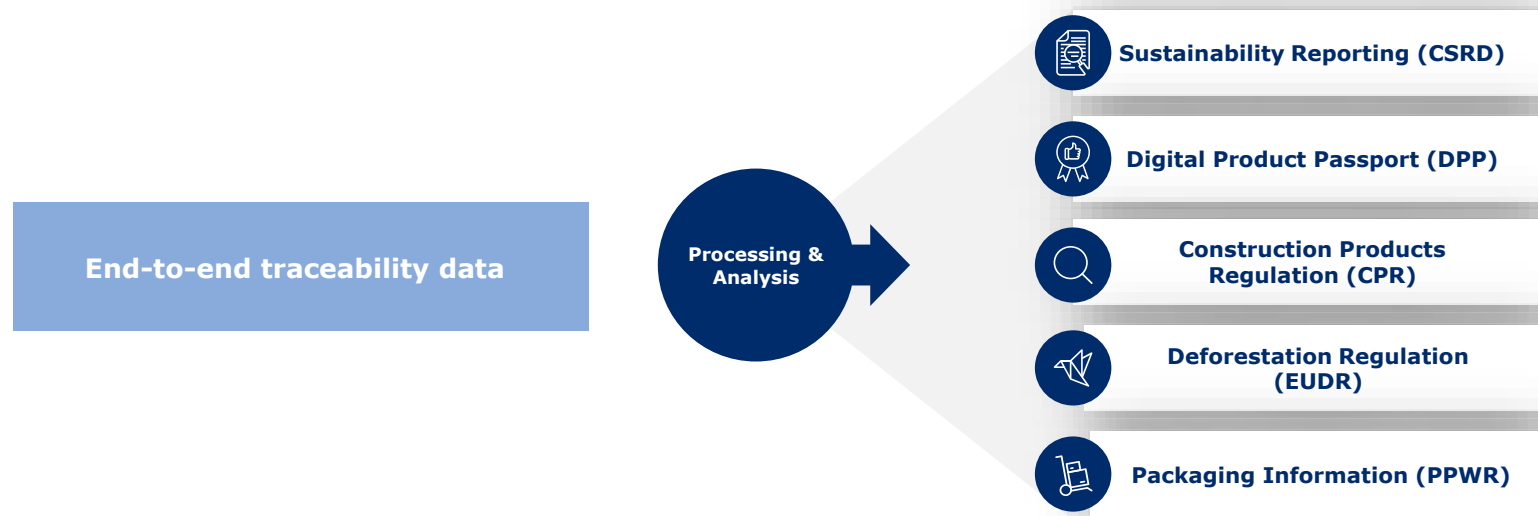
All parties must be able to receive and interpret the information correctly. This section describes basic principles of interoperable traceability systems that ensure efficient information exchange throughout the supply chain.



Guiding principles

1. One solution to address different needs

Multiple traceability-based regulations are about to come into force. Rather than developing separate solutions for each legal requirement, it is more efficient to implement one solution that can be adapted to meet different needs.



Guiding principles

2. Collaboration between different functions is key

Multiple functions and processes within an organisation need to work together so as to implement one solution that meets multiple needs.

It is important to involve different competencies and departments at an early stage so that the traceability solution can:

- Meet different needs
- Retrieve data from different systems
- Deliver data to different systems

Bringing together different competencies
- such as sustainability manager, IT, supply chain and master data manager - **ensures**
that **the traceability solution meets**
several different needs.



Guiding principles

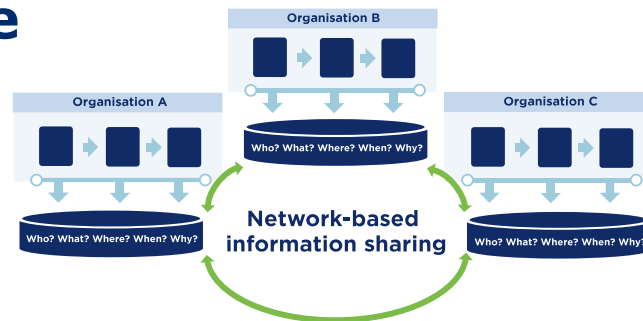
3. Each company has their own system and makes data available when needed

There are different models for sharing traceability data.

The most common are:

- **One step up – one step down:** Data is shared only with immediate parties. This approach is very common in the food industry.
- **Centralised:** All parties in the chain use the same system. This model is not recommended.
- **The network model:** The parties keep traceability data in their own systems but organise it so that different parties in the supply chain can get access to the data.

The traceability vision advocates the network model.



The network model

Network models can have different authorisations for who can retrieve information.

- In some models, **all parties** in the supply chain have the right to **request and retrieve data**.
- In other models, access may **be role-based** in the supply chain (e.g., to protect business-sensitive information) or require the querying party to be able to **prove their connection** to the object.

Guiding principles

4. Use global standards and models

Global standards and models simplify the implementation of traceability solutions by:

- Facilitating the specification of requirements for other parties and solution providers.
- Enabling reuse of lessons learned and experiences from previous implementations.
- Making it easier to compare different systems and solutions.

GS1 standards for traceability have several advantages



GS1 standards are used by companies and authorities around the world to meet various legal requirements and guidelines.

Example:

- **Europe: To** prevent counterfeiting of prescription medicines.
- **Digital Product Passports (DPPs):** To enable structured and interoperable product information under the EU Circular Economy Initiative.
- **United States – FDA and FSMA:** Can be used to meet the Food and Drug Administration (FDA) requirements under the Food Safety Modernization Act (FSMA) for increased food safety.
- **UN – UN Transparency Protocol:** GS1 standards are mentioned as a framework for the exchange of event data in the UN Transparency Protocol for global traceability.
- **Global Dialogue on Seafood Traceability (GDST):** Uses GS1 standards for interoperable traceability in the global seafood industry.
- **ISO standard for wind power:** To track components of wind turbines throughout the product life cycle using GS1 standards.

5. Share the right information at the right time

Traceability data is generated from various sources and at different stages throughout the product lifecycle. This data can be classified into several categories. Ensuring that the appropriate information is shared at the right time is essential for effective traceability. According to GS1 standards, business data shared between end users falls into three main categories: master data, transaction data, and event data.

Three categories of business data according to GS1

1. Master data

Descriptive attributes for objects, locations, and parties identified with GS1 identifiers.

For example:

- *Static data about products, locations, assets...*
- *Data about relationships with customers and suppliers...*

2. Transaction data

Trade transactions that trigger or confirm the execution of activities within business processes, from order to completion.

For example: Orders, transactions, deliveries, invoices...

3. Event data

Information about the activity of physical and digital assets. Describes where an object is, when it happens and why, throughout the supply chain. Allows you to track trade items in real-time.

For example: Production, shipping, receiving...

Guiding principles

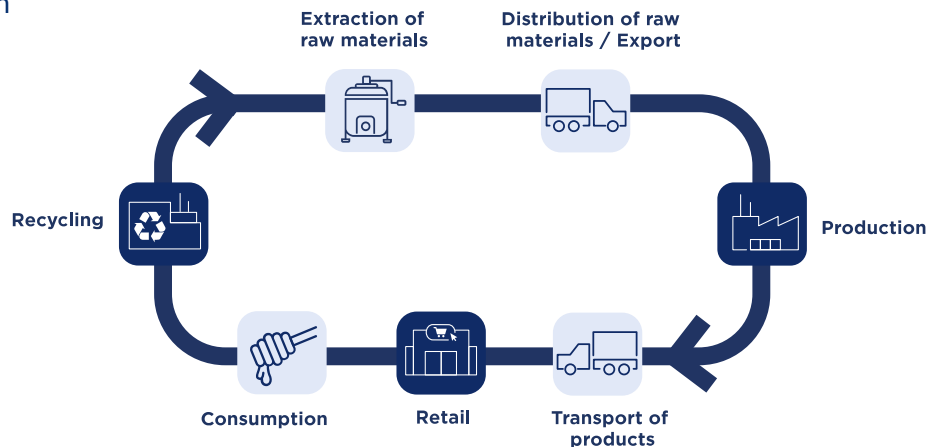
6. Introduce event-based traceability

Meeting future traceability requirements will involve real-time product tracking and may also necessitate data sharing between parties without direct business relationships. **Event-based traceability** can support this.

Event-based traceability:

- Tracks products throughout the supply chain, from raw materials to finished goods
- Can be applied to all types of products such as food, pharmaceuticals, textiles, electronics, technology and many other goods
- Breaks down complex supply chains into a series of events common to all commodities

Event-based traceability is a traceability approach that captures and records specific events in real time (or near real time) throughout a product's lifecycle. Each event provides details about what happened, when, where, and why, offering a dynamic, real-time view of the product's journey.



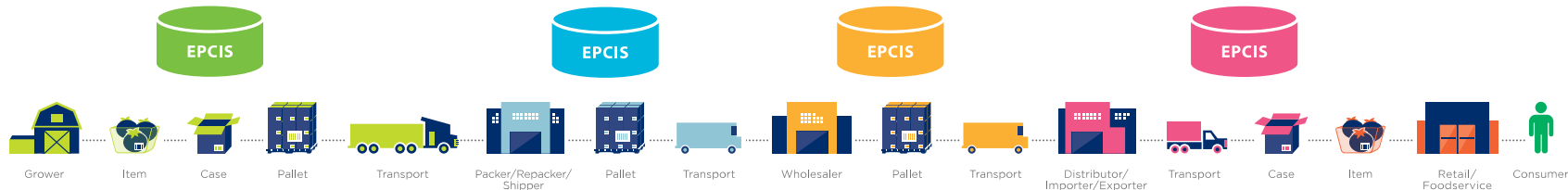
Guiding principles

6.1 Use GS1 standards for event-based traceability

EPCIS (Electronic Product Code Information Services) is an open standard which allows businesses to capture and share supply chain information about the movement and status of goods, both within their enterprise and with their business partners.

With EPCIS, organisations can:

- Share information about the physical movements and status of products as they move through the supply chain.
- Answer key traceability questions: **What happened? Who? Where? When? Why?**
- Implement a **traceability database (EPCIS repository)** as part of their IT architecture.
- Make data available through **requests** or **subscriptions** between parties in the ecosystem.



Guiding principles

7. Find a balance between transparency and confidentiality

Many companies are hesitant about increased transparency for fear of disclosing sensitive information. A good balance between transparency and confidentiality can be achieved by:

1. Only sharing necessary information and having mechanisms to control which information can be accessed by which parties.
2. Complying with the United Nations Protocol on Supply Chain Transparency (UNTP), which provides guidelines for how companies can share data securely. They have developed six principles:
 - Share only what provides value
 - Make public data available
 - If you have the item, you can see the information
 - Keys control access
 - Share only on demand
 - Edit sensitive information

Get started with traceability

Get started with traceability

Introduction – End-to-end supply chain traceability

A traceability system is the system used by an individual party to manage traceability and includes methods and procedures that the party uses to:

- manage traceability in their supply chains,
- increase internal visibility,
- share data with upstream and downstream parties.

Each organisation balances costs, benefits, and risks when designing their system, based on their role in the supply chain as well as the needs of their customers, regulators and other parties in the supply chain.

This section outlines the most common steps for designing and implementing a traceability system.

More information on the development of traceability solutions can be found in GS1 TraceWay, GS1 Global Traceability Standard GTS or in the GS1 Sweden Traceability Guide



Get started with traceability

1. Document the purpose and determine prioritised business needs

1.1 Document

Document why the organisation wants to implement or improve traceability.

This can be:

- Legal requirements or other known requirements
- Improving inventory management
- Preventing counterfeiting, fraud and gray markets
- Improving transparency
- Reducing waste

1.2 Identify priority needs

Have a long-term plan that meets multiple needs and identify business needs that can drive interest in traceability within your organisation.

This can be:

- Legal requirements
- Customer requirements
- Efficiency improvements
- Consumer trust



Get started with traceability

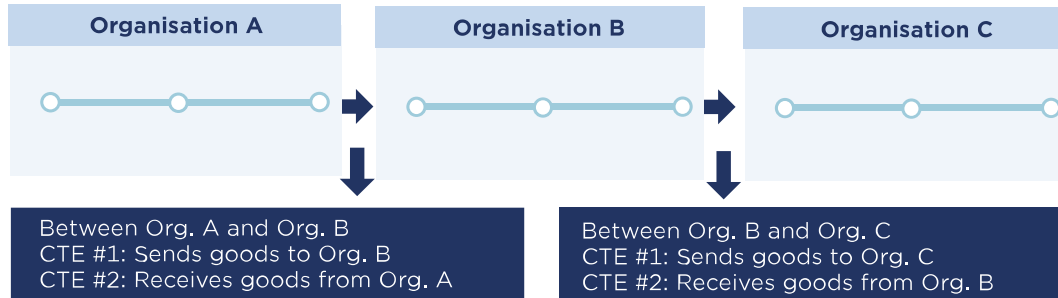
2. Describe the physical product flow and identify CTEs

2.1. Describe the entire product flow

Map the product's journey from origin to end of life, even outside your own organisation's direct touchpoints. By viewing the entire supply chain, you can create conditions for future-proof traceability solutions.

2.2. Identify CTEs

CTEs (Critical Tracking Events) are the critical events that must be recorded for effective traceability. This could be when a product is moved, transformed, or in other ways requires data to be collected for traceability purposes.



Get started with traceability

3. Create conditions for interoperability

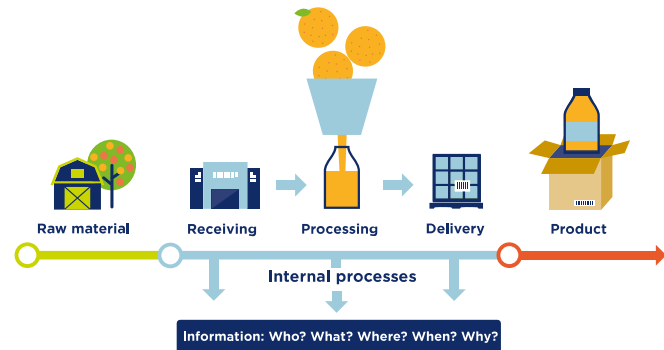
Coordination with partners in the supply chain is crucial to achieve traceability. GS1 standards enable interoperability by establishing common rules for identification, data collection, data sharing and data use.

Key Data Elements (KDE) ensure that data can be understood by all parties in the supply chain.

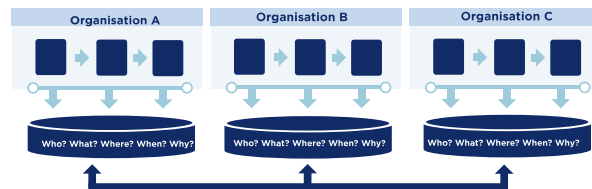
They define **Who, What, When, Where,** and **Why**, and are used to support product tracking, such as:

- Physical location where a product is managed
- Batch numbers of products received and delivered
- The amount of product manufactured or delivered
- Time of receipt or delivery

Internal traceability within each organisation



End-to-end traceability between organisations from primary production to consumer – including the entire life cycle



Get started with traceability

3.1 Identifying traceable objects using GS1 standards

Traceability item: **WHAT**

GS1 offers standards for identifying all physical objects – from raw materials to finished products.

These standards enable identification at different levels of detail (individual, batch, model) and answer the question **WHAT** to track.

Products and packaging can be identified using **Global Trade Item Number (GTIN)** in combination with batch and/or serial numbers.

Logistics units can be identified using **Serial Shipping Container Code (SSCC)**.

GS1 also offers standards for identification of assets such as roll cages, crates etc.

WHAT can be:

Raw materials,
components, packaging



Product



Product in
packaging



Pallet or
product on
pallet



Waste



Get started with traceability

3.2 Identifying parties and locations using GS1 standards

Traceability parties: WHO

In a traceability system, it is important to distinguish **which parties** play an important role in a product's life cycle, such as manufacturers, distributors, transporters or retailers. To understand the whole context, we need to know **WHO** played a role and sometimes also their relationship to others in the traceability chain.

Traceability locations: WHERE

A traceability site is a **physical area** that is part of a traceability system. For example, where objects are extracted, processed, received, recycled or destroyed.



Parties and Physical locations can be identified using Global Location Number (GLN)

The Global Location Number (GLN) provides companies with a method of identifying locations, both within and outside their organization, allowing businesses to know who is involved in transactions and where things are located throughout the supply chain. By uniquely identifying parties and locations, a GLN helps businesses track products, optimize processes, and provide greater visibility to transactions worldwide.

Get started with traceability

4. Register event-based data

How can EPCIS support organisations?

Product Traceability



e.g., “Where did a product come from and how was it made?”

Product Recall



e.g., “To which customer was a specific product shipped?”

Logistics



e.g., “How many of the shipments were punctual?”

Compliance



e.g., “Do the products that I am receiving meet regulatory requirements?”

Inventory



e.g., “Is there enough of the product in stock?”

Event data is characterised by the frequent collection of large amounts of data. Using the GS1 standard EPCIS, event data can be captured and managed to get answers to the questions – What, Where, Who, When, and Why.

EPCIS is used together with Core Business Vocabulary (CBV) to define why event data has been registered (e.g. delivery, goods received) as well as status (e.g. available, recalled, etc.).

Get started with traceability

5. Make traceability data available

Collecting and sharing of data between parties are essential components of traceability systems.

Future traceability needs require data sharing between parties that do not have direct business relationships (e.g., upstream, government agencies, and recycling).

However, simply sending data is insufficient. Larger amounts of data need to be made available, and mechanisms for retrieving data must also be implemented.

GS1 offers different solutions for sharing and retrieving data.



Get started with traceability

5.1 Share the necessary data at the right time

GS1 Web Vocabulary is the “anchor”, defining the data to be shared regardless of technology with a common definition and common basic business rules. The Web Vocabulary layer provides the interoperability across the different data sharing solutions.

Master data	Transaction data	Event data
What – Item identified with GTIN Who – Party identified with GLN Where – Location identified with GLN	What – Item identified with GTIN and batch and or logistic units identified with SSCC Who – Party identified with GLN Where – Location identified with GLN	What – Item identified with GTIN and batch and or logistic units identified with SSCC Who – Party identified with GLN Where – Location identified with GLN When – Time of event Why – Reason event is recorded
Shared with:		
GLN registry, GTIN registry, Links registry, data pool such as Validoo	EDI	EPCIS system to EPCIS system or link to traceability data using GS1 Digital link
Datacarriers such as Barcodes, 2D barcodes and RFID to ensure consistent representation of identities		

Get started with traceability

5.2 Making traceability data available

There are different ways of making traceability data available. The following three examples show how an organisation with an EPCIS repository can share traceability data with other parties in the supply chain.

Three examples

1.

Every organisation has an EPCIS system and data is sent between the systems according to the EPCIS standard.

2.

Organisations that have an EPCIS repository receive data from different parties in various formats and convert it into EPCIS format.

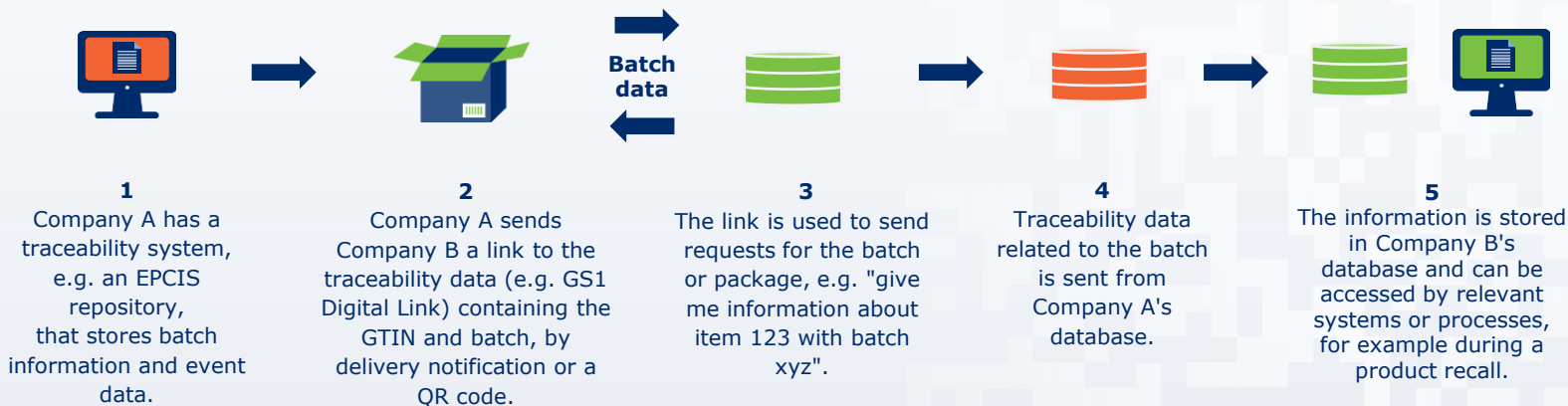
3.

Organisations send a link to companies, authorities, and consumers who can access the traceability data depending on authorisations.

See examples on the next slide.

Get started with traceability

5.2.1 Examples of how the link can be shared



Get started with traceability

5.3. Making traceability data available to consumers

1. Company



The company has a traceability system, e.g. an EPCIS repository, which stores batch information and event data.

2. Company



The company places a QR code on the product that contains a link to traceability data.

3. Product



The consumer scans the QR code with their smart phone.

4. Consumer



The consumer receives traceability information such as country of origin, environmental impact or recall status.

Strategic Traceability Framework

Resources

Resource

More information

1. More information about GS1 standards for traceability, examples from companies using GS1 etc.

[Traceability » GS1 Sweden](#)

2. GS1 Global

Traceability Standard – GTS2

[GS1 Global Traceability Standard | GS1](#)

3. GS1 TraceWay – Methodological support for traceability projects

<https://www.gs1.org/standards/traceability/traceway>