



Accurate barcode labelling

How to build resilient
supply chains

Research-led
thought leadership report

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Inside this report

Organisations are increasingly evaluating requirements for their technology investments. Brother International Europe commissioned VDC Research, a leading authority on the global markets for automatic identification and data capture (AIDC) technologies, to present its perspective on how businesses are adopting barcode labelling best practices in order to achieve an error-free traceability standard.

This report aims to outline the challenges associated with barcode printing technology investments and the measures taken to reduce, if not eliminate, mislabelling.

VDC's analysis is backed by extensive primary research across the following communities - barcode printer hardware vendors, labelling software solution providers, enterprise application vendors, and businesses making strategic investments in these technologies.

Who should read this report?

This research outlines the considerations driving organisations to make label printing related investments.

Businesses with existing and/or proposed investments in barcode labelling technologies will derive value from this report.

Who are VDC?

VDC Research is a leading analyst firm covering AutoID and Data Capture technologies and applications.



What questions are addressed?

The importance of effective barcode labelling

Solving operational issues with barcode labelling

What causes barcode labelling errors?

What is the true cost of labelling errors?

What is driving investments in thermal printing technology?

Label printing is now a dynamic, on-demand process

How has the philosophy around supply chain-related technology investments evolved?

Reducing errors through labelling automation



Executive summary

Barcode labelling volumes have grown significantly over the past few years as track-and-trace related initiatives take centre stage in organisations' evolving sourcing and distribution strategies. The need for identification is greater than ever before as raw materials and finished products move through the supply chain, aiming to maintain compliance with local regulations while also fulfilling demand in a timely manner.

Encoding the right information on these labels is especially important to meet the demands of data-driven global trade.

Label printing pressures have resulted in increased spending on barcode printing hardware along with greater consideration for labelling solution investments. This helps promote data consistency, error-free encoding, and synchronicity across globally distributed operating environments.

VDC's research indicates that businesses are automating processes, so their workers don't have to manually select the labelling template for products at any point during the various workflows. Label readability is crucial - as is the need to verify that the right label has been applied to the right product, matching the content that needs to be printed.



The importance of effective barcode labelling

Barcode labelling integrity is critical to running efficient supply chains, promoting error-free traceability, and generating visibility into product movement.



Company spotlight

European logistics service provider



There are both tangible as well as hidden/intangible costs associated with errors. Even a minor mistake can lead to sending the wrong product to the wrong customer, inventory/stock mismanagement, and disruption to the supply chain. Given the sheer volume of labels being printed every day, errors do happen due to manual processes. This leads to customer dissatisfaction, which can prove to be very costly to the business in the long run.



Organisations are increasingly making strategic investments in printing solutions designed to help them alleviate challenges related to labelling data consistency and synchronicity.

They are implementing serialisation processes with assigned serial numbers and unique identifiers, while also integrating GS1 standards (the foremost authority on creating global labelling standards), and others, into their labelling operations to enable end-to-end traceability and visibility.

Label printing solutions are also critical for several warehousing workflows including, but not limited to, inventory stocking, receiving (inbound), and shipping.



The need to have the right barcode label on the right product for accurate identification and adequately addressing compliance requirements is widely recognised as a key application.

Labelling is critical to organisations' overall supply chain management and traceability initiatives; errors have the potential to severely disrupt daily operations. The importance of access to dynamic content creation in order to keep pace with mass label changes, customer-specific requirements for branding and distribution, and increasing labelling volumes, cannot be overstated. This is placing a greater emphasis on labelling automation with certified integration to enterprise applications.

With sharply increasing shipping and receiving volumes, barcode labels have become critical to ensure that the right product is dispatched from the right warehouse at the right time and delivered to the right destination.

This includes being able to sufficiently address reverse logistics workflows in the event of recalls or returns.

Labelling technology investments are viewed as a means to:

- ✓ Enhance efficiencies and improve overall productivity
- ✓ Increase speed of delivery, stocking, picking, shipping and receiving
- ✓ Minimise errors and returns.



Solving operational issues with barcode labelling

VDC's research shows that large production and distribution facilities currently print, on average, 4,000 labels/per day; and labelling volumes are expected to grow exponentially up to at least 2025 as operations scale and ecommerce volumes expand.



Company spotlight

Europe-based manufacturing and warehousing company

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Our labelling application was not previously integrated with any ERP (Enterprise Resource Planning) system. It was a standalone software prone to error because of considerable manual data entry requirements.

It was also not scalable, which made it a non-viable investment since our growing organisation could not maintain manual labelling processes.

”

Challenges with current technology investments

The survey shows that the most significant challenges with organisations' existing technology investments are:

- Information distribution and management across the supply chain is inefficient (23%)
- Solutions are not future-proof, making it difficult to transition to next-generation deployment models (19%)
- Clunky hardware and/or software interface that will require substantial workforce training (15%).



Future proofing

- No transition to next-gen deployment models
- Solutions not scalable enough to keep pace with our growing organisation



Direct costs

- Low return on investment / high total cost of ownership



Security

- Vulnerable to data security breaches



Indirect costs – time / resource

- Significant application deployment times
- Clunky user interface, which requires a lot of training
- Information distribution across the value chain is not efficient



Fit for purpose solution / provider

- Legacy software integration is cumbersome and prone to errors
- Unwieldy software with maintenance issues
- No single vendor with comprehensive solution set

More than 90% of organisations surveyed indicated adopting a decentralised approach to labelling solution purchase, with investment decisions made at a local level as opposed to one that's standardised at the global headquarters.

This gives rise to an increase in overall spending, difficulty in adhering to compliance standards laid out by government/industry bodies and even large customers, inconsistent labelling practices that do not align with required formats and templates, and difficulty in issuing recalls when necessary.

Businesses have also historically relied heavily on static databases and manual label data entry processes because of two primary reasons—existing systems are not designed to communicate with one another, and data integration exercises are cost-prohibitive.

This is now changing. Leading labelling solution providers like Loftware (now combined with NiceLabel), Seagull Scientific, and TEKLYNX not only support high labelling volumes, but also handle data complexities, varied integration requirements, and distributed operational setups.



90%

of organisations surveyed indicated adopting a decentralised approach to labelling solution purchase.



Tighter integration of these labelling solutions with enterprise application software like Enterprise Resource Planning systems (ERP), Manufacturing Execution Systems (MES), and Warehouse Management Systems (WMS), is increasingly becoming a requirement as organisations generate millions of labels across manufacturing, shipping, and distribution.

By enabling seamless communication with broader data management platforms, those with labelling responsibilities have clear direction on data source, quality, and consistency.



Company spotlight

Leading Europe-based logistics and last mile delivery provider



It is critical to have our solutions flexible and scalable in order to meet the demands of our growing operations – having access any time and anywhere. It is also important for us to have access to a comprehensive suite of maintenance and support services for our labelling solutions, so we can troubleshoot as required.

We print over 5,000 labels every day, which makes it imperative to own and operate reliable hardware that is seamlessly integrated with enterprise solutions.





| What causes barcode labelling errors?

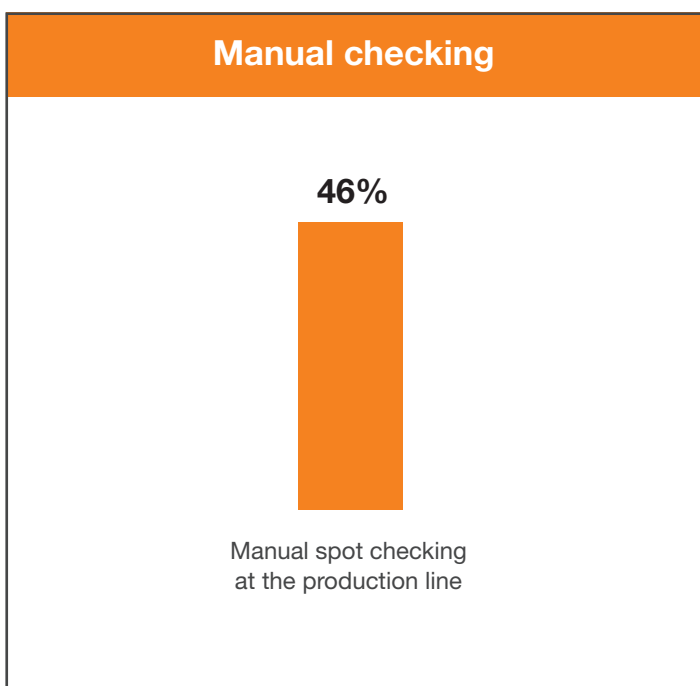
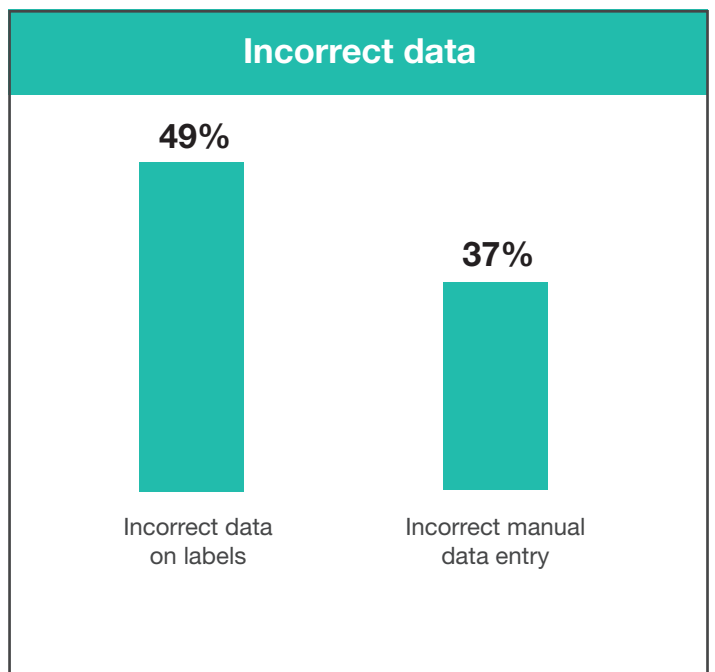
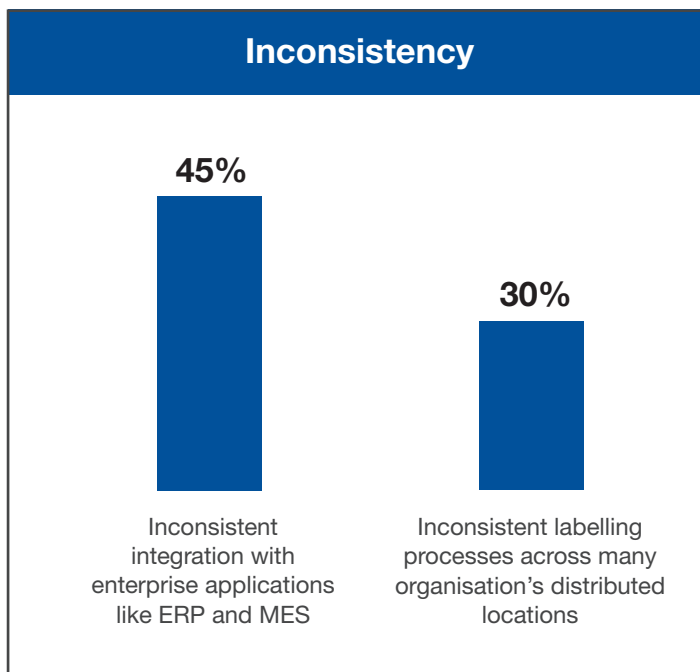
The Covid-19 pandemic brought to light previously ignored issues with data consistency, tangible and intangible costs associated with labelling errors, and the need for flexible/scalable track-and-trace operations.

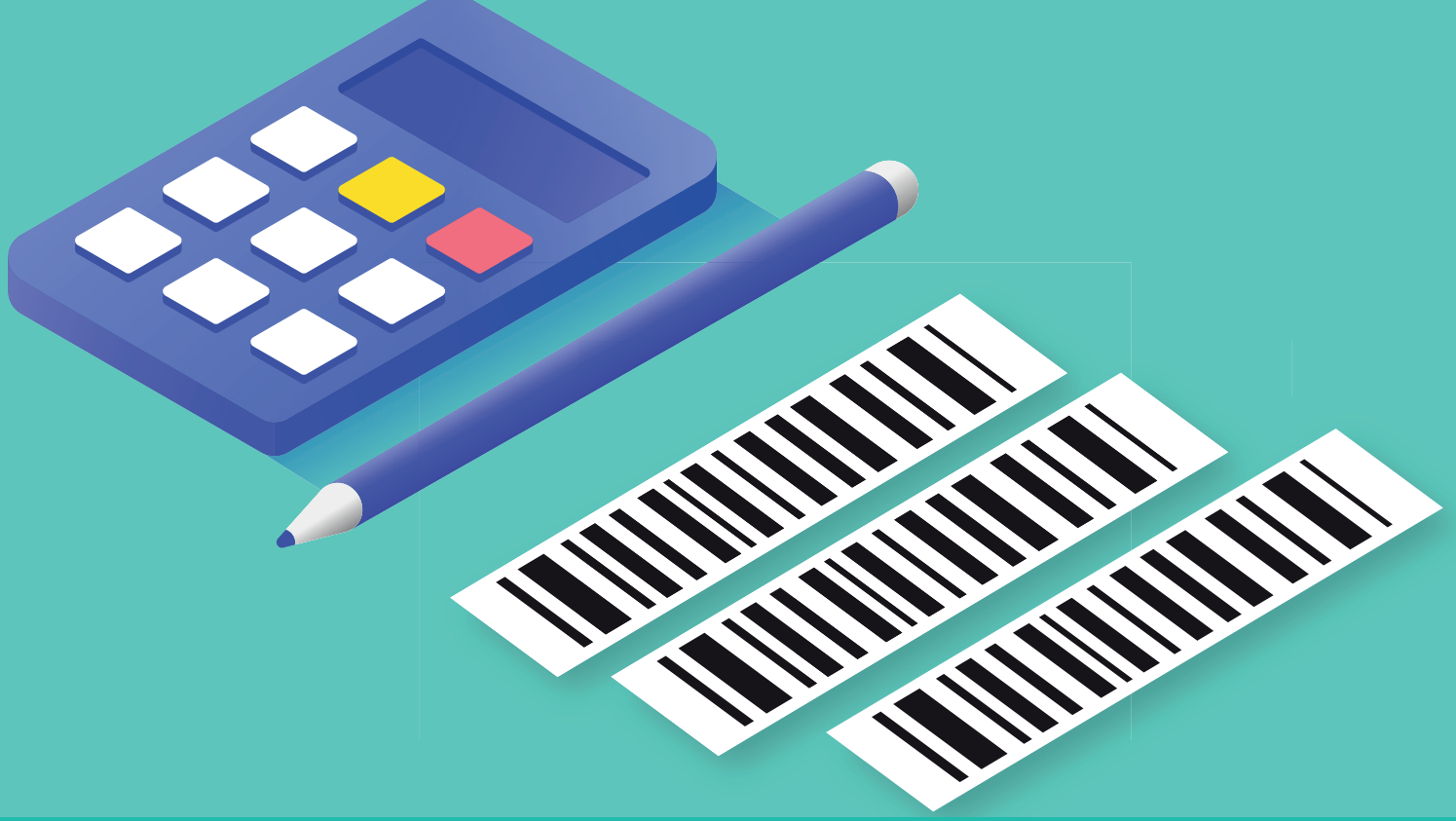
Eliminating manual labelling processes is a necessity in today's environment - to enable labelling data to be coordinated automatically without the need for human input/intervention, and improve overall labelling accuracy when costs are being more closely scrutinised than ever before.

VDC's research highlights the following as the primary causes for errors:

- Lack of clarity on labelling template to use (49%)
- Incorrect data on labels (49%)
- Manual spot-checking (46%)
- Unscannable barcodes due to poor label quality due to print and/or media quality (45%).

Reasons for barcode labelling errors





What is the true cost of labelling errors?

Eight in ten large transportation and logistics enterprises indicated that they experience at least one major labelling error per year. 70% of VDC's survey participants indicated that more than 1% of their packages are mislabelled (for a distribution facility printing 5,000 labels/per day, this would mean over 18,000 mislabelled packages annually). Exposure to these errors is only increasing with a sharp increase in global labelling volumes.

Despite extensive IoT (Internet of Things, referring to network-connected objects) penetration across most other aspects of the supply chain, many companies continue to rely on manual barcode labelling processes, thereby significantly increasing error incidence. Poor quality labels (due to media and/or print quality) are also a leading source of non-compliance and, as a result, chargebacks.

There are several tangible and intangible costs associated with errors including: scrapping the entire production batch affected by inaccurate labelling, regulatory penalties and fines for non-compliance, costly product recalls/restocking, entry of counterfeit products in the supply chain, and rendering the product unavailable during restocking.

Organisations are taking several steps in order to minimise errors and lower costs associated with incorrect or illegible labelling, such as: centrally managing data to reduce human error (49%); adding automated visual inspection to detect incorrect labelling (48%); and, investing resources to develop in-house expertise to educate, inform, and instruct workforces about labelling best practices (45%).

71% of VDC's survey respondents indicated that they have current or planned investments in built-in auto-verification and/or label inspection solutions (fully integrated with label printers) that confirm label data, character and number quality, and identify labels that do not conform to required standards.

Measures taken to reduce labelling errors:



Centrally manage data to reduce human error



Add automated visual inspection to detect incorrect labelling



Develop in-house expertise to educate, inform, and instruct workforce about labelling best practices



Invest in purpose-built labelling software solution



Restrict amount of manual input



Enable seamless data integration with enterprise solutions



Reduce manual interventions.



A leading European logistics operator indicated that all its errors are now exclusively in manual processes, especially since its decision to fully automate labelling applications. Seamless integration between the label printers and its home-grown enterprise application systems has proved to be the key to its success in lowering, if not nearly eliminating, labelling error rates.



Company spotlight

Europe-based logistics service provider



Our labelling application was not previously integrated with any ERP system. It was a standalone software prone to error because of considerable manual data entry requirements. It was also not scalable, which made it a non-viable investment since our growing organisation could not maintain manual labelling processes.



Brother insight:

Labelling errors can cost anything up to 1,000 Euros per pallet in fines which could potentially wipe out a significant profit for logistics companies tasked with securely handling goods. It is therefore vital that labels are up to standard.

Factors to consider when selecting the correct type of label include:

Surface adhesion

Consider whether the surface that the label will be fixed to is smooth or curved. It is an important factor to consider when deciding which type of label adhesive and material will be the most beneficial for your applications.



Temperature

Both application temperature and service temperature are important to consider when choosing a label. How long is the package likely to spend outdoors, in transport or in warehouses with differing climates?



Durability

A label with a longer lifespan is more likely to be exposed to chemicals, moisture, and abrasion, whereas a shorter lifespan will not require a highly durable label.





What is driving investments in thermal printing technology?

VDC's research shows that organisations prefer thermal printers for barcode labelling applications over any of the alternatives, like inkjet and laser.

This is driven by factors including lower total cost of ownership (TCO), including the cost of media and consumables; printer hardware availability at various price points, from low-end desktop models to high-end industrial printing solutions capable of keeping up with the rigours of high-volume, rugged environments; and better performance characteristics like print quality and durability, making them best suited for labelling applications.

Insight: Industrial label printer purchasing best practices

Find the right solution partner that understands your organisation's unique labelling requirements – holistic value-added services from free-demo testing, maintenance contracts, to next generation hardware, and software recommendations that support labelling accuracy and consistency are crucial to labelling success.



Search for the best supplies partner: while the cost of media is vital to margin profitability, the quality of the labels is also integral to order success and mitigating barcode readability issues.



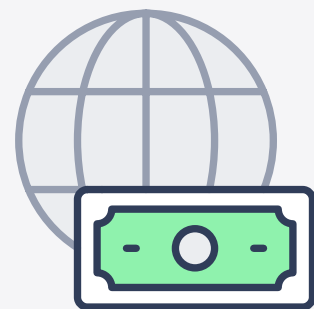
TCO is fundamental to industrial printer evaluation, as choosing the best value for your organisation's application requirement will help improve margin profitability.



Compatibility with software infrastructure is critical in order to optimise industrial printer effectiveness - from enterprise application integration to printer language emulation and remote management tools.



Consider barcode verification capabilities – cross checking ANSI labelling standards goes a long way to avoiding retail chargebacks and fines for relabelling that range from €10K - €20K per violation on average for the largest orders.



Understand relevant labelling compliance regulations and consider more data rich labels such as QR codes and application identifiers that can reduce scanning volume, lower the number of labels printed in warehouse workflows, and improve traceability across the supply chain.





TCO of thermal label printer hardware depends on various factors including: printer form (desktop vs. industrial), label volume requirement, price of consumables (label rolls, ink, ribbons, and print heads), and installation and maintenance requirements. Thermal transfer printers are popular for their label output durability where printed labels are required to last, while direct thermal labels have a shorter shelf life.

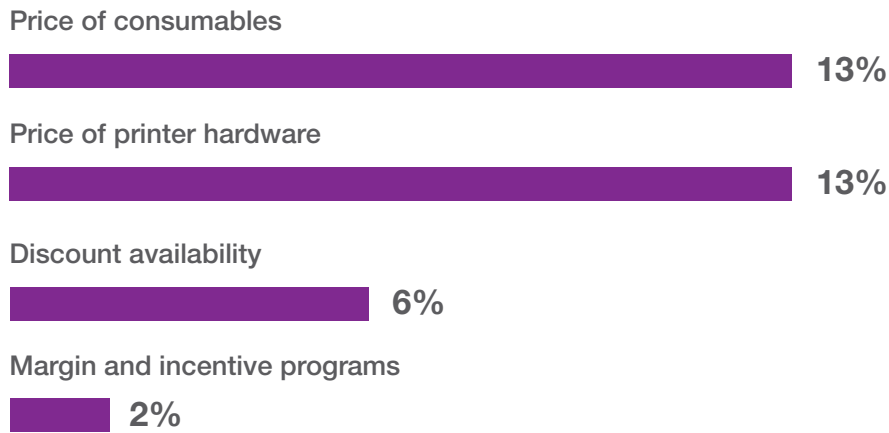
The latter are affordable and easier to setup/print due to the absence of ribbons; however, thermal transfer printers typically last longer because the ribbons help extend the life of printheads, translating to less frequent replacement. Direct thermal printers are being increasingly adopted for last-mile delivery types of applications whereas thermal transfer options are used in high volume, industrial printing environments.

3.8% Savings

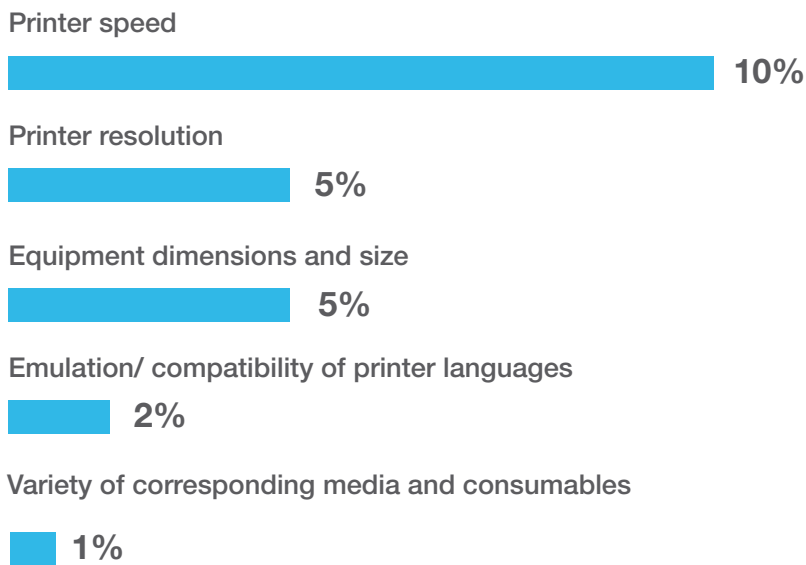
Over a ten-year period, on average, direct thermal printers cost organisations £237K while thermal transfer printers cost them 3.8% less at £228K, with average volume requirements of 835 label rolls per year.

Primary Selection Criteria for Label Printer Purchase and Deployment

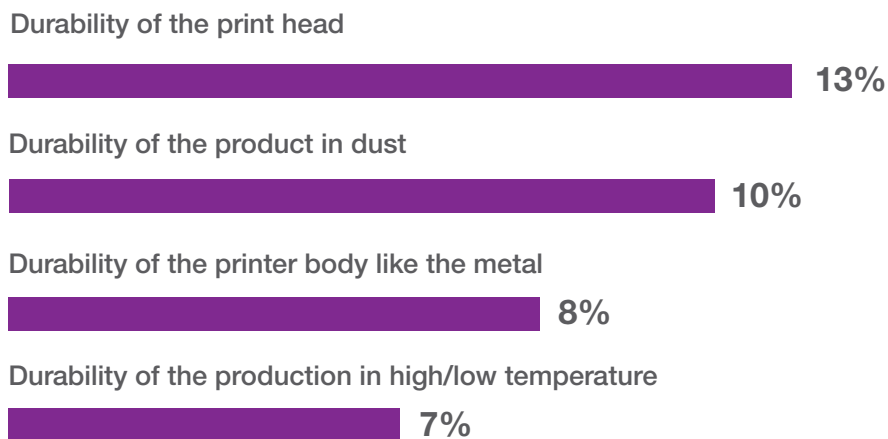
Price



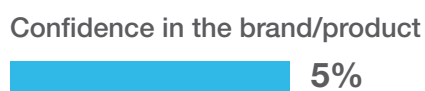
Features

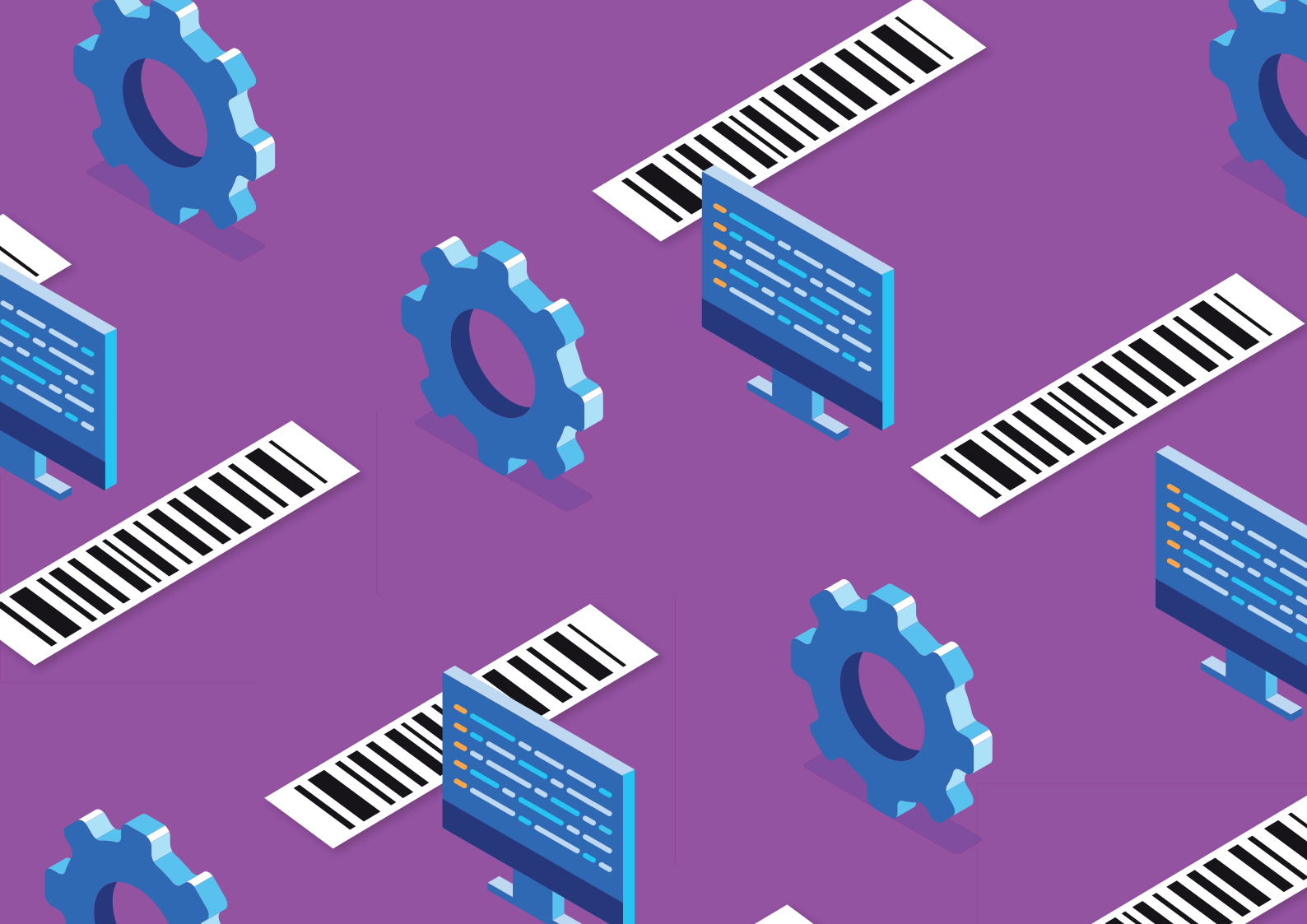


Durability



Brand





Barcode printers and labelling solutions are critical to logistics service providers' end-to-end automation goals. The most important factors taken into consideration for label printer hardware selection include price, durability, and functionality/performance.

At the same time, spend levels on consumables are consistently higher than that on hardware over the lifetime of a printer, making it imperative for businesses to invest in solutions that help them reduce overall printing costs.

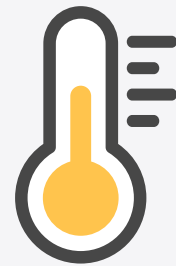
Product availability, (always) on-call servicing, low printer downtime for high-volume applications, and integration with existing infrastructure are the critical factors influencing thermal printer investments based on VDC's conversations with technology investment decision makers.

Do these requirements change significantly based on organisational revenues? The short answer is no. Businesses across tiers require consistent and reliable solutions that can sufficiently address their unique traceability objectives.

Brother insight:

When selecting the right equipment, generally warehouses will be looking at a choice between direct thermal and thermal transfer hardware. When deciding on the best solution, businesses must consider:

The type and durability of the label. If the product being labelled could be in the supply chain for an extended period or in extreme conditions such as direct sunlight or chemical contact, then the technology used should likely be thermal transfer. If the product has a short life in the supply chain and is not exposed to harsh environmental conditions, then direct thermal may very well be a good choice.



The total cost of ownership (TCO) of an industrial printer is an important investment evaluation metric to consider, from the price of media and consumables to initial hardware purchasing price, associated software licensing costs, and ongoing maintenance services.



Find the right balance between investment spend and printer performance. When evaluating, think in terms of print speed, resolution, durability, ergonomics, and automated features sets (such as auto-cutter, peelers and re-winders).



Compatibility with existing software infrastructure, including integration with ERP, WMS, and other multiple device management (MDM) platforms, and scalability support is a vital consideration.



Ease-of-use and plug-and-play readiness – will staff need specific training and support or can they hit the ground running?





Label printing is now a dynamic, on-demand process

GS1, the leading global standards organisation, developed the Global Trade Item Number (GTIN) to be used by businesses to uniquely identify all their trade items.

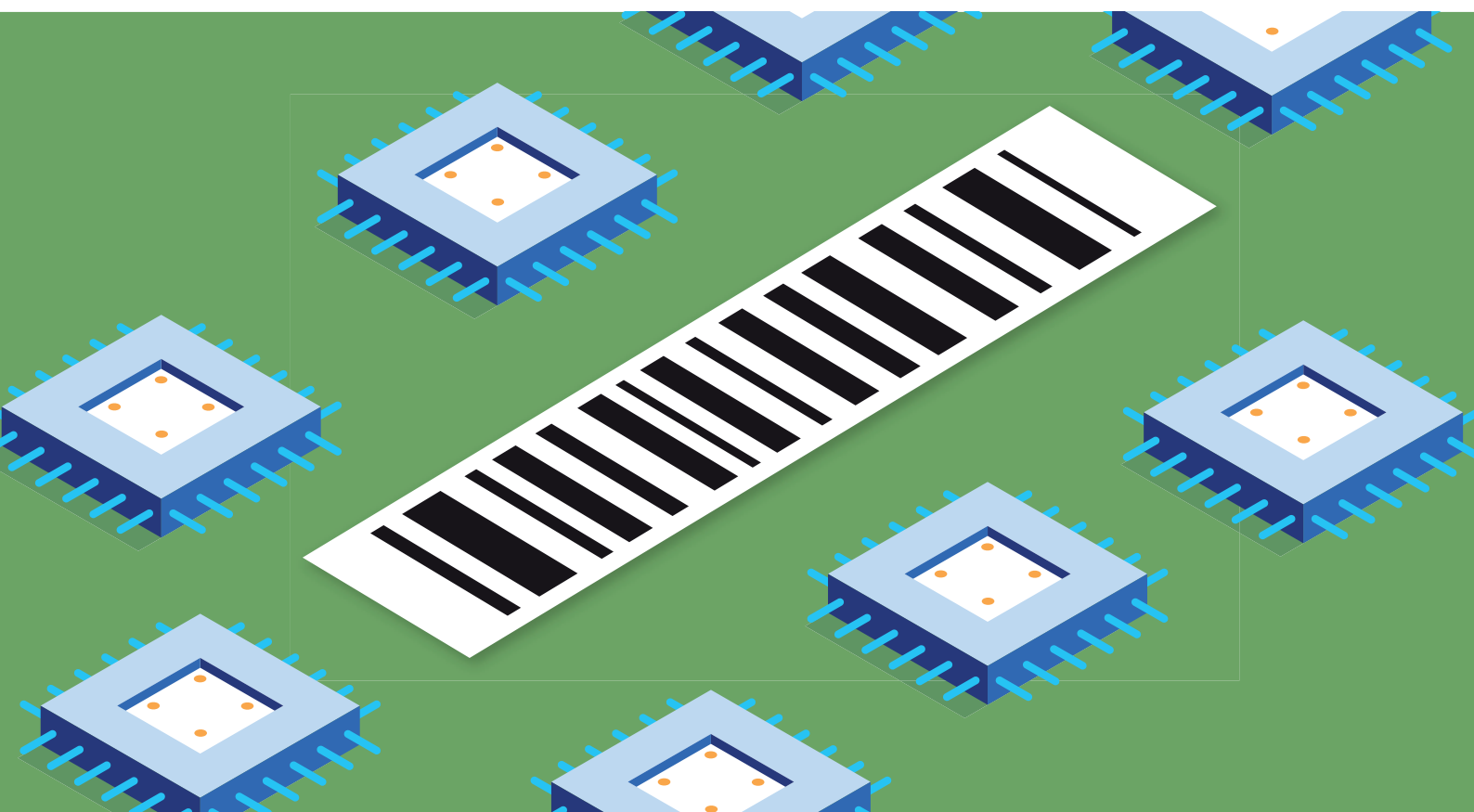
This 14-digit identifier coupled with a serial number allows organisations to also uniquely identify different items or each instance of the same product.

VDC's research shows that product serialisation (with GTIN and a unique identifier/serial number) can be used to determine if the item is genuine. It is essential for supply chain participants to use the same language for labelling - including advanced data carriers, like 2D barcodes and RFID tags, featuring different barcodes and GTIN formats - so there is no gap in communication or translation, in order to avoid a negative ripple effect throughout the supply chain.

This is becoming increasingly essential as the exposure to labelling errors is only increasing due to more dynamic labelling data requirements, broader supplier/partner network, and stricter compliance regulations.

Organisations are eager to improve the quality of labelling content, which depends on the printer's ability to integrate with enterprise application software in real-time. The need to invest in developing a partner network that can help build seamless communication channels between label printer hardware infrastructure and information management and control systems has never been higher.

Labelling platforms can no longer function as standalone solutions that do not communicate with other enterprise applications, as that would only serve to increase the risk of labelling errors. Data-driven labelling enables organisations to print uniquely identifiable information without having to create individual templates for each product.





Demand for more information on barcode labels is steadily driving the transition from traditional 1D barcodes to 2D symbologies, which can also store dynamic content. VDC believes this will drive the need for software and firmware updates in the future, especially as organisations prepare for more rigorous labelling requirements—including 2D barcode decoding, parsing, and printing—without complicating their operational processes.



Company spotlight

Leading Europe-based logistics service provider



Our organisation makes significant investments in order to develop all our solutions in-house. The servers talk directly with printers on the network across the world at many ports. It is important that when we initiate a print command at any European location, the label is printed within milliseconds at a warehouse in Asia, without any delays.





Brother insight:

To improve on faulty labels as a result of misprints, many businesses will be investing in printer hardware where each label printed with a barcode is verified at the point of print and then logged for auditing purposes to circumvent fines issued to the shipper or producer of goods. This will drive efficiency through the whole supply chain process.

With the addition of attributes such as batch/lot number, expiration date, and serial number on the label, the dynamic data content goes up significantly.

As more of this dynamic attribute encoding becomes a requirement, manufacturers and their packaging partners will need to set up their systems and capabilities to support the same. This will drive up the need for automating label data generation (and associated print jobs) as opposed to relying on manual processes to lower error incidence and adequately facilitate traceability or even targeted product recalls.



Labelling errors are often the root cause of excessive inventory carrying costs (for instance, due to restocking), and also negatively impact brand equity and customer confidence. Dynamic data printing is essential to error-free labelling. VDC's primary research indicates that returns management will be easier and more efficient if supply chain participants include dynamic attribute data in labels (including batch/lot number) and retailers are able to capture this information at the POS. This is a capability that is highly desirable but largely unmet today and can potentially lower cost of recalls.



Company spotlight

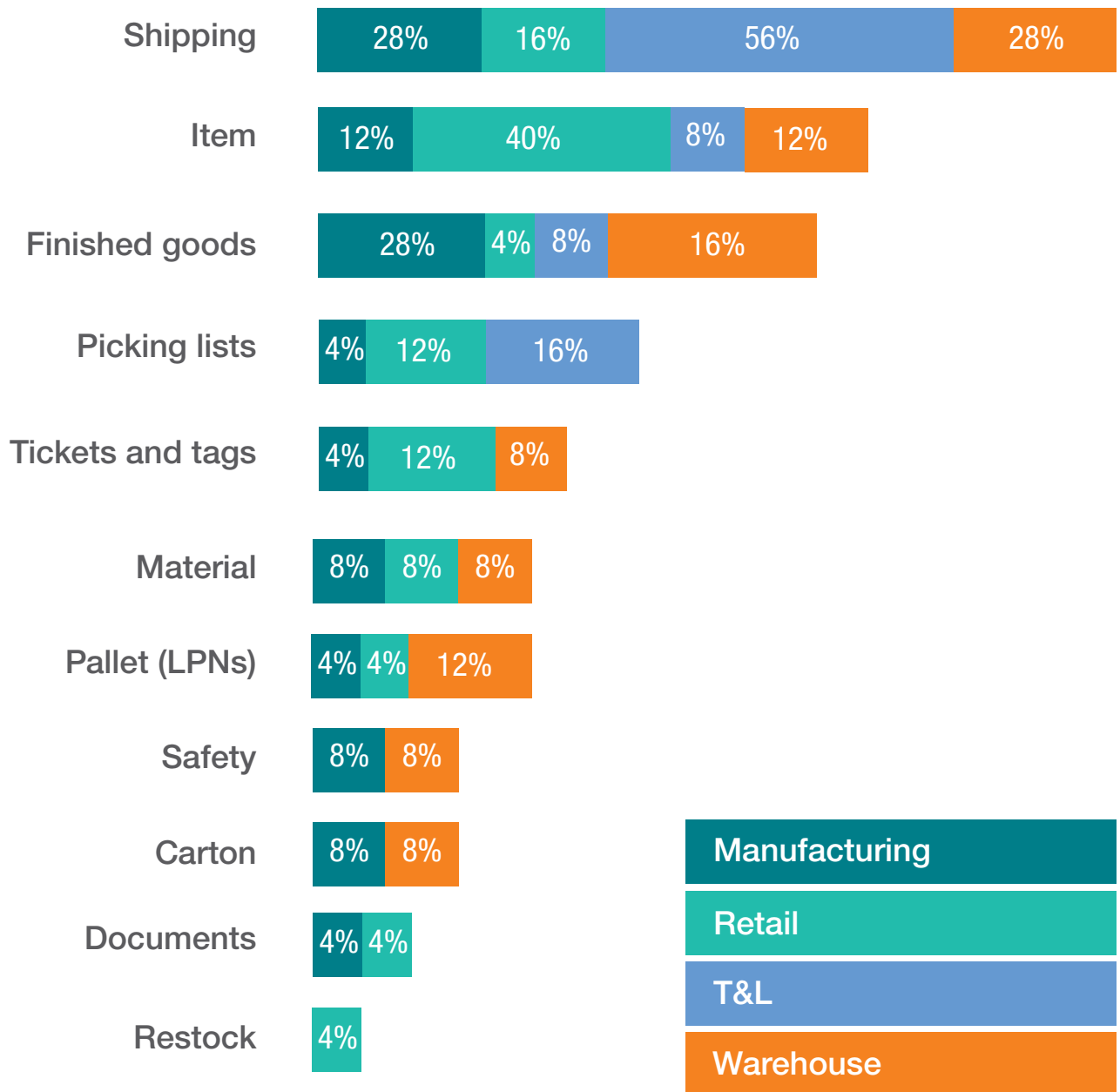
Global FMCG manufacturer



Our labelling processes were going out of control because of the number of templates that were being used for various workflows. Returns management in the event of recalls and returns became particularly cumbersome. We needed to standardise investments and centralise labelling ownership. The ERP system is now our single source of truth. This has helped us lower error incidence and has given us more visibility into product movement.



Types of labels printed by environment



Survey participants highlighted that packaging labels, restocking labels, and shipping labels had the most variable data requirements. This shows the importance of dynamic content for a large subset of labels, necessitating automation in order to eliminate the possibility of introducing errors to the labelling process across globally distributed locations.



How has the philosophy around supply chain-related technology investments evolved?

Supply chains are under intense pressure to work efficiently regardless of global demand and supply volatility, inventory availability, and the ongoing digital transformation.



Company spotlight

Europe-based warehousing services provider



Labelling errors are few and far between; those that occur are exclusively due to manual label application-related processes. We do not directly attribute any costs to labelling-related errors as labels are generated automatically after every scan for inbound operations, taking the human element completely out of the picture. We have also eliminated the need for manual selection of labelling formats and templates.



Stringent compliance mandates laid out by global regulatory bodies have stretched the capabilities of enterprise application systems, including labelling, thereby increasing the possibility of errors. Not only are consumers looking for hyper-accurate location information, but also deeper insights into product manufacturing and distribution.

It is important to acknowledge changes to supply chain management-related expectations and the role that technology, including barcode labelling, has to play in streamlining efficiencies and generating unprecedented levels of visibility. Businesses are implementing serialisation processes and integrating GS1 standards into their labelling operations to enable end-to-end supply chain transparency and visibility, and to maintain compliance with regulatory requirements.

Labelling data requirements are increasing sharply across globally distributed locations and supply chains. VDC sees a shift to an enterprise-wide approach to labelling solution purchase and deployment as organisations work to ensure data consistency and synchronicity, which is a move away from traditional siloed applications that do not communicate with each other.

Businesses are placing stronger demand for dynamic solutions that are flexible, modular, and scalable, and which can be tightly integrated with disparate systems to promote collaboration and consistency. Not only will this serve to modernise supply chains, but also optimise inventory management, facilitate data-driven decision-making that helps trim costs, and improve demand forecasting through predictive analytics.





Reducing errors through labelling automation

Taking the human element out of the equation is becoming increasingly important to everyday operations in order to minimise, if not eliminate, errors.

Labelling software solutions that support traceability automation initiatives will be critical to achieving the zero-error goal. VDC expects organisations to increasingly push for seamless integration of all track-and-trace solutions with enterprise-grade data management platforms. This will give those with direct labelling responsibilities clear direction and confidence on data source, quality, and consistency.

Seamless information flow across disparate applications is critical for business success and VDC expects to see a greater transition to labelling data automation in 2022. There will be heightened interest and investments in barcode printing solutions that help adhere to regulatory compliance standards while meeting organisational expectations of TCO, ROI, scalability, and flexibility.



Company spotlight

European logistics service provider

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When our labelling system was not integrated with the ERP system, it was prone to a lot of errors as considerable manual data entry was required. We were unable to leverage on-demand information. As our organisation grew, we decided to switch over from manual processes to those that are automated. We have moved to a centralised labelling process now that is flexible and scalable. This has helped us significantly lower, if not completely eliminate, labelling errors.

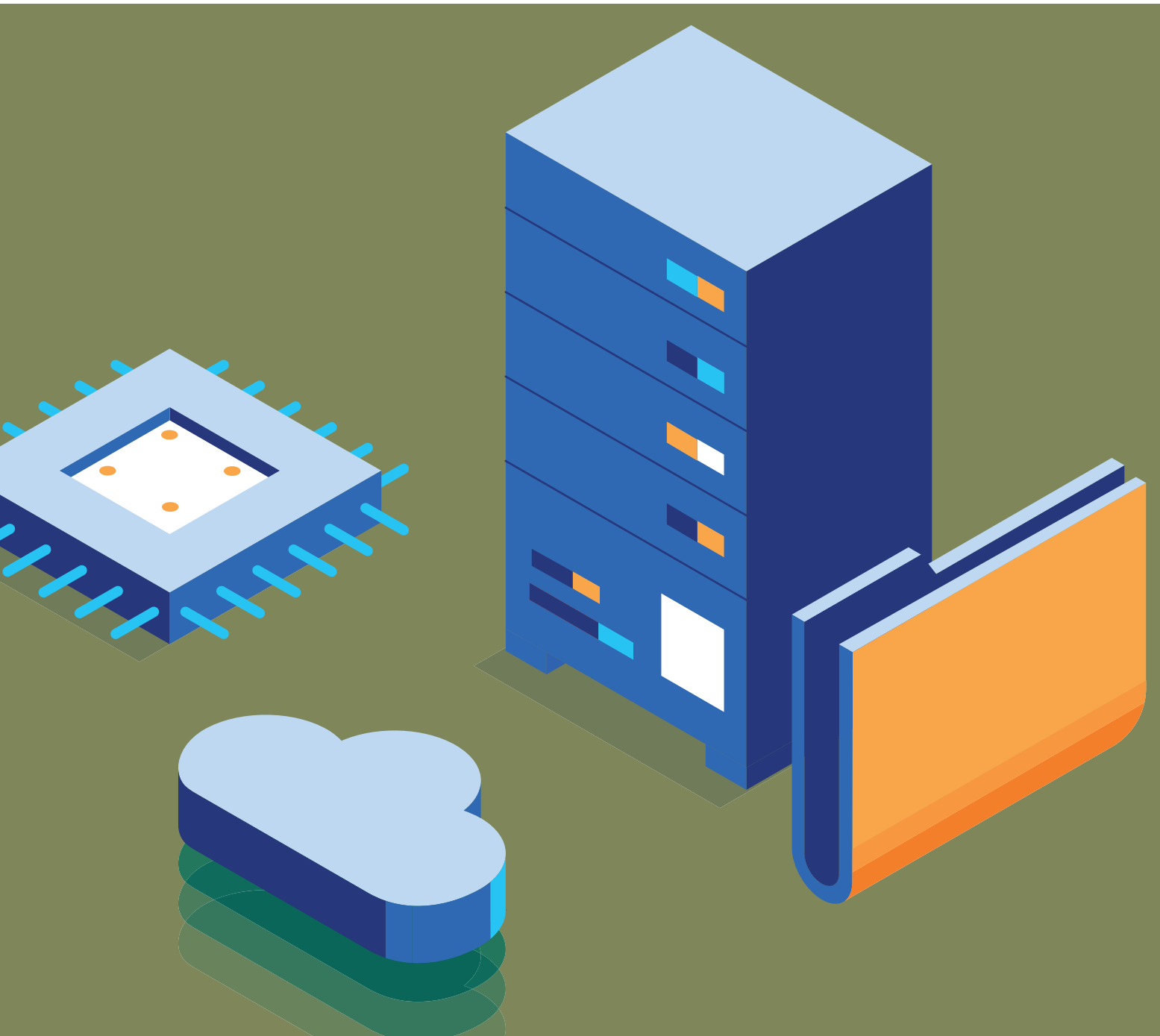
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Automating labelling processes across the supply chain will be key to controlling and minimising, if not eliminating, this issue. The goal is to have all labelling related information from a single source, with all participants needing authorisation and special permissions to make any changes to the database.



34%

of organisations deal with costly product recalls.



What changes should organisations make to their labelling processes?

1

Transition to centralised deployment of enterprise applications in order to maintain standardised dataset.

2

Lower reliance on and use of static databases and paper-based information docketts for labelling.

3

Invest in barcoding solutions that provide access to variable data, particularly in facilities with high labelling complexity and volumes.

4

Replace manual processes responsible for triggering labelling functions with print automation.

5

Develop in-house expertise to educate, inform, and instruct the workforce about labelling best practices.



brother

at your side

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