

# Implementing Total Cost of Ownership to Prevent Lost Revenue Opportunities



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When evaluating capital equipment purchases, manufacturers must consider the difference between “price” and “cost.” Price reflects a one-time upfront investment, while cost normally incorporates other factors such as cost of goods sold and related operating expenses, which influence the return on investment. When evaluating equipment, looking for the lowest price can affect the long-term costs. Over the long term, equipment decisions based solely on the upfront cost can contribute to lost revenue opportunities, as well as downtime, slowing machinery, and inconsistent quality.

A growing best practice in the industry is to base purchasing decisions on the total cost of ownership (TCO). While you may have already worked with TCO, let’s do a quick review on this concept. TCO:

- Considers the overall cost of buying, owning, and running a piece of equipment.
- Helps decision makers evaluate current equipment options to best compare bids from original equipment manufacturers.
- Captures the true financial impact across the organization of an equipment purchase.
- Aligns the various stakeholders by establishing the expectations of buyers and suppliers to ensure that a company controls costs, maximizes uptime, and does not lose out on important revenue opportunities.

Below we will explore real-life examples that illustrate how small changes can make a big difference to your bottom line.

## Primary Areas of Focus for TCO

Although TCO reflects the costs associated with one piece of equipment, the entire manufacturing process must be evaluated. This can range from changeover speeds to bottlenecks in the process. For pet food co-packers, who have many customers, recipes, package sizes, and SKUs to manage, these are the top four areas to consider:

- **Upfront Communication and Alignment of Departments** — In general, there is a product and package combination that has proven successful in the marketplace and warrants capital allocation for a full production line. When making this capital investment, all departments want a say in the direction of the project or capital funds. Marketing wants to try new packaging ideas, while R&D wants to do new product formulations, and operations wants to simplify the machine to make the plant run efficiently. Ultimately, the most cost-effective production line is when all the departments have agreement about what the expectations are for the production line when it is operational.
- **Planning for Changeovers and Flexibility** — Changeovers on a production line either involve a product recipe or a package change. Since the brand owner determines both, the co-packer

must have equipment that can adapt to a variety of demands. The co-packer relies on the setup providing a smooth transition from one product recipe to another and one package format to another. This may involve investment in multiple batch-processing systems or higher levels of automation where quick changeovers and high quality are not mutually exclusive. It can also involve the purchase of multiple pieces of equipment that perform similar jobs, but can do so simultaneously with a lower frequency of changeovers to meet different customer demands.

- **Scheduling Labor, PMs, and Training** — The production schedule must account for planned and unplanned downtime. This may include planned maintenance, planned cleaning, changeovers, and meal breaks. Across a production line, unplanned downtime happens. Implementing buffers in the scheduling process can help minimize the impact of delays across the production line and keep the operational staff from working in a reactionary mode. When a plant is reactionary, it begins to operate in “run-to-failure” mode, which generally leads to more breakdowns of the equipment and a greater need for emergency service. Rather than constantly trying to play catch up, operations should be focused on long-term approaches of the production line that enable the process to run more efficiently. Proper implementation of preventative maintenance procedures and a training program for operators will foster an environment of production line dedication.

- **Upstream to downstream pacing** — Any manufacturing process requires several different types of equipment that need to work together. For these different machines to work together efficiently, each piece of equipment should keep up with or exceed the desired pace of production. In our experience, the pace is generally set by the kitchen. In the case of pet food and treat co-packers, that point would be the equipment where the recipe is being produced or cooked — for example, an extruder or kettle. All equipment that comes after that point should be able to meet or exceed the production levels set by that extruder or kettle.

## A Deeper Dive into Overall Equipment Effectiveness

Overall equipment effectiveness (OEE) is a crucial aspect of total cost of ownership. It compares the number of acceptable units being produced over a period of time to the number of units that could be produced in that time. It is calculated as the product of the following three production metrics: availability, performance, and quality.

### Availability

Availability considers production downtime. Examples of availability losses include unplanned and planned down-



time during production hours, such as for maintenance, cleaning and sanitation, changeovers, and outages. Availability is calculated as Operating Time ÷ Planned Production Time.

If a company intends to run a particular machine for eight hours a day, but only runs it for six hours because it changed over the machine several times, then the availability score is calculated as 6 hours ÷ 8 hours = 75 percent.

## Performance

Performance measures the actual output against the potential output over a specified period. Performance losses occur when the equipment runs slower than the target rate for the product. Performance is calculated as Actual Run Rate ÷ Ideal Run Rate (Total Pieces ÷ Operating Time ÷ Ideal Run Rate).

Take, for example, a 10-lane packaging machine with an expected output of 40 cycles per minute to produce 400 packages per minute. If the machine operates at 35 cycles per minute, this is 350 packages — a loss of 50 packages per minute. Its rate performance is 87.5 percent (350 packages/minute ÷ 400 packages/minute = 87.5 percent). If the machine operates this way only for a single 8-hour shift, that's 24,000 packages of lost revenue! For some facilities, it can be much worse. This conversation becomes more critical as the sales price of the product increases or when the operating costs of a facility are higher.

## Quality

Quality is the opposite of the defect or scrap rate. It includes all the materials that were properly produced the first time through the process and excludes losses in that first cycle due to off-spec production and improper use of inputs. Quality is calculated as Good Pieces ÷ Total Pieces.

A low-quality score can be costly. Take the difference between a retort packaging machine that properly seals containers more than 99.99 percent of the time, versus a machine that performs the job only 90 percent of the time. To ensure seal quality, it is typical for pet food manufacturers to hold product for an incubation period of a few days and then reinspect it before shipping it out. When seal quality is unpredictable, a company must hold product for longer periods of time (one week to one month), which increases warehousing costs. Hiring staff to manually inspect each batch of containers for poor seals is also a major expense. Furthermore, packages that are improperly sealed may leak and render surrounding product unusable. This is a particular challenge with wet foods, and this will be a much bigger problem for the process with a 90 percent quality score than the one with a 99.99 percent quality score. A few bad seals can spoil an entire shipment, resulting in product being sent back at a significant loss to the pet food manufacturer.

Some manufacturers have been able to eliminate the incubation period altogether because they have developed a high-quality packaging process. This drastically reduces warehousing and inspection costs.

## Minimizing TCO into the Future

A focus point for minimizing TCO for the long haul is understanding how the different pieces of equipment will interact with each other into the future. As mentioned above, the overall process

should maintain a certain pace, and this should continue over many years. How is that accomplished?

A primary method is to ensure that each downstream piece of equipment can handle 5 percent to 10 percent more volume than the equipment before it. Such planning ensures that the process can handle day-to-day fluctuations in production, as well as long-term improvements in upstream equipment efficiency — either due to tweaks in the process or equipment upgrades. A key to minimizing TCO is understanding how future changes to a part of the line can affect the rest of the line.

In order to determine the specs needed for each piece of equipment, start with your production goals. Perhaps your plant's goal is to produce 225,000 two-ounce cups of cat food in one 8-hour shift. That is more than 14 tons of product (225,000 cups x 2 oz./cup x 1 lb./16 oz. = 28,125 pounds). Assuming the line runs for only 7.5 hours each shift, you will need cooking equipment capable of producing 3,750 pounds of finished food per hour (28,125 lbs. ÷ 7.5 hours = 3,750 lbs./hour).

Each subsequent step should be able to handle a bit more capacity. Take packaging, for example. The goal of 225,000 two-ounce cups per shift is equivalent to 500 packages per minute (225,000 cups ÷ 7.5 hours ÷ 60 minutes/hour = 500 cups/minute). However, adding a cushion for additional capacities in case efficiencies build upstream will be useful. The machine should be capable of handling 5 percent to 10 percent more than its expected input, or 525 to 550 cups per minute. Whether you opt for the low or high end of this range depends on the needs of your company and its long-term plans for efficiency improvements. If your company is planning on significant production increases in upcoming years, you may want the buffer to be greater than 10 percent.

We add a compounding 5 percent to 10 percent buffer to each of the next steps, which may be case packing and palletizing or other downstream processing equipment. Adding this buffer throughout the process can improve the performance for each piece of equipment, and thus the OEE score for the overall line.

## A Final Amplifying Note

An OEE score of 85 percent or higher is considered a “world-class” manufacturing environment. It generally takes a higher capital investment and a dedication to TCO from all parties involved.

In a production line, each piece of equipment matters. We offer a gentle reminder that the OEE score is the product of performance, availability, and quality, not the average. Thus, a high score in each area does not always translate into a world-class OEE score. For an entire production line, it is important for each piece of equipment to be at the highest level in order to achieve and maintain a “world-class” distinction.

We amplify this message when it comes to the broader TCO conversation. Aligning stakeholders across an entire production line and establishing desired outcomes of the entire team should help almost any organization capture the available revenue opportunities ahead of them.

