Interreg North-West Europe
COTEMACO
European Regional Development Fund

Success Story

Automation Roadmap for Lincolnshire Drizzle Company, UK

Assessing the current production processes and providing an automation roadmap to underpin future business growth

Automation Roadmap

Company description

The Lincolnshire Drizzle Company produce a range of dressings, marinades, and pestos from a small manufacturing facility in Grantham in the UK. All products use locally produced extra virgin cold pressed rapeseed oil to maximise the health benefits of Omega oils 3,6, & 9 and plant sterols, and provide a rich source of vitamin E, an antioxidant that contributes to the protection of cells from oxidative stress.
The core outlets for the products are through farm shops, garden centres, the Lincolnshire Co-operative stores, and a small amount of direct online sales.
All sales channels are growing and the business is looking to ramp up production from the current 'large kitchen scale' to small scale industrial production. The Lincolnshire Drizzle Company currently has 1 fulltime operative covering all aspects of the business: purchasing, production, marketing, sales, and distribution.

Current processes

As sales volumes increase, The Lincolnshire Drizzle Company have engaged with the COTEMACO SME support programme to improve production capacity, efficiency and productivity. The currently weekly production is c.500 units/week, with a projected need for 5,000 units/week with 2 years.
Current production is a predominantly manual batch process. Blending, Filling (Figure 1), BBE and cap labelling are performed manually, with 2 benchtop semi-automated machines for capping and side labelling (Figure 2).

Figure 1. Current manual blending and filling processes

The baseline process line configuration (Figure 3) has buffers between each operation and several double handling transfers where bottles are moved from the output of one process to input buffer of the next (rather than a common single buffer between processes). For ease of manual filling, products are mixed in sub-batches of c.3.5 Litres.

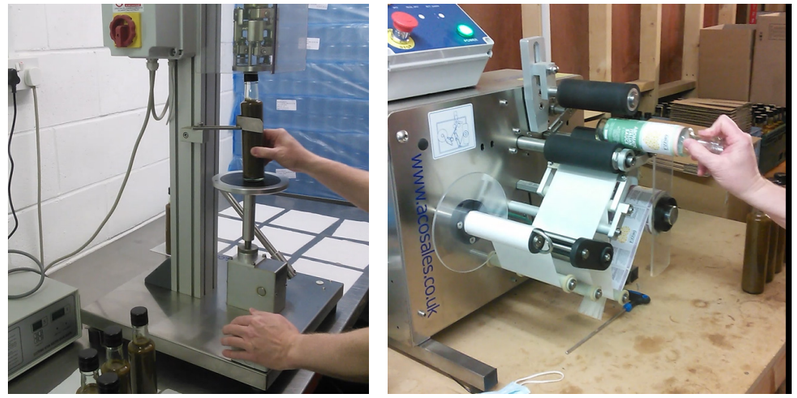

Figure 2. Current semi-automated benchtop capping and side labelling

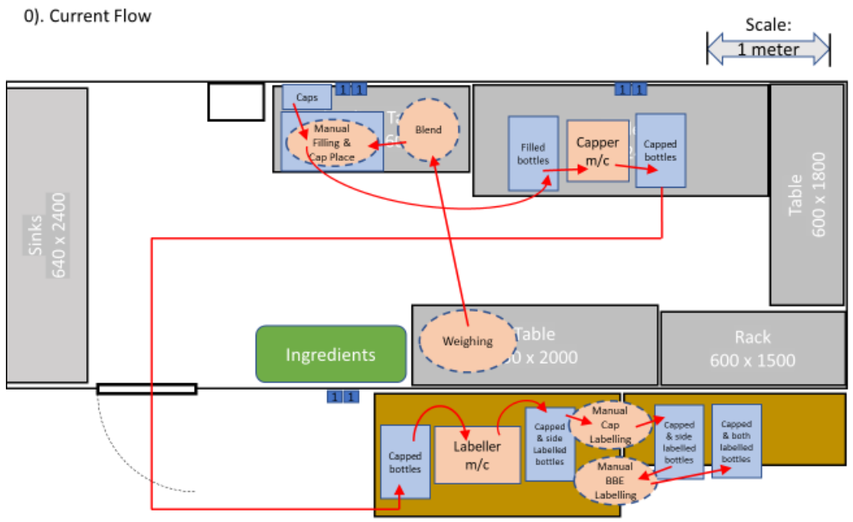

Figure 3. Current Process flow

Total process times with this baseline setup for a 50 bottle (12.5L) batch are c.319s per bottle (excluding resting time in buffers). The operations taking the most time over an entire batch are weighing and mixing (30%), filling (24%) and BBE labelling (13%).

SME Support Activities

It was clear from the outset that a step change immediately to a cobotic / robotic automation manufacturing solution would not be suitable for this 1-man SME at this point in time. There were restricted technical automation skills within the business, capital investment funding was limited, and beneficial gains could be achieved with

simpler, lower cost interventions as initial phases of a staged automation roadmap.
An initial assessment of the production operations was carried out to identify bottlenecks, effort intensive operations, and process flow issues where automation would provide business benefit. Based on these findings a series of options were produced, along with associated projected cost-benefit. These proposals were discussed and honed with the business and a priority sequence agreed. This formed the basis for the sequenced automation roadmap and is briefly described below. The baseline process flow is shown in Figure 3. The operations taking the most time over an entire batch are weighing and mixing (30%), filling (24%) and BBE labelling (13%).
To address the largest of these, working with larger sub-batches spreads the weighing and blending time over more bottles. The precise amount of improvement varies with batch and sub-batch sizing, but an outline model for a 50 bottle (12.5L) batch moving from a 3.5L to 5L sub-batch would reduce process to 221s per bottle (31% improvement). The effects for different batch and sub-batch sizes can be experimented with in the simple spreadsheet model developed as part of the business support.
Small gains can be made at little capital cost by modifying the process layout to effectively bring operations closer together to reduce non-value adding transfer times. These are:

- Smooth the process flow to capper by filling bottles at the pick-up location for the capping operation (Figure 4). This avoids the transfer from filling area to capper and reduces process time by 3% for a 50 bottle (12.5L) batch with 3.5L sub-batch.
- Move the labelling operation into the production space (Figure 5). This avoids the transfer from capper output to outer room and reduces process time by 4% for a 50 bottle (12.5L) batch with 3.5L sub-batch.
- Transfer each bottle directly from output of one process to input of next (Figure 5). This avoids the double handling times in putting bottles down and then picking them up again and reduces process time by 7% for a 50 bottle (12.5L) batch with 3.5L sub-batch. However, the operator would need to move with every bottle through the processes.

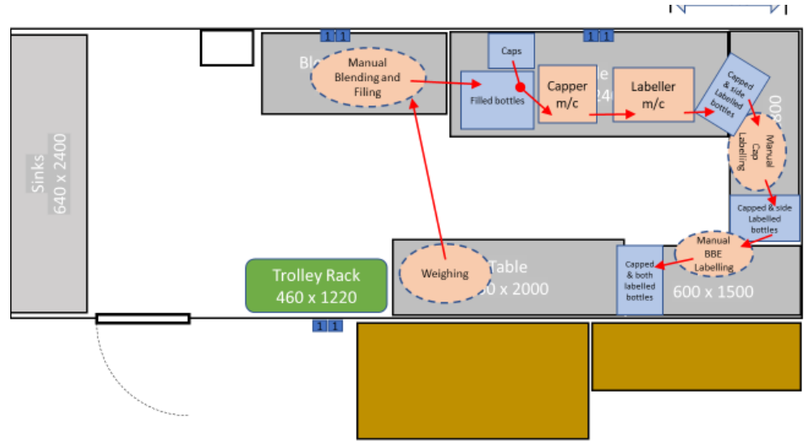

Figure 5. Labelling moved into production space.

At higher capital cost, equipment to address the bottle necks at filling and BBE labelling can be brought in.

- Incorporating a benchtop depositor (Figure 6) is projected to reduce mean filling time per bottle from 19s to 4s, resulting in an overall reduction in process time by 19% for a 50 bottle (12.5L) batch with 3.5L sub-batch. Estimated costs £6k-8k, including compressor to drive the depositor. An agitator in the supply hopper is required because of the propensity of the product to naturally separate.
- Purchasing a handheld printer to print BBE dates directly onto the label is projected to reduce mean BBE labelling time per bottle from 10s to 3s, resulting in an overall reduction in process time by 9% for a 50 bottle

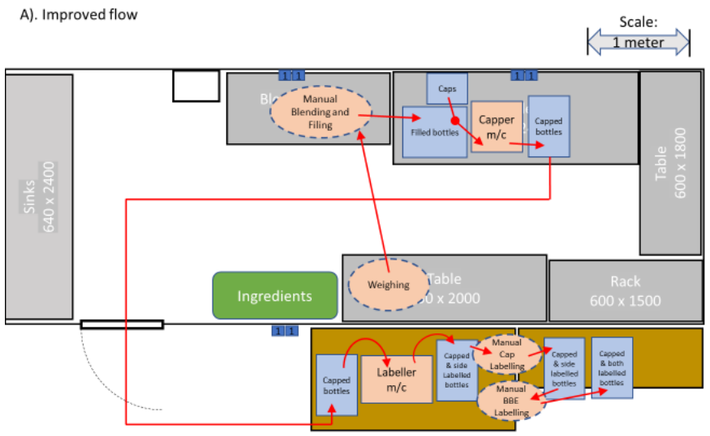

Figure 4. Revised layout with depositor

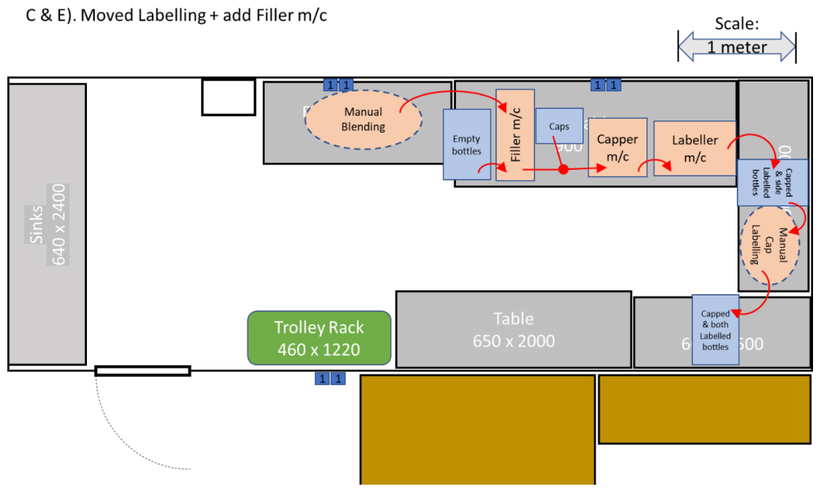

Figure 6. Layout with depositor for filling

- (12.5L) batch with 3.5L sub-batch. Estimated costs £800-£1,000.

As business grows there is a key decision to be made on how to increase production time available; this could be achieved by employing staff or investment in co/robotics to perform the manual handling of bottles between processes on the existing equipment. Using the cobot would free up staff time from the tedious repetitive bottle transfers, whilst avoiding the costs and complexities of employing a first staff member. A cell layout for this latter option is given in Figure 7.

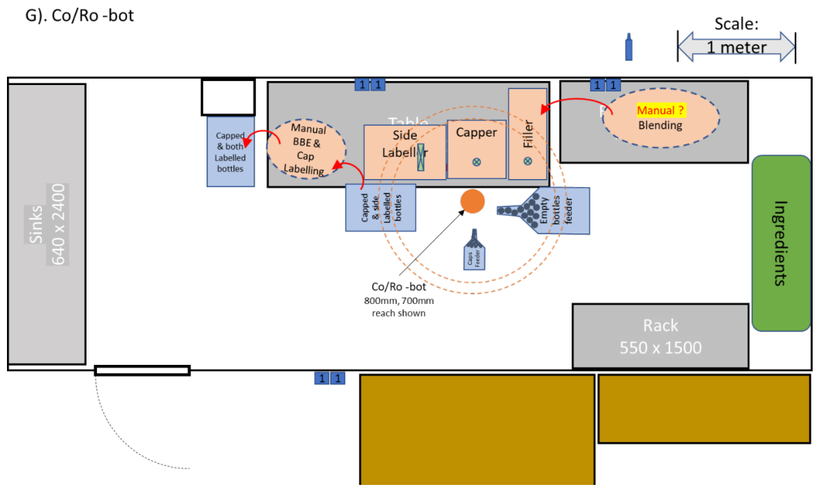

Figure 7. Co/Robotic cell for bottle handling

Blending can remain manual (although mechanisation would aid adoption of the beneficial increases in sub-batch sizes). Empty bottles would be collected and delivered under the fill nozzle of the depositor. Ideally, they would be collected directly from the packaging in which they are supplied to the business as this would require no preparation except moving the bottles in supplied packaging into place. Alternatively, the bottle would be placed in a gravity feed dispenser, or into known locations in a crate from which the robot could collect – thus avoiding need for sensing of the bottle position before grasping.

The depositor fill would be triggered from robot I/O rather than the previous footswitch. End of fill signal would be fed to the controller from the depositor piston returned sensor signal. The robot would collect a cap while filling is taking place.

Presentation of caps for picking will pose some challenges as these are supplied loose and will be in random orientations and positions. A vibratory feeder should be able to orient the caps for pick up, but trials would be required to confirm this. A bin-picking algorithm to pick individual caps from a loose pile could be used, but this would be a substantially more complex and costly approach. The collected cap would be placed on top of the bottle in the known location at the depositor, and the bottle then transferred to the ROPP capper machine.

At the capper, the signal to rotate the capping head would be sent by the robot controller, and the robot used to insert the bottle/cap up into the head (rather than the current lever operated platform).

The capped bottle would then be placed into the side-labeller, where operation is triggered as in manual use, by the presence of the bottle. The final action of the robot would be to transfer the capped and side-labelled bottle to an output location, where a human would inspect and apply BBE and cap labels.

It is estimated that the robotic cell option would reduce production time by 23% compared with the baseline manual process with a 50 bottle (12.5L) batch with 3.5L sub-batch. In addition, the system would operate autonomously and an operator would not be required through all processes. Estimated costs £25k - 35k.

Implementation

To date (August 2021) a handheld unit for direct BBE printing onto labels has been trialled and then implemented, reducing the BBE labelling time from c.10s to c.3s.

Further steps will be reviewed and implemented as time progresses and the enterprise grows. Business growth will be both the driver and financial enabler for adoption of further automation including co/robotic cells.

The main opportunity for co/robotics at The Lincolnshire Drizzle Company occurs later in the automation roadmap to remove the tedious and repetitive bottle handling operations between process stations. This approach integrates with previously implemented process units that were manually loaded and unloaded in earlier automated process configurations.

Interview

Impact of COTEMACO support on the Business

The key benefits of automating for The Lincolnshire Drizzle Company are in the reduction of time spent producing the product. In such a small organisation, time is valuable and any less time used in production can be spent on sales and marketing - the key enabler for business growth. The first implemented recommendation of direct BBE printing to labels saves c.7s per bottle, amounting to almost 1 hour every week that can be spent on other activities. The planned implementation of semi-automated filling would gain approximately an additional 2 hours per week. Not only is the extra time valuable to the business, a tedious repetitive task is removed giving a more satisfying and stimulating experience.

How could COTEMACO support you?

Via the SME support programme, COTEMACO engages with SMEs from the automotive and food sectors through field labs. These regional field labs in the UK, the Netherlands, Belgium and Germany are showcasing key production steps in the automotive and food industries, in order to tackle current low sectorial awareness and knowledge gaps. The field labs will exchange knowledge on different manufacturing tasks, such as handling and (un)loading.

With the COTEMACO programme, manufacturing SMEs are guided through the process of adopting collaborative robotic and shop floor digitalisation technologies, from the exploration of technological opportunities to the detailed definition of a business plan.

What is COTEMACO?

The project, which is an initiative of Interreg North-West Europe, aims to support around 60 SMEs in the automotive and food manufacturing industries with so-called „test environments“ and to encourage them to integrate collaborative robotic systems and digital technologies into their business. Accordingly, in addition to increasing production flexibility, the relocation of production abroad will be curbed and the number of jobs in manufacturing increased, which will generally lead to an improvement in the competitiveness of the companies involved.
In the project new technologies are implemented in application examples - the aim is to move from the prototype in the laboratory environment to the transfer to production, taking into account the legal situation and certifications.

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