



Smart packaging in Food & Beverage – from compliance to consumer engagement

UNLOCKING SAFETY, TRUST, AND EFFICIENCY
WITH CONNECTED PACKAGING

Executive summary

The global food and beverage industry continues to experience accelerated change. Rising consumer expectations, increasing regulatory requirements, and the mounting costs of recalls put unprecedented pressure on food producers to modernize their approach to product storage and transport.

One of the most significant milestones in this transformation is [GS1's Sunrise 2027](#) initiative, which includes the industry-wide adoption of 2D QR codes powered by GS1 Digital Link. By 2027, the traditional 1D barcode or UPC, which only holds basic product identification, will begin its transition to GS1 Digital Link-enabled 2D QR codes capable of providing far more information and engagement.

This transition to QR codes built on GS1 Digital Link standards represents a strategic opportunity for food producers to:

- Strengthen product traceability across complex supply chains
- Respond faster, easier, and more efficiently to recalls
- Ensure labeling and packaging are dynamic, real-time, and data-driven
- Deliver consumer transparency that builds trust and loyalty
- Unlock new channels for digital engagement and brand storytelling

This eBook equips food and beverage companies with the insights needed to lead the smart packaging transformation — delivering rich product data, reducing food waste, enhancing safety, increasing transparency, and strengthening brand loyalty in a price-sensitive market. Early adopters will gain a competitive edge through resilient supply chains and deeper consumer trust.



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Navigating new norms in food safety

The food industry has long carried the critical responsibility of ensuring consumer safety and preventing food-borne illnesses: where even a single misstep can have dire consequences for public health, brand reputation, and financial stability.

Consumers demand to know where their food comes from, how it was produced, and whether it is safe to consume. At the same time, regulators continue to tighten standards, and the costs of non-compliance, from managing recalls to reputational damage, can be staggering. According to a recent survey by GS1, nutrition, materials and ingredients, safety information, country of origin, allergens, and recall alerts were the kinds of product information most sought after by consumers.

77%

say product information is important when making a purchase

62%

are willing to spend more money on a product that offers detailed product information

79%

are more likely to purchase products with a scannable barcode/QR code (via smartphone) that provides additional product information

Enter GS1 Digital Link – a new GS1 standard for transparency, traceability, and authentication that is rapidly becoming the foundation of the next era of food safety. Instead of relying on static 1D barcodes that only tell part of the story, producers can now use a single GS1 Digital Link-enabled 2D QR code to carry the full digital identity of a product from farm to consumers.

For regulators, 2D QR codes ensure faster and more precise compliance checks. For producers, it delivers real-time visibility across the supply chain, helping identify risks before they escalate. For consumers, it transforms a simple product scan into an instant portal of trust - unlocking product details about origin, allergens, sustainability, and more.

The urgency of this transformation is underscored by [GS1 Sunrise 2027](#), a global initiative already being piloted in 48 countries representing 88% of global GDP. Retailers like Walmart, Kroger,

and Woolworths are actively testing 2D-enabled checkout lanes. By that deadline, all producers will be expected to begin replacing their 1D barcodes with 2D codes for point-of-sale transactions. Those who act early will not only reduce operational risk but also gain a competitive advantage by signaling leadership in safety, transparency, and digital innovation.

1D barcodes	2D barcodes
	
<ul style="list-style-type: none"> • Most only carry a Global Trade Item Number (GTIN) • Limited data capacity for the few carrying more than GTIN • There can be issues with the size on some packaging 	<ul style="list-style-type: none"> • Encodes a URL following GS1 identification system • Can readily carry GTIN and other important data on a smaller footprint • More reliable due to error-correction • Consumer engagement through QR code scanned with smartphone • Read QR code at point of sale (following GS1 global standards)

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The strategic role of GS1 Digital Link

As we delve deeper into the role digital technology plays in enhancing transparency, traceability, and consumer engagement in connected packaging, it is clear that 2D QR code solutions based on GS1 Digital Link are not just advantageous but essential for large-scale food producers. Integration of rich data through a unified 2D QR code (vs. multiple 1D barcodes) streamlines the complex processes involved in tracking food from origin to consumer. It also ensures a transparent product journey that bolsters consumer confidence and compliance with safety regulations.

Consider the example of one large-scale producer that faces challenges in managing the traceability of its diverse product lines, ranging from fresh produce to processed foods. Many traceability initiatives fail to scale beyond pilot phases due to operational complexity and lack of consistent implementation models across

global networks. By adopting [GS1 Digital Link](#)-enabled QR codes to connect its existing supply chain systems, this company can encode detailed product information into one simple 2D QR code. This shift not only simplifies tracking and tracing but also makes it possible for consumers to access a wealth of information — from farm location and harvest date to allergen and nutrition information simply by scanning a single QR code with their smartphones.

During the transition to GS1 Digital Link, products may carry both 1D and 2D barcodes to maintain compatibility with existing POS systems. While 1D barcodes support basic identification, 2D QR codes — enabled by GS1 standards and powered by solutions like [Loftware](#) — unlock dynamic real-time access to product data such as batch numbers, expiration dates, and sustainability attributes enhancing consumer trust and brand loyalty.

Operational benefits

According to [VDC Research](#), real-time traceability data is described as “unmatched” in its ability to optimize inventory management and supply planning. This is especially critical in regulated industries like food and beverage, where product movement visibility directly impacts operational efficiency. Plus, authenticity verification is essential to reduce the risk of counterfeits.

The benefits of GS1 Digital Link-enabled adoption paired with cloud-enabled labeling and packaging are enormous and wide-ranging. Firstly, with just one 2D barcode, food and beverage companies can significantly reduce the risk of errors in data handling, as information is digitized and centralized. This is crucial in product recall scenarios where a swift response is required. The ability to quickly trace a product’s journey back through the supply chain to help pinpoint the source of an issue helps mitigate the impact on public health and reduces financial and reputational damage to a company. Connected Packaging bolsters the ability to measure the number of recalled products by engaging directly with consumers during a recall event.

Also, the real-time data provided via 2D QR codes allows food producers to make more informed decisions. For instance, if a particular batch of products shows a trend of issues, producers can quickly investigate and address these problems before they escalate, accessing data by scanning the product on site. This proactive approach not only enhances safety but also improves operational efficiency, reducing waste and optimizing resource allocation.

Connected packaging for consumer engagement

In addition to operational benefits, adopting cloud-enabled enterprise labeling and smarter packaging with the ability to use one GS1 Digital Link-enabled QR code per product package significantly enhances consumer engagement. Today's consumers are more informed and conscious about their food choices. Instead of conducting a Google search, providing consumers with transparent and accessible information about the food they consume directly from their product package builds trust and loyalty. This is especially important in an ultra-competitive market where consumers have many choices and value authenticity and transparency.

For a company like [Loftware](#), which specializes in [product identification and supply chain visibility](#), the focus is on ensuring that its [connected packaging](#) solution is not only effective but also user-friendly and adaptable to various business needs. Loftware's offerings are designed to integrate seamlessly into existing operations, requiring minimal technical skills for customization and maintenance. This ease of integration is crucial for large-scale food producers who may be dealing with legacy systems and complex supply chains in a high-safety-risk industry.

As we look to the future, the role digital technology plays in smarter packaging and supply chain operations will only grow in importance. With regulations becoming stricter and consumer demands for transparency only continuing to rise, food producers must adopt innovative solutions that can keep pace with these changes. [Loftware's cloud-based labeling](#) and GS1 Digital Link-enabled [connected packaging solution](#) offers the scalability and flexibility needed to adapt to future challenges and opportunities in the food industry. By embracing technologies such as Loftware's, food producers can ensure they remain competitive and compliant, while continuing to build consumer trust and loyalty in an ever-evolving marketplace.

**\$10
million**

**the average recall cost per incident,
according to a study by the Food
Marketing Institute**

Global readiness, inclusive language, & symbol accessibility

Smarter packaging is not just about data — it is about delivering clarity, compliance, and inclusion across borders. As food producers expand into global markets, product traceability and transparency must evolve to meet the linguistic, regulatory, and accessibility needs of diverse audiences. Loftware's connected packaging solution, built on GS1 Digital Link standards, is uniquely positioned to support this transformation. While GS1 provides the foundational standards and tools for generating 2D codes, Loftware enables the delivery of dynamic, localized content — ensuring multilingual support, regulatory compliance, and accessibility across global markets.

Whether it is ingredient disclosures, allergen warnings, or sustainability claims, producers can tailor information to meet regional regulations and cultural expectations, enhancing both compliance and consumer trust.

By leveraging language-based routing, consumers can scan a product and instantly receive information in their native language. This feature is especially critical for global brands operating in multilingual regions, where clarity and trust hinge on linguistic accessibility.

In regions like the EU and LATAM, regulatory bodies increasingly mandate that product information be available in multiple official languages. Loftware's GS1 Digital Link-enabled solution helps producers meet these mandates by dynamically serving compliant content based on scan location and device language settings.

Loftware (along with Zappar) also supports inclusive code design to deliver dynamic content where QR codes can be paired with voice-enabled mobile experiences and clear iconography to ensure accessibility for visually impaired users. This aligns with global accessibility standards such as Americans with Disabilities Act, European Accessibility Act, Spain Draft Royal Decree and more, reinforcing a commitment to equity and usability.



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Managing recalls with connected packaging

To reiterate, navigating the complexities of food safety within large-scale production environments not only requires regulatory compliance but also a very proactive and strategic approach to avoiding and quickly responding to product recalls, the biggest concern for food manufacturers. Let's look more closely at how critical it is for food producers to have the ability to not only mitigate risks associated with food recalls but also enhance overall food safety measures.

Whether you're a global enterprise or a regional producer, solutions like Loftware's scalable connected packaging solution need to meet transparency and traceability needs without requiring deep technical expertise. This broadens access to advanced traceability tools and ensures that safety and transparency are universally achievable.

Recall management in food safety is a dynamic focus that demands a blend of technological insight and strategic foresight. Consider a scenario where an IT leader is tasked with deploying smart packaging across multiple production sites. Their role extends beyond

implementation — it involves anticipating risks, enabling real-time data access, and building resilient systems that reduce the likelihood and impact of recalls.

As in this example, the role of IT extends beyond the mere implementation of technology, as it involves a deep understanding of potential risks and the development of robust strategies to preempt them. For instance, by analyzing proactively collected and analyzed data, analysts can identify patterns that may indicate a risk of contamination or spoilage. This proactive approach not only mitigates risks but also enhances the company's ability to manage crises effectively, should they arise.

Digital transformation leaders can also champion the adoption of a culture that prioritizes food safety across all levels of the organization. This involves training teams to understand and use key technologies effectively, fostering an environment where safety protocols are second nature.

Collective responsibility for food safety

Additionally, by regularly reviewing and updating risk management strategies in line with emerging technologies and market trends, organizations can ensure that food safety measures are not just reactive but also anticipatory. In fostering such a culture, clear and consistent communication is key to not only ensuring that all team members are aware of protocols and expectations but also to build collective responsibility towards maintaining food safety. It is about creating a dialogue, where feedback from various departments is valued and used to refine strategies.

Strategic risk management in food safety is not a static process but an evolving one. As innovative technologies and methodologies emerge, IT teams must be adept at integrating these innovations in ways that enhance safety and efficiency without disrupting existing operations. This might involve pilot projects or phased rollouts, which allow for the evaluation of new systems under real-world conditions.

For companies like Loftware, providing transition guidance with digital innovation that caters to these needs is a priority. Their solutions and services are designed not just for key factors like compliance but for ease of integration and user-friendliness. This ensures that large-scale food producers can adopt modern technologies without the burden of extensive downtime or steep learning curves.

Again, strategic risk management for recalls in food safety is a critical component of modern food production. By leveraging technologies like Loftware's cloud-enabled labeling and connected packaging plus fostering a proactive, informed approach to risk management, food producers can significantly enhance the safety and reliability of their food products and greatly reduce the risk of recalls. This, in turn, not only complies with regulatory standards but also builds consumer trust and loyalty, ensuring the long-term success and sustainability of food production enterprises.

42%

According to PR Newswire, recalls from the U.S. Department of Agriculture (USDA) rose by more than 42% year-over-year

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Roadmap to GS1 Digital Link readiness

Navigating the integration of new smart packaging technologies, such as [Loftware's connected packaging](#) solution, into existing systems presents a unique set of challenges for digital leaders in the food production industry. This chapter offers practical advice on managing technology integration effectively to ensure seamless product identification, supply chain traceability, enhanced operational efficiency, and greater consumer engagement.

Battling compatibility with legacy systems

One of the primary obstacles IT teams face is the compatibility of modern technologies with legacy systems. Many large-scale food producers operate on platforms that may not initially sync well with newer technologies. For instance, integrating Loftware's connected packaging solution — which links GS1-generated 2D codes to dynamic content — strategic planning to ensure seamless communication across legacy systems and modern platforms.

Technology project leaders must conduct thorough system audits and compatibility tests before full-scale implementation. This preparatory step helps identify potential bottlenecks and allows for the development of customized solutions that bridge the gap between old and new systems.

Arming all stakeholders

Another significant challenge is ensuring that staff at all levels are trained and comfortable with the new technology. Change management is a critical component here. It involves more than just technical training; it is about fostering an understanding of how new systems can make daily operations easier and more efficient. For companies like Loftware, which emphasize ease of use and seamless integration, providing clear, user-friendly training materials and sessions can facilitate smoother transitions and quicker adoption rates.

Enhanced scalability and traceability for data security

Data security is also a paramount concern when integrating new smart packaging technology. As these systems often handle sensitive information regarding product origins, processing, and distribution, ensuring robust cybersecurity measures is essential. Technology leaders must work closely with IT security

teams to implement end-to-end encryption, regular security audits, and real-time monitoring to safeguard against data breaches. This not only protects the company's data but also assures consumers about the safety and reliability of the information they receive. To this end, Loftware's solutions are designed to meet stringent industry standards, including ISO27001 and SOC2 Type 2 compliance, ensuring secure and reliable data handling throughout the product lifecycle.

As companies grow and regulatory requirements evolve, scalability is a factor that cannot be overlooked. Smart packaging solutions must be able to expand and adapt without significant overhauls. This foresight in choosing scalable solutions can prevent future disruptions and additional costs. Loftware's labeling and connected packaging solution, for instance, is designed to accommodate growth, allowing for additional features and functionalities to be integrated as a company's needs expand.

Invest in support for future growth

Lastly, maintaining ongoing support and updates for new systems is crucial. Technology is continually advancing, and regulatory standards are frequently updated. IT teams should ensure that their chosen technology partners, like Loftware, provide continuous updates and support for their product solutions. This not only helps with keeping compliant with current laws and best practices but also secures them against emerging threats and technical issues.

Technology leaders play a pivotal role in ensuring that the integration of new connected packaging technologies goes beyond mere implementation. It is about strategically aligning them with the company's long-term goals for safety, efficiency, and consumer trust. By anticipating integration challenges and preparing accordingly, companies can ensure that the adoption of advanced smart packaging from companies like Loftware not only meets the current regulatory and market demands but also sets the stage for future innovations and improvements in food safety and transparency.

19.6%

FDA food recalls rose 19.6% in 2023 from 2022, with 2025 continuing to see frequent, high-profile cases involving contamination and undeclared allergens

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Future-proofing food safety and trust

In today's competitive food industry, the demand for transparency, traceability, and efficiency is more crucial than ever. This chapter aims to empower food producers by enhancing their product packaging practices, ensuring they not only meet but exceed the important contemporary standards for safety and consumer trust.

Imagine you are at the helm of a large-scale food production company. Your operations are vast and complex, involving numerous products where each follows its own unique journey from farm to table. Now, consider the impact of a smart labeling and packaging system that not only tracks each product efficiently but also integrates seamlessly with your existing processes. This is where advanced solutions like Loftware's come into play, offering a robust connected packaging framework for real-time visibility and consumer engagement with precision and ease.

Keep in mind, however, that adopting such advanced connected packaging is not just about implementing modern technologies but about understanding the strategic value they bring to your digital innovations and supply chain operations. As mentioned earlier, these track and trace capabilities provide real-time data that enhances decision-making and improves response times during critical situations, such as product recalls. By having detailed insight into every step of the supply chain, you can swiftly identify and address potential issues before they escalate, thereby safeguarding your brand's reputation and minimizing financial losses.

Managing, protecting, and connecting brands

Enhanced smart packaging solutions are not solely for crisis management but rather play a pivotal role in building and maintaining consumer trust. In an era where consumers are increasingly concerned about the origins and safety of their food, providing transparent product information can significantly boost consumer confidence. By allowing consumers to access detailed information about the products they purchase, you not only meet their expectations for transparency but also foster a stronger connection with your brand.

As we look to the future, the importance of robust product transparency and traceability technology will only continue to grow. Regulatory requirements are becoming stricter, and consumer

demand for transparency are at an all-time high. By embracing cohesive, efficient smart packaging solutions now, you are not just complying with current standards but also future-proofing your operations against upcoming changes and challenges.

Future-proof with smart food packaging

In conclusion, enhancing transparency with precise product traceability capabilities is not merely a regulatory necessity but a strategic advantage in today's market. By adopting and integrating advanced product identification and connected packaging solutions powered by the full scope and breadth of Loftware's, food producers can achieve greater operational efficiency, ensure compliance with safety standards, and build unwavering consumer trust. This proactive approach not only positions your business as a leader in food safety but also as a trusted brand that values transparency and quality above all — this is how a fully activated supply chain and connected packaging deployment can have on your global organization.



Ready to lead the future of food safety? Start your GS1 Digital Link journey today with Loftware's connected packaging solutions. [Contact an expert.](#)

Loftware is the global leader in product identification. Our cloud-based solutions power real-time collaboration, ensure compliance, improve authenticity, and deliver supply chain traceability from product development to consumer engagement. We provide scalable, data-driven labeling and packaging technologies that help companies boost speed to market, enhance efficiency, and connect physical products to digital experiences. Trusted by global brands and backed by over 40 years of innovation, Loftware supports customers across industries with offices in the US, UK, Slovenia, China, and Singapore.