

ENABLING RAPID LINE CHANGEOVERS

Using electronic work instructions to improve changeover processes—paving the way for manufacturers to recover valuable production time, accelerate margin, and control product quality



INTRODUCTION

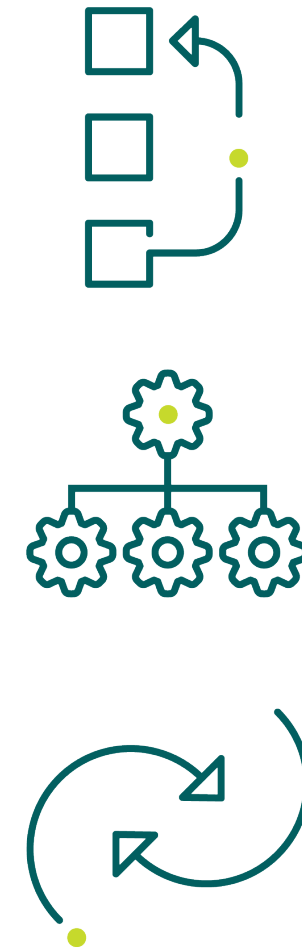
In today's fiercely competitive economy, manufacturers face intense pressures to boost production efficiency and meet increasing consumer demands.

Now more than ever before, consumers expect a constantly changing breadth of diverse, innovative products, and inventory managers everywhere have had to adapt to smaller, more targeted runs to meet demand and minimize excess inventory.

Most plants are running multiple products per line per day, including varieties of the same products as well as entirely different ones. All these different products being produced on the same line have resulted in many more production line changeovers in the factory compared to even just a few years ago—requiring processes, people and equipment to adapt. With capitalization of new equipment out of the question in this current “hold your cash” world, manufacturers need to look at improved changeover procedures.

A critical enabler is speed because the amount of changeovers a plant can perform is limited by the amount of time it spends on each changeover. Most plants today spend a significant amount of time on them between runs—translating into non-production time and higher costs per unit. Key obstacles include manual processes, which are more time consuming and prone to increased quality risk, and the time required to train operators to constantly perform new changeovers.

This white paper discusses how real companies have successfully enabled rapid changeovers through the use of electronic work instructions, also referred to as electronic standard operating procedures (eSOPs), to effectively guide operators through the process. Electronic work instructions help manufacturers gain the agility and speed needed to efficiently produce many different products on the same line without changeover delays—enabling the recovery of valuable manufacturing time, consistent product quality, and reduced excess inventory, all of which are critical to a better bottom line.



Changeover costs are seldom measured, but can total as much as tens of thousands of dollars per hour. It is estimated that for a one-hour daily changeover on a fairly significant packaging project with the line running 240 days per year, the annual cost is \$1.8 million.

GUIDING OPERATORS THROUGH CHANGEOVER PROCESSES

It is no secret that line changeovers cost money. In the past, most companies built this into the base cost because it was not performed frequently enough to track during their large production runs. But today, manufacturers find this formerly “hidden cost” growing exponentially as the number of changeovers increases and production run lengths are cut to reduce inventories.

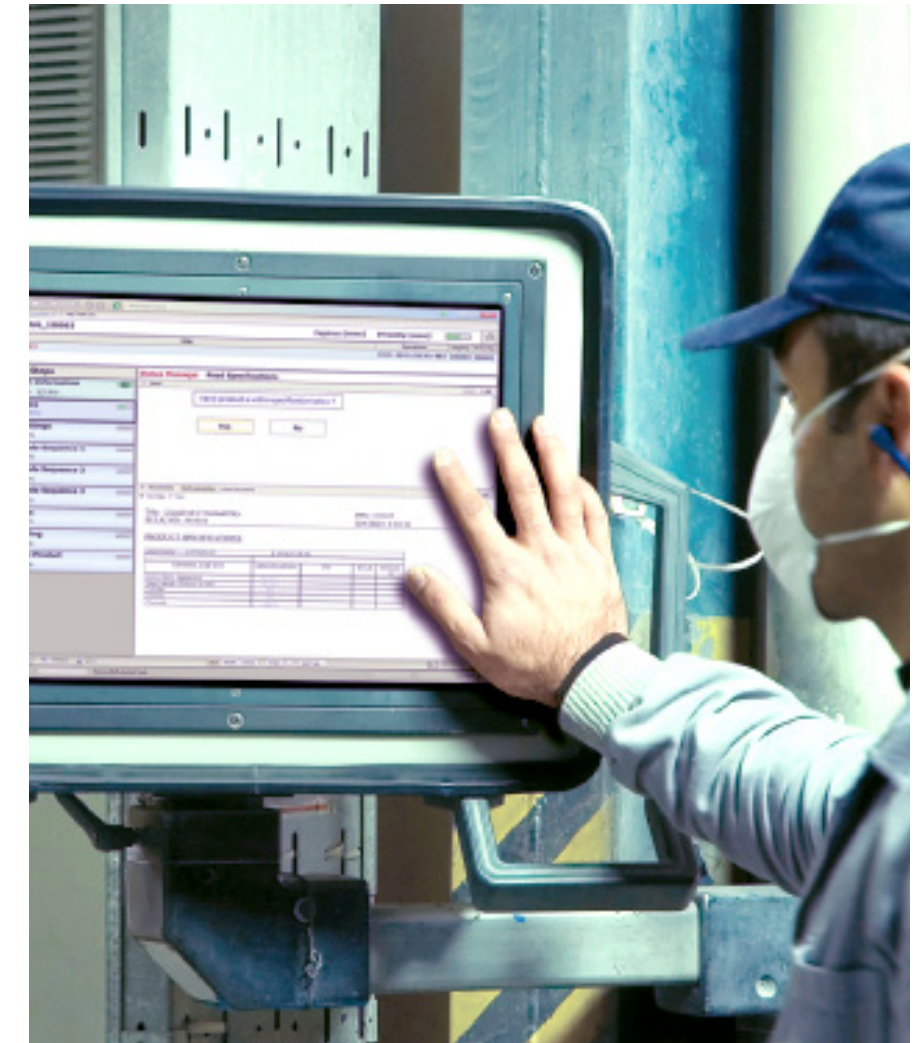
In a survey of Food Manufacturing readers, the majority of plants (57%) reported that they run two or three different products per line per day; 30% of respondents reported that line changes involved a change to an entirely different product; and 17% run more than ten packaging changes per day.

Line changeovers equate to non-production time with many labor hours spent cleaning, adjusting, and verifying machine setup. They also introduce greater risks because issues not addressed properly during changeovers can cause longer startup cycles, more rejected product, and increased machine malfunctions. It stands to reason that the more often changeovers occur, the higher the likelihood of negative effects.

For example, one manufacturer adjusted its production run to half the amount of product, allowing it to change flavors and sizes on the line to gain a more flexible production inventory level. But when it changed from a one line changeover per week to six line changeovers per week, the plant’s equipment failure rate doubled, which slowed down production, increased product rejects, and also resulted in extremely high operator overtime.

The company decided to take a step back and examine what happened; at the top of the list were ineffective changeovers. As it moved from one changeover to six changeovers per week, many new operators were brought into the process, but there was a lack of changeover procedures to guide them. Additionally, the new operators did not have the tribal knowledge or expertise of the original operators, opening the lines to more errors and lost time during line changeovers.

To address this challenge, the manufacturer implemented new electronic work instructions for changeovers to guide each worker through the tasks required to get the line ready for the next product or size change. These workflows captured the tribal knowledge of the company’s most experienced operators to help make every worker “the best worker” and incorporated best practices into the work processes for faster and better production setup. As a result, the company reduced its line changeover time by 25% and line start issues by 50% for significant time and cost savings.



GE Vernova software guide operators through electronic Standard Operating Procedures (eSOPs).

With the implementation of new electronic work instructions to effectively guide its new operators through changeover processes with increased accuracy and speed, a mid-sized consumer products manufacturer saved 25% of its line changeover time and cut its line start issues by 50%.

ENABLING RAPID LINE CHANGEOVERS

Speeding up the most costly part of a production line.

When asked about the time required to change over a production line, many companies will give general answers like, “We do that off shift” or “half a shift” or “a whole shift depending on the type of changeover we are performing.” The unfortunate issue is that they do not understand or know how long changeovers—a costly, nonsalable action—really take, particularly because in the past when changeovers were completed less frequently, the impact was minimal.

In today’s environment where there are constant changeovers, manufacturers that view line changeovers as a production run can leverage the power of information to quicken changeovers, hence driving increased productivity for a better bottom line. The use of eSOPs help systematize best practices and provide valuable information and critical visibility into changeover processes, including how long each actually takes and where and why issues occur—enabling improvements for effective production planning.

For example, one food manufacturer implemented an eSOP solution and turned its process improvement team onto the data. The team discovered that the same tasks were taking different amounts of time to perform, depending on the operator shift, which pointed to the need for better training. Additionally, it discovered that moving through the production mix worked better in one direction than others; for example, reducing bottle size was faster and easier than increasing bottle size.

Using the information from electronic work instructions to gain better insight about its changeovers, the company incorporated training and also changed its production to go from largest bottle size to smallest bottle size, reducing the overall time of a line changeover by 35%. The significant improvement resulted in less operator overtime, fewer product rejects, and reduced equipment failures—driving speed and production efficiency.

The valuable insight gained from the use of electronic work instructions enabled a food producer to uncover a significant improvement opportunity that led to the reduction of the overall time for line changeovers by 35%.

Ensuring high product quality with accurate setup

Quality as explained by one manufacturer’s Vice President of Quality is “a game of trust but verify.” Generations of companies have taken on different mantras to ensure quality, including “do it right,” “continuously improve,” and “Lean/Six Sigma.” Furthermore, many of these companies have realized that the operator is the first line of defense and have moved toward having the operator perform many of the quality verification steps.

For instance, one company realized that changeovers were impacting its product quality and implemented eSOPs to ensure that its operators would not miss any changeover steps, which if omitted, resulted in setup errors and rejected product. The use of electronic operating procedures prevented its operators from inadvertently skipping a step, ensuring production compliance with defined processes and minimizing errors that can lead to quality issues.

The workflows also enforced operators to enter critical parameters along the way, which could be verified against quality standards automatically—helping to ensure that the line was set up correctly and ready to run. With valuable information on product quality, operators could quickly respond to issues, allowing them to gain tighter control without additional headcount and reducing the reject rate.



ELECTRONIC STANDARD OPERATING PROCEDURES (ESOPS) VS. PAPER-BASED SOPS

The significant advantages of eSOPs include:

- Strong adherence to standard operating procedures as eSOPs can be used to ensure that lessons learned actually stick.
- Improved accuracy and repeatability as eSOPs are much less open to interpretation and abuse, either intentional or unintentional.
- A direct link to the plant to ensure that safety interlocks remain uncompromised and changeovers are followed in exact sequence.
- The ability to do what people are poor at doing — routinely collecting and collating masses of data.
- Powerful reporting tools that transform data into meaningful information, which is consumable by stakeholders across the organization for better decision making

WINNING THE EXCESS INVENTORY BATTLE

Companies with high volumes and low margins know that razor-thin inventories are paramount to their success. Reducing excess inventory can mean millions of dollars added back to the bottom line, which is why companies continue to push their supply chains to be more agile and drive toward a “make-to-order” nirvana.

To achieve this, companies must stop treating their manufacturing sites as black boxes that only report the finished product, and instead gain more information about the build process as it is happening. Real-time production information helps companies drive out unpredictability, which can then help them to reduce their safety stock to new lows—freeing up cash that would otherwise be tied up in product.

The advantage of successful line changeovers enabled by electronic work instructions expands beyond product quality and speed to improved predictability. Reliable changeovers allow companies to gain better insight into real-time production and the impact on inventory to enable proactive scheduling and planning of resources and materials. Therefore, companies do not have to hold unnecessary inventory levels—tying up real money that could be invested for growth or other strategic initiatives.

As a case in point, a warehouse manager for one of the world’s largest CPG companies previously had to rent three separate warehouses to hold excess inventory because the company could not accurately predict expected production. After implementing eSOPs, his production became much more reliable, whereby safety stock could be better aligned with actual production levels.

As a result, the company was able to reduce its excess inventory across its product lines, eliminating the need to rent three warehouses and saving the company millions of dollars per year in rental space.

Electronic work instructions enabled one of the world’s largest CPG manufacturers to reduce excess inventory, saving millions of dollars per year in rental warehouse space while enabling better planning of resources.



CONCLUSION

With increasing consumer demands for an endless variety of new products, manufacturers have had to keep up with smaller, more targeted runs and multiple products per line per day. In turn, a growing area of concern for manufacturers in today's fast-paced environment is the increased frequency of line changeovers, which results in significant non-production time, in addition to increased quality issues and costs.

As some leading companies have begun to discover, the key to quickening line changeovers without compromising quality relies upon guiding operators through changeover processes with electronic work instructions. The faster operators can set up machines and recipes correctly, the more efficiently manufacturers can produce many different products on the same line without changeover delays and errors—recovering valuable production time and delivering consistent product quality.

Furthermore, rapid and reliable changeovers enabled by electronic work instructions help manufacturers leverage improved predictability to drive proactive planning of resources, including the reduction of excess inventory. The critical insight manufacturers gain into real-time production helps drive increased agility across the plant—accelerating profit margins for a stronger bottom line.





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