



The Council of Supply Chain  
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# HOT TOPICS

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## Enhancing Supply Chain Visibility: The Role of 2D Barcodes and RFID Technology

Melanie Nuce-Hilton, Senior Vice President, Community Engagement, GS1 US

Data technology has come a long way since the Universal Product Code (UPC) barcode was first introduced in 1974. At the core of the barcode is the GS1 Standard, the Global Trade Item Number (GTIN), which is a numerical code that uniquely identifies products throughout the global supply chain and provides access to pricing information at point-of-sale (POS).

The linear, one-dimensional barcode has been a staple in supply chain management for half a century, but today's rapid technology advancements are both yielding and creating new demand for more robust data systems to drive an increasingly digital, interconnected global economy. In supply chain management, a transition to using new, [two-dimensional \(2D\) barcodes](#) and [radio frequency identification \(RFID\)](#) technology will play pivotal roles in fortifying supply chain visibility, thus enabling seamless tracking and monitoring of goods throughout the supply chain lifecycle.

### Beyond the UPC

2D barcodes can store significantly more data than their linear counterparts. This increased capacity means they can be encoded with extra product details such as batch/lot numbers, expiration dates, and manufacturing locations. As a result, 2D barcodes provide enhanced traceability and enable more sophisticated inventory management practices. This capability is crucial for addressing product recalls, shortages, and other disruptions effectively and quickly.

Increased traceability is particularly important under new regulations in the food industry. For example, the U.S. Food and Drug Administration's Food Traceability Rule, implementing section 204(d) of the Food Safety Modernization Act, requires extra supply chain records for certain high-risk foods. The rule encourages the use of electronic data technology, like 2D barcodes, to capture and share detailed information. This ensures that all stakeholders can readily understand and use the data, ultimately improving consumer safety.

Furthermore, advancements in smartphone technology have made it possible to scan 2D barcodes using mobile devices, empowering stakeholders at various points in the supply chain to access real-time information instantly. This accessibility promotes transparency and collaboration among supply chain partners, ultimately leading to improved efficiency and reduced operational costs. That same capability opens up entirely new possibilities for brand promotion and consumer engagement, as well. Brands can encode consumer-facing info – from product sustainability to recipes and promotions – in a web-enabled 2D barcode that shoppers can scan with their smart phones to access.



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## The Role of RFID Technology

RFID is another technology that takes supply chain visibility to the next level by providing near real-time, automated tracking of goods throughout the entire supply chain. Unlike barcodes, which require line-of-sight scanning and manual intervention, RFID tags use radio waves to communicate with RFID readers in an area – such as a truckload, warehouse or loading dock – allowing for seamless, hands-free data capture.

Each RFID tag contains a serialized, unique identifier that can be associated with specific product information. As goods equipped with RFID tags are detected through RFID readers, their movements are automatically recorded in the system, providing instant visibility into their whereabouts and status. RFID tags can even be read from a distance, making them ideal for tracking goods in transit or within large warehouse facilities.

## Improving Supply Chain Visibility

Transitioning product identification from the linear barcode to 2D barcodes and RFID tags will ultimately create improved levels of [supply chain visibility](#) so that trading partners can instantly monitor products' journeys from supplier to end-user, offering tremendous improvements in efficiency and accuracy. These advancing technologies allow for comprehensive tracking and tracing of goods from the point of origin to the final destination, enabling timely decision-making and proactive problem-solving.

For example, in the event of a product recall, having detailed information encoded in 2D barcodes and RFID tags allows companies to quickly identify affected batches and trace their distribution throughout the supply chain. This targeted approach minimizes the impact of recalls, reduces waste, and safeguards brand reputation.

Furthermore, enhanced supply chain visibility enables businesses to optimize inventory management, reduce stockouts, and streamline order fulfillment processes. By accurately forecasting demand and monitoring inventory levels in real-time, companies can avoid overstocking or understocking situations, thereby improving customer satisfaction and positively impacting the bottom line.

## Future Trends and Challenges

As technology continues to evolve, the future of supply chain visibility holds promise for even greater innovation. Advancements in data analytics, artificial intelligence, and digital technology are poised to further enhance the capabilities of 2D barcodes and RFID systems, enabling deeper insights and predictive analytics.

Along with these opportunities come challenges and interoperability issues. Ensuring the integrity and confidentiality of supply chain data remains a top priority, particularly in light of increasing demands and regulatory requirements. And data quality is more crucial than ever.



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Achieving seamless integration and accurate data exchange between various companies' technologies and systems is a significant challenge for many businesses. Overcoming these obstacles requires collaboration and standardization efforts across the supply chain to ensure that systems are compatible and can work together efficiently. This means businesses need to work together to develop common standards and practices to achieve interoperability, allowing for smooth communication and data sharing between trading partners.

Drastic improvements in supply chain visibility are needed and are, in fact, already at hand. With 2D barcodes and RFID technology playing key roles for tracking and monitoring goods with unprecedented accuracy and efficiency.

While RFID has been in wide use for about a decade, with millions of tags deployed to support key visibility and inventory management functions, there is still opportunity to do more. And with 2D, the retail industry has committed to begin accepting 2D barcodes at point-of-sale by 2027 as part of a GS1 US initiative dubbed "**Sunrise 2027**," and other industries are beginning to use them for traceability and consumer engagement purposes.

As these new data carriers gain widespread adoption, the entire supply chain infrastructure will power up to accommodate and improve the digitalized future of global commerce.

## About GS1 US

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