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Digital Empowerment

# Industry 4.0 – intelligent productivity

Plan a path to innovation and business value.

# Industry 4.0 – Plan a path to innovation and business value

The concept of "Industry 4.0" – also known as "the fourth industrial revolution" – refers to the ongoing automation of traditional production and industrial practices through the use of modern, "smart" technologies.

## How did we get here?

By the end of the 18th century, textile production had been mechanized and the first industrial revolution was born.

With the advent of the "Spinning Jenny" (the world's first industrial spinning machine) in England, there were significant changes in other traditional manufacturing industries, which triggered upheavals in society that continued until the middle of the 19th century.

After the American Civil War, came the first production line. A number of slaughterhouses in Cincinnati are said to have been the first to use production lines around 1870, but after they were introduced at Henry Ford's car factory in Detroit in 1902, they quickly became widespread.

This mass production triggered the second industrial revolution, which we now call "Industry 2.0".

It would be three quarters of a century before the next great revolution took place. "Industry 3.0" was the automation of production processes enabled by electronic components, industrial robots and IT systems. Although this type of production required far fewer workers than previous methods, the majority of automated processes still relied on collaboration and human intervention.

Whatever we choose to call the end result, the technologies that make this transition a reality include:

- Connected sensors using wireless broadband connections or "new G"-connectivity to exchange information with each other
- Machine learning and artificial intelligence (AI) solutions that transform enterprise, manufacturing and supply chain data into business value and enable more informed decisions
- Virtual reality, augmented reality and mixed reality platforms that enable enhanced visualizations and assisted maintenance, training and user processes
- 3D printing systems and Virtual Twin simulations of physical devices, systems and processes that enable virtual design, prototyping and testing capabilities.

These new technologies can be connected as elements of an Industrial Internet of Things (IIoT) and merged into an augmented physical production process to enhance efficiency and levels of automation not previously possible.

# The evolution of Industry 4.0

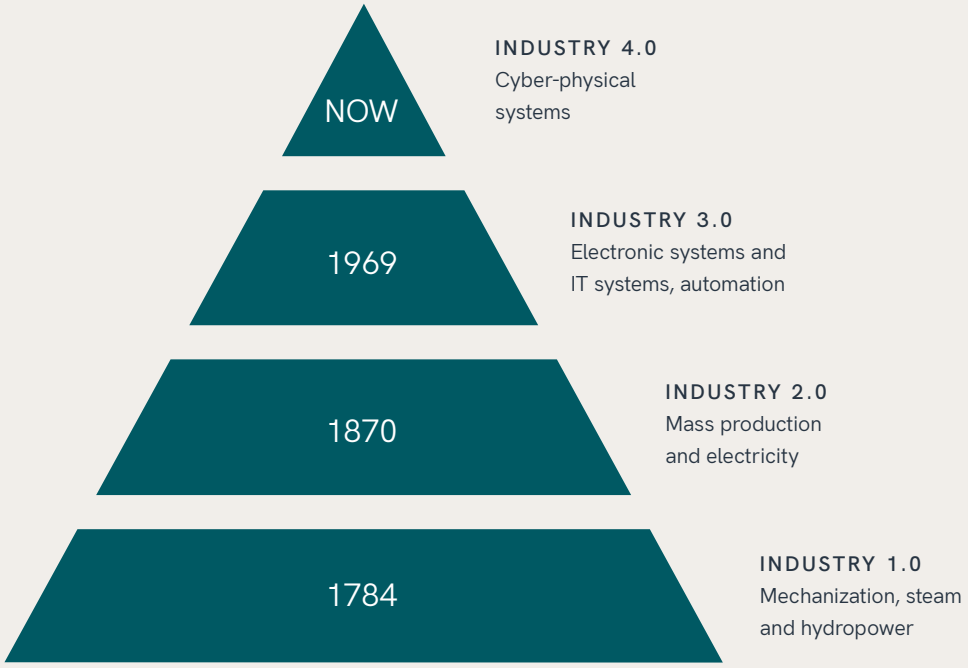
We are now in the midst of the fourth industrial revolution, based on the LEAN revolution of the 1970s, the wave of outsourcing in the 1990s and the development of IT and electronic automation that began at the turn of the millennium.

When this automation is combined with the advent of low-cost sensors, high-speed networks, innovations in autonomous robotics, computer-generated visualization, artificial intelligence, cloud & edge computing capabilities, the stage is set for a new vision of manufacturing based on a global network of machines in an intelligent factory setup, able to autonomously exchange information and control themselves and each other.

In short, a vision of a single ”cyber-physical system” that can operate autonomously, with full visibility throughout the supply chain and the entire product lifecycle – from design start to end of life.

Despite all the possibilities that this vision of Industry 4.0 opens up, it can be difficult to quantify the benefits of investing in these technologies without putting them into operation. This means that many companies still see Industry 4.0 technologies as unproven or even speculative.

However, one thing is certain: Industry 4.0, like the previous quantum leaps in manufacturing, will bring major changes to both society and business. So where can Industry 4.0 technologies add value to your company and how can you get ready for the shift to ”smart” connected manufacturing? This guide provides an insight into some of the possibilities and helps you start planning your own path forward.




The evolution of Industry 4.0

# Which technologies make up Industry 4.0?

The list of technologies covered by Industry 4.0, is constantly growing and evolving as new opportunities are exploited.

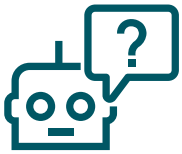
As is always the case in the IT world, technologies are often hidden behind industry acronyms, abbreviations and industry-specific terms. The list below is a quick guide to the most common Industry 4.0 components that you may see mentioned in this document and other materials.

## The Internet-of-Things (IoT)

**The Internet-of-Things (IoT)**, or sometimes **Industrial Internet of Things (IIoT)**, is the network of objects (such as pumps or valves) equipped with sensors and other technology to exchange the information they gather with other connected devices via wireless networks. This connectivity enables remote monitoring, control and simulation of the objects and the systems they are part of, based on the data collected.

## Augmented Reality (AR)

**Augmented Reality (AR)** allows the user to experience a version of the real world that has been digitally enhanced with additional information or simulated objects (e.g. Pokémon Go). **Virtual Reality (VR)** replaces the real world experience with a fully immersive computer simulation (e.g. gaming headset). **Mixed Reality (MR)** is a blend of both, where physical and digital objects coexist, interact and can be manipulated in real time (e.g. Microsoft HoloLens).



## Artificial Intelligence (AI) and Machine Learning (ML)

**Artificial Intelligence (AI)** and **Machine Learning (ML)** are related concepts that are often confused. AI is the creation of intelligent systems that can simulate human thinking and behavior. ML is a specific application of AI that enables a system to learn from input data and improve its own capabilities without programming. Big Data refers to the extremely large data sets, from many data sources and in many different formats, that AI and ML can analyze and interpret.

## Additive Manufacturing (AM)

**Additive Manufacturing (AM)** uses a digital model (or scan) and a **3D printer** for low volume production or customized objects. These objects can be used in production processes for prototyping and testing, or to facilitate the creation of other objects (e.g. a mold for an industrial injection molding machine).

## 5. generation (5G)

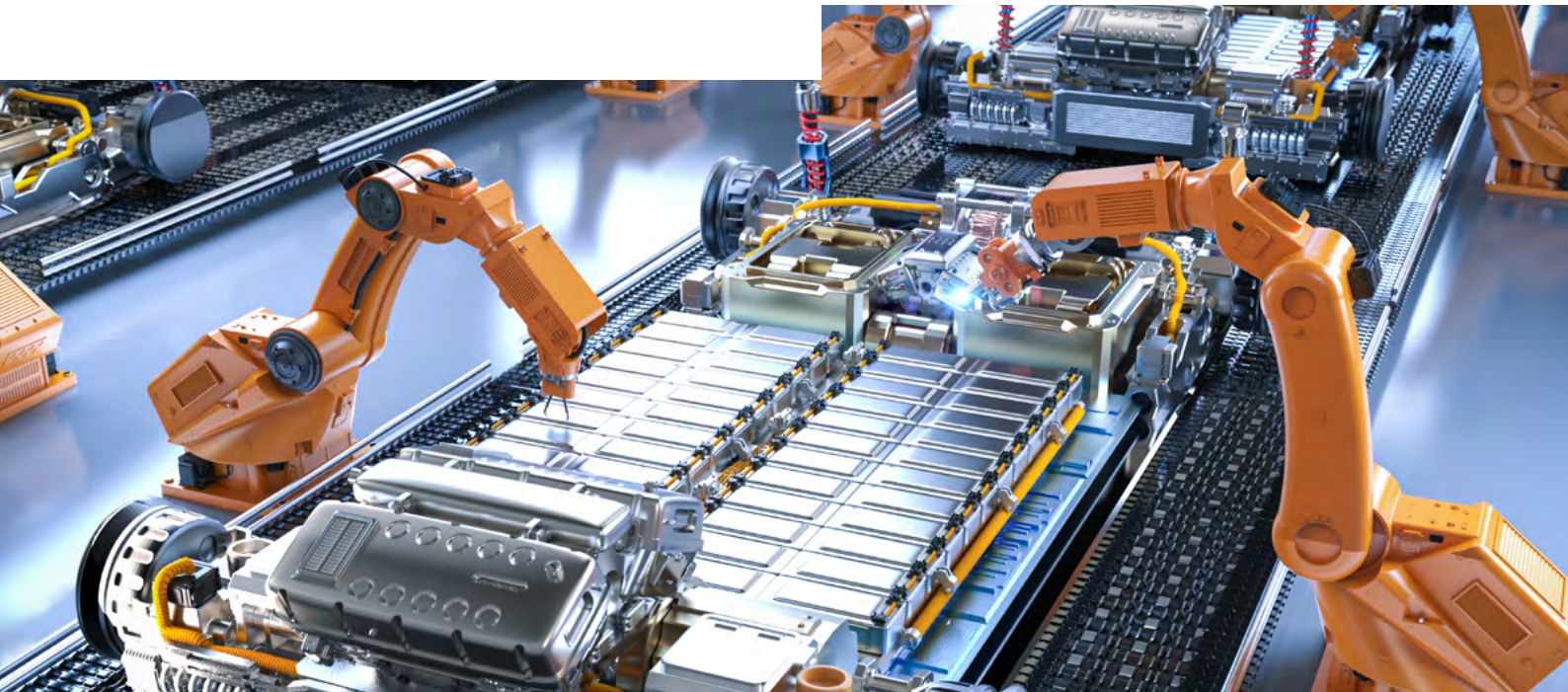
The **5th generation (5G)** mobile network standard offers faster data transfer speeds with lower latency (delays). The increased performance enables a more reliable, high-bandwidth wireless connection between sensors, machines and devices in the network. This makes 5G an excellent platform for data exchange for IoT installations in industrial production.

## Digital Twin

A **digital twin** is an exact virtual replica of a physical object, process or service. A twin can be used in the design and prototyping process, for example on a machine, to simulate and analyze daily operations under carefully controlled conditions, and to proactively predict errors or problems before they occur.

## Robotic Process Automation (RPA)

**Robotic Process Automation (RPA)** uses software ("robots") to mimic how a human interacts with digital systems to run a business process. RPA software uses the user interface to interpret data, provide answers and communicate with other systems to perform repetitive tasks – only faster, 24/7 and without errors.



# Create a foundation for innovation

## Streamline and simplify your company's backend systems.

Regardless of a company's manufacturing focus, implementing new, intelligent technologies has the potential to deliver benefits in terms of efficiency and cost savings. That potential includes companies that focus on, or expand, their business activities by providing on-site service and maintenance or product-as-a-service solutions to their customers.

Common to these manufacturing and service companies is the need to rationalize and optimize backend ERP and operational systems before making large investments in integrating data-rich front-end technologies and services.

Many businesses are still hampered by legacy technology that is both complex and siloed. This, in turn, leads to processes that are similarly complicated and fragmented. If backend systems do not fully support the company and enable agile processes and operational flexibility, they are unlikely to be a good starting point for the addition of new front-end technologies.

A modern ERP system that integrates all the key end-to-end processes that support day-to-day operations will help ensure process efficiency, information collection and analysis, cross-unit collaboration and structured knowledge sharing. Having these backend features in place helps break down silos and remove bottlenecks in your company, helping you to get more value from any additional front-end functions you choose to add.

An industry-specific solution based on a flexible and modular cloud-based platform such as Microsoft Dynamics 365 is an excellent foundation to build on.

A standardized industry solution can more directly enable and support critical manufacturing, supply chain and logistics processes across the enterprise and along the supply chain without the need for customization and patchwork solutions.

A production-focused solution helps bridge the gap between IT and OT (Operational Technology), ensuring that business processes and production processes can be combined into a single cohesive ecosystem.

The Dynamics 365 platform is continuously updated to integrate with, and utilize data from, new technologies and services as they evolve. Platform capabilities can also be expanded with the implementation of Microsoft Power Platform components.

This could include using Power Apps to offer low-code solutions that enable ad hoc business processes, or using Power BI for accessibility and utilization of relevant data across the enterprise.

The end result is a single integrated backend platform that will continue to add value to the company without the risk of becoming obsolete.

In short, the perfect starting point for the ongoing and recurring digital transformation of your business.

## As an integral part of a backend rationalization and simplification process, Power Platform offers benefits such as:

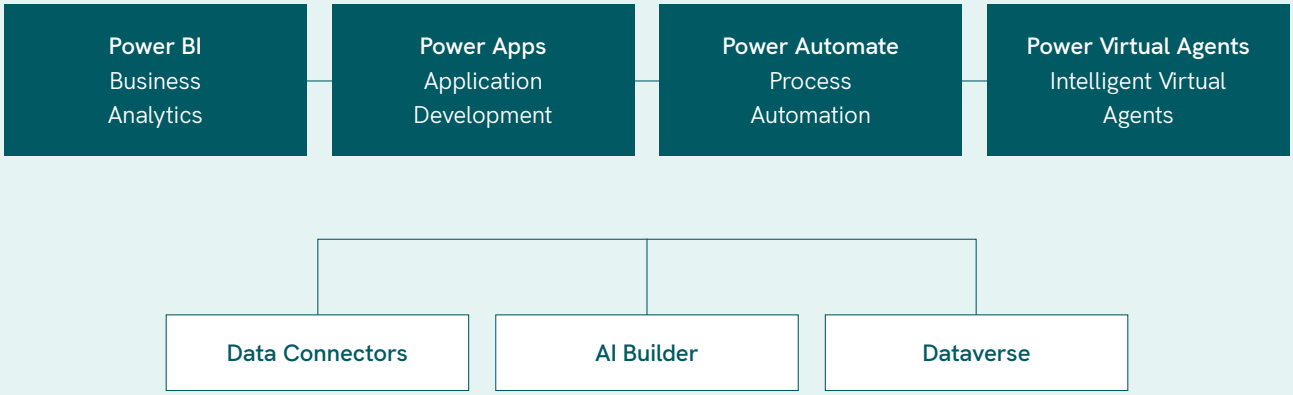
- A faster path to company transformation with flexible applications built with Power Apps
- Better and faster decisions as employees access and use relevant information in real-time via Power BI
- Increased employee satisfaction and output driven by the availability of modern productivity tools
- Ecosystem synergies based on built-in integration with Microsoft solutions such as Dynamics 365 and Teams
- Fewer data security risks compared to using ad hoc applications for desktop computers and mobile devices.

## Optimize your backend with Power Platform

Microsoft Power Platform provides tools that enable your IT team (or even unskilled developers) to implement great business ideas and customized processes through secure, low-code applications that can be designed and deployed in a fraction of the time it would take with typical application development processes.

What's more, Power BI makes advanced business analytics and reporting capabilities available across the enterprise and the entire workforce.

### Microsoft Power Platform




## Make a plan for the future – for your company and workforce

Ensuring your ERP foundation is in place is just one part of the process of preparing your company for the future. Moving from traditional assembly lines to intelligent connected manufacturing is an important milestone in an organization in many respects.

It's not just a company or technology transformation, but a cultural change that affects the way organizations are structured and managed. A company can only move as fast as its people.

The transformation may, therefore, raise concerns about the new skills required to operate and maintain "smart" technologies and the potential reduction of the workforce as a result of automation and digitalization.

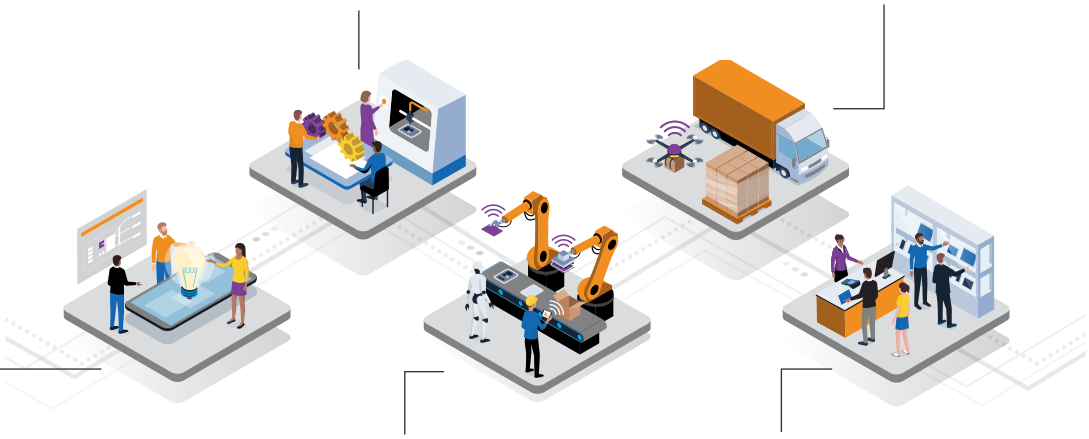
Implementing a technology shift while maintaining existing production capacity and workforce requires leadership and collaboration with a strategic partner who can ensure that the technological transition is accompanied by carefully implemented change management, user training and employee upskilling.

# Where can Industry 4.0 technologies bring value to your business?

Key areas of innovation across your company.

**Design & innovative engineering**
With Digital Twin simulations and 3D printing of materials for prototyping and testing.

**More cost-efficient logistics**
Enabled by an AI-based resilient supply chain and IoT-enabled warehouse efficiency.



**Effective business functions**
Through AI-assisted planning, forecasting and automation of processes and workflows.

**Efficient production lines**
Through process automation and AR/MR assisted predictive maintenance and operation.

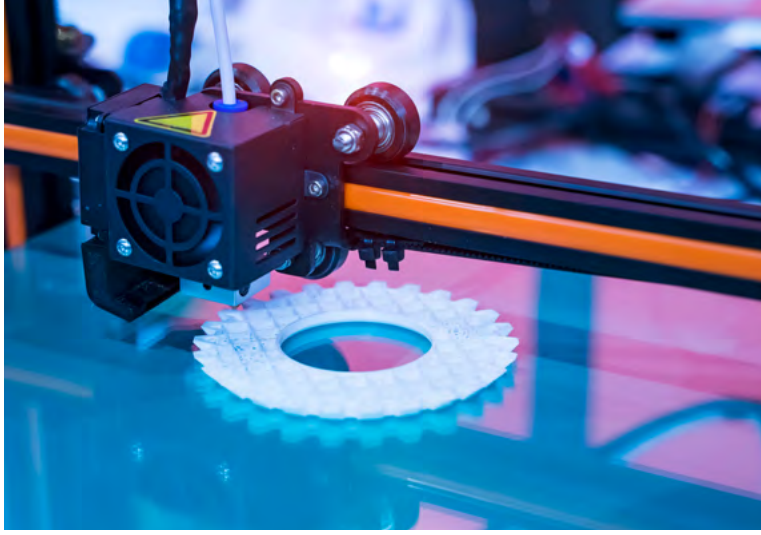
**Supply chain optimization**
With AI-based forecasting of customer trends based on industry data.

## Efficient business operations

The day-to-day operation of a manufacturing company involves generating and using large amounts of data from ERP, CRM and MES systems, for example. Add to this the information generated by sensor-equipped production equipment, other connected IoT devices and business partners throughout your supply chain. The result is a large and complex dataset in many different formats and protocols.

With this in mind, data analytics techniques and **artificial intelligence (AI)** technology such as **machine learning** are essential tools for visualizing and understanding these diverse data sets and converting such "big data" into actionable business insights that can be used to make smarter business decisions, enabling everything from more efficient planning and use of machinery and workforce to more accurate forecasting of material consumption and resource needs.

**Robotic Process Automation (RPA)** can replace many of the manual, repetitive tasks that steal valuable hours from your workforce. An automated RPA system can work faster and more accurately, without the need for coffee breaks, weekends or sick days. As a result, you should see immediate and significant reductions in costs, increases in quality and related improvements in both employee and customer satisfaction. An added bonus is that structured RPA processes mean improved ability to collect, organize, analyze and report on valuable business data. And you can use this data to plan how and where it would make the most sense to implement automation in other areas of your company.



## Design and engineering innovation

**3D printing or Additive Manufacturing** has already proven to be a significant capability for many manufacturers. It can be used for on-demand production of non-standard components in low-volume production and to enable mass customization of products in large quantities. In both cases, using Additive Manufacturing technologies means that multiple production processes can take place in the same physical location. This reduces transport and logistics costs and the need to stock non-standard components.

A 3D printed product can also be used as the basis for mass production of the final goods. For example, a 3D printed item can be used to create an injection mold that is then used in the final production process.

**Digital Twin** technology has started to replace the more traditional use of engineering simulations. Digital twins allow for analysis and optimization of simulations of physical objects or entire processes based on real-time IoT data from actual machines. The simulations produced can be used to test the limits of machine functionality and to make more accurate predictions of when machine breakdowns or process bottlenecks may occur and prevent them in the real world.

## Efficiency in the production line

Real-time monitoring and predictive maintenance of the production process, enabled by **connected IoT sensors**, enterprise asset management (EAM) software and advanced data analytics tools, is now an integral part of the workday on the production floor.

**Autonomous and advanced robotics** are increasingly being integrated into traditional manual assembly processes. Instead of outperforming employees, these robots are quickly becoming collaborative robots, or "**Cobots**" that use enhanced visual and spatial sensors to ensure they can work safely with and around your regular workforce. This is already seen by many as the beginning of a new generation of industrial automation.

The use of **augmented reality (AR)** and **mixed reality** (MR) applications is also starting to make its "virtual" mark on and around production machines. Their use can range from hands-on training and guidance for employees – such as how to use unfamiliar machines or how to install or remove components – to computerized and remote maintenance of machines by technicians and maintenance staff.

In both cases, the use of AR or MR hardware will mean that untrained employees can be upskilled faster to perform a much wider range of tasks. The ability to perform expert, **remote assistance** for machine operation, inspection or repair via a headset means that experts can guide and monitor critical operations anywhere in the world without having to be physically present. This is not only a great advantage for companies with dispersed production, but also for companies offering product-as-a-service capabilities or servicing products at the customer location.

## More cost-efficient logistics

Implementing connected IIoT sensors (such as RFID tags or weight sensors) in your loading areas and warehouse locations can speed up the process of receiving and loading goods and prevent overstocking or understocking by ensuring accurate inventory information is continuously updated in your inventory management system.

This gives warehouse managers a real-time inventory status and more time to plan and implement replenishment when stock levels fall below the limit. **Autonomous mobile robots** (**AMRs**) can take over many tasks associated with locating and moving inventory in the warehouse. They can move efficiently around the warehouse, picking and placing goods in collaboration with or instead of your warehouse workers. This saves time and allows your workforce to focus on more complex tasks, such as quality assurance and testing.

In addition to the above, automated robotic processes can also handle many of the simple, repetitive tasks that often dominate the warehouse. This can include inventory and shipment tracking, order processing and automated creation of standard documentation.

**Autonomous mobile robots (AMRs) can take over many tasks associated with locating and moving inventory in the warehouse.**

## Supply chain optimization

**Analytics and forecasting capabilities** can streamline procurement and execution processes by making them digitized and automated. Orders can be triggered automatically not only based on real-time information about your own stock and estimated consumption, but also on transparency into your suppliers' available products and logistics. This visibility across the supply chain allows for quick response and resilience, helping to avoid bottlenecks and stock shortages that could potentially threaten production planning and delivery to the customer.

The combination of **big data and machine learning** means you can use real-time historical information from across your own company and your ecosystem of partners, suppliers and customers to make predictions and estimates that guide supply chain activities.

This high level of insight can also help you turn your supply chain into a true value chain, where the focus is on making the supply chain decisions that add the most value to your products or services and result in an improved overall experience for your end customer.

# Fast, scalable, cloud-based data processing functions

Edge computing offers scalable, secure features without the need for expensive on-premise infrastructure. Edge computing complements and balances this approach by bringing computing and data storage capabilities for critical workloads closer to where the information is needed.

With fast local connectivity, such as 5G, data can be processed and analyzed by the smart device itself or by a local computer or server instead of having to be transferred to a data center for analysis. This reduces latency, shortens response times and saves costly bandwidth consumption from trips to and from the cloud.

The computing power and data storage capabilities needed to enable the data-intense and time-critical processes that are involved in Industry 4.0 technologies are increasingly being met by technologies for cloud and edge computing capabilities.

## Where are intelligent production technologies most valuable?

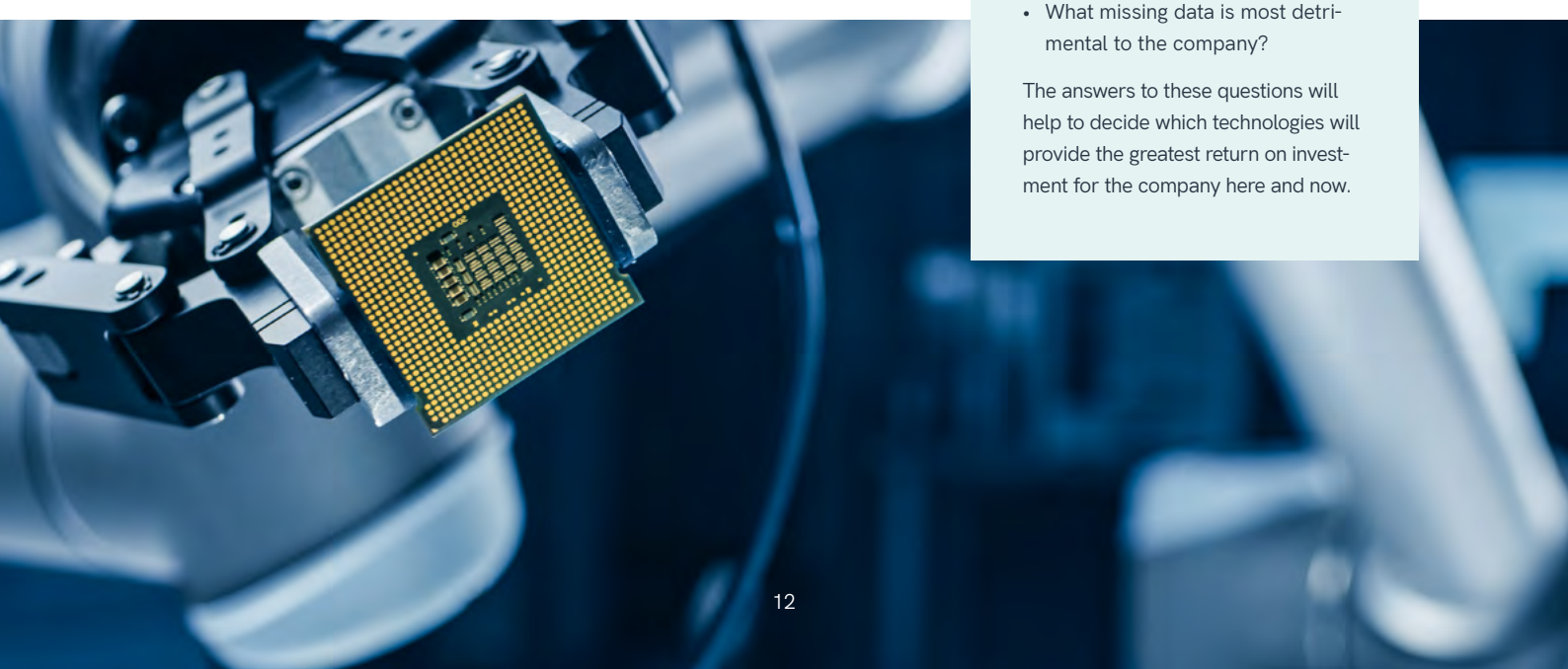
Industry analysts agree that the most widespread benefits in Industry 4.0 are due to better use of machines, increasing productivity and providing more accurate estimates of future demand.

Regardless of which technologies provide the benefits, it is crucial to gather, analyze and use data to better realize these benefits.

Many companies can get a clearer picture of how new technologies can help by asking themselves just a few fairly simple questions about their data needs such as:

- Which areas of the business process do we need to know more about?
- What data will potentially provide the biggest advantage in our daily operations?
- What missing data is most detrimental to the company?

The answers to these questions will help to decide which technologies will provide the greatest return on investment for the company here and now.



# Industry 4.0 – What's next?

Industry 4.0 focuses primarily on the digitalization and automation of industrial processes. As a result, it risks taking a skilled and experienced workforce out of the equation.

Industry 5.0 could potentially have more focus on how humans and intelligent machines can work together more effectively. That will put people back at the center of the production process. Instead of learning to deal with the emergence of new job-threatening technologies, future technologies will focus on improving interaction and collaboration to get the best possible combination of human and technological strengths.

One thing is certain – the pace of change and the speed of business will both continue to increase. Planning a pragmatic and value-based approach to harnessing the benefits offered by this iteration of the industrial revolution has never been more important.

## Benefits for your customers

At the end of the day, Industry 4.0 functions aren't just technology for technology's sake. The goal of the technology – and your goal when it's implemented – is to add business value and remove real costs by rationalizing daily processes and optimizing use of the company's two most valuable commodities: its business data and its workforce.
The end result of successful digitalization and automation should also be something that is obvious to your customers when they experience some, or all, of the following benefits:

- Faster response times – enabled by data transparency and process automation
- More competitive pricing – based on the company's cost and salary savings
- Improved quality and consistency – both in the products and services you deliver
- On-time and on-budget delivery – enabled by efficiency gains across the company
- Increased flexibility – to accommodate customer needs and expectations.

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