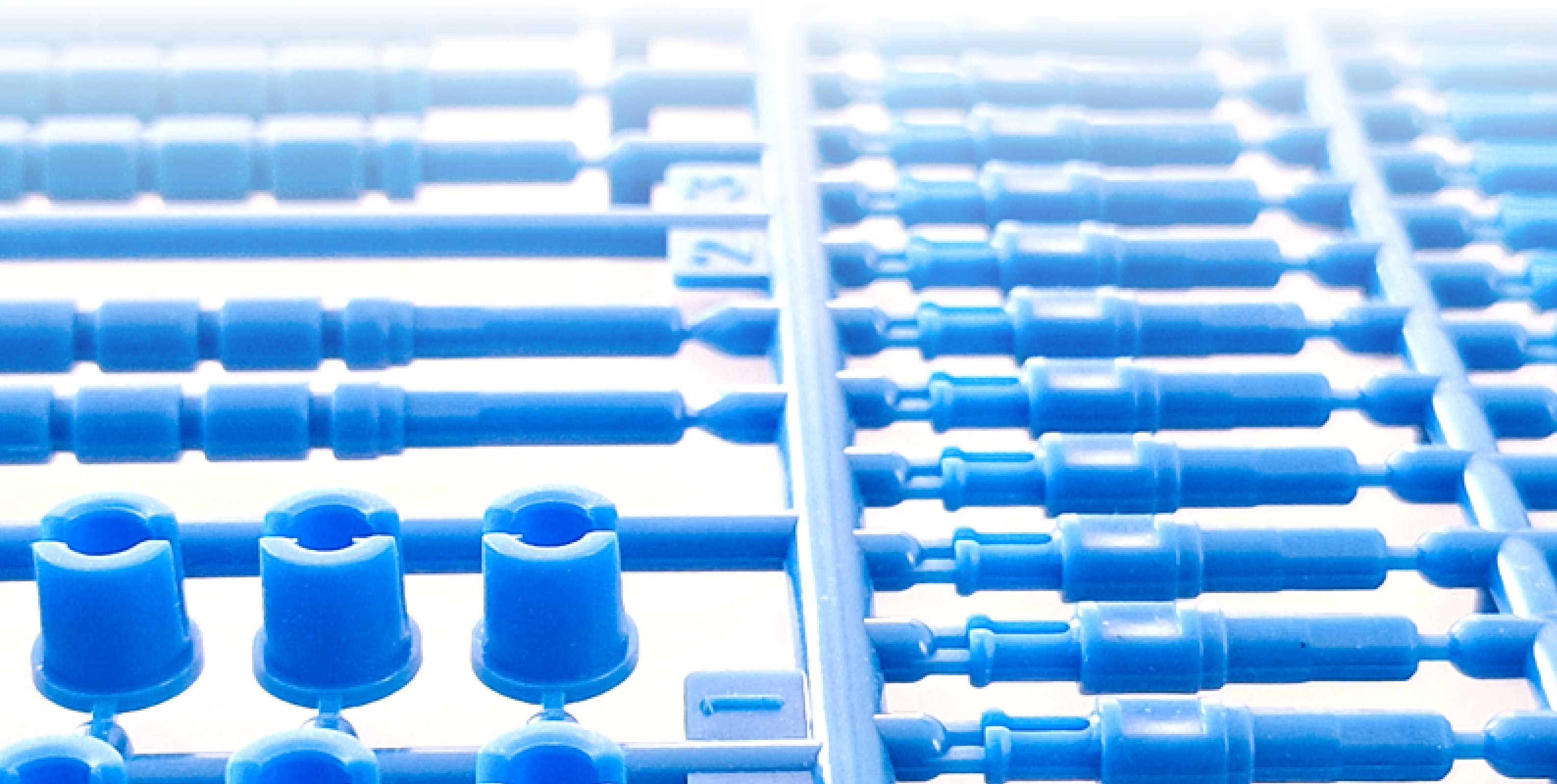
Data-Driven Transformation of the **Plastic Industry**

The plastics industry is currently at a historic turning point. Omnipresent in our daily lives, it must undergo a profound transformation to address unprecedented environmental, regulatory, and economic pressures, all while operating in an increasingly competitive landscape. Digitalization enables a shift from reactive to proactive management, allowing for the reconciliation of the variability of recycled or bio-based raw materials with quality requirements and economic performance.

The Sulo case study provides a concrete illustration of this situation: the integration of over 80% recycled material required rigorous traceability and enhanced controls. It also highlights the economic challenges posed by this variability and how digitalization enables us to address them.

Finally, combined with a Six Sigma methodology, this data-driven approach reduces the impact of raw material variability and ensures consistent quality. Data has become a “new essential ingredient” for competitiveness in the plastics industry.



Considered a key sector of the manufacturing industry, plastics processing supplies essential components to numerous markets, from packaging and construction to the automotive, household appliance, and medical sectors. It is currently undergoing a profound transition, driven by the scarcity of fossil resources, the rise of recycled and bio-based materials, and increasingly stringent regulatory requirements. Plastics manufacturers must balance competitiveness, material availability and variability, quality requirements, and reducing their environmental footprint, all while facing intense cost pressures and ever-shorter deadlines. In this context, operational excellence is no longer just a goal: it is a prerequisite for sustainability. The ability to capture, contextualize, and leverage industrial data is becoming a decisive factor in controlling processes, ensuring traceability, and stabilizing quality despite the variability of raw materials.

Performance Challenges in the Plastics Industry

The plastics industry has shifted from a linear model—based on the extraction of fossil resources, the manufacture of products, and their subsequent destruction or landfilling—to a circular economy that recycles used plastics, particularly in response to new regulatory constraints. These constraints give rise to three major challenges.

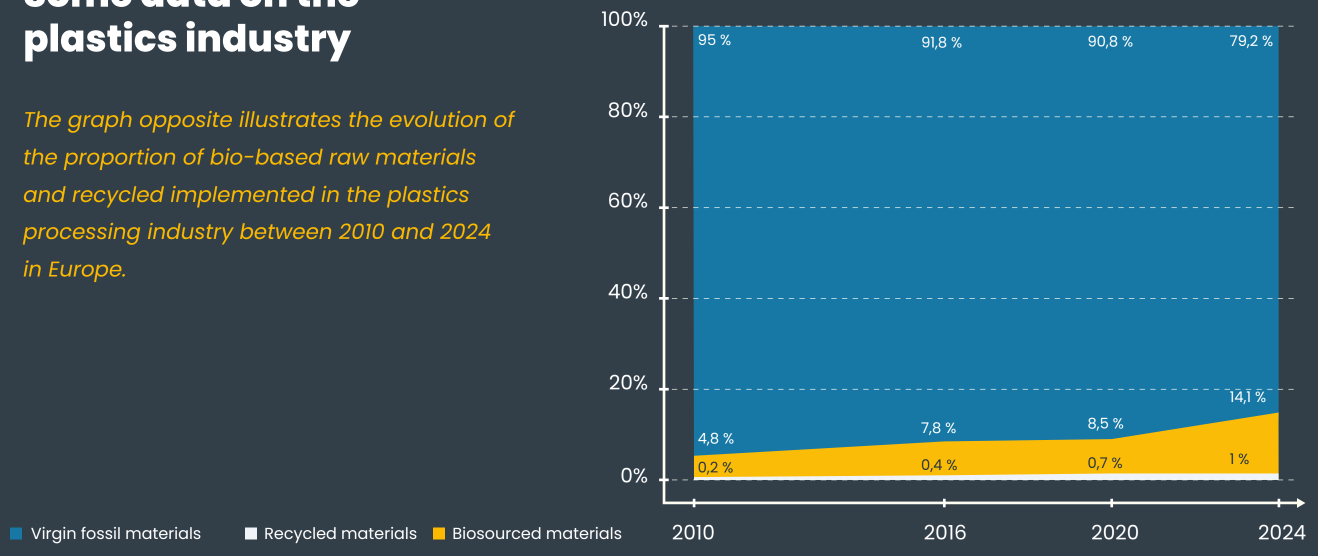
The environmental challenge: companies are under intense pressure to produce using a majority of renewable materials, while simultaneously reducing both their energy consumption and their overall carbon footprint. To achieve these goals, they must prioritize recyclable materials and reduce their reliance on petrochemical-based raw materials. They must also design recyclable products and invest in renewable energy sources.

The legal challenge: With the implementation of new regulations, such as the ban on single-use plastics and the requirement to document the origin of materials, companies must quickly find solutions to capture new markets while adapting their production facilities and processes to remain competitive. They must also meet strict traceability requirements, which are essential for compliance with these regulations.

The economic challenge: The transition to a circular model introduces new economic dynamics but also poses a major challenge in terms of volatility. The growing demand for recyclable materials, which may exceed supply, shifts market balances and causes fluctuations within the supply chain. The integration of renewable energy sources also increases the variability of energy costs, which can affect a company's profit margin.

Some data on the plastics industry

The graph opposite illustrates the evolution of the proportion of bio-based raw materials and recycled implemented in the plastics processing industry between 2010 and 2024 in Europe.



Digitalization as a Solution

In the face of these challenges, digital transformation offers concrete solutions. It enables a shift from reactive management to proactive and optimized operational control, based on detailed knowledge of raw material quality and better mastery of plastics processing. Yet many plastics processing companies still rely on outdated approaches to managing their most valuable asset: data.

- **Data access:** Data from key process equipment—like extrusion or injection molding—is often hard to access due to the machines' age and lack of connectivity.

- **Data fragmentation and silos:** essential information is often scattered across multiple systems. Process data is stored in production equipment automation systems, quality results in laboratory information management systems (LIMS), and raw material traceability in the ERP or MES. Very often, much of the data is still recorded on paper or in Excel files. As a result, operational teams rely on tedious manual processes to fill these gaps.

- **Process and production complexity:** in plastics manufacturing (injection molding, extrusion, thermoforming, etc.), performance depends on a large number of interconnected parameters (zone temperatures, pressure, speed, cycle time, material moisture content, recycled content, tooling conditions). Without a unified view that links materials, machine settings, and quality results, it becomes difficult to identify the root causes of productivity losses, scrap, or excessive energy consumption. Deviations are often detected too late, once non-conforming products have been produced or material has already been wasted. Attempting to optimize a process by looking at only one parameter at a time leads to suboptimal decisions in a multivariate environment.

- **Attracting young talent:** the sector must modernize its tools to attract younger generations by offering them a digital work environment aligned with their habits and lifestyle.

Digitalization bridges the gap between isolated silos of information. It is not merely about displaying graphs on a screen, but about creating a “single source of truth” for the entire organization, enabling numerous applications and placing them in the hands of subject matter experts.

- **Unified database:** a robust digital platform aggregates data from all layers (sensors, laboratory, maintenance, etc.), cleans it, and contextualizes it in real time. It thus ensures that the field technician, process engineer, plant manager, and financial controller share the same view of reality.
- **Monitor production in real time** to adapt operating parameters to the quality of raw materials and ensure compliance. Continuous monitoring of indicators and process parameters enables early detection of deviations and immediate adjustment of settings, reducing scrap and material waste.
- **Resource optimization and sustainability:** digital tools provide visibility into resource usage, enabling monitoring of energy consumption and material flows. Advanced analytics detect anomalies and excessive consumption, help identify energy-intensive processes, and enable higher output at lower costs while meeting sustainable development goals. In a context of volatility and fluctuations in the availability, quality, and price of raw materials, digitalization provides the agility needed to optimize production and reduce costs.
- **Equipment monitoring:** by anticipating equipment malfunctions, it becomes possible to better plan maintenance to avoid costly breakdowns, both in terms of maintenance costs and impact on product quality.
- **Improved access to information:** real-time dashboards and standardized reports provide management with accurate data for decision-making, while field personnel receive clear instructions and tools to best manage their production equipment. Thanks to immediate access to information, engineers and quality specialists can better understand processes, improve them, and optimize operations.

The Benefits of **OIAnalytics**

A specialized solution like OIAnalytics is designed to transform raw data into actionable insights and provide users with easy-to-use business tools to take action across multiple areas.

- **Democratization of data:** this platform makes performance data accessible and immediately understandable to everyone. Operators can view the real-time status of their production line, make the right decisions, and measure the impact of their actions on quality, energy consumption, or material yield.

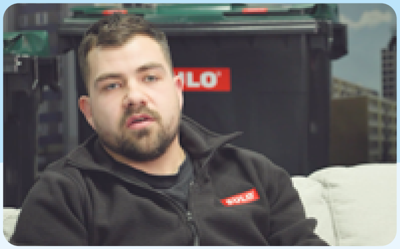
- **Going paperless:** The shift to data collection via PC or tablet eliminates manual data entry, which is error-prone and time-consuming. Information is centralized and immediately available.

- **Team engagement:** By giving employees the tools they need to better understand and improve the performance of their processes, this solution strengthens their engagement and sense of initiative.

- **Process optimization:** this is the heart of the system. By correlating production parameters (temperature, speed, pressure, etc.) and raw material quality with results (quality, material yield, energy consumption), OIAnalytics uses advanced analytics to identify optimal settings or the root causes of deviations. These advanced analytics capabilities help strike the right balance and deliver high-quality products while minimizing material losses and energy consumption, even when raw material quality varies.

Implementation example at **Sulo**

Sulo is Europe's leader in sustainable waste management and manufactures waste collection containers and bins. The company already uses 83% recycled materials in its products. The company collects old bins to recycle them and produce new ones.



Vincent Drouin,
Data Engineer

"We already had quite a few data analysis tools—Excel files, Power BI analyses, and so on. However, we struggled to correlate our recycled materials with our process data on the shop floor. OIAnalytics allows us both to ensure the traceability of our products (we select a bin and get an overview of all the data reported at that moment for that product) and to perform analyses, such as on the last 10,000 bins produced. That's where the magic happens: the tool will be able to highlight correlations and areas for improvement..."

The Challenge

The company faced complex management of its production equipment and difficulties in collecting data from these systems. It sought to increase production, better understand its manufacturing processes, monitor quality deviations, and control the integration of recycled plastic into its processes. It also wanted to better analyze the correlation between recycled materials, process data, and the quality of finished products.

The Solution

Implementation of a digitalization initiative with OIAnalytics to:

- save time on data analysis
- improve energy efficiency and reduce their carbon footprint
- improve product quality and meet customer requirements
- monitor testing on machines or prototypes

The Results

Employees were equipped with tablets, replacing paper, and equipment was connected. Teams were then able to leverage their data to address a wide range of issues.

Overall, a better understanding of production processes: the tool enabled data to be linked throughout the production chain, providing deeper analysis and more context around equipment alerts. Digitalization has thus helped stabilize manufacturing processes, a major challenge given the use of 83% recycled materials, whose quality is more variable.

OIAnalytics has also enabled a better understanding of the correlations between raw material characteristics, process parameters, and the quality of finished products.

Better product quality by adapting process control to raw materials: digitalization ensures complete traceability, from raw materials to finished products. This data enables better selection of raw materials and adjustment of equipment settings based on their characteristics. The tool also facilitates real-time monitoring of quality deviations, enabling adjustments to be made as early as possible and directly improving the quality of finished products for the customer.

Improved productivity and optimized performance by getting the most out of equipment: the tool enables near-instantaneous analysis by leveraging all collected historical data. The company has also been able to improve the performance of its production processes, as engineers and technicians have a better understanding of the processes and can test new conditions on the equipment to identify the optimal settings.

Time savings for teams: By automating many of the processes related to the collected data, teams have reduced the time spent on report generation, as well as on data processing and analysis to meet their daily needs.

Pascal Chignardet,
Process Technical Expert

"The tool makes our work much easier; it's a real way to monitor our entire fleet (machines, molds, etc.). We can monitor our injection molding machine from a computer - deviations, set tolerances, all our molding conditions."

Discover the complete testimony on our YouTube channel

The Sulo example demonstrates how OIAnalytics links material traceability, process parameters, and quality results to ensure the safe integration of recycled material, reduce scrap, and quickly identify new optimization opportunities to improve industrial equipment performance.

Six Sigma
in the Plastics Industry

In the plastics industry, the 6 Sigma approach offers a powerful framework for controlling processes and ensuring consistent product quality. It is an ideal approach for addressing the increased variability of raw materials and reducing its impacts. Digitalization and analytical tools are true catalysts for this approach.

The backbone of Six Sigma is the DMAIC improvement cycle:

D	Define
M	Measure
A	Analyze
I	Improve
C	Control

To illustrate the approach, let's take the example of a plastic injection molding plant that uses a high proportion of bio-based or recycled materials.

Define	M	A	I	C

The goal is to define the scope of the project. The team defines the problem, the objectives, the scope, and the expected benefits.

Problem: Some injection-molded parts come out of the press with defects; in particular, significant variability is observed during dimensional inspection, resulting in a high scrap rate.

Objective : Reduce the scrap rate to less than 2% within 5 months.

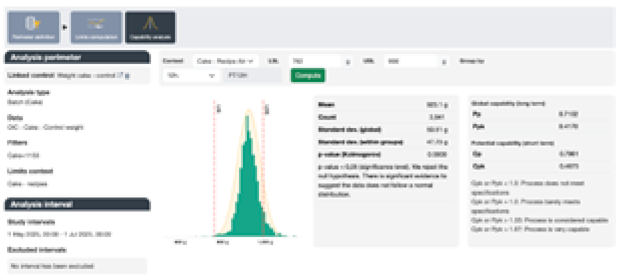
D **Measure** A I C

This phase involves quantifying the process's current performance to establish a baseline. The goal is also to compile reliable data.

Action : The team collects all relevant data. This includes raw material quality, recipes, injection molding machine parameters (temperatures, pressures, cycle times, etc.), dimensional checks, and more.

Result : The data reveal significant variability in the characteristics of the raw materials and the dimensions of the finished products.

Tools: control charts, process capability analysis.



SPC Analysis

Bringing processes under control using a 6 Sigma or SPC approach. An analysis workflow that determines process capability and establishes control limits and alert rules for key process parameters.

D M **Analyze** I C

The team analyzes the collected data to identify the root causes of variability.

Action : Using the right analytical tools, the team looks for correlations between purity variability, raw material quality, and other process parameters.

Finding : The dimensions of the finished product vary depending on the proportion of a specific recycled raw material used.

Tools : influence analysis, cause-and-effect diagram (Ishikawa), 5 Whys.

Influence Analysis

Understanding and optimizing a production process. Analysis workflow to identify parameters influencing performance and determine their optimal settings.

D	M	A	Improve	C

The goal is to identify, test, and implement solutions to eliminate the root causes.

Solutions : Two solutions are being considered. The first involves fixing the proportion of the impacting material to ensure dimensional tolerances. However, this option lacks flexibility and does not allow for adaptation to the fluctuating availability of this raw material. The second involves adapting the process based on the proportion used.

Action : Conduct tests for different recipes (proportion of the critical raw material). For each recipe, the known press parameters are varied to determine the operating parameters to be adapted for different recipes. After analyzing the results, a rule for adjusting the press parameters based on the recipe is established.

Tools: Design of Experiments (DOE), pilot tests, influence analysis.

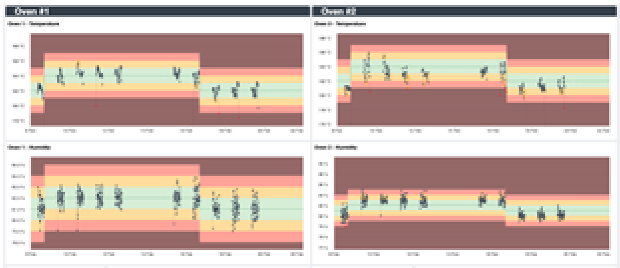
D	M	A	I	Control

The final phase aims to ensure the sustainability of the improvements achieved. It is essential to ensure that the process remains stable and under control over the long term.

Action : A new procedure for adjusting the press parameters is implemented to adapt the settings based on the raw material recipe used. Automatically calculated indicators are added to guide the operator in adjusting the parameters according to the recipe. Control charts are implemented for dimensional checks, enabling the detection of any deviations.

Result : reduced dimensional variability in the injected parts. The gains, with a scrap rate below 2% (reduced material waste, improved customer satisfaction), are tracked and documented.

Tools: control plan, control charts (SPC), alerts, standardization of procedures, training



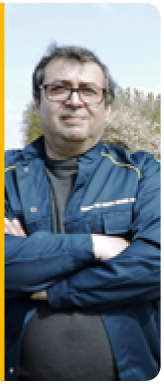
Control Charts

Automated management and implementation of controls and alerts for key process parameters.

In conclusion, when rigorously applied and supported by digital tools, the Six Sigma approach enables the plastics industry to transform its production challenges into a sustainable competitive advantage.

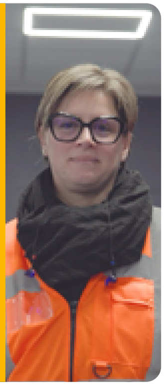
For more **information**

Testimony
Toshiba



Watch

Testimony
Sulo



Watch

How to go
from **data to operational decisions ?**

Read

Digital's impact on operational excellence:
new trends and industry insights

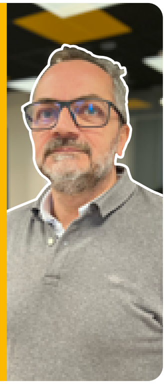
Listen

The principles of circularity:
how to make
it work
for industries?

Listen

Industrial Data Platform: an update on the current trends

Listen



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