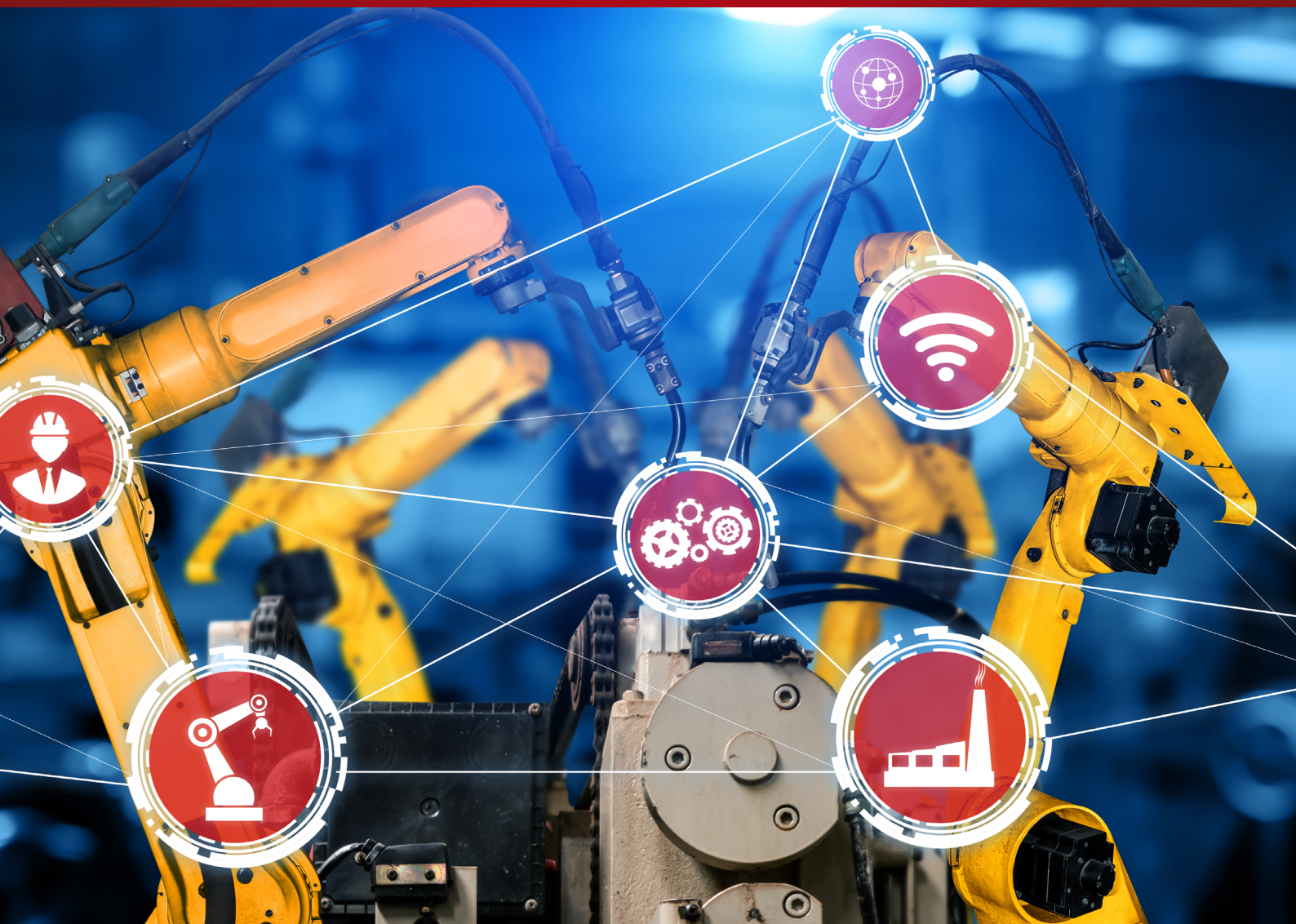
BECKHOFF New Automation Technology

Automation to Scale

Unlocking Efficiency and Innovation with Cloud-Based Engineering



In an industrial era where real-time visibility, connectivity and scalability are key to staying competitive, businesses are increasingly moving to the cloud. Why? Because in automation terms, having a cloud-based approach will help businesses stay ahead of the curve and reap the benefits of digitalisation.

Ultimately by migrating to the cloud, companies have the ability to rapidly scale resources as needed, pay only for what they use, and quickly deploy and iterate on applications.

Cloud engineering also ensures reliability, security, and global reach, allowing organisations to focus on their core business objectives.

This white paper examines the current industrial landscape, the challenges faced in automation with traditional technology and legacy equipment, and the reasons behind the industrial migration to cloud platforms and technologies.

It defines what cloud-based engineering is, the benefits it can provide, and its role in enabling digitalisation.

The current industrial landscape

While automation in industry is hardly novel, digitalisation – and the advanced technologies that fall under the Industry 4.0 umbrella – is indelibly changing the modern industrial landscape. While the third industrial revolution focused on the performance of individual machines or singular processes, the primary goal of Industry 4.0 is integration of systems and processes in an entire production value chain.

What does Industry 4.0 mean for automation?

At its core, automation is tasked with increasing the quality, precision, safety and productivity of industrial businesses. It can only achieve these goals, however, if the technology supports the growth and speed of demand. To compete in a world challenged by climate change, dwindling resources, and a volatile supply chain, industrial businesses must embrace the technologies of Industry 4.0 to maintain a competitive edge and meet demand.

This, in turn, has created a paradigm shift in how industrial businesses operate. In the modern industrial landscape, the need for remote collaboration and flexibility has increased. As has the need for efficiency, scalability and innovation. All of which can only be achieved through profound digitalisation – a necessity in the fourth industrial era. Importantly, cloud-computing is a key subset of Industry 4.0, providing businesses with the opportunity to access and manage data flow over the internet.

To ignore this progression, is to be left behind. To embrace it, is to embrace a future of smart, fast, sustainable productivity.

Coming together under Industry 4.0

According to McKinsey, if internet users searched the term 'Industry 4.0' on Google before 2014, they would be lucky to return any results.

By 2019, however, a McKinsey global survey found that 68% of respondents not only knew what the term meant, but viewed it as a top strategic priority[1,2]. This illustrates just how much the term has grown from that of a manufacturing buzzword, to one that encapsulates the industrial era in which the world is immersed.

KPMG defines Industry 4.0 as the coming together of many individual technologies combined in different ways to automate processes and data exchange at an enterprise level[3].

Current industry challenges around technology

When it comes to automation in the modern era, a primary challenge industrial businesses face is adopting technology solutions that will evolve as requirements change. For example, traditional infrastructure is often rigid and isolated, with inadequate data frameworks to support the instant interconnectivity and real-time data. However, cloud-based engineering offers a transformative solution to address these challenges, providing flexibility, agility, and advanced data frameworks to support dynamic business needs.

Common organisational challenges:

- Expense of infrastructure and hardware
- Insufficient storage on physical servers
- Limited access to real-time data and remote monitoring of assets due to strict IT protocols
- Security concerns around data protection and unauthorised access

What is cloud-based engineering?

In industrial automation, there are many processes, machinery and systems that need to work together. Cloud-based software engineering connects stand-alone elements into a cohesive and responsive ecosystem as data can be accessed from anywhere.

Essentially, cloud-based engineering facilitates services such as servers, databases, storage, analytics, and intelligence over the internet, by syncing all connected devices. This, in turn, allows for quick adaptability to industry needs by offering flexible resources and scalability.

All of this can be leveraged to get a panoramic view of data, to track trends, build customised reports and analyse them to improve processes. This is why cloud-based engineering is viewed as a game-changer – as it is reshaping how industrial businesses approach automation.

Why the cloud?

Cloud computing presents a huge opportunity for machine builders and plant operators: By maximizing the potential of PC- and cloud-based control technology to create automation networks, they can gain and retain a competitive edge over the intermediate and longer term.

Connecting machines and equipment – both locally and, more importantly, across multiple locations – not only breaks ground for new business models, it also boosts efficiency throughout production processes – from engineering to cloud-based operational data analysis to dependable predictive maintenance strategies for greater availability and less downtime.

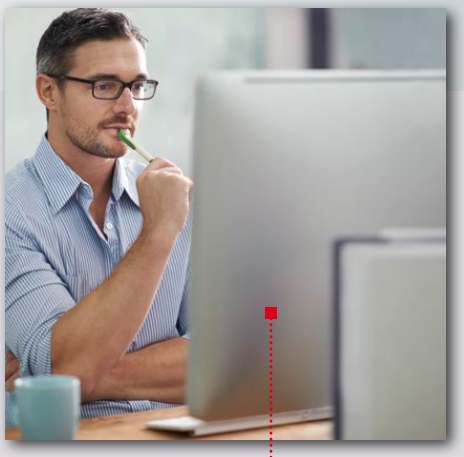
Another one of the main advantages of migrating to a cloud computing model is the infinite amount of space, offering companies ample room for growth and scalability. Cloud-based servers offer a practical solution for hosting systems and programs, and for facilitating data storage and exchange.

Conversely, physical servers will to support large volumes of data that industrial businesses require to enable the efficiencies that come through digitalisation. The benefits of cloud computing are well-documented.

For example, a global survey conducted by Dell in 2016, found that companies that invest in big data, cloud, mobility, and security enjoy up to 53% faster revenue growth than their counterparts[4].

In another study, cloud services provider RapidScale found that 94% of businesses saw an improvement in their security after switching to the cloud, while 91% said the cloud made it easier for them to meet compliance requirements[5].

In a nutshell, as industries make the move to the cloud, they are realising cost savings, scalability, better security, and the ability to use cutting-edge technology for innovation.



Benefits of cloud based engineering

Scalability:
Automation needs can vary significantly. Cloud-based engineering allows systems to expand or cut back based on demand. This flexibility helps companies adjust to changes swiftly, making it easier to handle different workloads.

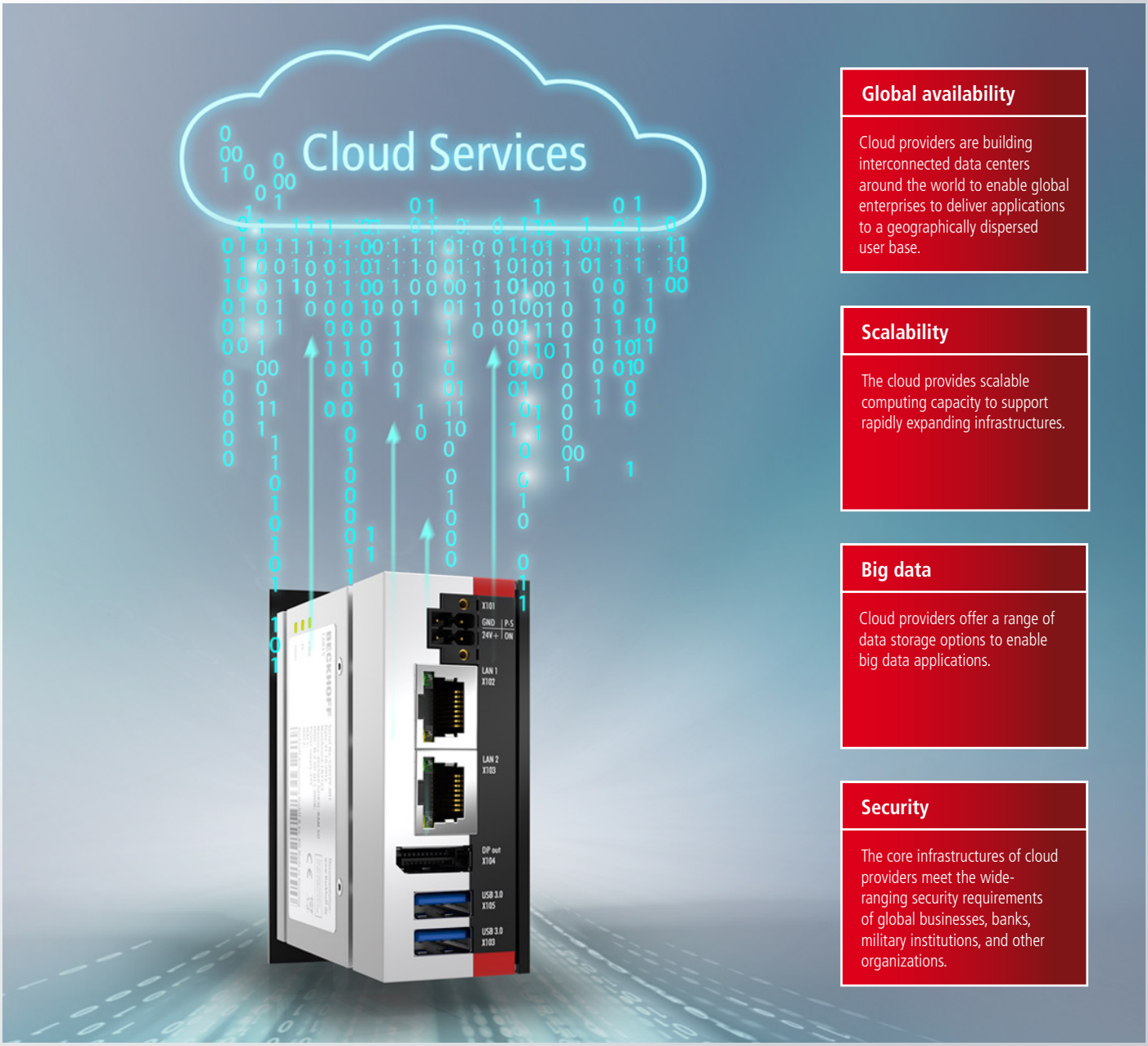
Collaboration:
Traditional setups struggle when teams are working remotely
Cloud-based engineering makes collaboration easy, letting teams work together no matter where they are. This enhances efficiency and decision-making.

Data accessibility:
In automation, decisions rely on data. Cloud-based solutions store and analyse data in one place, making it accessible. This not only helps with day-to-day tasks but also allows for smarter decisions based on insights gained from the data.

Security:
Automation deals with sensitive data and processes. Cloud-based engineering goes the extra mile in security because it makes use of data encryption, often more than what individual companies can do on their own. This ensures data safety and protection against cyber threats.

Cost savings through effective resource management:
Cloud-based engineering doesn't require a big initial investment in physical infrastructure. Companies pay for what they use, which allows them to optimise costs. In the automation sector, this means more resources for innovation instead of spending on maintenance.

Harnesses Industry 4.0 technologies:
Cloud platforms are perfect for integrating advanced technologies such as AI, ML, and IoT. In automation, this translates to more efficient processes. Cloud-based engineering is a gateway to using the latest technology for better results.



Global availability

Cloud providers are building interconnected data centers around the world to enable global enterprises to deliver applications to a geographically dispersed user base.

Scalability

The cloud provides scalable computing capacity to support rapidly expanding infrastructures.

Big data

Cloud providers offer a range of data storage options to enable big data applications.

Security

The core infrastructures of cloud providers meet the wide-ranging security requirements of global businesses, banks, military institutions, and other organizations.

Overcoming adoption challenges

Industrial businesses may have concerns about adopting cloud-based technology. Here are some commonly perceived challenges, with answers to the questions posed.

Interoperability

Will applications and services work seamlessly across different loud platforms?

As long as as there is an emphasis on adhering to international standards and open-source solutions, then the short answer is yes. Industrial businesses are advised to opt for technologies and frameworks that are widely supported and compatible across various cloud providers.

Data Portability

How easily can data be moved between different cloud providers or brought back on-premises?

With cloud-agnostic data storage solutions, data can be easily migrated between different cloud environments. Use standard formats and Application Programming Interfaces (APIs) for data interchange.

Cost Management

Will managing costs become complex when dealing with multiple cloud providers?

It doesn't have to be. Implement robust cost management strategies and leverage tools that provide visibility into spending. Use cost estimation and monitoring tools.

Security and Compliance

Will security and compliance standards be consistent across various cloud services?

Yes, as long as a business prioritises cloud-agnostic security practices. Implement a robust security framework that complies with industry standards and regularly audit and monitor security measures to ensure consistency across cloud platforms.

Vendor Lock-In

How can businesses avoid getting locked into a specific cloud provider's ecosystem?

Choose technologies and services that are not tightly coupled with a specific provider. Prioritise solutions with easy migration paths and consider multi-cloud management tools that provide a unified view of resources across platforms.

Performance and Latency

Will performance and latency vary significantly between different cloud providers?

Businesses can optimise their applications for cloud-agnostic deployment, to factor in the different performance characteristics of various providers. Utilising content delivery networks (CDNs) and edge computing will also minimise latency.

Skillset and Training

Will managing multiple cloud environments require a diverse skill set?

Probably. It's recommended that industrial businesses invest in training programs that cover cloud skills. Training sessions that focus on foundational knowledge that is applicable across different platforms will reduce the learning curve when working with new cloud providers.

78% of companies have adopted cloud in most or all part of their business

80% of manufacturing companies worldwide that adopted cloud computing have reported drastic operational improvements

The cloud has brought a 22% rise in profitability for manufacturing industries worldwide.

TwinCAT Cloud Engineering: A solution for now and the future

The 'Cloud Engineering' function that is available with Beckhoff's integrated software platform, TwinCAT, provides users with an easy means of engineering TwinCAT instances and controllers in the cloud. This adds a new dimension to Beckhoff's PC-based control technology, essentially creating a comprehensive platform in which industrial businesses can truly utilise the advanced technologies of Industry 4.0 – such as IoT infrastructures – to drive advancement and efficiencies in production.

Accessible through the Beckhoff website, this cloud-based solution offers registered users a range of functionalities. From creating TwinCAT Cloud Engineering instances to establishing secure connections with physical control hardware, users can seamlessly manage tasks remotely.

TwinCAT cloud achieves this in two steps:

1. Setting up Secure and Scalable Connections:

This involves establishing secure and scalable connections between geographically distributed control systems. It is necessary to support scenarios that involve big data or analytics, where data from various sources needs to be collected, processed, and analysed. The emphasis is on ensuring that the connections are not only secure to protect sensitive information but also scalable to accommodate the volume of data generated.

2. Ensuring Easy Remote Operation and Maintenance:

This step ensures that the interconnected systems established in the first step are easy to operate and maintain remotely. Once the connections are in place, the focus shifts to user-friendliness. The goal is to make it as convenient as possible for users to remotely operate and maintain these distributed control systems. This involves designing interfaces, controls, and maintenance procedures that are intuitive and accessible from a remote location, enhancing overall system manageability and reducing the need for on-site intervention.

Key features and benefits of TwinCAT 3:

- Seamlessly integrates with Microsoft Visual Studio, leveraging Visual Studio's capabilities to enhance engineering efficiency.
- Extends programming options to all IEC61131-3 languages and facilitates MATLAB, Simulink, IoT, cloud, and edge computing integration.
- Optimises industrial automation programming, promoting collaborative teamwork on one unified system and shared updated main code.
- Comes with free development software and testing, including all libraries.

All of the above results in automation concepts that fulfil the basic principles of an open and scalable control system. Both engineering and runtime can be flexibly extended by application-specific software modules, known as functions, so that the TwinCAT system can be perfectly adapted to suit individual requirements.

This modular concept is key to a modern, flexible, cost effective and stable platform with long-term availability, and machine series can be continuously developed over many generations with minimum migration effort.

Real case story: Yummy Bakery goes from the kitchen to the cloud

The Yummy Bakery pancakes of Belgium are available in almost every supermarket in the country. Based on a homemade recipe, this family owned-and operated business has had to scale with automation over the years to meet demand. More recently, this has meant adopting a cloud platform to start realising the benefits of digitalisation. Beckhoff's PC-based control technology and the TwinCAT programming tool are fundamental to this platform.

Starting small, Yummy Bakery together with CTRL Engineering, decided the first challenge to tackle in their digitalisation journey was weight inconsistences in the pancake production. The initial step was to monitor the pancakes' weight to detect deviations – this was achieved by using a servomotor as a virtual sensor to measure weight, in addition to a checkweigher used at the end of the packaging line. Importantly, they used TwinCAT in conjunction with their cloud platform to integrate all of the measured data and were able to reduce deviation in the pancakes' weight by 0.4g. This translated to a cost savings of up to 8% in raw materials.
The next step on the Yummy Bakery agenda is to automate quality inspection at the end of the packaging line by adding vision capabilities. Beckhoff is in the process of training a machine learning model to recognise more fonts. The potential profits could serve to install a second production line, adding 50% more production capability to the business.[6]

In summary

For industrial businesses, the ability to use cloud-based services is imperative to staying competitive. In particular, cloud-based engineering enables businesses to harness the benefits of digitalisation, including the use of advanced technologies to gain better insights, efficiencies and cost savings. Most importantly, cloud-based engineering allows for automation at scale. Based on Beckhoff's proven PC-based control technology, the TwinCAT software engineering tool provides a complete cloud-based engineering platform that will ensure businesses can evolve and advance with their production capabilities and innovation in the era of Industry 4.0.

Take your first step into the future of
automation with cloud-based engineering

► **www.beckhoff.com/en-au/products/automation/cloud-engineering/**

REFERENCES:

1. https://www.mckinsey.com/featured-insights/mckinsey-explainers/what-are-industry-4-0-the-fourth-industrial-revolution-and-4ir
2. https://www.mckinsey.com/industries/industrials-and-electronics/our-insights/capturing-value-at-scale-in-discrete-manufacturing-with-industry-4-0
3. https://assets.kpmg.com/content/dam/gated/au/pdf/2023/kpmg-industry-4.0-the-australian-manufacturing-advantage.pdf#msdynttrid=I6Kksyr24upRU6fTmpwaGA7HMkkt0gV3P27Ey2514VE
4. https://www.dell.com/en-us/blog/cloud-mobility-security-and-big-data-the-big-4-for-business-growth-study/
5. https://www.slideshare.net/rapidscale/cloud-computing-stats-security-and-recovery
6. https://www.beckhoff.com/en-en/company/news/from-the-kitchen-into-the-cloud-digitalization-recipe-for-the-pancake-of-tomorrow.html

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