



ABB

food quarter

The industry is digitalizing

Issue **01**

BEHIND THE SMART LAB DOORS

A walk around ABB's
smart lab of the future

EXPLORING THE WORLD OF VIRTUAL COMMISSIONING

How system testing can
benefit the food industry

FIVE MINUTE FOODIE

An exclusive interview with
Ocado's engineering and
product development manager



The industry is digitalizing



While writing the editor's note for the first edition of Food Quarter, I find myself reflecting on my experiences of digitalization in ABB. As a global business, this most important of industrial themes is a key part of our DNA.

But it's not just ABB that is experiencing digitalization on a large scale.

Large scale engineering projects across the globe are now impossible to complete without the tools and techniques that digitalization presents us with.

As Industry 4.0 and smart factory technology pushes engineering forward around the world, now is the right time to explore what it means to the food and beverage sector.

With the future of our industry in mind, I would like to point our new readers towards an article about a business which is truly embracing the future of technology. On page ten, in our first ever Five-Minute Foodie column, we learn how Ocado, the world's largest online only supermarket, uses robotics and automation to deliver incredible standards of customer service.

Just as digitalization is written into the very fabric of our being at ABB, you can see that the same is true at Ocado – a genuine champion of the fourth industrial revolution.

I hope our magazine helps you make progress on your journey towards a more digitalized way of working. Please enjoy this first issue.

Darcy Simonis

Darcy Simonis
Senior Vice President and General Manager, Global Food and Beverage Applications, ABB

Contents



Digitalization - not just for big businesses

04 **Digitalization and the food and beverage industry**

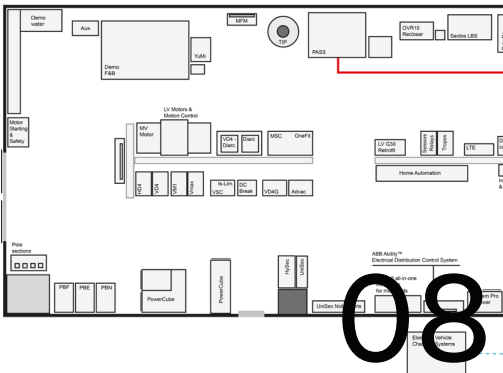
06 **Digitalization - not just for big businesses**

07 **Exploring the world of virtual commissioning**

08 **Behind the Smart Lab doors**

10 **Five minute foodie**

11 **Top 4 food manufacturing trends of 2019**



Behind the Smart Lab doors

Food Quarter issue 1

Digitalization and the food and beverage industry

Wikipedia, the world's largest free-content encyclopedia now has over 41,000,000 articles in 294 languages. If printed, the English articles alone would form an unrealistic 2,512 volumes. Without digitalization and the widespread use of computers, this amazing wealth of knowledge would be impossible. Here, Robert Glass, global food and beverage communications manager at ABB, explains the opportunities digitalization presents for the food and beverage industry.

The shift toward digitalization is a natural continuation for leading food and beverage manufacturers, as the president of the Grocery Manufacturers Association in the USA, Pamela Baily explained. Baily said "food, beverage and consumer products manufacturers are leveraging innovation to optimize service to consumers and trading partners."

Digitalization encompasses a transformation in the way industrial environments work. For the food and beverage industry, this means companies can better comply with legislation through a transformation in areas including connectivity, smart sensors, traceability, cloud computing and monitoring.

"Digitalization encompasses a transformation in the way industrial environments work"

Legislation

The Centre for Disease Control and Prevention (CDC) in the USA estimates that one in six Americans suffer with a food-borne disease each year and 3,000 deaths are attributed to food-borne illness. When people's lives are at stake there is no room for error. Similarly, in the EU, the General Food Law Regulation (EC) 2002 requires business operators to keep detailed records of food they supply and receive. Digitalization aids this process

by automatically collecting data such as food temperatures throughout production.

Smart Sensors

Well-kept traceability records and sensor data can increase transparency between businesses, producers and consumers. This allows plant managers to respond faster in emergencies and use evidence to rebuild public trust following recalls.

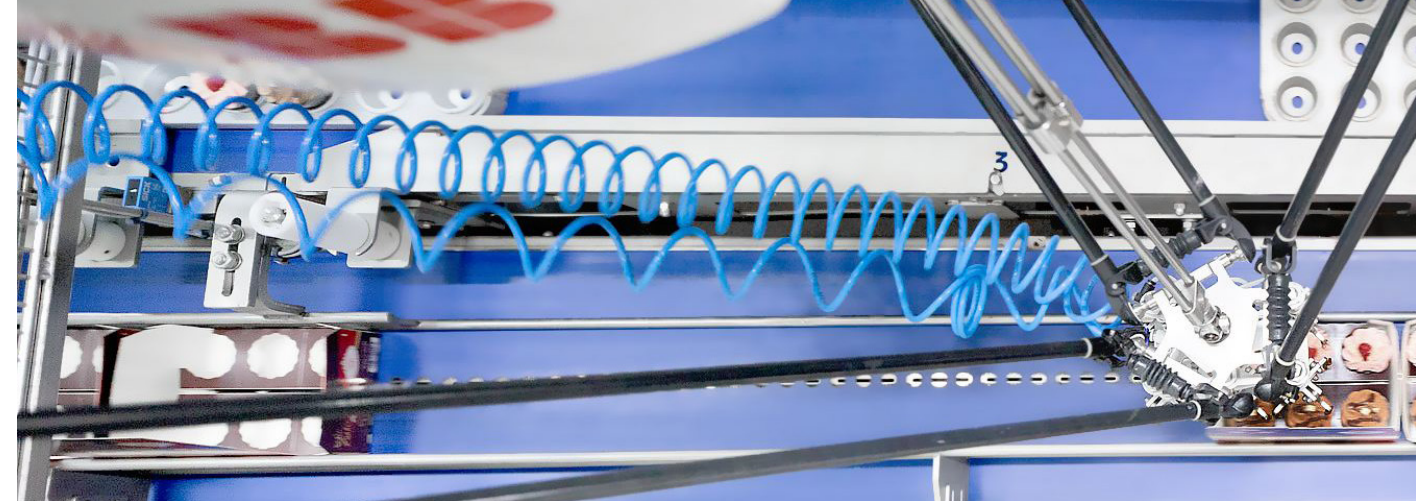
Sensors can aid traceability in two ways: they improve the accuracy of automated processes and they can track and store a variety of manufacturing data. Time-temperature history, physical shocks and other important credentials can be continuously measured and synchronized across the factory thanks to the IIoT.

Sensors used during food production can not only monitor products throughout the supply chain, they can also form part of a device such as a smart container, which can keep data such as temperature constant.

In the future, smart containers may be able to self-diagnose and correct, for example by self-heating the container so that it remains above a threshold set out by health and safety guidelines such as Regulation (EC) 852/2004.

Connectivity

For the first time in 2016, over half of the



world's developing population had internet access. As internet access widens and the price of networked devices drops, the volume of network traffic will continue to rise. Alongside this, the falling cost of producing devices such as WiFi-enabled temperature sensors mean they will become ubiquitous in industrial environments. However, more sensors lead to more raw data. This higher rate of data production presents issues of how to store and use the data.

WiFi connected versions of motion and temperature sensors themselves, when combined with cloud based storage may solve the problem of data capacity. Vast amounts of data can be instantly communicated, stored and even analyzed in the cloud, supplying useful information about traceability, production costs and predictions.

"Sixty per cent of US food and beverage manufacturers use the Internet of Things (IoT) to track and trace ingredients"

Cloud

Although almost sixty per cent of US food and beverage manufacturers use the Internet of Things (IoT) to track and trace ingredients, less than half are using the advanced analytics that are also available.

Cloud analytics, real-time monitoring, virtual commissioning and digital twinning — the ability to recreate the plant virtually — are just some of the techniques now helping plant managers in the food sector reduce unplanned downtime, improve safety and mitigate food emergencies.

Crucially, plant managers can use cloud systems to adapt to seasonal changes in demand, flexibly altering production setups, factory layouts and even reassigning staff without causing wider disruption.

Monitoring

The huge amount of data produced by the connected factory can be used for many purposes in the food and beverage sector, such as understanding why one machine is running hotter than another, or why one is not picking as many products. Many plants are using their own mobile networks to take monitoring to the next level.

Raw technical data has its uses, but these are greatly enhanced when the sensor data is combined with maintenance management or financial data. It is this consolidation that allows the information to come into its own and be useful for prediction, past analysis and optimization.

For example, on farms, sensors are used to monitor soil conditions, using the data to predict when animals are in heat and text the farmer with the information.

Although many businesses will be wary of the perceived complexity of undergoing digital transformation, it can bring about a competitive advantage.

Plant managers of the future should not only recognize the trend toward digitalization, but embrace the opportunities it brings, just as approximately 70,000 active contributors have wholeheartedly adopted Wikipedia, an opportunity produced by consumer digitalization.

Digitalization - not just for big businesses

When cellphones were first released in the mid-1980s, a handset would set you back \$4000 — the equivalent of almost \$10,000 today. Falling costs have made mobile devices affordable and there are now almost as many in use as there are people on Earth. However, this gradual price reduction is not exclusive to cellphones, it also applies to everything from personal computers to industrial systems. Here, Food Quarter investigates how smaller food manufacturers can take advantage of low-cost digital technology.

When the first cellphone was released in 1983, this breakthrough technology was reserved for high-ranking business people and the social elite. Yet, decreasing technological costs have led to cellphones becoming arguably the most common technology available today. In fact, the UN's 2014 telecommunications figures revealed that there are almost as many cellphone subscriptions as there are people on Earth.

This is indicative of a technological trend known as quality-adjusted price, which ties closely into the concept of Moore's law. As technology rapidly develops at a pace that leads to significant performance increases year on year, the cost of that technology decreases at a similar pace.

This presents an important opportunity for smaller businesses to take advantage of newer technologies that were previously only accessible to large companies.

In the food production industry, for example, there has been a significant increase in the adoption of digital technologies and software among larger businesses. Yet, food manufacturing companies of all sizes can tap into the productivity and efficiency benefits offered by digitalization.

“As technology rapidly develops at a pace that leads to significant performance increases year on year, the cost of that technology decreases at a similar pace”

The digital food plant

While equipment and robotics have been the key drivers of plant improvement in past decades, the rise of the industrial internet of things (IIoT) has placed greater importance on software and insight. In particular, many plant managers now use digital

solutions to monitor the status of equipment to mitigate performance problems.

For example, most food processing plants will have automated at least one part of the production line with a conveyor system. As with any piece of equipment, parts of this system will gradually wear down from repeated use over time. For critical components such as the motor, this leads to a slow decline in performance and risks downtime due to breakage.

Plant managers must therefore undertake predictive maintenance to address any issues before they become problems. To do this effectively, plant managers must have accurate performance data from the conveyor's low-voltage motors.

Rather than invest in new systems that feature IIoT functionality, businesses can install multi-function sensors to collect and analyse performance data.

For example, the ABB Ability Smart Sensor for motors allows engineers to digitalize food production plants with minimal expenditure. These sensors fit directly onto the motor's frame and monitor key performance factors such as temperature and vibration. This data is transmitted to the cloud, where it is analyzed and reports are generated for plant engineers.

What the data provides is new insight into the health of motors used in production, enabling a shift from reactive maintenance to predictive maintenance. With a simple “stop light” system of green, yellow and red lights, fleet motor status is simple to assess.

Just as cellphones are no longer exclusive to the likes of CEOs of listed companies, digitalization is not reserved for large food production businesses. By investing in the right equipment, plant managers can start integrating the benefits of digital technology at a pace and budget that meets their production.

Exploring the world of virtual commissioning

In 1895, pioneer of astronautic theory, Konstantin Tsiolkovsky, developed the concept of the space elevator, a transportation system that would allow vehicles to travel along a cable from the Earth's surface directly into space. While early incarnations have proven unsuccessful, scientists are still virtually testing new concepts. Here Robert Glass, global food and beverage communications manager at ABB explores the concept of virtual commissioning and how system testing can benefit the food industry.

Industry 4.0 continues to open up new opportunities across food and beverage manufacturing. In particular, these technologies help improve manufacturing flexibility and the speed and cost at which manufacturers are able to adapt their production to new product variations. Virtual commissioning is one of these key technologies.

What is virtual commissioning?

Virtual commissioning is the creation of a digital replica of a physical manufacturing environment. For example, a robotic picking and packing cell can be modeled on a computer, along with its automation control systems, which include robotic control systems, PLCs, variable speed drives, motors, and even safety products. This “virtual” model of the robot cell can be modified according to the new process requirements and product specifications.

Once the model is programmed, every step of that cell's operation can be tested and verified in the virtual world. If there are changes that are needed in the process automation or robot movement, these can be made on the same computer, allowing the robot to be reprogrammed, or changes made to the variable speed drives and PLC programming. The ABB Ability™ RobotStudio is one tool that enables this type of virtual commissioning.

Once reprogrammed, the system is tested again and if it passes, it's ready for physical deployment. This is where the real benefits become tangible. By using virtual commissioning to program and test ahead of time, less process downtime is required and manufacturers can reduce the changeover risks.

“Research by Austrian software testing firm Tricentis, estimated that software bugs, glitches and security failures cost businesses across the world \$1.1 trillion”

Automation programming and software errors in a system can be incredibly difficult and costly to rectify, particularly if they are found later on in the production process. Research by Austrian software testing firm Tricentis, estimated that software bugs, glitches and security failures cost businesses across the world \$1.1 trillion.



To achieve the full potential of virtual commissioning, the simulation must be integrated across the entire plant process, including both the planning and engineering phase.

The implementation of virtual commissioning brings with it a number of benefits. The ‘try before you buy’ concept allows plant managers to model and test the behavior of a line before making any physical changes. This saves time as the user can program the system's automation while testing and fixing errors. The use of a digital model can also reduce risk when changing or adding processes.

Just as you wouldn't build a space elevator without meticulous planning and years of small scale prototyping, it's very cost and time beneficial to build and test in a virtual environment where you can find the bugs and discover the unforeseen challenges and mitigate them without added downtime or loss of production. It's much better to discover that bug while on the ground versus at 100,000 feet midway between the surface of the earth and that penthouse in space.

Behind the Smart Lab doors

A guide to ABB's smart lab: helping create the food factory of the future.

Today, the world of automation, robotics, and power all intersect with digitalization. Understanding what this means for food and beverage plants can be challenging. Here, Paolo Perani, strategic business development manager in Italy, guides us around ABB's smart lab — where digitalization comes to life.

Digitalization is a word that food plant managers are working to understand completely. That's one of the reasons why ABB opened its smart lab, fitted with solutions from across the entire ABB portfolio with technical experts available to explain the technology.

The lab is set up so that visitors can get practical experience with genuine, functional technology and solution examples. From demonstrable flow control and monitoring systems for breweries to robots for picking and packing, there's something in place to serve every application. So, what exactly is on show?

Process technology

The smart lab features a functional representation of a water grid, which you would find in a milk production plant or a brewery, for example.

A 500 liter tank of water is connected through a simple valve-operated pipe. Connected to this is a suite of ABB technology including energy efficient motors powering pumps, an energy meter, high efficiency drives, and a series of liquid measurement meters. These measurement meters include a pressure gauge and a Coriolis mass flowmeter. The drives are also connected to ABB Ability condition monitoring for drives, a cloud based system that enables the possibility to monitor the units and all the relevant load indications like temperature, frequency, speed, and torque.

We begin the process by turning on the motor using a nearby touchscreen HMI panel. Water is pumped into the system and the meters measure their respective properties. The flowmeters provide data on the mass and volume of the flowing liquid. The system pressure is monitored, with a maximum threshold defined by us of 1.5 bar. The pressure data is transmitted to the drives and, as the pressure begins to exceed 1.5 bar, these drives automatically control the motors to decelerate the pumps.

Power

While ABB's Smart Lab doesn't have solar panels situated on top of it, it does have examples of the electrical equipment and components engineers

would need to make solar energy work for them to provide an on-site source of reliable power.

The network of equipment consists of a solar inverter, to convert the DC power from the installed photovoltaic (PV) panels into functional AC output. The lab includes a substation featuring a low voltage distribution board fitted with molded case circuit breakers (MCCBs) and a grid-feeding interface. This means that plants have the option of drawing energy from the mains network if the PV panels are not producing enough energy. Alternatively, it means that any surplus power generated can be fed back to the mains grid.

The Smart Lab also features an active ABB power quality filter (PQF) filter, which is used to regulate the sinusoidal waveform of the supply electricity and remove the frequencies associated with power quality problems such as harmonic distortion and electromagnetic interference. The PQF filters out the distorted electrical signals to reduce the losses in a network, which in turn increases the lifespan of components and devices, and equalizes the electrical load on the different phases.

In the Smart Lab, we also have technologies that showcase how making electrical equipment smarter can allow a plant's power to not only become more responsive to faults and problems,

but also how key indicators of electrical performance can be communicated wirelessly to other sites and remote managers.

The first of these is with a collection of electrical substations that are installed in the lab. In partnership with the University of Milan, ABB has developed an effective simulation that can recreate various faults in the cabling and specific substations so that we can demonstrate how our substation net-work will adapt to this.

Control and connectivity

Finally, we come to the most popular and widely discussed aspect of digitalization: connectivity. The Smart Lab allows us to see how managers can oversee this cross-communication effectively. The answer is with a control system, which for food and beverage businesses would likely be the 800xA distributed control system as it is best suited to the industry, which plant managers can use to monitor performance data across the plant in one central system.

That is the magic of ABB's Smart Lab. Not only can visitors see the technology in action, but they can tangibly see how it all connects together to drive food factory-spanning results — and that is the true power of digitalization.

Five minute foodie

In an exclusive interview with ABB, Sid Shaikh, engineering and product development manager at the world's biggest online food retailer Ocado, talks about his vision of the future food factory.



Food Quarter (FQ): What are the biggest problems with factories today?

Sid Shaikh (SS): Scale is probably the biggest challenge. Ocado receives 280,000 orders a week and we handle up to 15 million items a week. We've developed customer fulfillment centers (CFCs) where everything is monitored, from the inbound area where we receive stock all the way to the outbound area where goods are scheduled for delivery.

FQ: Can you explain how Ocado uses automation?

SS: While some of our competitors still manually pick items in store to fulfil online orders, we use dedicated fulfillment centers that use automation. Our latest facility houses thousands of storage bins, packed together in a grid design, covering an area equivalent to four football pitches stacked to the height of a two story house.

Thousands of robots travel on this grid, picking and placing products. This allows us to deliver online customer orders within a one hour slot.

FQ: How does automation help you to overcome problems?

SS: We need accuracy, repeatability and effective monitoring. Our high accuracy systems mean that, despite picking over 14m products a week, we have very low substitution rates.

FQ: How do you see AI playing a role in the future factory?

SS: We use artificial intelligence, learning algorithms and simulations to forecast changes. AI makes sense of historical data on ordering trends and seasonal demand. We mine this data to pick out customer preferences and buying behavior and order stock accordingly.

FQ: How will customers benefit from your approach?

SS: Lower pick times means that where it might have taken two hours to pick an order, it now takes less than five minutes. This shortens delivery times and means customers can change their orders much later in the process.

FQ: Walk me through what a factory of the future will look like?

SS: As you walk in you will see a fulfillment centre filled almost to the roof with products. As goods come in, they're automatically scheduled, unloaded and sequenced seamlessly. Human operators use forklifts to unload the trucks, assisted by robots that help by moving the heavier products. Goods will then be processed into a dense system of storage.

FQ: How will technology change to meet the needs of the future factory?

SS: The key components of the future factory build on and improve many of the technologies we already have today. These include motors, controllers, smart sensors, industrial control systems, power supplies and security systems.

Top 4 food manufacturing trends of 2019

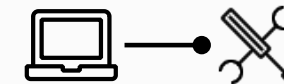
What technological trends will we see take over food and beverage manufacturing plants this year?

Condition monitoring

Helps determine the condition of machinery while in operation

Food and beverage plants can predict the lifecycle of machinery based on sensor readings

Plant managers can carry out maintenance work before breakage or unproductive downtime occurs



Green manufacturing

Creating products through economically-sound processes that minimise the negative environmental impacts

Manufacturers are moving away from the linear model of take-make-dispose and towards a more circular way of operating

This enhances the sustainability of operations, particularly in the food and beverage industry

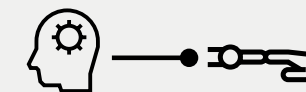


Human-machine collaboration

Most robots operate in cells and work separately from humans because of safety concerns

Collaborative robots use intelligent sensors that automatically stop the robot if it touches a human operator so they don't have to be in cells

Human-machine collaboration helps improve efficiency and allows humans to carry out more complex tasks



Virtual commissioning

Instead of using CAD drawings and developing products in an external environment, the process is modeled in 3D, which provides an accurate visualization of a factory layout

Plant engineers can see a digital representation of how the product will integrate and move as part of the line

They can resolve any potential technical issues before they become a reality reducing commissioning time by up to 25%





A plant of infinite possibilities.

Talk to us.

Are you constantly striving for increased efficiency? Working to integrate processes? Seeking to optimize every aspect of production? Our comprehensive portfolio and consultative approach runs from power to palletizing. So whether you need total traceability or simply higher efficiency, we have the answer. Discover the infinite possibilities at new.abb.com/food-beverage

