# IoT in production

# Big changes ahead in manufacturing

The latest on IoT adoption & technologies

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# In brief

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Within the next decade, the "smart" factory will become reality: most OEMs already manufacture products with embedded smart chips that facilitate AI (Artificial Intelligence) capabilities and IoT (Internet of Things) connectivity. New technologies

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like 5G and edge devices will even enable those products to send data to a cloud without necessarily having to use conventional industrial communication networks. This will allow OEMs to analyze their products while in operation, which, in turn, will lead to better evolutions in production, higher customer satisfaction and more reliable products. In this context, OEMs especially are facing several specific

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challenges: They have to work with standardized communication protocols and cloud-based IoT solutions for production. In this paper, we give some initial guidance in selecting and implementing IoT technologies that will enhance interoperability and create added value for customers.

# IoT use cases in manufacturing

**A major challenge** for manufacturing companies is to identify and establish the "correct" business model for the specific IoT use case. Typical IoT business models are subscription-based, pay-per-use or outcome-based, although hybrid models are also common. Companies also need to define new go-to-market strategies and build new sales channels, which, in turn, may also impact their ERP systems and delivery processes. In most cases, digitalization requires a consultative selling approach and not a product-centric one. There are also several IoT platforms on the market, and companies struggle to choose the "right" one for their purposes.

**However, two current general fields of industrial IoT applications will remain important in the future:**

On the one hand, the discrete manufacturing industry is using IoT to develop IoT-enhanced products and improve the productivity and efficiency of its manufacturing processes. This is also the main use of IoTs among continuous manufacturing industries like oil and gas, chemicals, and pharmaceuticals. For example, IoT makes it possible for machine OEMs to collect operating data and information on the customer behavior. They can then use this data to offer additional business models and services like predictive maintenance as well as improve the quality of the next product evolutions.

On the other hand, a closed life cycle data and information loop between product engineering and product operations will help OEMs improve future product evolutions in a process known as integrated engineering. IoT breaks existing data silos between OEMs and end users and replaces them with a shared information model, which can be used to develop holistic AI models. These have the potential of significantly improving products and increasing operational excellence, since they cover the complete life cycle of products from development to lifetime maintenance.

**2019**

**$305 billion**

> Biggest spenders on IoT solutions were organizations in discrete manufacturing ($119 billion), consumer IoT ($108 billion) and process manufacturing ($78 billion).

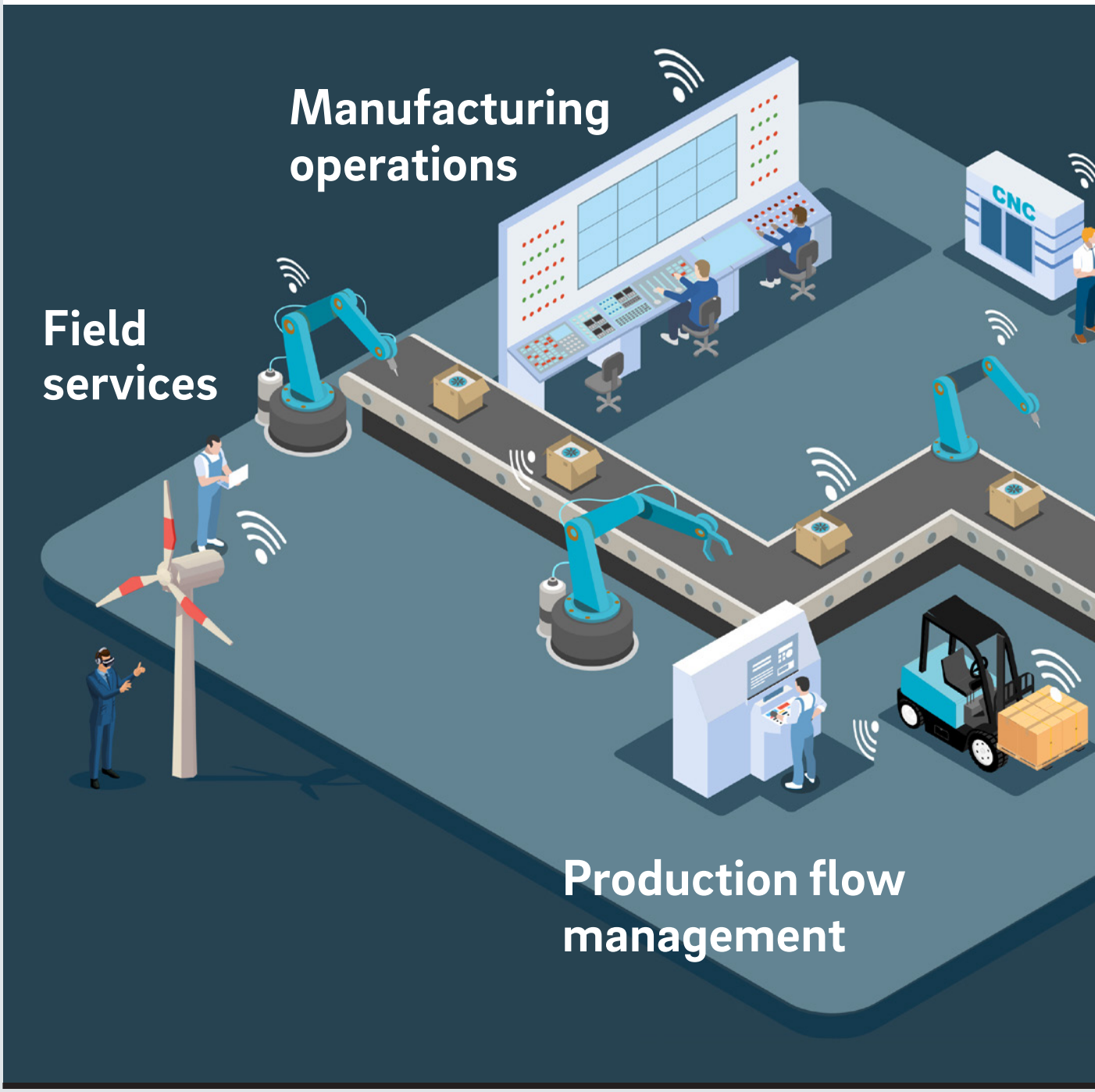
**2022**

**~$1 trillion**

> Worldwide IoT spending is growing by double digits and will surpass the $1 trillion mark.

# IoT in manufacturing processes

Important points in the assembly line – and beyond




Source: Roland Berger; Illustration: Adobe Stock

# Expert talk

DR.-ING. BERNHARD LANGEFELD, PARTNER


**What are the biggest challenges in implementing IoT applications?** Most companies fall into the trap of not focusing on customer needs, but rather considering which IoT solutions can be developed based on existing company knowledge and product portfolios. However, for an IoT business model to succeed, it is essential to put the customer needs for each solution first. Only when a solution offers real value can a recurring revenue stream be generated.

**How can manufacturers identify and establish the "right" business model for their specific IoT use case?** In most cases, digitalization requires a consultative rather than a product-centric sales approach. Typical IoT business models are subscription models, pay-per-use, offering additional services or results-oriented models. It is also important for companies to define new go-to-market strategies and build new sales channels. A customer co-creation approach can be a suitable method to ensure customer proximity and that product development serves the needs of the customer.

**Which IoT platform is the right one?** Companies often find it difficult to choose the "right" IoT platform for their purposes. It is of central importance to rely on open systems and standardized communication protocols that improve interoperability in order to realize added value for customers.

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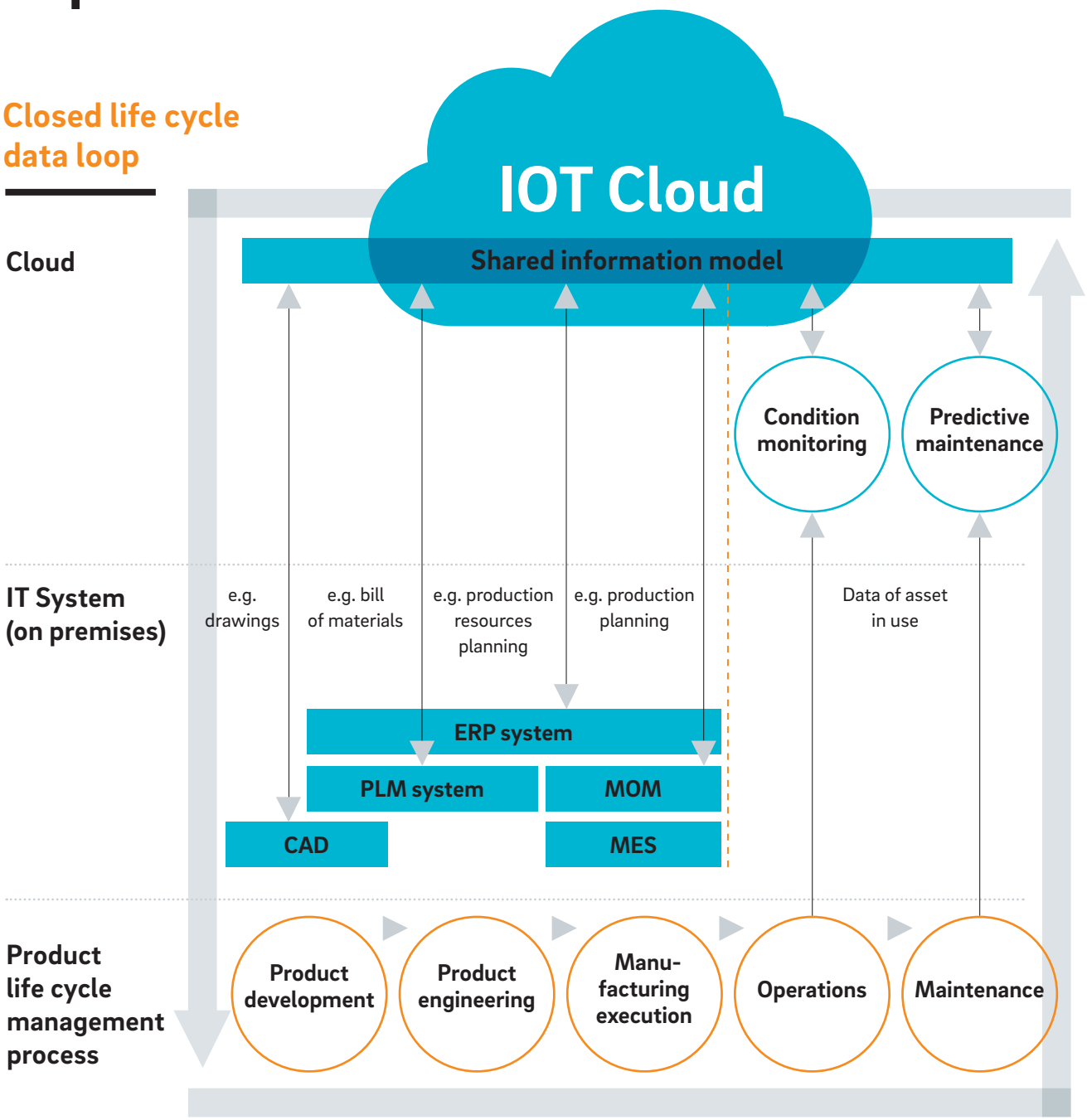
# From data to product – and back

The IoT cloud and the product life cycle management process




Source: Roland Berger

# Future perspectives for IoT business cases

**A few examples** of how IoT will enhance the machines of the future will demonstrate the enormous potential for IoT in the manufacturing industry:

- **Real-time monitoring:** real-time data sharing from connected machinery equipment offers a rich source of data about customer behavior that will improve maintenance and manufacturing processes throughout the product's life cycle. It will also help enhance predictive insights and allow faster response times whenever issues arise.

- **Insights for management:** connected products allow manufacturers and customers to engage in a two-way exchange about any problems and automate such tasks as scheduling service appointments. This will ensure that the assets are regularly serviced in an autonomous fashion with little inconvenience to the user.

- **Offering new business and service models:** IoT allows businesses to offer new business models like pay-per-use. Customers benefit from lower investment costs, and the OEM improves customer interaction and gets valuable insight into customer behavior.

Putting IoT use cases in production and IoT-enhanced products in context will allow companies to establish cloud-based IoT solutions for production operations, the central backbone of the closed information flow in a shared, semantic information model. Various connection technologies like wide area networks (WANs), local area networks (LANs), wireless local area networks (WLAN/Wi-Fi), long-term evolution (LTE), 5G, low-power wide-area networks (LPWANs) and edge devices allow multiple factories, suppliers and IoT devices to be connected. IoT can thus disrupt the conventional five-layer automation pyramid by directly connecting assets across all levels of standard production IT/OT infrastructure.

**"IoT breaks existing data silos between the OEM and the end user and creates a shared information model. Such a closed life cycle of data and information loop between product engineering and product operations will help OEMs improve future product evolutions, also known as integrated engineering."**

**DR.-ING. BERNHARD LANGEFELD, PARTNER**

# Ground-breaking IoT technologies

**New data storage,** transmission and processing technologies will accelerate the use and dissemination of IoT in the production industries in the upcoming years. Three key technologies are:

- **Edge devices:** edge devices control the flow of data between two networks, e.g. between a factory network and an IoT cloud. Due to security aspects, limited transmission speed to the cloud or cost, it currently makes sense to process and store data locally on edge devices. With edge computing, data cleansing, aggregation and analyses – such as event processing, machine learning and artificial intelligence models – are performed on the edge device, not in the cloud itself. This will result in reduced latency and bandwidth costs, faster response times and reduced traffic. Edge devices are connected to an IoT cloud via WAN, LAN and Wi-Fi for production operations, but technologies such as LPWANs and 5G are also possible.

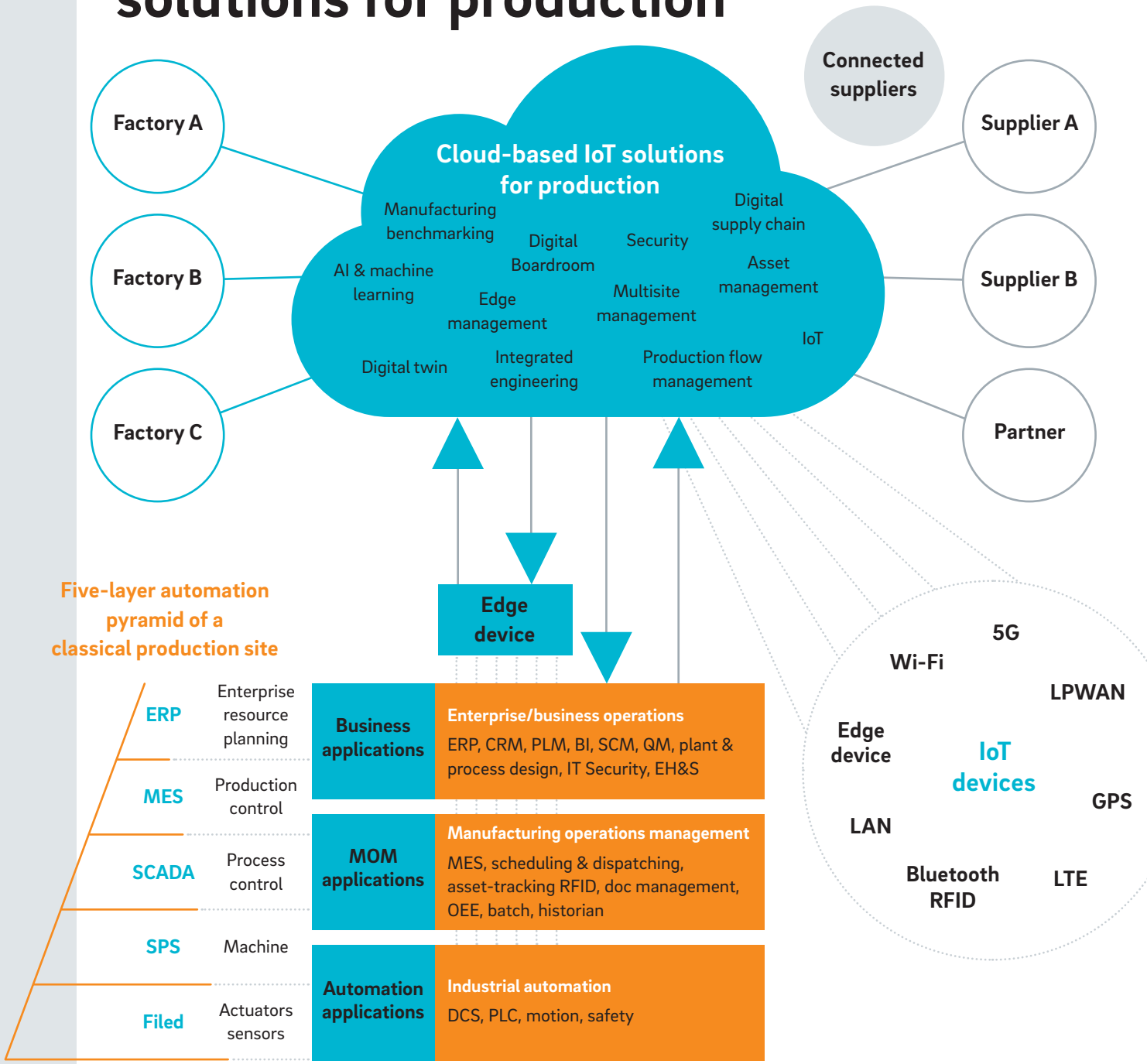
- **Low-power wide-area networks (LPWANs):** many devices connected to IoT transmit only small amounts of data, so they will require only a low bandwidth. Technologies like 4G/5G consume a lot of power and are highly complex, therefore making them expensive. LPWANs, instead, focus on connecting many low-cost, long-life devices that require broad coverage. Sigfox is recognized as the global LPWAN pioneer in the IoT segment. Some devices can operate for up to 20 years on just two AA batteries because they only become active when sending such simple messages as machine consumption data, or tracking or geotargeting codes. LPWANs enable companies to collect data almost effortlessly without spending time and money on meter readings or manual data processing, while also generating deeper insights into their processes and revealing unknown potential for improvement.

- **5G:** 5G is the latest in mobile connectivity and offers a transmission speed of more than 10 Gbps, which is about 100 to 1,000 times faster than 4G/LTE. In addition, more devices can be connected simultaneously without fear of network congestion. Network operators worldwide are currently investing hundreds of billions of dollars in 5G infrastructure and plan to implement the required infrastructure with full network coverage by 2025. Because such local networks are relatively easy to install and can support a large number of devices, 5G is ideal for use in factories. However, 5G will not play a role in all areas of the manufacturing industry. The cost of using 5G in an industrial environment cannot at this time be reliably estimated, making it difficult to calculate investments and industrial business models.

Most likely, most OEMs will manufacture products with embedded smart chips with IoT connectivity within 10 years. Technologies like 5G will enable these products to send their data into a cloud without touching traditional industrial communication networks. IoT will thus help OEMs to manage, update and analyze their products in use, resulting in higher customer satisfaction and more reliable products.

# Cloud-based IoT solutions for production

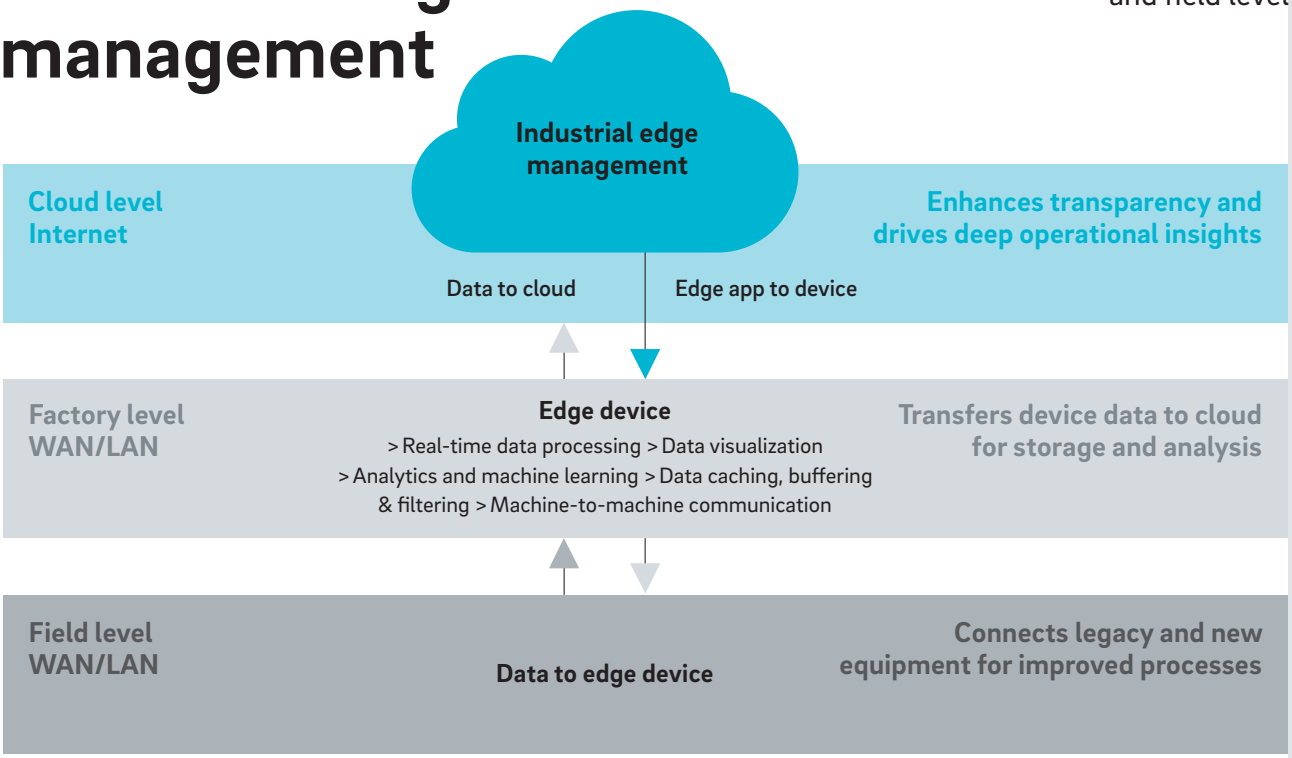
Integration of plants, suppliers and devices




Source: Roland Berger

# Industrial edge management

Interaction of cloud, factory and field level




## Key aspects for a successful commercialization of IoT products

### Business model

> Customer pain points identification
> Value proposition
> Business model design e.g. subscription product pricing
> ...
> ...
> ...
> ...

### Go-to-market

> Product offering
> Sales channel
> Sales material and enablement
> Order process
> ...
> ...
> ...
> ...

### Solution architecture

> Holistic digitalization concept vs. stand-alone solution
> Information model design
> Technical solution: SW & HW bundle, SW-only
> ...
> ...

### Deployment

> Technical specification
> Solution deployment process
> Provisioning of hot fixes, new features and releases
> ...
> ...
> ...
> ...

### Operations & Service

> Incident management
> ERP order process
> Billing and invoicing
> Legal documents e.g. software master agreement
> ...
> ...
> ...

**Initial phase** | **Sales** | **Productization phase**

Source: Roland Berger

# IoT business model maturity assessment

**Companies are currently** confronted by market, business model, cultural and organizational challenges, and many customers don't really know where to start with IoT. It is without doubt that IoT will become a major cornerstone of Industry 4.0. Nevertheless, the introduction of this technology in manufacturing industries will be on an evolutionary basis, not a revolutionary one.

To support the success of its clients on this journey towards IoT, Roland Berger is combining its expertise in strategy development with its in-depth industry and technology knowledge based on its experience from numerous IoT projects. Roland Berger has used this experience to develop an assessment for companies to determine their readiness to adopt IoT business models. The approach considers all aspects that are relevant to developing and implementing a successful IoT business model.

Starting by identifying the client's potential uses for IoT, Roland Berger screens possible data-driven use cases in terms of market maturity, company maturity, data availability and potential for creating added value. Here it is important to leverage existing experience and the business context, especially the upcoming needs of its customers.

The selected IoT use cases are then combined with business model detailing, value proposition, value chains and profit mechanisms.

For a successful commercialization of an IoT product, several key aspects need to be considered in the business model design, the go-to-market approach, the solution architecture, product deployment, and the operating and maintenance phases.

The Roland Berger IoT Maturity assessment helps to evaluate the product's maturity, identifies weak points, and recommends further fields of action for the successful commercialization of the individual IoT product of the client.

The maturity assessment and solving of open points can be supplemented by the Roland Berger data analytics team and our digital experts of our Digital Hub SPIELFELD. With profound industry knowledge, as well as outstanding expertise in strategy development, manufacturing operations and digitalization, we are the right partner to support your company on its IoT journey.

**SPIELFELD – a Joint Venture between Roland Berger and Visa – is designed to support large companies in their digital transformation. With different project formats always tailored to the specific needs of our clients, we propose dedicated methods for identifying and prioritizing the value and strategy impact of prototype ideas early on so that established industries can master digitalization and develop the skills to stay ahead of the game. SPIELFELD is fueling innovation, unlocking creativity and igniting the minds of a community working towards digital transformation. We are facilitating collaboration and conversations between key industries and innovators, the established and the new.**

**Roland Berger data analytics: Roland Berger is supporting its customers with a highly skilled data analytics team with knowledge ranging from data strategy to solution implementation. Multifunctional teams consisting of data scientists, data engineers and analytics consultants are on hand to support companies' strategic evolution to becoming data-driven companies and answer their strategic and operative business questions with data and analytics.**

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