



Whitepaper

Quality Management System

One step closer to fully autonomous mill

Data on product quality enters the digital realm

The introduction of digital technology in the milling industry has so far focused on automating production parameters and analyzing historic performance data. With the launch of the Quality Management System, Bühler is bringing the milling industry toward a new era of digitalization and advanced automation. Quality metrics obtained from the laboratory, inline sensors, or any other source are now automatically digitized and attached to the production process. This allows for data-driven decisions on one unique source of truth combining all master data and using it to trigger automatic process reactions, bringing us one step closer to the fully autonomous mill.

In recent years, millers have been adapting to the digital technological advances that are driving efficiency within their industry. These digital innovations aim to develop a fully autonomous mill, or in other words, to create a self-adjusting mill that can calculate and execute its own pre-determined production parameters within a closed-loop system without human intervention.

It's a bold ambition, and the industry is still some way off achieving its goal. But regular advances are being made, and the biggest move is to come with the change in the mindset of the milling companies and head millers, who need to adapt their daily operations to improve the efficiency of the impact they make on the final business profit. The other major area of

investigation until now has been big data. Once you have a mass of production data, you can explore it using algorithms to evaluate trends and see how best to set your production parameters to reduce waste, increase yield, cut costs, and optimize performance.

Focus on the laboratory

However, in recent months, the digital focus has shifted to the laboratory, an area of the mill that to date has been partially overlooked in the milling digital revolution. Walk into an average mill laboratory anywhere in the world and you will find an abundance of paper records and Excel spreadsheets. Think of your typical laboratory as a digital data terminus and storehouse.



Laboratory in a flour mill from 1929



Monitoring of production data from everywhere possible

Data flows hourly from many different sources, depending on the sophistication of the mill, leaving the laboratory staff to carry out and manually input much of the data analysis. Physical product samples are brought to the laboratory to be analyzed on different devices measuring water content, absorption rates, protein content, enzymes, color, ash content, etc. Production data is also fed into the laboratory, providing lot numbers, timings, recipe data, product characteristics, and production parameters. Some laboratories also receive real-time quality data from sensors on their production lines through their Multi NIR. A few of the largest and most sophisticated mills may also operate a Laboratory Information Management System (LIMS) to help automate workflows and manage samples. But even so, they are still working with disaggregated data that needs to be distributed within the company; office, laboratory, control room, clients' desks.

Manual inputs remain in the past

But it is mostly the laboratory staff who must, to varying degrees, record, collate, store, and retrieve all this data when it's needed. Staff collect data from different sources to produce the all important Certificate of Analysis showing that each production batch has reached the agreed quality specified by the customer. Storage and retrieval of all this often paper-based data must then be managed for auditing and traceability purposes.

That is until now. Over the past year, the Bühler research and development team has been exploring how to streamline the laboratory process to bring it into line with other digital advances

made in the milling sector. "We realized we have an opportunity to make some big improvements, and for the first time, we started seeing how we could digitally link quality and production data to get rid of many existing manual processes. So we started to develop the Quality Management System to make the process faster, more accurate, and more efficient," explains Javier Lozano Diaz, Bühler Product Manager Automation and Digital Services Milling Solutions.

Quality and production data united

In September 2023, Bühler announced the launch of its Quality Management System (QMS). "Bringing production and quality data together, as well as managing it in a single system, anytime, anywhere, means being able to access the data, and therefore knowledge, much faster, getting faster analytics, and allowing faster, data-driven decision making. It also means being able to speed up the rate at which an automated process can react to a quality deviation, which we believe is the biggest step we have made lately towards our goal of creating the SmartMill," explains Lozano Diaz.

Bühler customers currently access two distinct digital milling solutions under which Bühler's digital functionality is located. Mercury MES deals with the production processes, providing a central operating system in which a seamless flow of real-time data is used to provide automated control of the mill. Bühler Insights does all the data analysis using long-term data storage to evaluate trends to better optimize performance, assess production parameters, and provide a visualization of the mill's

key KPIs from one or several sites as a single overview. QMS is an umbrella concept comprising all the product quality related products that help our customers to control the processing quality that optimizes their end product,” explains Lozano Diaz.

Certificate of Analysis

On top of the improved accuracy and stability of the product quality, which helps to optimize efforts and costs, this solution takes care of the creation of the Certificate of Analysis to be provided to the end customers. In the past, laboratory staff had to marry production and quality data from different reports, which could be both time-consuming and prone to human data entry errors. The QMS can now digitally produce the data required on the Certificate. Another key benefit is the avoidance of data entry errors. Having to manually enter data from the laboratory analysis machines always meant the possibility of data being miskeyed, which in turn could lead to a production line being erroneously shut down.

Reaction time

QMS also saves time by improving management efficiency. Digital data can be accessed from all the laboratory workstations, making the distribution of work within the laboratory easier. Once the sample has been collected and the analysis is complete, data now flows seamlessly through the system, generating an instant alarm on the plant operator's screen if a production parameter goes out of range. If necessary, a

production line can be automatically shut down by QMS. This ensures that product quality remains constantly precise, and therefore minimizes costs. It also ensures that critical production data relating to quality is now available to everyone who needs it within the plant's operation team, including those working remotely.

“When we trialled QMS, we found that the plant operators liked the warning feature best because they immediately get a notification when their soft damage is high, for example, so they can immediately go to the machine and readjust it before they get a complaint from the bakery that the flour quality was not good enough,” said David Krause, Team Manager Technology Digitalization, who headed up one of the main trial sites piloting QMS.

Auditing and traceability

Storage and retrieval are also streamlined by QMS. As all batch data is held digitally on QMS, it is possible to do away with physical record keeping. It is no longer necessary to search through paper records or endless spreadsheets in Excel to find laboratory data linked to a particular batch. The QMS allows instant retrieval, enabling staff to apply a range of different search filters to find the relevant digital batch data. Finally, metrics relating to product quality generated by the laboratory such as moisture, ash, protein, wet protein, water absorption, and starch damage can now be fed into analytical tools such as Bühler Insights to evaluate trends, thereby improving product optimization. This data can also be used for multiple mill bench



Monitoring of production data from everywhere possible



Multi-NIR Online Sensor

marking so that the quality performance of different mills can be directly compared.

Lozano Diaz believes that the building blocks are now in place to make the automated mill a reality. “It’s a major step, we are now moving from concept to reality. The brain of the autonomous mill is an advanced automation system, designed specifically for the milling industry, and an assisting system that helps you to make use of the data, and even acts for you. If the brain now has all the quality data and all the production specifications, then it will be possible for it to make smarter and smarter decisions on how to optimize production with less human intervention. That’s why we are bringing Mercury MES and Bühler Insights to the milling industry,” says Lozano Diaz.

Increase profit by optimizing quality control. More information on QMS needed?

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