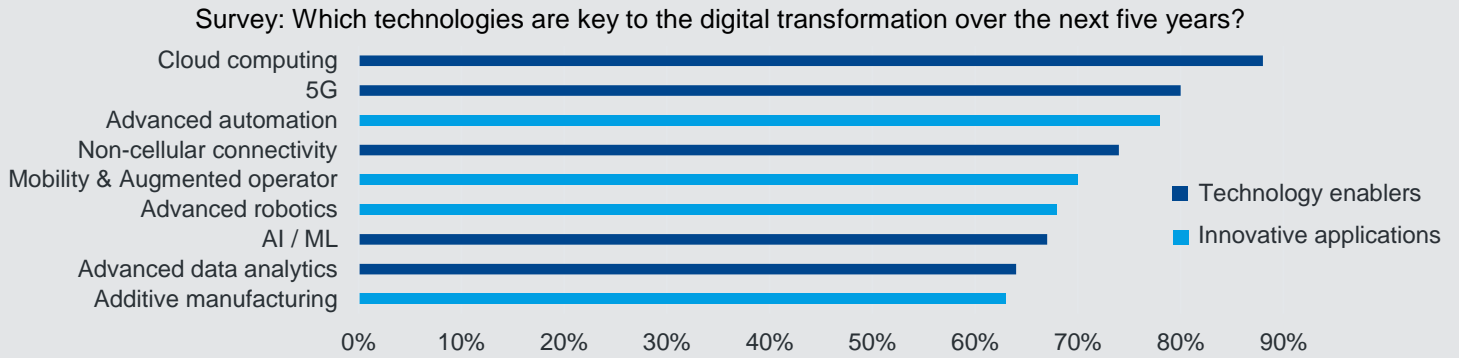# Managing Global Digitalization Challenges in Production

Decoding the path towards a digital factory - Getting inspired by key technologies for the manufacturing industry and learn to adapt as a company

| Figure 1 & 2 | Identified top trends in the manufacturing industry |

Survey: Which technologies are key to the digital transformation over the next five years?
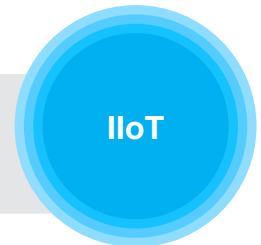

Survey: What percentage of investments are planned for the following digital initiatives in the respective years?
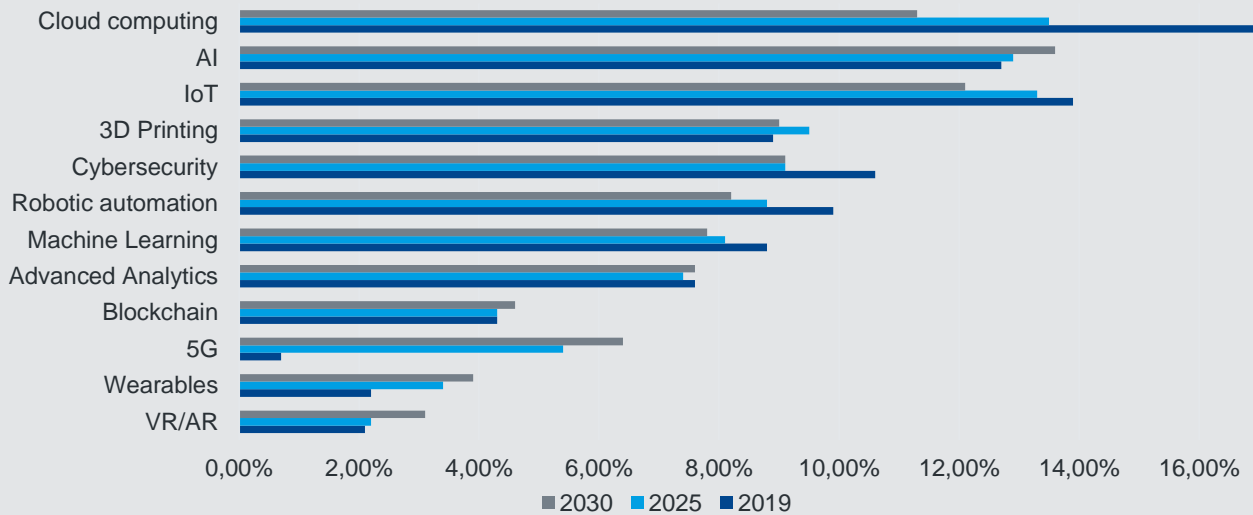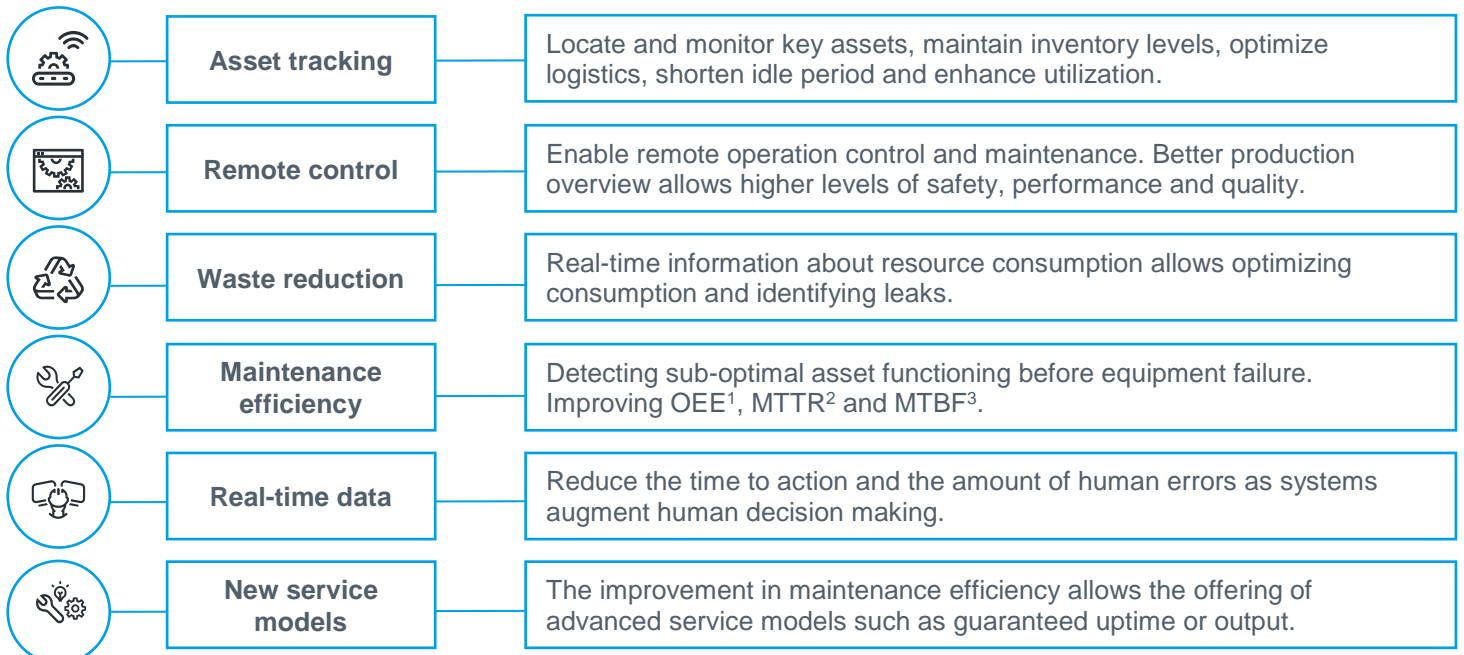

Source: Based on the analysis of existing surveys in the automotive and general industry (Capgemini, BCG, IBM, Bain, 2019 & 2020); Research Dürr Consulting

01 IIoT as the foundation of digital manufacturing

The market size for global IIoT platforms in manufacturing is projected to grow with a CAGR of 40% over the next 5 years. In combination with appropriate data analysis or AI based data insights, this technology provides various use cases for industrial manufacturers.
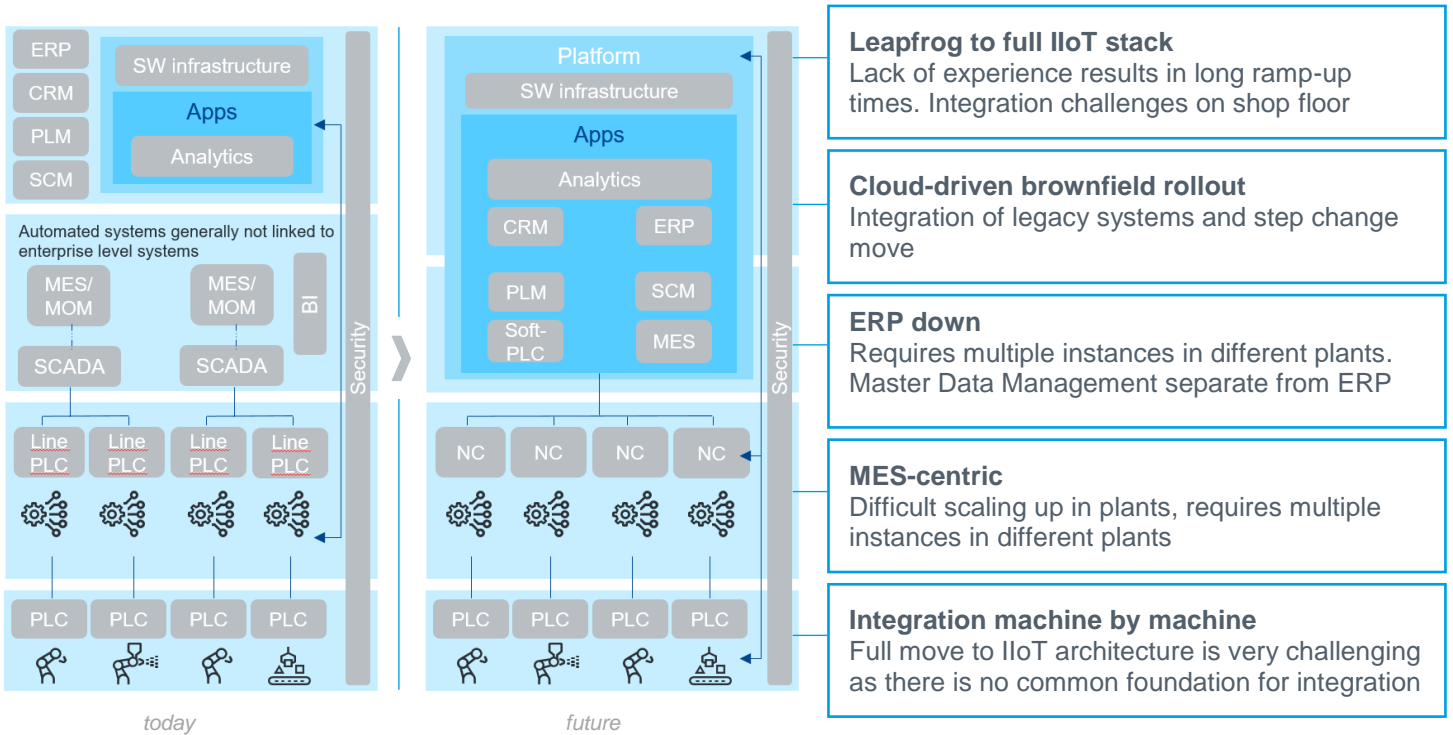
IIoT

Leveraging IoT for the manufacturing business

Asset tracking	Locate and monitor key assets, maintain inventory levels, optimize logistics, shorten idle period and enhance utilization.
Remote control	Enable remote operation control and maintenance. Better production overview allows higher levels of safety, performance and quality.
Waste reduction	Real-time information about resource consumption allows optimizing consumption and identifying leaks.
Maintenance efficiency	Detecting sub-optimal asset functioning before equipment failure. Improving OEE[1], MTTR[2] and MTBF[3].
Real-time data	Reduce the time to action and the amount of human errors as systems augment human decision making.
New service models	The improvement in maintenance efficiency allows the offering of advanced service models such as guaranteed uptime or output.

[1] Overall Equipment Effectiveness [2] Mean-Time-To-Repair [3] Mean-Time-Between-Failures

IT land-scape

The next generation of system integration will implement and leverage the advantages of the OPC UA IoT framework from the control level upwards and allows a greater use of data from different sources to be included in the analytics. Furthermore, the network will enable companies to optimize operations on a cross-plant level with a holistic view on the supply chain.

Figure 3 Trends in the industrial IT infrastructure

Leapfrog to full IIoT stack
Lack of experience results in long ramp-up times. Integration challenges on shop floor

Cloud-driven brownfield rollout
Integration of legacy systems and step change move

ERP down
Requires multiple instances in different plants. Master Data Management separate from ERP

MES-centric
Difficult scaling up in plants, requires multiple instances in different plants

Integration machine by machine
Full move to IIoT architecture is very challenging as there is no common foundation for integration
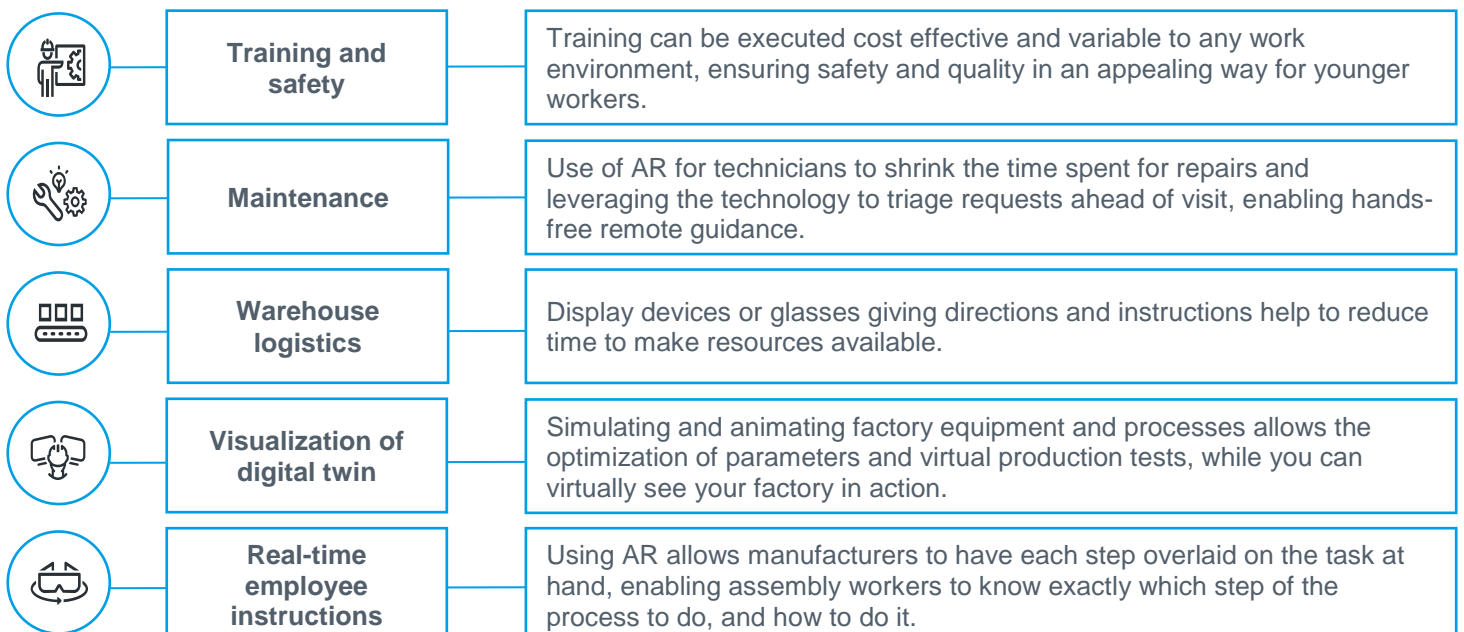
today   *future*

03 Virtual and Augmented Reality in the factory of the future

Augmented or virtual reality is often mentioned in the context of the next generation video games, but also offers a wide range of use cases in the manufacturing business. Industrial companies from all sectors make substantial investments into this technology, as the application becomes increasingly affordable.

AR/VR

How to use AR to generate value in a factory

	Training and safety	Training can be executed cost effective and variable to any work environment, ensuring safety and quality in an appealing way for younger workers.
	Maintenance	Use of AR for technicians to shrink the time spent for repairs and leveraging the technology to triage requests ahead of visit, enabling hands-free remote guidance.
	Warehouse logistics	Display devices or glasses giving directions and instructions help to reduce time to make resources available.
	Visualization of digital twin	Simulating and animating factory equipment and processes allows the optimization of parameters and virtual production tests, while you can virtually see your factory in action.
	Real-time employee instructions	Using AR allows manufacturers to have each step overlaid on the task at hand, enabling assembly workers to know exactly which step of the process to do, and how to do it.

04 Bringing the digital twin to life

The use of digital twins is expected to triple by 2022, compared to 2019 level. Most industrial companies already identified the advantages of simulations and are investing into digital twins on product-, process- and R&D level.

Digital Twin

Using a digital twin to save costs and increase transparency

Production efficiency	Reduction in operations and process variability and commission times. Troubleshoot potential issues on a production line before putting it into place and manage performance in real-time.
Service level	Improve the customer support through remote access (remote expert support on real-time digital model). Additionally, improvement of predictive maintenance and performance-based business models.
Quality management	Use the digital twin to detect quality issues proactively and trace them back to the source.
Logistics planning	The digital twin helps to optimize the supply chain and allows to gain a clear view of material usage to enable an automated replenishment process and establish a leaner production
Product-/ Process re-design	The digital twin can simulate different scenarios to identify possible improvements in the production system.

05 Using the cloud for next level data availability and connectivity

Cloud

The Global Cloud Manufacturing Market is expected to grow at a 19.8% CAGR during the forecast period 2019–2024.
Companies that move development to IaaS and PaaS clouds from Amazon Web Services (AWS) reduced downtime by 72% and improved application availability by 3.9 hours per user per year.

How the cloud improves shop floor operations
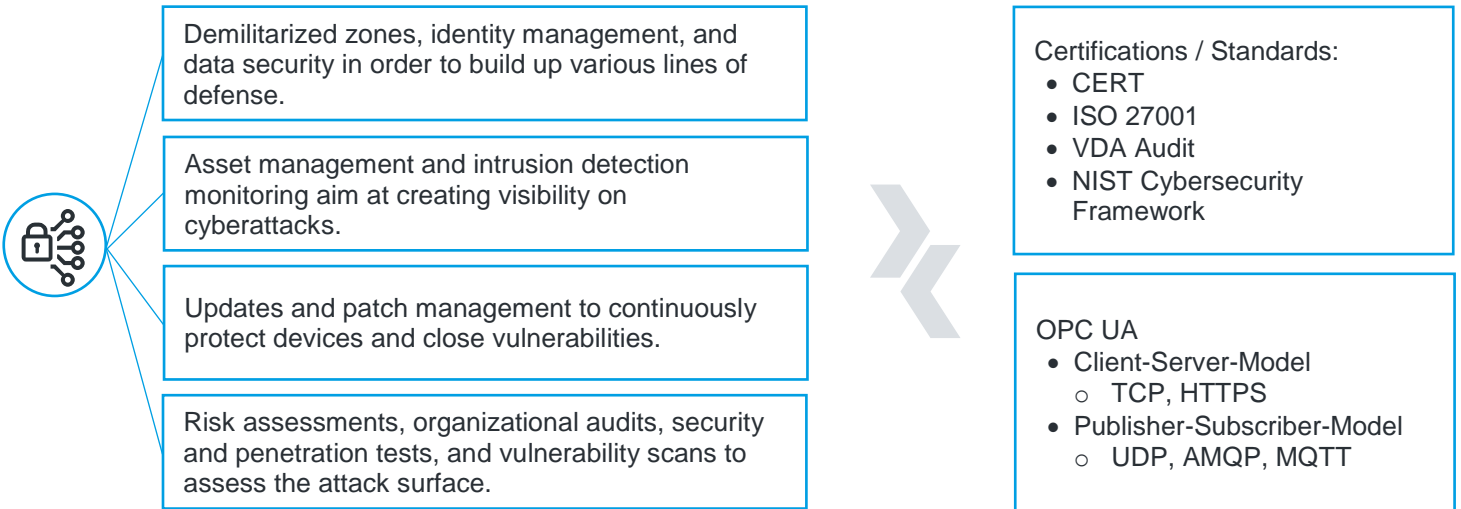
Scalable computational resources	Helping producers overcome such challenges as data latency, limited bandwidth, and intermittent connectivity on the shop floor.
Unify global operations	With a common cloud platform across all global operations, each branch can perform their jobs in a collaborative, synergistic way, enabling inter-site operation optimization.
Facilitate integration	Intelligently integrating data streams from several partners (e.g. Integrating the supply chain), platforms, and devices is much easier with a cloud based platform.
Change in consumption of products	Cloud computing will play a critical role as information technologies enable products to be remotely updated, maintained, or even sold as services, as part of an increasingly common business model called "servification".
Backup and disaster recovery	Businesses can store backup data in the cloud to keep those resources off-site, downloading backup data when needed. Reducing the risk of data loss and physical on-site destruction.

06 Safety first

In the eyes of customers, the suppliers and Industry 4.0 platforms are responsible for providing IT security. Over 60% of companies expect support in industrial security from their suppliers. Downtimes due to unpredictable cyber attacks are tremendously increasing.

Cyber-security

What safety issues are to consider during software development and implementation?
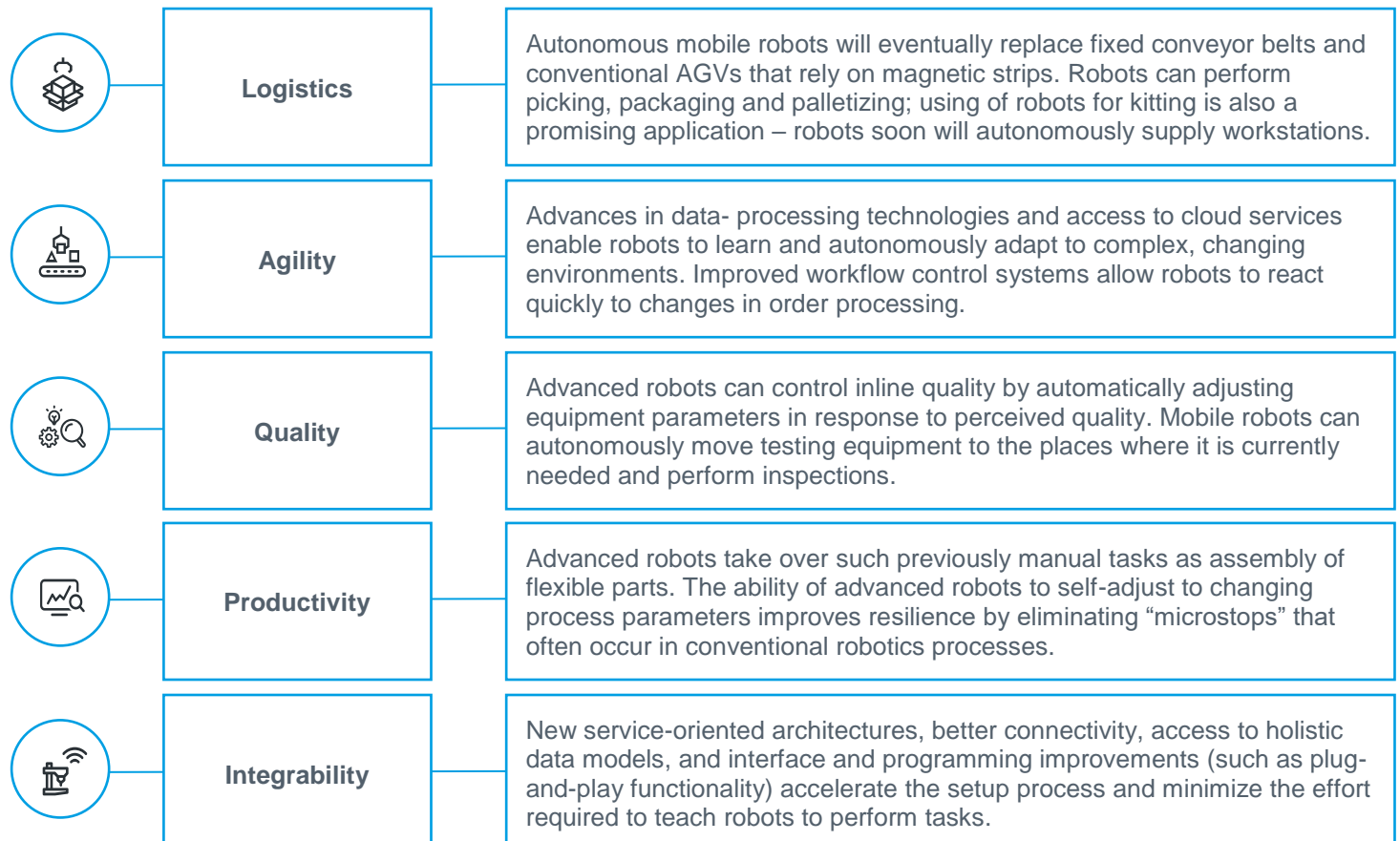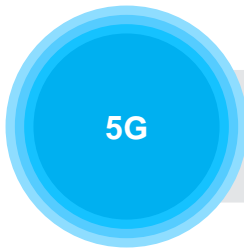
Demilitarized zones, identity management, and data security in order to build up various lines of defense.

Asset management and intrusion detection monitoring aim at creating visibility on cyberattacks.

Updates and patch management to continuously protect devices and close vulnerabilities.

Risk assessments, organizational audits, security and penetration tests, and vulnerability scans to assess the attack surface.

Certifications / Standards:
- CERT
- ISO 27001
- VDA Audit
- NIST Cybersecurity Framework

OPC UA
- Client-Server-Model
  - TCP, HTTPS
- Publisher-Subscriber-Model
  - UDP, AMQP, MQTT

07 Putting a brain into factory robots

Advanced robotics

The global market value of advanced robotics in manufacturing is going to triple by 2021 – from 1.2 bn USD (2018) to 3.7 bn USD. A great development is also happening in the global market value of advanced robotics in logistics, with a rise from 0.5 bn USD to 0.9 bn USD in the same period.

With access to new technological features, robots enhance manufacturing performance

Logistics

Autonomous mobile robots will eventually replace fixed conveyor belts and conventional AGVs that rely on magnetic strips. Robots can perform picking, packaging and palletizing; using of robots for kitting is also a promising application – robots soon will autonomously supply workstations.

Agility

Advances in data- processing technologies and access to cloud services enable robots to learn and autonomously adapt to complex, changing environments. Improved workflow control systems allow robots to react quickly to changes in order processing.

Quality

Advanced robots can control inline quality by automatically adjusting equipment parameters in response to perceived quality. Mobile robots can autonomously move testing equipment to the places where it is currently needed and perform inspections.

Productivity

Advanced robots take over such previously manual tasks as assembly of flexible parts. The ability of advanced robots to self-adjust to changing process parameters improves resilience by eliminating "microstops" that often occur in conventional robotics processes.

Integrability

New service-oriented architectures, better connectivity, access to holistic data models, and interface and programming improvements (such as plug-and-play functionality) accelerate the setup process and minimize the effort required to teach robots to perform tasks.

5G

08 The next generation of connectivity and speed

The 5G technology impresses with the enhanced mobile broadband speed, the ultra-reliability, low latency, massive machine type communication (number of connected devices per unit area) and allows more secure operations.

How does 5G perform compared to conventional connectivity?

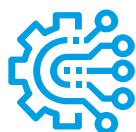|	5G	4G	Wi-Fi
Enhanced mobile broadband speed	20 Gbps for downlink and 10Gbps for uplink	1 Gbps for downlink and 500 Mbps for uplink	Approximately 4.8 Gbps
Massive machine type communication (Number of connected devices per unit area)	1 million/km^2	100 thousand /km^2	Not defined. Depends on the bandwidth required per device
Ultra-reliability and low latency	Network latency is less than or equals to 1 millisecond with 99.999% assurance of delivery	Network latency is 10 milliseconds	Network latency is less than 10 milliseconds for 5Ghz band

How can companies leverage the 5G technology for their business?	
Remote control and monitoring	• 5G can support the time-critical operations in remote plants from a central command center. • 5G can deliver the sensing or remote-control abilities of innovations like cobots, drones or self-driving cars with the right level of security • 5G will support the development of cloud-based, high resolution AR/VR services, driving adoption and enabling remote operations / maintenance / training solutions through AR/VR • 5G's faster wireless communication can provide high quality, real-time video feed for surveillance allowing remote control of distributed production lines. • 5G's ability to connect more devices with improved security will enhance the effectiveness of remote monitoring of en-route shipment conditions (e g., temperature and humidity)
Real-time services and analytics	• 5G's faster wireless communication, improved reliability and ability to connect 10–100x more devices can provide real-time information from a large set of devices, which can be converted into real-time insights leveraging edge computing • 5G will enable flexible management of edge and cloud resources, such as on-demand deployment of applications or data transfer • Low latency of 5G network will also enable the real-time emergency shutdown of remote systems • 5G will increase the effectiveness of monitoring and alert systems, leveraging its ability to connect more devices over more reliable and secure network • 5G's ability to connect 10–100 times more devices with better security protocols and 99.999% availability will make uses such as self-triggered order placement based on inventory levels possible.

09 How much future is in your factory?

What are the pain points on which most improvement is necessary? How digital is your factory compared to the competitors from your industry? Dürr Consulting will help you to assess the digital readiness of your factory and ensure to guide your manufacturing site to the next level of digitalization.
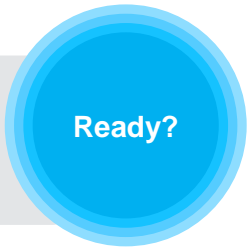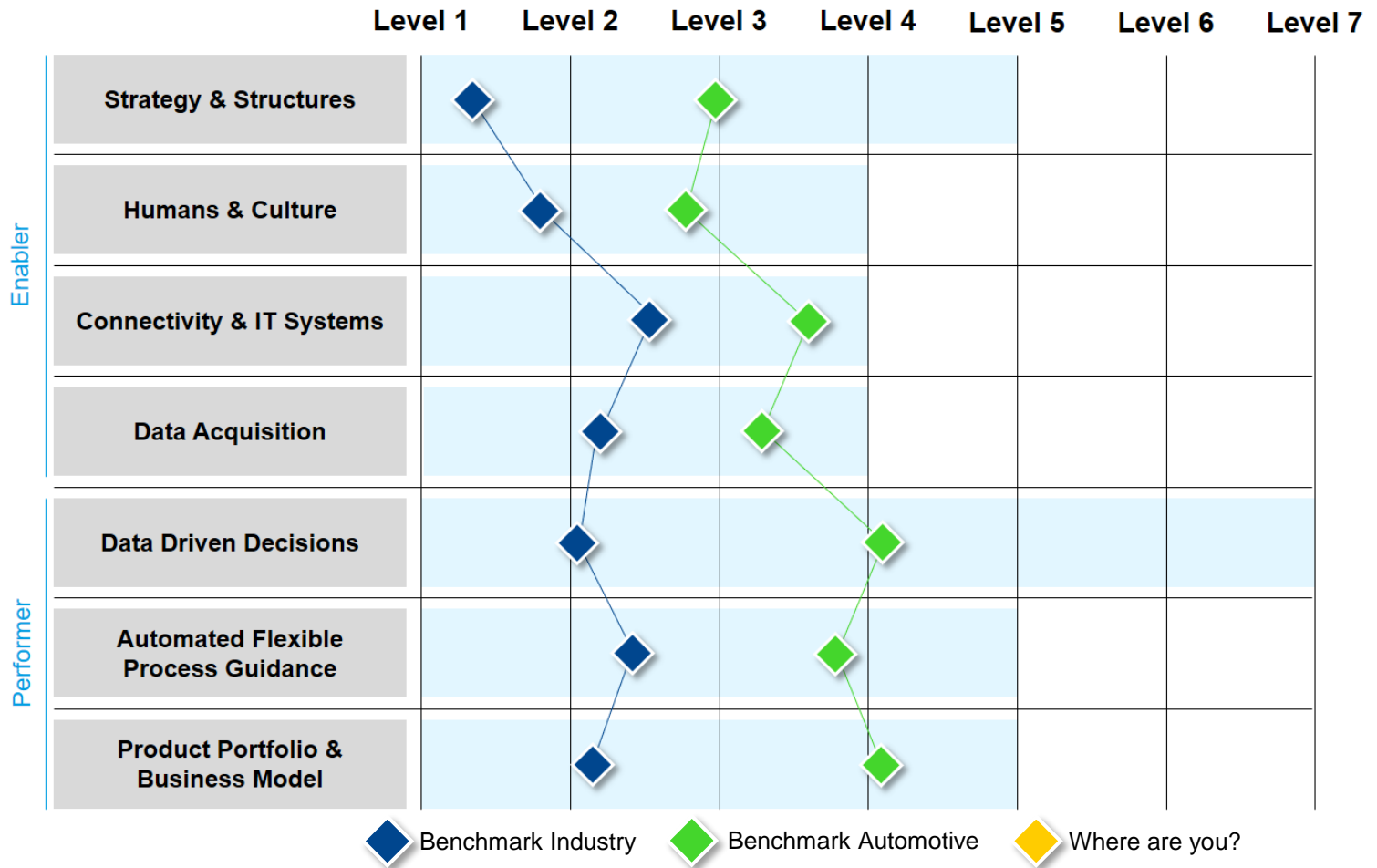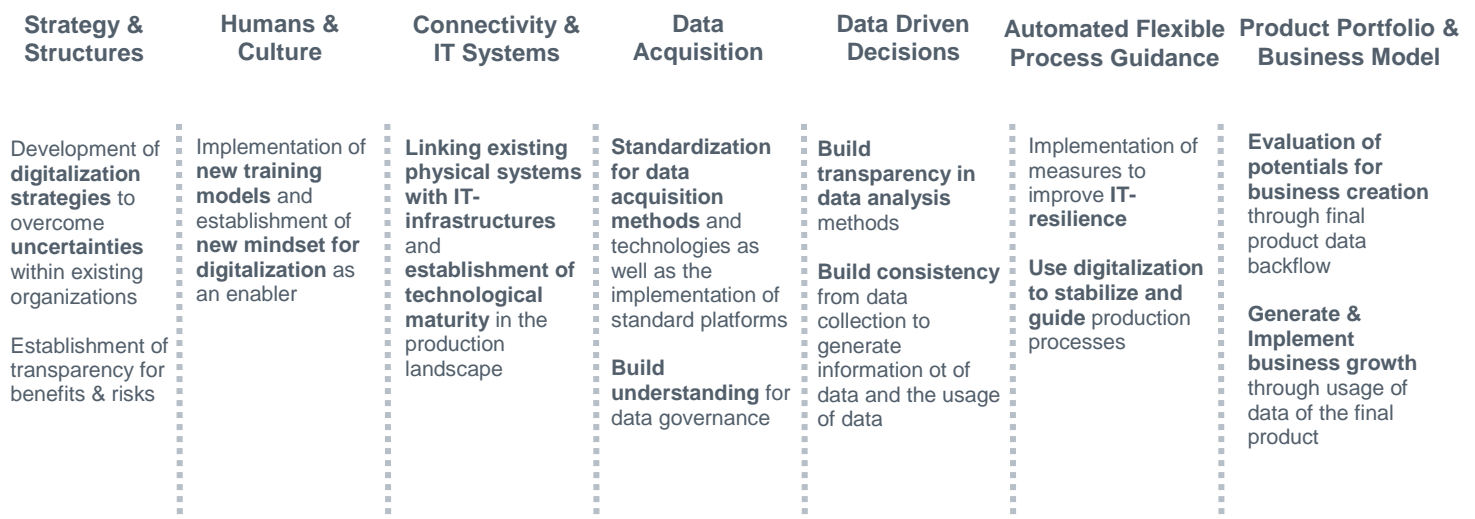
Ready?

Figure 4 — Benchmarking digitalization maturity in the manufacturing industry

Benchmark Industry · Benchmark Automotive · Where are you?

How to bring your factory to the next level

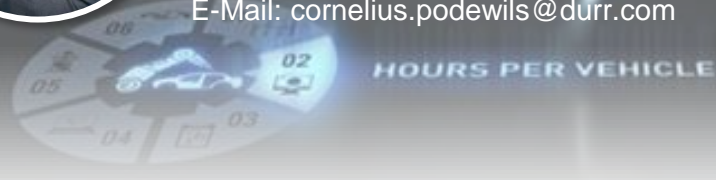| Strategy & Structures	Humans & Culture	Connectivity & IT Systems	Data Acquisition	Data Driven Decisions	Automated Flexible Process Guidance	Product Portfolio & Business Model
Development of **digitalization strategies** to overcome **uncertainties** within existing organizations Establishment of transparency for benefits & risks	Implementation of **new training models** and establishment of **new mindset for digitalization** as an enabler	**Linking existing physical systems with IT-infrastructures** and **establishment of technological maturity** in the production landscape	**Standardization for data acquisition methods** and technologies as well as the implementation of standard platforms **Build understanding** for data governance	**Build transparency in data analysis** methods **Build consistency** from data collection to generate information ot of data and the usage of data	Implementation of measures to improve **IT-resilience** **Use digitalization to stabilize and guide** production processes	**Evaluation of potentials for business creation** through final product data backflow **Generate & Implement business growth** through usage of data of the final product

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