GS1 case study

Driving end-to-end visibility and efficiency in India's dairy supply chain

India's dairy sector is driving its digital transformation with GS1 standards, enhancing visibility, efficiency, safety and trust. Interoperable data sharing and scalable traceability across the supply chain now provide consumers with transparency.

Ensuring transparency from farm to fork

Village (Farmers) — Milk Pooling Points — Bulk Collection Center — Processing Plants — Distribution — Retail

Challenge

India's dairy industry faces issues like information-sharing gaps and fragmented data-sharing. These obstacles reduce transparency and limit the ability of systems to meet the growing demand for trusted product information and a more secure, efficient and reliable supply chain.

Solution

GS1 India, with The Gates Foundation, Mother Dairy, UCDF Ltd. and the Department of Animal Husbandry & Dairying, implemented a GS1-based traceability system which tracks products from livestock health and milk sourcing to butter and ghee production.

Benefits

The GS1-powered traceability system drives digital transformation, improves efficiency and builds consumer trust. It strengthens India's dairy supply chain by ensuring consistent product identity, supporting export compliance and accelerating the adoption of GS1 standards across the sector.

With GS1-powered traceability, India's dairy industry is setting new benchmarks for supply chain visibility and efficiency. This innovative approach enables stakeholders at every level, from farmers to consumers, to track, trace and trust the journey of dairy products, building a more sustainable and secure agrifood system.

India's dairy sector plays a crucial role in feeding over a billion people, producing 240 million tonnes of milk annually. Despite this scale, however, until recently, the industry lacked a consistent, secure way to trace products from cow to consumer.

The dairy supply chain is vast and complex, involving numerous small-scale farmers, multiple intermediaries and various processing units. This fragmentation leads to inefficiencies, higher operational costs and difficulties in maintaining product quality and safety. Many dairy products cannot be traced back to their origins, making it challenging to identify and address issues such as contamination, spoilage or fraud.

To meet growing consumer demand for authentic and safe dairy products, the industry required a robust, transparent traceability system that would enhance trust, ensure food safety and streamline operations.

A unified and collaborative effort

To address this need, **GS1 India**, in collaboration with key partners including The Gates Foundation, the Department of Animal Husbandry and Dairying (under the Ministry of Animal Husbandry, Dairying and Fisheries, Government of India), Mother Dairy, Maahi Milk Producer Company Ltd and the Uttarakhand Cooperative Dairy Federation (UCDF Ltd.), worked together to implement an innovative livestock traceability system.

One traceability system was rolled out with Mother Dairy in the Gir Region of Gujarat, home to approx 10,000 farmers and approx 20,000 cows renowned for their nutrient-rich milk. GS1 standards were used throughout the supply chain, from livestock health and milk sourcing to the transformation of milk into butter and ghee.

Another traceability system involved the UCDF Ltd. and their premium Aanchal brand ghee made from Badri cows. Deploying traceability for this high-in-demand niche product demonstrated that the GS1 traceability framework is agnostic to scale.

Both systems empower consumers with transparent, trustworthy product information while helping producers enhance their supply chains. Additionally, they help protect the image and heritage of Gir and Badri cows and support high-quality milk production.

"Trust travels with data"

How GS1 standards make traceability possible

GS1 enables global traceability by providing a common language for supply chains, allowing systems to seamlessly communicate across various stakeholders. This ensures that each supply chain partner can choose the solution that best fits their needs, while knowing their investments are protected through interoperability.

At the heart of GS1 traceability solutions is the **EPCIS standard**, which records critical supply chain events, ensuring data accuracy, smooth interoperability and increased digitalisation. EPCIS answers the "what, when, where, why, and how" of products, capturing essential information like batch numbers, processing dates and shipment details. This standard not only enables real-time access to product status and location but also ensures that the data is easily shared between systems, from internal processes to external partners.
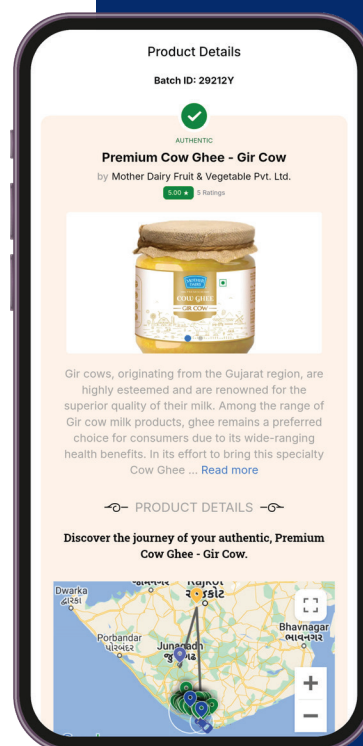
Additionally, GS1's unique identifiers, such as **GS1 GTINs** and **GS1 GLNs**, provide a robust framework for tracing products and locations. With **QR codes powered by GS1**, consumers can scan packaging to access detailed, real-time product information, enhancing transparency and trust.

Blockchain technology can be used in association with GS1 standards to create secure, verifiable data records. Together, they can enhance traceability - although GS1 standards alone are fully capable of providing a robust, proven framework for seamless data exchange and transparency in the dairy industry.

Tracking items, locations and events

In the Indian dairy supply chain, every step from cattle to consumer is carefully tracked to ensure transparency and product integrity.

GS1 standards define key traceable items and locations, allowing stakeholders to follow the journey of dairy products with clarity and confidence. These include:

- **Cattle:** Health records, identification and milking events
- **Milk:** Collection, pooling, chilling and transportation
- **Dairy products:** Butter and ghee processing and packaging
- **Locations:** Milk pooling points, bulk chilling units, processing plants

To achieve full visibility, critical events along the supply chain, known as Critical Tracking Events (CTEs), are also recorded and shared. These events represent key moments in the dairy product's journey, such as collection, chilling, shipping, processing and packaging. Each of these events is further described with Key Data Elements (KDEs), which are specific details like batch numbers, processing dates and transport times. For example:

- **Transformation events:** Raw milk to butter, butter to ghee
- **Transaction events:** Receipt and dispatch at each node in the supply chain
- **Location events:** Movement of milk through pooling and chilling plants
- **Packaging events:** Products are labeled with GS1 barcodes or QR Codes with GS1 Digital Link

> **GS1 standards provide a globally recognised framework for product and location identification, ensuring seamless interoperability across supply chains and building trust in product authenticity.**

It all builds on GS1's unique identifiers

At the core of India's dairy traceability systems are **GS1 Global Trade Item Numbers (GTINs)** and **GS1 Global Location Numbers (GLNs).**

Both Mother Dairy and Aachal are leveraging GTINs to strengthen product identity and trust. An initial pilot at Mother Dairy focused on ghee but highlighted opportunities to extend consistent product identification across a broader product range, including both retail-facing items (e.g. milk, butter) and intermediary products used in processing.

Looking forward, GTIN-linked product data will support export validation by enabling importing countries to verify product details, brand legitimacy and country of origin—enhancing regulatory compliance and trade efficiency.

In addition to GTINs, GLNs are used to unlock location-level transparency. The traceability systems cover a variety of source locations, including villages and processing units. Scalable, standardised location identifiers like GLNs uniquely identify each point in the supply chain, supporting full visibility and data interoperability across systems and stakeholders.

As more Indian dairy companies join the network, GLNs will enable precise tracking of product origin and handling. This will also support export compliance by allowing importing countries to verify sourcing from disease-free or deforestation-free zones, bolstering trust in cross-border trade.

> **GTIN and GLN data support export validation, allowing importing countries to verify product details, brand legitimacy and country of origin. This helps enhance regulatory compliance and facilitates smoother cross-border trade, benefiting India's dairy industry in global markets.**

Empowering consumers with real-time product information

The traceability system also uses QR Codes with GS1 Digital Link, which provide consumers with easy access to real-time, detailed product information, enhancing transparency and trust.

By simply scanning the QR Code on the packaging, consumers can instantly view the product's full journey from farm to fork. That's because the GS1 GTIN inside the QR code contains vital details, such as:

- Source farm and animal identity
- Milk procurement and transportation timeline
- Processing dates and packaging details
- Manufacturing locations
- Batch-level traceability data

Thanks to QR codes with GS1 Digital Link, consumers can scan packaging to access detailed product information, including sourcing, processing and certifications. This level of transparency strengthens consumer confidence in the safety and authenticity of the products they purchase.

This transparency ensures that each batch of dairy products meets the highest standards of purity, safety and quality. It gives buyers confidence that the product is genuinely made from Gir or Badri cow milk as claimed, while meeting stringent safety and quality standards.

The traceability system not only benefits consumers but also empowers farmers, distributors and retailers across the supply chain by allowing them to track, trace and authenticate every product in real-time. This end-to-end visibility fosters greater confidence in the dairy industry's ability to deliver high-quality, safe and authentic products to consumers.

The role of Verified by GS1 in scaling dairy traceability

As India's dairy sector looks to expand its traceability efforts, Verified by GS1 (VbG) offers a powerful foundation to extend trust, transparency and data consistency across the supply chain.

Verified by GS1 enables brand owners to share trusted product attributes—such as sourcing claims, certifications, and processing details—with downstream partners and consumers. Each item, like a unit of ghee, can be uniquely identified and connected to a reliable source, with verified data made dynamically available through QR Codes powered by GS1 Digital Link. This approach helps ensure that the information presented at the point of scan is accurate, current, and credible.

Verified by GS1 supports brand protection and encourages innovation across the industry by helping ensure the authenticity of product data throughout the supply chain. By linking products to verified sources, it improves the accuracy and reliability of the information shared with consumers and stakeholders. This increased transparency helps build trust and confidence.

Setting a new standard for dairy supply chain visibility

The GS1-powered traceability system, implemented in collaboration with key industry partners, has set a new standard for visibility and efficiency in India's dairy sector. Mother Dairy's Premium Cow Ghee and Aanchal Badri Cow Ghee now serve as world class examples of traceable, premium products that meet high standards of safety, quality and authenticity.

Through the use of GS1 standards and services—and in particular GTINs, GLNs, QR Codes with GS1 Digital Link and Verified by GS1—the system ensures that every product is transparent, authentic and easy to trace, building consumer confidence and improving operational efficiency. This initiative not only strengthens the brand integrity of Mother Dairy and UCDF but also provides the entire dairy industry with a scalable and replicable model for traceability.

The impact extends beyond traceability: the system also supports sustainability goals by ensuring responsible sourcing and protecting the heritage of traditional cow breeds. This project highlights the critical role of digital transformation in driving growth and operational excellence across the dairy industry.

With GS1 standards at its core, India's dairy sector is poised for sustainable growth, empowering farmers processors, brand owners, retailers and consumers while ensuring long-term brand protection and industry-wide innovation.

Successfully traced as of April 2025:

- 10 million liters of cow milk
- 6,000 liters of premium cow ghee
- 200,000 kilograms of cow butter

About Mother Dairy

Mother Dairy, established in 1974 under the National Dairy Development Board's (NDDB) Operation Flood initiative, is one of India's most trusted dairy brands. It was an initiative under Operation Flood, the world's biggest dairy development program, launched to make India a milk-sufficient nation. Over the years, Mother Dairy has contributed significantly to achieving this objective through a series of innovations and programs. Today, Mother Dairy manufactures, markets, and sells milk and milk products, including cultured products, ice creams, paneer, and ghee, under the Mother Dairy brand. The company also has a diversified portfolio with products in edible oils, fruits and vegetables, frozen vegetables, pulses, and processed food like fruit juices and jams to meet the daily requirements of every household. The company is committed to ensuring food safety, authenticity and consumer trust through rigorous quality standards and innovation.

www.motherdairy.com

About Uttarakhand Cooperative Dairy Federation

Uttarakhand Co-operative Dairy Federation Ltd. (UCDF Ltd.) is an apex-level state federation of district Milk Co-operative Unions in the state of Uttarakhand. They were established in 2001 to ensure sustainable prosperity for rural milk producers, fostering a self-reliant and empowered dairy ecosystem. Aanchal is known as the Dairy Cooperative brand of Uttarakhand.

https://ucdfaanchal.com

About GS1 India

GS1 India is a neutral, non-profit standards organisation set up by the Ministry of Commerce and Industry, Government of India, along with leading industry bodies and trade associations. GS1 India develops and implements standards for supply chains to improve efficiency, traceability and transparency across sectors. GS1 India promotes barcode adoption and enables streamlined operations and product authenticity in physical and digital marketplaces.

www.gs1india.org

About GS1

GS1 is a neutral not-for-profit organisation that develops and maintains the most widely used global standards for efficient business communication. We are best known for the barcode, named by the BBC as one of "the 50 things that made the world economy." GS1 standards improve the efficiency, safety and visibility of supply chains across physical and digital channels in 25 sectors. Our scale and reach—local Member Organisations in 118 countries, 2 million user companies and 10 billion transactions every day—help ensure that GS1 standards create a common language that supports systems and processes across the globe.

www.gs1.org
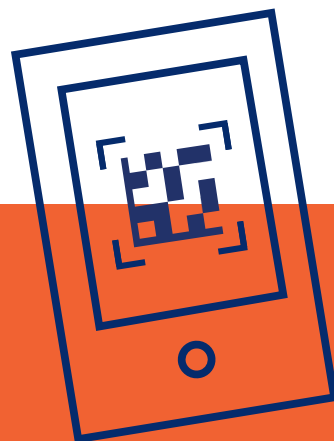
Get started with next generation barcodes!

Contact your GS1 Member Organisation to see how GS1 can help you begin your journey toward next generation barcodes!

www.gs1.org/contact