VERNE GLOBAL

WHITEPAPER

Manufacturing: The dawn of a new IT Age

By Alexander Deindl

Supernatural Powers

For the manufacturing industry, digital transformation is both a blessing and a curse: Developments such as Artificial Intelligence (AI), the Internet of Things (IoT) and Industry 4.0 allow for new business models and consistent focus on customer needs.

At the same time, tremendous data growth and new performance requirements drive up data center operations costs.

Manufacturing: The dawn of a new IT Age

We are living in the era of smart factories. Manufacturing companies are looking at digitalisation with IT trends such as Industry 4.0, the IoT and AI. People, machines, plants, even logistical processes and products communicate and cooperate with each other – new business models and market players come up. Criteria such as time-to-market, connected lean management and flexibility are key for a company's success in a globalised market. Everything is about build-to-order, configure-to-order and engineer-to-order, about providing your customers with highly-customised service – and about keeping your competitors at bay. Mass production becomes a doomed business model, custom production turns into a competitive factor.

However, it is also a time characterised by exploding data volumes, performance requirements and costs. The new IT era produces an abundance of structured and unstructured information: developments such as real-time and high performance computing, AI or the IoT result in hugely increased storage volume and computing power requirements. By now, aspects such as availability of electricity and cooling costs will have become business-critical. Yet, at the same time, IT budgets become cost-cutting casualties. And if that were not enough, an increasingly environmentally-conscious population puts additional transformation pressure on companies. It is the era of cloud.

Smart production systems

Digital transformation revolves around data. As the manufacturing industry integrates business and technical processes, data has a new importance: value chains become smart and increasingly comprise all stages of a product's lifecycle – from the initial idea and development all the way to production, use, maintenance and recycling. Customer requirements are anticipated and result in tailored solutions for individual needs. The automotive industry epitomises this development, where customisation with a virtually unlimited range of options which the customer can select for a vehicle has reached a new dimension. Digitalisation gives a whole new meaning to the old adage of 'the customer is king'.

However, developments do not only focus on the buyer. The producers themselves, suppliers, service providers and even partner companies also make a profit with the new opportunities that automation brings about.

Despite tailored manufacturing, production costs can be reduced, for example, by streamlining the entire value chain. Once all information for a manufacturing process is transparent, a manufacturer can promptly respond to the availability or shortage of raw material for specific production batches: in a fully-digitalised manufacturing environment, work pieces will find their fastest way through a production shop to the machine by themselves. Machines automatically re-tool themselves based on information from the work piece and may even order spare parts on their own. In the event that the system predicts a malfunction, the machine reconfigures the production process to avoid any downtime. Data that is only generated in downstream processes actively controls and influences current processes.

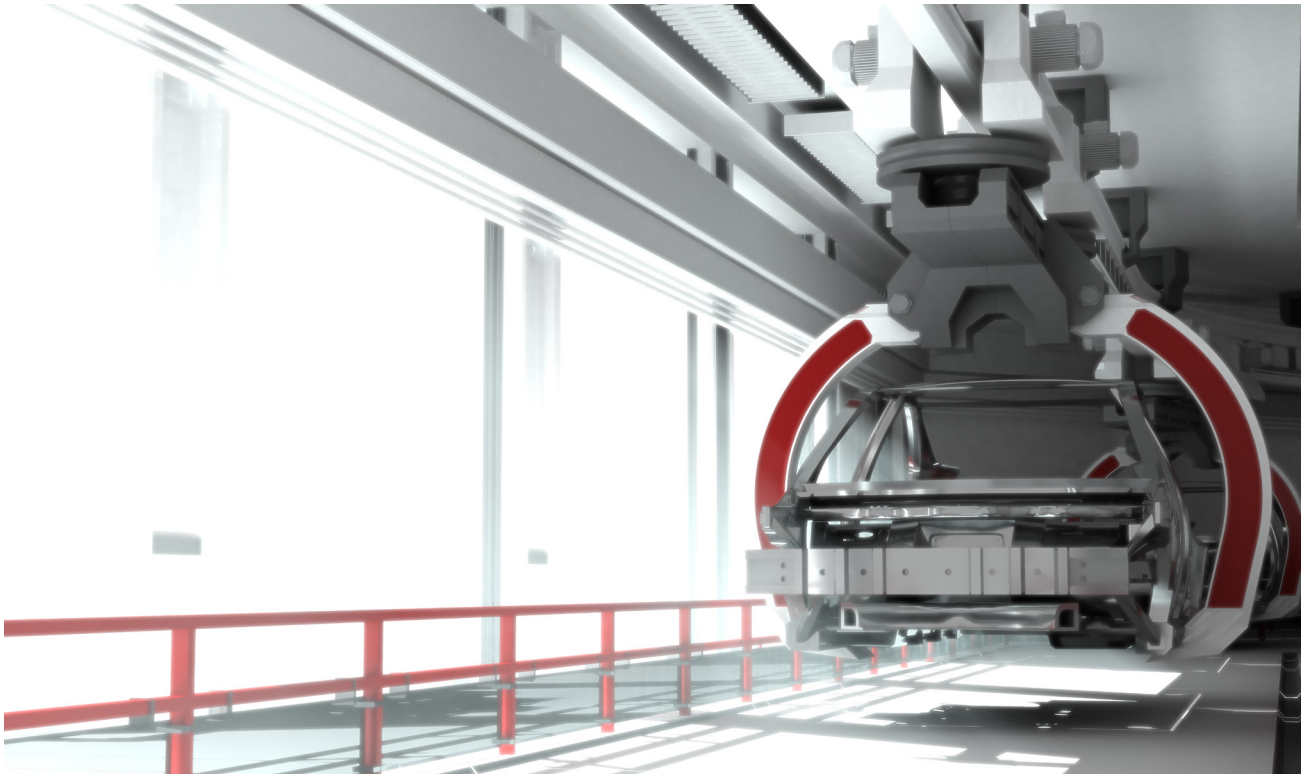
Changes for the organisation, processes and in-house IT

All of this is facilitated by interlinking, processing and analysing data from machines and by using this information. Equally important is the close coordination of components such as sensors (RFID), actuators and controller-managed sofware and hardware, so it is all working together. Billions of connected devices will lead to complex process flows that nobody would have imagined in the past.

In addition to modern network infrastructures, high-performance computers are also contributing to this digitalisation boom. They allow for real-time processing and simulations of highly complex computations as well as comprehensive analysis and reporting with data mining, smart metering or condition monitoring.

However, bright lights cast dark shadows: all of these developments have one thing in common – they require much more computing power and a new data storage strategy for the IT infrastructure in manufacturing plants. Depending on transmission frequency, our era of digitalisation is characterised by extremely large volumes of data generated by machines, development department and external data sources. After all, this ocean of Big Data also includes supporting the horizontal value chain, which also integrates systems from suppliers, dealers, service providers or customers.

In our globalised world, some estimated 80 percent of all activities of a company are already related to data and parties outside their own organisation today. This vast amount of information must be stored, processed and analysed in such a way that business processes can be positively influenced to generate real added value. The same applies to the frequently quoted buzzword in production: lot size one. As the complexity of product variants rises, so does the complexity in the spare parts business. To be able to operate efficiently even with small volumes, a smart factory needs autonomous, self-configuring and spread-out production resources, including planning and control systems. The necessary optimisation through machine and plant monitoring will ultimately result in even further data growth.



Digital transformation: The way forward with AI, IoT and Industry 4.0

The new opportunities with smart production systems and automation concepts – this applies equally for human-to-human, machine-to-machine and human-to-machine communication – do, however, pose a tough challenge regarding the cost/benefit calculations for IT in production and manufacturing companies. Mapping the processes with data from your own development department, machines and various market players, frequently requires a change in paradigm with regard to planning and implementing IT infrastructures.

Conventional data center infrastructures in the manufacturing environment with ERP (Enterprise Resource Planning), PLM (Product Lifecycle Management), PIM (Product Information Management) or MES (Manufacturing Execution System) systems from the good old client-server days are hardly able to cope with such spread-out data processing strategies.

In-house data centers often lack the necessary computing power for high-performance computing or real-time processing, and certainly lack the ability to manage and analyse device data across systems to be able to trigger responses in market player systems.

The technological shortfall in companies' in-house IT environment is even more severe when it comes to data growth. Many on-premise infrastructures are already stretched to their very limit in terms of storage requirements today. However, with IT-driven innovations such as IoT, Industry 4.0 or AI, the real data explosion has not even happened yet.

The cloud – key technology for digital transformation

Figures and facts indicate why cloud data centers and colocation facilities will increasingly become the IT/technical focal point for data storage and processing in the manufacturing segment. In addition to engineering data, 2D and 3D drawings, circuit diagrams and simulations, such data also include budget and capacity plans. The path to cloud-based digitalisation along the value chain also comprises the design, development, engineering, simulation and model prototype building as well as verification, measuring and test results all the way to the start of serial production and after-sales. An important component for working in the cloud, however, is that all market players are connected to be able to map the processes across the value chain on a uniform data basis. Logistics, production, service and development will then work together on a centralised platform in real time pursuant to Industry 4.0.

Nevertheless, the cloud can also be used for quality assurance today. The goal is to achieve further quality improvements in technical processes with a high error rate and a high level of sensor monitoring by using Industry 4.0 technologies. In practice, this applies for, e.g. thermoforming in a press or automated processes in a foundry, where mechanical parts are checked for quality using imaging methods such as infra-red scanning.

In general, however, when it comes to cloud technologies, you need to determine which functionalities should remain at the machine itself, which should go into the cloud and which should be assigned to the operational and technical systems. Noncritical machinery functions and analyses can be perfectly mapped in the cloud. ERP system functionalities are also typically suitable for outsourcing. Often, the introduction of auto-ID methods such as RFID is typically assigned to the cloud. Work pieces, load carriers and vehicles can be clearly identified; throughput time can be reduced by optimising the material flow.

It is also important to reduce throughput times in development and in the engineer-to-order process (time to market), where the cloud is suitable for introducing test simulations of production plants, for reducing the physical test stages of a product and for bringing the product onto the market faster. Other functions such as locking mechanisms in manufacturing that must be performed within milliseconds are usually handled by in-house data centers, the reason being that even the fastest data connections are subject to a certain degree of latency.

Cost factors

However, not all clouds and colocation services are the same. In typical pros and cons discussions, one aspect is often neglected: selecting the perfect location to keep the costs for power and cooling under control. As a result, in times of high power rates and highest cooling requirements, the climate-related conditions for running a data center are a crucial factor when deciding on a location.

This is one of the main reasons why in recent years parallel to the cloud boom, locations up in the far north have established themselves as ideal data center sites. There, the outside temperatures are naturally lower than in, for example, Central Europe. As a consequence, the effort and expense for cooling high-performance IT components are much lower; the costs for producers and their suppliers, partners and customers drop dramatically – not least because electricity costs are significantly lower.

At the same time, computing from the Nordics guarantees a lower carbon footprint as energy is typically generated from renewable resources such as geothermal and hydropower – good arguments for companies to promote themselves and their products as green.

Human factors

A topic that ofen comes up in connection with digitalisation in the workplace of the future, together with the question: where does automation make sense and where not?

To date, it has turned out that automation for many production types cannot be achieved without the extensive involvement of operators. If tasks such as controlling standardised routine in automation scenarios for example are transferred to CPS controls, then complex and experience-based decisions will remain with humans in the future and those people will consult real-time-enabled CPS assistants. Even implementing a typically hybrid architecture of on- and off-premise technologies in manufacturing operations requires know-how from IT.

Developers, IT specialists, automation engineers and other experts must work together and build up the necessary knowledge. However, it is also an undisputed fact that the role of humans will change profoundly as digitalisation proceeds. While their importance as a production factor will decrease, their controlling function with decision-making power will rise, with the exception of certain sections within the production that are hard to automate or order-specific.

Here, humans will remain indispensable.

Outlook

Digitalisation changes the game in the manufacturing industry. New business models come up, the connection of machines, people and external market players provides opportunities for the entire value chain. At the same time, however, this development is associated with huge data growth and high costs for computing power, storage capacity, electricity and cooling in data centers.

IT officers in the manufacturing business need to reduce the infrastructure cost without neglecting climate protection. Migrating to the private cloud and to high-performance colocation data centers is a perfect solution for combining sophisticated IT processing with low costs for electricity and cooling, while also being prepared for future technological requirements.

In the centre of all this is the human operator, whose work is shifing from routine tasks towards decision-making to generate added value.

Meet the author

Alexander Deindl is a trained IT journalist, author and editor in Munich. Having worked in a permanent position as editor for ten years, he has been a freelance writer and owner of Redaktionsbüro Deindl since the year 2000. His editorial focus includes IT topics from the B2B and B2C segment.

About Verne Global

Verne Global delivers data center solutions for high intensity computing, engineered for optimal high performance compute and built upon 100% renewable energy. Our clean grid and stable climate cuts costs and energy usage, and our expert team provides on-site, around-the-clock support to maximise performance and flexibility for customer workloads. Founded in 2012, our Icelandic data center campus powers some of the world's most innovative and demanding industries, including manufacturing, financial services, earth sciences, life sciences, engineering, scientific research and AI.

Make an impact from the ground up.

info@verneglobal.com | verneglobal.com