The Potential of Digitalization in Logistics and Production

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Digital technologies are omnipresent: at work, at home, and on the go in purses and pants pockets.
Industry 4.0 or Digitalization

Industry 4.0 – for companies there’s just no escaping it. Some have tried going on the offensive, others have tried watching and waiting, and yet others have even tried rejection, but no one can ignore it.

The term “Industry 4.0” refers to the networking of people, systems, and objects in real time within self-organized and optimized value chains. With “Industry 4.0” having lost its luster, the term “digitalization” is increasingly replacing it. Digitalization describes the transformation of analog processes to digital ones. Digital technologies are omnipresent: at work, at home, and on the go in purses and pants pockets. There’s more to digitalization that just digitalized photos or DVDs replacing VHS, though. The following pages offer insight into the world of opportunities opened up by the use of digital technologies in logistics and production.
A scenario in the near future

An end customer uses virtual reality to shape their product with laser scanners, VR glasses, and data gloves. They agree on the quantity, delivery conditions, and price in spoken dialog. This automatically establishes an order for the supplier, triggering a materials purchase order and a plan for resource use. By the time an employee starts assembling the customer’s product, all pre-production processes have been completed and logistics has provided material, tools, and information just in time. A self-driving transport system (SDTS) has specifically selected this assembly station, because the equipment and qualifications of the employees at this one are the best fit for the order and the previous project was completed on time. The SDTS, assembly station, and assembly modules being installed collaborate as a cyber physical system (CPS) to make these decisions.

Digital positioning aids assist employees with assembly and a robot turns heavy parts to ensure they are in the most ergonomically correct position. Following assembly and automated quality control, the SDTS conveys the finished product directly to the packaging station and then the automatic loading station. The end client is kept apprised of the order status and has confirmed the desired delivery address one last time. Planning experts still have the final say in decisions, but only interfere with the process as needed.

This story could be further embellished and details added. Digitalization technologies will soon support the entire order fulfillment chain. But what technologies are already available today?
Technologies for the digital future

Digitalization technologies can be organized into various company departments (see Figure on next page).

In addition to bar codes, QR codes are becoming increasingly popular in warehouses, since they make it possible to identify items without contact. RFID chips are also capable of recognizing items even without manual interference. Intelligent camera systems can identify specific (surface) characteristics in order to recognize items, making additional marking unnecessary.

Smart glasses and smart watches guide employees as they complete storage and picking tasks, help prevent errors, and ensure the accuracy of data by logging changes immediately. Smartphone apps or tablet PCs assist with these processes by initiating and confirming orders.

Intelligent load carriers that are constantly monitoring their inventory and independently reordering products as needed open up a world of opportunities.

For transport within the company, autonomous forklifts facilitate automatic unloading of product deliveries. SDTS transport products within the warehouse and supply the production line. They can navigate inductively, optically, or using a laser. Drones offer major advantages, since they can use three-dimensional space to convey transports without wasting production space. Their use in factories remains seriously limited, however, due to safety concerns.

Before the digital shadow can be used consistently, the product must first be thoroughly identified throughout. As early as pre-production and during other intermediary levels in the process, it must be possible to store data directly on the workpiece or at least clearly identify the piece, which is something that often fails due to the rough conditions in the workshop or the size of the workpiece. Here the boundaries are constantly being tested with technical advancements, such as image recognition and miniaturization.

Taking advantage of the extensive technical opportunities offered by digitalization yields a wealth of data (big data) so comprehensive that it would be nearly impossible for a company to store and evaluate all of it themselves. External services (cloud computing) are increasingly taking on this challenge themselves, while at the same time offering top-notch data security.

After all, having the best technologies doesn’t mean a thing if they are weighed down by ineffective processes. Processes should therefore be organized first and then digitalized.
Technologies Overview and Examples

**Warehouse**
- RFID, barcode, QR, image recognition
- pick-by-/put-to-light/vision/audio
- smart glasses, smart watches,
- augmented reality
- smartphone apps, tablets
- intelligent carriers

**Transport**
- automatic unloading
- driverless transport systems (AGVs)
- drones
- self-controlling units (CPS)

**Planning and control**
- higher planning quality through more up-to-date data
- less planning and rescheduling work, higher adherence to schedules
- electronic shop floor board

**Digital Shadow**
up-to-date information about:
- order status
- product status
- manufacturing system
- availability of materials
- transportation system
Getting processes organized? That means to go lean. Truly, in the age of digitalization, lean manufacturing is more relevant than ever before. Lean manufacturing offers plenty of potential for savings by reducing waste, shortening cycle times, and enhancing productivity. And all that without digitalization. Consistent implementation of lean manufacturing practices is also an outstanding prerequisite to digitalization. Lean manufacturing stabilizes and simplifies processes. Simple, stable processes form the foundation for reliable software applications. Furthermore, using new technologies can bring about change in current processes. One example is the way in which intelligent load carriers simplify the fulfillment of material requirements.

Once processes have been improved, there is even greater potential to leverage lean manufacturing using digital technologies. Lean manufacturing sets the standards and digitalization enables the early detection of deviations. Quick access to current data reduces waiting times. Flexible SDTS facilitate smaller inventory levels, since the transport times that need to be bridged are much shorter. Drones can move through three-dimensional space and don’t waste transport surfaces. By communicating amongst themselves and with tooling machines, transport vehicles work together to optimize capacity. Lower raw material inventories are needed for 3D printing technologies and less scrap material is wasted during production. Advanced sensor technology can preemptively detect any quality issues and permanently resolve them with intelligent data analysis.

Digital technologies are even capable of minimizing the newly recognized eighth type of waste - “unused employee potential”. Digitalization takes care of routine tasks usually done by employees, while also making processes more transparent. This gives employees more freedom to use their capacity and creativity for process improvements.

So it is clear that lean manufacturing (process optimization) and digitalization (suitable technologies) belong together methodologically. But which approach and which technology is right for the specific company? A potential analysis to determine the current status and identify potential for improvement can help with this.

Lean is a prerequisite to successful digitalization.
Industry 4.0 solutions help to further reduce waste identified by lean

**Inventory**
- up-to-date information
- shorter transport times
- 3D Printing

**Floor space**
- drones
- automatic identification

**Transport**
- automatic transports
- decentralized optimization (CPS)

**Mobility**
- smartphone
- tablets
- self-propelled workplaces

**Quality deficiencies**
- preventive quality control
- Data for continuous improvement

**Overproduction**
- current workload data
- short delivery times, short-term customer’s wishes

**Waiting time**
- current order information and availability
- prompt transports
The first step on your unique path to digitalization

Careful preparation is essential to the efficient execution of a potential analysis (see figure on the right). The main tool used is a questionnaire tailored specifically to the company, production system, logistics system, corporate area, and focal points. Later on, the questionnaire will serve as a guide for expert interviews.

Processes must be observed and experts interviewed in order to analyze the current status on-site. Material flow, production steps, and information flow processes are the main points of interest. Logistics and production technology as well as IT support are also recorded.

The information collected on-site and the data collected beforehand are then evaluated in order to identify potential for improvement. Lean manufacturing methodology is first applied while considering process-related improvement potential. It is only in the second step that the methods and technologies of digitalization are applied in order to further maximize potential. It must be possible to implement fundamental process-related improvements before this is considered.

Each process step is compared against the toolbox of digital technologies. This creates a framework that can be used to customize generally available solutions to meet the company’s special requirements. First, the technologies that are completely impractical for the processes being considered are eliminated. The remaining technologies are sorted in the interest of determining which ones are best implemented to achieve the long-term vision and which ones might be useful in the short-term or mid-term. Selected technologies are combined for both time frames to create an integrated application concept for each one. The potential of RFID, for example, is best realized when it is used starting at product receipt (inventory) and through to production (work plan) and delivery (shipping location).

It has proven practical to describe two concepts. A vision for the future serves as a goal that can be compared with the current state of affairs from time to time. It should be possible to implement the second concept as a basic scenario in a timely manner, but it should also constitute a first step toward realizing the vision for the future.

The approaches for improving processes and implementing digitalization laid out in the basic scenario are evaluated and prioritized based on the work required and usefulness. This yields recommendations for actions to be taken in the form of measures and projects. The final result is an implementation plan showing the necessary work, usefulness, and sequencing so that decision-makers within the company can guide implementation.
Four phases of a potential analysis

1. Preparation
   - company information
   - contact persons
   - data needs
   - agenda
   - questionnaire

2. Current status analysis
   - analyzing trouble-ridden areas
   - processes
   - technology
   - throughput time
   - floor space efficiency
   - organisation
   - productivity

3. Potential for improvement
   - qualitative criteria
   - quantitative criteria
   - evaluating benchmarks & alternatives

4. Recommendations for action
   - measures
   - effort vs. benefit
   - implementation plan
   - effort vs. time
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Miebach Group

Founded in 1973 by Dr.-Ing. Joachim Miebach in Frankfurt, Miebach Group offers international supply chain consulting as well as logistics and production engineering to large and medium-sized companies.

Experience of more than 40 years in countless projects led to the methodical approach of Supply Chain Engineering, designing network structures, processes and intralogistics of supply chain. Strategy and technology are equally taken into consideration because only the integration of both elements will render an optimal result.

We offer our services as consulting partner in 24 offices across the world. Miebach has 350 employees and ranges among the internationally leading consultants for logistics and supply chain design. Due to our presence in the key regions Europe, Asia, South and North America we can support our global customers effectively with our local background knowledge.

Expert Know-how

For more than four decades we have been developing innovative logistics solutions with the expertise required for efficient and functional supply chains:

Miebach Consulting’s strength is the integration of this expertise to offer holistic solutions which exceed the expectations of our customers. We design strategies, develop commercially viable concepts and specify IT solutions as well as technical installations down to the last detail. We assume responsibility and implement the developed solutions. Furthermore, we support our customers from the commissioning phase to the fine-tuning during live operation. We believe that the extra service helps to achieve our customers’ vision in the best possible way. Our permanent R&D initiatives often result in pioneering innovations.

Industry Specialization

Miebach Consulting offers consulting services covering a wide industry range. We think that industry specialization is essential to exactly understand the specific requirements and processes of our customers. But we also believe that the exchange of expertise between industries is the ideal way to develop innovative and best-in-class solutions for our customers.

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- 24 offices worldwide
- 350 employees
We will be gladly available to discuss this topic with you in person and more.

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