



# STUDY MACHINE LEARNING / DEEP LEARNING 2019

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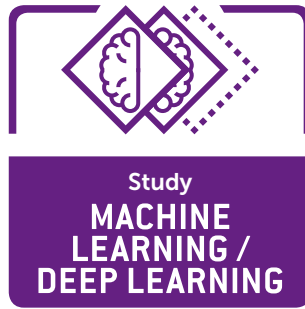
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# AI / ML have entered the corporate world



Jürgen Hill,  
Head of Team Technology  
and Chief Editor  
COMPUTERWOCHE

Dear Readers

Hardly any topic in the field of technology is currently subject to as much heated discussions as artificial intelligence and machine learning (AI/ML). Pessimists are of the opinion that Europe and specifically Germany are unable to keep pace in the global arena with the USA and China, therefore putting their prosperity at risk. Others fear millions becoming unemployed in view of the capabilities of AI, ML and intelligent and self-learning robots. On the other hand, those with a more positive view see massive potential in the field of AI and ML – particularly for an industrial nation such as Germany, which has already successfully applied the concept of Industrie 4.0 as a response to the challenges of the Internet of Things (IoT).

But what does the reality in 2019 really look like? Is Germany hopelessly behind – or is it a player at the forefront of technology? And what are companies really concerned about? These are just some of the questions that are answered by our Study on Machine Learning / Deep Learning 2019.

Frequently, these answers do not draw a black and white picture, but instead suggest a differentiated approach to this topic. The fact that machine learning technology is already being used by 57 percent of companies in Germany and that the number of businesses refusing

to use the technology is pretty low at twelve percent. The result of the findings that ML is no longer just considered a technology for IT departments, but also for applications such as customer service, optimization of production environments, etc. also puts an optimistic light on this topic.

So, everything is OK after all and the challenges posed by AI and ML have been successfully addressed? Unfortunately not. Companies still have immense problems when it comes to the data quality – not to mention a scarcity of experts such as data scientists. There are other sobering figures concerning this issue: Only nine percent of companies have integrated AI/ML into their business models. The situation regarding the fields of application is just as grim. Speech recognition and assistance systems are dominant.

In this regard, it may be useful to take a look at international trade fairs like the CES, MWC or HMI and evaluate what international competition is doing. Beyond the restrictions resulting from German legislation and European data protection regulations, our search for new AI / ML-enabled business models is actually only limited by our imagination.

I hope you will find this document informative and interesting

Jürgen Hill

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# The round tables



Machine Learning /  
Deep Learning 2019



## Between optimism and hesitation

Machine learning represents a key technology, and not just in the field of analytics. According to experts from software and consulting companies, it can for example help to bring relationships to customers and partners to a new level. However, there are various obstacles that need to be overcome. These include the orientation of projects for short-term success.

by Bernd Reder

In German companies, the hype around machine learning (ML) and its related technology artificial intelligence (AI) is slowly but surely being replaced by a more pragmatic approach. IT experts and specialists in the field are developing and practically implementing use cases for machine learning.

According to a panel of experts, who were invited by COMPUTERWOCHE to discuss the state of ML and AI in German companies, there are hardly any limits to the imagination.

"At Microsoft we are currently seeing that companies are certainly curious about machine learning and artificial intelligence. Numerous companies have kicked-off minor projects in this field," says for example Jürgen Wirtgen, Dataplatform Lead at Microsoft Germany. It is Mr. Wirtgen's opinion that both approaches are developing into becoming tools for companies that can be used just like any other software tools. "This, however, requires consulting agencies to make machine learning "simple" while handing the right tools to the users," says Wirtgen.

Telefonica has also noticed a "positive attitude" of German companies towards machine learning. Thorsten Kühlmeyer, Head of Business Analytics & Artificial Intelligence, explains that

the telecommunication service provider itself also leverages machine learning: "Machine learning and AI assist in maintenance and optimization of mobile networks, support social media analysis, accelerate processing of service requests and improve staff networking."

The financial and insurance sector is among the pioneers in the field of machine learning. "For example in the context of risk assessment for approving loans and credit applications," explains Kay Knoche, Principal Solution Consultant DACH Decisioning Solutions at Pegasystems – a software company. "This helps to clarify questions such as which up-sell and cross-sell products should be offered, whether claims can be handled unbureaucratically or whether expert assessments should first be obtained."

### **No reason for complacency**

However, there are also some critical opinions concerning how things stand regarding machine learning: "When compared to other countries like the USA, German companies have still not fully embraced machine learning. The reason for this is that German companies are less willing to take risks than their American counterparts," asserts for example Karl Schriek, Head of AI/Leading Machine Learning Engineer at consulting company Alexander

Thamm. In his opinion, German companies struggle with their own perfectionism when it comes to projects in the field of machine learning, an issue that interferes with the marketing of solutions.

Another weak point is highlighted by analytics expert Farhad Khakzad, who recently held the position of Head of Risk Analytics in an international technology company: "In general, it can be said that German companies suffer from a shortage of ideas when it comes to practical use cases. One reason for this is that companies often lack imagination concerning the scope and type of machine learning applications." Partially unrealistic ideas regarding the possibilities of this technology is another potential reason.

Paul-Louis Pröve, Consultant Data Analytics, Artificial Intelligence & Blockchain at Lufthansa Industry Solutions, sees the discussion around ML and AI "highly influenced by marketing statements, in line with the dictum: 'We are now also doing machine learning.'" Instead, a major proportion of companies first needs to develop use cases.

### **The "right" use cases are required**

Use cases that can be easily implemented represent an especially good starting point for companies. "The goal should not be to solve a specific business issue, but to get a feeling for the possibilities of this technology," stresses Dr. Karsten Johannsen, Business Development Executive Artificial Intelligence at Tech Data. It is important to provide the required data in advance and to check its quality. "Data preparation is currently the greatest challenge," confirms Christian Dyballa, Head of Sector Financial Services – Insights & Data at Capgemini in Germany.

*"German companies suffer from a shortage of ideas for practical use cases. One reason for this is that companies often lack imagination concerning the scope and type of machine learning applications."*

Farhad Khakzad, Analytics Expert

According to Thorsten Kühlmeyer, a multi-step approach is the best way to ensure that projects bring the desired success: First of all, companies are required to identify and analyze their problems. Based on this, a use case is developed. "Only then can the search for a suitable tool begin," explains the expert from Telefónica. Classic analytic procedures or AI approaches like deep learning and natural language processing are certainly worth considering.

Dieter Mayr, Expert for Digital Services – Vertical Market Solutions at the digitalization specialist A1 Digital, sees another option: "One possibility would be the use of user-friendly low-code platforms to facilitate quick development and testing of AI and ML applications. This way, companies can easily gain experience with machine learning." According to Mayr, the final goal is to "mold" expert knowledge into models and make these models available for AI and ML solutions.

### **Controversial: the significance of transparency**

The opinions of experts partly differ when it comes to the topics of transparency of algorithms and traceability of the results determined by machine learning and AI systems. Christian Dyballa from Capgemini considers it vital that there is transparency regarding how decisions based on machine learning have been reached. "You only have to think about sensitive areas like healthcare or autonomous driving."





Photo: IDG Business Media GmbH

The best way for companies to use machine learning, discussed by specialists from software and consulting companies. In the last row (left to right): Christian Dyballa (Capgemini), Dr. Kay Knoche (Pegasystems), Dr. Jürgen Wirtgen (Microsoft), Martin Bayer (COMPUTERWOCHE), Karl Schriek (Alexander Thamm GmbH), Dr. Dieter Mayr (A1 Digital), Paul-Louis Prüve (Lufthansa Industry Solutions); front (left to right): Thorsten Kühlmeyer (Telefónica Germany), Farhad Khakzad (analytics expert), Dr. Karsten Johannsen (Tech Data) and Dr. Frank M. Graeber (MathWorks)

***“Data preparation is currently the greatest challenge.”***

Christian Dyballa, Head of Sector Financial Services - Insights & Data at Capgemini

Kay Knoche from Pegasystems has another example: “It must be clear which predictors like age or gender, have an impact on approving a loan application.” Only in this way can it be verified that factors such as country of origin are not considered. According to Knoche, “every decision must be traceable”. There is another aspect: People should be able to recognize whether a decision was made by machine learning or AI systems.

This, however, cannot be easily implemented as Karsten Johannsen from Tech Data explains: “Understanding how and why AI makes decisions can generally only be determined based on classical ML approaches such as decision trees and other conventional classifying factors or “flat” neural networks.” When it comes to technologies such as deep learning, this is only possible with certain restrictions – if at all.

This is the reason that experts are of the opinion that the database of an AI instance must always be transparent. Additionally, comprehensive testing is required, e.g. of processes and the impact of specific data pools and models on results. “Negative effects should be minimized,” stresses Jürgen Wirtgen from Microsoft.

### **Complete transparency is still an illusion**

However, full traceability in the context of machine learning and artificial intelligence will not be possible, explains Farhad Khakzad: "Decisions made by humans are also not fully transparent – at least in most cases." This is the reason that it cannot be applied as a precondition for using ML and AI. "Particularly in connection with Deep Learning, this exception is a bit reminiscent of the search for the Holy Grail," notes Khakzad.

Karl Schriek of Alexander Thamm comes to a similar conclusion. The increasing complexity of ML solutions and algorithms can be seen to be decreasing transparency. His appeal: "The question we are to be concerned with is not: 'How can we make AI solutions more transparent?'; but rather: 'To what extent are we prepared to rely on non-transparent solutions?'"

### **Introduction to machine learning: Bringing everyone together**

Companies interested in using machine learning are not only confronted with questions concerning traceability and the search for suitable use cases. "To successfully implement projects, IT departments must be able to function beyond their classical remit," states for instance Jürgen Wirtgen from Microsoft. For example, internal IT specialists are required to ensure that the data used has a high quality.

*"As a society, the question we are to be concerned with is not: 'How can we make AI solutions more transparent?'; but rather: 'To what extent are we prepared to rely on non-transparent solutions?'"*

Karl Schriek, Alexander Thamm GmbH

According to Karsten Johannsen, another issue is that the level of collaboration between IT specialists and business decision makers could often be better. To optimize collaboration between IT departments, other specialist departments and management in the context of AI and machine learning projects, Karl Schriek advocates the following model: "A new department with members from all disciplines is formed. They collaborate to define use cases and products based on these technologies."

To make it easier to start working with ML, Dr. Frank M. Graeber has one more piece of advice: "It is a good idea to involve the respective domain experts in AI projects at an early stage or enable them to train machine learning models." This compensates for the lack of data scientists – at least partially.

*"It is a good idea to involve the respective domain experts in AI projects at an early stage or enable them to train machine learning models."*

Dr. Frank M. Graeber, MathWorks

### **Cloud technology can provide initial support when deploying AI and ML**

Projects such as these can be supported by cloud platforms providing AI and ML services. This approach is, for obvious reasons, heavily promoted by providers like Amazon Web Services, Google and Microsoft. "Cloud computing is an approach that facilitates the access to AI and machine learning and solves numerous problems," notes Paul-Louis Pröve from Lufthansa Industry Solutions.

Dieter Mayr of A1 Digital is also of the opinion that cloud-based AI and machine learning solutions can provide that all-important initial support: "It is crucial that companies use small projects as learning objects to gather experi-



ence in the field of ML. One example for this: Call center operators can use machine learning to optimize shift planning." According to Mayr, one additional benefit of this strategy is that it does not require major infrastructure investments. "This aspect is particularly important for commercial persons responsible for the finances. Additionally, this strategy saves money and personnel resources of IT departments." This approach allows IT departments to better assume the role of a "business enabler" in the context of ML projects.

*"Machine learning and AI promise to restore personal relations to customers that were lost due to the use of call centers and digital channels – i.e. the principle of traditional corner shops."*

Dr. Kay Knoche, Pegasystems

However, just the same as the other participants in the expert discussion, Dr. Frank Graeber from MathWorks also warns of unrealistic expectations when using cloud-based machine learning and artificial intelligence: "This may involve generic approaches that offer quick success in the beginning but do not contribute to establishing your own know-how."

Additionally, cloud-based machine learning is limited when it comes to complex applications: "In the case of industry-typical and business model-related requirements, for example, algorithms should address the specific individual cases," explains Farhad Khakzad. Nevertheless, it must be kept in mind that developing your own solutions requires considerably higher expenditure and more resources. From his perspective, however, both points are critical success factors when companies use AI and ML.

### **Don't only focus on short-term success**

Even if cloud-based ML services make it easier to enter this technology, companies should not overly focus on short-term success. According to the experts, the strategic aspect of machine learning, AI and Deep Learning are particularly important. According to Paul-Lois Pröve from Lufthansa Industry Solutions, these approaches can be "justified pretty much everywhere" – and not only in selected industries. One benefit involves the automation of processes that previously had to be manually initiated or controlled.

As strategic use case for machine learning, Telefónica and Pegasystems cite the example of improving the overall customer experience. "Machine learning and AI promise to restore personal relationships with customers that were lost due to the use of call centers and digital channels – i.e. the principle of traditional corner shops," notes Kay Knoche.

According to Karl Schriek, those wishing to take on complex applications should have good stamina. Because: "Just like any innovative approach, complex use cases or completely new AI-based business models require a certain willingness to take risks and potentially fail."

## Data scientists often feel isolated

Machine learning offers a significant potential for companies. However, many companies have misconceptions regarding the possible application fields of the various AI methods. The quality and preparation of data pose another considerable challenge. In this respect, data scientists often simply do not have suitable data.

by Jürgen Mauerer

Machine learning, as one form of artificial intelligence (AI), has found its way into our everyday lives. Algorithms are the foundation of (partly) autonomous cars and robots in manufacturing environments and devices like Alexa or Google Home, which allow Alexa and Google Home users to play music and search the web based on voice commands. More and more companies are beginning to recognize the potential of machine learning to optimize business processes and reduce costs.

What is the current situation of German companies and their AI projects? What are their goals when setting up intelligent systems? How are they going about this? What are the challenges in the context of machine learning? COMPUTERWOCHE invited eleven representatives from various companies to participate in a round table discussion on these topics.

### **AI is defined in various ways**

Companies use a wide range of terms when talking about artificial intelligence (AI): Machine learning, neural networks, Deep Learning, narrow AI, wide AI, strong AI or weak AI. "Every company has a different definition of the term artificial intelligence. A clear and unambiguous understanding of AI at all management levels is required. Particularly in medium-sized companies, hardly anybody knows which AI approach is suitable to solve which specific issue," notes Stefan Gössel, Partner Reply and Managing Partner at the strategic consulting company Leadwise Reply.

This is the reason that the participants in the round table first tried to clarify the various definitions. "I am afraid that it is already too late to find a common definition of the terms used in the AI environment. For me, artificial intelligence is the general term for data-optimized machines with functions that require complex programming based on traditional algorithms, but that could be solved relatively easily by a human. General AI, which clearly goes beyond its trained domain, is still way off in the future and is the subject of current research," explains Dr. Christoph Angerer, Manager AI Developer Technologies Europe at Nvidia. "However, specialized AI is already being used in many areas like voice and image recognition with machine learning." The specialist from Nvidia associates classic algorithms with machine learning, which are trained with data. He considers neural networks, which make deep learning possible as a subgroup of machine learning (ML).

For Ron Brandt, Vice President Consulting at CGI Germany, too many buzzwords are used in the AI domain. "We explain the various terms to our clients so that they really understand the subject matter. Artificial intelligence is the umbrella term for methods like machine learning, Deep Learning and neural networks. AI is not a product, but an approach leading to a concrete use case based on data. CGI always aims at offering their clients solutions for specific use cases. There is no "out-of-the-box," "one-size-fits-all" AI solution but only customized solutions."



Photo: IDG Business Media GmbH

The participants at the COMPUTERWOCHE round table discussion talk about their experience with machine learning in their day-to-day work and projects.

All participants in the discussion were unanimous regarding this point: The decisive factors are the concrete use case and the respective benefit for the client. And they warn their clients to not have any unrealistic expectations. "We always ask ourselves: What is the client looking for? Machine learning and statistical methods generally result in findings and key indicators to better control business processes. However, companies additionally expect artificial intelligence to automatically realized these processes and continuously improve them. This leads to some exciting challenges," explains Michael Mayerhofer, Chief Data Scientist at NTT Data.

Alexander Krock, Head of Cloud Customer Engineering DACH at Google, sees another risk besides exaggerated expectations: "Many companies pick up the buzzwords and think: 'Since everybody is using AI, we need it as well.' From my perspective, that is the wrong approach as it can lead to pure actionism without considering the actual added value for the business. One tip: Machine learning is very useful for repetitive use cases, for example, evaluating x-ray images. In applications like these, the machine becomes increasingly better at its task due to repetition and training of the algorithms used."

The consulting company Accenture has developed a catalog for its clients with scenarios and possible use cases for AI projects. "Most important are simple scenarios that offer relatively quick results. Aiming for the moon with major goals like 'With AI, we want to find the cure for cancer' must be considered over a very long term and explaining this to the executive management is very difficult. The top management often acts according to the motto: 'Data is the new oil, now where is my money?' This can be quickly realized with AI projects that initially make processes quicker, better and cheaper," explains Dr. Andreas Braun, Data + AI Lead at Accenture in Europe.

It may also be of benefit if providers themselves use their AI technology to improve processes or proactively respond to potential issues in the industrial production landscape (predictive maintenance). For example, this approach is applied by Siemens. "We employ a wide range of Siemens digitalization solutions in our own manufacturing environment, including an increasing use of AI and ML technology. This allows us to directly transfer the experience from our digitalization projects to our customers," says Katharina Lamsa, press spokesperson for Digital Factory at Siemens.

**Biggest challenge:****Data, data, data**

However, machine learning and other AI methods only make sense if the right database is available. Without exception, all participants at the round table discussion mentioned data quality, data preparation and data security as the biggest challenges in the context of artificial intelligence. "Companies are required to capture, aggregate, standardize and analyze data types and data formats from the widest range of sources. However, many companies did not do their homework. Or they have the data available but do not know what to achieve with the analysis. Is the intention to automate processes, achieve faster diagnostics or to improve customer service? The goal of AI projects must be clear," notes Alfred Ermer, CEO and Managing Director at Arago da Vinci.

Of course, data must fulfill all criteria for high quality like correctness, consistency, completeness, validity and homogeneity. "As usual in the industry, we invest approx. 80 percent of our time in searching for, capturing and preparing data for machine learning to optimize the efficiency of the development and operation of our networks and products," explains Kenza Ait Si Abbou Lyadini, Senior Manager Robotics & AI at Deutsche Telekom IT. "Our goal is to apply the existing uniform data model to break open the data silos we have accumulated over our long history and enable the reusability of use cases. Here, the responsible use of customer data is our top priority."

Similar or even stricter security standards also apply in the healthcare sector as high volumes of patient data are anonymized for processing in studies and pharmaceutical research. As a company in the field of pharmaceuticals and diagnostics, not only are we required to strictly guarantee data protection but also to ensure

data quality, and to bring the data into a uniform format before we are able to make use of the full potential of AI," stresses Dr. Markus Bundschus, Head Data Office at Roche Diagnostics.

**Data scientists often lack suitable data**

The precondition for success in pharmaceutical research, in which machine learning is to be applied to recognize biomarkers from a high volume of data, is close cooperation between engineers and data scientists with specialists in the respective field, e.g. biochemists. "The specialists must immerse themselves in the technology and support data scientists in understanding their specialist field," notes Bundschus.

This also applies to the industrial sector. Here, specialists in production are required to understand the significance of the data in order to evaluate the results of the algorithm together with data scientists. On the other hand, data scientists also need to understand the demands and challenges of the specialist departments – and they require suitable data for their analyses.

And this was a very surprising result of this discussion on machine learning and AI: Costly data specialists are often left isolated with insufficient or worthless data. The final statement on this particular issue comes from Steve Rommel, Head of IT Business Center Digital Manufacturing at Konica Minolta: "Data for AI projects or machine learning from various departments is often not tangible – key word: data silos – or cannot be merged for technical reasons. Other reasons may be a lack of data strategy or simply insufficient data quality. It is hard to believe: Data scientists often lack suitable data and do not feel sufficiently challenged."

# The key findings



# Management summary

An overview of the key findings



## Climbing the winners' podium

Machine learning (ML) has reached **third place** in the ranking of the most important IT topics. This technology is championed particularly by CEOs and IT departments. In contrast, specialist departments still need to be convinced about the benefits of ML.



## More than a toy for IT departments

**More than one third** of companies consider the use of machine learning in IT to be particularly beneficial. However, companies recognize that machine learning also offers benefits in other areas, such as customer service.



## Data quality must improve

**More than one third** of respondents are worried about the inadequate quality of the data fed into ML solutions. Managers, on the other hand, lack precise information on the benefits of machine learning.



## Here to stay

Almost **60 percent** of German companies are already using at least one machine learning application – and the trend is increasing. However, particularly small companies with low IT budgets still need to catch up.





## Pathfinders urgently needed!

Almost **40 percent** of small companies are unable to choose the “right” machine learning model. This is where the help of solution providers and consultants is needed. They have to put users onto the right path.



## Faster - higher - further!

Approximately **40 percent** of ML users aim, first and foremost, to make internal processes quicker and more efficient. But guess what: Machine learning can do even more, for example, form the basis for new business models and portfolios.



## Assistants set the tone

Alexa and intelligent navigation systems send their regards: A good **40 percent** of machine learning processes are used for voice recognition and in assistant systems. However, they now face competition in the form of software bots.



## Collaboration instead of ego trip

**More than half** of the companies seek external support from machine learning specialists to find and implement suitable solutions. Nevertheless, hardly any company wants to fully place their ML projects into the hands of a third party.

# 1. Machine learning is picking up speed in the German business landscape

Almost 30 percent of companies consider machine learning and artificial intelligence the top hot-topics in the field of IT. In comparison to 2018, this represents an increase of five percent.

Around 30 percent of German companies are planning to intensively engage with machine learning (ML) and artificial intelligence (AI) in the coming year. This particularly applies to large companies with 1000 and more employees (31 percent).

In the ranking of the most important topics in the field of IT, AI and machine learning are in third place behind cloud computing and cyber security (34 percent each).

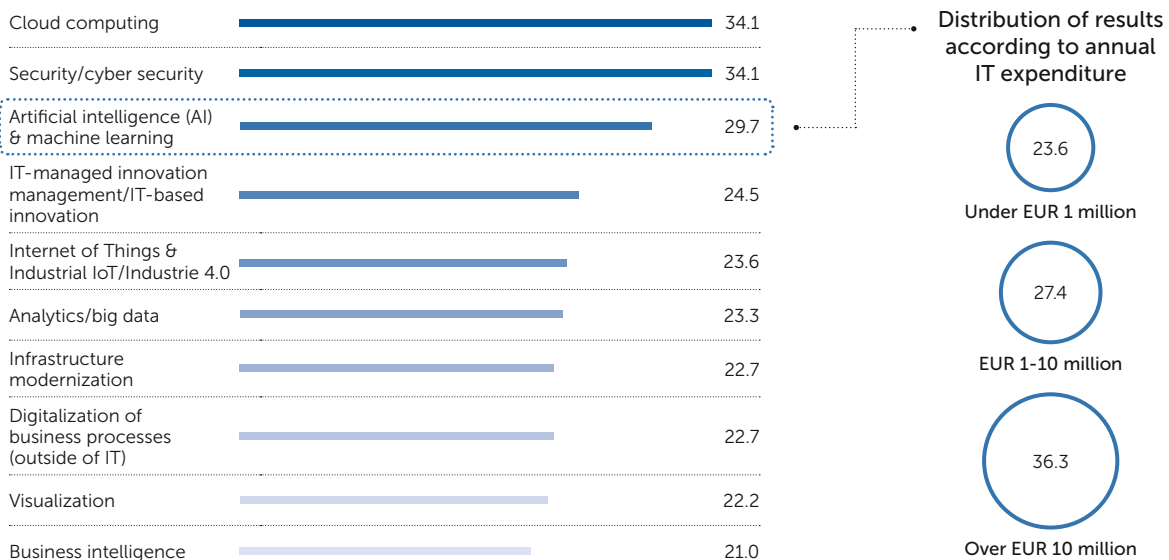
The relevance of AI and ML highly depends on the IT budget. Only 24 percent of companies with IT expenditures of less than one million euros consider these technologies to be of high relevance.

In contrast to this, machine learning has a high priority for more than 36 percent of companies with a high IT budget of more than ten million euros.

Particularly managing directors, CIOs and board members (32 percent) as well as IT staff (34 percent) consider AI and ML to have high priority. In contrast to this, specialist departments have not responded to these topics in the same way (22 percent).

## Which topics in particular will your company have to engage with in the field of IT in the coming year?

Figures in percent. Multiple answers are possible. The top 10 answers are shown. Basis: n = 343



## 2. More than a fifth of German companies use several machine learning applications

Approximately 57 percent of companies in Germany are already using at least one type of machine learning technology and more than 22 percent even a full range of applications such as these.

Only twelve percent of respondents do not use machine learning at all or have deliberately decided not to use this technology.

Particularly in larger companies with 1000 and more employees, already several ML applications are in use (28 percent). For smaller companies, this applies to 17 percent.

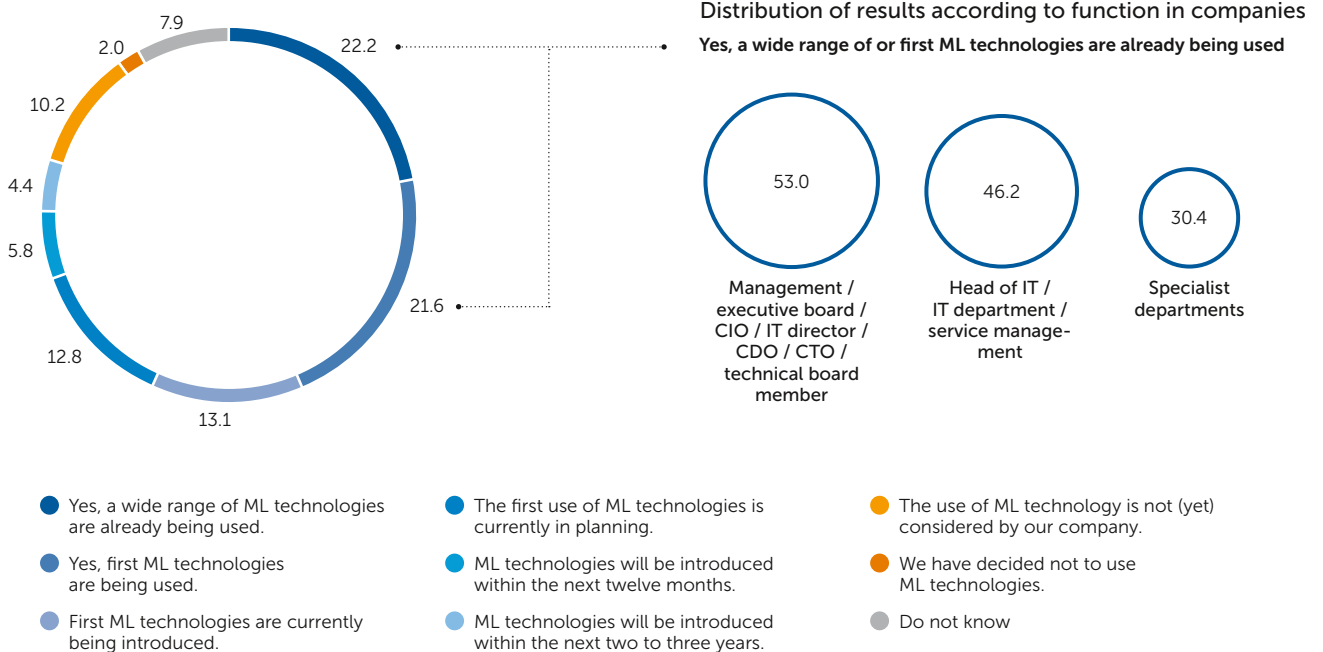
The higher the IT budget, the more that companies utilize machine learning: 37 percent of companies with a budget of more than ten million euros make use of a wide range of ML applications – however, only eleven percent of companies with a budget of one million euros.

Specialist departments are not as well informed regarding the status of ML in companies: Only 30 percent are aware that such applications are already used – in contrast to 53 percent of business decision makers.

The proportion of companies with fewer than 1000 employees that consider machine learning not relevant fell from 22 percent to 19 percent in 2018.

### Are machine learning technologies being used in your company?

Figures in percent. Basis: n = 343



### 3. IT departments and customer service especially profit from machine learning

Almost 36 percent of companies consider the benefits of machine learning to be the highest for IT departments. This is 13 percent less than in 2018. One explanation: Companies have recognized that ML solutions also offer benefits in other areas.

IT departments still enjoy the most benefits when using machine learning, e.g. in the recognition of spam e-mails and use of machine learning in diagnostic solutions.

This is followed by customer service (29 percent), production environment optimization (27 percent) and management support (27 percent).

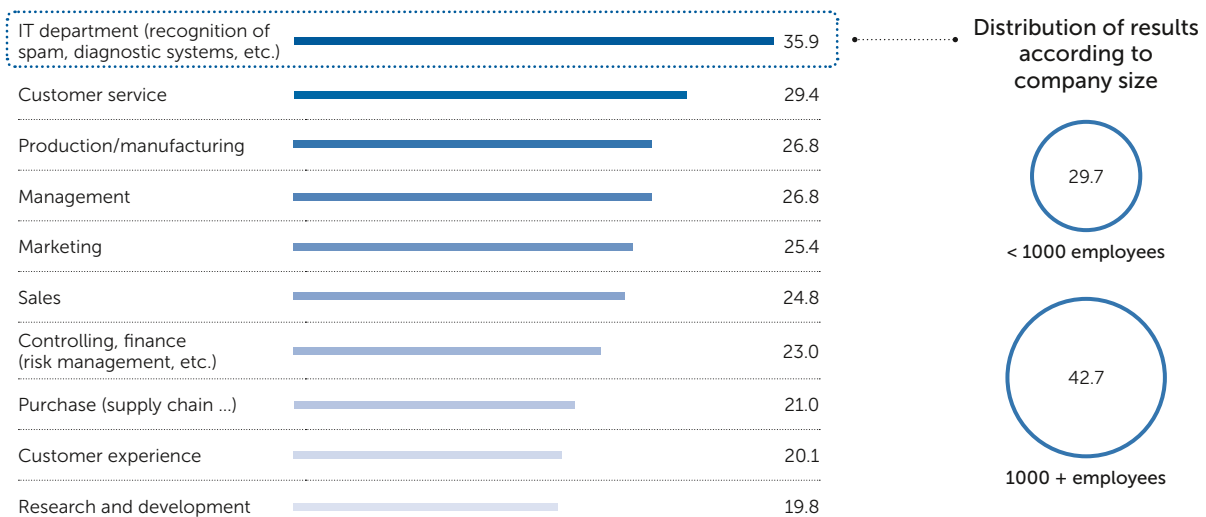
Particularly larger companies with correspondingly complex IT infrastructures consider the benefits of ML in IT to be particularly high (43 percent).

For companies with fewer than 1000 employees, the production environment (30 percent), purchasing (23 percent) and customer experience (24 percent) are important fields of use.

Executives (CEOs, CIOs) and IT specialists have in some cases other opinions. For instance, machine learning is considered to be a useful tool by 31 percent of decision makers in marketing, but only by 21 percent of IT specialists.

#### Which areas in your company do you think would benefit the most from machine learning or AI solutions in the future?

Figures in percent. Multiple answers are possible. The top 10 answers are shown. Basis: n = 343



## 4. The biggest obstacle is the insufficient quality of input data

The biggest obstacles when it comes to using machine learning involves the low quality of data and insufficient transparency of machine learning algorithms. On the other hand, lack of funds plays a minor role for projects such as these.

More than 34 percent of companies consider the low data quality to be the biggest problem surrounding machine learning projects. This applies to both large companies with 1000 and more employees as well as smaller ones.

Almost 30 percent of respondents struggle with the fact that ML algorithms are difficult to understand.

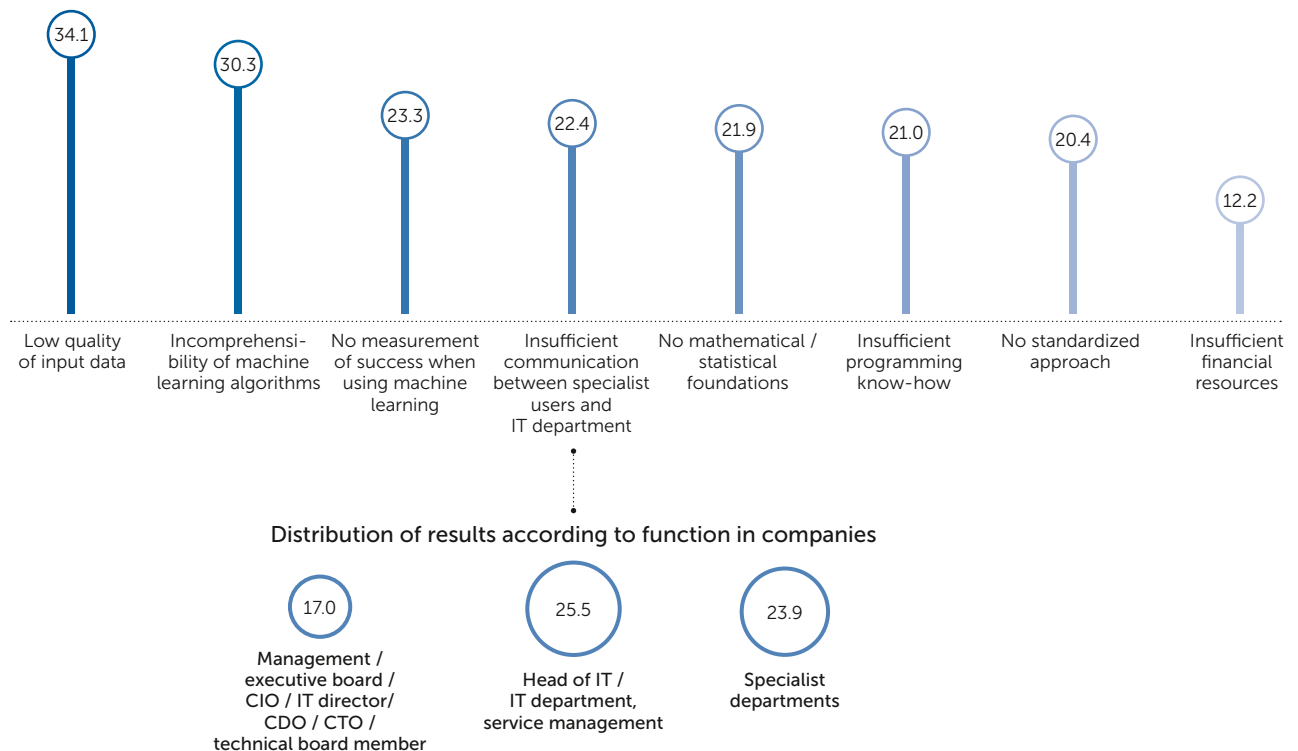
Particularly executives such as CEOs, CIOs and IT directors perceive the insufficient measurement of success as an issue (30 percent). They want to know in advance if the use of machine learning will be worth the expenditure.

Nevertheless, ML projects do not fail due to insufficient financial resources: Insufficient budget only represents an obstacle for twelve percent of companies.

However, companies have some catching up to do when it comes to communication: More than a fifth of companies considers an inadequate exchange of information between specialist departments and IT to be an obstacle when it comes to using ML.

### In your company, what do you consider to be the biggest obstacles for using machine learning?

Figures in percent. Multiple answers are possible. Basis: n = 343



## 5. Companies require support when choosing machine learning models and data

In the context of ML projects, data as a whole represents the main issue for more than 30 percent of companies. This applies to selecting, cleansing and understanding information.

36 percent of companies require better support when selecting information to be processed using machine learning.

32 percent of respondents require support in cleansing data and providing background knowledge for specialist departments (“understanding data”).

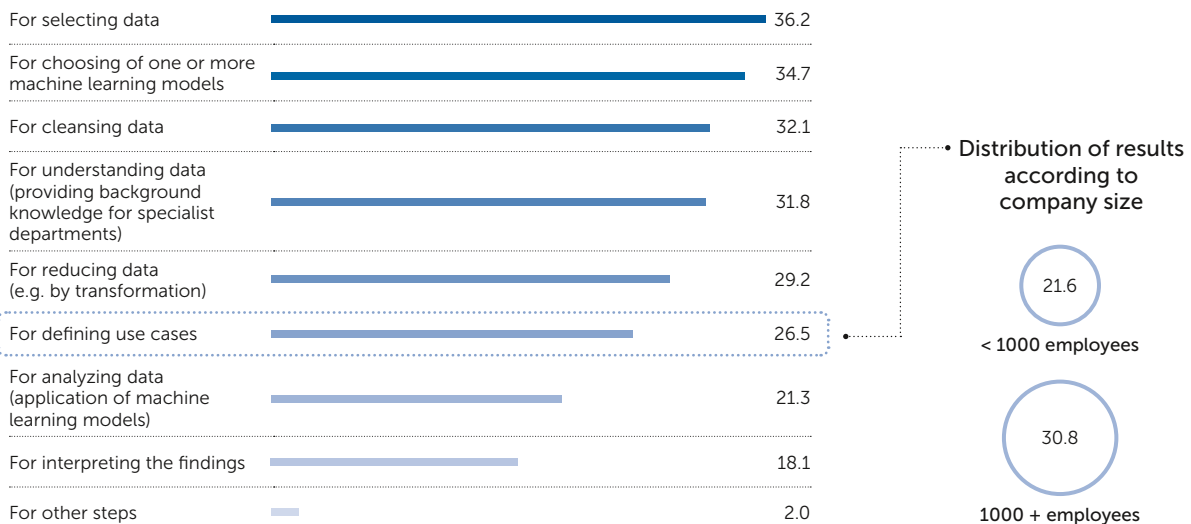
Particularly smaller companies with fewer than 1000 employees require support in choosing suitable machine learning models (39 percent). For larger companies, this is 31 percent.

More than a quarter of respondents (27 percent) require support from external specialists to draw-up use cases in the field of ML. Interestingly, this especially applies to larger companies (31 percent) and less to companies with fewer than 1000 employees (22 percent).

However, interpreting the results of machine learning is only considered to be a problem by 18 percent of the companies asked.

### For which step in the machine learning process does your company require more support?

Figures in percent. Multiple answers are possible. Basis: n = 343



## 6. Fields of application: Speech recognition and assistance systems dominate

Speech recognition and assistance systems represent well over 40 percent of the ML procedures used. Bots and robotics (30 percent each) have to catch up.

Almost half of respondents (49 percent) currently utilize machine learning in the field of speech recognition. This is followed by assistance systems (44 percent) and machine translations (43 percent).

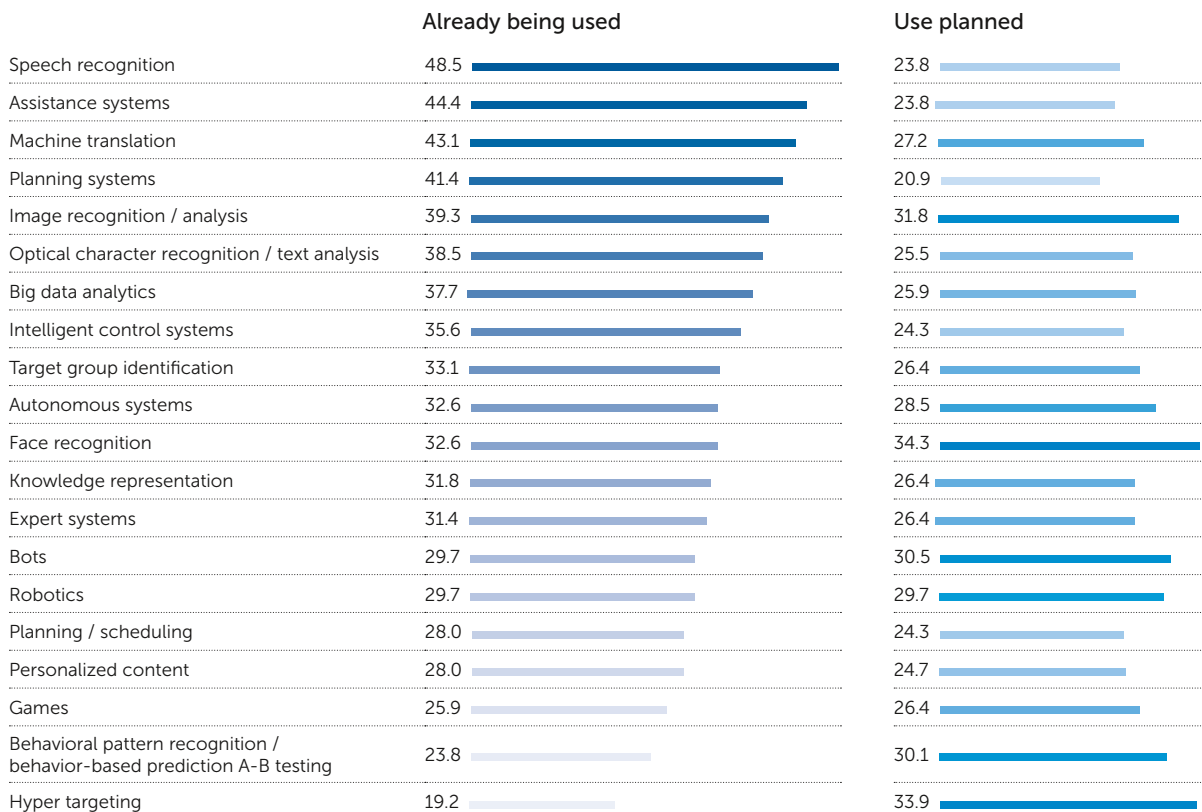
Particularly larger companies (1000 employees and more) use speech recognition (52 percent) and assistance solutions (49 percent). These results are nine or ten percent higher in comparison to smaller companies.

The lower range of the scale includes applications like software bots (30 percent), recognition and analysis of behavioral patterns (24 percent) and provision of personalized contents (28 percent).

However, 31 percent of companies are planning the use of new approaches like bots. 34 percent intend to use machine learning for face recognition and hyper targeting, i.e. targeting people in marketing campaigns.

### Which AI/ML methods do you use or are you planning to use in the future?

Figures in percent. Multiple answers are possible. The top 15 answers are shown. Basis: n = 239



## 7. Machine learning for improved internal processes and increased efficiency

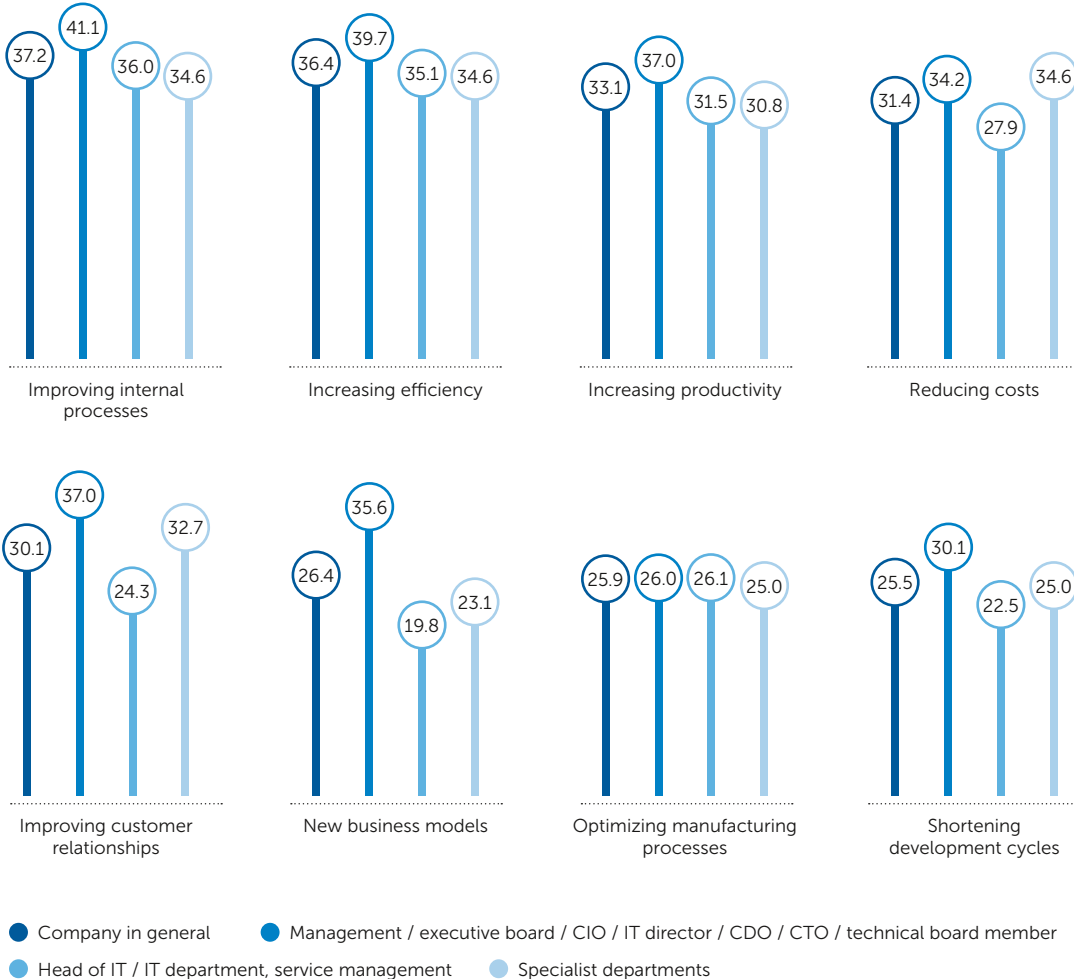
Optimization of internal processes (37 percent) and higher efficiency (36 percent) are the main goals that companies have when using machine learning solutions. Only approx. one quarter of respondents consider the technology a way to develop new products and services.

Particularly for managing directors and CIOs, process optimization based on ML is of considerable significance (41 percent). The same applies to an increase in efficiency (40 percent).

Approx. 31 percent of respondents primarily consider ML solutions to be a way to reduce costs. The aspect of low costs plays an important role, particularly for managing directors (34 percent) and specialist departments (35 percent), less so for IT specialists (28 percent).

### What are your reasons or goals for introducing machine learning?

Figures in percent. Multiple answers are possible. Basis: n = 239



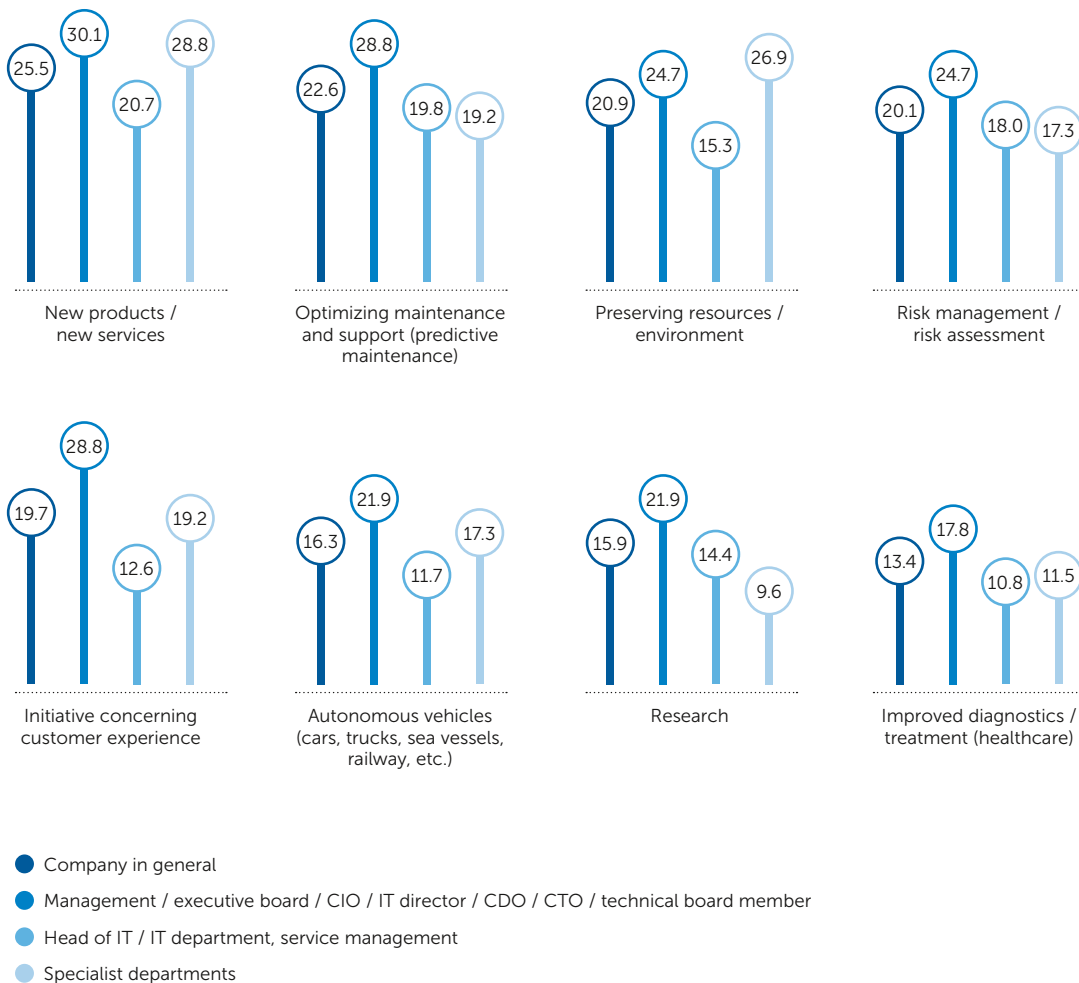


Additionally, 36 percent of CEOs and IT executives see machine learning as a way to develop new business models, and approx. 30 percent intend to develop new portfolios and products based on ML. Such aspects are clearly of less relevance for IT departments.

Particularly pronounced are the differences between business decision makers and IT departments in terms of considering machine learning as way to improve customer relations: 37 percent of business decision makers consider this to be a reason for introducing ML solutions. This opinion is shared by only 24 percent of IT experts.

### What are your reasons or goals for introducing machine learning?

Figures in percent. Multiple answers are possible. Basis: n = 239



## 8. External service providers play a crucial role

Around 38 percent of German companies manage machine learning projects completely in-house. However, the majority (55 percent) utilize external support as required.

Particularly small companies (1000 employees or fewer) prefer an in-house approach (44 percent) when it comes to implementing and operating ML solutions. This applies only to 36 percent of large companies.

However, the majority of respondents prefer a variable model: In-house operation with support from external specialists as required (55 percent). In this case, usually two to three service providers are used (46 percent).

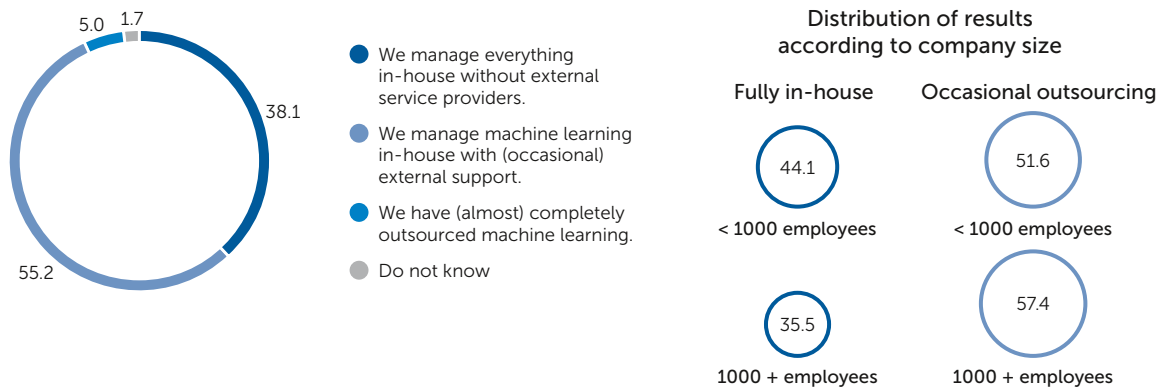
Approximately 31 percent of the responding companies even cooperate with four to five external specialists. These are particularly user companies with an IT budget of more than one million euros (68 percent).

Approximately 13 percent of respondents rely on just one external partner. This mainly applies to smaller companies (18 percent).

On the average, only five percent of the respondents consider completely outsourcing machine learning.

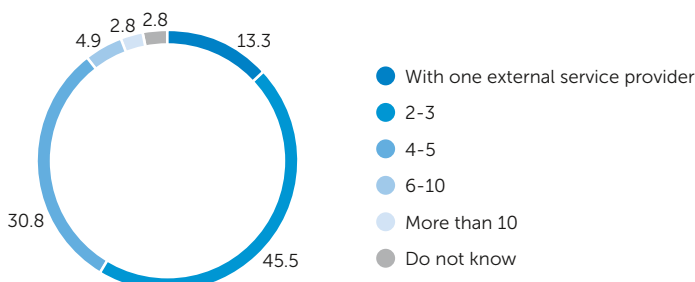
### In your company, is machine learning exclusively handled in-house? Can you manage without external support or do you collaborate with external service providers?

Figures in percent. Basis: n = 239



### How many external service providers in the field of machine learning does your company work with?

Figures in percent. Basis: n = 143



# Additional study results



# 1. CIOs and CTOs are the key players in this domain

The head of IT or technical department is the central point of contact when it comes to selecting, implementing and operating machine learning solutions in 50 percent of companies.

This applies to both larger companies with 1000 and more employees as well as medium-sized and small companies. This means that the majority of companies follow a centralized approach regarding the responsibility for ML.

In this respect, companies with an IT budget of less than one million euros are an exception: Only in 29 percent of these companies do CIOs or CTOs hold the responsibility for machine learning. Problematic: In 31 percent of these companies, the responsibility for machine learning and AI has not yet been clarified.

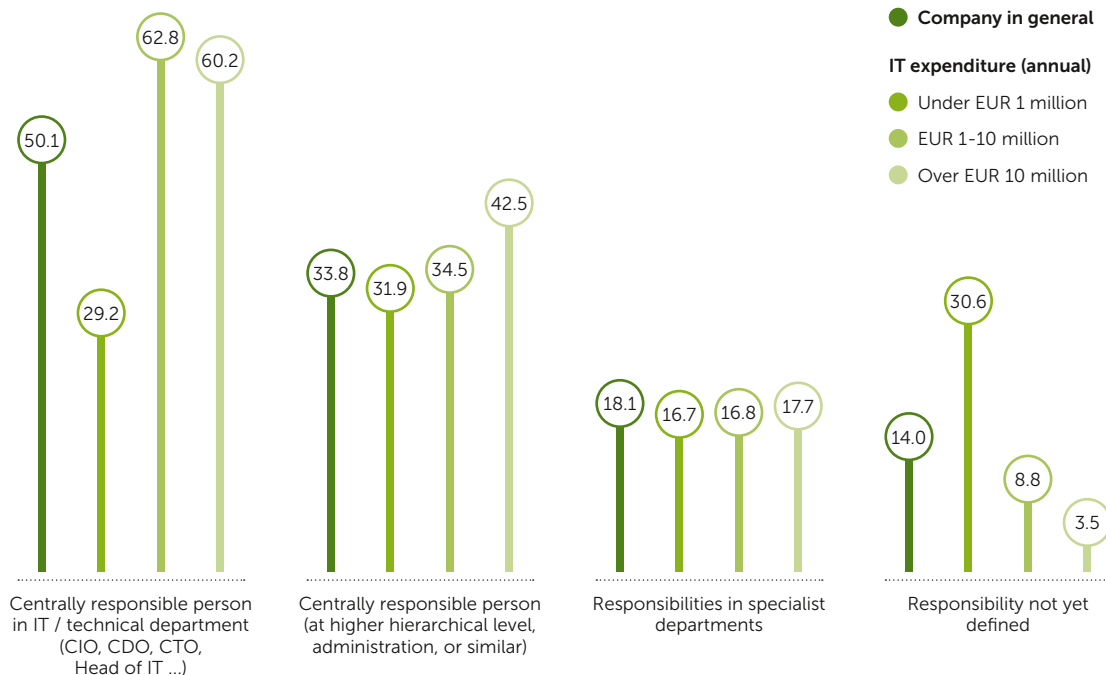
In total, 14 percent of the companies that responded have not yet appointed a person responsible for ML.

Business decision makers and administrative departments are responsible in 34 percent of cases.

Specialist departments have central responsibility in only 18 percent of companies.

## In your company, is there a person centrally responsible for machine learning or is this responsibility distributed between the various specialist departments?

Figures in percent. Multiple answers are possible. Basis: n = 343



## 2. IT infrastructure and data are there – but where are the machine learning experts?

Half of the respondents have the required IT systems and data for machine learning applications at their disposal. However, the companies are lacking specialists and the know-how when it comes to developing and using ML algorithms.

Respectively, 50 percent of companies have the IT and network infrastructure and data to initiate machine learning projects.

This also applies to EDP resources (48 percent), network bandwidth (40 percent) and graphic processors for complex machine learning calculations (39 percent).

But it is the “human factor” that is in short supply: Around 39 percent of companies intend to bolster their ranks of machine learning experts – no easy task in view of the shortage in the labor market.

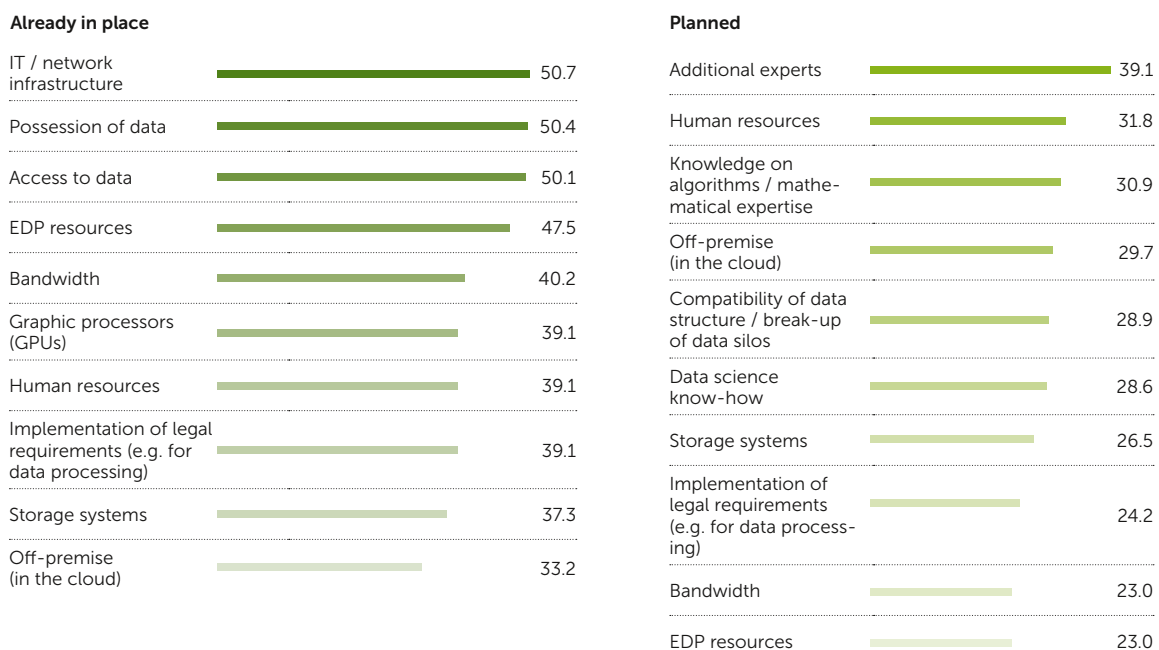
Approximately 31 percent of participants in the study complain about a lack of specialized knowledge, particularly regarding mathematical processes and how ML algorithms function.

About 30 percent of companies plan additional investments in cloud-based machine learning resources.

Particularly smaller companies intend to revise their data structure and eliminated their data silos that inhibit the use of machine learning (32 percent). This problem is shared by only 26 percent of companies with 1000 employees or more.

### Certain technological conditions must be met when using AI-assisted processes. Which preconditions have already been met or will be met in your company?

Figures in percent. Multiple answers are possible. The top 10 answers are shown. Basis: n = 343



### 3. Machine learning primarily depends on transaction data and log information

Particularly smaller companies rely on data captured internally to feed ML solutions. For example, this includes their own contract and order information (21 percent) and customer data (33 percent).

Transaction data is the most important source (30 percent) for ML solutions – particularly in larger companies with 1000 employees and more (33 percent) and an IT budget between one and ten million euros (40 percent).

Smaller companies increasingly use their customer address data (33 percent). This is complemented by their own contract and order data (21 percent). This type of data is only used by 13 percent of large companies.

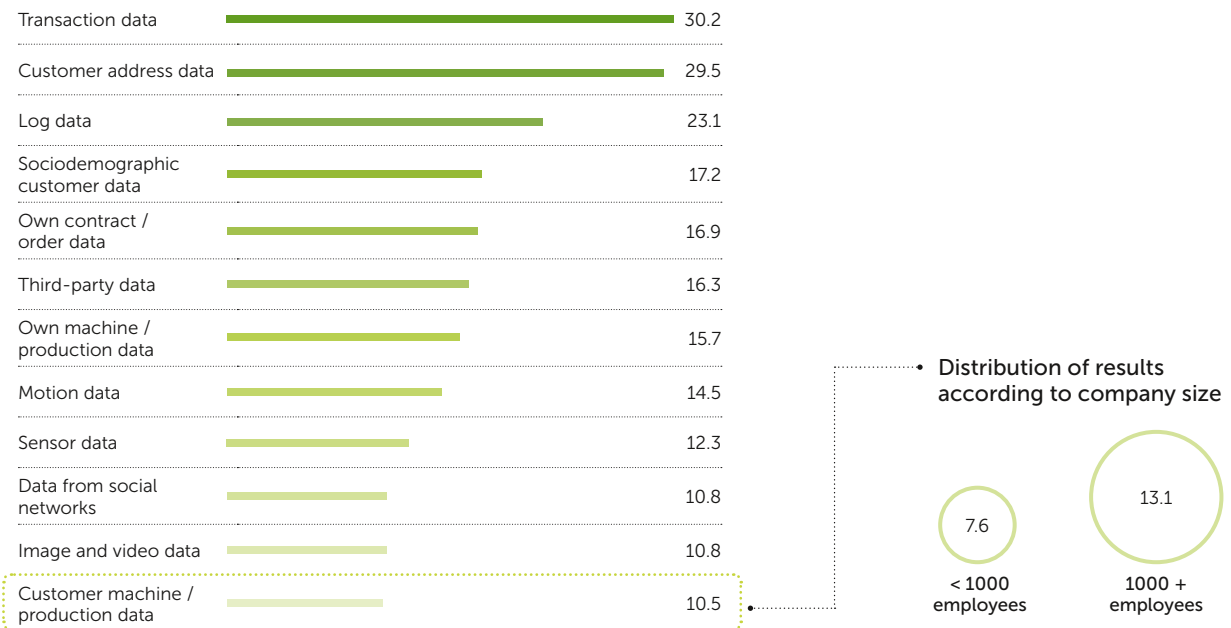
Machine and production data from customers is already evaluated by around 13 percent of larger companies. This includes applications such as the predictive maintenance of production systems.

External information sources (16 percent) and in-house production and machine data (16 percent) can be found in the midfield of the data sources that are used.

Information from social media (11 percent) and sensor data (12 percent) play a subordinate role.

#### Which of the available sources and types of data are currently being used in your company for data analytics?

Figures in percent. Multiple answers are possible. Basis: n = 325



## 4. In the context of machine learning, the cloud is accepted as data storage

More than half (52 percent) of respondents are prepared to save and store machine learning data in a cloud. Another 40 percent have a positive opinion of this option. Only six percent of companies rule out the cloud as an option..

Both large and small companies support storing data in a cloud environment to the same extent.

Slightly lower approval rates can be found in companies with an IT budget below one million euros (88 percent). Companies with a budget of more than one million euros tend to have less reservations regarding the cloud (94 percent positive responses).

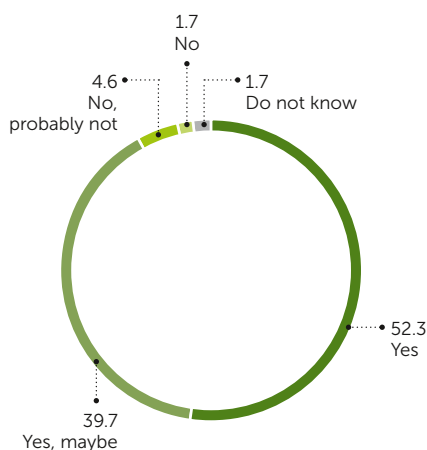
Managing directors and CIOs (92 percent) as well as IT specialists and division managers (94 percent) are in favor of the cloud.

On the other hand, the approval rates in specialist departments are slightly lower (89 percent of responses were "Yes" and "Yes – maybe").

Companies that decide not to store ML data on a cloud give particularly two factors for this stance: Concerns regarding data protection (33 percent) and the unclear legal situation (27 percent). 27 percent refer to insufficient security.

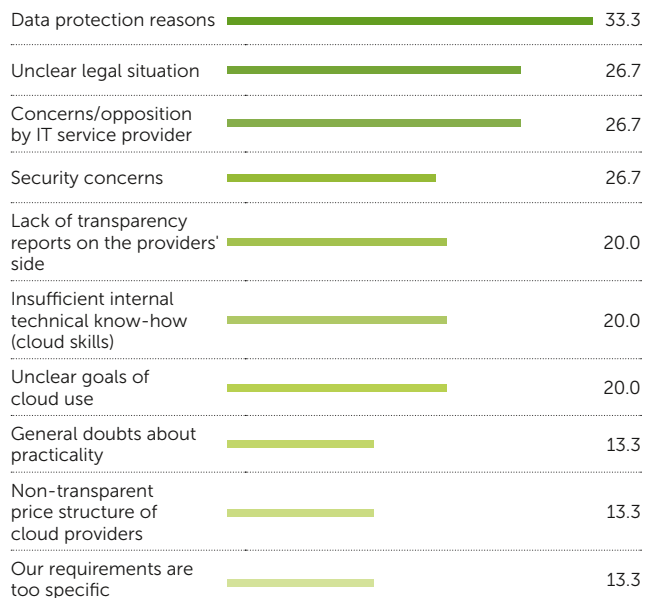
### In the context of AI/machine learning, is your company prepared to save data in the cloud?

Figures in percent. Multiple answers are possible. Basis: n = 239



### In the context of AI/ML, why is your company not prepared to use the cloud?

Figures in percent. Multiple answers are possible. The top 10 answers are shown. Basis: n = 15



## 5. IT consultants and service providers are the preferred suppliers of ML solutions

Companies prefer ordering ML solutions from IT consulting companies (28 percent) and IT service providers (27 percent). However, other suppliers like system houses and cloud service providers have good opportunities.

There is no one-and-only supplier. Companies actually make use of numerous sources – from IoT specialists (25 percent), through allrounders such as IBM, SAP and HP (23 percent) to cloud service providers (23 percent) and system houses (23 percent).

In addition to consultants, large companies particularly prefer IoT solution providers and IT service providers (28 percent each) as well as allrounders (29 percent).

When it comes to machine learning, companies with fewer than 1000 employees mostly rely on data science providers (22 percent), application providers (18 percent) and ICT network providers such as German Telekom (23 percent).

As ML providers, system houses and system integrators play an important role for companies with an annual IT budget of up to one million euros (29 percent). Less important for such companies are cloud service providers (15 percent) and IoT specialists (twelve percent).

### Who supplied your machine learning solution?

Figures in percent. Multiple answers are possible. The top 10 answers are shown. Basis: n = 239

Company in general		Distribution of results according to company size	
		< 1000 employees	1000 + employees
IT consulting company	28.0	23.7	31.2
IT service provider	27.2	26.9	27.7
IoT solution provider / IoT specialist (full stack provider)	24.7	20.4	28.4
Allrounders (e.g. IBM, HP, SAP)	23.0	15.1	29.1
Cloud provider (Amazon, Google, etc.)	23.0	21.5	24.8
System house / system integrator	23.0	22.6	23.4
IoT platform provider	21.8	14.0	26.2
ICT network provider / TC carrier (e.g. German Telekom, BT)	20.1	22.6	19.1
Data science provider	17.6	21.5	15.6
Group IT service provider	17.2	16.1	17.7



## 6. Price, user friendliness and low operating costs are the primary selection criteria

Low-cost (39 percent), easy to handle (36 percent) and cost-effective in operation (36 percent) are the main criteria for machine learning solutions. Less important are factors like the reputation and the expertise of the provider (26 percent) and the integration capability into company scenarios (28 percent).

Particularly for companies with fewer than 1000 employees, a low price (43 percent) and easy operation (40 percent) are important factors when selecting an ML solution.

In contrast, larger companies are looking for a seamless adaptation to company scenarios (30 percent). This factor is particularly “on the radar” of managing directors (37 percent) and less important for IT specialists (23 percent) and specialist departments (21 percent).

Also when it comes to ease of operation, there are different opinions: 43 percent of executives and 39 percent of specialist departments consider this to be an important criterion, however, only 30 percent of IT specialists agree.

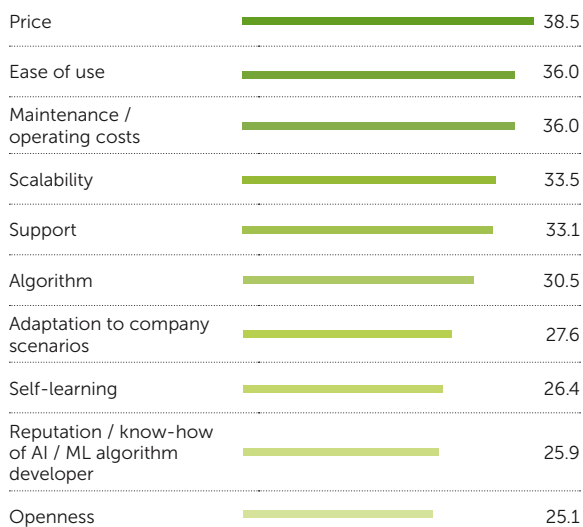
Interfaces (APIs) to third-party programs are mostly important for large companies (28 percent) and considerably less so for companies with fewer than 1000 employees (14 percent).

When it comes to support, all companies and departments are on the same page: Approximately one third of respondents consider this to be a key selection criterion.

### Which criteria are decisive for your company when selecting a suitable machine learning solution?

Figures in percent. Multiple answers are possible. The top 10 answers are shown. Basis: n = 239

#### Company in general



#### Distribution of results according to company size



## 7. Small companies want ML service providers with favorable prices – large companies look for high scalability

One third of users of machine learning solutions are expecting a good price-performance ratio from external service providers. This point is decisive particularly for small companies with fewer than 1000 employees (39 percent).

In contrast, large companies place a lot of emphasis on the high scalability of solutions provided by service providers (30 percent).

However, this mainly applies to CEOs and CIOs (32 percent). This aspect is less important for IT and service management staff (23 percent).

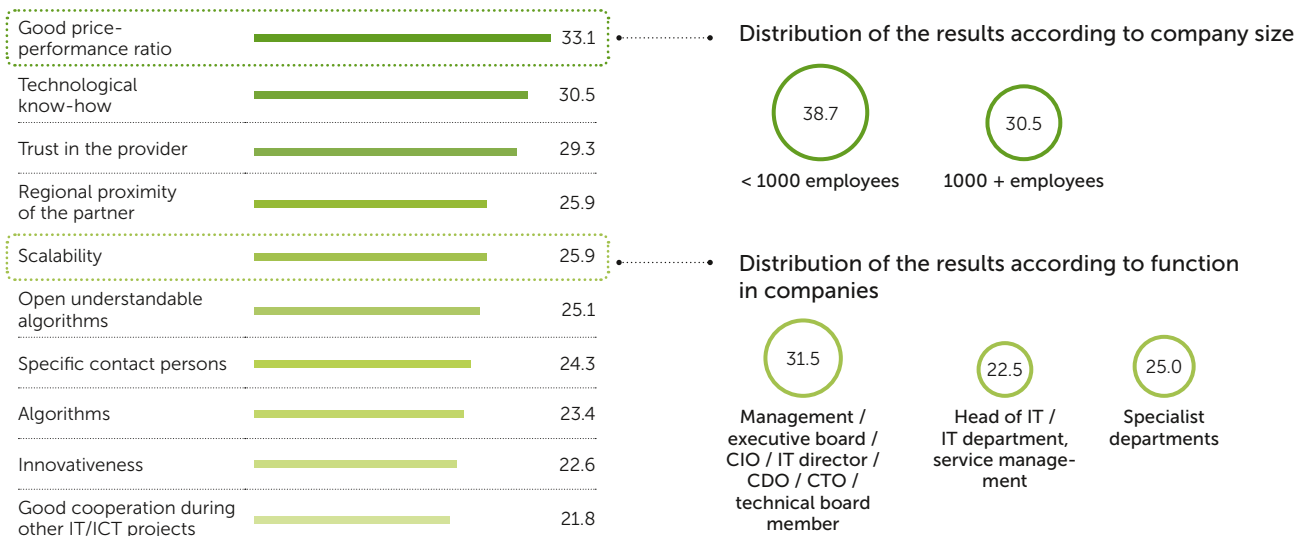
In-depth technological know-how of the service provider is important for 31 percent of respondents along with having a trustworthy partnership (29 percent).

However, of lesser importance is whether a company has already worked together with a service provider in the past on other projects (22 percent). This means, the service provider is required to win over the customer’s trust for every single machine learning project.

It is worth noting that particularly companies with a low IT budget of less than one million euros (32 percent) as well as managing directors and IT director (29 percent) would like to have a fixed contact person in the solution provider’s organization.

### In the field of machine learning, what are the decisive criteria for your company when selecting a suitable service provider?

Figures in percent. Multiple answers are possible. The top 10 answers are shown. Basis: n = 239



## 8. Only nine percent of companies have integrated machine learning into their business model

Currently, machine learning and artificial intelligence are used by more than half of German companies only selectively, e.g. to analyze data. Less than one tenth of companies have widely incorporated this technology into their business model.

Around 40 percent of respondents are currently using marketable AI APIs like Watson or other machine learning services. However, the data basis remains mainly ignored.

This approach is followed by 37 percent of smaller companies (1000 employees and less) and 44 percent of large companies.

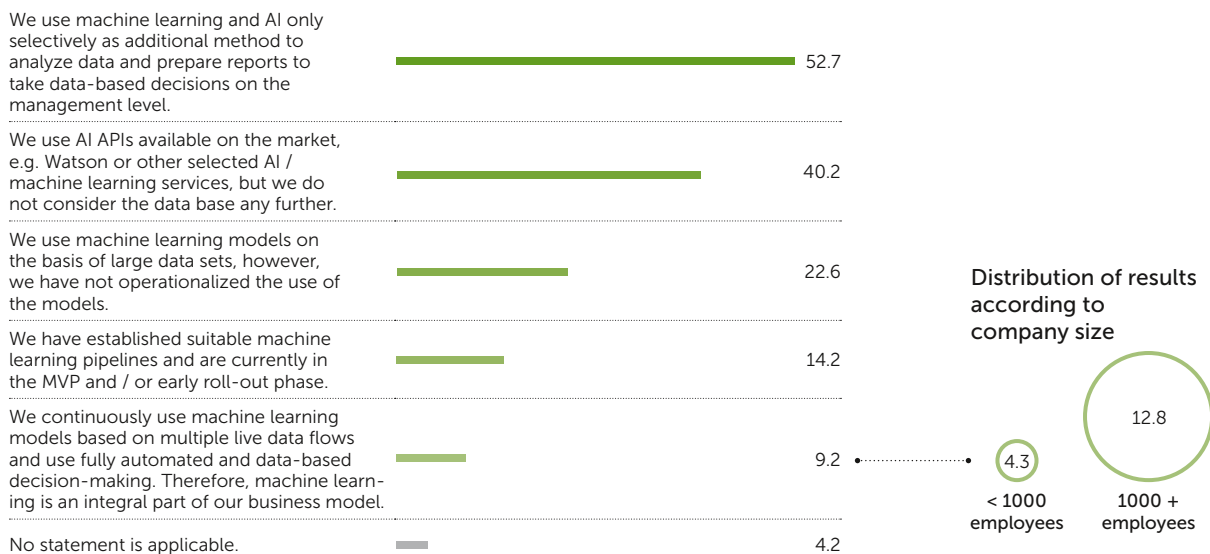
The majority of companies (53 percent) is already using ML and AI for selected data analysis projects, and creates reports based on them.

In this group, companies with an IT budget between one and ten million euros are particularly well-represented (58 percent).

Machine learning models with multiple live data flows and automatic, data-based decision-making are only applied by nine percent of the study participants. Among these are 13 percent of larger companies and only four percent of small and medium-sized companies.

### To what extent are machine learning and AI processes already in operational use in your company, i.e. beyond the testing phase?

Figures in percent. Multiple answers are possible. Basis: n = 239



## 9. Open-source versus proprietary: open-source machine learning modules dominate the market

More than half of companies exclusively or mainly use machine learning modules based on open-source software. Slightly more than 30 percent follow a strategy that uses both.

15 percent of users exclusively use machine learning based on open-source software. Such solutions are also mainly used by a further 36 percent.

Particularly companies with a low IT budget below one million euros (21 percent) and companies with very high IT expenses of more than ten million euros (19 percent) exclusively preferred the open-source approach.

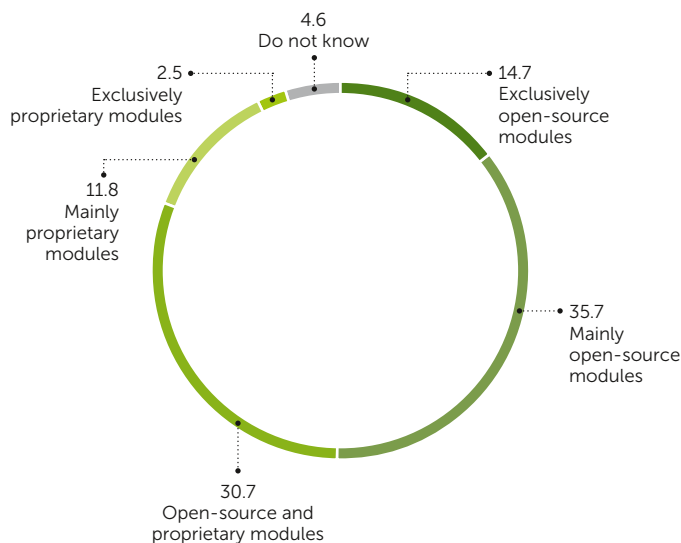
Mixed use of proprietary and open-source software can be particularly found in large companies (33 percent) and companies with an IT budget between one and ten million euros (32 percent).

In contrast to this, companies with a lower budget (IT expenses below one million euros) exclusively or mainly use proprietary machine learning products – a total of approx. 18 percent.

In comparison: In the Machine Learning Study 2018, 53 percent of respondents replied that they prefer open-source modules. Proprietary solutions were preferred by slightly more than 15 percent.

### Does your company use open-source or proprietary machine learning modules?

Figures in percent. Basis: n = 238



## 10. Challenges: hacker attacks and a lack of traceability in the decision-making

From the perspective of users, there are also negative aspects to machine learning and AI. These include the risk of hacker attacks (25 percent). Almost the same number of companies (23 percent) are concerned that the decisions of ML and AI systems can no longer be comprehended by humans – keyword: insufficient transparency.

Particularly managing directors (29 percent) and the staff in specialist departments (28 percent) see a high risk of “AI-optimized” cyber-attacks. IT departments, however, are less concerned about this (20 percent).

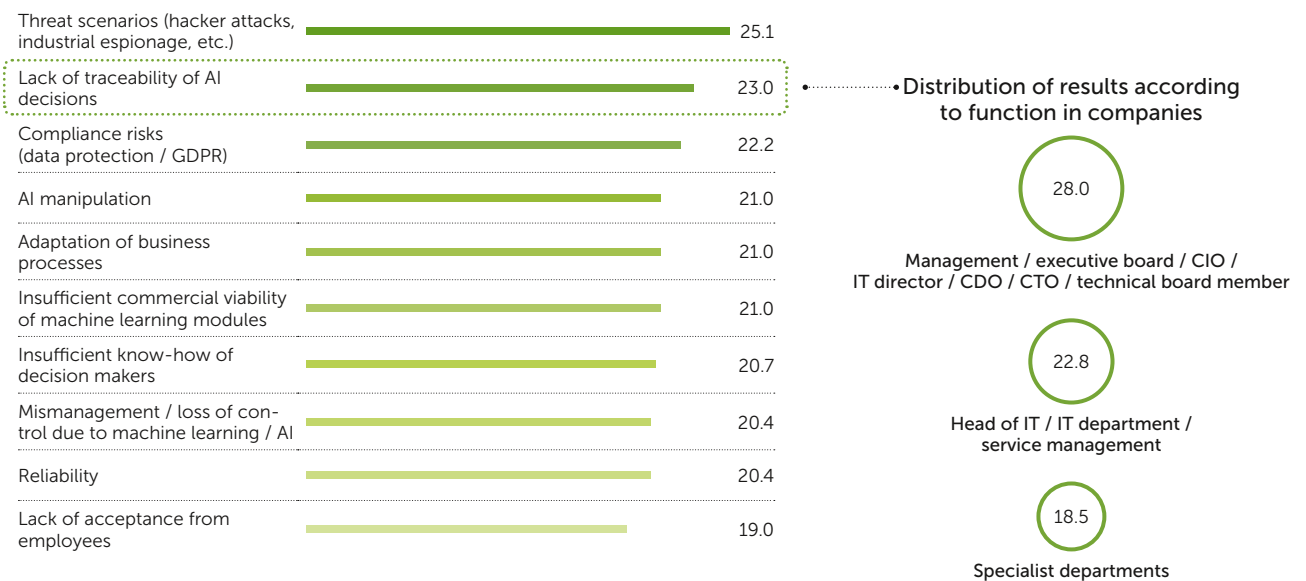
Particularly decision makers like CEOs and board members are also concerned about a lack of transparency regarding decisions taken by AI and machine learning systems (28 percent) and that such solutions may cause issues in connection with compliance and data protection (27 percent).

Clearly fewer risks are seen by companies when it comes to poor integration of ML and AI models in business processes as well as insufficient commercial viability of machine learning solutions (21 percent each).

Despite the lack of IT specialists in Germany, only 19 percent of respondents consider insufficient know-how in the fields of AI and machine learning to be an issue. A possible explanation: Expertise is acquired externally.

### What do you think are the challenges and risks posed by machine learning and artificial intelligence?

Figures in percent. Multiple answers are possible. The top 10 answers are shown. Basis: n = 343



## 11. Machine learning and artificial intelligence increase competitiveness

More than 60 percent of companies are of the opinion that AI and machine learning boost the competitiveness of Germany and open up new business opportunities. However, the respondents also believe the ethical aspects of these technologies need to be discussed.

Around 62 percent of companies expect an increase in competitiveness of Germany as business location by using ML and AI.

Less optimistic than IT specialists (65 percent) and employees in specialist departments (61 percent) are managing directors and board members (56 percent).

In contrast to this, executives expect of both technologies to create more business opportunities for their companies (66 percent).

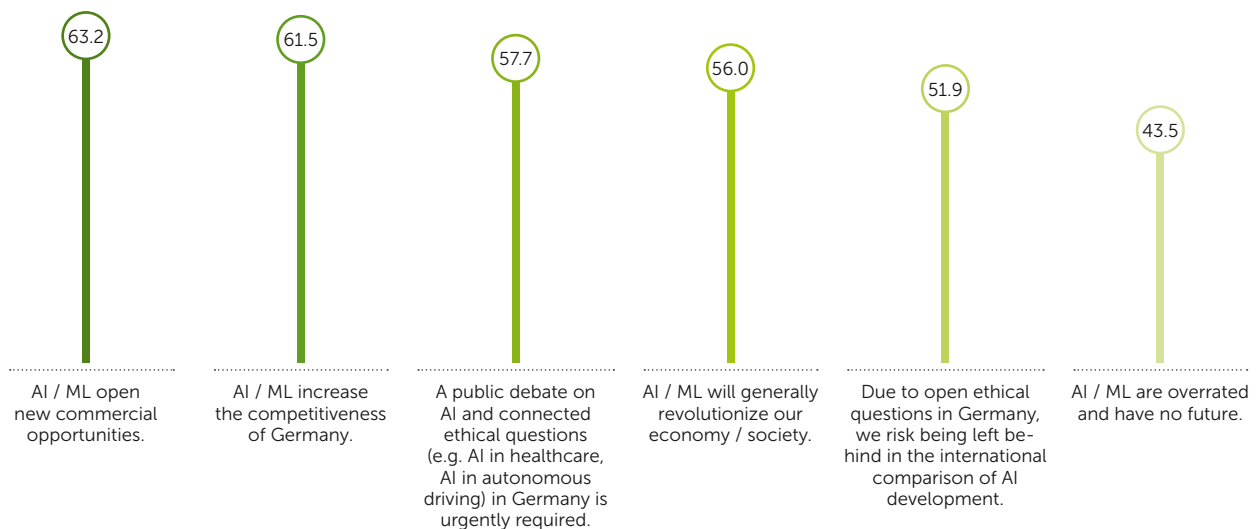
However, some doubts are also expressed: According to 58 percent of respondents, a general discussion on the ethical issues in connection with AI and machine learning is long overdue. For example, this concerns applications like healthcare and autonomous driving.

According to 52 percent, such ethical questions must be addressed promptly to ensure that Germany can keep pace in the fields of machine learning and AI.

Only 44 percent of companies consider both technologies to be overrated "hype" without a future.

### To what extent do you agree with the following statements regarding machine learning and artificial intelligence?

Figures in percent. The top 6 answers of "fully agree" or "agree" are shown. Basis: n = 343



## 12. On-premise and private clouds are primarily considered as machine learning platforms

Approx. one third of companies rely on in-house data centers or a private cloud when it comes to machine learning projects. Public cloud services are currently only used by 15 percent of the participants in the study.

Around 18 percent of companies prefer systems in their own data center as the platform for machine learning solutions. This is the generally preferred approach.

A private cloud is considered by 14 percent to be a suitable approach. Also in this case, companies retain full control of their ML solutions and the data being processed.

Already 51 percent of companies use or intend to use a public cloud. Nevertheless, only 15 percent also want to use this IT platform for machine learning.

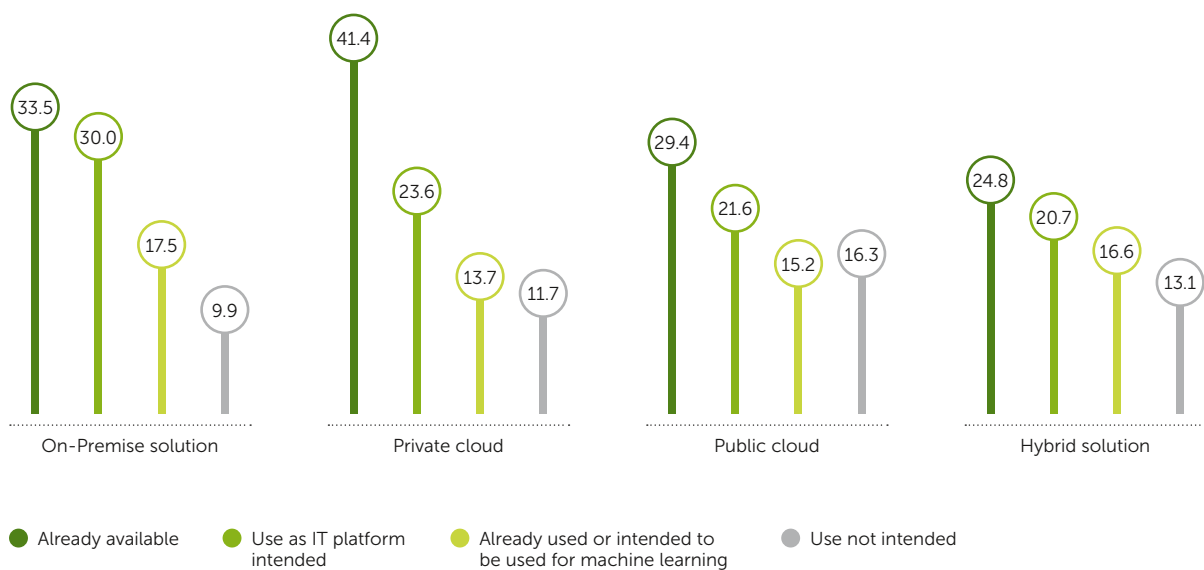
A hybrid-cloud approach in conjunction with ML is preferred by 17 percent of companies. However, in this case it is still unclear as to what extent IT resources in a public cloud are used in the context of machine learning and AI projects.

With regard to the company size, large companies (1000 employees and more) are more likely to employ public clouds in conjunction with ML (16 percent) than smaller companies (14 percent).

Small companies tend to prefer a private cloud platform (17 percent). This only applies to eleven percent of large companies.

### Which types of IT platforms are available in your company and which are to be used for ML?

Figures in percent. Multiple answers are possible. Basis: n = 343



### 13. Data strategy of companies: the foundations already exist

At least in some areas, companies are employing data strategies conducive to the use of machine learning. For example, long-term data, e.g. from machines and systems, is recorded by more than 80 percent of companies.

Around 89 percent of the participants in the study stated that there is a possibility for recording long-term data in their company.

However, this approach is mainly taken by companies with a high IT budget of ten million euros or more (91 percent). This figure is 88 percent for companies with a budget of less than one million euros.

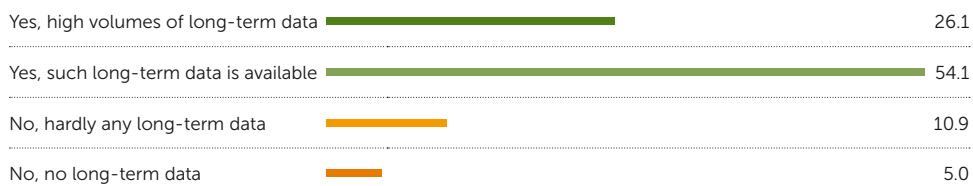
More than 80 percent of respondents noted that long-term data is not only captured but also stored for later evaluation. For example, this includes information captured from machines and production facilities over a period of several years.

A balanced result is reached regarding the type of available data: In 42 percent of cases, unstructured data, and in 43 percent of cases, structured data is available.

In contrast to this, there is still a need to catch up regarding marking data (meta data, time of data capture): Only 49 percent of companies have developed suitable strategies.

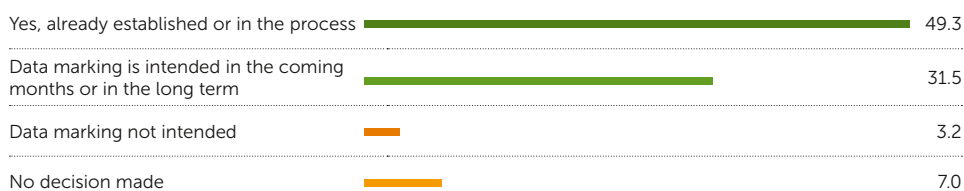
#### Is long-term data already captured and stored in your company (e.g. while machines and systems are continually operational over several years)?

Figures in percent. Basis: n = 303



#### Has a strategy for data marking (meta data, time of data capture, status of the machine at the time of data capture, etc.) been established in your company?

Figures in percent. Basis: n = 343





# A look into the future



## Machine learning has reached Germany

Yes, it is true: German companies often look at new technologies from every possible angle before using them. The same applies to machine learning (ML). However, according to a study on the topic of “machine learning” carried out by IDG Research Services, the spell has now been broken. Companies in Germany openly recognize the benefits and the strategic significance of this technology.

by Bernd Reder

Science fiction movies are full of rebellious AI systems and cyber dictators seeking to take over the world and to drive humanity, at best, to a hide out on a Jupiter moon. And although some hysterical debates around the topic of machine learning (ML) and artificial intelligence may suggest it: We are not even close to a scenario like this. According to AI specialists, it will still take several decades before hu-

man-like robots and smart sports cars like K.I.T.T from the TV series Knight Rider will be making their début.

However, this does not mean that machine learning and AI do not play any role in economies and societies. This is proven by the study “Machine Learning 2019”. It shows that German companies have in the meantime recognized



the opportunities offered by machine learning applications. Concepts like predictive maintenance of production facilities, power plants and cars are not possible without machine learning. Additionally, numerous projects in the fields of environmental protection, urban planning and healthcare show that intelligent algorithms can contribute to improving standards of living in industrialized societies.

### **Companies are recognizing the potential of machine learning**

The fact that German companies now see the benefits that machine learning has to offer is a very positive development. This is proven by the fact that today at least one machine learning application is used by almost 60 percent of companies. Admittedly, this is often a first attempt. However, test like these are necessary to implement ambitious projects in the future.

Use cases and business models for machine learning are also developed by medium-sized companies. It goes without saying that this sometimes requires slightly more time than in a large company in the automotive or chemical sectors. Such companies have a considerably higher IT budget. This is the reason that particularly medium-sized companies seek support from external ML and AI specialists.

### **New opportunities for service providers and IT companies**

This also opens up a new business field for service providers: System houses, consultancy firms and even IT vendors can offer support for machine learning projects – even beyond simple provision of servers, storage systems or cloud resources. Expertise in the field of machine learning is required.

For service providers, establishing this kind of know-how is worth the effort. On this topic, the study of IDG Research Services clearly declares: The merits of yesterday do not really count today. Almost 80 percent of users are prepared to switch to a new technology partner if their current system supplier is unable to offer support in the field of machine learning.

### **Homework first**

Of course, users cannot pass on the responsibility for their machine learning projects to their partners. However, the study shows that this is also not their intention. Particularly medium-sized companies act according to the principle: "External support is appreciated. But we get to keep the know-how!". This approach is understandable – key word: Protection of intellectual property. However, companies should carefully consider how far they want to follow an isolationist approach like this. The success of machine learning projects mainly depends on whether sufficient qualified training data is available for ML systems.

Speaking of data: Data is one of the largest "building blocks" that users of machine learning have to be concerned with. A large proportion of companies faces considerable problems when selecting and preparing data for ML solutions. There is still a lot to do and this (unfortunately) against the background of a serious scarcity of data scientists in the job market. However, whining about it won't get us anywhere. Unfortunately, not even the smartest machine learning algorithm is able to transform useless input data into valuable information and predictions just like "spinning straw into gold" – that only happens in fairy tales.

# Our study partners introduce themselves





## On the path to machine learning and artificial intelligence with Siemens "Digital Enterprise"



In the context of its overarching concept of "Digital Enterprise", Siemens offers a comprehensive portfolio for digital companies. The Digital Enterprise Suite from Siemens includes software-based systems and automation components covering all requirements of the industrial value chain. Teamcenter is its backbone, the most popular digital life cycle management solution in the world. In real production environments, products like Manufacturing Operations Management (MOM), Simatic IT and Sinumerik CNC control systems as well as the Simatic S7 controller portfolio have proven their worth on a global scale.

In mechanical engineering and production machinery applications, digitalization impacts numerous approaches and processes. It considerably extends the production spectrum to increase the productivity in the overall machine environment. It transforms the way in which products and production equipment are developed, production processes are designed and structured and operating states are detected, captured and optimized. Digitalization supports quicker implementation of ideas, unleashes innovation, increases production rates and shortens the time to market.

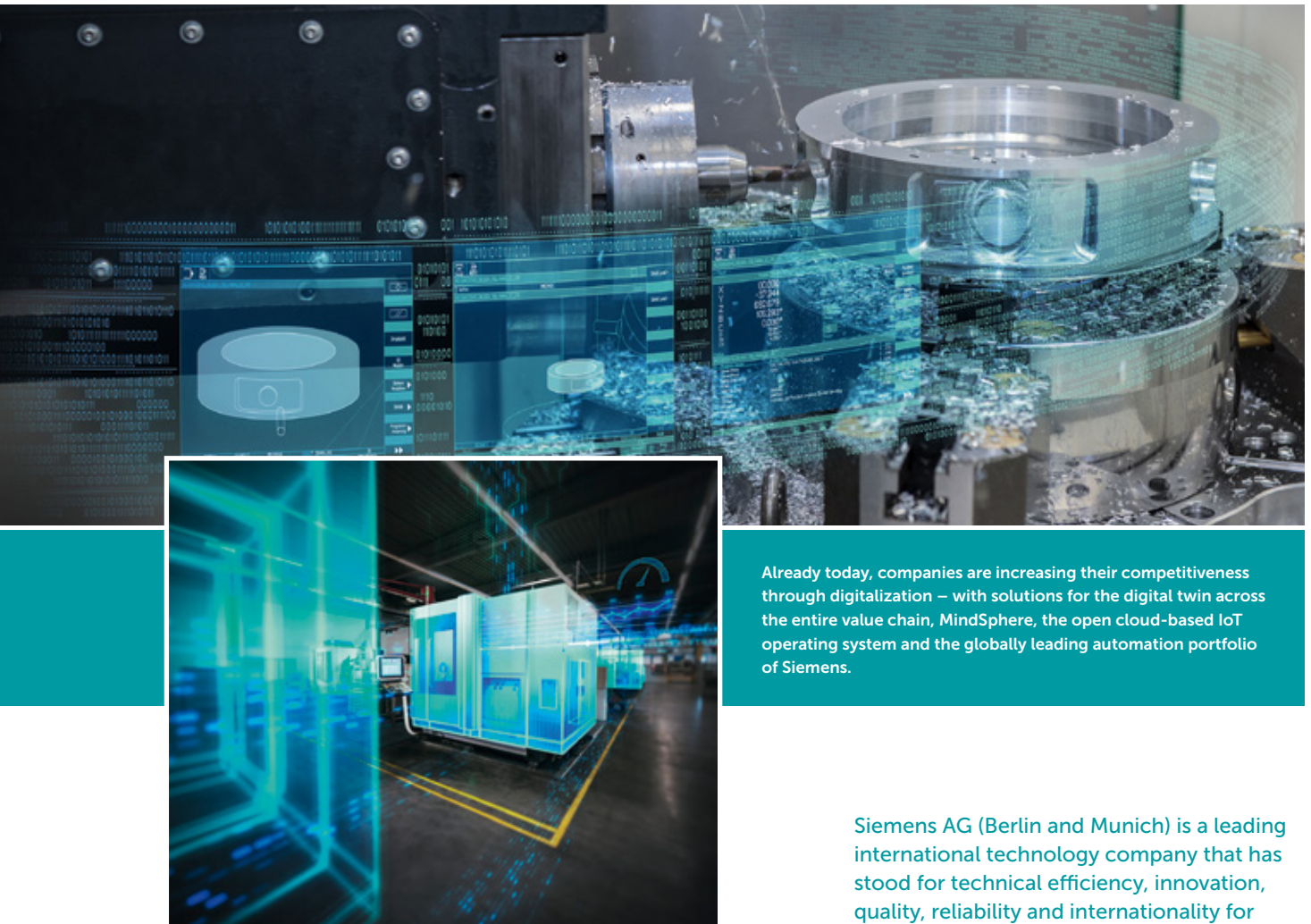
The completely new opportunities generated by linking the digital to the real world clearly boosts productivity and allows new business models to be created. This applies to machine manufacturers as well as machine operators. It is just as relevant for small and medium-sized companies as for the giants of the industry. Digitalization becomes the central driving force for growth and profitability of mechanical engineering in the future.

The path to reach this goal lies in full digital and real integration of all technologies and processes across the individual stages of the value chain in the development and operation of machines. The digital twin plays a decisive role here – and involves the simulation of real objects in the digital world. This means integrating the various digital twins into a single data model. The digital twins involved are for the machine or the final product to be manufactured with it, for the production process and for production itself.

**MindApps**  
Optimization of the performance of assets, energy and resource consumption, maintenance and services

**MindSphere**

Siemens offers numerous connection and application options for MindSphere, its powerful and open cloud-based IoT operating system for digital factories.



Already today, companies are increasing their competitiveness through digitalization – with solutions for the digital twin across the entire value chain, MindSphere, the open cloud-based IoT operating system and the globally leading automation portfolio of Siemens.

All these steps require that high volumes of data are captured, processed and analyzed. In addition to data processing inside or close to the machine, connection to the cloud plays an increasingly important role. In this process, for example, maintenance and update of in-house server operation is no longer required. The advantage of the cloud also becomes clear in digital applications: Instead of having to develop everything in-house, the cloud offers configurable apps with a comprehensive range of functions. This makes machine operation more transparent and efficient. Setting up and managing the various services and apps are conveniently realized from the cloud.

**Digitalization is the basis for machine learning and artificial intelligence.**

Siemens AG (Berlin and Munich) is a leading international technology company that has stood for technical efficiency, innovation, quality, reliability and internationality for more than 170 years. The company is active all around the globe, primarily in the fields of electrification, automation and digitalization.

Siemens is one of the largest manufacturers of energy-efficient and resource-saving technologies. The company is also one of the leading providers of efficient power generation and power transmission solutions, a pioneer in infrastructure solutions as well as for automation, drive and software technology for the industrial sector.

Further, the company and its listed subsidiary Siemens Healthineers AG are leading innovators in the field of medical imaging equipment like CT and MRI scanners as well as in laboratory diagnostics and clinical IT. At the end of September 2018, the company had approx. 379,000 employees worldwide.

[www.siemens.com](http://www.siemens.com)

**SIEMENS**  
*Ingenuity for life*



## Tech Data invests in an artificial intelligence (AI) team

At the beginning of March 2018, the 7-member Artificial Intelligence Acceleration team of the Munich distributor was founded and has since then been involved with the development and expansion of artificial intelligence projects. In addition to simplifying the introduction to this complex topic and focusing on the growing field of AI, the main task of the experts is to support sales partners when executing projects.

### Tech Data Advanced Solutions

As an active link in the technology ecosystem, we help our manufacturers to grow and our sales partners to be more successful. In this process, our innovative approach and our well-founded expertise in the fields of data centers, software, cloud computing, converged and hyper-converged, mobility, analytics, security and IoT solutions are of crucial significance. This enables our partners to offer the end-to-end solutions their clients need in the course of IT transformation to secure their competitiveness.

In the acquisition and implementation of customer projects of channel partners, the team leverages resources from established IT providers and coordinates the collaboration with external providers (e.g. start-ups, ISVs, etc.). The primary objective of the mission is to further develop the ecosystem between traditional partners and new service providers (start-ups, AI solution providers, ISVs, consulting companies, etc.).

The team with its in-depth expertise and extensive know-how in the fields of AI, cognitive infrastructure business, high-performance computing and cloud technology consists of business development experts, client technical architects and sales professionals with AI expertise. Dr. Karsten Johannsen is the Business Development Executive and is responsible for the technical management of the expert team. Detlev Jacobs is the Team Leader of Artificial Intelligence and has a personnel management role.

Photo: shutterstock.com / PopTika



Barbara Koch, Managing Director Advanced Solutions of Tech Data Germany & Austria, welcomes the new team of experts: "I am very proud to present the first team of AI experts in the field of distribution in the DACH region.

With our investment in the Artificial Intelligence Acceleration Team, we continue to focus on this topic and intend to identify new partners and execute new projects.

Applications like Deep Learning, machine learning or Power AI require technologies for data processing that can be realized by offering solutions such as Watson, cloud services and infrastructure. In the future, our sales partners can also expect software solutions from other manufacturers."

Interested sales partners can obtain detailed information on our range of AI solutions under [www.techdata.de/ibm-ai](http://www.techdata.de/ibm-ai) or from the experts of our Artificial Intelligence Acceleration Team by sending an e-mail to: [ibm-ai@techdata.com](mailto:ibm-ai@techdata.com).



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Lufthansa Industry Solutions

# Your Partner for digital transformation

Whether developing a company-wide digitalization strategy, networking machines using IT services, or providing mobile platforms for company-wide collaboration: Whenever companies intend to execute projects in the field of digitalization, Lufthansa Industry Solutions is the perfect partner.

We have clients from a wide variety of different industries. They are working in aviation, logistics and transportation. They come from manufacturing and the automotive sector or are publishing, tourism, energy or healthcare companies. Regardless of the industry they come from, however, they share the same great challenge of our time: They are required to design their IT environment across the entire value chain so that costs are reduced while profits and efficiency can be sustainably increased. Put succinctly, it is all about future sustainability of the company.

Lufthansa Industry Solutions supports companies in achieving the required digitalization and automation of their business processes – whether medium-sized company or DAX corporation.

To realize this, we not only focus on the IT system required but also on the specific business of our clients with all of its associated internal and external challenges. After all, digital transformation covers the entire structure and culture of the company and extends beyond company limits up to collaborating with partners, clients and suppliers.

## **Our project experience and industry know-how**

We enjoy a long history of collaboration with many of our clients. We combine the resulting project experience and industry-specific know-how with our comprehensive service and technology portfolio.

This is the reason that we work with interdisciplinary teams. Whether cloud, SaaS or data analytics – Lufthansa Industry Solutions covers the full spectrum of IT services in either an advisory capacity or as system integrator. In this process, we have always been working with the aim of ensuring maximum security and quality – particularly as our roots are in aviation, a highly digitalized and security-sensitive area.



*“Digital transformation offers our clients a high potential for growth and new value creation models. We support companies in opening up this potential through automation and digitalization of their business processes.”*

Bernd Appel, Managing Director of Lufthansa Industry Solutions





### **Our main focus**

- Process consulting/process organization
- IT consulting (processes, technologies, infrastructure)
- IT system integration and development
- Application management and operation in IT system operation
- Program and project management
- Strategic consulting

### **Our special expertise**

On their path to a data-driven company 4.0, our Data Insight Lab competence center offers support for clients from different industries. In this area, data scientists and data architects work together with companies to merge, structure and analyze their data. The objective is always to assess the value of data and to use the results to achieve maximum value.

Additionally, we have bundled our project management expertise in the Project Management Excellence business division. This allows us to support our clients in efficient and cost-saving implementation of their specific IT projects.

### **The service portfolio covers:**

- Drawing up and executing big data solutions – from developing the architecture through execution up to training personnel
- Developing analyses and reports or fully data-based products in the context of minimum viable products (MVPs, products with a minimum scope of functions)
- Using and consulting on technologies in the field of machine learning and artificial intelligence for evaluation of unstructured mass data
- Intelligent analysis of sensor data
- Prototyping in the Data Insight Lab

Lufthansa Industry Solutions TS GmbH based in Oldenburg provides comprehensive know-how in the field of technology. The experts support our customers when it comes to developing software and operating and maintaining applications. Quality assurance, test management and infrastructure consulting are also part of our core competences.

### **Smart Data Analytics at Lufthansa Industry Solutions**

Comprehensive, cross-department use of company data helps making better decisions, developing more specific products and maintaining machines in a more economical way. Client management and the supply chain can also be optimized by evaluating data. The basis for this is big data analytics and technologies. These have a considerable impact on the success of the company – also in view of the increasing relevance of prediction of results based on comprehensive real-time data analysis.

Lufthansa Industry Solutions supports companies across the entire data ecosystem and links big data analytics with classic business intelligence technologies. In the company-internal Data Insight Lab Competence Center, data scientists and data architects work together with companies to develop strategies and use cases. Additionally, the data is analyzed and assessed by experts in order to build data platforms for business operations.



**Lufthansa  
Industry Solutions**



# IoT platform of in-GmbH: The brain of production

The production system of the future is highly networked. How can an Internet of Things (IoT) platform help solve related tasks?

sphinx open online, an open IoT platform, allows data from various sources to be merged, intelligently processed and systems to be actively influenced. Using the “model in the middle” approach, digital twins of plants, systems and processes can be networked with one another facilitating data exchange with additional software systems for value-added services. Processes similar to the brain can be realized in this way: continuous machine learning, analysis of chronological sequences, deriving forecasting, optimizing as well as system control.

The unique feature of the “model in the middle” approach realized with the sphinx open online IoT platform is the possibility of merging and parametrizing all relevant technologies in one consistent system. Services can be linked, and user interfaces freely designed. Data fusion, historization, analysis, machine learning, forecasts, speech

recognition and synthesis as well as rule-based interaction with systems are merged by means of a consistent event-based model. This facilitates control circuits that go beyond system limits and autonomous action.

The IoT platform enables connection of data-processing systems (horizontal) and physical entities (vertical) – from the cloud, on-premises or on the edge. This facilitates ongoing development, change and rolling out of data models, processing logics and user interfaces while systems are operational. Additionally, data-processing services from partners can be connected, for example for outsourcing CPU-intensive processes or targeted use of external know-how.

## Model mind and future predictions

“Changes in reality change the model, changes to the model change reality”, explains Siegfried Wagner, managing director of in-integrierte informationssysteme GmbH. “Additionally, the dimension of time is taken into account by the ‘model in the middle’ approach. With the model mind, lessons can be learned from the past and predictions can be made. This allows us to recognize and solve tomorrow’s challenges already today. This way, the platform enables a timely response to results for optimization of complex systems with numerous framework conditions. Additionally, unpredictable disruptions are reliably solved by rule-based empirical data without the need for human intervention.”





**SPHINX  
OPEN**

## Intelligent Solutions for Industrie 4.0 and IoX

in-integrierte informationssysteme GmbH is based in Konstanz and has been specialized in integrated business processes since its foundation in 1989, offering software products, SaaS solutions and consulting services. Innovative strength, high-quality products, successful projects and motivated employees are the basis for efficient solutions and long-term satisfaction of clients.

sphinx open online is a highly versatile IoT platform that has been used since 2011 and is continuously extended. In connection with procedures in the field of machine learning, complex systems are actively optimized. Whether in the smart factory, on the shop floor, in smart devices or in the form of smart services: Complexity can be controlled, decisions are optimally supported, and processes are optimized and automated. The platform is used worldwide in production and energy management. In close cooperation with partners and clients in the fields of electro mobility, safety and security, logistics etc., new solutions and services are developed.

The clients include medium-sized companies and large corporations in the fields of automotive, system and mechanical engineering, manufacturing and aviation.

Thanks to the structured and agile approach, tried and tested architectures and web-based business solutions, they have numerous advantages: simple introduction, quick information for decision makers, better collaboration, integration of mobile processes, shorter lead times, higher flexibility, know-how protection, consistent data, better traceability, increased transparency and high user acceptance.



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## A1 Digital – your Partner for E2E solutions plus connectivity.

The system house for digital transformation.

Based on increasingly widespread connectivity and higher connection speeds, the digital transformation is in full swing and massively changing traditional **business models**. Digitalization is not just a passing trend, nor a topic reserved to IT departments. It is a strategic core topic and is appropriately relevant at the executive management level.

A1 Digital supports companies in the challenging process of digital transformation as a **one-stop-shop for digitalization and technology consulting**.

In this process, A1 Digital develops the best technical solution for interaction with clients, optimization of business processes, development of new business models and for communication with partners and suppliers.

A1 Digital – founded in 2017 as a subsidiary of **A1 Telekom Austria Group** – focuses on Europe and covers the markets of the group in the CEE region as well as new Western European markets and particularly in Germany. A team of experienced specialists offers consulting on **IoT services** like asset tracking, fleet management, smart metering and **machine learning** and AI applications (artificial intelligence). Thanks to innovative and scalable **cloud services** and the new **security portfolio**, the digital value-added chain is further optimized.

In the business year of 2018, the increasing rates in cyber-crime were taken addressed by establishing a dedicated security team. In addition to security consulting services, the portfolio also includes an internally developed vulnerability scanning solution to identify and show potential security flaws in IT systems.

Photos: shutterstock.com / Alexander Supertramp, maxuser



## Highlight – project technology

The EU Helix Nebula initiative relies on the Exoscale platform from A1 Digital.

The Helix Nebula initiative is a partnership between industry, aerospace and science. The objective is to employ open cloud services to establish a dynamic and seamlessly integrated ecosystem between research facilities and companies. As technology provider for the project, a consortium led by RHEA, a professional engineering service partner, was selected. They rely on Exoscale, a subsidiary of A1 Digital, for the entire infrastructure.

Currently, the initiative has more than 40 public and private partners including CERN of the European Organization for Nuclear Research, one of the world's largest and most renowned centers for scientific research.

The unique API (application programming interface) functions and short reaction time for providing a cloud infrastructure make Exoscale the ideal platform for the project.



### Product portfolio of A1 Digital at a glance

- Industry-specific applications in the field of IoT with new IoT platform
- Exoscale hybrid cloud platform and cloud-based workplace products
- Security solutions for cloud, IoT and OT (operational technology) for instance, hacker protection

[www.A1.Digital](http://www.A1.Digital)

# Study design



# Study profile

<b>Publisher</b> .....	COMPUTERWOCHE, CIO, TecChannel and ChannelPartner
<b>Study partners</b> .....	<p><b>Platinum partners:</b> Siemens AG Tech Data</p> <p><b>Gold partners:</b> Lufthansa Industry Solutions GmbH &amp; Co. KG</p> <p><b>Bronze partners:</b> in GmbH A1 Digital</p>
<b>Population</b> .....	Senior (IT) and IT security officers of companies in the D-A-CH region: strategic (IT) decision makers at the C level area and in the specialist departments (LoBs), IT decision makers & IT specialists from the IT field
<b>Participant generation</b> .....	Sample-taking from the IT decision maker database of IDG Business Media; personal e-mail invitations to participate in the survey
<b>Total sample</b> .....	343 completed and qualified interviews
<b>Study period</b> .....	January 31 to February 2, 2019
<b>Method</b> .....	Online survey (CAWI)
<b>Questionnaire development</b> .....	IDG Research Services in coordination with study partners
<b>Implementation</b> .....	IDG Research Services
<b>Technological partner</b> .....	Questback GmbH, Cologne
<b>Survey software</b> .....	EFS Survey Fall 2018



# Sample statistics

<b>Industry distribution*</b>	Agriculture and forestry, fishing, mining.....	4.7 %
	Energy and water supply.....	6.7 %
	Chemical and pharmaceutical industry, life science.....	9.9 %
	Metal-producing and processing industry.....	9.0 %
	Machinery and plant engineering.....	12.8 %
	Automotive industry and suppliers.....	9.3 %
	Manufacturing of electronic goods, IT industry.....	13.7 %
	Consumer goods, food and luxury goods industry.....	7.6 %
	Media, paper and print industry.....	4.7 %
	Construction industry, trades.....	4.1 %
	Wholesale and retail (including online).....	10.2 %
	Banks and insurance companies.....	9.3 %
	Transportation, logistics and transport.....	7.6 %
	Services for companies.....	17.8 %
	Hospitality industry, tourism.....	4.1 %
	Public administration, local authorities, social insurance companies.....	12.0 %
	School, university, university of applied sciences.....	4.7 %
Healthcare and welfare.....	6.4 %	
Other industry group.....	5.2 %	
Not specified.....	2.9 %	
<b>Company size in Germany</b>	Fewer than 100 employees.....	9.6 %
	100 to 999 employees.....	33.5 %
	1000 to 9999 employees.....	37.9 %
	10,000 employees and more.....	16.0 %
	Not specified / do not know.....	2.9 %
<b>Turnover category in Germany</b>	Less than EUR 100 million.....	19.5 %
	EUR 100 to 999 million.....	24.5 %
	EUR 1 to <2 billion.....	17.5 %
	EUR 2 to <5 billion.....	16.6 %
	EUR 5 billion and more.....	11.4 %
Not specified / do not know.....	10.5 %	
<b>Annual expenditure in IT systems</b>	Less than EUR 1 million.....	21.0 %
	EUR 1 to <10 million.....	32.9 %
	EUR 10 to <100 million.....	22.2 %
	EUR 100 million and more.....	10.8 %
	Not specified / do not know.....	13.1 %

\* Multiple answers are possible



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### Bernd Reder

Bernd Reder has been working as a journalist for media, PR agencies and companies for about 30 years. He focuses on information and network technology, cloud computing, IT security and mobility. Before he became a freelancer, he worked in the editorial offices of leading specialist industrial publications.

These include Elektronik, Network World, Digital World and Network Computing.

## Our Team of Authors



### Alexander Jake Freimark

In 2009, Alexander Jake Freimark left the editorial staff of COMPUTERWOCHE to become a freelancer. He writes for media outlets and various companies and focuses on the field of corporate publishing.

He specializes in technological innovation as well as in the transformation of organizations, markets and humans.



### Christoph Lixenfeld

Christoph Lixenfeld has worked as a journalist and author for Süddeutsche Zeitung, Spiegel, Focus, Tagesspiegel, Handelsblatt, Wirtschaftswoche, COMPUTERWOCHE and numerous other publications for 25 years. He is also active in radio broadcasting, particularly for DeutschlandRadio, and TV production, for example for the ARD magazines Panorama and Plusminus. He covers, among other things, the topics of economics and IT.



### Jürgen Mauerer

Since October 2002, Jürgen Mauerer has been working as a freelance IT journalist in Munich. He mainly writes about current topics and trends in the field of IT and the economy for publications like COMPUTERWOCHE, com! professional or ZD.NET. Additionally, he offers consulting and support to PR agencies

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### Oliver Schonschek

Oliver Schonschek is a free analyst and journalist and writes for leading specialist media including COMPUTERWOCHE and CIO about IT, security and data protection. He has published and authored several specialist publications and has been distinguished several times in the US as an influencer and media

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### Michael Schweizer

Michael Schweizer is a free editor and author based in Munich. He often writes about people and questions relating to personnel and careers in the IT environment. He is particularly interested in everything to do with science, such as independent studies on complex topics. In the position of freelance

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## Our study series



## Preview of study series

- May 2019: **Managed Services**
- May 2019: **Process Mining & Process Automation**
- June 2019: **Data Analytics & Data Protection**
- September 2019: **Digital Customer Experience**
- September 2019: **Augmented & Virtual Reality**
- October 2019: **Endpoint Security Management**
- November 2019: **Internet of Things**
- December 2019: **IT Service Management**
- February 2020: **Cloud Native**
- March 2020: **DevOps**
- April 2020: **Data Management / Data Quality**
- April 2020: **Robotics**

Study projects are started with initial editorial round tables about three to four months before the specified publishing date.

(State of planning as of March 2019, subject to change)

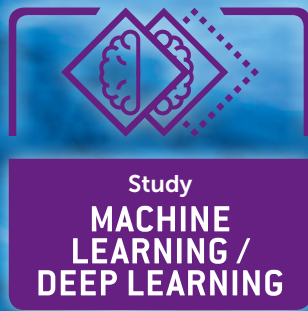
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