SUSTAINABLE PACKAGING STARTING FROM A SMART CONTROL OF THE PRODUCTION LINE

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index

summary

Sustainability is an increasingly important aspect of today's society and a growing number of companies aim to introduce sustainability-oriented actions into their industrial strategy.

Sustainability of product packaging covers both materials and production processes. Here below, we consider this second aspect, presenting its general features and illustrating a specific example offered by ZACMI, an internationally renowned Italian company, a manufacturer of food packaging machinery, at the forefront of the search for a sustainable approach.

goals

ILLUSTRATING
KEY ASPECTS OF PROCESS SUSTAINABILITY IN INDUSTRIAL PACKAGING

HIGHLIGHTING
MARKET TRENDS AND THE DIGITAL CONTRIBUTION

PRESENTING
ZACMI'S CONTRIBUTION IN SUSTAINABLE PACKAGING PROCESSES

VIEWING
IN DEPTH TO INTRODUCE A SPECIFIC CASE

Sustainable Packaging Process

Two key aspects are covered with regards to sustainability in the packaging process:

1 FILLING ACCURACY

2 EFFICIENT CONTROL OF THE LINES

There are two crucial points in terms of filling accuracy: one is to prevent over-filling, as this would lead to a rise in cost, and secondly, not of less importance, is to avoid under-filled containers, that are weighed only after being packed, and, according to the law, this would mean their subsequent rejection and a severe loss in production.

As far as the efficiency and control of the production lines is concerned, it is fundamental to consider the cost of any additional unforeseen hours that create a high impact on the expected performance.

Therefore, it is necessary to measure the "Overall Equipment Efficiency" (OEE), that includes parameters such as availability, performance and quality of the system:

OEE = availability x performance x quality

Where:

- Availability is the percentage of effective time worked as opposed to time available. The percentage of scheduled time during which the plant operates (e.g. shift, working day or week) compared with the actual production time of a plant making parts or semi-finished items.
- Performance is the percentage of parts actually worked compared with parts that can be worked in theory. The planning calculates workable parts at optimum speed; a lower performance shows a drop in production.
- Quality is the ratio between compliant pieces compared with the total output. In this way, drops in production are visible as rejected items or reworked items that affect general efficiency.

Usually, in a mass production plant, where the crossing time of product lots is longer than an eight-hour shift, 85% is a good average performance index.

As there is no single value that can be applied to all aspects of the production process, the overall measurement, as described above, is a valid instrument to improve production efficiency.

MARKET TRENDS

Today, the market of packaging machine manufacturing shows different trends, e.g.:

- Integration of production lines and joint management of the lines,
- Accurate monitoring of a production line and of its performance,
- Increasing variability of products to be packed,
- A massive return to cans, mainly due to the recent pandemic that registered an increasing demand of preserves.

THE DIGITAL CONTRIBUTION

In view of supporting the above-mentioned market trends and to meet the specific need of sustainable processes, the 4.0 Industry pattern plays a basic role with a

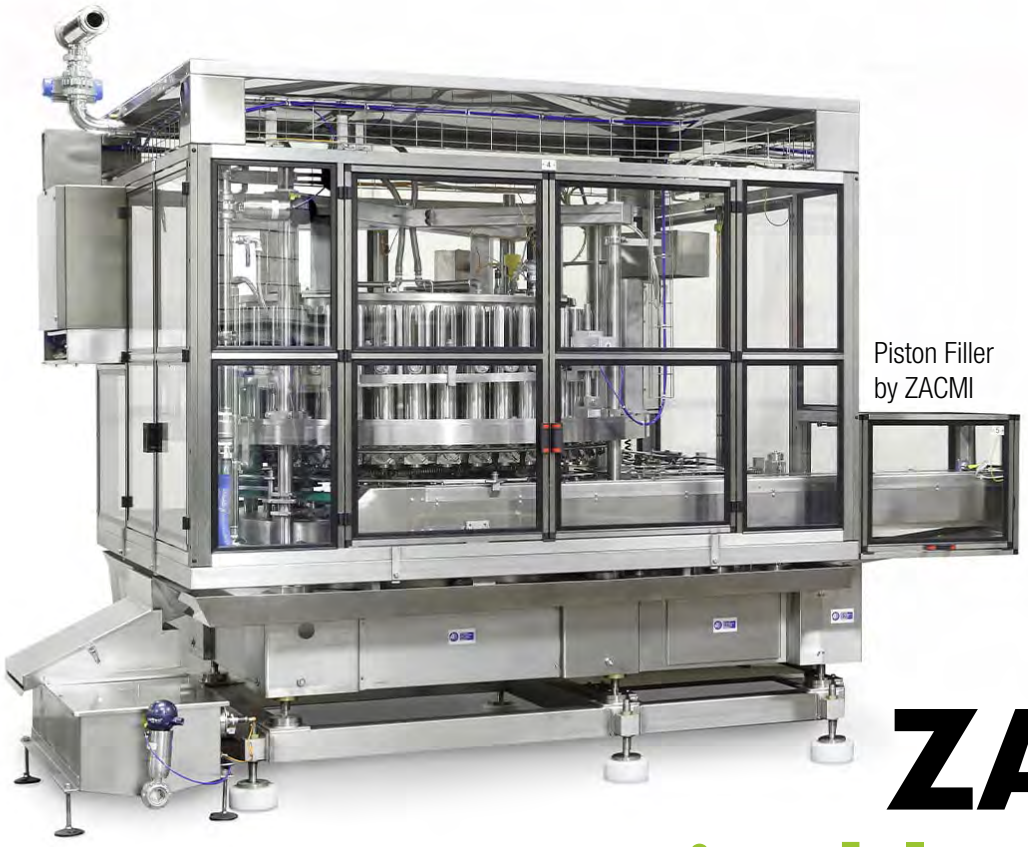
fundamental contribution offered by digital transformation.

Considering this background, an extremely important aspect is data collection and analysis, in order to optimise the operation of individual machines as well as entire production lines.

In fact, the Big Data Analysis is a necessary support, both to improve the performance and to avoid non-predicted machine stops, through preventive or even predictive maintenance strategies.

An additional, valuable point is the possibility, offered by a digital tool, to manage machines remotely, both for operation and workers' safety.

Lastly, a connected machine is a player of the supply chain. To make an example: if today we can download datasheets and drawings of single components from ZACMI machines, the next step will undoubtedly be, placing an order of components directly from the control panel.



Piston Filler
by ZACMI

ZACMI

A Sustainable Choice in Food Packaging

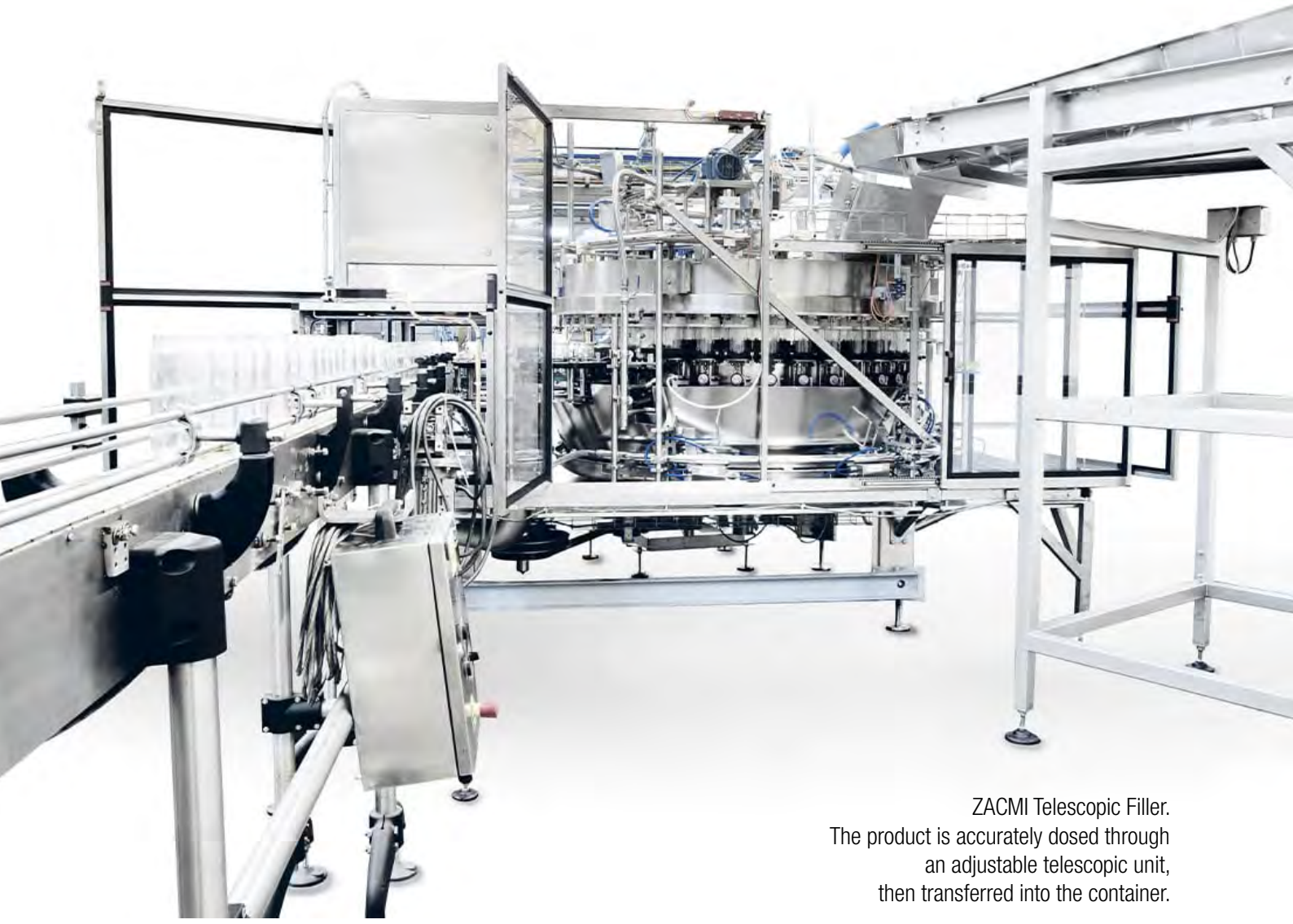
ZACMI, established in the ‘50s, has grown in time to reach an internationally relevant proportion, focusing on the search for the most suitable response to the need of each single client, as a result of continuous innovation.

In relation to sustainability, in 2021, ZACMI obtained the ISO 14001 certification for the ability to control and reduce its environmental impact. The company works towards increasingly efficient lines and high performance of its filling and closing equipment.

Over 2,500 ZACMI filling and closing machines are operating in the world, with different models and different features, both highly efficient and sustainable. In fact, ZACMI machines are made of 98% recycled materials, with special attention to consumption.

For example, the Piston Filler by ZACMI is designed to fill liquid and viscous products, with or without suspended solids:

- The Vertical Piston model offers an extremely accurate filling, no dripping, fully automatic C.I.P. (Clean-In-Place), no need for manual intervention,
- The Vertical Valve Piston Filler includes the automatic product dosing system that prevents product waste,
- The Linear Valve Piston Filler is suitable for low-speed running, whereas the Flowmeter Filler is suitable for filling, where the highest hygiene levels are required.



ZACMI Telescopic Filler.
The product is accurately dosed through an adjustable telescopic unit, then transferred into the container.

ZACMI Vacuum Filler is the perfect solution to complete the filling process of containers pre-filled with solid products, or to fill products in one shot. The machine is equipped with a dedicated pump and a rotary distribution system that creates a vacuum in the container, after which the container meets the product distribution tank through special valves.

Lastly, the ZACMI Telescopic Filler is suitable to fill a wide range of solid products, such as vegetables, meat, fruit and powder products, due to the choice of specifically developed customized instruments. The machine can be equipped with a "No can - No fill" device that allows filling only in the presence of a container.

FILLING ACCURACY

Fillers and relevant system solutions that cover the filling, closing and labelling stage as well as the subsequent handling and packaging operations, apply increasingly sophisticated techniques, suitable for different types of containers.

There are, therefore, different fillers suitable for a specific product and a specific plant technology.

Some of the most critical features are speed, quality of the process, as well as accuracy and rapid programmes to carry out various operations on a complete plant. This means that, not only each individual machine, but the entire line needs to ensure the required speed and accuracy.

As far as the filling process technology is concerned, there is machinery that operates through a rotary motion of the container fillers, labellers and seamers and machinery that operates in line through intermittent or continuous motion.

In both cases, the system includes compact yet dynamic and flexible components. There is a rotating platform to checks speed, synchronization and automation.

The unit is equipped with smart sensors and actuators, to modulate the force applied to prepare and handle the items and also includes diagnostics in view of a predictive maintenance so as to reduce unexpected machine stops.

ZACMI Monoblock, including two or more machines operating together to wash, fill and close the containers.

EFFICIENT CONTROL OF THE LINES

A major challenge of the packaging industry is a smart control of production lines, to ensure speed, quality and low costs.

In this perspective, an accurate measurement of resources and a smart use of process data of the packaging supply chain are crucial, both to improve line efficiency and to ensure a transparent supply chain from any point of the manufacturing line up to the delivery to the final customer.

In particular, information must be transmitted automatically and in a timely manner to obtain a coherent and correct transfer, for example, by means of IoT sensors all along the production line.

In this way, parameters like: product availability, waiting time, occupation of the line, need of maintenance and so on, can be monitored in real time to improve the entire production process.

A SPECIFIC CASE: SUSTAINABLE PACKAGING FOR A SAUCE AND PESTO LINE

As mentioned above, production costs are extremely affected by even the smallest increase in efficiency of the line (OEE).

The following case testifies this, in terms of industrial filling. ZACMI developed the project in cooperation with the customer, a manufacturer of sauces and pesto. The following table shows the main data of the line:

JARS PRODUCED IN ONE HOUR	**24.000**
EXPECTED WEIGHT IN EACH JAR	**190 g**
YEARLY WORKING DAYS	**300**
DAILY HOURS WORKED OVER THREE SHIFTS	**20**
OEE	**90%**

Filling accuracy is shown through the standard deviation σ: the lowest, the most accurate.

Considering a possible statistical variability, the Italian law tolerates that a small percentage of packed items in each lot contain an amount slightly lower than planned; mistakes in terms of a higher net quantity compared with the average content are tolerated; as a matter of fact, they neither benefit nor damage consumers, whose protection is of course the main scope of the regulation.

Packages that do not meet the accepted tolerance can be sold if the error is lower than twice the maximum tolerance permitted, as specified in standard tables showing the maximum tolerance in weight. Nevertheless, it is prohibited to sell a single packaged product that has an error greater than twice the permitted tolerance.

In our case, the expected weight of each jar is 190g ± 3σ in 99.7% of jars.

Switching from a σ ±0,9g to a σ ±0,7g means that 99.7% of actual weight is within an interval that differs from the expected value by ±2.1g instead of ±2.7g, with an average saving of 0.6g per jar.

Considering the above mentioned design data, a saving of 73.44 tons of product per year, corresponds to:

- Saving of raw materials, steam, energy, water
- Or the opportunity to produce approximately 386,500 jars more per year using the same resources.

Conclusion

In the days ahead, the success of a company and its profit will be more and more bound to sustainability: from raw materials to a higher performance of machines and production sites (the subject of this white paper), to logistics and transport.

Because of its basic role within the life cycle of products, mainly food, packaging is a privileged field for sustainable choices; the digital contribution through precision mechanisms, measurement and control, allows the improvement of the production stages, hence reducing costs and carbon print.

Ultimately, the basic rule of sustainable manufacturing is the search for the “right fit”, for example in container filling or in the performance of production lines, as demonstrated in the specific case mentioned above.

A sustainable process in the packaging industry, is a feasible aim through cutting-edge solutions like those offered by ZACMI.

Final Key-points

- Sustainability in industrial packaging requires attention to materials, as well as processes
- In particular, process sustainability means filling accuracy and high performance of production lines
- ZACMI, a leader in industrial packaging automation, focuses on filling and performance with extremely innovative machines
- An example shows that even a slight improvement in filling efficiency, strongly influences total production costs and, ultimately, sustainability.

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