

Technical article

2D Code Migration – Where Vision Meets Reality

How to avoid the hidden pitfalls

Tuttlingen (Germany), January 13, 2026 – The move to GS1 2D codes is one of the most ambitious transformations in modern packaging. For many producers, it's a necessary step toward transparency, automation, and digital readiness. Yet between the vision and real-world implementation, there are practical hurdles that can slow progress or create unexpected costs. Understanding these challenges early makes all the difference – and helps turn a compliance project into a success story.

Technical risks: tiny codes, big impact

2D codes are dense, data-rich, and highly detailed – which means printing precision is critical. Small deviations in droplet size, ink adhesion, or substrate reflectivity can cause scanner errors. Materials such as glossy film or transparent plastic require excellent contrast and stability to maintain readability.

Variable data adds complexity: as batch or expiry details change, so does the code pattern. Without consistent calibration, print quality can deteriorate. Inline code verification is therefore essential – ensuring that every single code printed on the line is readable before it leaves the factory.

With LEIBINGER printers manufacturers can maintain code integrity at real production speeds, minimizing rework and waste.

Organizational risks: when data doesn't flow

Technical performance alone isn't enough. Many projects struggle because the organization behind the data isn't clearly defined. Who owns the GS1 master data? How do IT, production, and quality departments coordinate updates?

If systems like ERP, MES, and printers aren't fully synchronized, the digital workflow breaks down. The result: wrong data on the right code – or the right data printed too late.

A successful migration requires clear process ownership and data management, as well as fully reliable hardware.

External factors: the wider ecosystem

Even if everything works internally, external conditions may lag behind. Not all retailers' POS scanners are 2D-ready yet, so during the transition phase, dual coding – printing both a 1D barcode and a 2D symbol – will remain necessary in many cases.

At the same time, Human Readable Codes (HRC) continue to play an important role. Some key information such as expiry date must still be printed in plain text to ensure accessibility and visual verification by the end user. HRCs provide a vital backup when scanners fail, and they help operators and inspectors quickly confirm product data without additional tools.

Another aspect is user acceptance. For operators, retailers, and consumers alike, 2D codes represent a new way of interacting with packaging. Workflows and habits will evolve gradually as understanding and confidence grow. This is not the end of the journey – it's only the beginning, and the industry will continue to learn and adapt with every step.

Regulatory and data-protection requirements add another layer of complexity. The more information a code carries, the more critical strong data governance becomes. And while investment in new hardware and software is significant, it's a future-proof investment – preventing costly recalls, manual rework, and process delays further down the line.

Conclusion

The 2D migration is not a sprint – it's a strategic evolution that requires planning, collaboration, and reliable partners. Those who act early will enjoy higher efficiency, improved compliance, and a clear competitive edge.

LEIBINGER supports manufacturers worldwide through this transition – with printing systems built for variable data, durable performance, and unmatched precision.


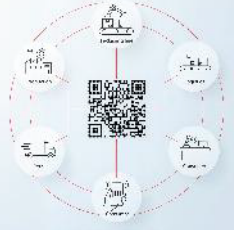

Next in the LEIBINGER 2D Codes Migration series:

Let's look ahead. The GS1 2D code is only the beginning – the real revolution is the digital product passport. All published articles from the series can be found at leibinger-group.com.

www.leibinger-group.com

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Image captions:

	<p>A smart solution for maximum code readability even on transparent packaging: first the background print, then the code - all in a seamless process with CIJ.</p> <p>Source: Paul Leibinger GmbH & Co. KG</p>
	<p>The networked 2D code ecosystem.</p> <p>Source: Paul Leibinger GmbH & Co. KG</p>
	<p>Reliable CIJ printing for variable codes on a wide range of materials.</p> <p>Source: Paul Leibinger GmbH & Co. KG</p>

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About Paul Leibinger GmbH & Co. KG (LEIBINGER)

LEIBINGER is a global specialist in coding & marking systems with its headquarters in Tuttlingen (Baden-Württemberg), Germany. This third-generation family-run company founded in 1948 employs a payroll staff of around 350 employees. Its primary focus is on the development and production of industrial inkjet printers and inks for use in the marking and coding of products. The solutions created by LEIBINGER are defined by their high quality standards and their innovative technologies. As the inventor of a ground-breaking nozzle sealing technology that makes ink-based marking and



coding systems significantly less susceptible to contamination, now with tens of thousands of installations worldwide, LEIBINGER is able to assure higher productivity in the production of food and industrially manufactured products. Through its subsidiaries in the USA and China and its global network of around 150 distribution partners, LEIBINGER is able to maintain a close relationship with its customers right around the world.
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