

The State of Digital Disclosure and Smart Packaging

FOR THE CONSUMER PACKAGED GOODS INDUSTRY



KEY FINDINGS

92%

of Americans own
a smartphone (2025)

102.6M

U.S. users scanning
QR codes by 2026

100K+

products on SmartLabel
across 80+ companies



EXECUTIVE SUMMARY

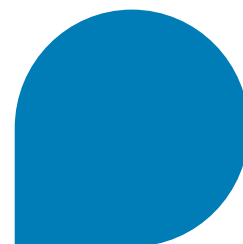
The State of Digital Disclosure and Smart Packaging for the CPG Industry

The consumer packaged goods (CPG) industry is navigating a profound shift in the way product information is stored, transmitted, regulated and consumed.

Driven by the complexities of globalized supply chains, evolving environmental and health regulatory frameworks, the proliferation of smartphones with just-in-time information and an unprecedented consumer demand for more information and transparency, the physical product label has outgrown its traditional roles. Historically serving as the main informational interface between the manufacturer and the consumer, the spatial limitations of traditional packaging provide constraints on the volume of data that manufacturers are able to provide at point of sale. Digital tools like Quick Response (QR) codes are a solution that allow manufacturers to provide consumers with robust additional details that go beyond the label; these include granular nutritional profiling, allergen warnings, supply chain traceability, packaging sustainability, sourcing histories, and a brand's corporate ethos.

In response, the CPG industry has rapidly accelerated the adoption of smart connected packaging, predominantly leveraging QR codes and two-dimensional (2D) barcodes to deliver comprehensive digital product information to the consumer. In fact, 2D barcodes have been so successful that GS 1, the organization that standardized the traditional linear barcode, introduced Sunrise 2027, a comprehensive industry-wide initiative to upgrade point-of-sale (POS) hardware and software systems to scan and process data-rich 2D barcodes seamlessly alongside traditional linear barcodes.

Further, Congress supported the use of smart packaging



The physical product label has outgrown its traditional roles.





EXECUTIVE SUMMARY

with the passage of the National Bioengineered Food Disclosure Standard in 2016. Industry supported and has welcomed the use of the QR code labels with hundreds of millions of units of consumer packaged goods, representing over a thousand brands and a hundred thousand products utilizing this technology [1]. We recognize that the U.S. Department of Agriculture (USDA) is now faced with a court order requiring it to revisit the regulation on digital disclosure and text message options. The basis of this conclusion rested on the fact that USDA was required by the law to show that the BE disclosures were accessible in a study [2]. However, the data that informed the study's finding of barriers to accessibility was based on a 2017 study which examined data reviewed in 2016 and includes cited references that date back as far as 2010 [2]. Today, the hurdles identified by the study the near-universal adoption of smartphones and the pervasive expansion of high-speed broadband networks have increasingly rendered such judicial concerns obsolete [3]. As such, we are providing data to support that the digital disclosure option is not inaccessible in 2026, thus potentially providing an expeditious pathway for a re-proposal of the rule by USDA.

This whitepaper provides a comprehensive, data-driven analysis that supports digital disclosure as the ultimate democratizing force in the modern omnichannel retail environment. By synthesizing the latest 2025 and 2026 data concerning broadband infrastructure expansion, mobile device adoption, consumer behavioral trends, and regulatory compliance, this it demonstrates how QR codes equipped with standardized routing protocols which actively resolve the limitations inherent in static physical labels. What's it showcases how QR codes bridge the critical gap between regulatory compliance and consumer education, establishing a newly interactive paradigm of corporate transparency.



"Digital disclosure [is] the ultimate democratizing force... establishing a newly interactive paradigm of corporate transparency."



The Evolution of Digital Labeling: Bioengineering Disclosure Act

In 2016, the National Bioengineered Food Disclosure Standard was passed to establish national uniform standards for Bioengineered Food Disclosure and to avoid a state patchwork of inconsistent laws [1]. This law permitted food manufacturers to disclose the presence of bioengineered (BE) or genetically modified organism (GMO) ingredients via a digital QR code rather than explicit on-package text [4]. However, a study required by the law, based on 2016 data and older, found that the digital disclosure option provided challenges to accessibility [2].

In 2022, the United States District Court for the Northern District of California, responding to a lawsuit brought by the National Grocers which challenged, amongst other things, the rules implementing the BE food Disclosure Standard [5], instructed the USDA to revise the rule to ensure that electronic or digital link disclosures are paired with an appropriate on-package element to address accessibility concerns [6]. On appeal, the Ninth Circuit Court of Appeals when considering the digital disclosure and text messaging options for displaying the BE information, determined that these regulations should be vacated on a reasonable timeline [7].

However, as mentioned below, today, nearly ten years after the 2017 study data was collected, current data is strong in support that the current BE disclosure regulation is accessible, given that broadband access has increased, smartphone usage has increased, and education about QR codes has increased, amongst other factors described in this whitepaper, to provide adequate knowledge to consumers. As the litigation regarding vacatur proceeds, USDA may be able to use this data to support finalizing the disclosure rule with the same QR code requirement under the BE rule [5].



The Challenge of Information Overload and Physical Labeling Limitations

The modern consumer is subjected to immense data saturation. Mandating that all pertinent product information reside exclusively in plain text on physical packaging for transparency ignores the psychological and practical realities of human information processing and leads directly to a phenomenon known as information overload [8]. According to academic research, when consumers are confronted with overly dense, text-heavy physical labels, overall comprehension decreases precipitously [8].

A May 2025 study conducted by the National Science Foundation (NSF) revealed a significant gap between consumer expectations and the efficacy of current physical labeling practices [9]. Physical labels force a zero-sum game upon CPG manufacturers. The spatial real estate allocated to a mandated regulatory warning takes space away from nutritional information, usage instructions, or sustainability narratives. Unyielding spatial constraint limits manufacturers' ability to convey necessary detail in the provided packaging space. Relying on complex alternative formats like interpretive Front-of-Package (FOP) labeling only exacerbates the information overload issue, ultimately frustrating consumers and defeating the purpose of the disclosure.

Digital disclosure resolves these spatial limitations. A QR code acts as a dynamic gateway, allowing the consumer to access information hierarchically. A shopper scanning a QR code can immediately view critical allergen information. Similarly, if the consumer wants to know the geographic origin of a particular ingredient or verify a fair-trade certification, the information can be readily available without limitation in the digital interface [10]. Digital platforms provide infinite real estate to translate complex supply chain data into digestible, consumer-friendly formats, fundamentally enhancing transparency [10].



“When consumers are confronted with overly dense, text-heavy physical labels, overall comprehension decreases precipitously, leading directly to a phenomenon known as information overload.”





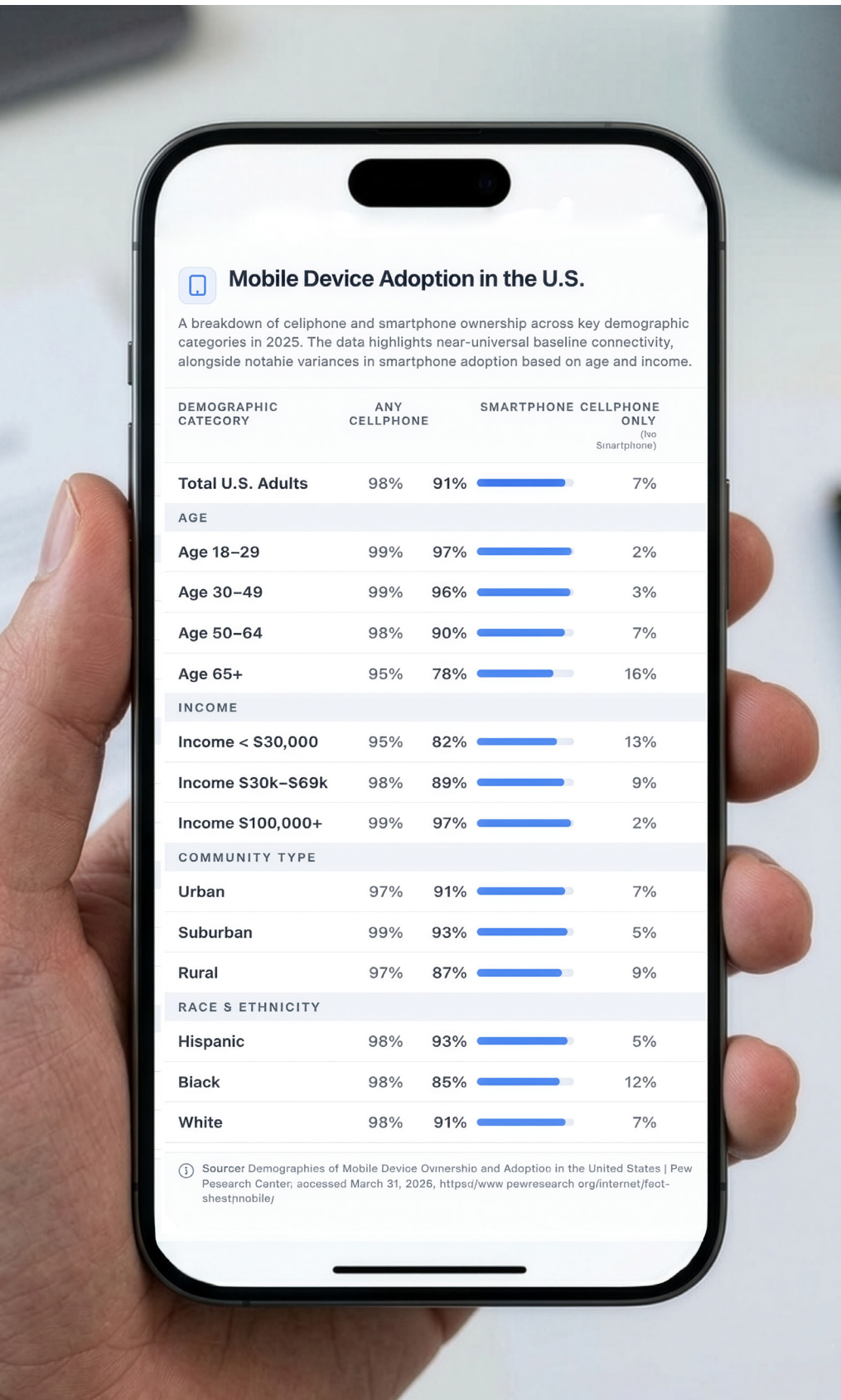
Eradicating the Digital Divide: Infrastructure and Device Adoption

The premise that millions of consumers lack the hardware or connectivity to use smart packaging, known as the “digital divide,” as digital technology was emerging was the primary constraint in the transition to digital labeling [3]. However, the empirical reality of digital technology in 2025 and 2026 demonstrates that aggressive federal broadband deployments and sweeping mobile adoption rates have largely mitigated these concerns.

Ubiquitous Smartphone Adoption Dynamics

Extensive demographic data published by the Pew Research Center in 2025 demonstrates that mobile connectivity has reached near-total saturation. As of mid-2025, an overwhelming 98% of Americans own a cellphone of some kind, and smartphone ownership has surged to 91%, up drastically from just 35% in 2011 [3]. A detailed demographic breakdown reveals that smartphone adoption is remarkably consistent across socio-economic, racial and geographic lines, ensuring wide accessibility for digital disclosures.

The hardware required to decode smart packaging is overwhelmingly present in the pockets of the American consumer, validating the mobile phone-first approach of digital disclosure. Thus, while Pew Research Center’s data indicates that 16% of U.S. adults are “smartphone-only” internet users—meaning they own a smartphone but do not have a traditional home broadband subscription—this demographic is still capable of scanning a QR code in a retail environment via cellular networks [3].



Mobile Device Adoption in the U.S.

A breakdown of cellphone and smartphone ownership across key demographic categories in 2025. The data highlights near-universal baseline connectivity, alongside notable variances in smartphone adoption based on age and income.

DEMOGRAPHIC CATEGORY	ANY CELLPHONE	SMARTPHONE	CELLPHONE ONLY (too Smartphone)
Total U.S. Adults	98%	91%	7%
AGE			
Age 18–29	99%	97%	2%
Age 30–49	99%	96%	3%
Age 50–64	98%	90%	7%
Age 65+	95%	78%	16%
INCOME			
Income < \$30,000	95%	82%	13%
Income \$30k–\$69k	98%	89%	9%
Income \$100,000+	99%	97%	2%
COMMUNITY TYPE			
Urban	97%	91%	7%
Suburban	99%	93%	5%
Rural	97%	87%	9%
RACE & ETHNICITY			
Hispanic	98%	93%	5%
Black	98%	85%	12%
White	98%	91%	7%

Source: Demographics of Mobile Device Ownership and Adoption in the United States | Pew Research Center, accessed March 31, 2026, <https://www.pewresearch.org/internet/fact-sheet/mobile/>



As of mid-2025, an overwhelming 98% of Americans own a cellphone of some kind, and smartphone ownership has surged to 91%, up drastically from just 35% in 2011.

Source: Pew Research Center, National Public Opinion Reference Survey, June 2025 [3]



The BEAD Program: Transforming the Rural Broadband Landscape

To address the remaining connectivity gaps—particularly in rural environments—the \$42.45 billion Broadband Equity, Access, and Deployment (BEAD) Program has transitioned into its critical execution phase in 2025 and 2026 [11]. Prioritizing unserved and underserved locations, the BEAD initiative is rapidly transforming the national digital landscape. By deploying fiber and alternative technology pathways, the program ensures that high-speed internet access—the foundational infrastructure for seamless in-store digital disclosure—is becoming a universal public utility, effectively closing the digital divide [11, 12, 13]. This expansion actively counsels in favor of smart packaging activation; as of March 2026, QR codes are being actively used within official NTIA Technical Assistance resources to provide stakeholders, state officials, and applicants with quick access to critical program data.

The Economics and Scale of U.S. QR Code Adoption

Early assumptions suggested that consumers might find QR codes burdensome, theorizing that shoppers would not take the time to pull out their devices and scan items in the grocery aisle. However, behavioral and economic data from 2025 and 2026 disproves this hypothesis [15]. The QR code has firmly transitioned from an experimental marketing novelty into a deeply embedded, high-intent interface for product discovery.

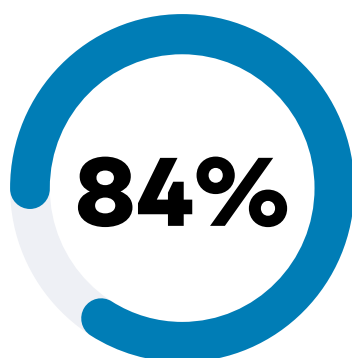


U.S. Market Valuation and Usage Projections

The economic footprint of the QR code ecosystem within the United States reflects its structural importance to modern commerce. The United States QR code market is projected to reach \$568.8 million by 2033 [14]. The volume of active QR code usage mirrors this financial growth. By 2026, it is projected that 102.6 million U.S. smartphone users will scan QR codes, revealing a steady climb in mainstream adoption and building upon the massive momentum seen in 2025, where 99.5 million U.S. smartphone users actively scanned QR codes [15]. Moreover, roughly 84% of smartphone users have scanned a QR code at least once, showcasing profound mainstream penetration [16].



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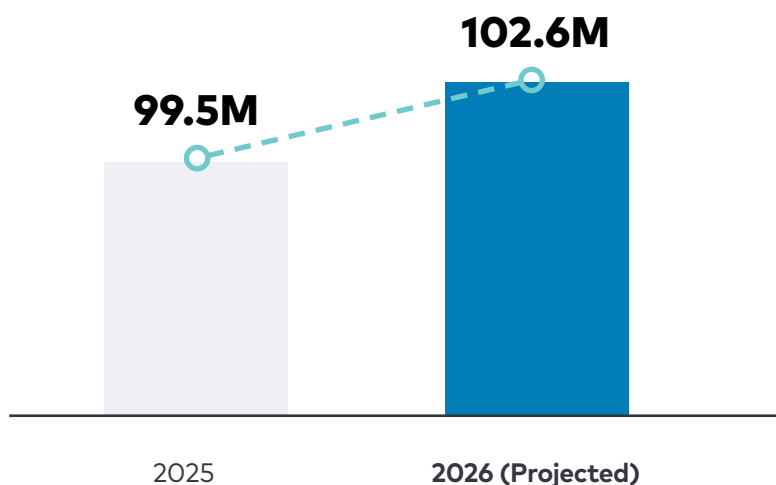
Mainstream Penetration

Roughly 84% of all smartphone users have scanned a QR code at least once.

Data reflects projections and historical records of United States smartphone users actively scanning QR codes. Source: ElectroIQ Statistics

U.S. Active Scanners

Active smartphone users scanning QR codes (in millions)



Key Insight: The steady climb reflects massive momentum, adding over 3 million new active scanners to reach 102.6 million by 2026.



CPG QR Code Integration and Dynamic Tracking

Within the CPG sector specifically, integration of QR codes is nearly absolute. By 2025, 92% of CPG brands had already adopted QR codes for their product packaging [17]. Crucially, the industry has shifted heavily toward the use of dynamic QR codes. Unlike static QR codes, which encode a destination URL directly into the visual pattern and cannot be altered, dynamic QR codes utilize a short redirect URL pointing to a backend server [15]. Dynamic codes provide marketers with “clean,” highly reliable data signals regarding consumer intent—meaning the data is free from third-party tracking interference and accurately reflects direct, authenticated consumer engagement. They allow brands to track scan volumes, the time of engagement, device types and geographic locations in real-time, enabling mid-flight campaign adjustments and instantaneous destination updates without the need to recall or reprint physical packaging [18, 19].

Consumer Behavior: The Omnichannel Reality

The modern shopping journey is no longer a linear path terminating at a physical shelf; it is a complex omnichannel experience. The Food Industry Association (FMI), in partnership with initiatives like SmartLabel, emphasizes this shift. FMI GroceryLab research indicates that omnichannel engagement—or the cohesive integration of the shopping experience across in-person and online touchpoints—has become the industry standard, with penetration exceeding 90% [20]. Consumers routinely blend their physical and digital shopping experiences, utilizing mobile devices in the aisles to inform physical purchases.

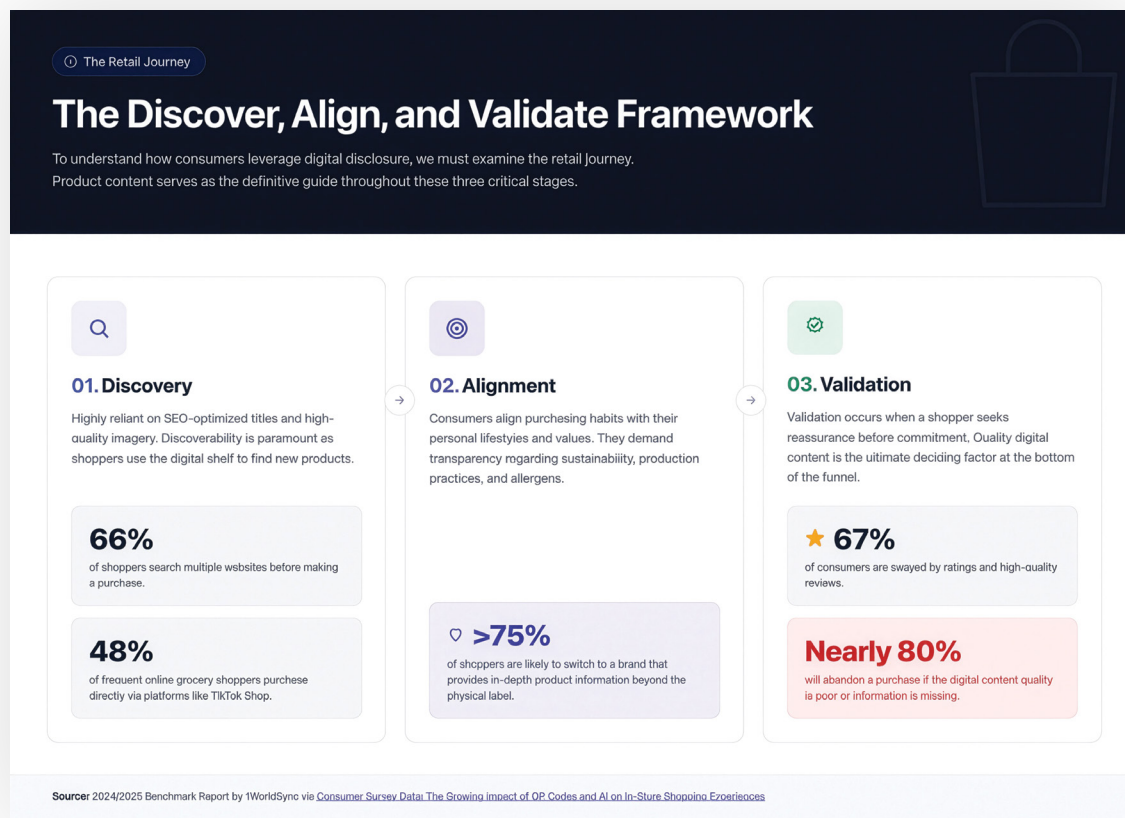




The Discover, Align, and Validate Framework

To understand how consumers leverage digital disclosure, one must examine the retail journey, which is categorized into three stages: Discovery, Alignment, and Validation [10]. According to a 2024/2025 benchmark report by 1WorldSync, a trusted data syndicator, product content is the definitive guide throughout this process [10].

QR codes act as the bridge between the physical product and this digital validation process. 1WorldSync data reveals that 64% of all consumers have scanned a QR code while shopping in a physical store, and this number jumps to 75% among frequent online grocery shoppers [10]. Shoppers use these codes to conduct price comparisons, read customer reviews and check nutritional information in real-time [10].





Post-Purchase Engagement and the Rise of AI

The utility of the QR code extends well beyond the point of sale. Post-purchase, 61% of all consumers (and 72% of frequent grocery shoppers) continue to interact with brands by scanning QR codes on products they have already purchased [10]. This allows consumers to access exclusive offers, user manuals, recipe tutorials and recycling instructions, fostering long-term, personalized brand loyalty [10].

Simultaneously, the integration of Artificial Intelligence (AI) is rewriting the rules of product discovery and consumer interaction. FMI data shows that consumer usage of AI tools surged dramatically from 30% to 59% in less than two years, with the segment of "regular users" growing nearly fourfold [20]. Currently, 50% of shoppers use AI for specific food-related tasks, such as generating recipes, researching nutrition facts, and meal planning [20]. 1WorldSync corroborates this, showing that 31% of shoppers (and 53% of those aged 25-34 years) use AI tools like ChatGPT or Google Gemini as personal shopping assistants in-store [10].

These personal AI assistants can seamlessly interface with digital data accessed via a QR code. For example, shoppers with specific dietary restrictions can scan a QR code, and their on-device AI can instantly analyze the extended ingredient list against their health profile to provide a personalized safety assessment. This level of granular transparency is functionally impossible without the structured digital data foundation provided by smart packaging.



The Business Case for Smart Packaging

The CPG industry is actively embracing smart packaging as a strategic imperative, demonstrating that the sector is moving decisively in this direction. In 2024, food retailers invested over \$10 billion in technology, averaging 1% of total sales, while suppliers allocated an even higher 1.5% of sales to digital transformation. [20]

This investment is fundamentally driven by the need for efficiencies and productivity in an era characterized by higher costs, tight profit margins, labor challenges, and supply chain unpredictability [20]. According to NielsenIQ's (NIQ) Consumer Outlook: Guide to 2026, manufacturers can no longer rely on the "pricing playbook" of endless price hikes to drive growth, as consumers are financially "tapped out" due to compounding inflation [21]. Future growth depends strictly on volume—capturing more shopping trips through sharper assortments, innovation and strategies that stretch discretionary dollars [21].

Smart packaging delivers direct Return on Investment (ROI) across multiple operational vectors:

- **Inventory Optimization and Traceability:** Brands are utilizing 2D barcodes to automate data capture for batch lot and serial information at the moment of scanning. This decreases dependency on manual data entry and enhances inventory precision in manufacturing spaces, warehouses and retail locations.
- **Targeted Recall Management:** In the event of a contamination issue, retailers are executing highly targeted recalls using advanced barcodes. Instead of pulling an entire product line from the shelves, POS systems automatically block the sale of specific compromised batches, mitigating massive financial losses and protecting the brand's reputation.



- Retail Media Networks (RMNs): Retailers like Amazon, Walmart and Target have already transformed their online real estate into comprehensive advertising platforms [21]. Brands are integrating digital disclosures with RMNs to capture the attention of potential customers during the decision-making process, delivering highly personalized, native advertising content [21].
- Reducing Packaging Costs: Companies are leveraging smart packaging to maintain a clean, minimalist physical aesthetic while digitally housing legally required multilingual disclosures and extended sustainability narratives [10].

Regulatory Compliance as a Catalyst for Digital Disclosure

As consumers demand a more robust description of the sourcing, ingredients, and additional substances in products, regulatory bodies at the state and federal level have implemented QR codes to provide these disclosures. Digital disclosures are becoming the de facto standard for compliance without destroying the aesthetic and functionality of product packaging.

Resolving the Risk of Narrative Contradictions

In the modern corporate governance landscape, “narrative contradictions”—instances where a brand’s physical label, its corporate sustainability report and its online marketing present conflicting data—are viewed as severe compliance risks [22]. Regulatory bodies, investors and stakeholders scrutinize corporate coherence [22]. Asset managers actively penalize incoherence, and divergent narratives can depress institutional ownership, heighten volatility and increase the cost of capital [22].



Static physical labels are susceptible to creating incongruencies. A minor formulation change or a sudden change in a supply chain vendor requires physical labels to be redesigned, approved, printed and redistributed—a process that can take months or even years [22]. Dynamic QR codes can help mitigate this risk. Digital labels can be updated instantaneously, ensuring every scan delivers the most accurate, real-time information, thereby aligning the product's physical packaging with its digital destination [18].

The Embrace of Digital Disclosures by State Regulators

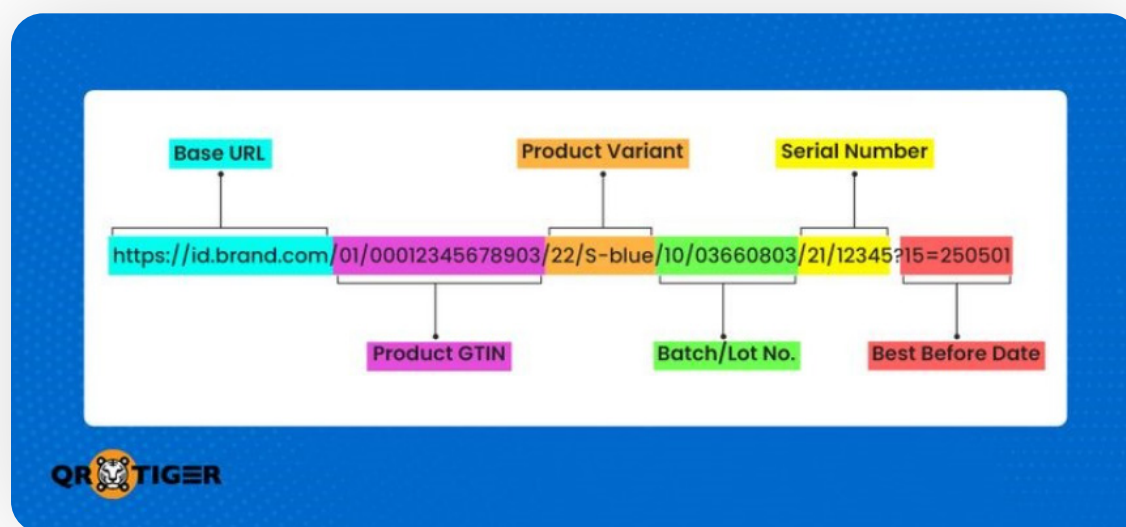
State legislatures and industry associations recognize that QR codes are essential tools for transparency and disclosure. Industry created digital standards like SmartLabel® leverage QR codes to comply with multiple state regulations, such as California's SB258 (Cleaning Products Right to Know Act) and AB 1989 (Menstrual Products Right to Know Act) [23]. Operated by the Consumer Brands Association, SmartLabel has been adopted across the CPG industry as a trusted digital compliance standard. Today, more than 80 major companies use SmartLabel, representing over 1,000 brands and more than 100,000 individual products and is used by millions of consumers each year.

Stringent state food safety laws that mandate the use of QR codes demonstrate the efficacy of digital disclosure tools like SmartLabel. For example, Louisiana's recent disclosure law requires food products that contain any of 44 specified ingredients—including additives such as Aspartame, Sucralose, Red dyes 3 and 40 and BHA—to digitally disclose the ingredients. To comply, manufacturers must place a QR code on the label, accompanied by text informing consumers that scanning the code reveals ingredient information. The QR code must link directly to a manufacturer-controlled webpage—SmartLabel meets this requirement—that prominently features the disclosure, together with a statement that directs users to the Food and Drug Administration's (FDA) official food chemical safety page [24].



GS1 Sunrise 2027: The Global Transition to 2D Barcodes

The GS1 Sunrise 2027 initiative is the ultimate validation of digital disclosure as a permanent, industry-wide standard. For decades, the global supply chain has relied on the one-dimensional (1D) Universal Product Code (UPC) and European Article Number (EAN) [25]. However, the 1D barcode is limited in its architecture; it typically encodes only a Global Trade Item Number (GTIN), functioning merely as a static price lookup tool at the checkout register [25].



To address the mounting demands for traceability, authentication and consumer transparency, the global retail industry and the global standards body GS1, have established 2027 as the target date by which all retail POS systems must be capable of scanning and processing 2D barcodes (such as QR codes and DataMatrix), which replace the UPC barcode [25].

This transition is powered by the revolutionary GS1 Digital Link standard [26]. Unlike a traditional static QR code that points to a single marketing webpage, a 2D barcode powered by GS1 Digital Link connects a product's unique identity (its GTIN, plus application identifiers for serialized data) to a structured web URL, creating a powerful "single-carrier" solution that is inherently context-aware.



The Digital Link standard ensures that a single 2D barcode serves multiple purposes based on the scanning context: if a consumer scans the code with a smartphone, they are routed to a dynamic digital disclosure page featuring product information; if a retailer scans the exact same code with a POS scanner, the system processes pricing, tracks inventory and can check for batch-specific expiration or recall data [26].

Evolution of Product Identification

A capability comparison between traditional 1D barcodes and modern 2D GS1 Digital Link QR codes. As retail demands increase, the limitations of standard UPC/EANs are being overcome by high-capacity, multi-functional 2D standards.

FEATURE CAPABILITY	1D Barcode UPC / EAN	2D Barcode GS1 DIGITAL LINK QR
Data Capacity	Highly Limited (GTIN / Product ID only)	Infinite (GTIN, Batch, Expiry, Serial, URLs)
Consumer Engagement	None. Requires separate tools.	Direct smartphone scanning to multimedia
Traceability & Recalls	Requires manual lot tracking and removal	Automated batch/serial tracking for surgical recalls
Physical Space Efficiency	High physical space requirement	Compact, frees up primary packaging design
POS Functionality	Horizontal laser scanning only	Omnidirectional, camera-based scanning
Authentication	Easily duplicated	Real-time product authenticity verification

Research indicates vast industry support for the transition from 1D to 2D barcodes. A 2020 GS1 US study found that 82% of retailers and 92% of brand owners support moving from the standard UPC to data-rich 2D [27]. The benefits of 2D barcodes for consumers are compelling: 79% of shoppers are more likely to purchase a product featuring a 2D QR code that unlocks more information, and 62% are willing to spend a premium for products that offer this elevated level of transparency.



The "Legitimacy Premium" and Consumer Shopping Priorities

Transparency and ethical sourcing are no longer peripheral concerns; they are core drivers of modern purchasing behavior. Market data demonstrates that 73% of consumers are willing to pay more for products that provide complete transparency regarding ingredients and sourcing practices, while 86% rank product traceability as extremely or very important [28]. Savvy consumers, particularly Gen Z (74%) and Millennials (79%), are investigating supply chains and questioning manufacturing practices, demanding to know the authentic "story" behind their food [28].

Key Consumer Shopping Priorities

Factors rated as "Extremely" or "Very Important" by consumers when making purchasing decisions. While price remains the ultimate driver, product information accessibility and accuracy heavily influence consumer choices.

PRIORITY FACTOR	IMPORTANCE	% RATING
Price		90%
Accurate and up-to-date product information		82%
Detailed product information		75%
Health benefits		69%
Clean Label (Ingredient clarity)		57%
Easy access to product info (e.g., scanning QR)		51%
Allergen information		50%
Brand name		41%
Sustainability and eco-friendly labels		38%
Recyclability labels		37%



Deep digital transparency plays a direct role in building brand equity and consumer trust. Academic research on corporate Environmental, Social, and Governance (ESG) disclosures identifies this effect as the “legitimacy premium.” [29] When brands proactively use digital platforms to disclose rich, verifiable supply chain data, they can effectively address consumer concerns about “greenwashing”—the practice of making unsubstantiated or misleading environmental claims [29]. While price remains the paramount driver for consumers, the demand for accurate, detailed and easily accessible information follows closely behind [10]. QR codes serve as the optimal vehicle to deliver on these secondary and tertiary priorities. By shifting complex product information to a digital environment, brands can maintain a clean, uncluttered packaging aesthetic while delivering deeper value to inquisitive consumers—building trust and loyalty in ways that on-pack labels can no longer achieve [10].



Conclusion

In today's consumer market, QR codes and digital disclosures are essential instruments for transparency. Judicial decisions limiting digital-only disclosures, particularly in the case of bio-engineered foods, were based on outdated data which showed the existence of a persistent and exclusionary digital divide [4]. That premise, however, is no longer supported by empirical reality [3]. Widespread smartphone adoption and near-ubiquitous high-speed internet access have fundamentally transformed how consumers access information, effectively eradicating the accessibility barriers cited in earlier litigation [3]. If USDA were to survey the accessibility of the digital disclosure option in its regulation today, this data supports that a different conclusion would be reached. In contrast, continued reliance on physical-only labeling increasingly creates a retail environment characterized by information overload, spatial restrictions, delayed safety notifications and inherent regulatory inconsistencies [8, 22].

A summary of empirical data presented in this report:

- The Infrastructure is Universal: With **91% smartphone adoption** across all major demographics, age and income brackets, coupled with massive federal investments bridging the rural broadband divide, the hardware and network prerequisites for digital disclosure are universally established [2, 11].
- The Consumer is Highly Engaged: QR code scanning is a normalized, high-intent behavior. With projections showing more than **102.6 million U.S. smartphone users scanning codes by 2026**, consumers are using these digital gateways to uncover product truths, validate reviews and ensure ethical sourcing [15, 16].
- The Regulations are Converging: State governments such as California, Louisiana, and Maryland **are incorporating digital disclosures as a required method to display** contaminant testing results or additional ingredient information to consumers, proving that QR codes are useful tools for compliance [23, 24].

- The Industry is Standardizing for the Future: The GS1 Sunrise 2027 initiative ensures that 2D barcodes powered by the GS1 Digital Link will act as a unified, global key. This transition unlocks POS efficiency, automates inventory and recall management and simultaneously provides a dedicated channel for unprecedented consumer transparency and trust [25, 26].

Smart packaging liberates vital product data from the physical confines of cardboard and plastic. By strategically transitioning to 2D barcodes and standardized digital disclosures, the CPG industry is empowering consumers with real-time, interactive and verifiable information. The QR code is the foundational architecture of a transparent, accountable and consumer-centric future.





Works Cited

[1] National Bioengineered Food Disclosure Standard, Pub. L. No. 114-216, 130 Stat. 834 (2016). <https://www.congress.gov/114/plaws/publ216/PLAW-114publ216.pdf>

[2] DELOITTE, Study of Electronic or Digital Link Disclosure: A Third-Party Evaluation of Challenges Impacting Access to Bioengineered Food Disclosure, U.S. DEPT OF AG. (July 2017), <https://www.ams.usda.gov/sites/default/files/media/USDADeloitteStudyofElectronicorDigitalDisclosure20170801.pdf>

[3] Pew Research Center. "Demographics of Mobile Device Ownership and Adoption in the United States." 2025. <https://www.pewresearch.org/internet/fact-sheet/mobile/>

[4] Center for Food Safety. "Court Rules QR Codes Alone Unlawful for GMO Food Labeling." 2022. <https://www.centerforfoodsafety.org/press-releases/6714/court-rules-qr-codes-alone-unlawful-for-gmo-food-labeling>

[5] 7 C.F.R. §§ 66.106–66.108. (2018). Electronic Code of Federal Regulations. Retrieved May 5, 2026, from <https://www.ecfr.gov> at <https://www.ecfr.gov/current/title-7/subtitle-B/chapter-I/subchapter-C/part-66/subpart-B/section-66.106>

[6] *Natural Grocers v. Vilsack*, 627 F.Supp.3d 1130 (N.D.Cal., 2022).

[7] *Natural Grocers v. Rollins*, Ninth Circuit Court of Appeals, No. 22-16770 D.C. No. 3:20-cv05151-JD, decided October 31, 2025. <https://cdn.ca9.uscourts.gov/datastore/opinions/2025/10/31/22-16770.pdf>

[8] PMC. "Knowledge, perception, and practical understanding of food labels: A cross-sectional study among Bangladeshi consumers." 2024. <https://pmc.ncbi.nlm.nih.gov/articles/PMC11521752/>

[9] NSF. "NSF Research Shows Americans Demand Greater Clarity and Standardization in Food Labeling." May 14, 2025. <https://www.nsf.org/news/americans-demand-greater-clarity-standardization-food-labeling>

[10] 1WorldSync. "Consumer Survey Data: The Growing Impact of QR Codes and AI on In-Store Shopping Experiences." 2024/2025.

[11] FCC. "Broadband Data Collection Shows Access to High-Speed Internet Services is Expanding!" 2025. <https://www.fcc.gov/news-events/blog/2025/05/20/broadband-data-collection-shows-access-high-speed-internet-services>

[12] Pew Research. "Demand for Broadband Workforce Expected to Rise to Meet BEAD Requirements." 2025. <https://www.pew.org/en/research-and-analysis/issue-briefs/2025/10/demand-for-broadband-workforce-expected-to-rise-to-meet-bead-requirements>



[13] National OnDemand, Inc. "How BEAD Is Definitively Transforming Broadband Access." <https://nationalondemand.com/federal-bead-program/>

[14] Digital Journal. "QR Code Labels Market in USA Is Expected To See a growth of 5.4%..." <https://www.digitaljournal.com/pr/news/qr-code-labels-market-in-usa-is-expected-to-see-a-growth-of-5-4-with-us-568-8-million-by-2033>

[15] ElectroIQ. "QR Code Statistics By Usage and Facts (2025)." <https://electroiq.com/stats/qr-code-statistics/>

[16] barKoder. "30 Shocking QR Code Stats You Need to Know (2025)." <https://barkoder.com/blog/30-shocking-qr-code-statistics-you-need-to-know-in-2025>

[17] QrTiger. "53 QR Code Adoption Rate Stats You Need to Know in 2026." <https://www.qrcode-tiger.com/qr-code-adoption-rate>

[18] Philomathnews. "QR codes in 2025: How the latest trends are reshaping customer engagement." <https://philomathnews.com/qr-codes-in-2025-how-the-latest-trends-are-reshaping-customer-engagement/>

[19] Scanbuy. "QR Code Engagement: Turning Consumer Curiosity into Measurable Marketing Impact." <https://scanbuy.com/blog/2025/12/qr-code-engagement-turning-consumer-curiosity-into-measurable-marketing-impact>

[20] FMI. "Digital Engagement Transforms Grocery Shopping 2026." <https://www.fmi.org/blog/view/fmi-blog/2026/04/29/digital-engagement-is-transforming-grocery-shopping>

[21] NIQ. "Consumer Outlook: Guide to 2026." <https://nielseniq.com/global/en/insights/report/2025/consumer-outlook-guide-to-2026/>

[22] Harvard Law School Forum on Corporate Governance. "Narrative Contradictions." <https://corpgov.law.harvard.edu/2025/09/13/narrative-contradictions-the-invisible-governance-risk/>



[23] Hogan Lovells LLP. "Texas and Louisiana Enact Laws Requiring Warning Labels and QR Code Notices for Food Ingredients" <https://www.hoganlovells.com/en/publications/texas-and-louisiana-enact-laws-requiring-warning-labels-and-qr-code-notices-for-food-ingredients->

[24] Louisiana State Legislature. "Laws Requiring Warning Labels and Digital Disclosures for Consumable Products." <https://www.legis.la.gov/legis/BillInfo.aspx?s=25rs&b=SB14>

[25] GS1 US. "2D Barcodes at Retail Point-of-Sale Implementation Guideline" / "Sunrise 2027 guideline." <https://ref.gs1.org/guidelines/2d-in-retail/1.0.0/GS1-2DRetailPOS-Guideline-i1.0-r-2024-05-28>

[26] GS1 US. "GS1 Digital Link for Product URLs." <https://www.gs1us.org/industries-and-insights/standards/gs1-digital-link>

[27] GS1. "Compliance for 2D barcodes at Point of Sale (POS)." <https://www.gs1.org/industries/retail/solution-provider-2d-readiness>

[28] Atomix Logistics. "Why Transparency and Ethical Sourcing are Non-Negotiable for CPG Brands." <https://www.atomixlogistics.com/blog/cpg-brands-transparency-ethical-sourcing>

[29] Journal of Marketing & Social Research. "The Legitimacy Premium: How Mandatory ESG Disclosure Laws Reshape Brand Perception and Consumer Trust." <https://www.jmsr-online.com/article/the-legitimacy-premium-how-mandatory-esg-disclosure-laws-reshape-brand-perception-and-consumer-trust-439/>

[3] Pew Research Center. "Demographics of Mobile Device Ownership and Adoption in the United States." 2025. <https://www.pewresearch.org/internet/fact-sheet/mobile/>

[4] Center for Food Safety. "Court Rules QR Codes Alone Unlawful for GMO Food Labeling." 2022. <https://www.centerforfoodsafety.org/press-releases/6714/court-rules-qr-codes-alone-unlawful-for-gmo-food-labeling>



- [5] 7 C.F.R. §§ 66.106–66.108. (2018). Electronic Code of Federal Regulations. Retrieved May 5, 2026, from <https://www.ecfr.gov> at <https://www.ecfr.gov/current/title-7/subtitle-B/chapter-I/subchapter-C/part-66/subpart-B/section-66.106>
- [6] *Natural Grocers v. Vilsack*, 627 F.Supp.3d 1130 (N.D.Cal., 2022).
- [7] *National Grocers v. Rollins*, Ninth Circuit Court of Appeals, No. 22-16770 D.C. No. 3:20-cv05151-JD, decided October 31, 2025. <https://cdn.ca9.uscourts.gov/datastore/opinions/2025/10/31/22-16770.pdf>
- [8] PMC. "Knowledge, perception, and practical understanding of food labels: A cross-sectional study among Bangladeshi consumers." 2024. <https://pmc.ncbi.nlm.nih.gov/articles/PMC11521752/>
- [9] NSF. "NSF Research Shows Americans Demand Greater Clarity and Standardization in Food Labeling." May 14, 2025. <https://www.nsf.org/news/americans-demand-greater-clarity-standardization-food-labeling>
- [10] 1WorldSync. "Consumer Survey Data: The Growing Impact of QR Codes and AI on In-Store Shopping Experiences." 2024/2025.
- [11] FCC. "Broadband Data Collection Shows Access to High-Speed Internet Services is Expanding!" 2025. <https://www.fcc.gov/news-events/blog/2025/05/20/broadband-data-collection-shows-access-high-speed-internet-services>
- [12] Pew Research. "Demand for Broadband Workforce Expected to Rise to Meet BEAD Requirements." 2025. <https://www.pew.org/en/research-and-analysis/issue-briefs/2025/10/demand-for-broadband-workforce-expected-to-rise-to-meet-bead-requirements>
- [13] National OnDemand, Inc. "How BEAD Is Definitively Transforming Broadband Access." <https://nationalondemand.com/federal-bead-program/>
- [14] Digital Journal. "QR Code Labels Market in USA Is Expected To See a growth of 5.4%..." <https://www.digitaljournal.com/pr/news/qr-code-labels-market-in-usa-is-expected-to-see-a-growth-of-5-4-with-us-568-8-million-by-2033>



- [15] ElectroIQ. "QR Code Statistics By Usage and Facts (2025)." <https://electroi.com/stats/qr-code-statistics/>
- [16] barKoder. "30 Shocking QR Code Stats You Need to Know (2025)." <https://barkoder.com/blog/30-shocking-qr-code-statistics-you-need-to-know-in-2025>
- [17] QrTiger. "53 QR Code Adoption Rate Stats You Need to Know in 2026." <https://www.qrcode-tiger.com/qr-code-adoption-rate>
- [18] Philomathnews. "QR codes in 2025: How the latest trends are reshaping customer engagement." <https://philomathnews.com/qr-codes-in-2025-how-the-latest-trends-are-reshaping-customer-engagement/>
- [19] Scanbuy. "QR Code Engagement: Turning Consumer Curiosity into Measurable Marketing Impact." <https://scanbuy.com/blog/2025/12/qr-code-engagement-turning-consumer-curiosity-into-measurable-marketing-impact>
- [20] FMI. "Digital Engagement Transforms Grocery Shopping 2026." <https://www.fmi.org/blog/view/fmi-blog/2026/04/29/digital-engagement-is-transforming-grocery-shopping>
- [21] NIQ. "Consumer Outlook: Guide to 2026." <https://nielseniq.com/global/en/insights/report/2025/consumer-outlook-guide-to-2026/>
- [22] Harvard Law School Forum on Corporate Governance. "Narrative Contradictions." <https://corpgov.law.harvard.edu/2025/09/13/narrative-contradictions-the-invisible-governance-risk/>
- [23] Hogan Lovells LLP. "Texas and Louisiana Enact Laws Requiring Warning Labels and QR Code Notices for Food Ingredients" <https://www.hoganlovells.com/en/publications/texas-and-louisiana-enact-laws-requiring-warning-labels-and-qr-code-notices-for-food-ingredients->
- [24] Louisiana State Legislature. "Laws Requiring Warning Labels and Digital Disclosures for Consumable Products." <https://www.legis.la.gov/legis/BillInfo.aspx?s=25rs&b=SB14>



[25] GS1 US. "2D Barcodes at Retail Point-of-Sale Implementation Guideline" / "Sunrise 2027 guideline." <https://ref.gs1.org/guidelines/2d-in-retail/1.0.0/GS1-2DRetailPOS-Guideline-i1.0-r-2024-05-28>

[26] GS1 US. "GS1 Digital Link for Product URLs." <https://www.gs1us.org/industries-and-insights/standards/gs1-digital-link>

[27] GS1. "Compliance for 2D barcodes at Point of Sale (POS)." <https://www.gs1.org/industries/retail/solution-provider-2d-readiness>

[28] Atomix Logistics. "Why Transparency and Ethical Sourcing are Non-Negotiable for CPG Brands." <https://www.atomixlogistics.com/blog/cpg-brands-transparency-ethical-sourcing>

[29] Journal of Marketing & Social Research. "The Legitimacy Premium: How Mandatory ESG Disclosure Laws Reshape Brand Perception and Consumer Trust." <https://www.jmsr-online.com/article/the-legitimacy-premium-how-mandatory-esg-disclosure-laws-reshape-brand-perception-and-consumer-trust-439/>