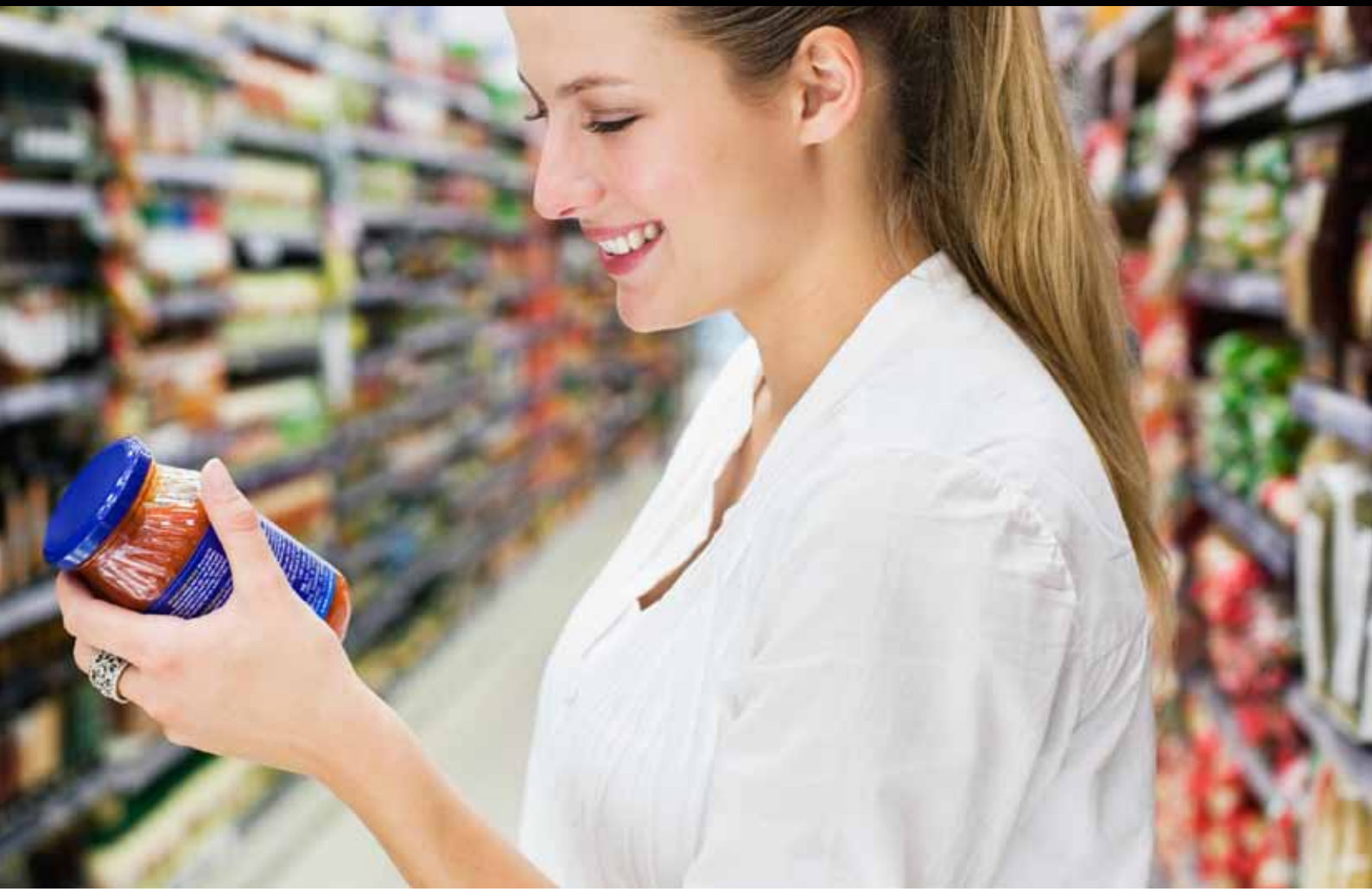
# The benefits of integrating identification and inspection



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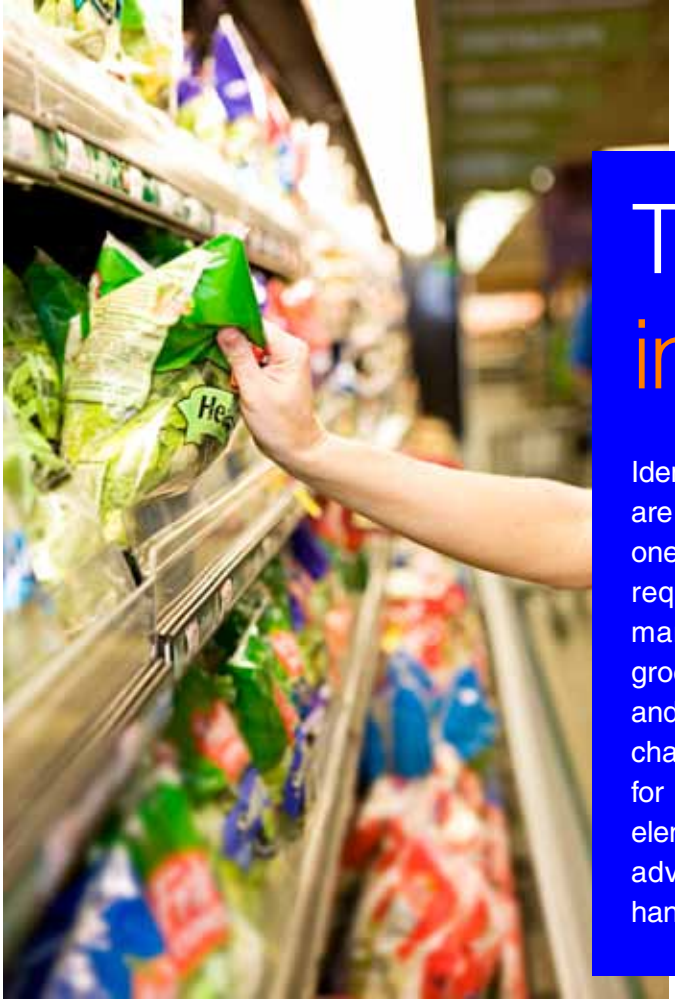


# The benefits of integration

Identification and inspection in food manufacturing are often regarded as two discrete processes; one bound by a plethora of legal and compliance requirements, the other an inherent part of manufacturing operations. As the food and grocery industry follows world's best practice and moves towards a more collaborative value chain management approach, there is a call for streamlined processes that integrate these elements, offering improved production visibility, advanced product traceability and error-free handling.

*Dannielle Furness*

Australia's food and grocery manufacturing industry is one of the nation's most significant employers, retaining about 300,000 workers and boasting a turnover of $108 billion in the 2011-12 financial year, according to the Australian Food and Grocery Council (AFGC).

The AFGC annual report for the same period states that the local food manufacturing industry is entering a particularly challenging phase, as external pressures combine to create difficult market conditions. These outside forces include aggressive price war tactics which negatively impact on margins, increased regulatory demands which add to overall manufacturing costs and complex and uncertain labelling specifications that serve to encumber manufacturers and create increased financial obligation.

Never has a process of rationalisation been more important; in an industry constrained by regulation and compliance requirements, where accurate product identification and communication of information forms the backbone of the value chain.

## Identification and recognition

The average grocery item on Australian shelves displays an abundance of external information; some legally required for sale and some included as part of the manufacturing process. Typically, a product will encompass the following information on primary and/or secondary packaging elements during part, or all, of the distribution journey:

- Date and batch information
- Barcode and product labelling
- Product identification marks and branding
- Carton and pallet labels

Each of these indicators is an important channel for identification and traceability at some point during the manufacture and distribution of food product items. Current developments in packaging technology are being driven by the need for high yield and low-cost output. The end result must be produced reliably and repeatedly and the identifiers must be legible, or the whole process is thrown out.

### Date and batch marking

Date marking on primary packaging provides the end user with information on how long products can be stored prior to consumption. Food Standards Australia New Zealand (FSANZ) develops and administers the ANZ Food Standards code, which encompasses labelling obligations. Under the code, date marking for products with a shelf life of less than two years falls into two categories: 'use by' and 'best before'.

Foods that must be eaten within a particular time frame for health and safety reasons are marked with a use-by date and it is illegal to sell the product once that date has passed. Best before is less stringent in that it indicates food may be eaten beyond the labelled date but may have diminished in quality. The exception to the date stamp rule is bread, which is marked with a 'baked on' or 'baked for' date if the product has a shelf life of less than seven days.

Batch marking in manufacturing is a valuable quality control tool for traceability. As food safety is the ultimate responsibility of the producer, it is vital to be able to move quickly in the event of a recall and to limit exposure using accurate batch tracking. In addition to primary packaging requirements, date code information is essential on secondary packaging. The Food Standards Code stipulates that all marking be indelible and clearly legible.

There is a range of available marking technologies for batch and date coding and the most appropriate is driven by the product and packaging form. Primary packing options include label application, laser coding, thermal transfer overprinting and con-

tinuous inkjet, with other alternatives including drop on demand and print and apply being used chiefly for secondary packaging.

## Barcode and product labels

Barcodes present product data in machine-readable form and provide a capture point at various stages of the production and distribution process. The barcode system was developed in the United States in 1973 by the Uniform Code Council (UCC), which is now known as GS1 US. Europe followed suit in 1977 and Australia in 1978. Today we have full global compatibility through the GS1 System.

GS1 Australia is part of the global not-for-profit organisation. The local arm issues barcodes and administers the GS1 system, which was developed to allow ordering, tracking, tracing, delivery and payment for goods across the supply chain, anywhere in the world.

The GS1 system includes GS1 Identification Keys, which supply access to specific information about a product. These numbers include the Global Trade Item Number (GTIN) - an 8-, 12-, 13- or 14-digit number that is unique worldwide.

Data carriers, such as barcodes, are used to encode the GS1 ID Keys to facilitate communication, data collection and exchange of information between trading partners.

The grocery and liquor industry in Australia is moving towards adoption of the key principles of efficient consumer response (ECR), which dictate that consumers are served better through a value chain that exercises collaborative management.

ECR best practice involves delivering superior business results while reducing costs and by achieving efficiency through streamlining processes. To that end, accurate data capture at all points of the supply chain is essential, with electronic data interchange (EDI) and barcodes being the primary forms of communication in this process.

GS1 Australia has published a set of guidelines for barcoding and numbering in the Australian grocery and liquor industry, which lists a number of benefits associated with using a standard industry approach as follows:

- More accurate information
- Real-time information
- Reduced manual entry
- Improved traceability (including for product recalls/ withdrawals)
- Common identification across industry
- Improved stock handling
- Improved stocktaking
- Reduced picking errors
- Reduce customer order errors

Barcodes can be printed directly onto products or form part of the artwork in pre-printed labels, which are applied using inline label applicators. Generic film packaging, commonly used in fresh produce and snack foods, employs a thermal transfer overprint process which can be used with form fill and seal machines to print barcodes during the packing process.

## Product identification marks and branding

Product identification and branding are important for protection against counterfeit products, particularly in the pharmaceutical and industrial industries. Laser coding and marking is often used in these applications, as it provides a fast method for printing high-quality permanent codes.

*Never has a process of rationalisation been more important.*

Laser marking uses no consumables, so the cost of ownership is low and investment payback relatively cheap. Laser marking is being increasingly used in the wine industry, where bottles are unobtrusively marked with identification numbers.

## Carton and pallet labels

Legible carton and pallet labels are integral to the smooth flow of product through the supply chain. Distribution centres hold thousands of pallets at any one time and cartons are sorted through a series of automated processes. Accurate and legible carton barcode placement is imperative to avoid the costly and inefficient practice of manual handling and identification.

Pallet labels also have a defined format and placement under the Australian Grocery and Liquor Industry requirements, whereby a GS1 Logistics Label must be placed on the fork entry side of the pallet exterior. Failure to meet or adhere to these standards can have broad implications; direct and indirect costs are passed on to retailers as the time to carry out the receiving process extends from a few seconds per pallet to minutes. Manual intervention is required as pallet details need to be rekeyed and a new generic label printed and applied on-site. Generic labels generate further problems as they prevent accurate serial shipping container code (SSCC) traceability, potentially adding significant costs.


In the case of generic cartons and SSCC pallet labelling, automated carton print-and-apply solutions can be used to print a GS1 and retailer specification compliant barcode label, which is then applied to one or more sides of the package. In the case of low volume lines, a standalone barcode label printer with integral software can also be used to manually apply the labels.

## New technologies

As technology improves and differing application requirements drive a need for change, development in data carriers continues to deliver significant advances. The advent of 2D codes including GS1 DataMatrix and QR (quick response) in recent years meant that larger amounts of data were able to be stored in a more compact format.

The newest development in data carriers, the GS1 DataBar, was introduced to complement the standard barcode, rather than replacing it. These marks are capable of carrying more data in a smaller package size, which makes them suitable for items that were previously unable to carry a code, such as fresh fruit and vegetables.

The increased information capacity means that data carriers can now contain product records including weight and expiry dates, as well as serial and batch numbers, while the reduced footprint means that valuable space can be used for product branding and marking.

DataBars are currently in wide use in the United States and extensive trials in Europe and Asia, with full global open trade scheduled for 2014.

To further increase efficiencies in communications and data exchange, EPCglobal (a division of GS1) is currently developing standards for the Electronic Product Code (EPC) to support the use of radio frequency identification (RFID). RFID is not a new technology, but has come down in price significantly in recent years, resulting in increased use. The benefit it offers above the more widely used barcode marking is the ability to be read without a direct line of sight. Each tag contains a microchip and antenna, which is read as it passes by or near a reader station. The technology is particularly effective for identification of bulk materials in areas where a direct line of sight may be difficult, such as pallet identification and tracking in a distribution centre.

## Inspection

In today's fast moving lines, product inspection is no longer a job for a set of human eyes. There is a range of inspection technologies in food and grocery covering everything from physical parameters to the presence of impurities:

- Vision inspection ensures that the physical appearance and dimensions of a product match expectation. This includes checking closures for tamper seals, fill levels and product content.
- Checkweighing systems automatically check the weight of packaged goods and remove packs that fall outside specified tolerances.
- Metal detection and X-ray is common in the food industry to ensure not only that product remains contaminant free but to minimise downtime on affected machinery in the event of contaminant damage.

### Vision inspection

Machine vision inspection reduces labour costs and assists in the minimisation of reworks, rejections and recalls. Comprising a camera and customisable software, the system is integrated into the production line, checks the product against predetermined criteria and displays data back. The data is interpreted in real time and if the product is not shelf-ready the system then instigates the appropriate predefined course of action: product rejection, raising an alarm or stopping the line altogether.

Real-time reporting software also allows the manufacturer to identify the cause of rejects quickly and to take preventative action to avoid further instances.

### Checkweighing

Inline checkweighers are paramount to ensure product is of the proper weight.

By increasing the accuracy of package weights, a producer/manufacturer can reduce waste caused by overweight packages - the reduction in give-away increases the number of packages which can be filled from the no-longer-wasted product.

At the simplest level, the checkweighing process is used to identify goods that fall outside manufacturing tolerances and to remove them from the line, ensuring they don't end up on retail shelves.

Stand-alone manual weighers can be used for weight-based marketing with an integrated database, while fully automatic labellers can be integrated into existing automated production lines to carry out weigh and weigh price labelling automatically.

The reporting capability of a checkweigh system ensures that both short- and long-term statistics can be evaluated and stored for future reference. Production data reporting on random testing for packaging conformity and information on materials, machines, batches, shifts and alarm messages, including a time stamp, allows the manufacturer to identify trends and process efficiency quickly and easily. This in turn reduces costs, provides greater customer satisfaction, leads to fewer line stoppages and provides a greater degree of transparency.

### Metal detection and X-ray

The presence of glass, bone, metal (ferrous and non-ferrous), stone and other contaminants can spell disaster in food processing. Metal detection and X-ray systems assist in ensuring that products meet expectations in both safety and integrity. Today's more advanced systems are capable of much more than foreign object detection; they are able to check for completeness and broken products and can be used to inspect fillings inside food products.

Smart systems can easily learn product features, such as aluminium clips on the end of smallgoods, so there are no inaccuracies when identifying foreign bodies.

## Why integrating identification and inspection makes sense

Much of the food manufacturing process takes place using automated equipment, but the trouble with automated lines is that they are not infallible; a production tool can easily move out of tolerance or human error could lead to an incorrect machine set-

up. Either of these issues could quickly lead to a large quantity of bad production items.

Early detection and correction of problems benefits the manufacturer in terms of realising less wastage, provides the ability to identify and fix upstream issues and to avoid costly recalls.

An integration software system desegregates the processes to deliver a more efficient product traceability solution via a centralised control approach. The integration of labelling, coding and other end-of-line packaging equipment such as vision systems and scanners creates a more streamlined operation.

The key benefit to implementation of an integrated software solution is the added security it provides. The provision of a single data management point ensures that coding is always accurate and that inspection characteristics are intrinsically linked to that coding. The centralised approach means that correctly labelled product will come off the line and always meet with packaging integrity, weight and fill level requirements, as well as being contaminant-free.

## Specific benefits of an integrated approach include:

- **Coding and labelling errors are eliminated:** Through a system of centralised control, the correct code (barcode, data code or batch code) is always placed on the correct product at the correct time. This lessens the risk of product recall, rework, lost production, wasted materials and penalties from customers, as well as the subsequent brand damage that can occur.
- **Increased efficiency:** Centralised management of coding data eliminates the need for message editing on the factory floor. Line performance is improved as product changeovers can be executed quickly and easily. Fault alerts and warnings for any devices connected to the network are communicated instantly via a human machine interface (HMI), dashboard, scoreboard, email or SMS.
- **Simplified message design:** The WYSIWYG editor and centralised database formats make message design quick and simple for coding and labelling products.
- **Centralised product ID management:** All coders and labellers on a production line are networked, which means that primary, secondary and tertiary product identification is controlled centrally, reducing the chance of errors and improving efficiency.
- **Real-time production visibility and reporting:** The system tracks real-time production effectiveness, performance and quality information for packaging lines. Detailed production data for a day or even several years of operations are stored in a central database and accessed via the internet or extranet. The availability of comprehensive performance information allows manufacturers to make improvements and changes as required.
- **Process improvements:** By analysing data over time, manufacturers can improve production processes. If maximum downtime is recorded due to a carton erector, or products are consistently overweight because a filling machine needs adjusting, these problems can be easily identified and a rectification plan developed.

*The trouble with automated lines is that they are not infallible.*

## What works today should work tomorrow

As retail, regulatory and organisational needs change, existing hardware, equipment and software solutions must be readily reconfigured to meet simple individual or large-scale operations, whether it be one plant or one hundred.

Some businesses have straightforward requirements, needing no more than an off-the-shelf solution which provides management of primary and secondary coding, as well as labelling and manual pallet SSCC labelling. It may also feature remote fault diagnostics, alerts and rectification capability.

At the other end of the scale, a software solution must be able to grow with a business and incorporate tailored logic to meet the differing needs and business processes relevant to specific industries. It should not only be able to work alongside existing MRP, WMS, SCADA or ERP systems, but also factor in future technologies.

Accurate data collection puts the power back into the hands of the user. A smart software integration solution will provide data for in-depth, real-time production line performance monitoring. It should offer accurate production efficiency information including idle times and breakdowns, and identify the cause of any production stoppages. This type of information gives the user visibility and insight into production efficiencies by date and line, allowing immediate action to avoid downtime, and means that long-term strategic decisions can be made on the basis of facts, not 'feel'.

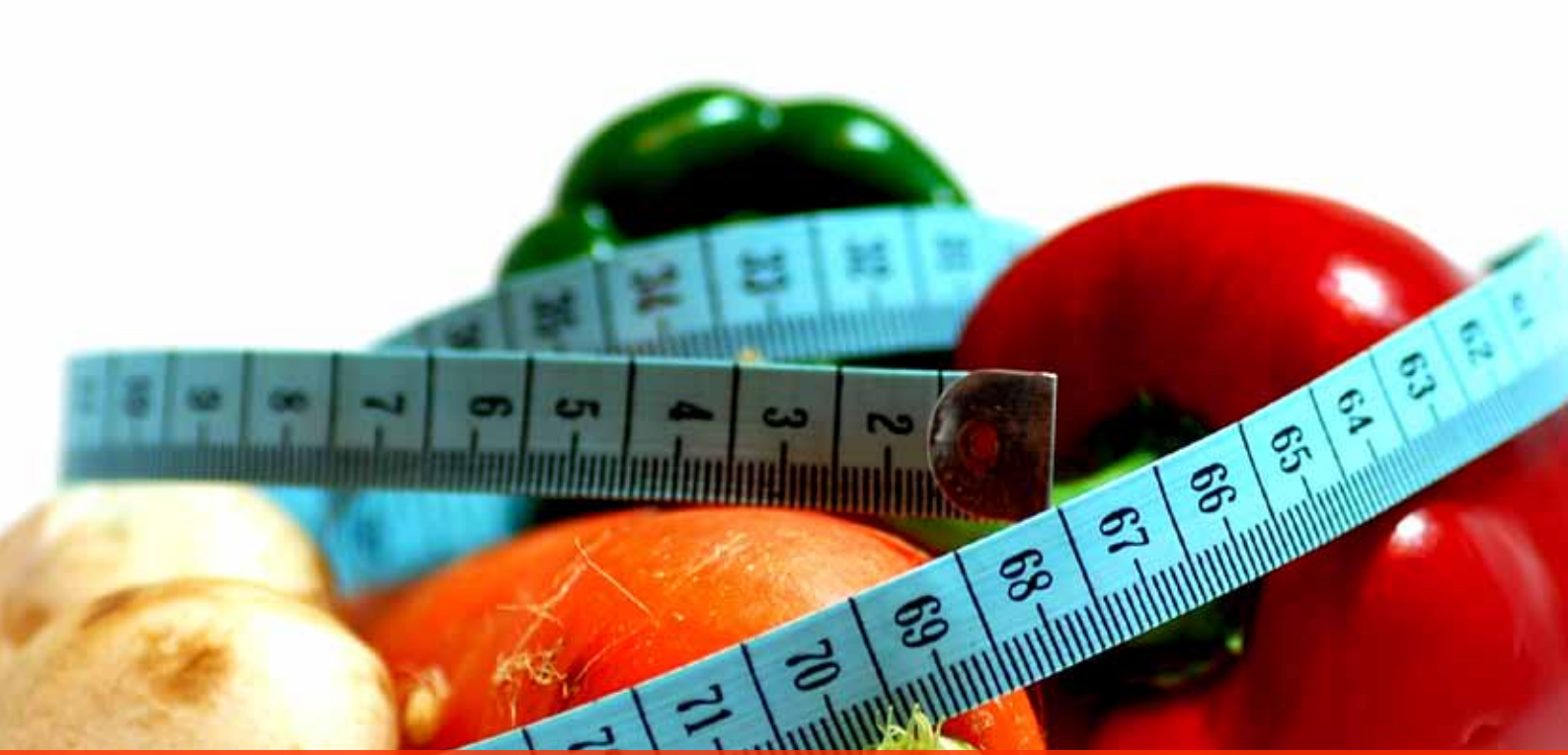
Having access to detailed operational information in real time means that operators and line supervisors are instantly aware of current production efficiencies against known targets and are therefore able to quickly address them and avoid significant productivity losses.

## Streamline to success

In a market increasingly influenced by external forces, where costs continue to escalate and margins are continually put under pressure, the argument for rationalisation of manufacturing processes and efficiency improvements is clear.

Continually changing technologies and regulatory requirements as well as the individual needs of a business means that there is no 'one-size-fits-all' solution in software integration. As companies strive towards a more customer-focused approach, delivery of the right product with less wastage, fewer recalls and optimised manufacturing processes will set them apart from competitors.

Employing a solution that not only provides immediate efficiencies but allows for future growth and change just makes good business sense. ■



# What you can't see and measure, you can't manage

Integrating identification and inspection processes gives:

- Better visibility into the packaging area, which was previously a black hole.
- An overall picture of what is happening on the production line - such as rejects per hour rates in real time - via integrated dashboards.
- The ability to streamline the process, then pinpoint and manage bottlenecks.
- The ability to link a batch of products to rejects.
- A simplified inspection and identification process: barcodes can be verified against specifications, such as labels, product filled, packaging elements weights.

## Problem: Spillages from yoghurt tubs when stacked, probably due to ill-fitting foil lids.

**Solution:** A vision system integrated with ID package code management software that has dashboards will show the exact rejects per hour rates in real time. Dashboards will show the overall number of yoghurt lids applied, as well as the 'good' (well-sealed) and 'bad' (not properly sealed) lids. An integrated vision-ID system will also enable operators to pinpoint and manage bottlenecks: reports will show if a particular machine has been causing downtime, so a decision can be made to replace it and remove the production-line bottleneck. Similarly, the origin of problem batches can be analysed.

**Benefits:** An overall picture of what is happening on the production line; ability to streamline the process, then pinpoint and manage bottlenecks; ability to link a batch of products to rejects.

## Problem: Overweight strawberry punnets are causing fresh produce packer to lose profits.

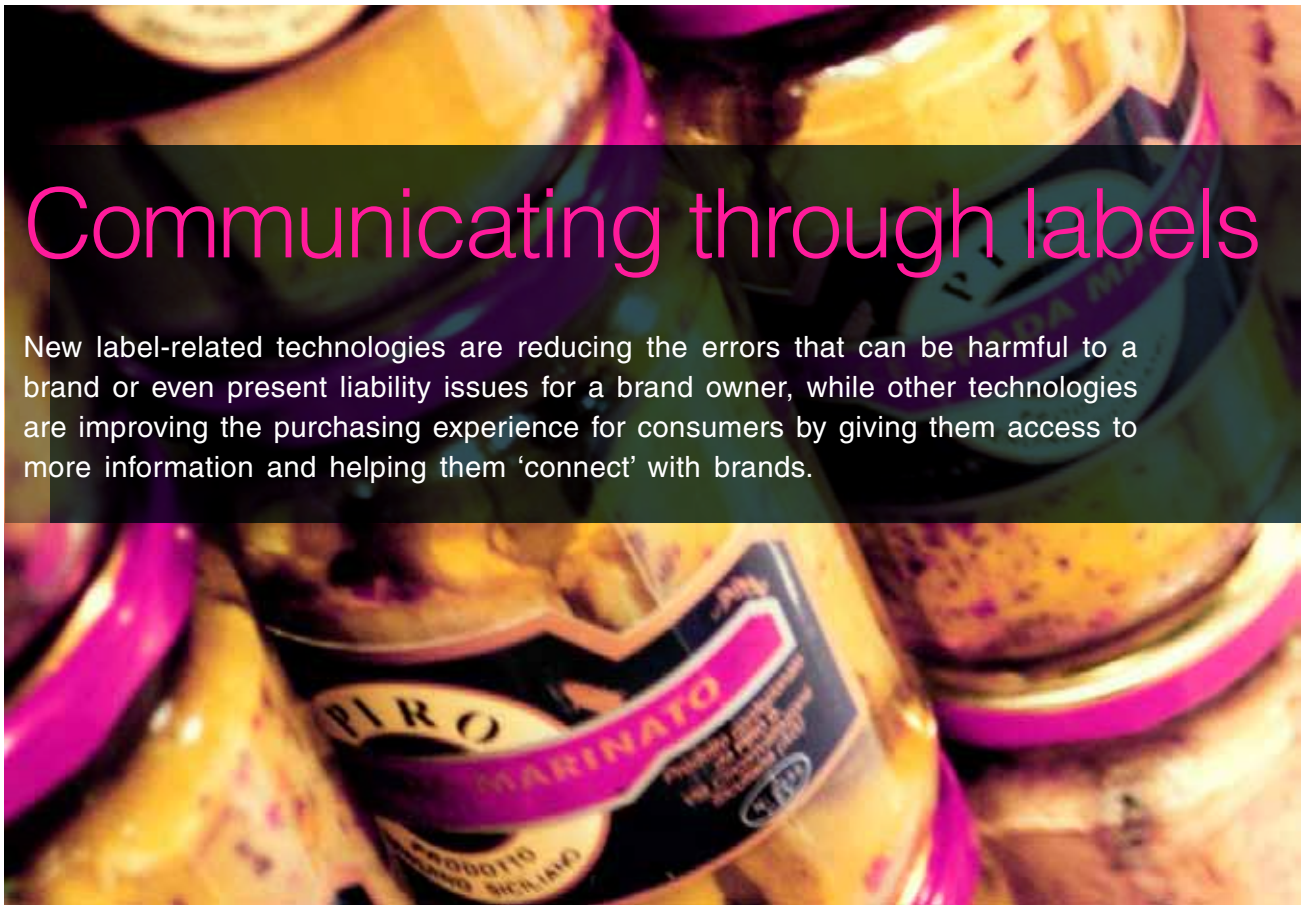
**Solution:** Vision, inspection and ID can be integrated so that a best-before date can be coded online onto pre-printed labels (which already have the brand and weight) for strawberry punnets. Via checkweighing, any products over the specified weight will be rejected. While not much in individual punnets, this saving quickly adds up over just one week, saving profits.

**Benefits:** better visibility into the packaging area, which was previously a black hole; simplified inspection and identification process

## Problem: Wrong product is in the tub; barcode is not correct for that product; and/or not scannable.

**Solution:** A vision system simplifies the inspection and ID process: cameras in the vision system are linked with package code management software; together they verify the barcode against specifications for that product, and also verify the barcode is scannable. Products in the wrong tubs set off an alert and stop the line, allowing operators to quickly fix the problem. This would only be possible manually at very slow speeds and would therefore create a bottleneck. Incorrect barcodes will also be automatically rejected.

**Benefits:** Simplifying the inspection and identification process. ■




# Communicating through labels

New label-related technologies are reducing the errors that can be harmful to a brand or even present liability issues for a brand owner, while other technologies are improving the purchasing experience for consumers by giving them access to more information and helping them 'connect' with brands.

Long gone are the days when the label on a food or beverage just communicated the contents of the package and the name of the manufacturer. Now they are integral to both the processor's relationship with the purchaser and with supply chain optimisation, product recall procedures and more. This means the importance of label accuracy is more significant than ever.

## High-speed production lines hinder label accuracy

Very few food production lines in Australia are dedicated to a single product. Most manufacturers process a diverse range of products through each line, which exponentially increases the likelihood of labelling errors occurring. With hundreds of containers being processed every minute on high-speed production lines, an error used to result in considerable numbers of out-of-spec products which had to be either reworked or dumped.

But now, label inspection systems can be set up to ensure perfect product presentation and confirm label ID every time. These systems can automatically inspect labels on all packaging to detect and automatically reject packages and containers with label issues.

Labels must be inspected for many things:

- Does the label match the product?
- Misalignment
- Legibility
- Correct use-by/best-before date
- Correct lot number
- Correct batch number
- Does every product have a label?
- Is the barcode correct?
- If product has more than one label, has the correct pairing been selected?
- Is the overlap alignment correct for wrap-around labels?
- Is the label correctly positioned on the product?
- Is the label damaged, dog-eared, etc?
- Is the product double-labelled?
- 2D data matrix code verification
- Barcode verification

Manufacturers can minimise the risks of mislabelling by fully automating the label inspection process. Using new vision inspection systems, manufacturers can ensure that every label on every pack is verified. No more checking some samples and hoping they were representative of the whole batch!

In-machine label inspection systems can be interfaced to labelling control systems using discrete I/O, fieldbus or TCP/IP protocols, and the line PLC or plant SCADA systems may be configured to write the appropriate information to the vision system during set-up.

The label inspection systems can be installed alongside metal detectors, X-ray inspection systems and check-weighing systems, solving multiple quality assurance systems simultaneously.

## Supply chain integration

The information and barcodes printed on the labels, along with other new technologies such as eMessaging, RFID and data

synchronisation, can drive efficiency in the food industry supply chain. A recent joint industry/academia research study, by the Department of Management and Marketing in the Faculty of Business and Economics at the University of Melbourne and GS1 Australia, aimed to gain a deeper understanding of the issues that affect the adoption and use of supply chain technology standards in Australia.

Key findings of the research clearly show the adoption of a number of GS1 standards-based technologies can lead to more integrated and efficient supply chains. Peter Chambers, GS1 Australia's General Manager, Operational Initiatives, said, "Technologies such as barcodes, eMessaging, radio frequency identification (RFID) and data synchronisation can significantly improve transactions between supply chain industry partners."

The study also revealed that reduced transport costs and greater efficiencies are benefits Australian businesses can realise with the successful implementation of standards using open communication channels, collaboration and focus on innovation and data quality.

Manufacturers can potentially track each pack through the supply chain using these latest communication technologies. This type of advanced data collection simultaneously enhances traceability and allows manufacturers to prove 'due diligence'.

## Moving beyond product identification

### GS1 DataBar

Currently, barcodes can only identify a product using a globally unique number known as the Global Trade Item Number (GTIN). But increasingly, retailers and manufacturers want to know more. They want to know expiry dates, weights, batch numbers, serial numbers, ingredient information... and now they can.

The GS1 DataBar enables expanded barcode implementation by meeting the objective of identifying small items and carrying more information than the standards and technology of current EAN/UPC barcodes. It encodes brand identification and dynamic data so that consumer and food safety programs can be instituted at the point-of-sale (POS). Additional benefits from implementing GS1 DataBar include: automatic markdowns at POS; expiration date management; improved product replenishment; traceability to the POS; and category management.

There are currently seven different DataBar variations, four of which have been approved for use at POS:

- GS1 DataBar Omnidirectional
- GS1 DataBar Stacked Omnidirectional
- GS1 DataBar Expanded
- GS1 DataBar Expanded Stacked

The two Omnidirectional versions can be smaller than the existing EAN/UPC barcodes and so can be used on the small products that are currently difficult to barcode. This makes it easier for retailers as more and more products can be quickly and accurately scanned.

The expanded versions allow users to encode additional information, such as expiry dates, weights, batch numbers, serial numbers and more. Retailers and manufacturers will be able to use such additional information to meet future customer demands and regulatory requirements.

Retailers will be able to capture dynamic data at the POS. Information such as product recall notifications can be instantly communicated at the POS, enhancing consumer safety and minimising retailer liability. Automatic markdown and expiration date management will also be possible at the POS using DataBar.

DataBar will take product traceability to a new level, as the identity of purchasers will be possible if they use loyalty cards when they make the purchase.


*The importance of label accuracy is more significant than ever.*

### QR codes

QR (Quick Response) codes are essentially 'print-based hypertext links' and are equivalent to mobile phone-readable barcodes.

The matrix barcodes are optically machine-readable labels that give consumers much more information about the item and company. Their fast readability and greater storage capacity compared to standard UPC barcodes has made them popular outside their original automotive industry application.

Applications include product tracking, item identification, time tracking, document management, general marketing and much more.

Originally designed for industrial uses, QR codes have become common in consumer advertising. Typically, a smartphone is used as a QR-code scanner, displaying the code and converting it to some useful form (such as a standard URL for a website, thereby obviating the need for a user to type it manually into a web browser).

Although initially used to track parts in vehicle manufacturing, QR codes are now used over a much wider range of applications, including: commercial tracking; entertainment and transport ticketing; and product/loyalty marketing. The most common reasons for consumers clicking on QR codes are to get a coupon or discount deal, find out more detailed product information or to enter a competition.

The QR code system is patented by its inventor, Denso Wave, but the company has declared that it would not exercise its patent rights. This means that the QR Code can be used at no cost. ■

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