Choosing cost-effective coding, labelling and inspection systems : an eBook

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Why you should care about total cost of ownership

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Australia's business climate has never been so competitive. While seemingly untouched by the crisis that brought much of the world to its knees not so long ago, our local economy suffers other significant stresses - particularly in the manufacturing sector.

The landscape shifted pretty quickly - when the Aussie dollar strengthened to levels not seen or sustained for decades, cheap imported product became increasingly attractive to local buyers. The challenge for Australian manufacturers in this environment is to find ways to reduce costs, while still maintaining high-quality output.

When the bottom line isn't really the bottom

While many manufacturers opt for staff cuts and facility closures or consolidations to make an immediate positive impact on profits, the savviest operators realise the obvious - sometimes the bottom line isn't really the bottom. They understand that investing in core business competencies and optimising the management of non-core activities is the most effective way of delivering a sustainable competitive advantage.

A key non-core business activity in manufacturing is the life cycle management of capital assets and machinery that supports overall business operations. To fully and effectively manage these elements requires optimisation of the total cost of ownership, or TCO. Contrary to what most business owners and operators think, TCO is not just a job for the accountants. TCO affects multiple parts of the business and should be factored in not only for purchasing, but for many ongoing operational and staffing decisions as well.

Contrary to what most business owners and operators think, TCO is not just a job for the accountants.

What is TCO?

As the name implies, total cost of ownership refers to all costs - direct, indirect and hidden - associated with the procurement and operation of capital assets. TCO assessment should cover the full equipment life cycle:

- Acquisition
- Operational maximisation
- Performance maintenance
- Timely disposal

Direct vs indirect and hidden costs

Direct costs are usually those planned within a budget, where purchase orders are generated and invoices paid. This clearly defined process makes it easier to identify and track these types of costs.

In comparison, indirect costs and hidden costs are more difficult to measure and quantify. These costs are often not factored in to the TCO of assets or, as is often the case, factored in at initial assessment yet not monitored over the life of the equipment to ensure that original expectations are actually being met.

Is your payback period calculation even close?

When purchasing capital equipment, it pays to undertake a thorough analysis that factors in all costs, prior to making any buying decisions. Equipment investment is often made on the basis of a calculated 'payback period' - ie, the expected time frame in which the equipment cost will be fully recovered. Unfortunately, this metric becomes irrelevant in a scenario where hidden costs are not

defined or captured and the true economic implication is therefore not understood.

The obvious

Direct costs tend to be easily identifiable and are therefore more likely to be correctly factored into purchasing decisions:

- Capital outlay
- Consumables
- Service and maintenance
- Spare parts
- Labour

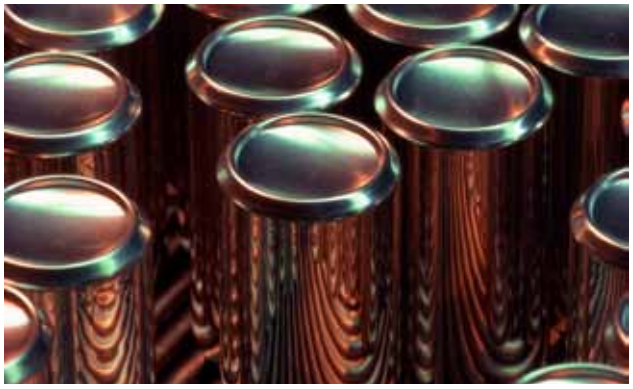
TCO in action

To illustrate the TCO framework, we'll use the Australian manufacturing industry as an example. Manufacturers must maintain required regulatory and compliance standards in the production of goods, which include coding and labelling obligations. When determining the costs associated with investment in labelling machinery, a manufacturer may consider some or all of the following direct costs:

- Capital outlay - the cost of the equipment itself.
- Consumables over the period - labels and other physical elements that are exhausted through the production process and require continual re-purchase.
- Routine maintenance - to ensure that equipment remains in operation when required.
- Service contracts - designed to ensure equipment performance.
- Corrective maintenance - in the event of a breakdown or malfunction.
- Spare parts - required through general wear and tear or breakdown.
- Installation costs - labour costs associated with the original equipment installation and set-up.

While all of these costs are completely relevant and obviously need to be factored in, they don't provide the potential buyer with the whole picture. Again, using labelling machinery as an example, the purchaser needs to consider the 'hidden' elements:

- Unplanned downtime in the event of an equipment breakdown.
- Shipping if the servicing requirement is return-to-base.

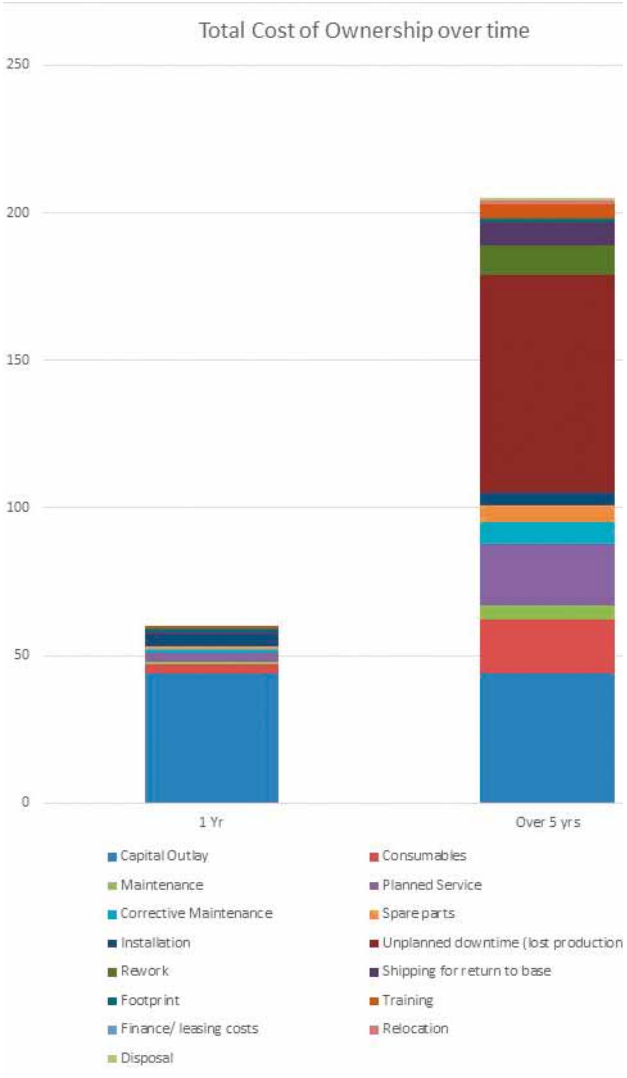


- Planned downtime due to routine maintenance tasks.
- Operator training.
- Financing costs if it is a lease/rental arrangement.
- Cost of disposal.
- Training time.
- Equipment relocation installation costs - in the event of physical changes to lines and factory layout or due to relocation to a different facility.

The hidden

These can have a huge impact on the actual cost of ownership

- Forced downtime due to maintenance or breakdown
- Return-to-base shipping for service
- Training and associated labour costs
- Relocation installation costs
- Cost of disposal



Disclaimer: This is a guide only. Costs will vary based on industry, product, equipment, usage and other factors.

Key takeaway:

- Total cost of ownership is much more than the initial cost of capital.
- The quality and reliability of the equipment greatly influences the costs.
- Unplanned downtime, recalls and rework can be the biggest hidden costs.

For example, return-to-base servicing for equipment might seem to be the cheaper alternative initially but the downtime caused as a result of the machine being sent for repairs can be a much larger problem.

Be proactive with TCO

Manufacturing organisations can save money, increase equipment performance and improve workforce productivity simply by understanding the life cycle costs associated with equipment ownership and by implementing proactive strategies and tactics to optimise these costs.

Some of the recommended strategies to minimise TCO and maximise the ROI on equipment include:

- evaluate the equipment reliability and factor in the capital cost vs cost of downtime - a cheaper alternative that is only operational half the time is not delivering savings in the long run;
- regularly inspect and maintain machinery, with fixed-price service contracts - any planned and managed downtime is more economical than an unforeseen crisis, especially if it avoids additional delays due to the unavailability of parts, tools or maintenance labour;
- invest in proper operator training - don't run the risk of failures and subsequent expensive reworks, or any unplanned downtime, due to simple operator error or incorrect machine settings;
- evaluate the mean time between failure, response times and same-day fix rates - the clichés are true; time is always money and knowledge is always power;
- look at capital outlay vs ongoing overheads - remember that a low capital cost/high running cost combination is a hidden TCO.

Questions you should ask yourself when identifying hidden costs include::

- Have our operators received proper training?
- How many different supplier relationships am I managing?
- Am I buying and standardising on the best equipment available?
- Am I leveraging my purchasing power and volume?
- Have I compared the TCO between one manufacturer and another to know if I am really getting the best value for money?
- Do I know if it's going to cost more to service existing equipment than if I were to buy new?

You can easily eliminate additional financial burden through rationalisation of your asset base.

Your answers to these questions will help you determine whether or not you have hidden costs. You can easily eliminate additional financial burden through rationalisation of your asset base and by reducing the number of suppliers with whom you do business. This will not only maximise your purchasing power and lead to increased operator performance, but also reduce some of the management and administrative obligation that comes from dealing with multiple manufacturers and service providers.

TCO assessment will not only assist in asset life cycle management, but provide additional benefits including budgeting and planning assistance, guidance for capital acquisition prioritisation and clarity when making lease versus buy decisions.

The equipment life cycle is just that - a cycle. This means that business decisions made in each phase can have a direct impact on factors in the next phase. For instance, an unwise decision at the acquisition stage can have disastrous effect on the ongoing operations - decide to go with the low capital outlay yet less reliable option and you may see a snowball effect generating more non-operational hours and reworks. Similarly, by electing not to implement a program of preventative maintenance, you may go down the path of an expensive series of emergency repairs and a premature requirement for disposal and repurchase ... And so the cycle continues.

Companies that take a holistic view to TCO - those that inherently understand that today's out-of-pocket expense is not the only contributing factor to ongoing profitability - are likely to have a significant and sustainable competitive advantage over other vendors in their industry. And let's be honest ... in today's economic environment, what business can afford not to think that way? ■

Five tips for selecting coding and labelling equipment

1. Discuss and evaluate all aspects of the application

No single solution will be suitable for every application. To ensure the codes and labels remain intact and legible, make sure you know exactly how your product will move through the supply chain and how your customers will store your product.

Apart from the basic application details like line speed, product substrate/surface, message, message format etc, key questions to ask include:

How will your customer store the product?

Whether your product is destined for the fridge, freezer, microwave or can be left out in the sun all day, it's important to ensure the labels and codes remain as clear as the day they were applied.

How long will the product remain on the shelf?

Labels and codes need to remain legible for at least as long as the product is on the shelf - and ideally for as long as it's in the consumer's keeping as well.

How long will the consumer retain the packaging?

Is the product designed to be consumed in one sitting, like a chocolate bar, or might it sit in a cupboard for weeks or even months, such as UHT milk?

For carton labelling, consider direct transfer vs thermal transfer labels:

Some other questions that need to be answered before you can make a choice are:

- Are you looking for equipment for one production line or will it be moved to other lines as well?
- What is the range of products that the equipment needs to code?
- What is the physical space available for the coding system?
- What is the current process? And will it need to be modified?

Direct transfer vs thermal transfer labels

System	Suitability
Direct transfer	• Suits products with less than 12 months' shelf life (label doesn't need to last long). • Print fades after about six months and does not handle heat, humidity, sunlight and direct friction. • Ideal for perishable products.
Thermal transfer	• Suits products likely to endure friction, temperature changes or dampness. • Print is also resistant to chemicals, humidity, UV rays and abrasion (label needs to be more durable). • System offers higher print speeds. • Ideal for products to last more than six months, such as 'long-life' goods.

You also need to consider legal and compliance requirements, if any, as directed by the government, standards organisations as well as your customer.

2. Ascertain message and legibility criteria

The message you need to code will depend on the product itself, any legal requirements and any internal traceability needs you have. So it could be just a simple date/batch code, an internal barcode or a more complex date/batch code plus a nutrition and ingredients panel.

Unsurprisingly, different systems do different things better than others. Whether your product requires only a simple numeric code or a longer, more complex message will determine which system is best for you.

Consider these points:

Does the code have to conform to strict legibility standards?

Some codes have well-defined guidelines. Pallet labels are a good example, with very specific formatting and rules defined by GS1, as well as retailers, which enables the smooth flow of product through the supply chain.

Does the code need to be scannable?

Whether it's directly coded or on a label, an unscannable barcode not only wastes time at the cash register or warehouse, it can have costly implications for the supply chain - and many retailers are intolerant of products that cause scanning errors.

Is your container a dark colour?

Legibility can be an issue on dark containers; some ink colours are just too difficult to see, in which case you'll need a light-pigmented ink to ensure your code is legible. But even if you don't have a dark-coloured container, it's wise to take into account whether your packaging colour or substrate may change in the future, and if so, you may need to consider a coder that can code with lighter pigments.

Does your code or information need to be indelible?

Some coding needs to be indelible - for example, that on food products. Indelible coding won't fade, run or be rubbed off during normal conditions of use and storage. Depending on your application, laser coders or continuous inkjet (CIJ) coders or thermal transfer overprinters (TTOs) could be a good choice.

3. Look at various options to achieve the same result

CIJ vs TTOs

CIJ and TTOs, for example, will give similar results - but which will work best for your situation?

In CIJ printing, tiny, electrically charged droplets of ink are expelled from a print-head nozzle to form a character or pattern. It is a non-contact form of printing which permits coding on a range of sizes, shapes and substrates.

A benefit of CIJ printers is their wide range of printing speeds, extensive substrate adhesion compatibility and ease of installation. Be aware, however, that CIJ printers require regular maintenance and housekeeping, plus a supply of ink and solvent consumables.

CIJ can code variable information and is suitable for:

- product-identification codes
- batch numbers and date codes
- graphics, such as logos
- text, including upper and lower case, and large characters

TTOs are suitable for coding on flexible packaging films and self-adhesive labels. A thermal print-head melts ink based on wax or resin from a thin thermal transfer ribbon coating onto the substrate to be printed. TTOs are most commonly used in the snack food, confectionery and fresh produce sectors.

An unscannable barcode not only wastes time at the cash register or warehouse, it can have costly implications for the supply chain.

TTOs are often used for printing simple date and batch codes, but can also be used to print:

- logos
- product descriptions
- ingredients lists
- nutritional panels
- fully compliant barcodes

Laser vs inkjet

As in the comparison above, inkjet and laser technologies perform a similar end result, yet one could never completely do the job of the other, nor fully replace the other.

Rapid advancements have widened laser applications to the point they can now mark clear and legible barcodes; while changes in inkjet technology continue to be incrementally steady - for instance, improvements to two of its former weaknesses (maintenance and ongoing consumable costs) have made those points its strengths. Laser technology has a higher capital cost, but a major strength is its lower operational costs - no consumables - making it a cost-effective solution over time.

So which is better for your application?

Laser technology:

- creates a very sharp, indelible mark, and is often used for aesthetic purposes;
- is most suited to high-volume applications, typically those operating two shifts a day with production rates higher than 100 products/minute;

- can mark fully compliant barcodes on secondary packaging when coupled with laser-reactive inks preprinted on the packaging substrate (while ink costs are higher, savings can be made with generic cartons);
- can also mark flexible packaging material where no special laser field exists - the original field for a small character inkjet code often suffices - so can be used on snack food and confectionery packaging (this applies to fibre YAG lasers only, not CO_2 lasers);
- other applications include food, beverage, cigarettes and pharmaceuticals through to heavy industry.

Inkjet technology can code on primary and secondary packaging (including fibre cartons and shrink wrap) to code:

- date and batch codes
- human-readable text
- graphics

Applications vary broadly across sectors, from food and beverage, to pharmaceutical and cosmetics, through to automotive and timber.

4. Look beyond upfront cost when researching

The initial money you hand over when buying new equipment isn't all you'll end up paying. Be sure you also consider direct, indirect and hidden costs.

Direct costs include consumables, routine maintenance, corrective maintenance, spare parts and installation costs.

Indirect and hidden costs include downtime if equipment fails, downtime due to routine maintenance, operator training and cost of disposal to name just a few.

5. Analyse available support, operating costs and maintenance procedures

Available support

Buying cheap equipment from overseas might seem like a good idea while it's working well, but once it runs into issues, you might start wishing you'd bought from a local distributor. What you save on the purchase price can be very quickly eaten up in lost production, spare parts, the cost of corrective maintenance (particularly if return-to-base repair is required) and labour costs.

Direct costs include consumables, routine maintenance, corrective maintenance, spare parts and installation costs.

Then there's the frustration of dealing with a manufacturer in a different time zone, manuals translated from another language into English (losing some of the meaning along the way), conflicting public holidays and so on - these all could see your downtime further blow out.

Operating costs

Consider the costs of things like consumables, power, disposal of waste, routine maintenance, servicing and labour costs associated with set-up and changeover.

Particularly for small operators, a single machine may be called on to code or label for a range of products, each with different information, sizes and colours. As we know all too well, time is money, so if changing over the set-up for different products is difficult, perhaps it's not the best one for your purposes.

Maintenance procedures

Some points to consider:

- Maintenance frequency: How does this fit in with your planned maintenance schedule?
- Who does the job: Can your staff be trained to carry out maintenance in-house, or will you need to pay for - and organise - a technician from the manufacturer or distributor?
- Accessibility: Does the entire machine need to be taken to pieces to maintain or replace a single part, further blowing out your downtime? Or does it contain drop-in/drop-out components, which can save both downtime and a technician's fees?

Whenever your labeller or coder is out of action, the entire production line grinds to a halt, or builds up as a backlog. Do your research on new equipment before you purchase - or risk being caught out when you need your line to be up and running. ■

Detect early and detect often

Which inspection system is right for you?

Anecdotal claims suggest that it costs five times as much to recall a product as it does to distribute it, even before other costs such as legal claims, product disposal, loss of reputation and loss of market share are considered. A sure way to avoid these costs is to avoid recalls, and you can do this by identifying and fixing any out-of-specification product before it leaves your plant. Modern inspection systems can help you check, detect and respond to problems, but the question is: which inspection system is right for you?

Proper management of risk always involves assessment of what exactly could go wrong, the effects it might have and the likely consequences, including costs. Legislation often demands that a food business take reasonable steps to prevent such events. This naturally leads one to examine the possible prevention steps and to assess their cost.

Machine vision systems dramatically increase the number of inspections; reduce human error, eyestrain or repetitive motion injuries; and allow an increase in production speed and accuracy.

Know your product and process

Choosing an inspection system without knowing what you are looking for is a sure way to purchase a failure. What are the biggest concerns before your product leaves your door? Weight? Packaging? Contaminants?

Where do most errors occur in packaging? What contaminants are you likely to find, what contaminants do you want to check for, and where do they come from? Is your product homogenous or multitextured? Do you need to inspect several different products on one line? How is the product packaged and will the packaging interfere with the detection method?

Ideally, you want to find problems early in the process to reduce the cost of rework or scrap. To do this you must not only know what issues you are looking for, but also determine the optimal place in the process to detect them. This information will influence which technology is most applicable.

Other factors to start considering include:

- Line speed: The inspection system must be able to keep pace with your line speed.
- Integration: The inspection system must be able to 'talk to' and be integrated into your process automation and data collection systems.
- Futureproof: The inspection system will probably have a 5+ year life span so you need to ensure that it will have the capacity to cope with future increases in line speed and throughput.
- Hassle-free: You can't just stop your plant while you wait for a solution if the inspection system has problems - choose a supplier who will be available with assistance and spare parts in a timely manner if the system does not perform as per specification.
- Automation: Automated systems use software to make defect decisions and do not rely on the operator's vision. The software compares the image with preset measurements and rejects defective products automatically. If a product is rejected, it can be removed with an automated rejection mechanism, such as air blow-off systems, drop flaps, retracting conveyors or sweep arms.

Once you have determined what you want to achieve you can start looking at the different inspection systems that are available.

Visual inspection

Machine vision inspection systems can be used to:

- inspect the presence, position and formation of a barcode or use-by date;
- validate the presence and position of labels;
- check closures of tamper seals to make sure the correct caps are on by colour;
- detect fill levels in bottles or jars and the packaging's content;
- sort food and beverage products based on marking;
- count products;
- provide 360° inspection where several cameras can capture images which are then pieced together.

As stated earlier, due to automation, not only can vision inspection systems dramatically increase the number of inspections (compared with manual inspections), they can reduce human error, eyestrain or repetitive motion injuries and allow an increase in production speed and accuracy.

These systems offer an immediate and traceable return on investment, and their affordability has opened up this option to small and medium-sized enterprises as well as larger ones.

As an added benefit, the systems can be integrated into other production line technology, meaning your automated solutions work as one. Any faulty products can be redirected for rework, re-packaging or relabelling, or rejected if the error cannot be rectified.

Checkweighing

Modern checkweigh systems do more than just check the product's weight. They can pay for themselves in a very short space of time by controlling overfills as well as preventing underfill. Reducing overfill tolerance by as little as 10% can increase batch yield considerably - and this can easily be achieved at full line speed.

Contamination detection

A well-developed Hazard Analysis Critical Control Point (HACCP) plan can help prevent, reduce or eliminate foreign contaminants in raw materials and finished products. Depending on your product and packaging, technology such as X-ray inspection or metal detection systems can help you in your foreign materials reduction program.

Metal detectors and X-ray systems for food applications must be very sensitive, easy to use, fully automatic, fast, extremely robust, reliable and cost-effective. They need to be able to run for many years in all types of factory environments and make reliable pass/fail decisions on literally millions of products. A successful system will have a high level of success in finding contaminants, but minimal false detections.

Finding the system you need now, while taking into consideration any future changes, is a balance, and will require you to plan ahead. It is important to have an inspection system adequate for the task, but avoid 'bells and whistles' that add capability you may never use, and cost.

The only way to be sure that a system will work for you is testing. Seed product with expected contaminants and then see if the process finds them at an accuracy level in line with your predetermined risk acceptability.

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X-ray systems

The contaminant-detection capability of X-ray systems is directly related to the density of both the product and the contaminant: the denser the contaminant, the darker it will appear on the image and the easier it will be to identify.

X-ray inspection systems can be used to detect several types of contaminants, but there are many others that an X-ray system may find hard to detect, including cardboard and paper, hair, insects, low-density plastics and stones, soft bones and cartilage, wood and thin glass (such as fluorescent tubes).

While X-ray systems can be more versatile than metal detectors, on the down side, they are more expensive and have a shorter expected life span.

Metal detectors

Today's metal-detection technology is extremely effective but there are some limitations to consider:

- Products packed in a metal container, wrapped within a metallised film or containers with a metal lid.
- Products with high salt and/or moisture content that reduce the sensitivity of a conventional metal detector.
- Non-metallic dense contaminants such as glass and stones, which can't be identified by an electromagnetic induction device capable of detecting metal only.
- Thin wire strands can be problematic for metal detectors because of orientation.

Metal detectors work best for bulk conveyed or piped product, or products in small packages. In general, metal detection systems are less expensive than X-ray units and last two to five times longer.

Tandem systems

To find the widest range of contaminants possible, use a combined system: for instance, a metal detector can easily find aluminium, while an X-ray cannot; an X-ray can easily find glass and stone, while the metal detector cannot.

Also, X-rays can easily inspect the inside of a package to assure product integrity.

Proper management of risk always involves assessing what exactly could go wrong, the effects and the likely consequences - including costs. As noted, legislation often demands that a food business take reasonable steps to prevent such events, and a good inspection system will be one of your best investments in managing your risks. ■

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