

# THE 4<sup>TH</sup> INDUSTRIAL REVOLUTION

## HOW SMART MANUFACTURING WILL BRING ABOUT THE 4<sup>TH</sup> INDUSTRIAL REVOLUTION



A radical business transformation, driven by disruptive technological developments, is expected in the near future. This transformation has been named the “fourth industrial revolution” or “industry 4.0”. At the heart of industry 4.0 are smart factories based on the “internet of things”. They will make it possible to control the value chain in real-time, in a highly automated way.

A high number of trends is being discussed in industry and media and many leaders experience a need for fast-paced change. For example in retail, the pressure of keeping up with the changing demands and multi-channel fulfillment is enormous and a matter of “life and death”. The landscape

of players has changed dramatically in recent years. The multitude of trends, that companies are supposed to work with, can be confusing without a clear vision and strategy that binds everything together.

The industry 4.0 vision unites many trends and technological developments in a common context.

*At the heart of the industry 4.0 vision are highly flexible and productive smart factories.*

Smart factories are expected to profitably manufacture even smallest batch sizes in high wage countries (which partly addresses sustainability issues). In industry 4.0, business processes are designed, engineered, and changed dynamically in an upgradeable infrastructure. Flexible and automated value chains also support a healthy work life balance and the integration of older workers.

Smart factories are production systems that include the use of smart and networked machines, warehousing systems, and production facilities. These flexibly configurable systems will be integrated through the use of information and communication technology. Control processes based on big data analytics will enable highly-automated, adaptive value chains that react in real-time. Analytical results will be applied to everything from planning and production improvement to product development.

Products, business models, and value chains will need to adapt to the changing requirements. The powerful vision of industry 4.0 can lead the way for this transformation.

*Our increasingly intelligently networked world changes customer requirements and in consequence also products, business models, and value chains.*

In this intelligently networked world, an increasing number of products are characterized as “smart”. These products deliver additional value through the use of networked sensors, actuators, and analytics. For example, home automation with smart plugs, cameras, etc. is easily installable even by consumers. Apps tell us about our health and can together with wearables monitor our well-being, while collecting data that we can share with our doctors. In short: almost everyone is using smart products on a daily basis for different purposes.

As a consequence, customer requirements change. Smart and sensitive consumers demand customized products, easily accessible information and purchasing via multiple channels, as well as short delivery times. In addition, sustainability of the product, its manufacturing, and its distribution is expected. However, all of this should not lead to significantly increased prices.

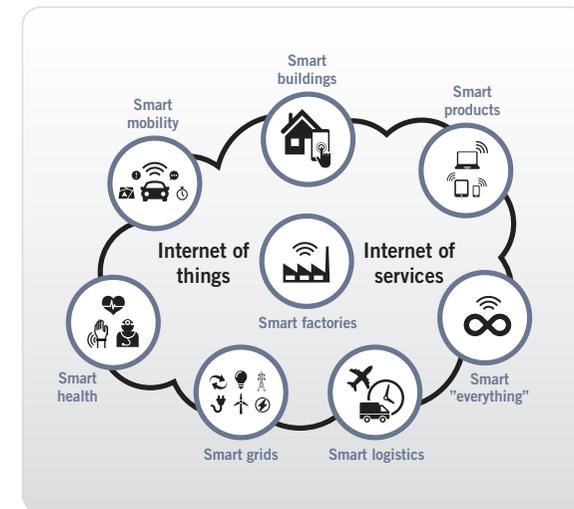


Figure 1. Intelligently networked world



# INDUSTRY 4.0

## THE KEY ASPECTS OF IMPLEMENTING AN INDUSTRY 4.0 STRATEGY & SOLUTION

Four key strategic elements must be addressed when implementing an industry 4.0 strategy:

- 1 Vertical integration of systems and business
- 2 Horizontal integration of in-company and inter-company value chains
- 3 Integrated engineering of the product and the associated manufacturing system over the whole lifecycle
- 4 Transformation to smart product and service offerings

**1 Vertical integration** is meant to connect the business from sensor and actuators on the shop floor up to the ERP systems and the KPI on management level – in real-time. In the other direction, control actions such as plan changes will affect the system down to the shop floor. Autonomous parts of the total system will be able to automatically adapt to changes.

Manufacturing Execution Systems (MES) will be central in bridging the communication gap between shop floor and management level.

**2 Horizontal integration** refers to the digitally supported connection of supply chain processes from supplier to customer. The horizontal integration will stretch beyond company boundaries, connecting suppliers and customers

through digitized value creation networks. Industry 4.0 is likely to generate new business models, in which production capabilities are not rigidly distributed in the value chain. Instead, the supply chain will consist of collaboration networks that utilize manufacturing capabilities flexibly among partners. Tasks will be distributed according to factors such as capability, capacity and proximity to the customer.

All information from shipping, manufacturing, and usage will be stored in the cloud, enabling full traceability. Real-time control will make it possible to steer customer-specific adaptations through the value chain in minimal time.

Sales & Operations Planning (S&OP) processes will play a key role in realizing the horizontal integration, as the increased demands on flexibility and mass customization require reliable and accurate forecasts. Big data analytics are a powerful enabler for this.

**3 Integrated engineering** of the product and the manufacturing system is a necessity. The product must be designed to be produced in the smart production system. It must also have the smart functions that the customer requires and that are needed to deliver advanced services based on data collection and analysis.

Feedback, in the form of data coming directly from the product in use or the manufacturing and distribution system, will be used to improve both the product design and the manufacturing processes.

**4 Transformation of product and service offerings** is a natural part of an industry 4.0 initiative. Transforming the value chain through integration, as described for the previous three key features, will improve efficiency, while the development of new smart products and services will foster business growth.

By utilizing sensors and connectivity in products, it is possible to improve performance and enhance customer value. By feeding back data from product usage, it is possible to offer tailored new services, especially in the aftermarket.

In addition, data gathered from the product in use can be analyzed and sold as a product in itself. One example is health statistics generated from smart devices and apps that can be sold to healthcare players.

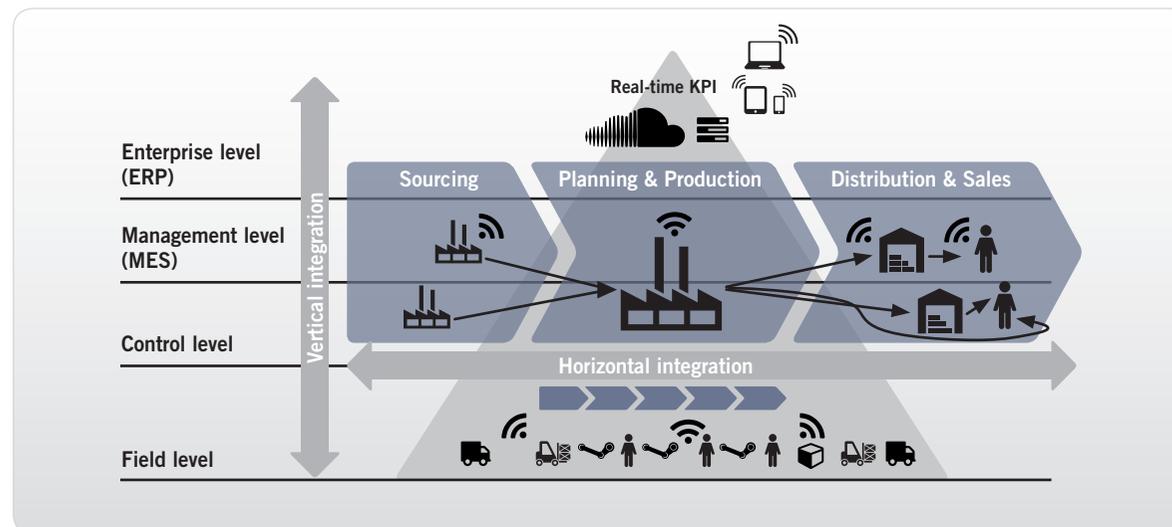


Figure 2. Horizontally & vertically integrated smart factory



# DIGITIZATION STRATEGY

**AMBITION LEVELS MIGHT DIFFER, BUT EVERY COMPANY NEEDS A DIGITIZATION AND INDUSTRY 4.0 STRATEGY**

Studies anticipate productivity (i.e. efficiency) gains through industry 4.0 in the range of ~20% or more. Revenue growth of ~10-15% over 5 years is expected. 80% of German companies plan to have both digitally integrated their value chain and transformed their offer by 2020. Whatever your expectations are – now is the time to assess your position and define your strategy.

A first step on the digitization journey is to assess where you stand in terms of a digitized, horizontally and vertically integrated value chain and integrated engineering across the



lifecycle. The assessment should also cover the integration of “smart digitization” in products and the service portfolio.

The second step is to understand the potential for increased digitization in your business both through changes in the product and service portfolio and transformations in the value chain.

As a third step, the perceived gap should direct which digitization activities to prioritize in an industry 4.0 strategy and roadmap.

There is a strong belief among industrial experts that industry 4.0 will have a disruptive effect within a foreseeable future and that the landscape of players will change. The question is how to position oneself.

Manufacturing companies are expected to initially dominate the industry 4.0 market. But they will eventually come under pressure from information and communication technology giants that will push into their territory. As an example, Google is investing in self-driving cars, advanced robotics companies and biotech.

There are two basic strategic options. One is to embrace the digital transformation and to try to capture opportunities as a first mover. This also means accepting the development costs and risks of being the first to implement new solutions.

The second option is to take a waiting position and only implement what has proven successful. This reduces the risks of failed investments. On the other hand, lagging behind and weakening the market position can prove to be devastating in the rapidly evolving global competitive environment.

Sweden and Swedish companies in general have a good starting position compared to other European players with regard to being able to implement industry 4.0 solutions. For example, the workforce qualification, the innovation environment, and the technology adoption and readiness are good. In this regard, Swedish companies have a head start, compared to players from more traditionalist countries.

***It is time to identify and capture opportunities for growth and efficiency gains.***

## KEY ENABLING TECHNOLOGIES

Industry 4.0 is enabled by disruptive technological developments. The role of some key enabling technologies is outlined below.

**Simulation and modeling** can help to optimize forecasting, planning, and manufacturing processes.

**Virtual reality** applications can dramatically shorten development cycles for both products and manufacturing systems, while also reducing costs.

**Systems of systems** are horizontally and vertically integrated system landscapes that enable collaboration across the extended value chain.

**Big data analytics** are at the core of the development of new services, the use of customer data for planning and development, as well as the use of manufacturing and supply chain data for efficiency improvements.

**Smart industrial systems** based on the internet of things and machine to machine communication can be designed as manufacturing units that are self-controlling in real-time.

**Additive manufacturing** technology enables rapid prototyping and decentralized manufacturing with “lot size 1”.

**Advanced automation and robotics** are the key for flexible, highly productive manufacturing systems.

**Cybersecurity** solutions enable the transfer and storage of large amounts of sensitive data in a secure way.

**Cloud technology** and wireless communication technology make it possible to receive and archive the captured data and make it available for analysis and use from anywhere.



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