



STUDY INDUSTRIAL EDGE COMPUTING 2021

In cooperation with our exclusive study partner

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A current study project by



Partner

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Imprint

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Cloud or Edge?

The attitude of companies in the D-A-CH region regarding the Cloud has for many years been characterized by a discreet reluctance. Perhaps you don't need to 'jump on every train' and introduce every new technological achievement immediately. In particular, the German SMEs has always done well with the tactic to let others go first and wait to see if they get a 'bloody nose.' The realization that data in a Cloud is by no means less secure than in the basement of your own data center, however, took a long time to take hold.

In the meantime, the Cloud is no longer considered to be the devil's work and is now increasingly considered an attractive option. But even if it meets the security requirements, the Cloud is not always the best or ideal solution.

Especially in the manufacturing industry, digital transformation is causing the volume of data to explode. In production machines and machine tools, in processes and systems, data is generated with valuable information for the company. It makes sense to analyze them immediately at the point of origin and not first transfer them to a cloud, which is then much more complex to access later.

What does the reality look like in industrial companies today? Do the on-site experts even know the options that are

available to them? How do you solve the problem – Cloud or Edge Computing, in which the data is processed de-centrally at the 'edge of the network' – that is, at the edge?

Or do you prefer solutions in which both are used and linked with one another, that is, local data processing with subsequent forwarding to the cloud?

Exciting questions in an environment of change. Reason enough for IDG Research Services and Siemens to take a closer look behind the scenes and to do a study on Industrial Edge Computing. Given the market dynamics, it can only be a snap-shot, but one that is worthwhile. The results of the survey allow the conclusion that companies are to a large extent ready to embark on new paths and solutions. You see the opportunities and the abundance of areas of application.

So, is this the end to a modest reluctance? Let's see.

I wish you an inspiring read.

Matthias Teichmann
Director IDG Research Services

Edge and Cloud!

Whether locally or in the cloud, on their own or via a service provider – companies take different paths to capture and analyze data from production and based on this, to continuously improve their processes.

In the meantime, and this is also shown by the present study, the trend is moving away from traditional local data processing – which keeps all hardware and software in the company and so requires a lot of own effort for software maintenance – towards cloud-based data processing. The advantage of cloud-based data processing: applications can be easily updated, managed, and scaled, as updates can be installed on all servers via a central cloud-management system.

While Cloud Computing is becoming ever more established, at Siemens we see the development of Edge Computing as a logical addition.

Edge Computing enables users to close the gap between traditional local and cloud-based data processing, depending on their individual production requirements. In contrast to the central data processing of Cloud Computing, Edge Computing works with a decentralized data processing concept. Functionality and intelligence are being shifted away from centralized server landscapes in the Cloud to the data source in the au-

tomation system and so to the Edge of the network. The advantage: high-frequency data can be captured, pre-processed, and analyzed locally in real time, with almost no backlash.

Edge Computing is a reasonable solution, especially for industrial applications that require high computing power, such as AI or machine learning applications.

According to the present study, AI and ML applications are already being used intensively by over two thirds of the companies surveyed.

So, it is exciting to see where the journey is headed. One thing is certain, however: digital transformation is already changing the way manufacturing companies analyze and improve their processes. In the interplay of Cloud and Edge Computing, production processes can in future be made even more transparent and therefore more efficient and economical – all in accordance with the necessary security standards. This means that the ever-increasing amount of data will also be able to be handled safely and flexibly in the future.

We hope you enjoy reading the study!

Katharina Lamsa & Andreas Friedrich
Press Spokespersons
Siemens Digital Industries



Knowledge is power. Ignorance jeopardizes the future...

A **good third** of production managers and PLM/supply chain experts have never heard of Industrial Edge Computing or have no knowledge of corresponding projects in their own company

Management Summary

Overview of key findings

63%



53%



51%



Diversity instead of the 'killer application'

Quality optimization (**63 percent**), condition monitoring (**53 percent**) and the optimization of machine processes (**51 percent**) are the most frequently mentioned fields of application.

57%



19%



High feel-good factor

Almost **six out of ten companies** are satisfied or very satisfied with their (initial) experience with Industrial Edge Computing. IT managers have a more critical point of view (**19 percent**).

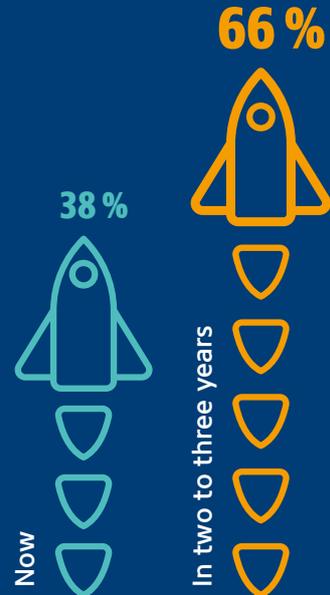
AI and ML as an all-purpose tool

On the one hand, companies want to use AI and ML to improve existing internal processes (**50 percent**), but on the other hand they also want to try new things: new products (**44 percent**) or develop innovative business models (**33 percent**).



Industrial Edge Computing as a high-flyer

For **60 percent of companies**, Industrial Edge Computing will be very important in two to three years at the latest. This is already the case today for a **good third** of companies.



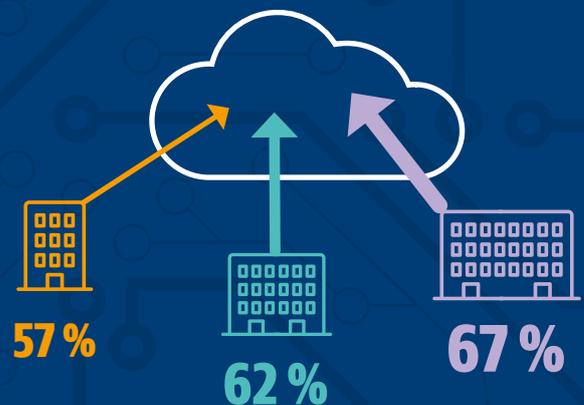
No fear of the future

Two thirds of companies use AI and ML-based analysis solutions. However, too few IT platforms still have such functions.



Cloud is cool!

The affinity to the Cloud correlates with the size of the company: only **57 percent** of small companies, but **62 percent** of medium-sized companies and **67 percent** of large companies would store data in the Cloud or at least in EU data centers.



AI prefers an Edge platform

When it comes to the platforms on which AI and machine learning applications run, **36 percent** prefer Edge platforms and almost **21 percent** prefer the Cloud. Around **34 percent** of those surveyed expect that both approaches will be used equally.

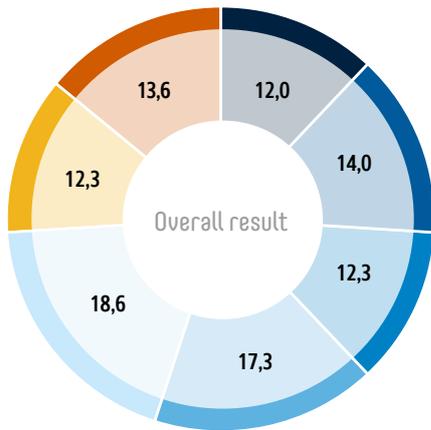
The key results

Numbers and analysis that are particularly important from the point of view of the IDG market research team

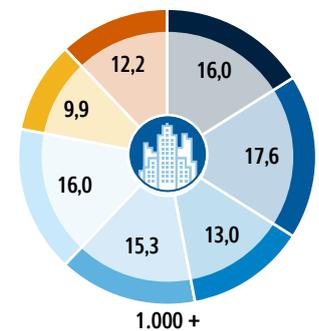
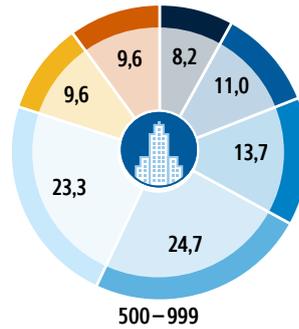
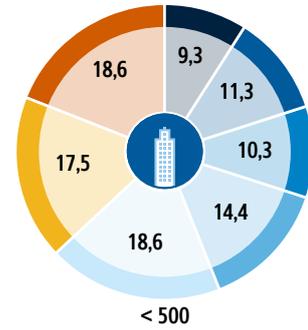


What is the status quo in your company regarding Industrial Edge Computing?

Numbers in percent. Basis: n = 317



Result split by company size



Production specialists are not yet very familiar with Industrial Edge computing.

Around 36 percent of production managers and 36 percent of PLM and supply chain experts in German companies have not yet heard of Industrial Edge Computing or have no knowledge of corresponding projects in their companies. Twenty-six percent of the companies are already using this technology. Another 30 percent are in the planning phase.

This means that the communication between the specialists in the areas of manufacturing technology, OT, production, and PLM on the one hand and the management on the other should be optimized.

This is because around 49 percent of managers are informed about Industrial Edge Computing and its use in the company.

Larger companies in particular (34 percent) with more than 1,000 employees are already

betting on Industrial Edge Computing or have started field tests.

On the other hand, figures are lower in small and medium-sized businesses: only 19 percent of companies with 500 to 999 employees and 21 percent of smaller companies with fewer than 500 employees use Industrial Edge Computing. It is conceivable that these companies do not have enough knowledge about this technology and its advantages, i.e., there is a need for clarification.

- Industrial Edge Computing is being used on a large scale.
- First field tests with Industrial Edge Computing.
- Industrial Edge Computing will be introduced soon.
- Currently working out a (new) strategy for data processing.
- Industrial Edge Computing is generally considered.
- No activities / no current plans
- Never heard of Industrial Edge Computing

For 60 percent of companies, Industrial Edge Computing is very soon of great importance.

This applies to the period in two to three years. Thirty-eight percent of those surveyed already rate this approach as vital or very important. The companies are therefore aware of the relevance of the technology. However, this is especially true for large companies: for 69 percent, Industrial Edge Computing will be a key technology in the medium term.

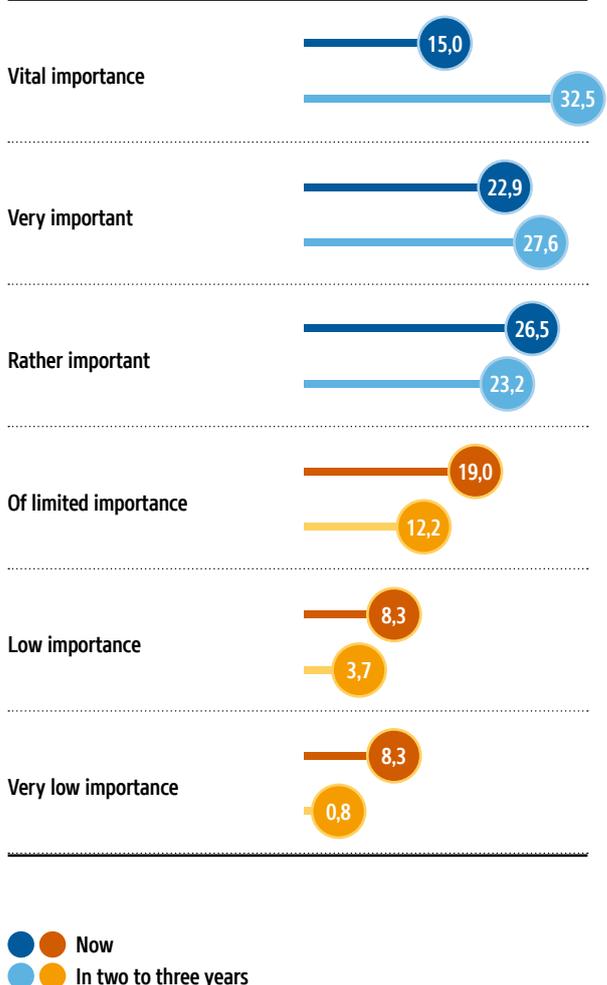
However, only 56 percent of medium-sized companies come to the same assessment with up to 1,000 employees and 35 percent of the smaller companies. But also – or especially – companies of this size can benefit from Industrial Edge Computing.

It is noticeable that 72 percent of production and manufacturing managers will attach high to very high importance to Industrial Edge Computing in two to three years.

This does not match with a result of Key Finding 1 – consequently almost a third of

What is the significance of Industrial Edge Computing in your company today, and what significance will it have in two to three years?

Numbers in percent. Filter: Participants who know what Industrial Edge Computing is about. Basis: n = 260

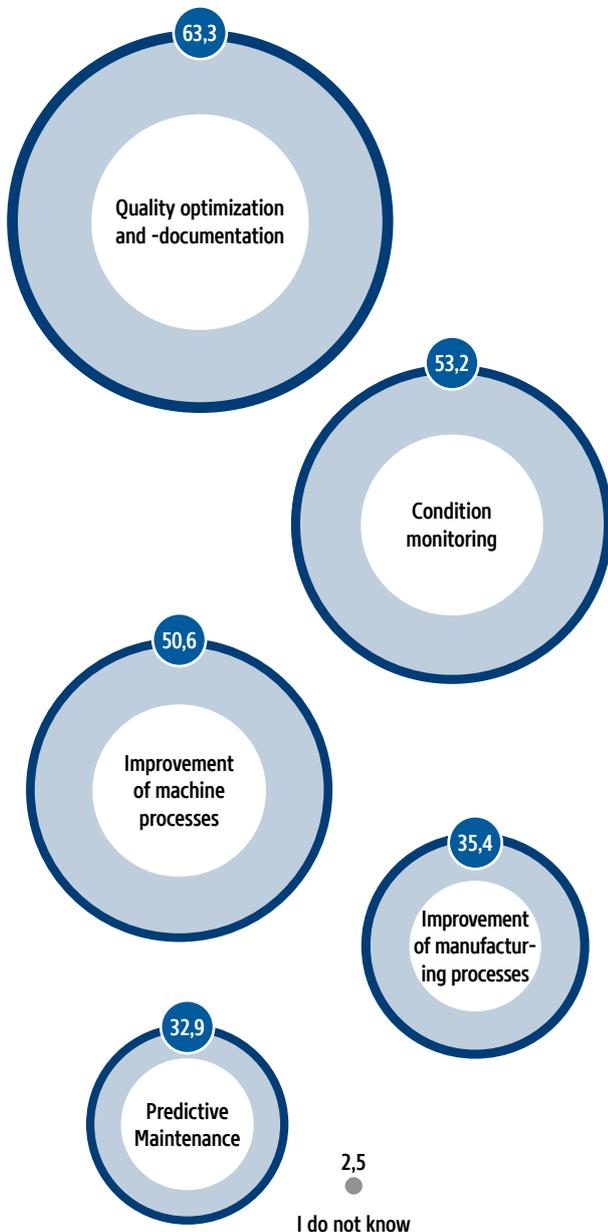


these experts have not yet heard of this technology or corresponding (pilot) projects in the company – possibly an internal communication problem.

There is also a need for information about the possible applications and advantages of Industrial Edge Computing among logistics and supply chain specialists. Only 35 percent rate the technology as relevant in two to three years. There are already successful examples of applications today, for example in the beverage industry.

In which application areas do you already use Industrial Edge Computing?

Numbers in percent. Multiple answers possible. Filter: Companies in which Industrial Edge Computing will be introduced soon, is already being tested in field trials, or is already being used on a larger scale. Basis: n = 79



Companies use Industrial Edge Computing in many different areas of application

There is no such thing as a single 'killer application.' Rather, there are several central fields of application, such as quality optimization (63 percent), condition monitoring (53 percent) and the optimization of machine processes (51 percent). This underlines the far-reaching potential benefits of Industrial Edge Computing.

One third of the companies use the technology in the future-oriented area of predictive maintenance. This applies equally to small, medium, and large companies.

There are clear differences, depending on the size of the company, or regarding the application scenarios. For example, 43 percent of smaller companies (less than 500 employees) use Industrial Edge Computing to optimize manufacturing processes, but only 28 percent of medium-sized companies.

For medium-sized companies, on the other hand, the improvement of machine processes (61 percent) and condition monitoring (72 percent) are more important than for small and large companies.

Noticeable differences in perception of the use of Industrial Edge Computing can also be seen between CIOs and Chief Digital Officers (CDOs) as well as the heads of production and manufacturing. CIOs and CDOs place more emphasis on predictive maintenance (60 percent) and quality optimization with the help of this technology, while production specialists focusing on better manufacturing and machine processes (71 percent each). Here, too, there is a need for coordination between the two 'worlds.'

Artificial intelligence and machine learning are used intensively

It is positive that 66 percent of those surveyed already use the AI and machine learning (ML) functions of the IT platforms they use. Another 29 percent of the companies are planning to do this. However, only about 37 percent of the platforms currently have such functions.

In particular, small companies with fewer than 500 employees (77 percent) and large companies (68 percent) use AI and ML-based analytics solutions. They clearly recognize the potential that these approaches offer.

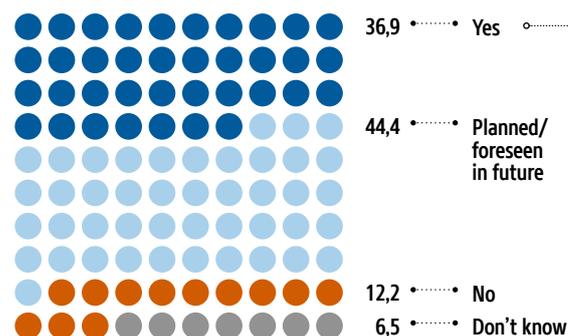
In contrast, only 50 percent of medium-sized companies use AI and ML-based analytics solutions. However, 42 percent of them plan to use AI and ML for analytical purposes. One possible reason for this delay is the lack of specialists such as AI specialists and data scientists, and another is the lack of suitable business models and application scenarios.

Around 73 percent of the specialists from production and manufacturing stated that AI and ML are already being used. In the area of supply chain, logistics and PLM, on the other hand, it is only 50 percent.

This is likely to be related to the fact that, according to 48 percent of the specialists from the areas of logistics and supply chain, the platform providers first have to implement appropriate AI-based analysis functions. In production this is only for 35 percent of the solutions the case.

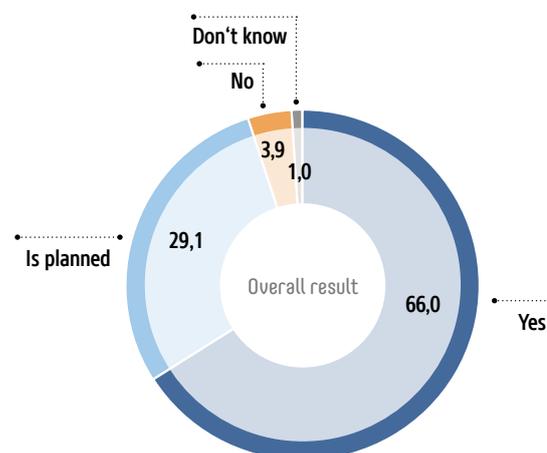
Does the provider of your IT platforms offer AI/ML-based analysis solutions?

Numbers in percent. Filter: Companies using IT platforms. Basis: n = 279



Do you use these AI/ML-based analysis solutions from your IT platform provider?

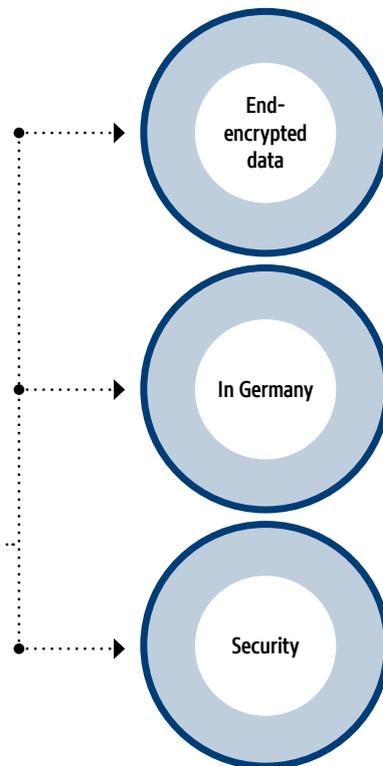
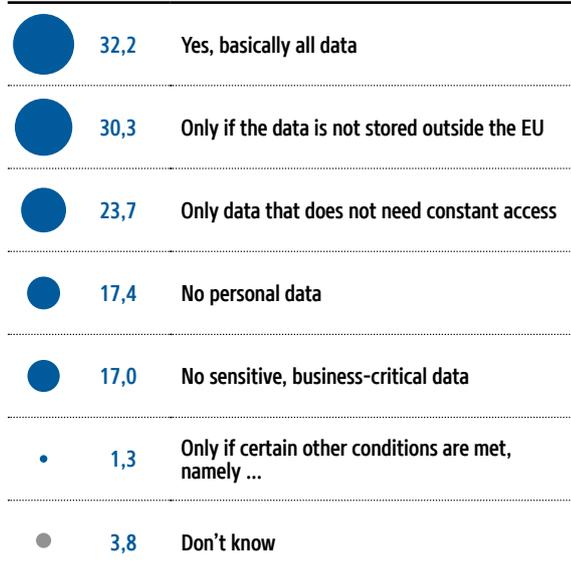
Numbers in percent. Filter: Respondents whose vendors/providers offer AI/ML-based analysis solutions. Basis: n = 103



Is your company ready to process data with Cloud applications?

Numbers in percent. Multiple choices possible. Basis: n = 317

Overall result



Companies of all sizes are open to data processing in the Cloud.

German companies' reservations regarding the Cloud are decreasing. Almost a third would save and process all information, including production and manufacturing data, in a Cloud. Another 30 percent only if this information is stored in data centers in EU countries.

This means that companies are ready to process sensitive data from application development, production, and logistics with the help of Cloud-based IIoT and Industrial Edge Computing platforms.

In particular, business decision-makers would generally save all data in the Cloud or at least in Cloud data centers in the EU (76 percent). It is no surprise that IT security experts are more cautious: only 52 percent share the view of the managing directors.

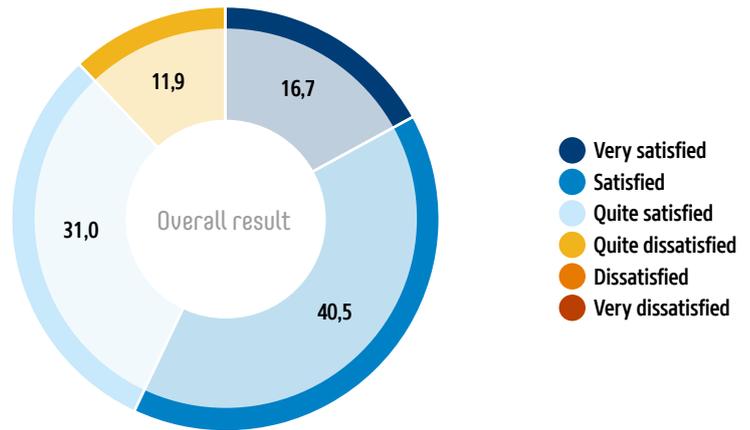
In contrast, Cloud Computing is a viable option for production and manufacturing managers (61 percent), as well as for logistics and supply chain specialists (62 percent). This shows that managers, IT professionals and manufacturing professionals alike see the benefits of the cloud.

There are differences according to the size of the company: only 57 percent of small companies would store data in the Cloud or at least in EU data centers. The values are higher for medium-sized companies (62 percent) and large companies (67 percent).

6

How satisfied are you with Industrial Edge Computing in your company at the moment?

Numbers in percent. Filter: Companies that have already made initial field tests with Industrial Edge Computing or are already using it on a large scale. Basis: n = 42



First experiences with Industrial Edge Computing highly positive

More than 57 percent of companies are satisfied or very satisfied with their (initial) experience with Industrial Edge Computing. Managers (88 percent) as well as CIOs, chief technology officers and chief digital officers (75 percent) come to this assessment. Another 31 percent are 'quite satisfied.' This shows that the technology and corresponding solutions meet expectations.

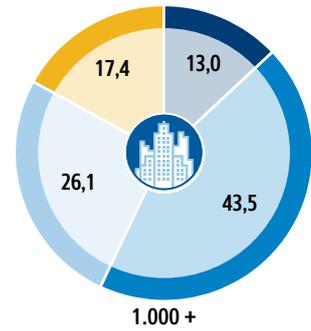
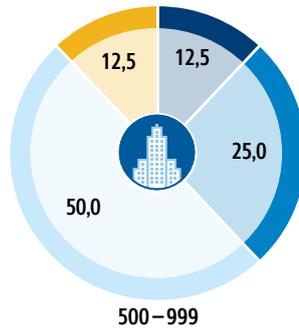
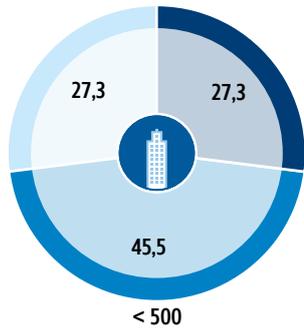
On the other hand, IT managers (44 percent satisfied/very satisfied), IT security experts (67 percent) and production and manufacturing experts (67 percent) are somewhat more cautious.

This may be related to the fact that, in practice, these professionals have faced one challenge or another in implementing industrial edge computing solutions while managers and CIOs are more likely to tend to accompany such projects from the strategic point of view.

What is striking is the small proportion of medium-sized companies (38 percent) who rate their experience with Industrial Edge Computing as satisfactory and very satisfactory. The comparative values for small firms (73 percent) and large companies (57 percent) are significantly higher.

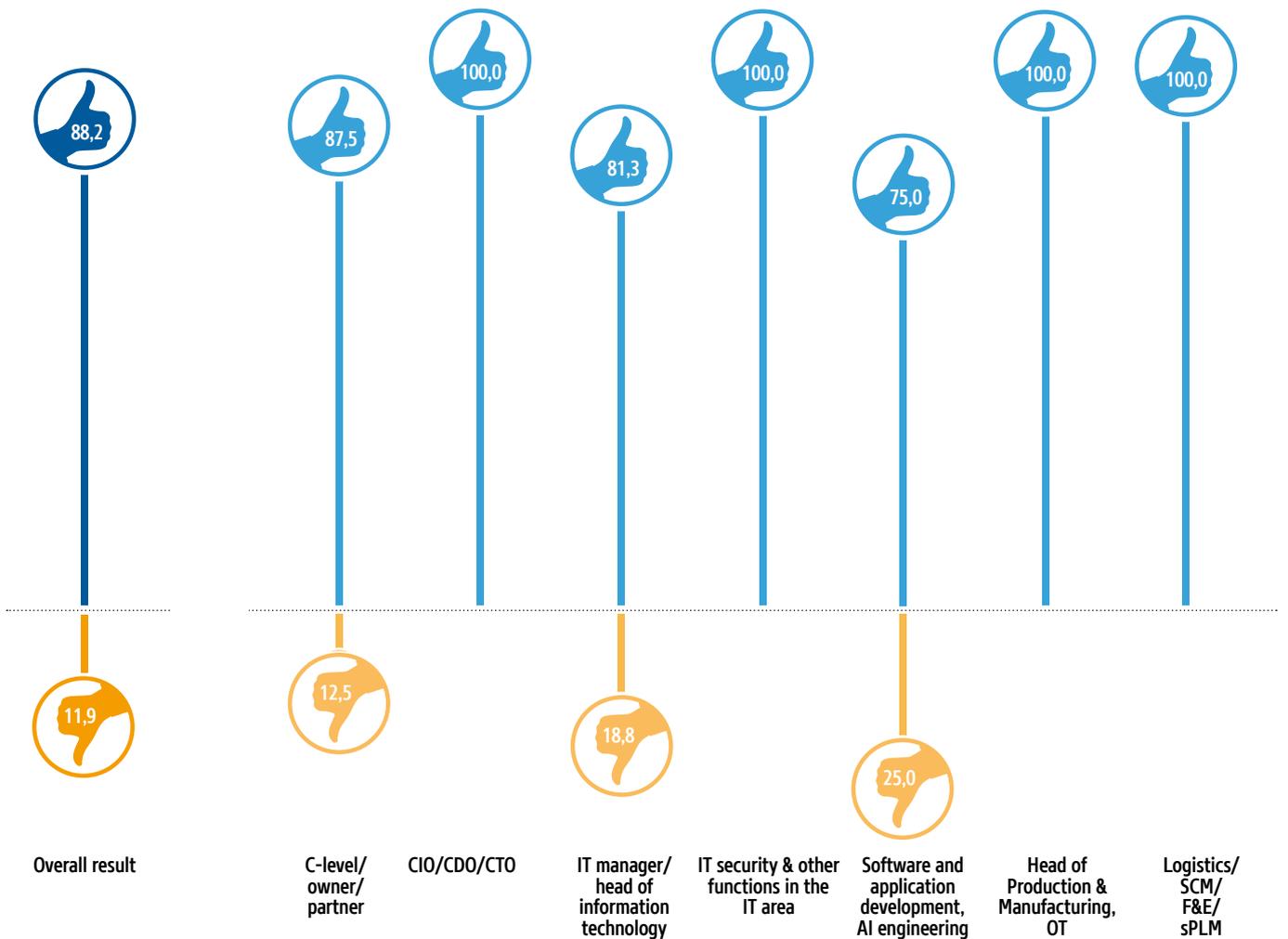
Small and medium-sized businesses may have problems linking their manufacturing environments with Industrial Edge Computing, for example, because of a lack of expertise, expectations that are too high and the lack of specialists.

Result split
by company size



Das scheint nicht zu stimmen, im Deutschen steht hier „Unternehmensbereich“

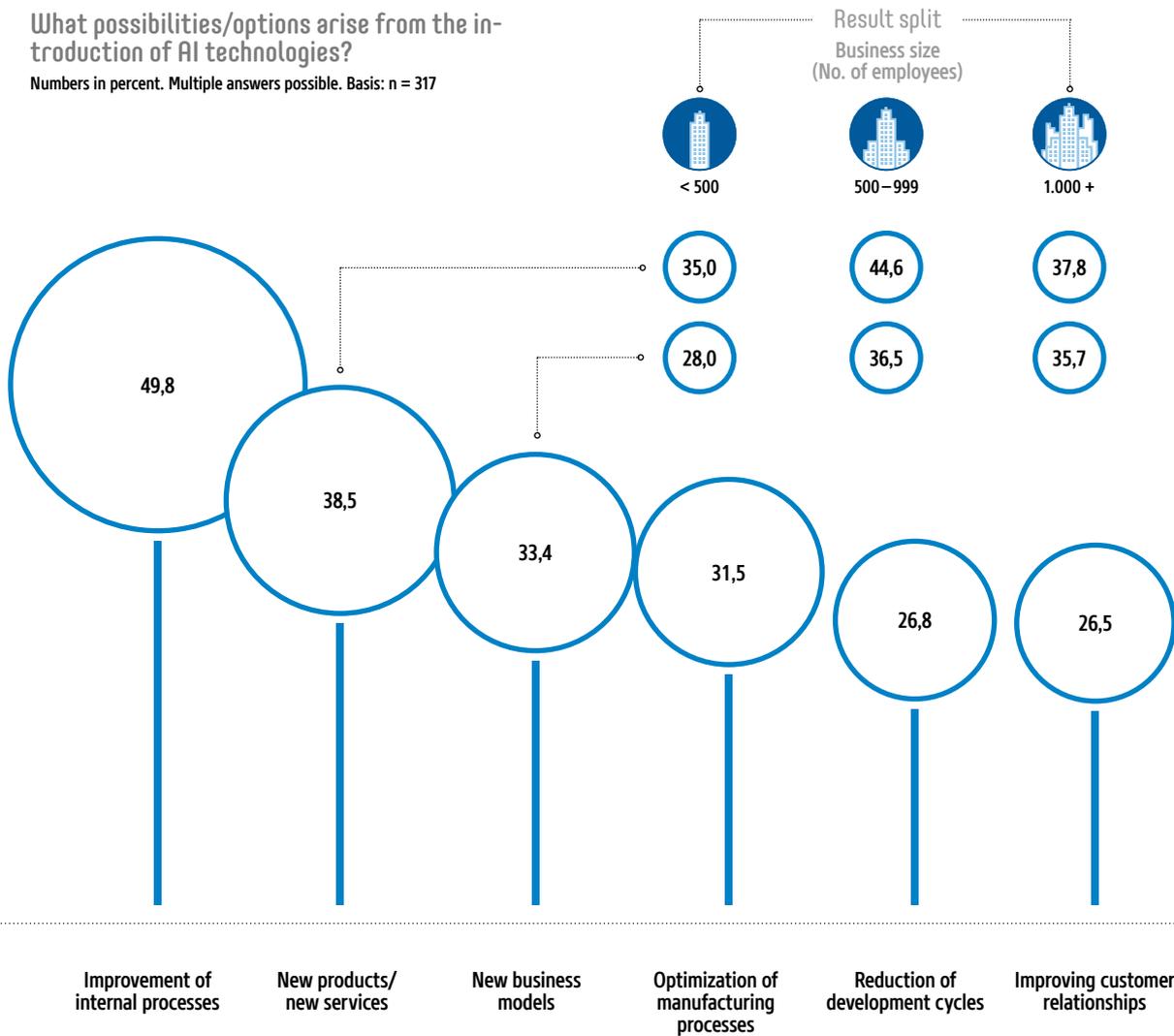
Result split
by company size



● Quite satisfied to very satisfied ● Quite dissatisfied to very dissatisfied

What possibilities/options arise from the introduction of AI technologies?

Numbers in percent. Multiple answers possible. Basis: n = 317



With the help of AI, companies want to optimize processes and develop new offers

When asked what opportunities and options arise from the introduction of AI technologies, the imagination of the respondents is undoubtedly stimulated. Improving internal processes is the top mention, but there are very many different possible areas of application.

For half of the companies, improving internal processes is the most important reason for using AI and machine learning – in other words, a highly likely field of application aims to optimize existing structures.

However, this technology is certainly also used to try new things, such as developing new products (39 percent) or creating innovative business models (33 percent).

AI is also very important (32 percent) as a tool for improving production processes. Understandably, this is particularly important for the heads of manufacturing and production (48 percent).



AI technologies are innovation drivers, especially from the perspective of software developers and AI engineering professionals. The keyword here is new products and business ideas.



In particular, medium-sized companies (100 to 499 employees) use the innovation potential of AI, for example for the development of new products (45 percent) and business models (37 percent). On these points they outperform small and large companies.

AI technologies are innovation drivers, especially from the perspective of software developers and AI engineering professionals. The keyword here is new products and business ideas.



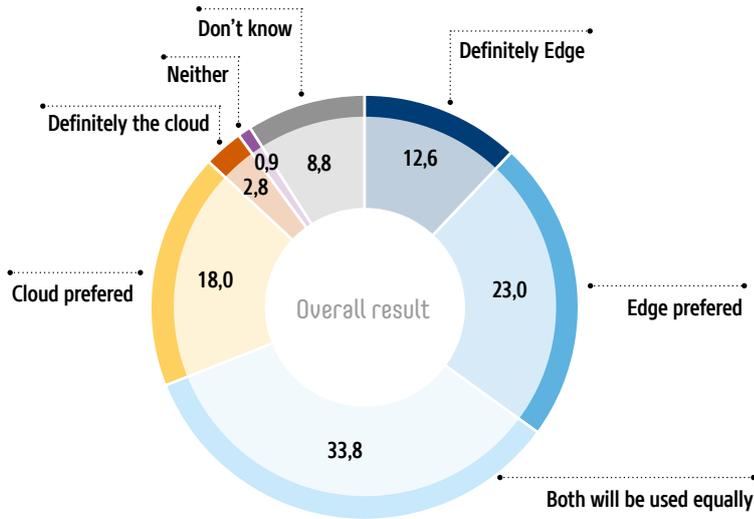
AI is very important as a tool to improve production processes.





Do you prefer Edge or Cloud as a platform for AI and ML applications?

Numbers in percent. Basis: n = 317



AI and ML applications are delivered via Edge and Cloud platforms

There is no clear winner when deciding on which platforms to run AI and machine learning applications – but there is a recognizable trend: 36 percent of companies prefer Edge platforms, while 21 percent prefer a Cloud. Around 34 percent of those surveyed expect that both approaches will be used equally.

The result shows that there is a significant shift from AI and machine learning towards Edge Computing. This is probably due to the short response times that are required in production environments.

Obviously, IT managers (37 percent) and production specialists (38 percent) in particular see this connection. Only around 20 percent of these experts would prefer to locate AI and ML applications in a Cloud environment.

It is interesting that 59 percent of managers

and business owners favor Edge Computing platforms. What this insight is based on is not clearly understandable, especially since only 31 percent of CIOs/CDOs and 26 percent of software developers and AI engineering experts share this opinion.

Especially for CIOs and Chief Digital Officers (52 percent), Edge and Cloud are equal platforms for AI and ML. This may be because these experts have a broader range of use cases and business cases for these technologies in mind.

Study design – everything you need to know about the structure and methodology of the study

Study profile

Editor COMPUTERWOCHE, CIO, TecChannel and ChannelPartner

Exclusive study partner: Siemens

Populations Top (IT) responsible for companies in the D-A-C-H region: strategic (IT) decision-makers in the C-level area and IT decision-makers & IT specialists from the IT sector from industrial and production areas..

Generation of participants Sampling in the IT decision maker database of IDG Business Media as well as to meet quota requirements via external online access panels, personal e-mail invitations to the survey.

Total sample 317 completed and qualified interviews

Investigation period..... March 23, 2021, to April 7, 2021

Method Online survey (CAWI)

Questionnaire development IDG Research Services in coordination with Siemens

Execution IDG Research Services

Sample statistics

Industry distribution *	Metal producing and processing industry	15.8%
	Mechanical and plant engineering	16.4%
	Automotive industry and suppliers	17.0%
	Aircraft and spacecraft construction	3.5%
	Intralogistics	3.5%
	Manufacture of electrotechnical goods, IT industry	33.4%
	Consumer goods, food and beverages industry	9.1%
	Media, paper and printing industries	4.4%
	Other manufacturing industry	7.3%

Company size Germany wide	Under 100 employees	5.7%
	100 to 499 employees	25.9%
	500 to 999 employees	23.3%
	1,000 to 9.999 employees	30.6%
	10,000 employees and more	14.5%

* Mehrfachnennungen möglich

Digital Transformation: setting a good example

With the Digital Enterprise, Siemens is consistently pursuing the digital transformation of industry, both for its customers and in-house. One example is the Siemens Electronics Works in Amberg (EWA). Optimized throughput, ambitious cycle times or effective security measures – thanks to numerous solutions from the Digital Enterprise portfolio, the future of industry is already a reality in many areas.

350 production changes daily, a portfolio of around 1,200 different products, 17 million Simatic components per year – to ensure that production runs smoothly in view of these figures at the Siemens electronics plant in Amberg (EWA), around 50 million process and product data are evaluated there and used for optimization. In addition, cutting-edge technologies such as artificial intelligence (AI), Industrial Edge Computing or a Cloud solution enable highly flexible, maximally efficient, and reliable processes here today.

Industrial Edge Computing and AI for more throughput

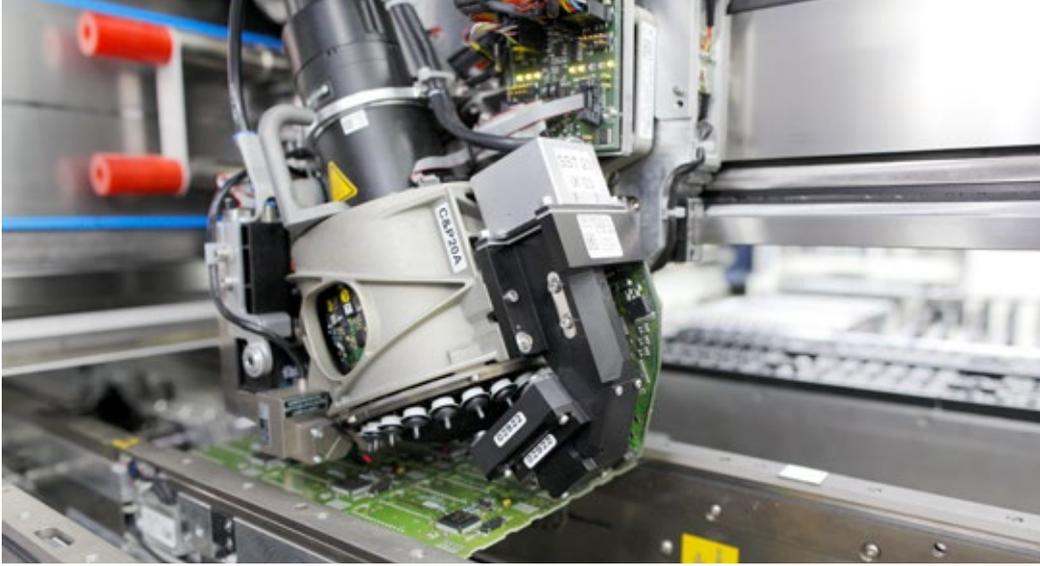
„Using Edge Computing, data can be processed right where it is generated, namely directly at the system or at the machine,“

explains Dr. Jochen Böning, Head of Strategic Digitalization at Siemens-Amberg.

For example, at EWA this is done at the production line for assembling printed circuit boards for components of the decentralized periphery. It is precisely here that production is not yet optimized enough. And this is not due to the availability of the system or the quality of the process. The bottleneck is to be found at the end of the flat module production, with the automatic X-ray inspection. This is because the fingernail-sized flat modules contain functionally relevant BUS connectors with various connection PINs. In a non-integrated test, the solder joints of these connection PINs are X-rayed to check that they are functioning properly. Should another X-ray unit be purchased for around 500,000 euros?



The Siemens Electronics Works in Amberg (EWA) is an Industry 4.0 reality – cutting-edge technologies are already marking the next stage of digital transformation.



When assembling printed circuit boards, an AI-controlled model provides reliable information about the probability of errors in the printed circuit boards

The alternative is artificial intelligence. The data from the sensors is transferred to a Cloud through the TIA (Totally Integrated Automation) environment, consisting of the controller and the Edge device. Here the experts train an algorithm based on AI and the process parameters. The algorithm learns how the process data relate to the quality of the soldered joints and also controls a model that runs on an Edge application on the system. “The model provides a prognosis as to whether the soldered connections on the circuit board should be classified as all right or not, i.e., whether an end-of-line test is necessary or not.

Thanks to closed-loop analytics, this data can be considered directly in production,” Bönig explains further.

Early warning system prevents nasty surprises

Closed-loop analytics and Industrial Edge technology are also used in milling. The milling spindle used to cut grooves in the flat modules for Simatic products did not always work smoothly due to the milling dust generated. The reason was initially unclear. As with the automatic X-ray inspection, the Siemens experts rely on a combination of Edge Computing and AI for predictive maintenance. To do this, the team isolated two parameters that were evidently related to the unplanned failures: the speed of the milling spindle and

the electrical current required for the drive. This data was loaded in an Edge device in which a pre-trained algorithm recognizes correlations between abnormalities in the process data and downtimes in real time and feeds them back into production. Based on the open, cloud based IoT operating system MindSphere, the Performance Insight app makes the results available to users. The system operators are informed of the situation between twelve and 36 hours before a possible system failure and can act in good time.

But MindSphere doesn't just save the data and anomalies. The algorithm also must be trained further to deliver ever more precise results. “That is exactly what happens in MindSphere. The integrated digitalization environment at EWA ensures the required seamless interaction between automation, Industrial Edge and Cloud Computing,” explains Florian Meierhofer, IoT expert at EWA.

Role model as a digital enterprise

Conclusion: at the Siemens Electronics Works in Amberg, hardware and software solutions, industrial communication, cybersecurity, and services work together optimally. This enables smooth production processes thanks to continuous horizontal and vertical integration. The EWA is therefore a model example of the Digital Enterprise from Siemens, which will continue to pursue the path of digital transformation in the future.

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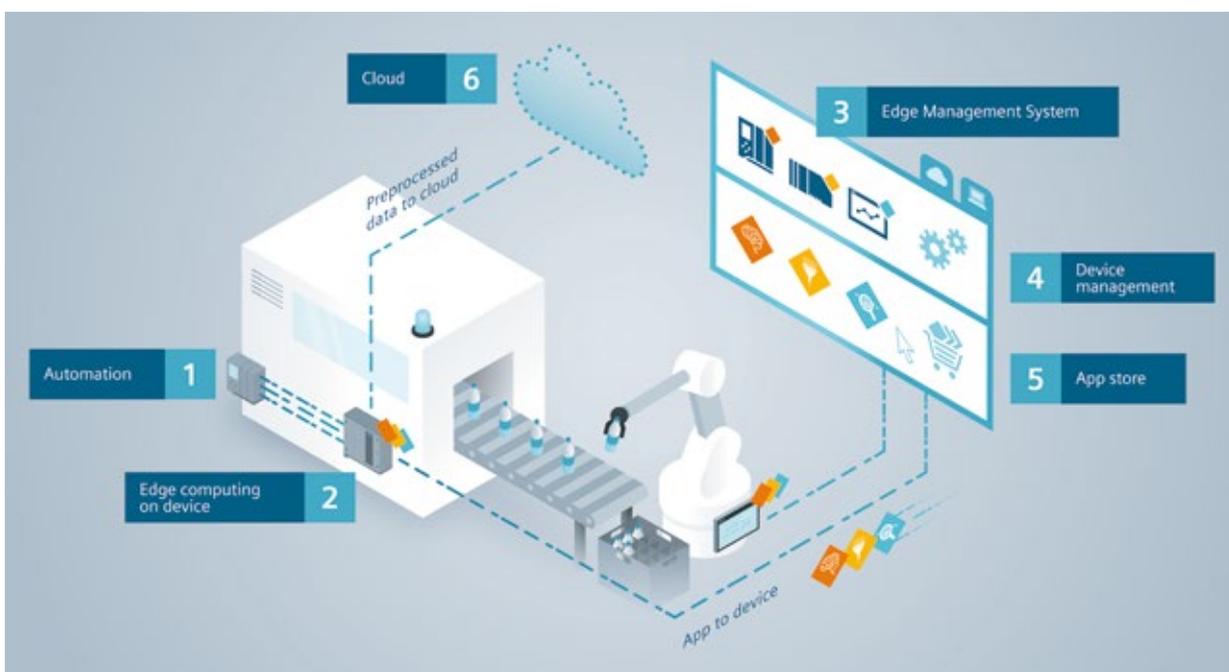
Industrial Edge for machine building and plant construction – the easiest way to integrate information technology in machines

The machine-level data analysis in automation systems is complex to this day, only scalable to a limited extent and requiring continuous expenditure for maintenance and servicing to meet the requirements of the latest application software and current safety mechanisms.

This is where Industrial Edge comes in and simplifies the collection and analysis of machine data. It expands automation technology to include high-level languages, container technology and the ability to flexibly provide and manage functionalities remotely.

Industrial Edge offers a tried and tested Edge infrastructure with a central management system, an integrated process environment and a wide range of applications and micro-services that make the provision of innovative services significantly easier.

The Cloud and Edge Computing solutions from Siemens include ready-to-use software solutions to use machine data locally in real time at the machine or globally across machines with the latest information technology (IT). This enables you to offer your customers innovative services and apps anywhere in the world.





Siemens Industrial Edge at a glance:

- Open infrastructure for the machine-level execution of high-level language-based Docker applications
- Simple and high-performance data exchange with any automation and Cloud system for local and global analysis
- Flexible and controlled provision of machine software worldwide with an Edge Management System
- Fewer maintenance costs thanks to ready-to-use infrastructure and security / firmware updates
- Minimal investment through Edge integration in HMI, IPC, and PLC
- Open ecosystem of devices and applications for automation technology
- Billing of machine services via the app marketplace

Siemens Digital Industries (DI) is an innovation leader in automation and digitalization. Closely collaborating with partners and customers, DI drives the digital transformation in the process and discrete industries. With its Digital Enterprise portfolio, DI provides companies of all sizes with an end-to-end set of products, solutions, and services to integrate and digitalize the entire value chain.

Optimized for the specific needs of each industry, DI's unique portfolio supports customers to achieve greater productivity and flexibility. DI is constantly adding innovations to its portfolio to integrate cutting-edge future technologies.

Siemens Digital Industries has its global headquarters in Nuremberg, Germany, and has around 76,000 employees internationally.

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