The new pig slaughterhouse for CP Group in China was built using the BIM model, which not only determines the design and construction phase, but also serves as an important tool for facility and lifecycle management.

The enterprise of the future

Fourth industrial revolution brings digitalization and sustainability into focus

The Covid-19 pandemic, climate protection measures, skills shortages, rising inflation and the raging African Swine Fever present companies with many new challenges.

By Christian Falkenstein, Shaarath Thondanure and Yael Friedberg

The food industry consists largely of small and medium-sized enterprises with production sites in rural areas, which in many regions ensure jobs are maintained and created. However, new solutions are also required to be successful in the future in an environment that includes a highly competitive food industry, rising costs and climate targets. Innovative digitalization solutions mean processes can be optimised, which in turn leads to cost savings.

Plus, there is the option of reducing food losses and handling raw materials, water and energy more efficiently. Climate change is another great challenge of our times; solutions and strategies must be found to enable food production that is climate-friendly, sustainable and economical at the same time. This also becomes increasingly important with changing legal requirements and constantly increasing CO_2 costs.

digitalization in the food industry

digitalization and the optimisations it brings offer diverse options to meet the challenges faced by food-producing companies and society in general. Production networking, automation and digitalization secure the industry's sustainability, and the smart factory model (smart and networked factories) can be a key factor for the future of food production. Implementing digitalization has to date differed greatly in the various industries.

The food industry introduces digitalization plans at a slower pace than other sectors, such as the automotive industry. The reason for this lies above all in the fact that the food industry is frequently still dominated by manual processes and the multitude of different products impedes the use of universal automation solutions. digitalization, however, increasingly shapes the way products are manufactured and the focus is more and more on the concept of the "smart factory". These smart factories are highly digitised and networked production sites that work almost entirely autonomously. Smart factories can be used to optimise the most diverse processes throughout the entire value creation chain and consequently increase efficiency and productivity.

Factory planning with modern tools

Important in the planning and implementation of a smart factory are the client's requirements and the target dates for the production programme, which this must define as precisely as possible in the run-up to any planning project. Many areas of a factory's planning and operation are now dominated by digitalization. The method for working with BIM (Building Information Modelling) is therefore constantly making inroads in the construction planning sector.

A great variety of planning software is used in most construction projects. BIM is a method for planning and managing construction projects with the aid of software. It is a new approach that raises the planning from the 2D area into the 3D area. This method processes the compiled three-dimensional models in a joint project, which can be monitored and worked on by all involved in the planning – architects, engineers, suppliers and further project participants. This produces a continuous exchange of constantly up-to-date information and planning statuses. The static planning model can then also be fed with live data from the production system and the entire building, and consequently used long-term for the building management as well.

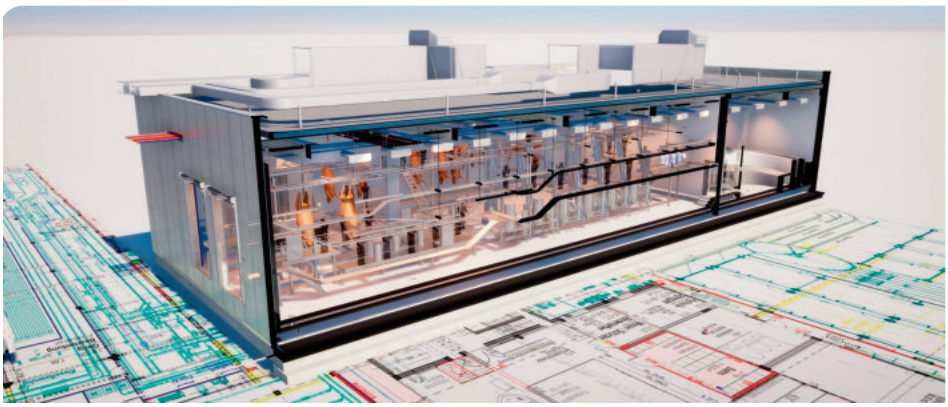
Working with BIM therefore promotes cooperation and enables:

- Smarter decisions in the planning and construction process
- Virtual tours in the 3D model
- Future operating costs simulation and forecasts
- Collision-free planning
- Compilation of cost forecasts and schedule sequences
- Support with certifications
- Basis for facility and lifecycle management (cradle to cradle)
- Comprehensive project documentation

Process optimization is based on the analysis of data from a production site's various processes and areas/departments. Data can be collected at every point of a process via software, sensors or image processing. Due to the high data volumes (big data), it must be decided which data will be specifically collected and analysed, in order to improve the processes with the relevant findings. Data planning is therefore the key to automation, digitalization and the future of predictive process planning.

Requirements for implementing a smart factory

The implementation of a smart factory requires IT systems that can network, manage and simplify processes. Various control systems are used within a company, and selected according to the intended use. Enterprise Resource Planning (ERP) systems usually form the cross-company basis here. The ERP system can also be de-



The meat processing companies and slaughterhouses of the future will have completely new digital capabilities at their disposal.

scribed as a "central nervous system" and is used for planning operational resources. This supports the needs-based planning and control of all business processes cross-departmental at company level. It connects the most diverse departments with one another – finance and accounting, HR, production planning and control, purchasing and logistics, for example. ERP systems enable complete, gap-free documentation and therefore simplify the traceability of products.

The full potential of a smart factory very much depends on successful communication, so its successful implementation requires an infrastructure that enables data transfer. The more automation and digitalization options are used, the more data usually has to be transferred, which is why the communication transmission should be well-developed, in order to handle the high data volumes required. The networks (mostly still broadband, but more and more 5G) must enable a high data transmission rate, should have short latency periods, and be both fail-safe and real-time capable. 5G can be used to wirelessly connect everything within a production site, and combined with cloud solutions and the right computer performance it helps provide real-time communication.

digitalization and networking in the smart factory can entail security risks, which require comprehensive IT security management, whereby the entire system and all its components must be protected. Cyberattacks can massively damage a company, and the number of attacks on food-processing companies is increasing. The introduction of new technologies, which often communicate via wireless networks and work with external cloud systems, also increases the scope for attacks on these companies, so evidently effective prevention and defence are required.

digitalization and automation, often combined with artificial intelligence (AI), are the basis for implementing a smart factory. Sensors form the foundation for data collection at the lowest operational level. They are the first step to achieve the smart factory's goal and can be used at the most diverse points in the process to collect data. A multitude of sensors are used in the food industry to collect real-time data and continuously maintain process lines, detect and remove possible bottlenecks early on, to thus prevent downtimes. Image processing is also an extremely useful tool for quality assurance and can also collect data throughout the entire value creation chain. Robots and other assistance systems, aptly-named "cobots" (collaborative robots, which assist people) are used in processes to relieve humans of difficult work steps or offer another form of assistance and consequently make the work easier and increase productivity. This ensures the operators of mechanical equipment must only exert minimum effort. In the future people will therefore take on more controlling and guiding functions and increasingly leave manual work to machines and robots.

Sustainability

Sustainability is one of the most important focus points of today's society. Legal requirements are increasingly stipulated to create a more environmentally friendly and more sustainable world, and ensure that governments, companies and individuals must commit to making more sustainable decisions. Numerous countries have committed here to becoming climate-neutral by 2050 – a colossal feat with colossal changes for all industries. digitalization and the Internet of Things in particular are tools to make food processing more sustainable. Climate goals can be achieved with the use of renewable energies, by optimising processes, flexible load management and the energy and resource savings potential this entails, as well as the development of newer, more sustainable products.

The factory building and production processes have a significant impact on resource requirements. First of all, during the construction itself, immense volumes of materials and resources are consumed, and buildings then also influence the amount of resources used and the energy requirements during operation. Buildings must therefore also be monitored for sustainability across and beyond their entire service life – from construction to operation right through to dismantling.

The goal of every planning project should be a climate-neutral factory, defined as a factory operated with renewable energy sources, which does not generate any climate-damaging emissions. Photovoltaic systems on factories' roofs and facades can, for example, deliver some of the energy required for production. Further energy requirements can be covered with biogas, pellets or geothermal power, among other options. Surplus energy can then be buffered or surplus heat can also be passed on to neighbouring factories via a local heat network.

Digital production processes will be connected, automated and flexible in the factory of the future. The Internet of Things, analytics and artificial intelligence will improve efficiency, downtimes and maintenance, and in the best-case scenario minimise the latter two. New relationships develop between people and machines. Productivity and quality are increased significantly. The smart factory is highly efficient and sustainable. The concept of the smart factory will also make increasingly greater advances in the food industry. The digitalization process is critical for companies to stay competitive, and in the years ahead the trend will intensify towards a more highly automated and networked production environment. The smart factory can thus be an effective way for many enterprises to achieve the goal of working more transparently, more sustainably and also more cost-effectively. A step-by-step move towards a smart factory is therefore the right way forward for most companies.

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