5 Factors That Will Drive ROI for Food & Beverage Manufacturers

How F&B can use automation innovations to stay competitive and to help boost their ROI.

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The food and beverage processing and packaging industries must strive to keep abreast of the latest automation innovations both to stay competitive and to help boost their ROI -- all while cost-effectively building high-quality products. Here are the five most important industry trends affecting food and beverage manufacturers' ROI.

Automation Offers More Flexible Options

Obviously, when a plant scales past a certain size, automation becomes necessary for the facility to remain competitive in the market. An automated plant leverages numerous advantages, mainly low cost of operation. A notable trend here is the increasing rise of automation technologies that are more flexible and efficient than in the past.

Consider, for example, the Anysize technology, an innovative passive, pneumatic-based positioning system for Polyethylene Terephthalate (PET) conveyor lines. The system frees food and beverage plants from having to make time-consuming manual adjustments when changing over a packaging line to accommodate different bottle, package, or case sizes. A recent compact version is designed specifically to fit into tighter spaces for conventional mechanical conveyors.

In the past, dedicated beverage packaging lines handled just one or two products, with either fixed guide rails or two-position pneumatic cylinders attached at 3-ft to 4-ft intervals along the conveyor for changing the guide rail width to a second size. When the number of available bottle sizes increased, bottlers continued adding more cylinders until they ran out of space on the machine. The arrangement made it costly, difficult, and time-consuming to package new beverage products and was typically limited to four bottle sizes. In contrast, system users need only input a desired guide rail width, and the technology automatically makes a thousand or more positioner adjustments, to tolerances of a few millimeters from each other, down the entire length of the line.

In building the more efficient system, the developer first considered using electronic technology to make what's typically called an "infinite positioning" system that can accommodate any bottle, package, or case size within a certain size range. But systems that used traditional electronic linear

actuators and stepper motors were prohibitively expensive for packaging or conveying lines that required multiple positions.

The pneumatic-based Compact Anysize positioning system for packaging conveyor lines frees food and beverage plants from having to make time-consuming manual adjustments when changing over a packaging line to accommodate different bottle, package, or case sizes.

The pneumatic-based solution provides a simpler and more cost-effective approach because it is based purely on the pressure of the plant's compressed air system. The pneumatic system has but one moving part per positioner and quickly pays for itself by providing faster changeovers while reducing labor and maintenance costs.

In another example, this time from the world of controllers, Programmable Automation Controllers (PAC) represent an advancement over Programmable Logic Controllers (PLC), and can thus affect a plant's throughput, efficiency, and ROI. A PLC is typically a single microprocessor device used to automate operation in food and beverage processing equipment as well as manufacturing machinery. PLCs were created in the 1960s to replace relay-based systems. Most PLCs are programmed in ladder logic -- a graphical representation of coils and contacts that mimics the appearance of wiring diagrams engineers used to represent physical relays and timers. Ladder logic defines sequences of machine events and reactions via real-world input and output devices. Typically, modern PLCs are programmed in PC-based software. They are said to be best suited for both simple and high-speed machine control.

On the other hand, PACs are more suited to complex automation system architectures. Most PACs are programmed in current programming languages such as C or C++ and, as such, can support all of the control requirements across a modern food and beverage plant such as digital and discrete I/O; analog I/O for flow, temperature, and pressure; and voltage, current, and low frequency analog

inputs. Current PACs, or so-called “next-generation” controllers, besides being able to connect to almost any FieldBus, are using Ethernet-based platforms such as Powerlink or EtherCAT, both deterministic technologies that let the system “know” if information got to where it needed to go. Some newer PACs even have HMI runtime software embedded in it, which gives users a single development environment for their controls and HMI application. Users can then connect an inexpensive Web-browser screen off the controller to see the developed screens. In addition, a new mobile app lets plants browse into their controller for real-time data analysis using mobile phones or tablets. Current PACs are often used in complex labeling and packaging applications, and they can show quick return on ROI because they support highly increased production efficiencies.

Lowering Energy Costs

The high cost of energy has made it critical for a food production facility to cut the energy consumption of its equipment throughout the plant. Estimates say that electric motor-driven systems consume more than one half of all electricity in the US and more than 70% of all electricity in food manufacturing applications. To help improve the energy efficiency of your operation, an effective approach is to first evaluate the motors. The initial purchase of a motor represents only about 2% of its total lifetime cost, with power usage making up the remaining 98%. Typically, upgrading a plant’s electric motors to more energy-efficient models can result in a 13% energy saving.

One example, which is suited to clean-in-place, high-pressure, highly caustic washdown settings such as those found in food and beverage, pharmaceutical, and packaging applications, comes from Parker’s MPW stainless-steel servo motor. The motor features segmented core technology, which can yield 40% higher torque per unit size than conventionally wound servo motors.

Some motor manufacturers take an aluminum-housed motor and insert it into a steel can to protect it from process and washdown fluids, and to give it the dimensional features required for easy cleaning. However, this causes the motor to operate inefficiently because of the heat build-up within the steel can. Parker's motor winding is potted directly to its stainless-steel housing, allowing for a more efficient motor that can provide more power from a smaller frame size. In addition, many motor manufacturers use a separate bolt-on front flange, which creates an extra seam that might allow the ingress of fluids from the product being processed or the solutions that are being used for high-pressure cleaning of the equipment. One solution from Parker is its MPW motor, designed with a front flange that is single-piece construction with the main housing. This eliminates the seam and the potential for motor failure from this type of contamination. In addition, the motors are sealed to IP69K test specifications. Further supporting the capability to drive your plant’s ROI, the motor also features connectors that allow for easy plug-and-play with all widely used drive technology.

When it comes to drives, another automation technology in the form of Variable Frequency Drives (VFD) saves energy, especially in centrifuge, pump, and fan applications. Some studies have shown that the payback period is typically less than a year. In most food-processing plants, the motors that operate pumps and fans on equipment such as packaging machines run at constant speeds, with flow rates often adjusted via automated mechanical valves. However, this approach wastes energy. Motors running at constant speed always consume the maximum amount of energy, even during the times when lower speed operation would be sufficient. Using the right kind of drive with the motors makes them more versatile and efficient for applications that might not always need as much speed

and torque. VFDs let equipment operate more efficiently because the drives regulate the speed of the motors -- and therefore fan and pump flow rates -- electronically and in response to operating conditions, thereby reducing energy consumption and extending the mechanical life of motors, pumps, and fans and even ancillary equipment such as ducting and pipework.

The MPW stainless-steel servo motor is designed for clean-in-place, high-pressure, highly caustic washdown settings such as those found in the food and beverage industry. The motor features segmented core technology, which can yield 40% higher torque per unit size than conventionally wound servo motors.

For example, in a relatively complex application, replacing outdated components with a Parker AC890 VFD and other devices helped a major bottling contractor boost productivity by eliminating the problem of cans on a can warmer line getting too hot, deforming, and, as a result, jamming the line. A jam could cost the company up to $6,000 per incident. The company wanted to upgrade the existing 20-year-old control system that used fixed speed "across the line" starters for pump control. But the physical mounting space would not permit installing the estimated 80-inch-wide cabinet needed for conventional drives and peripheral devices.

Here, the AC890 VFD supported the matching of motor speed in what amounted to an eight-axes-of-motion application. The drive is compact, so it required much less mounting space than conventional drives. Additionally, a common bus eliminated the need for eight individual line reactors and circuit breakers. The complete system fit on a 36-inch x 60-inch panel installed in an existing stainless-steel enclosure, eliminating the expense of a new cabinet. To cool the drives, the can warmer's makeup water was used in an air-to-liquid heat exchanger, which needed far less energy than an air conditioner. The solution completely eliminated line jams due to cans deforming, making for a fast ROI.

Networked Plants for Better Decision-Making

Even before Internet technology started to enter the industrial arena, many food and beverage manufacturers wanted to collect data off the plant floor. In addition to wanting to collect data about various processes, companies wanted the capability to log in to a database, retrieve production information, and then run reports against the data to improve their operations. The reality was that in the past, data resided in isolated siloes with very little of it being turned into information. In addition, when data did show up on reports, it typically lagged what was happening on the floor in real time. There was no way for plant personnel to find out -- right now and right where they were -- exactly what was going wrong on line number three, for example.

Fortunately, current tools allow the capturing of data and making it available as information in real time. For example, Human Machine Interface (HMI) software and hardware lets facilities display data on the plant floor to inspire operators to up their production, or customize the data for other audiences such as a manager who may want to see only plant production data. Current HMI products let facilities create a private solution that lets them view their process data internally on their Intranet or externally on the Internet. The approach lets users see information, such as errors on a particular machine, on any browser. Plant personnel can see current production relative to target production, adjust settings on the machine remotely, and provide Key Performance Indicators (KPIs).

The capability to deliver information in real time has significantly changed the whole data-collection model. The capacity to access data in real time on the HMI screen or remotely on a mobile device, such as a smartphone or a tablet, gives personnel information that lets them make adjustments mid-shift. In other words, timely information is being delivered across standard Web technologies, letting facilities adjust processes in real time.

In a recent scenario, a typical manufacturer in the food and beverage industry became an early adoptor of the Parker Factory Display (PFD) HMI product because it wanted to display production efficiencies on each production line. According to a plant engineer, the company first deployed PFDs on the worst-performing lines in the facility. The use of the large visual format has since made those lines among the most efficient in the plant. This is largely because employees know that their output is being measured, which encourages a friendly competitive spirit. Efficiency improvements were a direct result of data that the displays uncovered.

In a different example, a large fruit and vegetable food processor was looking for a better way to visualize critical information on the plant floor, including production metrics, faults, stop reasons, and lean data. The company wanted to implement a plant-wide system of up to 20 large format displays. It selected PFD technology because the unit did not require PLC code changes due to standard driver availability. In addition, the technology includes Web-publishing capabilities that let facilities move information anywhere it is needed.

Food Safety at the Forefront

Manufacturers must adhere to standards and constantly changing regulations that influence the design of the machinery used in food processing settings. For example, products such as pneumatic components must be made of corrosion-resistant material and they must use food-grade lubricant.

Because the food and beverage industry is evolving toward pharma-type processing environments, facilities must ensure their processes perform clean and sterile operations.

Xpress HMI is being used on a packaging machine in a food processing plant.

For example, recently, Safe Quality Foods (SQF) released a 7th edition amendment in section 11.5.7 stating that compressed air used in the manufacturing process must be clean and present no risk to food safety. This came about because compressed air is often in direct or indirect contact with food products and impurities in the compressed air can contaminate the food product, resulting in change of color and taste, and reduced shelf life. Worse yet, having food exposed to bacteria and other micro-organisms can result in product recalls.

Fortunately, the use of sterile air filters can eliminate this problem, thereby helping your plant garner quick returns on its ROI. For example, some filters provide a 6-log reduction of microbial contamination from compressed air and other gases, remove all viable organisms, are USDA/FSIS accepted for use in federally inspected meat and poultry plants, and comply with FDA regulations.

To be even further on the safety side, easy-to-use compressed air microbial detection devices are available that let food safety personnel quickly test for microbial contamination in compressed air that comes into contact with food and food contact surfaces. Until now, the only devices capable of sampling compressed air systems for microbes were expensive, cumbersome, and required lengthy sample times and extensive training. In contrast, the new device is portable, weighs less than 1 pound, and comes with connection tubing, shut off valve, pressure regulator, and metering orifice. To obtain a sample, personnel need only plug the unit into the compressed air system, expose the

petri dish for 20 seconds, and then incubate the dish for 24 to 48 hours. The device assists users with identifying Hazard Analysis and Critical Control Point (HACCP) risks.

The drying of electrical cabinets is also critical. The meat and dairy industry demands absolute cleanliness and sanitation in their food preparation areas, which are therefore washed down nightly. Every square inch of equipment is sprayed with hot (140F), high-pressure sanitizers. These sanitizers are caustic or acidic, depending on the food product. Much of the equipment is pneumatically operated, but the industry is increasingly moving to electronic controls that are housed in "water-tight" NEMA 4x cabinets. However, these electrical cabinets eventually develop leaks, allowing moisture build-up on electronic components. This leads to premature component failure, which results in a need for emergency services and causes production downtime.

In this case, special cabinet dryers provide great ROI by purging the inside of the cabinets with very dry air that eliminates moisture. The cabinet air dryers are designed specifically for washdown areas and require no electricity, so they have low operating costs. An added benefit is that the positive pressure they produce also keeps dust out of cabinets.

Shortage of Workers?

According to recent Bureau of Labor Statistics Employment Projections, the number of US workers in manufacturing in general are projected to decline slightly -- from about 151,000 workers in 2012 to about 146,000 workers in 2022. The same is true for workers in food manufacturing. Their numbers are expected to decline from about 148,000 in 2012 to about 143,000 in 2022. In addition, the report says that while economic growth will lead to many job openings, more than two thirds, or 67.2%, of these openings are projected to come from replacement needs due to workers retiring or otherwise leaving the workforce. Therefore, companies will probably no longer necessarily have large manufacturing staffs with engineering and automation expertise in-house to rely upon. Instead, they must count on top-level partners.

Conclusion

Future developments will continue to include products for automation that are flexible, efficient, and innovative. Food and beverage manufacturers will increasingly need to ensure that their plants are more energy-efficient. Additionally, as the world goes increasing digital, the capability to access production information anywhere will be a big competitive advantage. The quality and longevity of these technologies will continue to improve into the future, reducing customers' maintenance costs and increasing their production, and thereby helping boost their ROI.

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