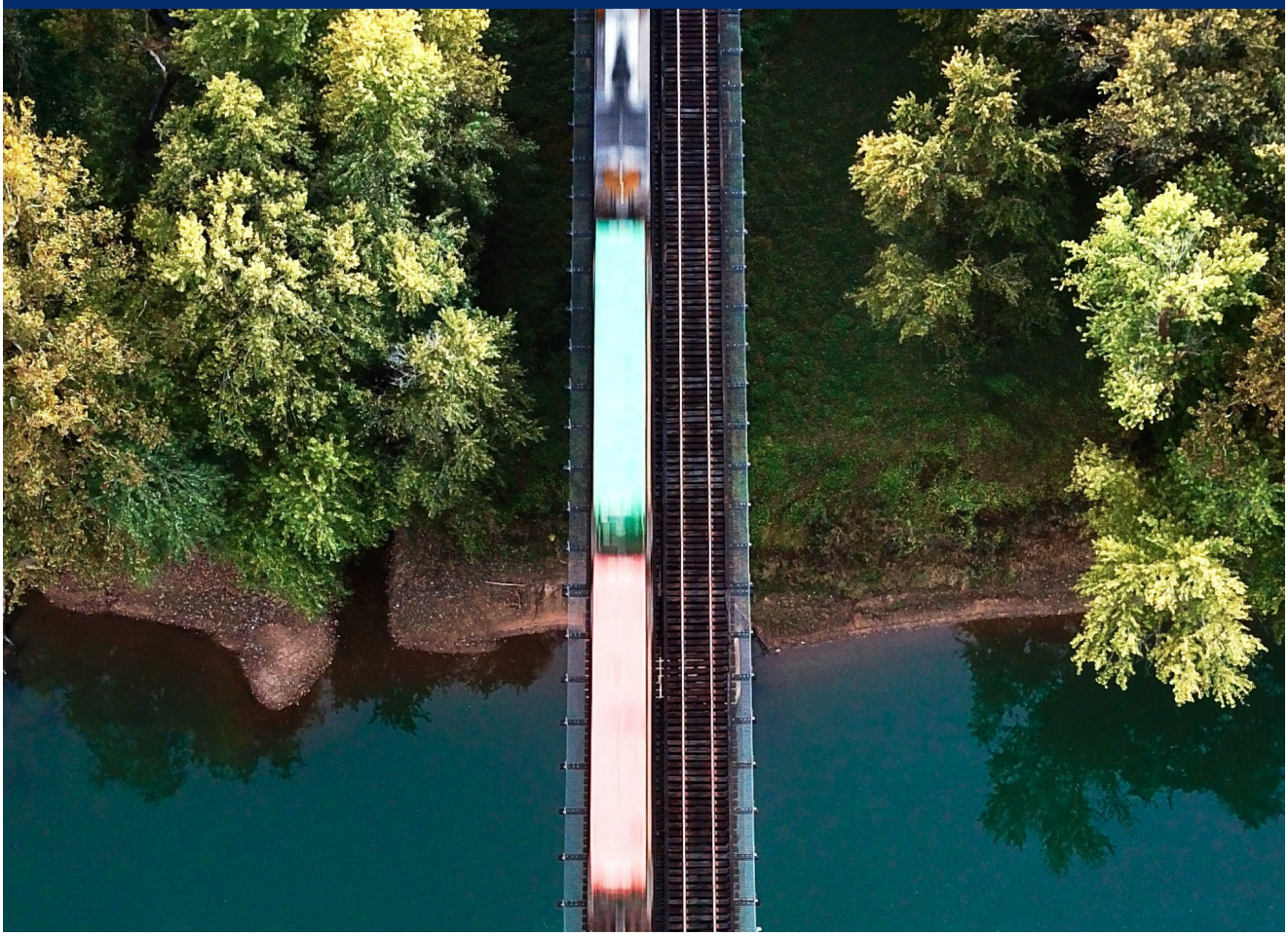
The Global Language of Business

Accelerating Value Chain Digitalisation

A Position Paper on the use of GS1 standards and services as a tool to help companies address regulation more efficiently



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1. Executive Summary

This paper addresses the emergence of data requirements that companies increasingly face, and how traceability[1] and transparency[2] are emerging as strategic imperatives to address these requirements on a global scale. This paper aims to help companies to establish an approach to more effective gathering of value chain data[3] to prepare for and align with requirements across regulations without unnecessarily duplicating efforts. This is done by offering guidance to companies on how to efficiently address the emerging challenges posed by regulations and other requirements by using GS1 standards and services.

Companies face several fundamental value chain drivers

Companies are currently facing increasing regulatory requirements, as well as growing consumer and trading partner demand, resulting in a need for robust and reliable value chain data. There is also an ever-present need to mitigate risks and uncertainties associated with complex regional and global value chains, as well as limited cross-value chain collaboration commonly seen today. Emerging needs require data sharing between all actors, even those that don't have a direct business relationship with each other. Companies need to ensure that a robust system that underpins value chain transparency and traceability is in place and that it can address the emerging needs from regulators, trading partners and consumers.

The emerging requirements for sustainability, circularity and product & consumer safety are key drivers for traceability

Requirements addressing sustainability, circularity and product safety on both the global and regional levels have created an urgent need for companies to ensure traceability of their data throughout the value chain. Companies across different sectors are experiencing an increased demand for more complete information about products, such as country of origin for imported goods and information about where products (and their sub-components) have been produced, as well as chain-of-custody information. These common requirements accelerate a company's need to improve transparency and traceability, as well as to share data throughout the value chain.

Achieving traceability throughout the value chain remains challenging

To meet the growing demand for traceability, many companies are intensifying efforts to facilitate seamless and efficient data sharing across the value chain. However, this remains difficult. The lack of standardised and accurate data collection and processing internally at companies is a challenge. Additionally, the internal understanding of existing standards and the maturity of data sharing capabilities is limited, and the articulation of the business value for data sharing is lacking. On top of this, limited cross-value chain collaboration with other stakeholders is still a barrier around the world.

Recommendations for companies to address these challenges

As an increasing number of requirements come into force, companies are reconsidering how they operate as they are required to start gathering accurate and detailed data about their operations and value chains. To address the emerging demands for data and increase value chain transparency, companies can take a holistic approach to the common data requirements they increasingly face. In this way, companies can accelerate and build value.

Working on enhancing traceability should start by identifying the drivers and prioritised business needs, such as legal compliance, efficiency improvements, consumer communication or environmental performance. Companies can then map the product flow, identifying necessary supply chain activities to be captured including data elements to ensure effective traceability and sufficient availability of traceability data. Finally, companies can enhance internal operations and appoint a responsible individual, foster cross-functional collaboration and participate in trade associations or forums for a company-wide and industry-wide understanding of the challenges and approaches ahead.

With a structured and purposeful approach, companies can unlock substantial value beyond mere regulatory compliance. This includes precise data insights enabling better decision-making, enhanced interoperability and value chain collabo-

[1] Traceability can be defined as the ability to trace the history, application and location of an object in a value chain. This can also include related processes such as transformation and distribution. [based on UNECE Rec 46]

[2] Transparency can be defined as the ability to make relevant information available for all elements of the value chain in a harmonized way, which allows for common understanding, accessibility, clarity and comparison. [based on UNECE Rec 46]

[3] Value chain is defined as the full range of activities or processes needed to bring a product or service from its conception to its end use and beyond. The value chain includes entities with which the enterprise has a direct or indirect business relationship and which either supply products or services that contribute to the enterprises own products or services or receive product or services from the enterprise. [based on OECD Due Diligence Guidance for Responsible Business Conduct]

ration. The benefit will be future-proofing of value chains and driving toward a coherent approach to addressing requirements, which can contribute to improving the access to data along the value chain. This can help any company to accelerate towards a circular economy and sustainability.

With this new level of access to value chain data, companies, as well as authorities and consumers, will all be ”consumers” of data, gaining the required access to different types of data based on their specific needs. Underpinned by a robust, standards based, distributed and interoperable digital eco-system.

2. Introduction: The unstoppable drive towards sustainability

The global sustainability transformation is ongoing, and industry needs to evolve with it to ensure the capabilities needed in the future for a circular economy are developed. The ways of doing business are changing rapidly with a quickly evolving regulatory environment front and center. The global business community is experiencing a transition towards a circular economy with focus on sustainability, significantly changing the way we do business. Therefore, businesses need a deeper understanding of their value chains to future-proof and be ready to address their emerging business challenges.

Multiple regulations globally require companies to disclose sustainability and consumer safety information and progress. This increases the pressure for companies to have transparent information about their own operations and across their value chains. As these requirements come into force, it will become essential for companies of all sizes to access detailed and accurate traceability data throughout their value chains.

2.1 Regulatory pressure is global

The regulatory pressure on companies to provide sustainability and consumer safety data is global, but the European Union (EU) is leading the way in many areas. The Green Deal was launched in December 2019. It is a roadmap to make its economy circular and climate-neutral by 2050. It aims to transform the EU into a modern, resource-efficient and competitive economy, ensuring no net emissions of greenhouse gases by 2050 and economic growth decoupled from resource use. To support the ambitious targets of the European Union, a number of regulations aimed at creating a more environmentally conscious and socially-responsible corporate landscape within the EU are being put into force. Examples are Corporate Sustainability Reporting Directive (CSRD), EU Deforestation Regulation (EUDR), EU General Product Safety Regulation (GPSR), Packaging and Packaging Waste Regulation (PPWR), Eco-design for Sustainable Products Regulation (ESPR) and the Construction Product Regulation 2024 (CPR-2024).

The EU is not the only region which has implemented mandatory regulations or voluntary disclosures. There is a mounting regulatory push globally as well, with examples from Canada, USA, Brazil, South Africa and Australia to name a few. There are now requirements for companies to track and report sustainability and consumer safety related claims. In many cases, applicability is dependent on size of the company, industry and type of product.

Regulation/Directive
Australia Modern Slavery Act
Canada Bill S-211 Fight Against Forced Labor and Child Labor in Supply Chains Act
US New York Fashion Sustainability and Social Accountability Act
Brazil CVM 193 Resolution
South Africa CIPC's ESG Reporting Framework

2.2 Commonalities across regulations

Regulations will significantly impact actors across value chains by imposing various obligations related to product performance, sustainability requirements, due diligence and reporting. Regardless of the type of regulation, compliance will require comprehensive value chain data, requiring actors to collect, store and share detailed information.

In this paper, we are addressing the common data requirements across different regulations globally. We focus particularly on those requirements which support companies more effectively gathering value chain data points to comply to a broad range of regulations without duplicating efforts. To simplify this overview, the regulations can be categorised into those that concentrate on company-level information and those that target product-level information.

2.2.1 Company level reporting requirements

CSRD (EU Corporate Sustainability Reporting Directive), CSDDD (EU Corporate Sustainability Due Diligence Directive), and TCFD (Task Force on Climate Related Financial Disclosures) aligned disclosures are examples of requirements which aim to harmonise how companies present and track their sustainability performance, including the actions taken to improve sustainability practices. Consequently, the regulations require companies to transparently disclose sustainability information, including both environmental activities and human rights. Companies must collect and manage data internally, but also maintain a sufficient overview of the company's entire value chain (this may vary by regulation and/or company size). This includes integrating information from suppliers and partners, implementing robust data collection processes, ensuring the accuracy and reliability of reported data through internal and external audits and continuously improving data collection and reporting processes.

For example, companies will need to report on the following data categories:

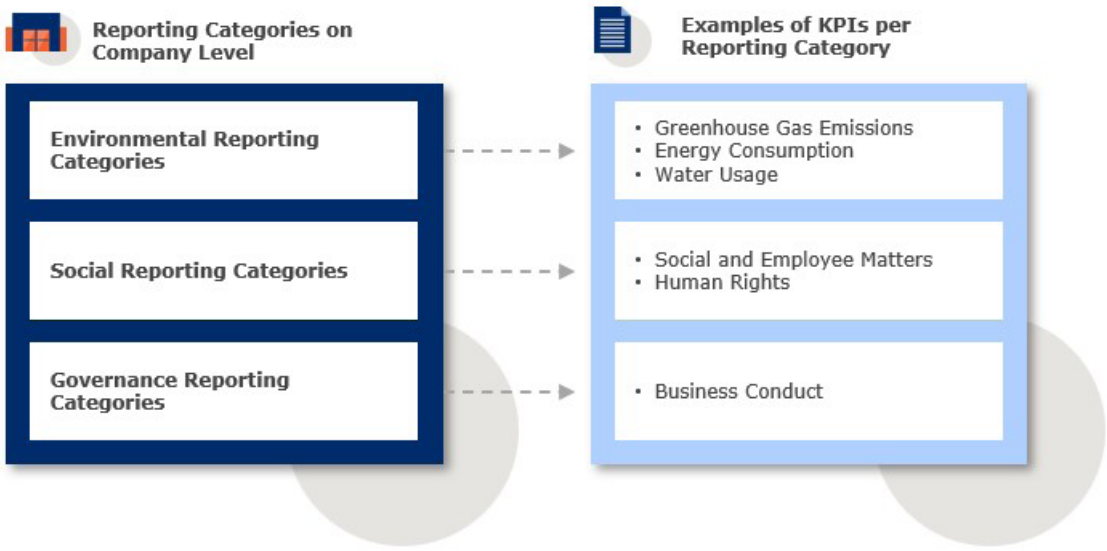

Illustration 1: Examples of company related information required for CSRD and CSDDD.

2.2.2 Product level requirements

EU Deforestation free Products Regulation (EUDR), PPWR (EU Packaging and Packaging Waste Regulation), including Extended Producer Responsibility - EPR, CPR (EU Construction Products Regulation), ESPR (Ecodesign for Sustainable Products Regulation) including Digital Product Passport - DPP, are a few regulations from the European Union which will require value chain data points at a product level. Each regulation has its own purpose and the requirements to comply with the regulations vary. Additionally, these regulations are largely focused on products in certain industries. However, to meet the regulations' requirements, traceability data will be necessary.

Across these regulations, there are similar data categories that will be required. Such data categories include (not an exhaustive list):

- **Contact Information:** E.g., names, postal addresses, and email addresses of businesses, individuals, operators, or traders involved in product creation
- **Country of Production:** E.g., country, trade register number or equivalent, of where product has been produced
- **Product Description & Information:** E.g., product name, information about the product's material composition including the origin of raw materials, intended use, life span and recyclability
- **Quantity:** E.g., quantity of the relevant product

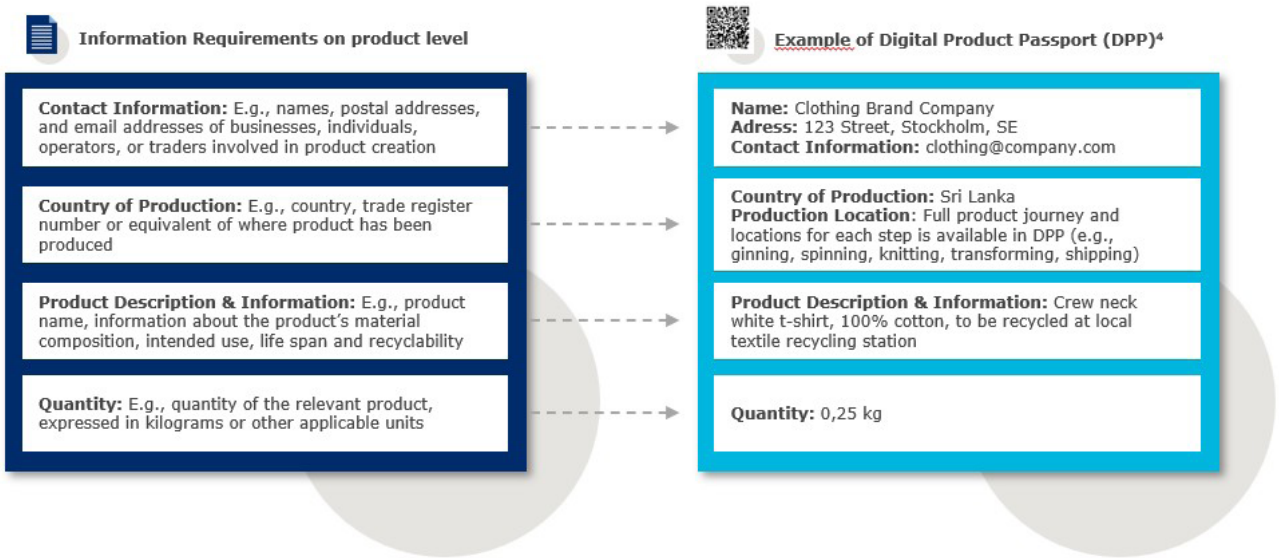

Illustration 2: Example of information required for product related regulations, such as Digital Product Passport (DPP)[4].

[4]Please find a more detailed Digital Product Passport example of a White T-shirt here: https://ref.gs1.org/tools/demo/2024retail/

3. Industry's emerging challenge: Addressing sustainability product & consumer safety regulations

Companies face several challenges in addressing regulations, including:

- Clarity on the regulatory requirements – including the commonalities of emerging regulatory requirements
- Standardisation of data generation and data sharing processes
- Beyond compliance, there is a lack of articulation of the business value for data sharing
- While needed in the future, today there is a limited cross-value chain and cross-industry collaboration
- Lack of harmonisation of requirements across regulations

Failure to address these challenges often leads to inaccurate and incomparable reported data, highlighting the need for improved transparency and efficiency in data management.

3.1 Companies need clarity on regulatory requirements

With the increasing number of regulations, companies find it complex to understand the legislative landscape, which is increasingly complex and challenging, particularly around what data to collect and share and how to effectively comply. Some companies are adopting a "Wait and See"-approach, meaning that they are waiting for more clarity regarding what the regulations are requiring in detail and when they will come into force. In addition, companies are hesitant to invest in the technical solutions required until the regulatory landscape is fully set. However, the regulatory landscape continues to evolve in very dynamic ways. Companies can be caught unprepared waiting for more clarity on what the regulatory requirements will be and when they come into force.

3.2 Companies approach the regulations in siloes but a siloed approach to the requirements will be unfeasible

A siloed approach to regulations complicates the process of collecting and sharing data for each regulation. To gather and share data separately for each of the regulations, companies must handle large volumes of data and spend significant time and effort just to achieve compliance. It has already proven to be challenging for large companies to be compliant and, for the smaller companies with even fewer resources, it might be a substantial challenge. Policymakers are urged to move towards a more harmonised legal framework with standardised common data requirements.

3.3 Data is in a non-standardised format

Companies utilise different methods for recording data across their value chains, with varying levels of data quality. Companies have, in many cases, not agreed on what specific information should be available and generated, resulting in non-standardised data across the value chain. Smaller actors usually do not have the resources to support the granularity and frequency of data collection and sharing across the value chain that may be required.

Addressing these challenges demands harmonisation and reuse of data across regulations, with commonly agreed sets of data needed to ensure speed and scale of implementation, while enabling companies of all sizes to be capable of meeting the requirements.

3.4 Manual data sharing remains a widely used approach

Companies collect data across value chains today, but the process is often manual and requires significant time and effort. The lack of standardised and automated data collection and sharing (as explained in section 3.3 above) complicates processes, leading to inefficiencies and poor data quality. Legacy processes for data collection and sharing, such as forms and Excel spreadsheets, create challenges for interoperability, efficiency and scalability. Data collection is particularly challenging at the beginning and end of the value chain, e.g., at the farm or during the recycling stage. Companies recognise the need for data transparency in these processes but face difficulties due to global and complex value chains, combined with resource restraints.

Manual data sharing, e.g., via email or supplier portals limits the transparency beyond the adjacent actor in the value chain and hinders access to necessary product-level data (as it would require automated data sharing due to the volume). Adding to this, there is also fatigue among suppliers who have to adjust their operations depending on the customer. This results in unique requirements to share data on multiple supplier portals (and/or on third-party platforms), fill out formulars and submit other relevant information in a bespoke manner to some of their customers. In addition, many companies are reluctant to implement data

sharing solutions that are dependent on third party platforms, due to concerns about data privacy and security.

3.5 The reported data often becomes inaccurate and incomparable

To comply with the regulations addressing sustainability and consumer safety, companies are typically creating sustainability reporting data by converting and calculating different data points. For example, the CO_2 footprint of a raw material can be estimated using the volume of the raw material and the average emissions of the production site for that specific raw material. The limited traceability and transparency beyond the nearest actor in the value chain makes companies use high-level, template-based calculations. The limitations in standardised data generation, collection and sharing, thereby limit the possibilities of creating meaningful reporting data.

The data collection and sharing layer in illustration 3 below refers to collection and sharing of primary, calculated, and reference data across the value chain, such as activity, supplier, or expense data. This also includes how companies store data in various systems, such as ERP, supplier, sales, purchasing, and HR systems.

The limitations of non-standardised data leads to variable and incomparable apples to oranges type data, both internally and externally. This can lead to decisions being based on inaccurate information, reducing the value of the data. The current 'one-up, one-down' information sharing between actors in the value chain is not sufficient going forward. There is an urgent need to evolve from this approach. Addressing the key challenges that are central to companies including: Clarity on the regulatory requirements – including of the commonalities of emerging regulatory requirements; Standardisation of data generation and data sharing processes; Beyond compliance there is a lack of articulation of the business value for data sharing; While needed in the future, today there is a limited cross-value chain and cross industry collaboration; Lack of harmonisation of requirements across regulations.

To achieve the required traceability, stakeholders in the value chain will have to move towards acting in congruence, as the data is only as strong as the weakest link in the chain.

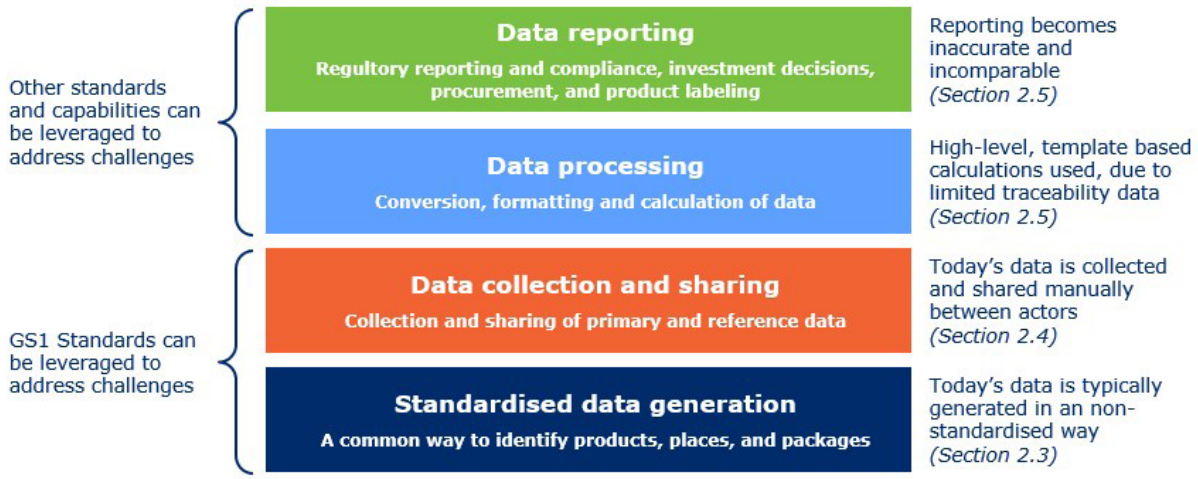

Illustration 3: Current challenges and capabilities required for value chain traceability.

3.6 The full value chain view

Previously companies have relied on their immediate suppliers for information, but today companies face a new reality regarding data sharing requirements where they need accurate and up-to-date data from trading partners throughout their entire value chain. This requires data sharing between all actors, even those without a direct business relationship with each other. This is resulting in a need for robust and reliable value chain data. There is also an ever-present need to mitigate risks and uncertainties associated with complex regional and global value chains. It is therefore important to ensure that a robust system underpinning value chain transparency and traceability is in place that can address the emerging needs and help companies adapt their operations.

3.7 Downstream data consumers

Value chains are international, and sharing traceability information throughout the value chain is challenging. With a robust, standards based, distributed and interoperable digital eco-system in place, information becomes accessible across different jurisdictions, for different trading partners and market surveillance authorities at different steps in the value chain, including the end consumer. All these stakeholders are “consumers” of data, and the use of GS1 standards enable the transparency and scalability required while promoting international trade.

With all the relevant downstream partners, including appropriate authorities, getting access to the data needed while it is still managed by the companies themselves, there will no more be a need to ask companies to upload detailed product and traceability data to government data bases, offering limited business value to the companies. A distributed system based on GS1 standards ensures all stakeholders can leverage the identifier of the product to access the required data. With end consumers of data getting instant access, real transparency will be possible. Benefiting all downstream actors when data can be made available to relevant stakeholders on request.

4. Recommendations for companies to future proof their value chains

There are a number of activities companies can initiate to future proof value chains. This can be done by designing and implementing traceability solutions to address emerging regulatory requirements on sustainability and consumer safety while also preparing to meet voluntary trading partner requirements. Below are the key steps which can be taken to get started.

4.1 Initial steps towards addressing the requirements

4.1.1 Identify drivers and prioritised business needs

Identify the drivers and prioritised business needs for why the company wants to implement or improve traceability. These reasons may include, e.g., complying with legal requirements, efficiency improvements, transparency towards consumers or improved environmental performance.

4.1.2 Map the product flow and identify Critical Tracking Events (CTEs)

To get started, companies are recommended to create an overview of the entire product flow. This includes mapping the product's journey from origin to the end of its lifecycle, even beyond the direct contact points of its own organisation. By viewing the entire value chain, companies can create the conditions for future-proof traceability solutions.

As a part of this, companies are recommended to identify Critical Tracking Events (CTEs). These are the critical events that must be recorded for effective traceability to be possible. CTEs include instances when a product is moved, transformed, or otherwise requires data collection to be traceable through the value chain, see illustration 5 for simplified value chain example of CTEs.

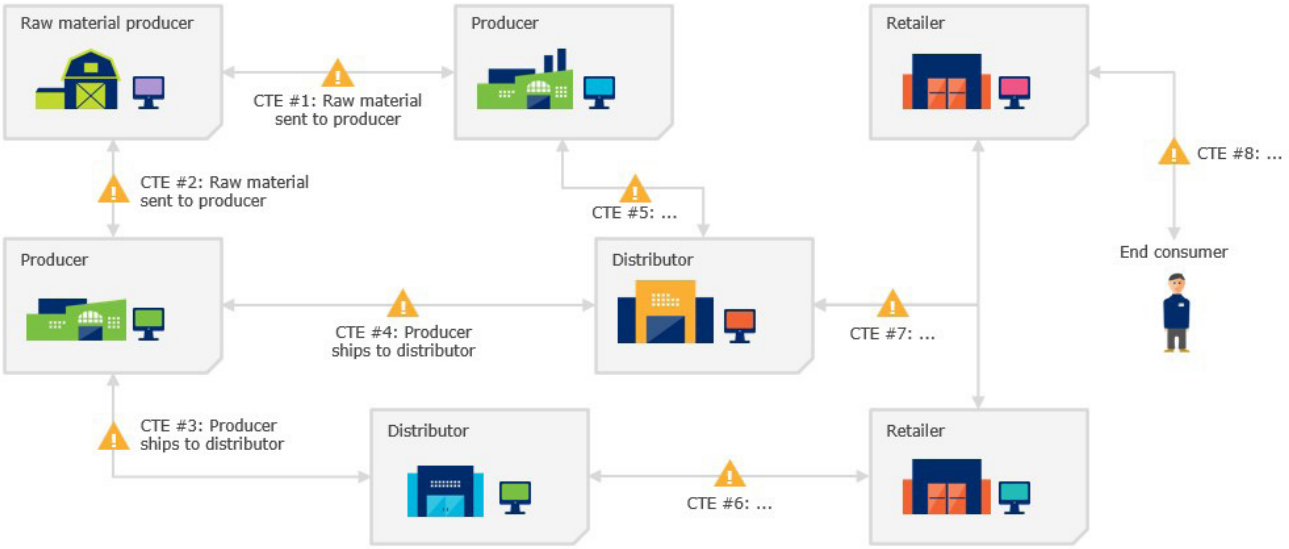

Illustration 4: Simplified example of Critical Tracking Events (CTEs) throughout the value chain.

4.1.3 Create pre-requisites for interoperability by identifying traceable objects, places and parties through Key Data Elements

Collaboration with actors across the value chain is crucial for achieving traceability. GS1 standards enable interoperability by establishing a common language for identification, data collection, data sharing, and data usage. Key Data Elements (KDE) ensure that data can be interpreted by all parties in the value chain. All Critical Tracking Events contain the elements Who, What, When, Where, and Why as a base to support product tracking, but additional KDEs such as quantity are often necessary. A set of Key Data Elements may therefore include, for example:

- Physical location handling a product (Who, Where)
- Product identification (What)
- Batch numbers for received and delivered products (What – increased granularity)
- Quantity of manufactured or delivered products
- Time of receipt or delivery (When)
- Identification of raw materials with corresponding batch numbers (What)
- Activity – what actually happens e.g., assembly (Why)

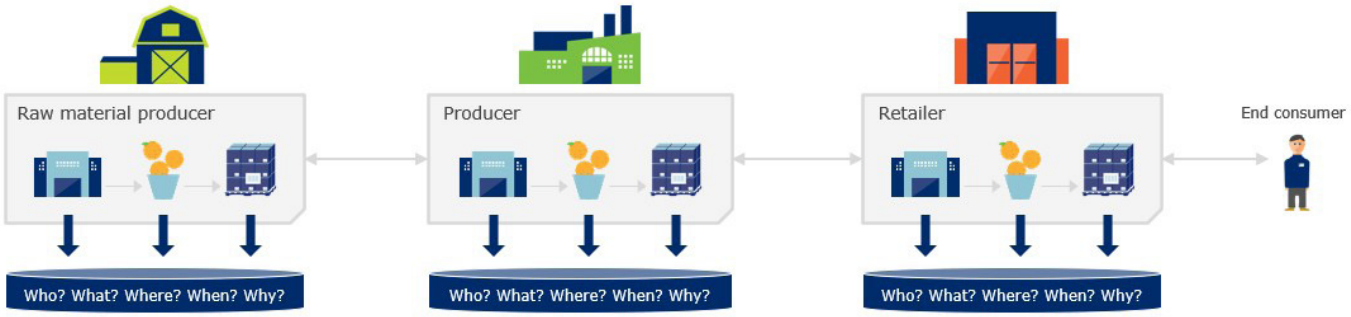

Illustration 5: Example of Key Data Elements (KDEs) throughout the value chain.

4.1.4 Capture and share traceability data

Capturing and sharing data between actors is important to achieve value chain objectives and key components in distributed traceability systems. Future traceability needs require data sharing between all actors, even those without a direct business relationship with each other. At the same time, it is not enough to just send data; specific data needs to be made available to relevant actors, and mechanisms for retrieving data also need to be introduced.

4.1.5 Leverage existing identifiers and data carriers already widely used by industry

Identification schemes and data carriers are ubiquitous across value chains. While there are a wide range of schemes, there are de-facto schemes already in place for specific sectors and product categories, with GS1 standard being the prevailing identifier for retail and healthcare products (and increasingly for building materials etc.). These schemes are embedded in company operations and hard to change. Therefore, implementation should build on existing identifiers and data carriers e.g. barcodes and QR codes rather than introducing new schemes.

4.1.6 Collaborate across functions in the organisation

To succeed with traceability, it is essential for organisations that company leadership is engaged and that it appoints a responsible person within the company, that has the appropriate mandate. In addition, many functions and processes within a company need to collaborate to achieve traceability. It is important to involve different competencies, departments and leadership early on so that the traceability solution can meet various needs, retrieve data from different systems and deliver data to different systems. By bringing together different competencies and functions (e.g., Sustainability, IT, Value chain, Finance, and Data), it is easier to ensure that the traceability solution meets various needs.

4.1.7 Collaborate with peers through trade associations or relevant forums

Companies can utilise trade associations or other industry forums to gain learnings, insights and create synergies. Industry associations can engage with their counterparts on national or international level, to ensure the interest of their members is taken into account. Companies are recommended to explore if joining and engaging

their trade association or other forums is a relevant option for them.

4.2 The value to be captured by companies

If done correctly, companies can gain value from traceability data across their value chains. The main value that can be captured is:

- Increased efficiency based on digital ways-of-working, moving away from manual data generation, collection and sharing
- Correct basis for decision making due to accurate, detailed and transparent data collection
- Future proofing value chains for scalability

4.3 Utilising GS1 standards to accelerate traceability

Organisations commonly face challenges in accessing accurate product information across the supply chain. These issues are not necessarily the result of lacking traceability systems, but rather the prevalence of isolated, non-standard solutions that cannot interoperate effectively. Companies can embark on their traceability journey by leveraging GS1 standards. GS1 traceability standards address these challenges by enabling system interoperability, automating data exchange, and enhancing visibility throughout the supply chain. Interoperability remains the cornerstone for building an efficient and reliable traceability framework.

Traceability data includes a specific traceability event, such as a production batch or shipment, and typically includes a mix of master data about products and locations, along with event-specific details like production time, quantity, and batch information of the products involved. The GS1 Registry Platform (GRP) is a global registry of Global Trade Item Numbers (GTINs) and Global Location Numbers (GLNs) that can be used to share core Master data about products or locations between actors in the value chain. By registering and making their GLN and GTINs searchable on GRP, suppliers can allow actors across the value chain to verify authenticity of the GLNs/GTINs and access information about them and their products.

The GRP also provides an opportunity to register links to additional product-, party- or location-related data stored in the suppliers' own repositories. it may be utilized to discover extended product information and traceability information for a product. For sharing of more product Master Data, there is growing interest in using more recent GS1 standards such as the GS1 Web Vocabulary and the Global Data Model (GDM).

These two, combined with the GS1 Registry Platform's linking feature, offers a modern, flexible methodology by which master data about products, parties and locations can be easily accessed in a scalable manner, no matter where that data is being authoritatively stored or kept.

For sharing batch specific data, such as the time of production, companies will be dependent on utilizing standards for visibility data. Visibility data are records of the completion of business process steps. These capture what objects participated in the process, when the process took place, where the objects were and will be afterwards, and why. The GS1 EPCIS standard enables disparate applications to create and share visibility data, both within and across actors.

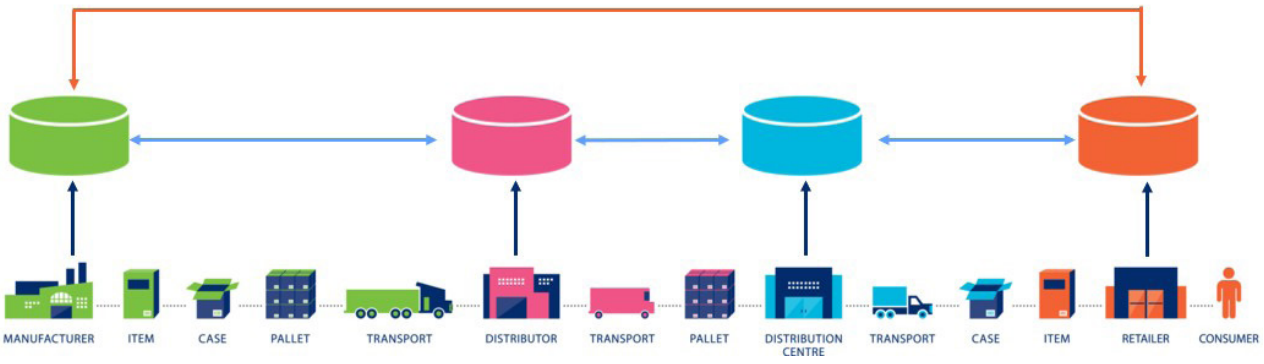

Illustration 6: Using GS1 standards, each supply chain actor manages his own traceability data repository. Traceability data is shared with the nearest trading partners (blue arrows). With GS1 standards, a supply chain actor can grant access to upstream or downstream actors allowing them to access their traceability data (illustration example orange arrow: a manufacturer allows a retailer to access data). This can be facilitated by using the GS1 Global Registry´s link feature to locate the relevant traceability data repository.

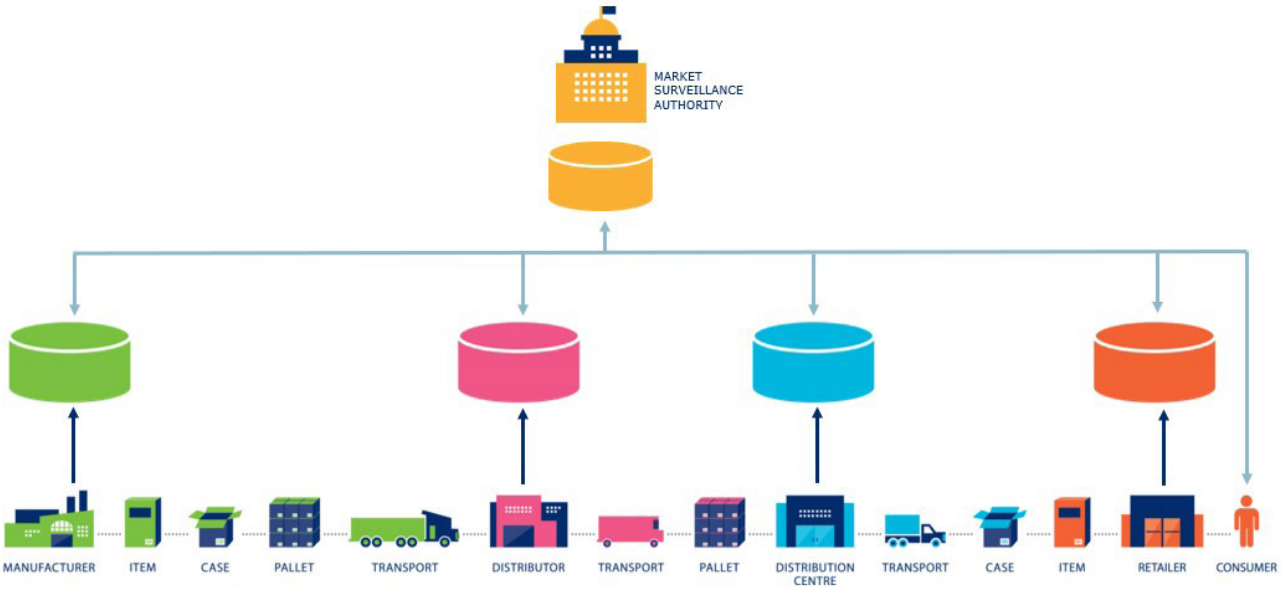

Illustration 7: Market surveillance authorities and consumers may rely on the same GS1 standards based infrastructure to access the appropriate product or traceability data.

5. Conclusion

There is an increasing demand for ethical practices and a need to mitigate risks in complex, global value chains, largely driven by regulations addressing sustainability and product safety globally. This has triggered the need for enhanced traceability and transparency. Companies are intensifying efforts to facilitate information sharing and traceability across value chains, yet this remains challenging. The recommendations provided in this document aim to support companies in navigating these challenges effectively.

If companies succeed with implementing traceability data across their value chains, they can unlock value beyond regulatory compliance, including improved decision-making and increased trust with partners. Embracing these approaches will not only ensure compliance but also promote sustainable growth and innovation in the global corporate landscape.

About this paper

Recommendations in this paper are based on learnings from the Nordic Circular Accelerator by Nordic Innovation, where GS1 Sweden together with +40 companies of varying sizes and industries have participated in a circular data sharing program including interviews with key stakeholders, e.g., trade associations, standards experts and companies.

About GS1

GS1 is a global organisation with 120 national member organisations. We provide a common digital language for businesses through unique identification, proper labelling, and automatic data sharing for products, locations, and other physical objects. With the help of GS1, companies can improve efficiency, safety, sustainability, and traceability.

GS1 is:

Industry-neutral and not-for-profit, where any profits are reinvested in the business. User-driven, open and collaborative, where GS1 standards are developed in collaboration and are open and inclusive for all companies.