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1 OVERVIEW

This white paper introduces the GS1® Visibility Framework and explains how it can be applied to provide increased visibility into business processes within a variety of industries. It will help organisations answer:

- What does visibility mean to my business?

- What is the business value of visibility?

- Is getting to the next level of visibility worth the effort?

- What processes, technologies and standards are appropriate and useful?

It will help readers develop this insight by:

- Providing a common-sense definition of visibility that can easily be applied to multiple industries and business processes;

- Describing the standards, processes and technologies that can uniquely identify objects and activities to provide visibility throughout organisations and supply chains;

- Presenting examples of how organisations in the food, apparel, retail, pharmaceutical, healthcare and other industries have used these standards and technologies to manage inventory, prevent diversion, ensure product authenticity and safety, facilitate recalls, meet documentation and reporting requirements, track and manage assets, and improve other business processes;

- Documenting how standards-based approaches enable more productive and mutually beneficial relationships among trading partners.

The paper also addresses differing definitions of visibility, along with other visibility-related technologies and processes. By understanding the common elements needed for visibility, and the standards and tools that support them, organisations can make informed decisions regarding their options for improving visibility and the business value of pursuing them.

2 WHAT IS VISIBILITY?

"Visibility" is a commonly used term in business. However, visibility can mean different things to trading partners in the supply chain. To a manufacturer, visibility into processes may mean knowing how many days of production can be supported by the raw materials on hand. Visibility for retailers could mean that inventory levels reflect the total of what's on the shelf, in the back room, at the distribution center and in transit. Healthcare requires an added element of visibility, which is the capability to capture and document the chain of custody of a pharmaceutical product.

Consultants and solution providers have their own diverse views on visibility. ERP systems, supply chain management software, barcodes, radio frequency identification (RFID), mobile and wireless computers, database programs and web-based information exchanges are all promoted as visibility solutions. In fact, all of these might be components of visibility, but alone do not provide a full solution. Multiply these information delivery options against all the items and business processes that organisations need visibility into, and it is easy to see how visibility can take so many forms and mean different things to different people.

Despite this diversity, there are some common requirements for visibility and common building blocks for attaining it. For an object to be visible in a business process, the item or event must first be identified, its activity captured, and the information shared in a common way so that all who need information about the item or event can understand it. The technologies and processes used to identify, capture and share information vary considerably, but these core elements are present in all successful visibility programs.

Critical to achieving visibility in the end-to-end supply chain is collaboration between trading partners. Today, companies are gaining better visibility into their own processes. But supply chains are becoming more global with many tiers of trading partners. End-to-end visibility requires integrated infrastructures and alignment of supply chain processes. Trading partners need to agree to share data so that they may benefit from real-time information on what is happening outside their own walls all along the supply chain.

3 KEY DEFINITIONS

As used here, visibility is the ability to know exactly where things are at any point in time, or where they have been, and why. Visibility is not a business application or process unto itself. Visibility is a capability that allows a company to achieve various business goals through seeing more event-based information relating to business processes making use of that visibility data in business applications. Fundamentally, if you can't "see" something, you can't measure it – and if you can't measure it, it's probably costing your business too much.

It is also important to understand the relationship between visibility-driven processes and the visibility data types and standards that support them.

Visibility is the ability to know exactly where things are at any point in time, or where they have been, and why.

Visibility-driven business processes include:

- **Track (forward)** – Determining the downstream locations of products in the supply chain ("Where has it gone? Where is it now?")

- **Trace (backwards)** – Identifying the upstream history of where a product has been at what times ("Where has it been?")

- **Pedigree** – Determining and confirming the chain of custody and chain of ownership of a product as it moves through the supply chain

- **Product Authentication** – Confirming a product identity and whether it is genuine, and not a counterfeit

- **Inventory** – Monitoring and managing the stock of products at one or more locations

- **Returnables** – Processing products returned by a customer and confirming that the returned products were legitimately purchased

These are just examples; there are literally hundreds of business processes and applications that may make use of visibility.

In thinking about the technology components that work together to enable visibility, the key components are the type of data needed for visibility and the supporting standards. There are three principal types of data that work together to provide visibility: **master data, transactional data** and **event data**.

- **Master Data** is static data that typically describes locations, assets, products, and parties. This data makes it possible to interpret data elements that occur in physical event data and transactional data. For example, a physical event may reference the Global Location Number (GLN) to identify the location where the event took place; master data associated with that GLN provides descriptive information about the corresponding location, such as its address, latitude and longitude, etc.

- **Transactional Data** represents business process activities – either amongst trading partners or within an operation. Typical processes include purchase order, delivery, invoicing, payment, scheduling and support services.

- **Event Data** are actual observations made in the physical world of products or other assets. Each observation says what was observed, when it was observed, where it was observed, and why it was observed (that is, what was the business context in which the observation took place). Often physical event data is generated as the result of automatic identification, such as scanning a barcode or reading an RFID tag.

4   WHY IS VISIBILITY IMPORTANT?

The value of visibility lies in the value of information and how business processes can be improved with this information. With real-time visibility on product and transaction flow along the supply chain, companies and organisations involved can act upon this information and derive clear business value.

Here's an example of how visibility adds value in the retail and consumer goods industries. A retailer expects increased sales of toys in the weeks leading up to New Year. The common response would be to order additional products from suppliers to build up safety stock at stores. If the retailer had extremely accurate inventory systems and visibility into actual inventory levels on store shelves, in the back room, at its distribution centers and for goods in transit, it could reduce its safety stock (and the associated inventory carrying costs) without increasing the likelihood of experiencing an out-of-stock event. Top supply chain performers are 1.5 times more likely than laggard firms to treat in-transit inventory as available inventory for safety stock calculations. Standards-based, technology-enabled processes provide the needed visibility to reduce out-of-stocks by 30 percent, and safety stock by up to 27 percent, studies have found.

> **The value of visibility lies in the value of information and how business processes can be improved with this information.**

Visibility can benefit many sectors and stakeholders, depending on which business processes are impacted. For example:

- **In consumer goods and general merchandise**, visibility at item-level allows the manufacturers and retailers to better manage and track their inventory – it can help achieve stock accuracy and ensure no lost sales or surplus stock, reduce shrink, identify counterfeits and better manage returns or recalls.

- **In the food industry**, visibility can help provide traceability from the producer all the way to the store or food service provider. This allows producers and manufacturers to meet quality and regulatory requirements, manage recall more effectively or communicate on the origin of the product to the end-consumer accurately, increasing consumer safety as well as enhancing efficiency.

- **In transport and customs**, visibility can enable real-time tracking of products in shipment, or facilitate customs clearance, providing information to speed up product identification and reduce inspection time. Customs jurisdictions require better visibility in order to implement policy objectives on border security, product safety and integrity and accurate collection of duties.

- **In healthcare**, visibility can provide traceability for medication or medical devices along the supply chain all the way to the patient in the hospital. It can also help meet emerging regulatory requirements and combat counterfeiting. For example, in the United States, beginning in 2015, serialisation and pedigrees will be required for medications sold in California. Complying with them using manual-paper-based processes can be time-and cost-prohibitive, so technologies that increase visibility in these processes are essential.

Visibility goes beyond the traditional trading partners in the supply chain. In today's digital world where consumers are more connected and require more information about the products they buy, providing visibility to the end-consumer is becoming important for manufacturers and retailers. Consumers expect immediate information about what they are buying, whether it was produced in a sustainable manner, what nutritional value it has or when it will be delivered to them.

Supply chain visibility translates to business value. Best-in-class supply chain performers, measured as those companies with the lowest out-of-stocks, lowest landed costs and highest on-time shipment rates, also have the most visibility into their supply chains, a leading study found. These best-in-class performers are significantly more likely to have batch- or SKU-level visibility into their inbound and outbound inventory and to have online visibility into the status of purchase orders and shipments. They are also 60 percent more likely than laggards to have batch or item-level visibility. Top performers are nearly twice as likely as all other companies to provide role-based visibility to both employees and external trading partners.

However, there can be no visibility of an item or asset until there is a standard way for all stakeholders in the supply chain to identify it, and capture and share information about it.

5   THE GS1 VISIBILITY FRAMEWORK

The GS1 System of Standards is an integrated suite of standards that, when used together, enables the visibility of items or assets (i.e., trade items, reusable assets, fixed assets, and work-in-process) through common ways to uniquely identify, capture and share information relating to their movement or their state.

The GS1 System of Standards is a framework for visibility, that provides organisations with the what, when, where and why of an item's movement, enabling them to make more-informed business decisions.

At the core of the Framework, GS1 Standards for Identification provide the link between a product and the information pertaining to it. A company can assign to a product, for example, a unique identification code called a GS1 Identification Key, in accordance to allocation rules determined by GS1. By doing so, the company defines a set of standardized information about the product (e.g., size, weight, brand, etc.).

One of the most well-known GS1 identification keys is the Global Trade Item Number, or GTIN, which is for example by the EAN/UPC barcode. Using the GTIN and other GS1 identifiers, companies and organizations around the world are able to uniquely identify physical things such as trade items, physical locations, assets, and logistic units as well as logical things like a service relationship between a hospital and a patient, for example.

What item or asset?
Where in the supply chain?
When was it there?
Why was it there?

The GS1 System of Standards: a Visibility Framework

IDENTIFY
GS1 Standards for Identification

Company	Product	Logistics & Shipping	Location	Asset	Services
• Global Location Number (GLN)	• Global Trade Item Number (GTIN) • Serialised Global Trade Item Number (SGTIN)	• Serial Shipping Container Code (SSCC) • Global Shipment Identification Number (GSIN) • Global Identification Number for Consignment (GINC)	• Global Location Number (GLN)	• Global Individual Asset Identifier (GIAI) • Global Returnable Asset Identifier (GRAI)	• Global Service Relation Number (GSRN) • Global Document Type Identifier (GDTI) • Global Coupon Number (GCN)

CAPTURE
GS1 Standards for Automatic Identification & Data Capture

GS1 BarCodes

EPC/RFID

| EAN/UPC | ITF-14 | GS1 DataBar | GS1 DataMatrix | GS1 QR Code | GS1 Composite Barcode | EPC HF Passive | EPC UHF Passive |

SHARE
GS1 Standards for Automated Data Exchange

Master Data	Transactional Data	Event Data
• Global Data Synchronisation Network (GDSN)	• eCom (EDI) : EANCOM, GS1 XML Business Message	• EPC Information Services (EPCIS)

Figure 1: GS1 Standards framework

Scanning the barcode or reading the EPC/RFID tag automatically captures the GTIN, which provides the unique identification of the item. By scanning a bar code or reading an RFID tag, the unique identification number it carries is automatically captured and provides a link to the information related to the item. This provides an automated way of identifying things as they move along the supply chain and providing data related to them as needed. To ensure interoperability, industries have agreed on the GS1 Standards for Automatic Identification and Data Capture (AIDC), which define how the unique GS1 identification keys are used in approved barcodes and RFID tags, for different business applications. This is the basis for visibility, allowing billions of transactions to be made every day.

The captured data can then be shared in a variety of ways using standards and technologies that the GS1 framework supports. When this powerful automated identification system is combined with data-sharing methods, transactional messaging standards such as electronic data interchange (EDI), and/or event information, the connection is made between these physical or logical things and the information the supply chain needs about them.

> **There can be no visibility of an item or asset until there is a standard way for all stakeholders in the supply chain to identify it, and capture and share information about it.**

5.1 Identify

The GS1 System has globally accepted identification keys that provide a common language to communicate product information from company to company. The GS1 Identification Keys for products is the GS1 Global Trade Item Number (GTIN). For decades, this GS1 Identification Key has facilitated the sharing and communication of product information among supply chain partners. Moreover, it has provided the foundation for innovative improvements in supply chain management for many industries, including the well-documented advances in the retail and consumer goods sectors. As with the Serial Shipping Container Code (SSCC), the Global Individual and Global Returnable Asset Identifiers (GIAI and GRAI), the Serialised GTIN (SGTIN) takes serialisation

capabilities down to the item level, which offers enhanced tracking and tracing within visibility-driven process areas.

All GS1 Identification Keys can be expressed in different types of data carriers, such as text, barcodes and RFID tags, and in different types of messages such as EDI or XML.

Figure 2 below highlights several types of GS1 Identification Keys.

The GS1 Identification Keys shown below can be completed with attributes to provide more data such as serial number, weights, measures, expiry dates or batch number, as well as rules for allocating GS1 Identification Keys..

GS1 Identification Key	GS1 Identification Key Title	Type of Supply Chain Information
GTIN	Global Trade Item Number	trade item class
GLN	Global Location Number	locations & trading partners
SSCC	Serial Shipping Container Code	logistics units
GIAI	Global Individual Asset Identifier	individual assets
GRAI	Global Returnable Asset Identifier	returnable assets
GSRN	Global Service Relation Number	service relationships
GDTI	Global Document Type Identifier	document types
GSIN	Global Shipment ID Number	shipments
GINC	Global Identification Number for Consignment	consignments
GCN	Global Coupon Number	coupons

Figure 2: Types of GS1 Identification Keys

5.2 Capture

The GS1 Standards for Automatic Identification and Data Capture (AIDC) Standards define how industry uses bar code and RFID technology to ensure a seamless flow of information between trading partners all along the supply chain.

These standards define how to encode GS1 Identification Keys on approved data carriers such as GS1 Bar Codes and EPC/RFID tags. They also define how this is done for different business applications, for example variable measure fresh produce or small medical surgical instruments, as agreed by the relevant industry in GS1 AIDC Application Standards. Finally, they specify consistent interfaces to readers, printers, and other hardware and software components to ensure that the information can be read in different business applications. This is the basis for global, automated identification of trade items, logistic units, locations, assets and service relations worldwide and enables connectivity to information shared in the supply chain about them.

Scanning bar codes or reading RFID tags speeds data collection and eliminates manual data collection errors, e.g., illegible handwriting and data entry errors. The GS1 System enables users to automatically identify all product configurations, packaging, transportation, distribution, inventory, display location and sales touch points, by automatically processing the data captured from the GS1 Barcodes or EPC/RFID tags. Additional information such as best-before-dates, serial numbers and batch numbers may also be encoded into GS1 Bar Codes or EPC/RFID tags.

GS1 Barcode Standards include:

- **EAN/UPC** – A family of barcode symbols typically used in retail that speed the checkout process, reduce errors, and improve inventory management

- **ITF-14** – Used to uniquely identify trade items in the supply chain, not intended for point-of-sale

- **GS1-128** – Used for trade items, assets, logistics units such as cartons, cases, pallets, and returnable assets; supports fast and accurate tracking of inventory

- **GS1 DataBar** – Created to identify hard to-mark products such as loose produce or cosmetics, this barcode provides more data (GTIN as well as attributes like batch number or expiry date) in less space. It allows these products to be scanned at the retail point-of-sale.

- **GS1 DataMatrix** – Used primarily in pharmaceuticals, medical device manufacturing, and also in aerospace, this 2D (two-dimensional) barcode holds large amounts of data in a relatively small space

- **GS1 QR Code** - Used by brand owners to engage consumers via their mobile devices, to provide additional product information, promotions, etc.

EPC/RFID tags consist of a microchip attached to an antenna. The EPC/RFID tags can carry the GS1 Identification Key associated with an individual item, along with additional data needed to support supply chain processes. EPC stands for the Electronic Product Code, an RFID-friendly encoding scheme for GS1 Identification Keys. EPC/RFID tags can be read without visual contact, making them very useful for processes such as real-time tracking of items or assets or stock-taking of multiple products.

5.3 Share

The GS1 System provides three standardised data types – master data, transactional data and event data – and also supports multiple standardised ways to share the information. eCom for Electronic data interchange (EDI), Electronic Product Code Information Services (EPCIS), the Global Data Synchronisation Network (GDSN) and other data pools can be used to share master, transactional and physical event data. The table below lists GS1 standards to support data sharing.

The Global Data Synchronisation Network provides a way for trading partners to synchronize data that is held in their respective databases. It is built around the GS1 Global Registry and uses GDSN-certified data pools for sharing data. The GS1 Global Registry is the GDSN's "information directory" that details who has subscribed to trade item or party data, guarantees the uniqueness of the registered items and parties, and ensures that all data pools in the network are complying with a standards-

Data Type	GS1 Standards	Type of supply chain information
Master Data	• Global Data Synchronisation Network (GDSN)	e.g., product description, dimensions, brand owner, product classification...
Transaction Data	• eCom (EDI): EANCOM, GS1 XML Business Message	e.g., purchase order, despatch advice, invoice, payment...
Event Data	• Electronic Product Code Information Services (EPCIS)	What, where, when, why - e.g., received or shipped, picked & packed, conditions of goods during shipment, availability of goods at specific location...

Figure 3: GS1 standards for automated information exchange

based set of validation rules. GS1-certified data pools are electronic catalogues of standardised item data. They serve as a source and/or a recipient of master data. Data pools can be run by a GS1 member Organisation or by a solution provider.

Electronic Product Code Information Services (EPCIS) is a standard that enables a means to store and exchange physical event data including the what, when, where and why about physical observations, regardless of the technology used to capture that information. This allows companies to associate and share additional information, or events, relating to an item's identity. For example, companies can associate information such as the time and date that an item was read, the location of that read, and whether it was being shipped or received. Information that can also be related to the item includes temperature, associated purchase orders, and the business reasons for why the product moved. This additional information can be associated in an EPCIS database or repository. Having this granularity of information provides organisations with real-time visibility of items inside an enterprise or between trading partners. This, in turn, enables companies to realise the full benefits of auto identification which is to make use of the information that has been captured.

With the advent of the GS1 barcodes, it became important for trading parties (such as a supplier and retailer) to be able to share product information. GS1, with its user community, has been developing eCom guidelines for EDI implementation for over a quarter-of-a-century for sectors such as food and beverages, retail, healthcare, industrial/commercial industry and public sector. Driven by the need to develop and/or improve electronic communication amongst trading parties, the GS1 eCom guidelines provide roadmaps for enabling computer-to-computer communication for many strategic business processes, including order-to-cash, product pricing, sales reporting, financial, organisational structure, transportation and product planning. Master data, as well as other data relevant for the business process, is carried in product-based messages. The GS1 Identification Keys, such as the GTIN and GLN, represent core data to many of these messages. Additionally, resulting from the development of the Internet, GS1 XML messages are also available to complement eCom (EDI) messages within a business environment.

See Appendix for more information about the data types and examples of how they can be shared using standards and technologies supported in the GS1 System.

5.4 Summary

The GS1 System provides a comprehensive framework for companies to identify products and other business entities, capture visibility data, and share this data with trading partners to achieve global supply chain visibility. It is a solid foundation for supply chain traceability and other visibility-driven business processes and applications.

Organisations in different sectors are already using this framework to gain visibility into their supply chain processes. A few examples are detailed in the following section.

Fundamentally, if you can't "see" something, you can't measure it – and if you can't measure it, it's probably costing your business too much.

6 HOW GS1 HELPS ORGANISATIONS GAIN VISIBILITY

6.1 What is GS1

GS1 was established by manufacturers and retailers to develop mutually beneficial standards and, for over 30 years, it has helped business communities in multiple industries to address supply chain challenges. It is a neutral not-for-profit organisation, which facilitates collaboration amongst trading partners, organisations and technology providers, leveraging standards to ensure visibility along the entire supply chain.

GS1 is a fully integrated global organisation, with over 110 member organisations representing multiple stakeholders in the supply chain across the world. Today, GS1 is the most widely used supply chain standards system in the world: close to two million companies across 150 countries rely on its standards and services for the effective management and control of their supply chains. GS1 operates in multiple sectors and industries, ranging from retail & consumer goods to healthcare, transport, defence and aerospace.

GS1 and its member organisations across the world provide assistance to companies and organisations by playing four primary roles:

1. Developing industry insights to all stakeholders' needs;

2. Recommending, developing or adapting standards to meet the identified needs;

3. Providing community leadership to encourage participation in industry problem-solving initiatives and adoption of relevant standards; and

4. Helping industry identify or develop the solutions and services needed to implement desired standards and business processes.

The GS1 portfolio includes:

- **The GS1 System of standards** – Provides the technical standards to improve the efficiency of business processes and enable supply chain visibility, through automation based on globally unique identification and digital information, as described in the framework in the previous section of this paper. Application standards complete the picture, specifying for a particular business application the set of technical standards to which end user systems must conform, in order to achieve mutually agreed interoperability goals.

- **GS1 Solutions** – A convenient package of standards, guidelines and services to address a specific business need or process, to assist the implementation of GS1 Standards to achieve particular business goals. There exist GS1 solutions for example for Traceability or Upstream integration.

- **GS1 Services** – Provides assistance to parties implementing GS1 standards. This includes training, services such as GEPIR, a look-up service about GS1 Identification Keys, or GDSN-certified data pools for master data management. The provision of these services may vary from country to country.

The global language of business

Overall Benefits:
Collaborating to create more efficient, safer and sustainable value chains

Solutions and services:
Solving business issues with global standards

GS1 System of standards:
Enabling visibility in the value chain

| **Identify** | **Capture** | **Share** |
| GS1 Standards for Identification | GS1 Standards for Automatic Identification & Data Capture •GS1 BarCodes •GS1 EPC/RFID | GS1 Standards for electronic Information Exchange •GS1 eCom •GS1 EPCIS •GS1 GDSN |

Figure 4: GS1 portfolio in summary

Early success in the consumer goods and retail industry attracted the attention of other industries, which have sought the assistance of GS1 in developing identification, technology and communication standards to solve their specific business challenges. Today GS1 helps provide visibility to many industries and sectors, including aerospace, apparel, consumer goods, foodservice, fresh foods, Do-It-Yourself (DIY), healthcare, oil and gas, transportation and logistics, retail and others. The following section highlights a few of these efforts.

6.2 How it all comes together

GS1 standards and solutions are developed from the bottom up by organisations and individuals that want to use them. Initiatives from local GS1 organisations reflect actual use cases and how standards and processes are adopted in real world operations. The examples that follow show how organisations have gained visibility and profited from it, and how GS1 can help solve common business challenges.

6.2.1 Visibility Example 1: Traceability in the healthcare sector

Companies in the pharmaceutical supply chain are adopting GS1 standards to provide electronic pedigrees and meet other traceability needs. For example, pharmaceutical products can be associated with GTINs that can be encoded in barcodes and/or RFID tags. The codes can be automatically read at different process points to record transactions such as physical transfers or changes of ownership. The transaction record could be used to document the item's chain of custody. Pharmaceutical production batch codes can also be encoded, or they could be held in an EPCIS database with other information specific to the product, with the encoded GTIN serving as the key for accessing the database record.

Visibility in the pharmaceutical supply chains, enabled by GS1 standards, is already becoming a reality in many countries. In Ireland, for example, the National Centre for Hereditary Coagulation Disorders in the St James's Hospital in Dublin has achieved total visibility of haemophilia medication in their supply chain thanks to GS1 standards. They allocated unique GS1 identifiers to each patient, drug and location in the supply chain and used GS1 barcodes on their haemophilia medication. This

SUCCESS STORY:
Healthcare industry collaborating with GS1 for improved visibility

GS1 Healthcare is a global, voluntary user community that brings together all healthcare supply chain stakeholders, including manufacturers, distributors, healthcare providers, solution providers, regulatory bodies and industry associations. Members include over 60 leading healthcare organisations worldwide.

To meet the growing demands of increased visibility and efficiency in the healthcare supply chain and improve patient safety, the GS1 Healthcare community have endorsed GS1 standards and been driving the adoption of GS1 data carriers. For example, in December 2011, they set a goal of 2015 for the implementation of GS1 DataMatrix on regulated healthcare trade items where the current needs are not being met by other GS1 data carriers.

To facilitate adoption of GS1 Standards, local member organisations such as GS1 US are collaborating closely with industry groups and healthcare supply chain partners. GS1 US has developed a variety of educational materials and outreach programs. These include the GS1 Healthcare US 2015 Readiness Program, which provides simulation methods for U.S. pharmaceutical supply chain members to prepare their organisations for serialisation, gain insights into the benefits of supply chain visibility and drive industry practices.

For more information on the latest initiatives of GS1 Healthcare, visit www.gs1.org/healthcare

enabled them to track the medication from the manufacturer all the way to the patient. It helped eliminate product wastage due to cold chain failures or documentation issues, and more importantly it increased patient safety. Now, in the event of a recall, the Centre can identify where 100% of the batch has gone within 10 minutes.

6.2.2 Visibility Example 2: Product & food safety

Retailer and suppliers of consumer goods have been using GTINs and barcodes to track the movements of products along the supply chain and benefit from efficiency gains for years. As new concerns are arising around consumer safety and sustainability, they are now using them to build into their supply chain the foundations for increased food safety, reducing waste in the supply chain and improving product information to their customers.

Recent consumer safety crises have highlighted the importance of traceability and the need for fast and accurate recall processes. Trading partners are seeking to gain increased visibility on where their products are coming from and where they are being sold, to ensure safety and comply with regulatory requirements. GS1 standards provide the basis of such upstream and downstream visibility, enabling the automated capture and exchange of traceability information and guaranteeing interoperability between trading partners.

For example, the GS1 Global Traceability solution provides a framework for manufacturers about how to implement a traceability system based on GS1 standards that complies with international regulations. In the event of a problem, this can ensure a rapid recall of a product, thanks to its accurate identification and immediate localisation in the supply chain. Furthermore, the GS1 EPCIS standard for sharing event data facilitates the tracking and tracing of items across borders, providing an automatic way of sharing real-time traceability information between multiple trading partners.

CASE STUDY :
How GS1 US is Helping Improve Food Safety

A recent, ongoing engagement provides an excellent example of how GS1 works with industries. A founding group of 55 foodservice companies sought to drive waste out of the foodservice supply chain, improve product information for customers, and establish a foundation for improving food safety and traceability.
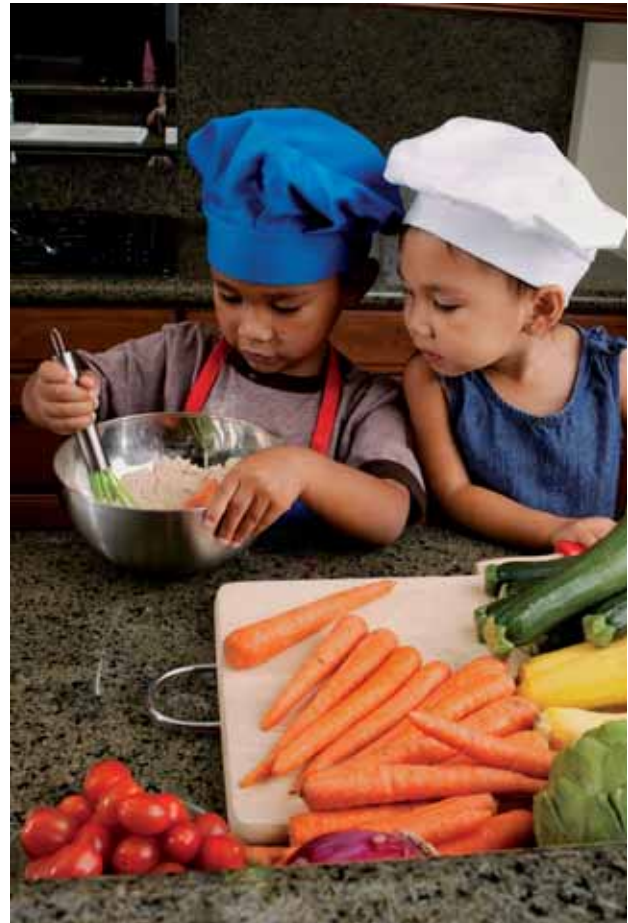
The members concluded that GS1 standards could help make progress on all three goals, and approached GS1 US for assistance. The result is the Foodservice GS1 US Standards Initiative, which launched in October 2009. The Initiative is striving for adoption of GS1 standards by 75 percent of the foodservice industry, measured in terms of revenue, by 2015.

Voluntary members are beginning with GLN and GTIN adoption, and will share their product data through the GS1 Global Data Synchronisation Network. Regardless of a given community's familiarity with GS1 standards, GS1 US will work with its members to help engage other members and gain endorsements from influential community members; form industry leadership groups, involving necessary stakeholders; form working groups – to identify business processes and create use cases; and develop industry adoption roadmaps and best practices – to solve the community's targeted challenges.

With existing communities, GS1 US will continue to add areas of assistance. In recent years, these communities have added food safety to the list of objectives they seek to ultimately achieve through supply chain standards. Two prominent examples are the Produce Traceability Initiative (PTI), and the XML Traceability Implementation Guide.

Visit the Foodservice GS1 US Standards Initiative Web site for more information about the Organisation and its latest activities :
http://www.gs1us.org/industries/foodservice

6.2.3 Visibility Example 3: Inventory management in Retail and General Merchandise

Manufacturers and distributors are motivated to improve visibility by more than simply meeting traceability requirements. They recognise the business benefits to improving visibility, which include improving inventory turns, reducing returns and unsaleables, lowering safety stocks and reducing overall inventory levels.

The role standards play in delivering these benefits has been well proven by businesses in the retail, apparel and consumer goods industries. From the standardised barcode used to identify items at the point-of-sale and trigger inventory replenishment transactions, to data Synchronisation standards and solutions that help trading partners track and rationalize inventory throughout the supply chain, the ability to identify, capture and share product information in a standardised way enables many beneficial business processes.

More recently, retailers across the world in apparel or general merchandise have started to use the EPC/RFID technology to get real-time item-level visibility at retail stores, as well as along the supply chain. For example, GS1 US and VICS (Voluntary Interindustry Commerce Solutions Association) led an industry-initiative with retailers in North America (see case study below) piloting item-level tagging with EPC/RFID. These cases have demonstrated clear benefits of using item-level EPC/ RFID: close to 100% in-store inventory accuracy, a 75% reduction in stock-taking time and improved shelf-availability, leading to increased sales.

Some of these retailers are collaborating with GS1 Hong Kong on a feasability study, led by the University of Arkansas, to take supply chain visibility to the next level and achieve source-to-store visibility. Tagging garments with EPC/RFID at the suppliers and using EPCIS to track them could enable traceability along the apparel supply chain, increase order fulfillment, reduce chargebacks and improve logistic management for these trading partners.

CASE STUDY : Tangible benefits from item-level visibility in the Apparel supply chain

Research by the University of Arkansas, sponsored by GS1 US and the American Apparel & Footwear Association, quantifies the benefits that retailers and suppliers can get from implementing item-level EPC/RFID tagging. Their study is based on the pilots of leading US apparel retailers (such as Bloomingdale's, Dillard's, JCPenney, NineWest) and three suppliers.

They found that using item-level EPC/ RFID tagging improved in-store inventory accuracy for retailers from 65 to 98 percent. Sales increased up to 15 percent, in part because the improved inventory accuracy led to improved shelf availability. They also found that 96 percent of out-of-stock situations are caused by inventory issues in the store, rather than by an event in the supply chain. Automated processes that leveraged standards-based identification and communication to verify deliveries and record items into store inventory reduced receiving time by 85 percent, and there was also a 75 percent reduction in the time required to take in-store inventory.

On the supplier side, the researchers discovered that suppliers' estimates for their outbound shipments were much higher than the actual shipment count accuracy, in part because the companies were auditing very small percentages of those shipments. The costs of incorrect shipments, including chargebacks, are very high. With EPC/ RFID enabling audits on 100 percent of shipments, the frequency of incorrect shipments can drop to zero, creating savings equal to the cost of implementing the RFID system.

Learn more about this research on the GS1 US Apparel website : **www.gs1us.org/apparel**

6.2.4 Visibility Example 4: Shipment tracking in Transport & Logistics

Companies and organisations operating in today's global environment are faced with a growing complexity of their supply chain, with multiple tiers of trading partners, intermodal transport and cross-border trade issues. In a recent Aberdeen study, 78% of Chief Supply Chain Officers identified improving extended supply chain visibility as a top priority.

To gain visibility into their operations and mitigate risk, increased collaboration with trading partners, third party logistic providers and customs is becoming critical. GS1 standards play an important role in providing the interoperability needed to automatically capture and share data for tracking goods or assets between these different parties.

The visibility obtained with such data brings many benefits. Knowing where a shipment is and when it will arrive can optimise transport planning and warehouse management. For example, GS1 Colombia has helped a logistics provider set up a collaborative platform based on GS1 standards for key retailers in the country, their suppliers

and transportation enterprises. This platform enables the users to track the trucks transporting their goods in real-time using multiple technologies, from GPS to EPC/RFID, and led to a 50% saving in transportation time as well as a 67% reduction in communication costs.

Similarly, knowing what is in a container, whom and where it came from facilitates cross-border procedures. This accelerates customs clearance, limits security risks or counterfeit goods, and reduces costs associated with lengthy and labour-intensive checks. GS1 has a long working relationship with the World Customs Organisation (WCO), the intergovernmental Organisation uniquely focused on customs matters. In the US for example, GS1 US is working with the United States Department of Agriculture (USDA) to improve the visibility concerning imported product at North American borders.

GS1 EPCIS can add particular value to the transport and logistics processes of an end-to-end supply chain. It allows different organisations to access information about physical events happening outside their own walls. With EPCIS, they can to track the real-time movements of trucks, wagons or shipments carrying the goods.

6.2.5 Visibility Example 5: Internal Production & Logistics Applications

Businesses can benefit from standards-based visibility even if the process or product never goes beyond the four walls of the enterprise. Visibility standards and practices help organisations implement best practices for managing their internal assets and processes. By using standards to identify, capture and share information, organisations avoid having to develop and test proprietary systems, can implement their solutions more quickly, and are ready to quickly "break the fourth wall" should there be a business-driven change that required them to share visibility information.

For example, many hospitals are taking advantage of real-time location systems (RTLS) to wirelessly track the whereabouts of IV pumps, wheelchairs and other equipment. While RTLS systems often leverage different wireless technologies and standards, they all can use standardised Global Location Numbers (GLNs) to clearly specify exact locations within the facility, and use Global Individual Asset Identifiers (GIAIs) to uniquely identify specific pieces of equipment. Using these standards frees software developers and IT administrators from developing customised serial numbering systems, while also positioning the Organisation to easily integrate other standards-based solutions. The data centre automation market is moving in this direction. Several leading manufacturers of servers and other IT equipment are including EPC/RFID tags into the products they build to facilitate automated asset tracking by their customers. Commercial IT asset tracking and management systems have built-in support for serial numbers, so manufacturer-tagged products can be easily included in these programs.

Similar GS1 standards are also commonly used to track shipping containers and other reusable assets, to manage warehouse locations or to support work-in-process tracking and other internal operations. Uniquely identifying components and assemblies as part of work-in-process tracking makes it easy to automatically build audit trails as part of production records, which in turn helps isolate manufacturing defects and minimize rework. Automating audit trails supports processes that improve process throughput by at least 10 percent, improve labour productivity at least 15 percent and reduce process failures at least 20 percent, according to an Aberdeen Group study.

USE CASE : How companies are using GS1 standards for Asset Management

In Japan a fresh foods company is using GS1 EPC/RFID to track the metal cage trolleys it uses to transport its goods throughout its supply and distribution chain. Prior to this system, lost cage trolleys in one distribution centre were costing the company over ¥10 million per year. Thanks to the increased visibility into the movement of its trolleys, the company can do a full inventory within minutes and has eliminated any losses. Similarly, in France a major retailer is using a similar system to track returnable fresh produce crates. Also, a Scandinavian company specialised in returnable transport systems for horticulture are tracking millions of flower trolleys as they are sent across the world thanks to EPC/RFID tags, to ensure more efficient inventory management and reduce losses.

There are numerous other ways to benefit from using standard, open systems for internal applications. Supply chain-oriented standards and processes can be applied to track materials transferred among an Organisation's departments and facilities. Enterprise asset management (EAM), warehouse management system (WMS) and other enterprise software can run more effectively if they receive timely, accurate data from barcode and RFID data collection and communication systems. Standards can add value to any process where visibility is desirable.

7 CONCLUSION

Visibility means knowing exactly where a given asset is at any point in time, and improving the management and control of those assets. With visibility into assets, events, processes and the supply chain, organisations can stop making assumptions and start making informed decisions based on accurate information about actual conditions.

There are many business benefits achieved through global visibility of assets and events throughout the supply chain, and improved visibility can also greatly enhance supply chain safety and integrity. Visibility provides the information needed to drive decision making throughout organisations and throughout supply chains. By knowing where things are, where they're going and where they've been, organisations can manage their resources more responsively and efficiently.

Although specific visibility requirements vary greatly, the fundamentals for providing visibility are universal. Gaining visibility at any level requires the ability to identify, capture and share information. By putting these funda-mental capabilities in place – supported by standards – organisations can extend visibility throughout their operations and their supply chains, leading to improved business processes and increased productivity.

The GS1 Visibility Framework provides the standards and supports the technologies needed to gain organisational and supply chain visibility into assets and processes. It includes specific resources to identify, capture and share information that can be adopted for multiple business processes in different industries. GS1 standards and services have already helped many organisations improve their internal operations and supply chain performance. The GS1 Visibility Framework will help extend and enhance these benefits by facilitating adoption of the technologies and processes that are fundamental for gaining visibility.

8 APPENDIX: SHARING BUSINESS DATA

Different types of data support visibility and a common language is needed for trading partners and different organisations to share this data.

Event data and **transactional data** are distinct types of data, though they are often related. A physical event is a record of something that actually happened in the physical world, and may or may not occur in the context of a business transaction. For example, shipping goods through a loading dock door typically involves both a business transaction (the transfer of custody) and a physical observation (the goods are actually observed leaving through the door). In contrast, the movement of a product from the back room of a store to the sales floor may result in a physical event if there is an RFID reader or other automatic identification device that detects this movement, but there may be no associated business transaction. Likewise, a business transaction does not necessarily imply any physical event, as in a "drop shipment" where ownership of a product changes but its physical location does not. **Master data** are data that make it possible to interpret data elements that occur in physical event data and transactional data. Master data typically exists to describe locations, items and asset classes and parties.

GS1 provides standards to support the automated exchange and sharing of these different types of data, as shown in the figure below.
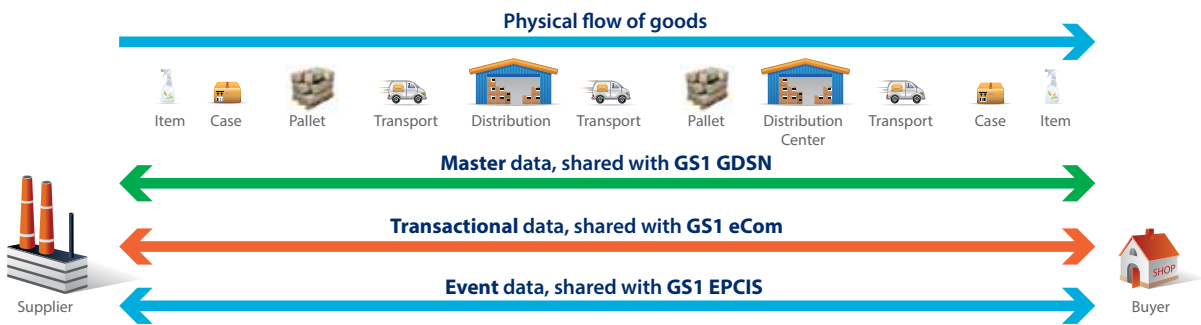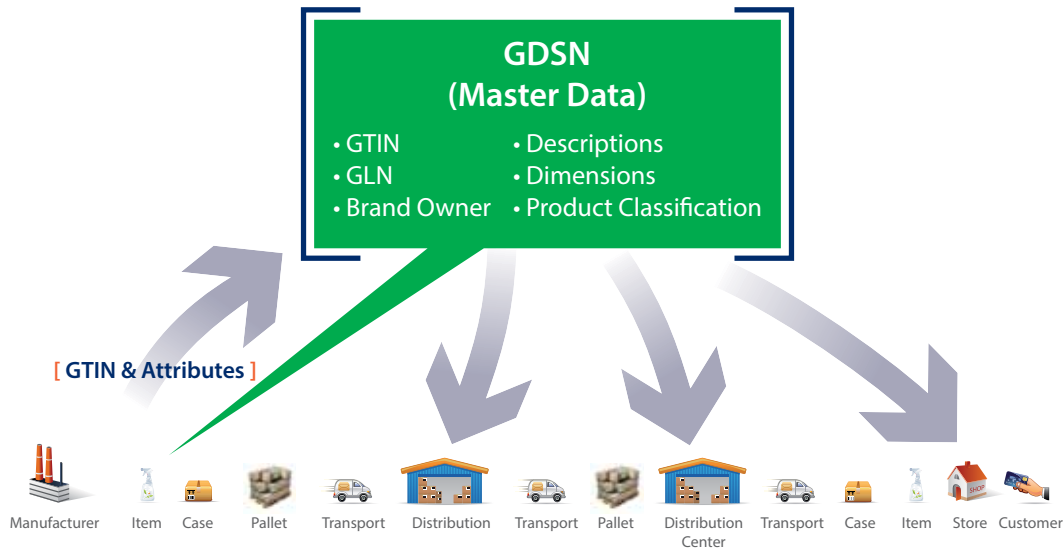

Figure : GS1 standards for automated exchange of business data

Master Data

Master data enables "one source of truth" for specific product information. This type of data typically exists to describe locations, items and asset classes, and parties. The GS1 standard that supports master data is the Global Data Synchronisation Network or GDSN. With GDSN, trading partners always have the latest information in their systems, and any changes made to one company's database are automatically and immediately provided to all of the other companies that do business with them. The graphic highlights how master data associated with a product can be captured and shared throughout the supply chain.

Master Data with GS1 GDSN

GDSN
(Master Data)

- GTIN
- GLN
- Brand Owner

- Descriptions
- Dimensions
- Product Classification

[**GTIN & Attributes**]

Manufacturer Item Case Pallet Transport Distribution Transport Pallet Distribution Center Transport Case Item Store Customer
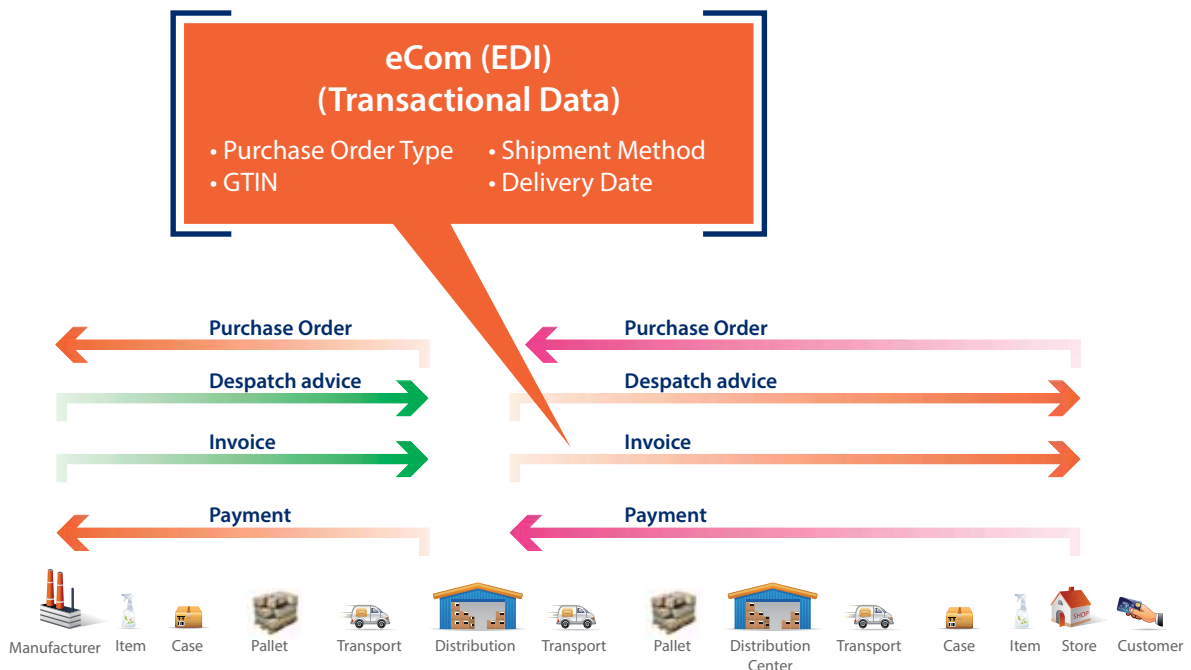
Transactional Data

Transactional data provides evidence of the completion of a business transaction, such as the completion of a transfer of ownership (purchase and sale) or a transfer of custody (shipping and receiving). GS1 standards that support transactional data are called GS1 eCom. They include EANCOM, the GS1 standard for Electronic Data Interchange (EDI) and GS1 XML Business Message Standards. The graphic illustrates how eCom can be used to exchange transactional data among manufacturers, logistics providers, distributors and retailers.

Transactional Data with GS1 eCom (EDI)

eCom (EDI)
(Transactional Data)

- Purchase Order Type
- GTIN

- Shipment Method
- Delivery Date

Purchase Order

Despatch advice

Invoice

Payment

Purchase Order

Despatch advice

Invoice

Payment

Manufacturer Item Case Pallet Transport Distribution Transport Pallet Distribution Center Transport Case Item Store Customer
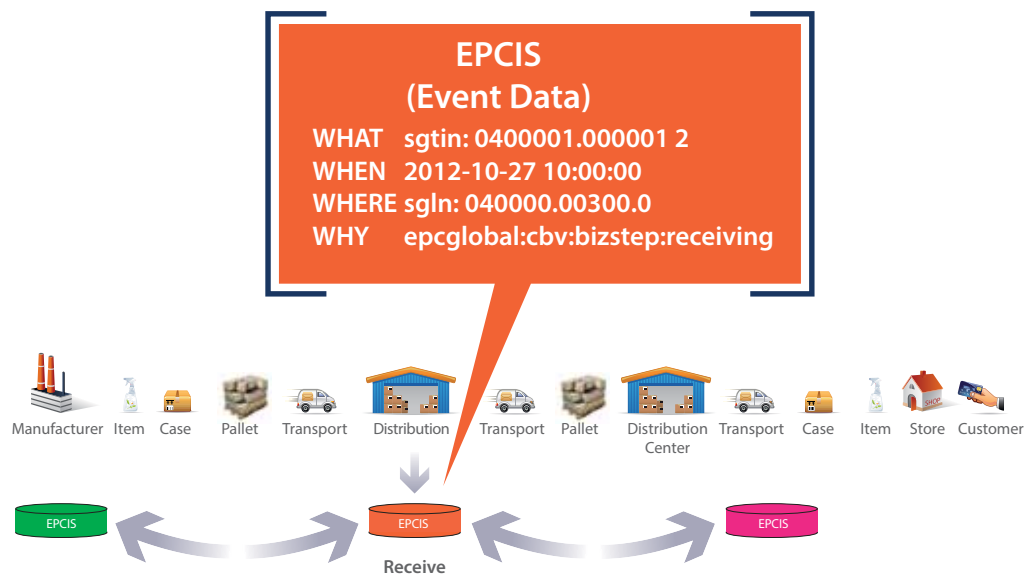
Event Data

Events are actual observations of products or other assets made in the physical world. Each observation captures what was observed, when it was observed, where it was observed, and why it was observed (that is, what was the business context in which the observation took place).

Often event data is generated as the result of automatic identification, such as scanning a barcode or reading an RFID tag. The GS1 standards that support physical event data are EPC Information Services or EPCIS and the Core Business Vocabulary (CBV).The graphic provides an example how event data and EPCIS can be used together to provide item visibility.

Event Data with GS1 EPCIS

EPCIS
(Event Data)

WHAT   sgtin: 0400001.000001 2
WHEN   2012-10-27 10:00:00
WHERE sgln: 040000.00300.0
WHY   epcglobal:cbv:bizstep:receiving

Manufacturer   Item   Case   Pallet   Transport   Distribution   Transport   Pallet   Distribution Center   Transport   Case   Item   Store   Customer

EPCIS   EPCIS   EPCIS

Receive

GS1 - Collaborating to make your supply chain more visible, efficient, safe and sustainable with global standards.

About GS1

GS1 is a neutral, not-for-profit organisation dedicated to the design and implementation of global standards and solutions to improve efficiency and visibility in supply chains. It engages a global community of trading partners, organisations and technology providers to understand their business needs and, based on those needs, develops global standards. It is driven by close to two million companies, which execute more than six billion transactions daily in 150 countries with the GS1 System of Standards. GS1 has local member organisations in over 110 countries. Its global office is in Brussels.

Visit our website at **www.gs1.org**.

For more information

For more information about how the GS1 System of Standards can improve your visibility-driven business processes, contact your **local GS1 organisation** at **www.gs1.org/contact.**

More detailed information about the GS1 System of Standards can be found in the **GS1 System Architecture** and the **GS1 System Landscape** papers at: **www.gs1.org/gsmp/process/arch_group**

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