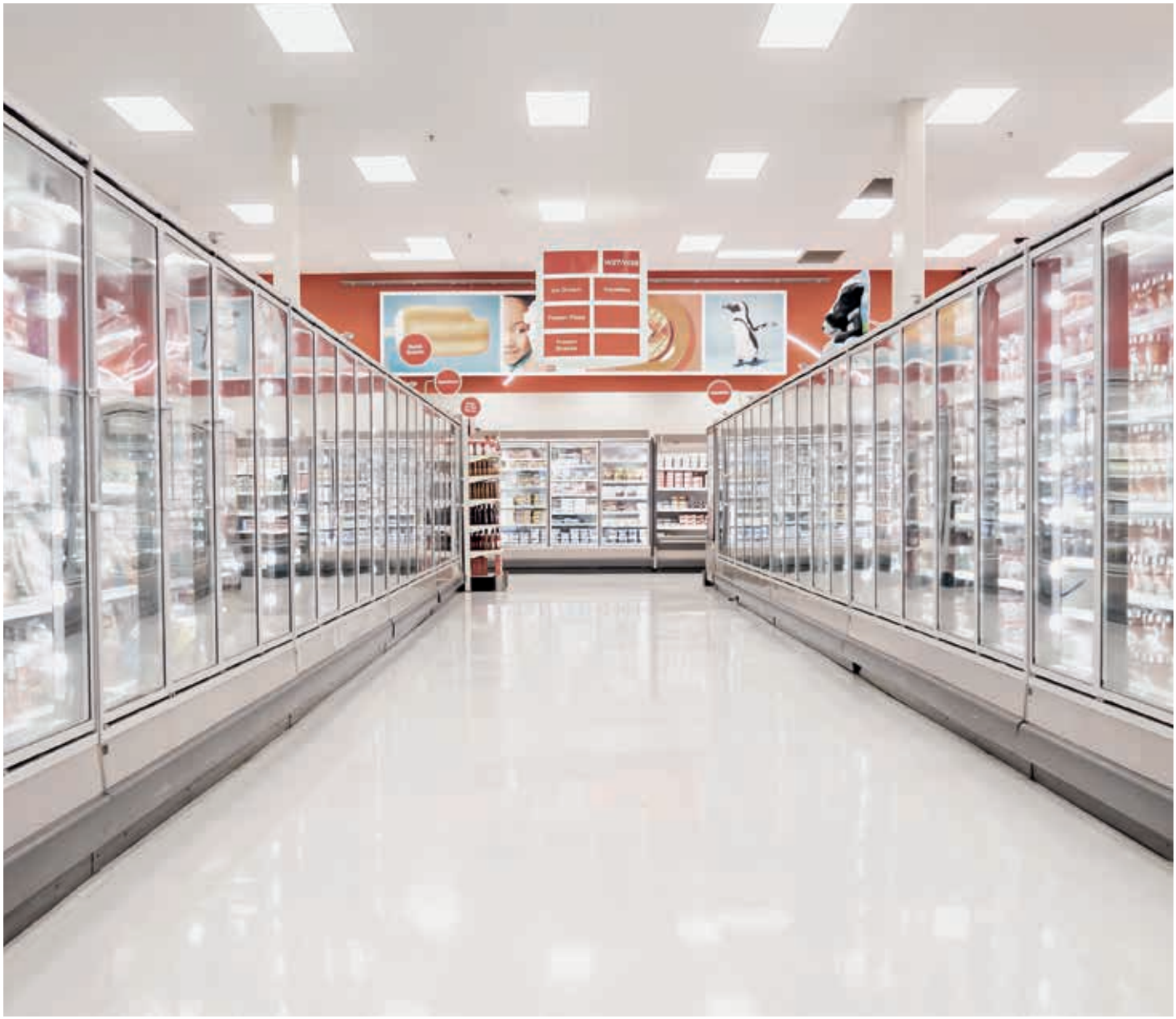

When bytes meet bites

What the Internet of Things, Services and People means for the food and beverage industry

DOMINIQUE STUCKI – What do food and beverage plants produce in large quantities – besides food and beverage of course? The answer is digital data. With virtually every device today having some level of digitalization, there is electronic data literally everywhere. Collecting and analyzing it can unlock information about every aspect of the process as well as of the condition and performance of the equipment. However, in many cases much of this data remains on the factory floor, marooned in so-called “islands of information”. But all this is changing.

1 A modern food or beverage factory represents a complex choreography of different interconnected processes.

The food and beverage industry is facing a plethora of challenges. These include the unrelenting drive for greater profitability through better utilization of assets and inventory, the addressing of production bottlenecks as well as the tightening of regulatory demands for greater traceability of products and ingredients. All of these requirements can be met through transparency and access to timely and actionable information.

The degree of automation of a plant may vary from factory to factory, and even between installations within the same site. Disparate systems reflecting different designs, ages and manufacturers present a variety of data protocols. Information is rarely shared automatically, and data gathering, inventory and analysis remains a slow and manual task. Such manual collection of data not only implies delays but also raises concerns over the quality of the data as errors are easily made and difficult to detect.

Sharing knowledge, building predictability

In this digitalized age, virtually every device in a factory relates to form of electronic data. Every sensor, every actuator and every controller is continuously generating, consuming or processing electronic information. But although the devices themselves are more digital than their predecessors, it remains the Achilles heel of process plants that information is often not suitably shared or analyzed. The most important enabler of change in this area is what ABB calls the “Internet of Things, Services and People” (IoTSP).

Just like the conventional Internet, the IoTSP enables communications between disparate devices for a range of different purposes. One important concern in a food and beverage plant is keeping track of inventory and equipment → 1. For example an employee’s misjudgment might lead to the wrong ingredient being added to a mixer, or the right ingredient added in the wrong quantity or at the wrong time, or incompatible ingredients being mixed. Such errors can be avoided if a positive identification of the ingredient is required before it is added, for example by an employee scanning a bar code on the package using a handheld scanner – or even better, by using an intelligent device on the ingredient’s container permitting it to “talk” directly to the mixer.

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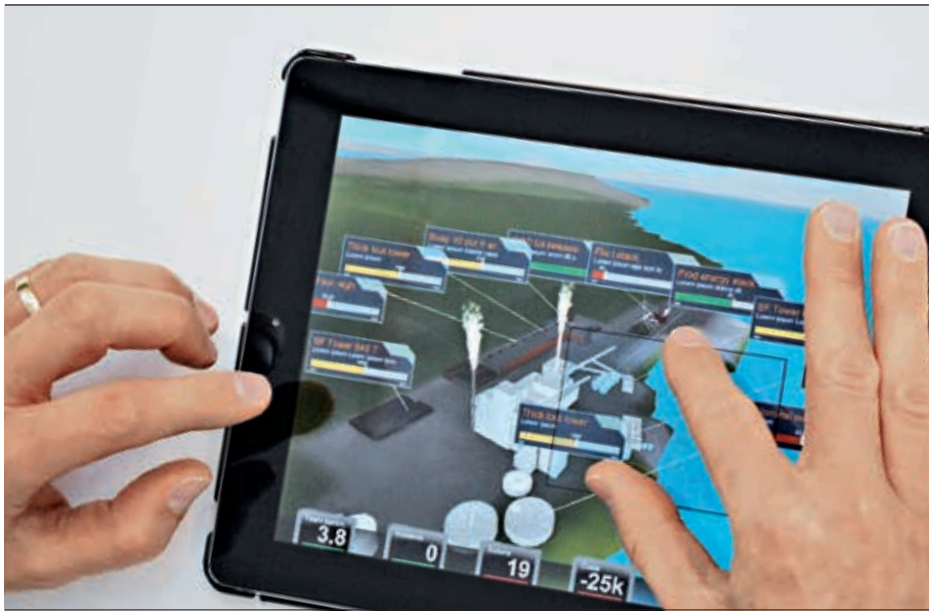
Title picture
Where does that food item on the supermarket shelf come from? What ingredients and what machines were used in preparing it? These facts can be vital for food safety, especially if a recall is necessary, but they also unlock savings and efficiency for the manufacturer. The Internet of Things, Services and People (IoTSP) is making this possible.

2 Management is supported in its decision making by readily available information.



Incorrect or expired ingredients can be excluded from the process and the exact provenance and history of any ingredient can be instantly traced.

Attempted incorrect actions can lead to an alarm being raised or, better still, to the action being disallowed completely (for example by an access flap refusing to open).

This not only means that incorrect or expired ingredients can be excluded from the process, but also that the exact provenance and history of any ingredient can be instantly traced, making it easier to identify the precise batches and even individual units in case of safety incidents. Without this traceability, far larger quantities would have to be recalled leading to a greater waste of resources and financial damage as well repercussions for a company's reputation.

Besides the ingredients, the status of the equipment itself can be tracked. By maintaining knowledge of when a piece of equipment, for example the mixer mentioned previously, was last washed and keeping track of which ingredients have been mixed in it since, a plant can on the one hand avoid downtime and water use through unnecessary washing while on the other hand ensure there is no risk of contamination. This can include keeping better track of ingredients that may contain allergens and other special ingredients.

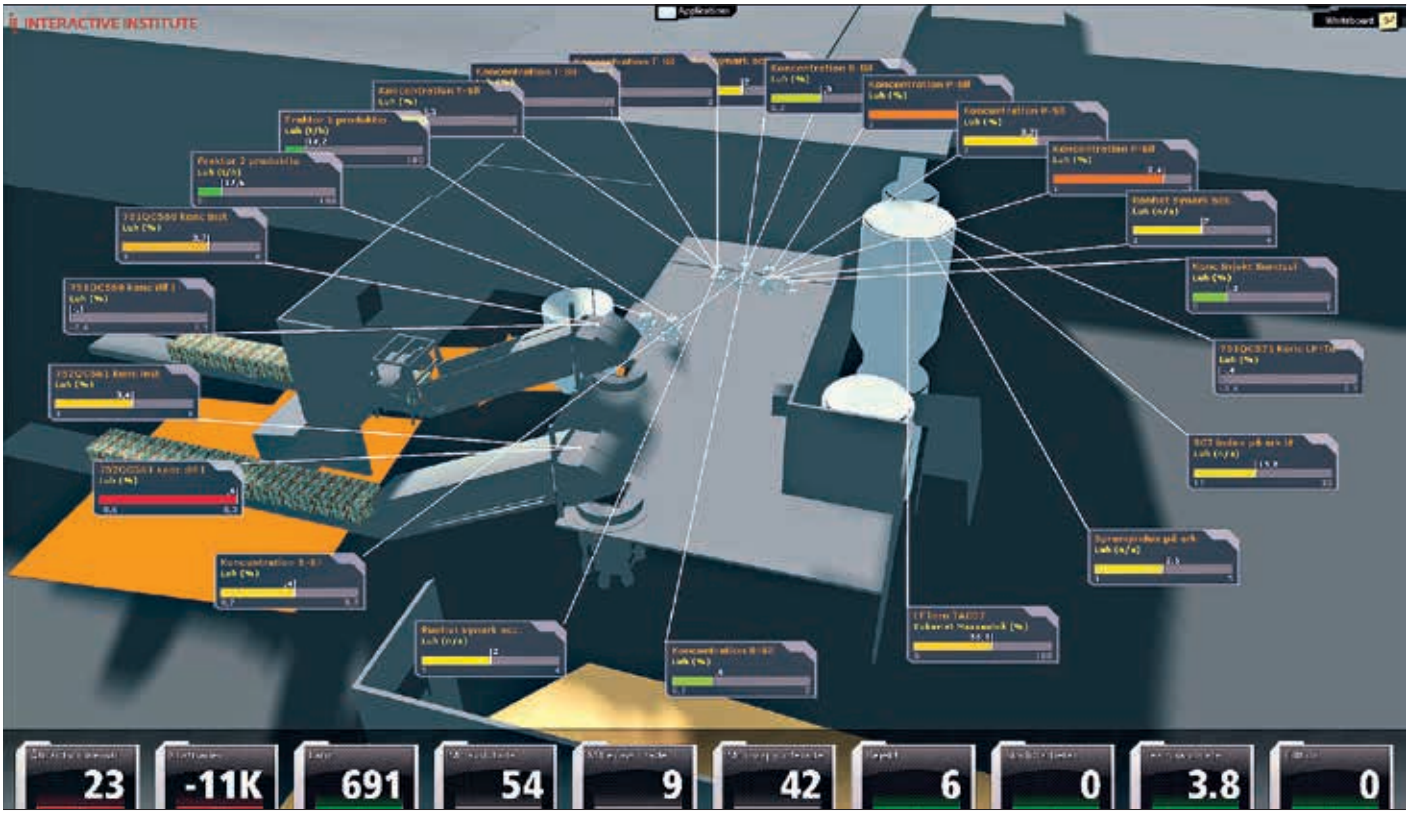
Traceability can also be extended to people. If equipment is aware of the identity of the human controlling it, operators can be excluded from equipment they are not qualified to work on. Such a system can also keep track of and remember which employees tended certain equipment or spent time in critical locations. If it is discovered subsequently, for example, that an employee was ill while at work, the ability to identify the areas and process steps where contamination could have occurred can help contain the damage and initiate a focused recall.

Besides safeguarding the quality of food, the IoTSP can also improve safety for employees. If an employee's clothing contains embedded intelligence, this can talk to the IoTSP and verify that the employee is wearing the appropriate protective garments for his or her tasks. For example, certain tasks may require a hard hat while others may require breathing masks. The same method can also be used to ensure that clothes and tools have been cleaned appropriately and not used in a contaminated area or with incompatible ingredients.

Food for thought

With all electronic devices within a plant sharing information in real time, plant management is able to oversee a plant's activities and is able to schedule them more effectively. A few mouse clicks suffice to identify overall equipment effectiveness or reveal the exact quantity and locations of a given ingredient or product within the plant and track even the smallest of delays → 2.

3 Example of a view of part of a factory. Drilling down reveals further data.



Operators can be excluded from equipment they are not qualified to work on.

Such measures do not just add predictability and accountability to the flow of ingredients within the complex choreography of a production plant, but also have significant cost saving potential. A central focus of supply chain management is on keeping down costs by minimizing inventory. Many volumes have been written about “just in time production”, extolling the advantages of minimizing or eliminating stockpiles. Such stockpiles are often held “just in case” at every production step to compensate for the unpredictability of, or insufficient knowledge concerning upstream and downstream activities. In other words, stockpiles are a symptom of insufficient data sharing and lack of synchronization between manufacturing steps. Stockpiles represent capital needlessly tied up, not only in the value of the inventory itself but also of the floor space and supporting facilities required. In the case of food and beverage this is even more pertinent than in many other industries as freezing and cooling rooms often represent the costliest part of a factory.

The implications of the IoTSP can extend far beyond the factory. By sharing data from the production process of an ingredient’s supplier, supply delays can be predicted and activities rescheduled to accommodate them. Similarly, if the trucks delivering ingredients can be tracked, delays can be anticipated. Looking downstream, if distribution centers and supermarkets agree to share their inventory data in real time, a factory can anticipate replenishment orders before they are placed, rather than producing to fill a warehouse.

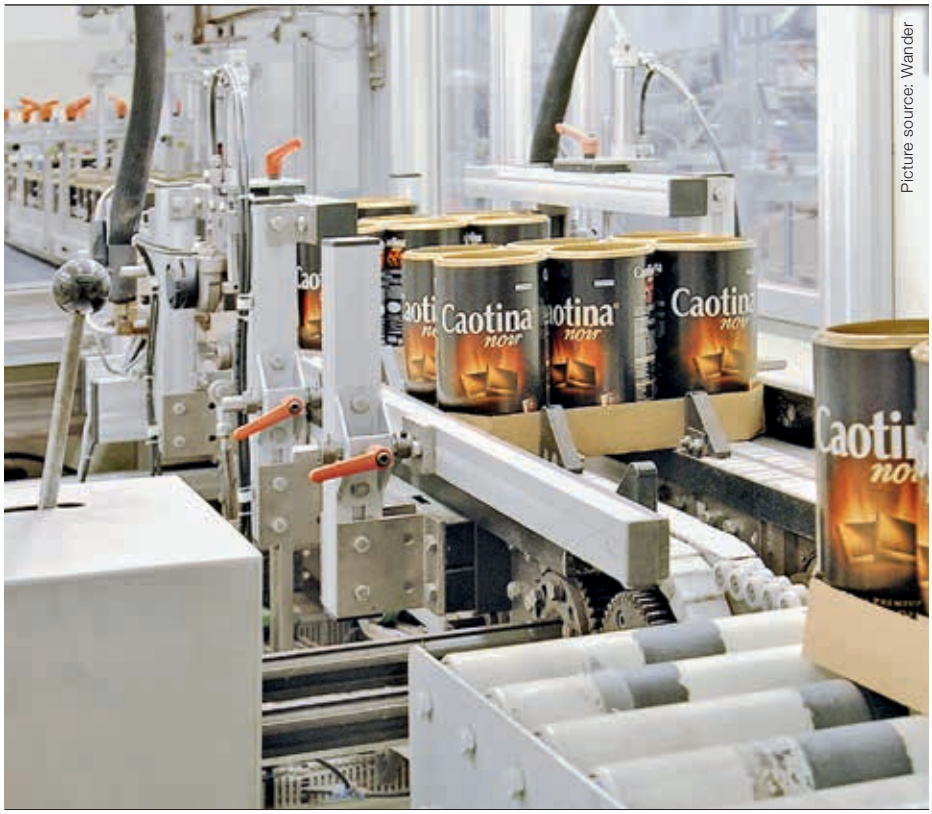
Broader external data can also be acted on. For example if weather data is taken into account, a sudden increase in ice cream sales can be predicted.

The IoTSP also makes it easier to collect statistics and present and analyze them. Long term trends can thus be observed and outliers or long-term shifts flagged for investigation. With all data available electronically, it is easy to “drill down” and look at individual indicators and data streams and identify the causes of anomalous behavior before too much inventory is lost → 3.

Predictive maintenance

Much of what applies to processes and activities can also be said of the equipment itself. Its condition is often insufficiently understood and degradation and

4 Wander (here showing the company's Caotina brand) uses manufacturing execution systems (MES) from ABB. [Picture source: Wander]



Picture source: Wander

failures are not predicted. Maintenance is thus reactive rather than proactive and unplanned downtime causes costly losses of production.

Much of this can be avoided simply by making better use of data that is already being collected. With its vast experience in the field, ABB can proactively recognize the symptoms of different types of equipment defect and predict failures before they occur. Analysis of a drive's torque data can, for example, reveal the telltale signature of a bearing that is likely to fail soon, or a belt that is encountering too much friction.

Besides harvesting existing "marooned" data, specific additional data can support service and diagnostics. For example, ABB supplies smart devices for motors that capture vibrations and share these for analysis. Data captured is made available to an ABB service center that can warn the customer of necessary maintenance actions long before a failure occurs.

Another example is remote monitoring for ABB robotics installations ensuring reliable operations and improved yield.

Simulation

When changes need to be made to a plant, for example by adding new equipment or including a completely new line, the owner wants to be sure that this will harmonize with the existing equipment as well as wanting to know the exact performance and space required. The owner wishes to perform tests as early as in the design phase as possible to reduce risk and verify anticipated return on investment. Ideally, this should be achieved prior to any investment transaction.

This is where the power of simulation and the virtual world comes into play. Setups can be simulated and equipment tested in a mixed hardware and simulation environment. ABB offers simulation packages. Besides its value in preparing installation, simulation is also a powerful tool for training operators.

Appetite for the IoTSP

With its long experience in automation for process industries, ABB is well placed to provide IoTSP services for the food and beverage industry and help them overcome the challenges of the coming years → 4.

Long-term trends can be observed and outliers or long-term shifts flagged for investigation.

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