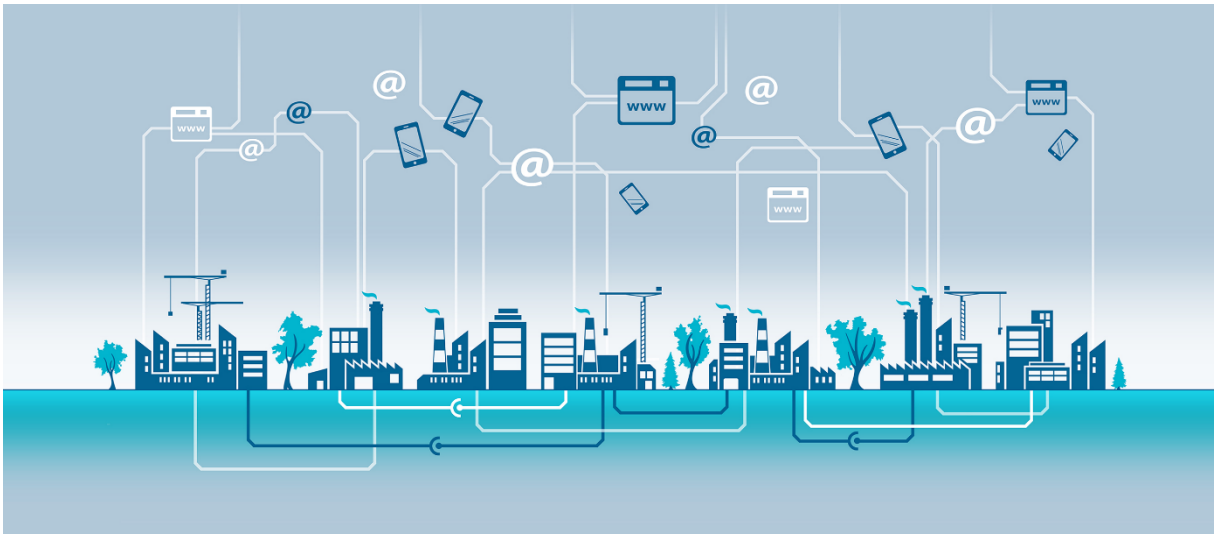
European Union
European Regional
Development Fund

Future Ecom
Interreg Europe

Project Future Ecom:

State of the Art Report

Smart Production



Thorsten Brinkman, GILDE

GILDE

1) Introduction on Smart Production

Smart Production is a technological concept that uses machines connected via the Internet to monitor the production process. The goal of Smart Production is to advance the automation of manufacturing processes and use data analysis to improve production performance.

Smart Production is a specific application of the Industrial Internet of Things (IoT or Industry 4.0) and turns IoT into reality. The implementation of Smart Production involves the integration of sensors into manufacturing machines to collect data on their operational status and performance.

Ideally, the networking of embedded production systems and dynamic business and engineering processes takes place in a networked factory (Smart Factory). It enables the profitable manufacture of products even for individual customer requirements up to lot size 1. In this context, this is also referred to as mass customization (customer-specific mass production).

At universities and research institutes, work is being done on the Smart Factory within the framework of so-called model factories. The most important components and tools in a Smart Factory are: Cyber-physical systems (CPS - Cyber Physical Systems), modern and efficient information and communication technology, big data technologies, embedded systems for controlling and monitoring the Smart Factory and the production process, services of Cloud Computing, flexible and intelligent logistics systems and wireless communication technologies such as Bluetooth or RFID (Radio Frequency Identification).

The cyber-physical systems are responsible for the mediation between real and virtual components. They form the interface between the hardware and the intelligence in the Smart Factory and are exposed to high physical demands. The systems are equipped with sensor, processor and radio technology for data exchange. Due to the huge amount of data that is generated in a Smart Factory over the entire manufacturing process, technologies

from the Big Data environment have to be implemented. Large amounts of data, often in unstructured form, have to be stored and processed. Short access times and high-performance data processing are the basis for the Smart Factory concept.

2) Summary

Digitalization is associated with the 4th industrial revolution. National and global developments are influenced by this. Production processes, trade and services are facing massive changes in the near future. This creates opportunities and risks for companies.

Not only, but especially for smaller companies, the question arises how they can recognize technological and social changes through digitization and the associated changes in their business models at an early stage and react to them in good time.

The SmartFactoryOWL provides companies in East Westphalia-Lippe with an industry 4.0 testing-environment with which they can experimentally and practically initiate the switch to Smart Production.

3) Current situation

Companies are called upon to increasingly engage in the digital upgrade of their production lines. According to a study by McKinsey, networked production in Germany alone promises growth of 207 billion euros by 2025. But many decision-makers are still acting cautiously. This is confirmed by another study by Deloitte. The reason? There is no concrete idea of the results and goals of networked production. Many companies are not in a position to easily transfer the complex principles of industry 4.0 to their operations.

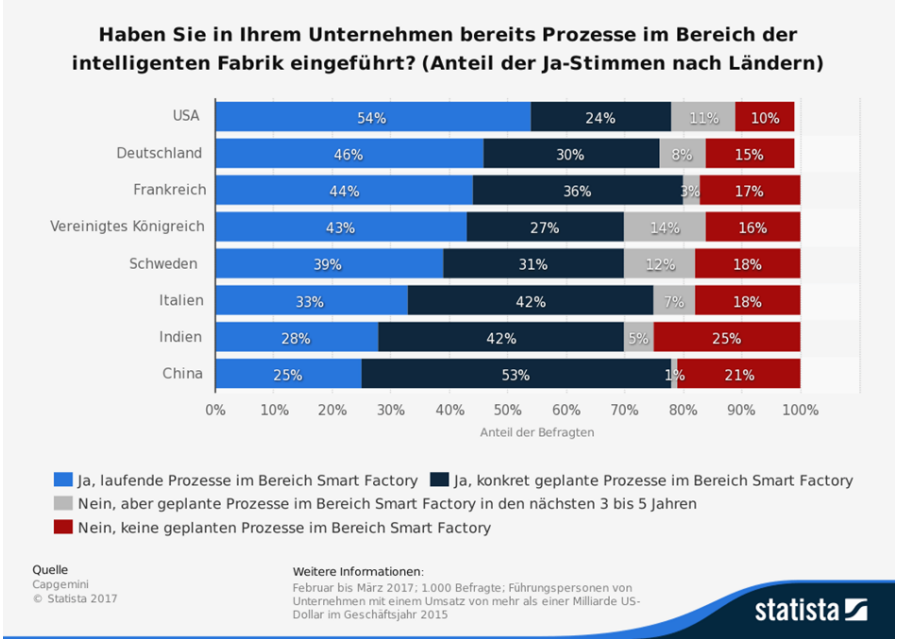
According to McKinsey, states that are the first to successfully integrate Internet technologies into production have the very best growth prospects. According to McKinsey, Germany is in a promising starting position in perfecting the Internet of Things. If the economy were able to set standards in this field and develop high-revenue business models,

this could increase Germany's gross domestic product (GDP) in 2025 by 207 billion euros or almost five percent. At the same time, many new jobs would be created. Conversely, however, this also means that if the changeover fails, just as much economic output will be lost in extreme cases - with all the negative consequences for employment.

According to Deloitte, the opinion of the decision-makers about the possibilities of Smart Production is as far apart as the actual degree of implementation in the companies. For some, it is merely a synonym for more or less new technologies whose benefits have yet to be proven. Others see it as a holistic "Smart Factory" that already creates concrete added value and is integrated across the entire value chain.

A more detailed analysis, however, reveals how unclear the wealth of ideas and concepts and their understanding are in many companies. In many places, the ideally networked and „intelligent factory“ seems to be more theory than reality - and it is usually completely unclear what quantifiable added value the individual technologies generate. This in turn makes a well-founded investment decision difficult - or even impossible.

In an international comparison, there are clear differences in the development of Smart Production and Smart Factory. According to Capgemini, the USA plays a leading role here. In Europe, Germany, France and Great Britain occupy a strong position. China has a backlog demand to register. However, more than 50% of the companies surveyed there are currently planning concrete projects in the Smart Factory sector.



A Huawei study compares the industry 4.0 capabilities of China, Germany, Japan and the USA. This provides a differentiated picture of the current situation. Each of the four countries has strengths and weaknesses that need to be exploited or remedied.

In Germany, the importance of the Internet of Things for the economy has been recognized and is concentrated under the keyword Industry 4.0 on the manufacturing industry. The German Industry 4.0 Initiative is supported equally by politics and the private sector and is bundled under the umbrella of the Industry 4.0 Platform. The concentration on manufacturing reflects the importance of this sector for the German economy. The manufacturing industry in Germany generates an above-average share of gross value added for a developed country and is of great importance for the German labour market.

In the development of industry 4.0, far-reaching changes in the world of work are to be expected. Entire job profiles will disappear or change fundamentally, especially low- and medium-skilled workers will find it more difficult to find jobs. Against this background, a well-educated population and an efficient education system are important prerequisites for mastering the challenges facing industry.

4) Current Approach

Challenges

As a general rule, many manufacturing companies are afraid of losing security and of spending too much time and money. This results in high costs for the implementation of sensors on a broad basis. The uncertainty of companies is further exacerbated by the complexity of developing predictive models.

Another, possibly biggest challenge is the processing of large amounts of data - Big Data. This poses a great challenge for IT systems. Nevertheless, experts are certain that data masses of the size required for Smart Production can be processed without any problems within a few years. However, it is important that all machines speak one "language", i.e. you should choose one or a few types of communication when developing such systems.

However, the lack of standards and interoperability is the biggest obstacle to the widespread use of smart production. Technical standards for sensor data have not yet become so widespread, preventing different types of machines from exchanging data and communicating effectively with each other.

In the United States, the National Institute of Standards and Technology (NIST) is trying to develop and promote standards. In Germany, the Digital Association Bitkom, the German Engineering Federation and the German Electrical and Electronic Manufacturers' Association want to draft standards. However, there is no end in sight to the standardization process.

In summary, Deloitte sees the greatest risks of Smart Production in the following aspects:

- Securing IT security for smart industrial applications

- Technology standards not yet established

- Lack of know-how

- Fear of setting the wrong priorities and/or being unable to produce competitively in the long term due to lack of knowledge and missing business cases

Opportunities

The Smart Factory offers a number of advantages over traditional production processes and manufacturing facilities. According to Deloitte, the biggest opportunities for Smart Production are through supporting sustainable business growth, by more efficient process design, by more ergonomic workplaces and environments, an early quality assurance using Smart Analytics applications and ensuring the long-term satisfaction of interface partners and customers.These benefits include in detail:

- Lean and optimized processes

- lower production costs

- shorter production times

- Production of individual products at mass product prices

- Increase in productivity

- lower warehousing costs

- transparent supply chain

- automated, efficient ordering processes

- Lower personnel expenses in production

- Greater flexibility in production

- Shorter time-to-market for new products

- Fast implementation of innovations

- Fast adaptation to new or changed product requirements

- Consumption-controlled production supply

- increased delivery reliability

- agile reaction of the production process to fluctuations in market demand

Regional Support

Many companies do not know how they can shape the first steps towards digitisation and where the greatest potential lies. The SmartFactoryOWL determines these potentials and supports companies in their entry into the digital age.

The SmartFactoryOWL is a joint research and demonstration factory of Fraunhofer IOSB-INA and the Technical University OWL. It is an industry 4.0 demonstration center and an official test field of the international Industrial Internet Consortium (IIC). SmartFactoryOWL is also an accredited test environment and a member of the Labs Network 4.0 of the Industry 4.0 platform. SmartFactoryOWL also belongs to the "EU listed Key Enabling Technologies Centre".

Through guided tours and qualification offers in the SmartFactoryOWL, company representatives are introduced to the technologies of networked digitization and shown how future business models can emerge from it: From product development to production and networking. The future of production and work is already visible today in the SmartFactoryOWL. The services of the SmartFactoryOWL offer a broad spectrum around the topic industry 4.0 and everything that is relevant for companies, their employees and their (future) customers.

The SmartFactoryOWL is a certified industry 4.0 test environment. In this industrial environment prototypes can be developed and tested for use in production environments. This allows especially small and medium-sized companies to be supported intensively, e.g. in projects lasting one to several weeks for the development of new products. This ensures an optimal market launch.

5) Best Practice

Two good examples on Smart Production/Smart Factory are presented in the appendix. One is „Smart-Innovation-Campus“ and the other is „training programme for transfer mediators“,

which trains key multipliers on their own digitisation skills to help their target groups, particularly small and medium-sized enterprises and to develop Smart Production.