

# *Data exchange as a first step towards data economy*

*How relevant is data exchange for digitisation? What are the options for implementation? And which role can Industrial Data Space take on as an open, standardised approach? We asked more than 200 executives in Germany for their views.*

**INDUSTRIAL DATA SPACE ASSOCIATION**





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# Preface

Dear Reader,

Data form the foundation of every application system, yet data alone do not create any societal or economic added value. Only when data are turned into information by means of enrichment and context can they bring about added value. This added value, which at first appears to be trivial, is the cornerstone for what is known as digitisation today and what the digital agenda of the German Federal Government is based on. This is how data have become an economic good in their own right. By combining and analysing data fully, novel ways and possibilities for adding value emerge. This change is by no means just a catchword anymore but has already become reality and is now leading to comprehensive changes in all areas of society.

One of the challenges resulting from this change is to ensure safe, cross-company data exchange as an enabler for smart services or as the driving force behind implementing digitisation strategies in companies. For these particular use cases, no established, cross-industry architectures are available at the moment. At the end of 2014, Industrial Data Space was initiated by a joint committee made up of members from the worlds of business, politics and research. The essence of this architecture is to provide a virtual data space for the safe exchange of data that is based on a common governance model.

As an accounting and auditing firm, PwC stands for trust. As a founding member of the Industrial Data Space Association, we want to contribute our trust towards the development of this architecture and to help companies in all sectors on their way towards becoming data-driven companies.

All these developments motivated PwC to conduct a study with more than 200 companies from different industries and of different sizes by putting this approach to Industrial Data Space to the test in real businesses. It was our objective to evaluate this at this early stage to see whether the concept of Industrial Data Space will be accepted in business and which potentials it includes as well.

We thank you for your interest in this study and hope you enjoy reading it.

Hanover, March 2018



**Harald Kayser**

COO PwC Europe & CDO [PwC Deutschland](#)  
[PricewaterhouseCoopers GmbH WPG](#)

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## Foreword

Dear Reader,

A fundamental feature of digital transformation and the data economy is to make data from physical objects such as machines, components and the humans interacting with them available digitally so they can be utilised. The increasing aggregation and interlinking of these data enhances their value – and is now quite common. However, the real potential of this wealth of data in companies does not seem to have been exhausted yet – and the full potential of combining data from different data sources, companies, sectors and ecosystems seems to be even more tempting and cannot be predicted.

Currently, this places companies in a dilemma: there is obvious potential for increasing efficiency or even creating completely new business models which is certainly worth striving for, but on the other hand there is uncertainty as to how a company's own precious data can be made secure and commercialised sustainably.

The Industrial Data Space concept sees the worlds of business, science and politics coming together to present an open approach to cut the Gordian knot. What would be possible if companies were in a position to exchange data with other companies without losing control over their own sensitive and profitable data? And what if we stopped others playing “I spy with my little eye ...”?

This study helps us to investigate how well the concept of Industrial Data Space will be able to gain a high degree of acceptance, and become a standard for data interoperability, and therefore sustainably accelerate the data economy. Within the Industrial Data Space Association, companies, research institutions, associations and institutions are all pushing forward the development of Industrial Data Space and pursuing the honourable objective of setting an international standard for sovereign data interoperability. It will be necessary to collect requirements from all sectors and scenarios if we want to gain widespread acceptance for the application of Industrial Data Space.

It is therefore essential that we pursue current developments and conduct individual market research. The latter can only lead to revealing insights if experts from a range of different subject areas contribute their points of view. For this study we conducted a detailed, comprehensive and methodically sophisticated survey in which more than 200 executives from as many different companies from all industries participated. We thank you all for your contributions.

For us and for the further development of the Industrial Data Space idea, these results are extremely valuable, in part surprising and above all an important aid to continue the adaption and development of the configuration of Industrial Data Space.

We wish you an exciting and insightful read.

Dortmund and Frankfurt, [March 2018](#)

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# *Table of contents*

Table of figures.....	8
Table of tables .....	9
A Executive summary.....	10
B Changes due to digitisation .....	13
C Cross-company data exchange – insights.....	17
D Industrial Data Space as an open, standardised and safe approach for data exchange between companies .....	25
E Conclusion .....	40
F About the procedure.....	42
Contacts.....	45

## Table of figures

Fig. 1	Architecture of the overall study on Industrial Data Space .....	10
Fig. 2	Data exchange between companies as an essential feature of digitisation and data economy.....	11
Fig. 3	Example applications for IDS in companies .....	12
Fig. 4	Changes within their own company due to digitisation over the past five years.....	13
Fig. 5	Expected development: the influence of digitisation over the next five years .....	14
Fig. 6	Prevalence of digitisation strategies in companies.....	14
Fig. 7	How much are companies involved in looking into digital trends? .....	15
Fig. 8	How much are companies involved in looking into digital trends according to their size? .....	16
Fig. 9	Data exchange currently carried out by companies with other companies or institutions .....	18
Fig. 10	Types of company currently involved in data exchange .....	18
Fig. 11	Regularity of data exchange with other companies according to company size.....	19
Fig. 12	Projections for the demand for cross-company data exchange over the next five years.....	20
Fig. 13	Opportunities provided by the present possibilities for cross-company data exchange .....	21
Fig. 14	Intensity of looking into the topic of cross-industry data exchange in companies so far .....	22
Fig. 15	Obstacles which mean companies do not approve of data exchange on conventional platforms .....	24
Fig. 16	Components at system level.....	26
Fig. 17	Functional architecture.....	27

Fig. 18	Designation of specific application possibilities for Industrial Data Space in companies .....	31
Fig. 19	Expected improvements through Industrial Data Space .....	37
Fig. 20	Success factors for Industrial Data Space .....	39
Fig. 21	Architecture of the overall study on Industrial Data Space .....	42
Fig. 22	Role/position of subject.....	44
Fig. 23	Sectors of companies in the survey .....	44

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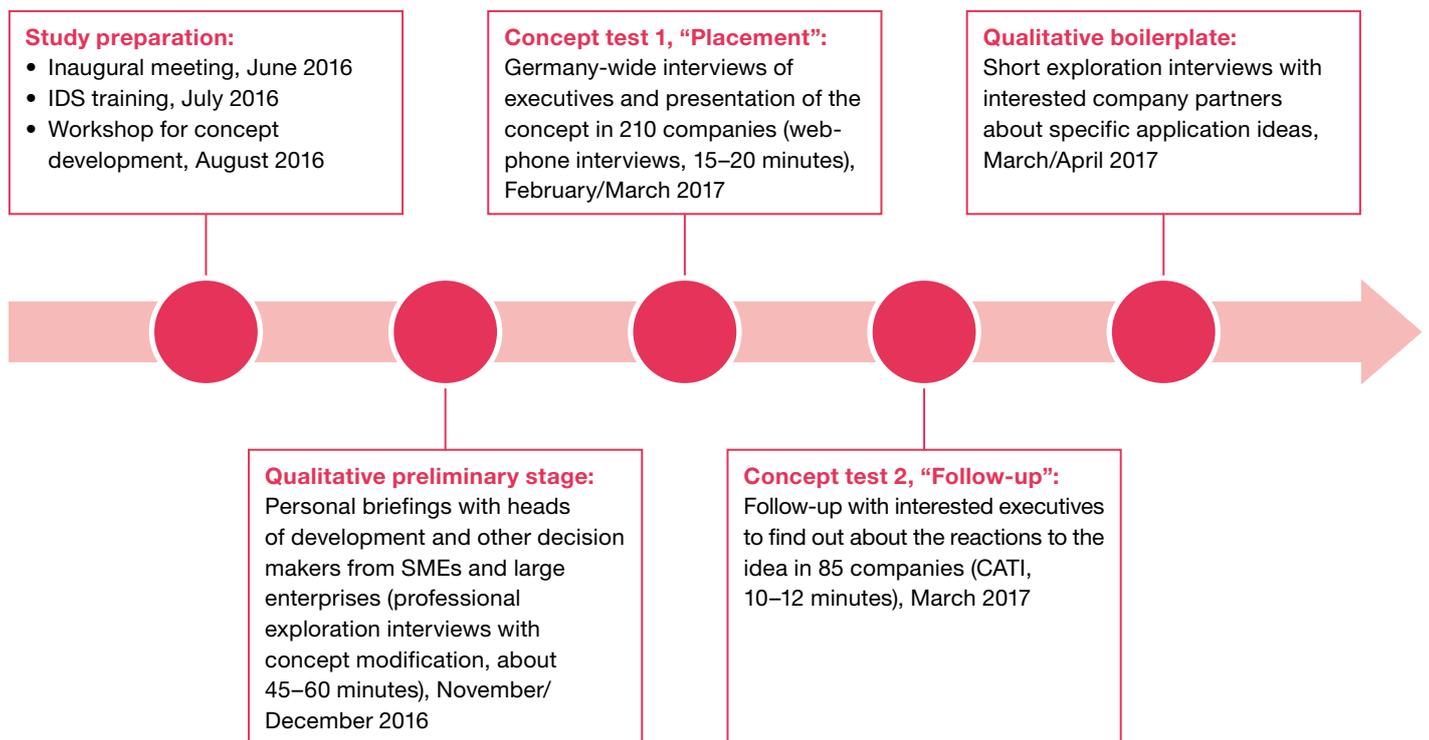
## ***Table of tables***

Tab. 1	Spontaneous opinions about Industrial Data Space – positive and ambivalent examples .....	28
Tab. 2	Spontaneous opinions on Industrial Data Space – negative and ambivalent examples .....	29
Tab. 3	Advantages of Industrial Data Space, example aspects .....	30
Tab. 4	Disadvantages of Industrial Data Space, example aspects .....	31
Tab. 5	Possible applications for Industrial Data Space in companies, examples .....	32
Tab. 6	Specific ideas for applications for Industrial Data Space in companies .....	33

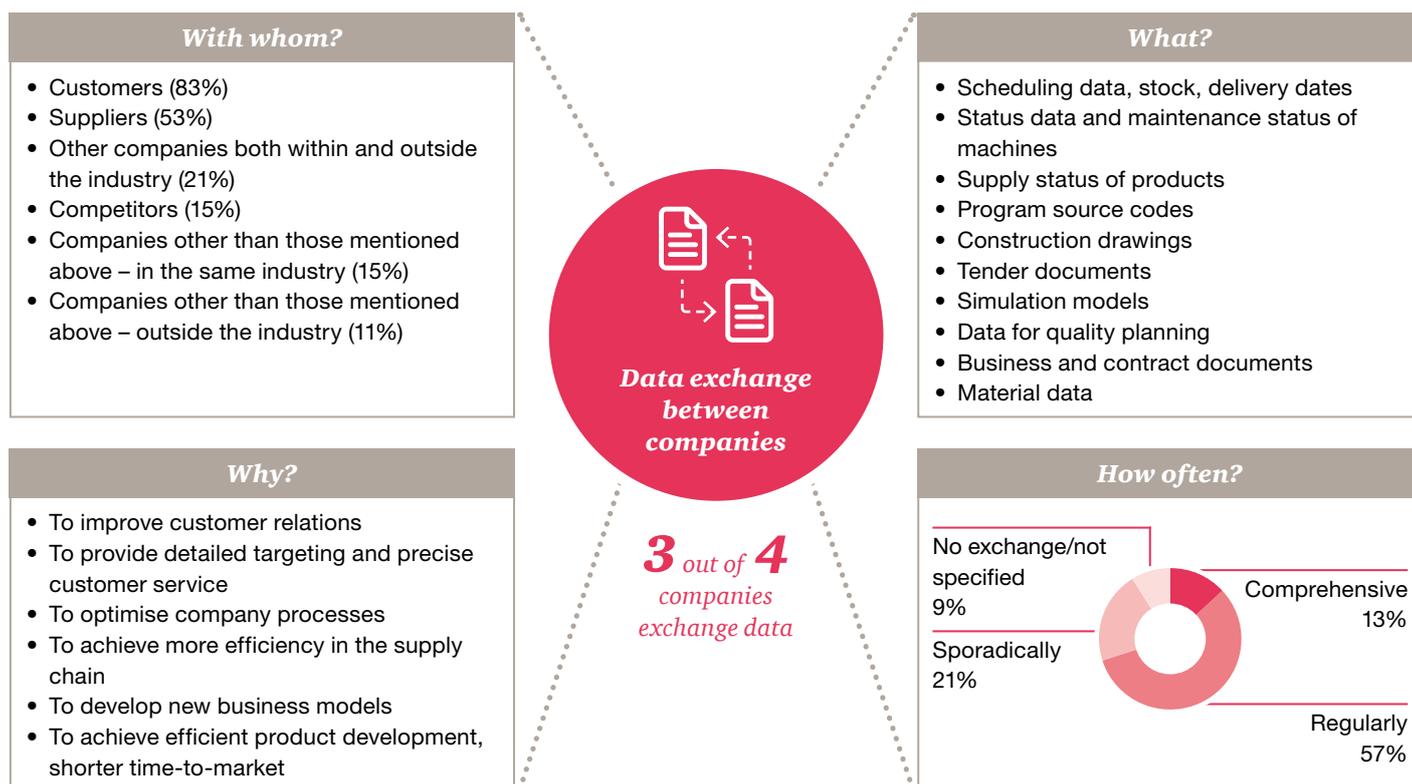
# A Executive summary

This study portrays the current mood among German companies with regard to the extent to which data are already being shared between companies in Germany and the requirements, attitudes and conditions which the idea of Industrial Data Space has to face up to. For this purpose, executives from 210 large enterprises, small and medium-sized companies and institutions throughout Germany were asked to participate in this survey. In these so-called **placement interviews** spontaneous reactions to the concept of Industrial Data Space were collected from within the companies. As part of the interview, the participants had to access a specially prepared website comprising a simplified concept presentation. Then 84 **follow-up interviews** identified the extent to which the concept was discussed in the companies afterwards and whether specific application ideas were developed in that context. The survey was prepared in extended personal briefings (professional explorations) together with representatives of the target group and then evaluated qualitatively in **short exploration interviews**.

**Fig. 1 Architecture of the overall study on Industrial Data Space**



**Fig. 2 Data exchange between companies as an essential feature of digitisation and data economy**



### **Data exchange between companies as an essential feature of digitisation and data economy**

- More than 80% of the companies believe that digitisation will have a strong influence on their company.
- Currently, three out of four companies already exchange data.
- 74% of the companies assume that the demand for data exchange will increase in the medium term.
- Digitisation strategies are noticeably fewer in SMEs than in large enterprises. The main trigger for digital strategies seems to be security aspects.
- Data exchange is the basis for added-value processes today. Regular or comprehensive data exchange lies within 63% of companies.
- Awareness of cross-industry data exchange seems to be present in companies – more than 40% of the companies are considering this at a strategic level.
- 62% of data exchange is done with companies other than customers and suppliers, 15% of which is with direct competitors.

**Challenges and obstacles for data exchange**

- 29% of the survey participants are mainly afraid of security risks and worried about losing control over their data.
- About a quarter stated that too much complexity in combination with high financial expenditure is the biggest problem.
- More concerns arose because of too little information being available about implementation details or participating companies.

**Industrial Data Space as an open and standardised approach**

- Large enterprises express a distinct interest in Industrial Data Space (61%). In particular, after carrying out the follow-up interviews nearly every second participant reported positive feedback from the management on this topic.
- According to the participants, one of the biggest advantages of Industrial Data Space is the increase in data security.
- Potentials for optimisation and improving the quality of data exchange: processes and cost structures are perceived as great advantages.

**Example application**

**Fig. 3 Example applications for IDS in companies**



## B Changes due to digitisation

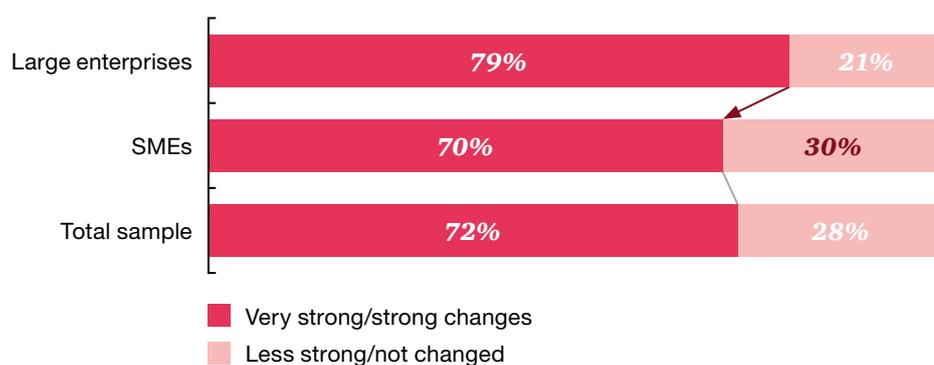
### Large enterprises feel the pressure of change more than SMEs

The systematic use of modern information and communication technologies to solve tasks in politics, administration, industry and other essential parts of society is commonly known as digitisation. This trend has had an impact on most companies in recent years. During the telephone survey every fourth decision maker stated that their own company had undergone dramatic changes due to digitisation in the past five years. The respondents of the large enterprises with more than 500 employees in Germany seem to feel more strongly affected by changes so far than their colleagues from small and medium-sized companies.

*“Digitisation offers opportunities but increasingly allows for no margin of error. Where the human factor can gather and interpret vague things in a personal discussion ... this is not possible online.”*

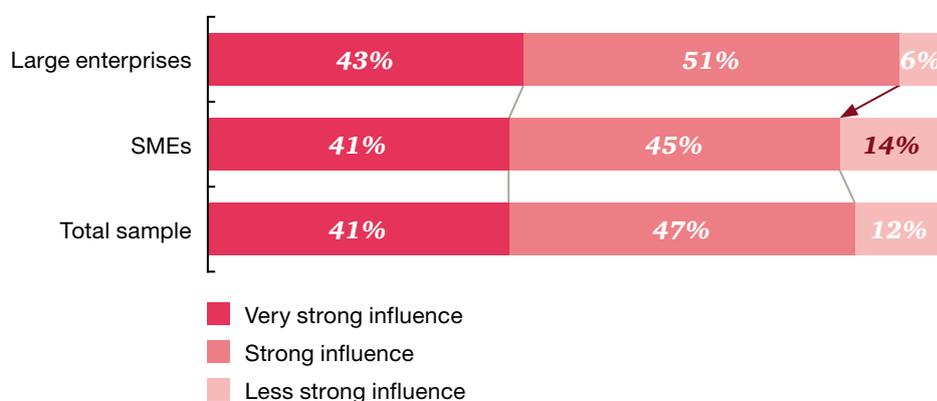
Head of Supply Chain in a retail company

**Fig. 4** Changes within their own company due to digitisation over the past five years



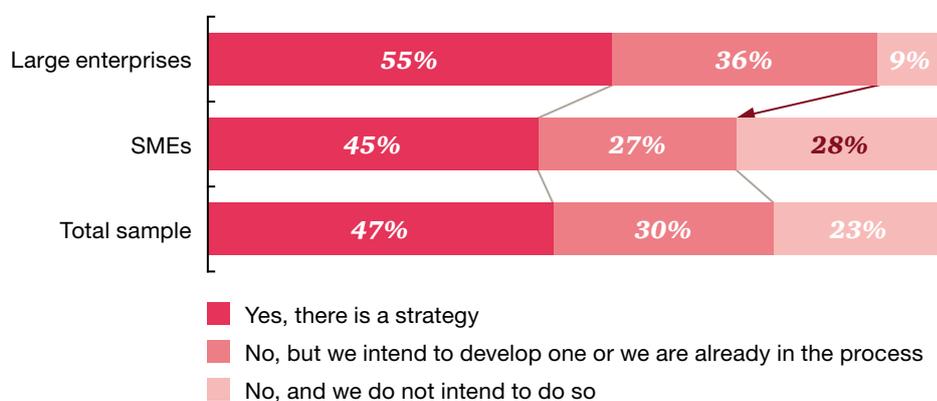
The pressure of change due to digitisation did not only penetrate large enterprises more strongly than in SMEs in the past years. The expectations with respect to the medium-term influence of digitisation on company development also vary depending on the company size. SMEs assumed more often than large enterprises that digitisation will only have a little influence on company development over the next five years.

**Fig. 5 Expected development: the influence of digitisation over the next five years**



Indeed, medium-sized companies seem less frequently to see the necessity to react to the general digitisation tendencies in society by means of a digitisation strategy. Whereas the large enterprises predominantly state that they have a digitisation strategy (55%), this is less often the case in SMEs. Nine out of ten large enterprises (91%) already have a strategy or are in the process of developing one, with guidelines, master plans and comprehensive digitisation concepts. This is only valid for 72% of SMEs. About every fourth medium-sized enterprise (28%) has no strategy and does not intend to change that.

**Fig. 6 Prevalence of digitisation strategies in companies**



It is worth noting in this context that a higher proportion of security-sensitive companies involved with the topic of cybersecurity<sup>1</sup> have a digitisation strategy than companies that pay less attention to internet security.<sup>2</sup>

### Cybersecurity is a hot topic in companies

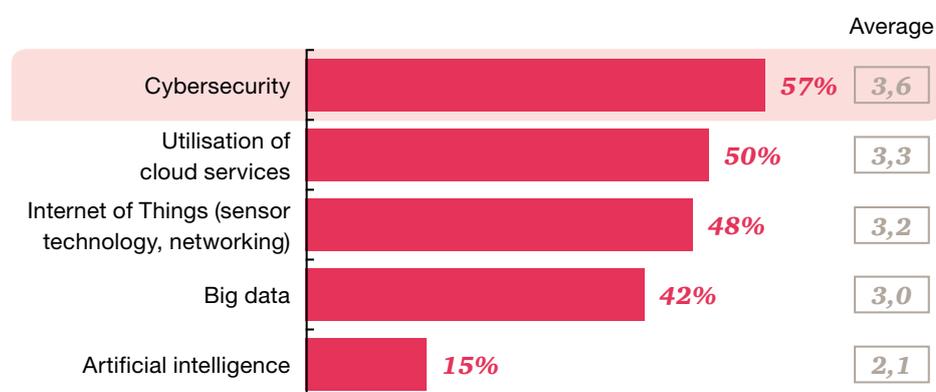
Before digitisation and the opportunities and risks this can lead to are considered, it is topics like cybersecurity, big data, artificial intelligence, the cloud or the Internet of Things that are increasingly the subject of public discussion. But these topics are also, and mainly, being dealt with in the world of business.

According to company representatives, of the five predefined digital topics, the topic of cybersecurity is the one that is currently being considered the most. Even during the initial briefing for this study, it became apparent that questions about data security are a particular worry for company representatives for many very different reasons. It is not only a matter of technology, it is also a question of the human factor.

Six out of ten companies are having intensive or very intensive discussions about questions of cybersecurity and risk management in the face of potential hacker attacks. The use of cloud services and the Internet of Things are also topics that are considered very intensively or intensively in every second company. Only 15% of the companies are discussing the topic of artificial intelligence intensively or very intensively at the moment.

**Fig. 7 How much are companies involved in looking into digital trends?**

Presentation of proportions for evaluation points 5 and 4 “very intensively/intensively” on a scale from one to five



*“It is the people who are not ... all consciously included and made aware of the topic. There are hackers who hit on employees in social engineering, gain their trust and get hold of the company’s secret data that way.”*

Executive in a technology company

*“It is true that there is a horrendous flood of data. And it is better to have it than just to want it, that is why we collect it. However, this is really about collecting the right data and including them sensibly in the processes so as to lead to monetary success later on.”*

Head of a medium-sized logistics company

<sup>1</sup> The survey was carried out by means of a subjective assessment rating based on a scale from one to five, the exact wording was: “I will now name five digital topics. How intensively are these topics currently being discussed within your company? You can rate them between 5 = very intensively and 1 = not looking into the topic at all. You can use the figures in between to set it at different levels.”

<sup>2</sup> For this purpose the 120 companies that are looking into the topic of cybersecurity/risk management particularly intensively and that rated the significance of the topic in the company with 4 or 5 on a scale of one to five were compared with the 85 companies that currently pay hardly any attention to that topic (evaluation points 1, 2 or 3 on the one-to-five scale).

*“The time when medium-sized companies were scared of the cloud is over or coming to an end.”*

Head of Development in a mechanical engineering company

*“There are two problems delaying the solutions. First of all: data security. Secondly – and that is just as bad: silo mentality. There are people that produce closed systems to use them.”*

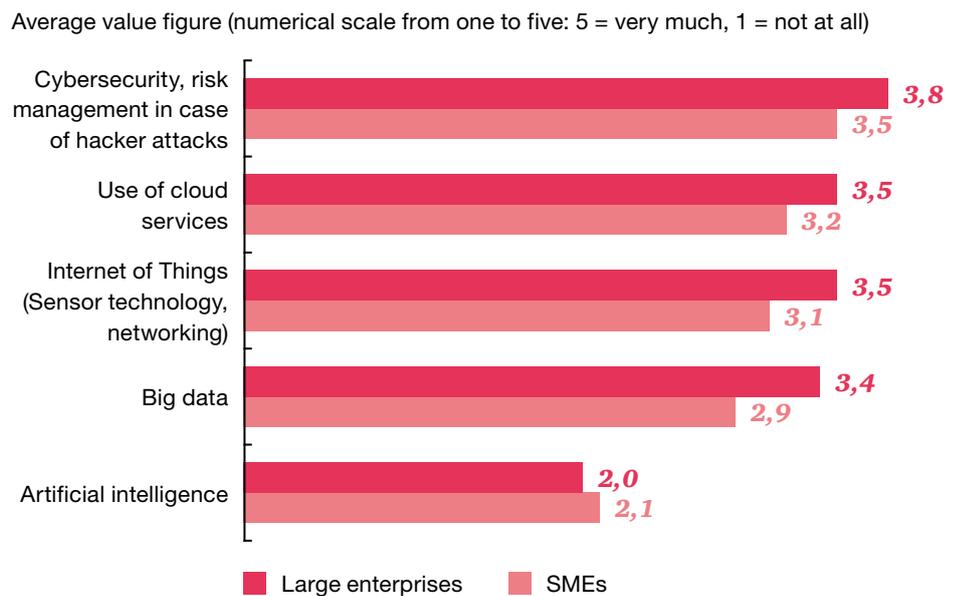
Executive in a telematics company

It is evident that the intensity with which predefined topics are discussed in companies depends on the size of the company. The opportunities and risks of using cloud services, questions of cyber security or about the Internet of Things are more intensively discussed in large enterprises than in small and medium-sized enterprises (SMEs).

It is particularly clear that there are differences with respect to big data. This topic is also discussed more intensively in larger enterprises than in smaller companies. In SMEs, 23% of companies state that they are not concerned with that topic at all (evaluation point 1 on the one-to-five scale); in larger enterprises only about every tenth company states this (9%).

Very intensive discussion about digital topics is apparent for almost all of the aspects in larger enterprises, with one exception: the topic of artificial intelligence. This topic is currently not being discussed so much, regardless of the size of the company. Some 50% of medium-sized and 45% of large enterprises explain that they are not looking into that topic at all. It is the only one of the predefined topics where evaluation is below the theoretical average on the one-to-five scale (3.0) that was used for the questioning.

**Fig. 8 How much are companies involved in looking into digital trends according to their size?**



Questions of cybersecurity and risk management for potential hacker attacks play a less important role in SMEs than in larger enterprises (evaluation points 1 and 2 on the one-to-five scale: 24% compared to 9%). Every third large enterprise (32%) discusses the topic “very intensively” (rating 5 on the one-to-five scale). It is valid for 28% of the medium-sized enterprises. That corresponds with one discussion partner’s thesis from the initial briefing for this study (Head of Development in a mechanical engineering company) that security requirements become more defined for bigger companies: “As a rough guide you can say the bigger the company is, the more secure the structure.”

## C Cross-company data exchange – insights

### **Data exchange between companies is the rule today**

Data exchange is considered to be a “big topic” – but what does that mean specifically? Internally, it happens to a great extent in most companies anyway and is growing all the time. One discussion partner from a mechanical engineering company stated in the briefings: “Colleagues can access virtually all the data at the headquarters from all the different locations around the world. This is now being extended to all production sites as well.” And cross-institutional data exchange is more the rule than the exception in the companies who took part in the survey.

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Today, three out of four companies already exchange data with customers, suppliers or other companies and institutions.

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However, this is not about normal e-mail correspondence or just transferring financial and tax data to the authorities; this is about a veritable exchange of data between companies, for example, from within a supply chain like provisioning and inventory, production processes, maintenance and the supply status of products. Information about program source codes, construction drawings, requirement documents, simulation models, data for forward quality planning and even commercial and contract documents are already being exchanged between companies.

Data exchange with other companies also plays a role when core processes within product development require direct involvement, “because you have to share things with the customer directly within the process.” This also involves the topic of normalisation. The different formats used by different project partners have to be aligned with each other, as the head of development of a technology partner remarks in the briefing: “Interfaces to suppliers and designers have to be developed where plastic datasheets stating the pliability or electronic features of materials are documented or transported.”

Inter-company data exchange also plays an important role in core processes in manufacturing and classic supply chain management, e.g., dispositive data, inventory reports, supply volume and supply dates or the quality management of deliveries. This is not necessarily about real time either. “The customers expect the same from us as what we demand from suppliers: interim examination certificates and information about when a new step is achieved in the chain. Technical data from the machines themselves have to be exchanged as well, for example, the amount of wear and tear parts are undergoing, temperature data needed to avoid disturbing the processes. That is why we also look at that intensively. Maintenance intervals are deduced from such data. First, we set them close together, then we see on the basis of the data whether we have to set them further apart or even closer together.” (Executive of a mechanical engineering company).

*“We don’t have to pretend that data exchange between companies is completely new or not common practice and state of the art. It is quite complex because there is so much to organise, but if you need and want exchange, it can be achieved today. ... tools are already available.”*

Executive in a technology company

*“A software-based service, a business service solution for invoice processing is, for example, also available in the insurance industry. Complete claim settlement. That includes a database and these are the synergy effects a service provider can offer for several insurance companies. They offer the service on an IT basis, collect the use cases from different companies and can evaluate them. Then everyone in the industry can benefit from the results.”*

Executive in a financial service company

*“In our increasingly networked world, it goes without saying that data exchange must increase more and more. Yet, the more creative the industry, the more daunting IT processes seem to be for the people involved.”*

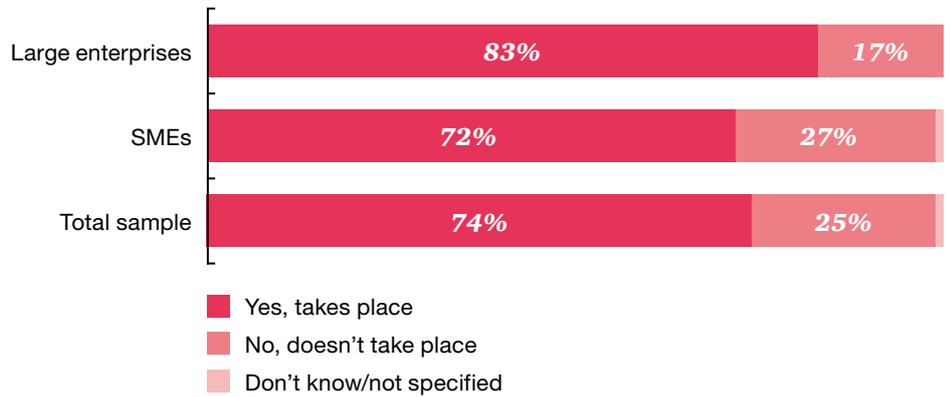
Executive in a retail company

*“We have nondisclosure agreements with our suppliers ... program source codes and construction drawings are shunted to and fro. This is the same for the customers who purchase equipment from us and sign a service contract. There is a modem which we can use to access the equipment in the companies. The customer can call our hotline day and night and receive first-level support through an operator and then, according to their requirements and the contract, they can access second-level support through our specialist department. Our staff can then log in to the company.”*

Executive in plant manufacturing

Large enterprises state even more often than SMEs that they exchange data with other companies. In large companies data exchange takes place in eight out of ten companies. In SMEs numbers are not quite so high but it is still the majority at seven out of ten companies.

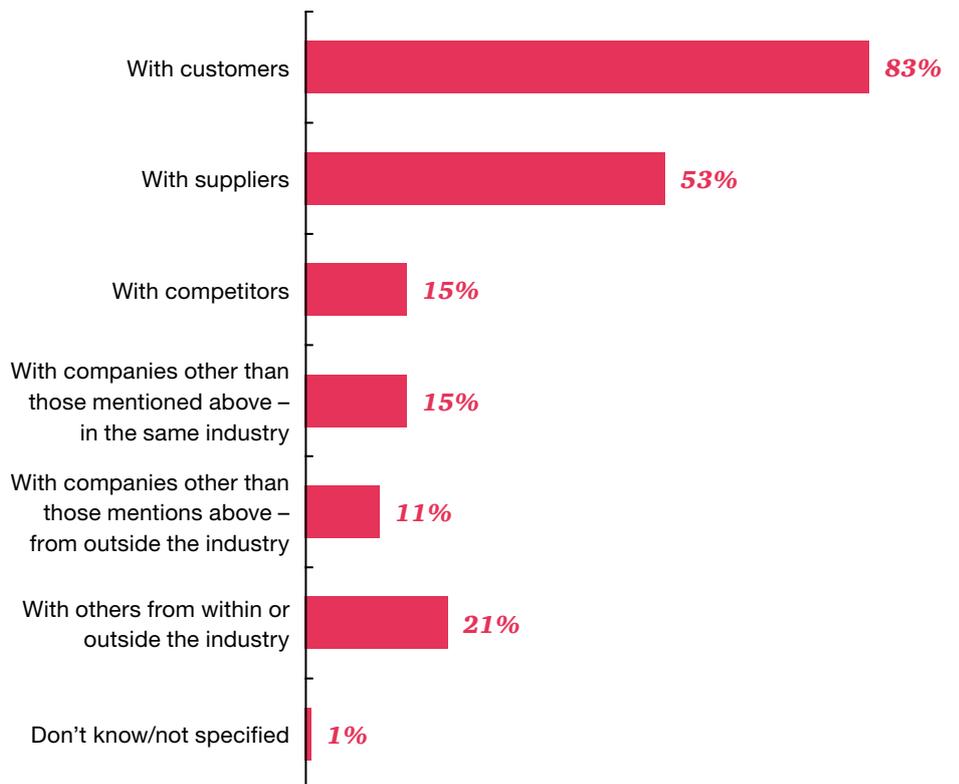
**Fig. 9 Data exchange currently carried out by companies with other companies or institutions**



If there is inter-company data exchange, then it is mainly with customers and suppliers: eight out of ten companies that exchange data with other companies do it with companies that are their customers (83%). And every second company that exchanges data with other companies shares data with their suppliers (53%).

**Fig. 10 Types of company currently involved in data exchange**

Basis: Companies that exchange data with other companies, n = 156



Competitors play a subordinate role with 15%. In answer to the question of what type of company their companies exchange data with, the respondents mentioned on average two of the predefined categories per company. Three out of four companies that exchange data with other companies besides customers, suppliers or competitors state that this data exchange is (also) carried out within the same industry.

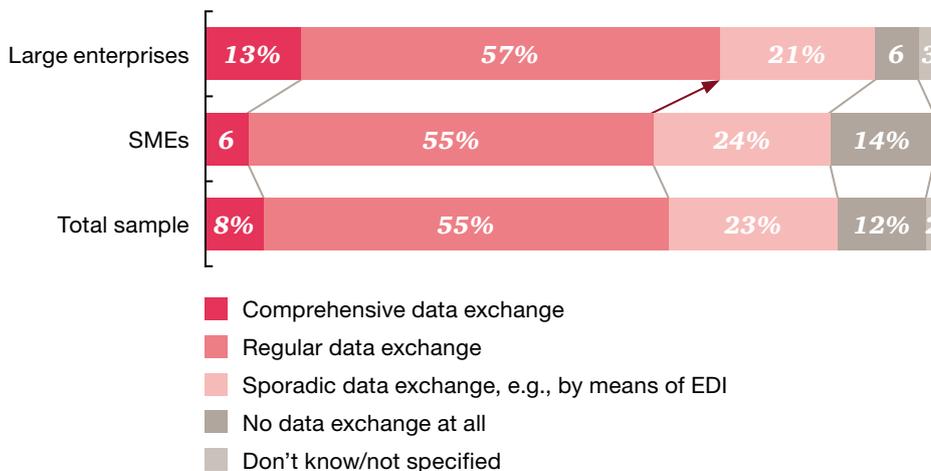
If you apply that to the total sample of the companies taking part in the survey, it emerges that 62% of all companies already share data with their customers and 39% of all companies already exchange data with their suppliers.

If you consider the supply chain processes in the companies, the majority of company representatives consider data exchange with customers, suppliers or other companies to be regular or even comprehensive (63%). The intensity and regularity of data exchange closely correlate to the size of the companies. Regular or comprehensive data exchange with other companies is conducted in 70% of the large enterprises and in 61% of the medium-sized enterprises according to the respondents' observations. In contrast, only 27% of the large enterprises carry out only sporadic or no data exchange at all according to the company representatives. In the medium-sized companies a good 38% of the respondents answered that there is no or at most only sporadic data exchange.

*“I'd love to set up EDI with suppliers, and to develop common standards of how to quickly transfer orders in that way. But the multitude of partners in the supply chain and the different standards for the individual stakeholders complicate or hamper such extensive projections.”*

Head of Supply Chain in a retail company

**Fig. 11 Regularity of data exchange with other companies according to company size**



**63%** of companies exchange data regularly or comprehensively.

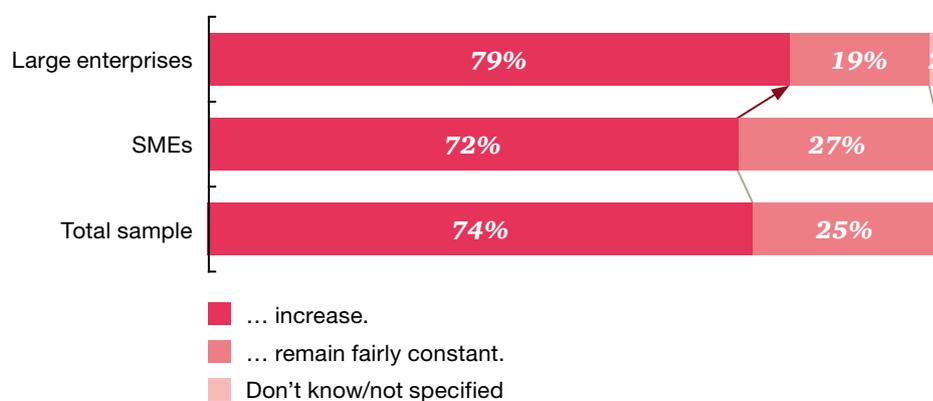
**According to the majority, demand for inter-company data exchange will increase in the medium term**

Overall it is clear that the overwhelming majority of company representatives (74%) believe data exchange with other companies will increase in the medium term.

Large enterprises expect demand will increase more often than the SMEs do, who more often believe that there will be stagnation.

**Fig. 12 Projections for the demand for cross-company data exchange over the next five years**

In the next few years, demand for data exchange with other companies will probably ...

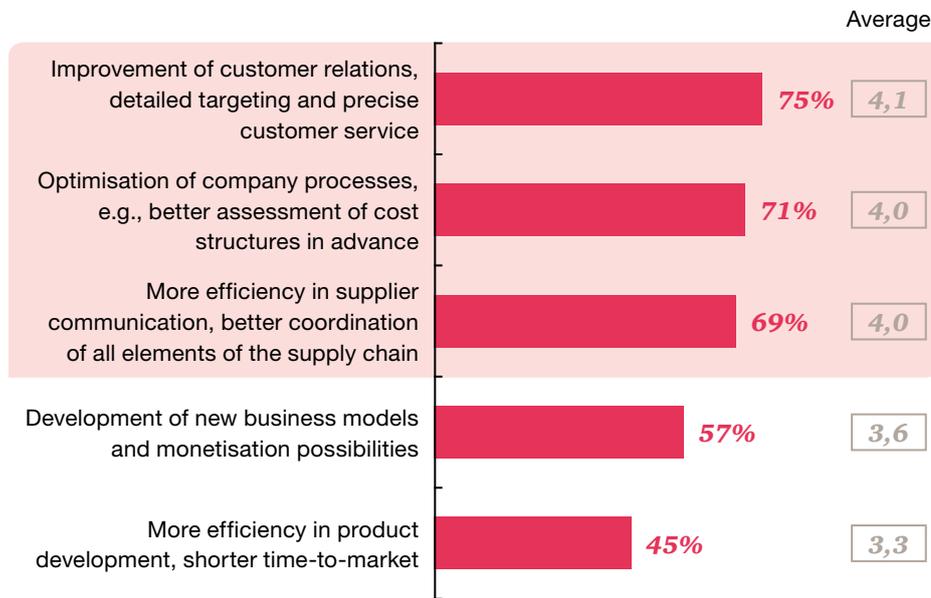


If companies use today's possibilities for data exchange, it is mainly opportunities for improved customer relations that will emerge, according to the respondents' point of view.<sup>3</sup>

<sup>3</sup> These questions were also answerable on a scale from one to five. You could rate the statements between 5 = very strong chances through new possibilities of data exchange between companies, and 1 = no chances at all.

**Fig. 13 Opportunities provided by the present possibilities for cross-company data exchange**

Presentation of the proportions for evaluation points 5 and 4 “very /rather strong chances” on a scale of one to five



*“We ... are lagging behind new developments. ... That is exactly why I need data exchange ... pure online players like Amazon are digitally driven anyway, they are the real protagonists on the market. Amazon is already the largest distributor. They create these digitised structures in their own interests. How can I make my life even easier, how can I tie up even less capital.”*

Head of Supply Chain in a retail company

The respondents from the companies have very high expectations when it comes to optimising company processes and increasing the efficiency of communication with suppliers. In the context of these operative questions regarding customer relations, operational processes and communication with suppliers, there is general agreement that data exchange provides significantly improved opportunities.

Yet, there is a parting of the ways when it comes to the two predefined more strategic and creative aspects of product development and innovation of business models. These two specifications polarise opinions: although agreement is still high, a relatively high proportion of company representatives believe that the new possibilities of data exchange provide relatively few chances or no chances at all. Some 16% see hardly any chances for the development of new business models (evaluation points 1 and 2 on the one-to-five scale) and 24% of company representatives do not see any chances for higher efficiency in product development and shorter time-to-market being provided by the new possibilities of data exchange.

**Stakeholders in the companies who are looking into the topic of cross-industry data exchange**

The follow-up questions<sup>4</sup> delivered a clear answer to the question of how different company areas have been looking into the topic of cross-industry data exchange so far: it is mainly the people specifically responsible for digitisation who are involved with this topic in the companies in the survey. In 24% of the companies that took part in the follow-up sessions there is no specific person with this role (mainly the case in SMEs) but the people responsible for digitisation in 54% of the companies are looking intensively into this topic, and 27% of the companies are even looking very intensively into this topic. The people in company strategy roles and IT/EDP departments play an important role in this context, although 17% of the medium-sized companies do not have an IT department.

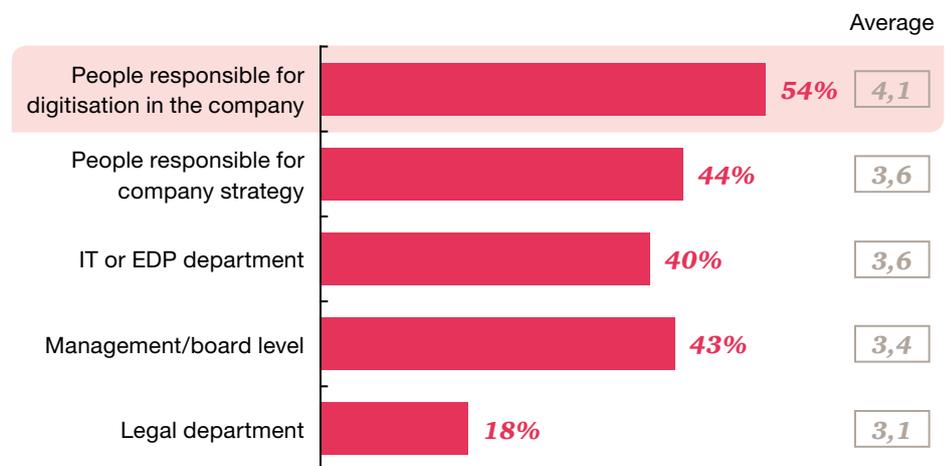
*“In small companies it is sometimes the company electrician who takes care of IT.”*

Head of Development in a mechanical engineering company

In SMEs the topic of cross-industry data exchange is more often discussed at C-level than in the large enterprises where company functions are more differentiated (average value 3.5 versus 3.2 on the one-to-five scale). The top value of 5 for the management level looking into this topic very intensively is given by 26% of SMEs and only by 11% of the large enterprises.

**Fig. 14 Intensity of looking into the topic of cross-industry data exchange in companies so far**

Presentation of proportions for evaluation points 5 and 4 “very intensively/intensively looking into this topic” on the one-to-five scale  
Basis: follow-up interviews, n = 84



<sup>4</sup> The exact wording of the question was: “How intensively have the different areas of your company been looking into the topic of cross-industry data exchange so far? I will read five different company areas to you. You can rate each of them between 5 = very intensively looking into the topic and 1 = not looking into the topic at all.”

### **Barriers for data exchange**

The biggest obstacle given for why data exchange with other companies via conventional business platforms is not supported is the fear that core data and business secrets could be exposed. The majority also consider it to be problematic that it is not possible to check who is going to read the company's own data if they are uploaded to a conventional platform. Particularly critical with respect to the two issues are security-sensitive companies which are very much involved with looking into cybersecurity topics in general. Technology, IT and communication companies and semi-governmental institutions tend to be represented more and manufacturing companies were represented less than average in this group.

Some 55% of the respondents from the 210 companies and institutions perceive it personally as a (very) big obstacle if there are no liability regulations in place to deal with cases of infringement.<sup>5</sup>

The least relevant barriers out of the six predefined obstacles seem to be concerns that the platforms are not able to achieve the desired cover and critical mass to make exchange an interesting possibility. Practically every third (35%) respondent awards only points 1 or 2 for that on the scale.

*“There is a lack of commitment in the specialist department. This also demonstrates a limited amount of confidence in one's own company, in one's own abilities. Sharing competitive information is dangerous. Anyone who can use the shared information more intelligently will be way out in front in the end. So, this is a strategic question.”*

Executive in a financial company

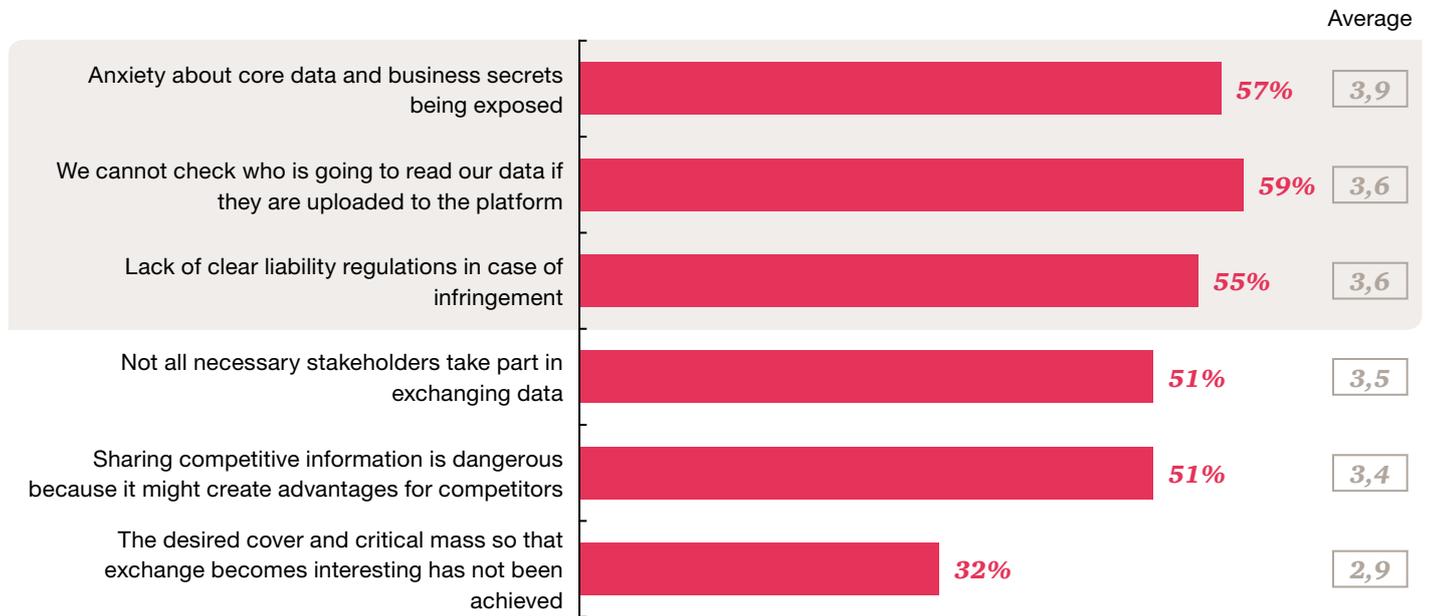
*“The ability to objectify data and information is not among brokers' interests.”*

Head of Department in a financial services company

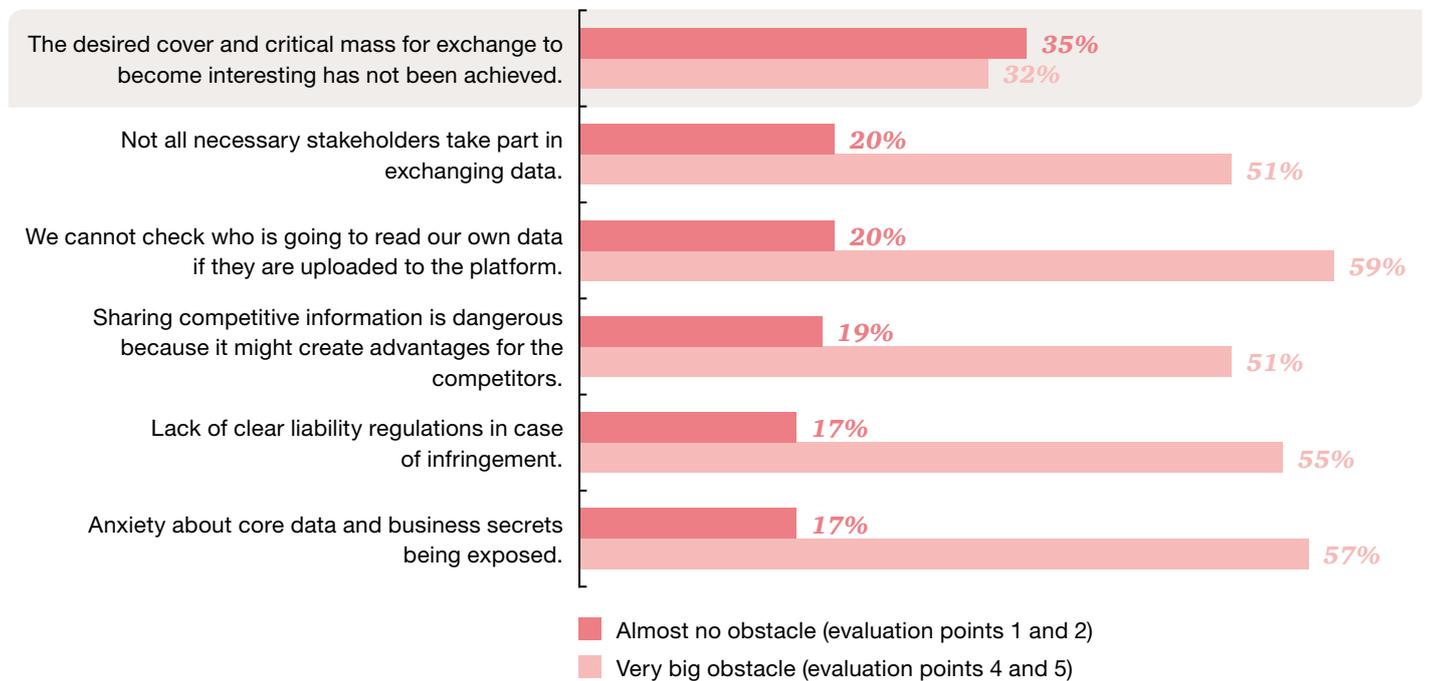
<sup>5</sup> The questions on this topic were again conducted using a scale of one to five: “Please, state to which extent you currently perceive this to be an obstacle. 5 = ‘it is a very big obstacle’, 1 = ‘it is not an obstacle’. You can rate them from 1 to 5.”

**Fig. 15 Obstacles which mean companies do not approve of data exchange on conventional platforms**

Presentation of the proportions with evaluation points 5 and 4 “very big/rather big obstacle” on the one-to-five scale



Presentation of the proportions with evaluation points 1 and 2 “(almost) no obstacle” on the one-to-five scale



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## ***D Industrial Data Space as an open, standardised and safe approach for data exchange between companies***

Industrial Data Space enables companies to share data with other market participants in a simple, regulated and self-determined way so that the data providers do not have to expose their sensitive or profitable data. On the other side, data users can get access to data they could not access otherwise and thus generate added value.

Industrial Data Space is a secure peer-to-peer data network, not a cloud. Every company that wants to participate can become both a data provider and a data user. Networking with other participants in Industrial Data Space is conducted via software (a secure gateway in a certain area of the internet), the so-called connector, by means of which the search for other companies, data usage control and the selection of the desired security level is conducted.

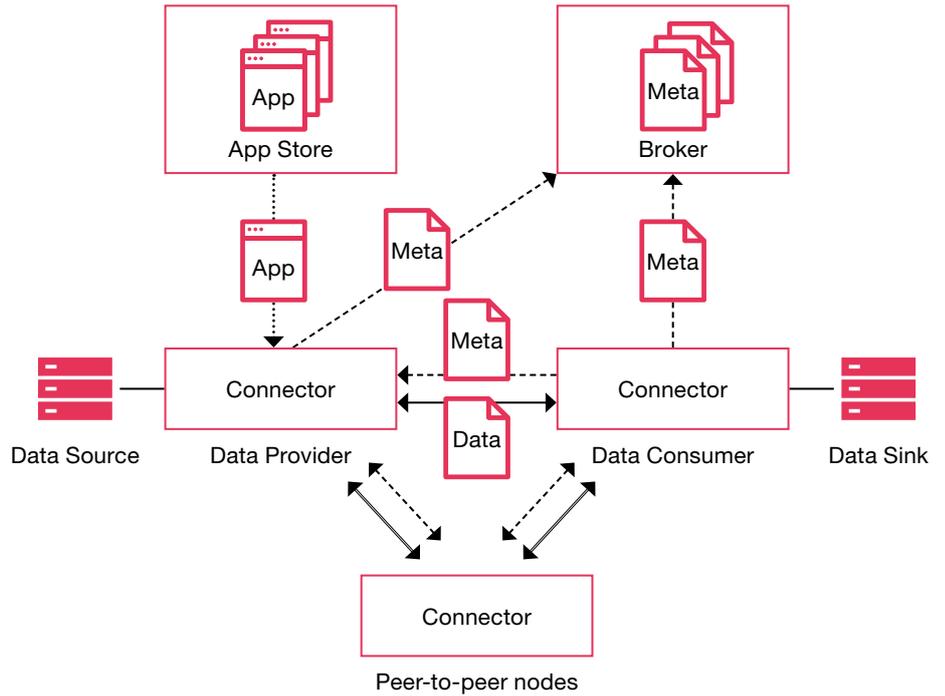
The Industrial Data Space initiative is jointly funded by the worlds of politics, business (more than 100 companies from 12 countries) and research (at the centre is the Fraunhofer-Gesellschaft in Germany with 12 institutes and other European research institutions) and is organised and registered as an open, non-profit association.

Industrial Data Space can only be used by companies that have committed themselves beforehand to play by jointly defined rules with respect to security, interoperability, data security and contract design. In case of infringements, there are clear liability regulations. The data provider gets assurance that their data can only be used the way they want it to be. So data users only gain access to the data according to the data provider's conditions. Data sovereignty is guaranteed by the following three aspects:

- Data remain decentralised at the connector of the respective data owner if desired and depending on the application scenario and are not integrated in a joint data pool
- A precisely graded certification concept according to the profile for each participant (as much security as necessary)
- Security of infrastructure through new technological solutions and all established security functions like encryption, access control, identity management and others

Industrial Data Space consists of the entirety of all the connectors and brokers, a clearing house, a registration authority and an app store. The connector represents a standardised interface to Industrial Data Space for the participating companies. This access point allows, on the one hand, specific and controlled deployment of one's own data and, on the other hand, authorised access to data belonging to other participants. Industrial Data Space is therefore not a central data memory but follows a federal architecture concept.

**Fig. 16 Components at system level**



	Dataset(s) transferred from Provider to Consumer		Data exchange (active)
	Metadata Description of Datasets/Provider/Consumer		Data exchange (inactive)
	Application for specific data manipulation		Metadata exchange
			App download

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### Reference architecture

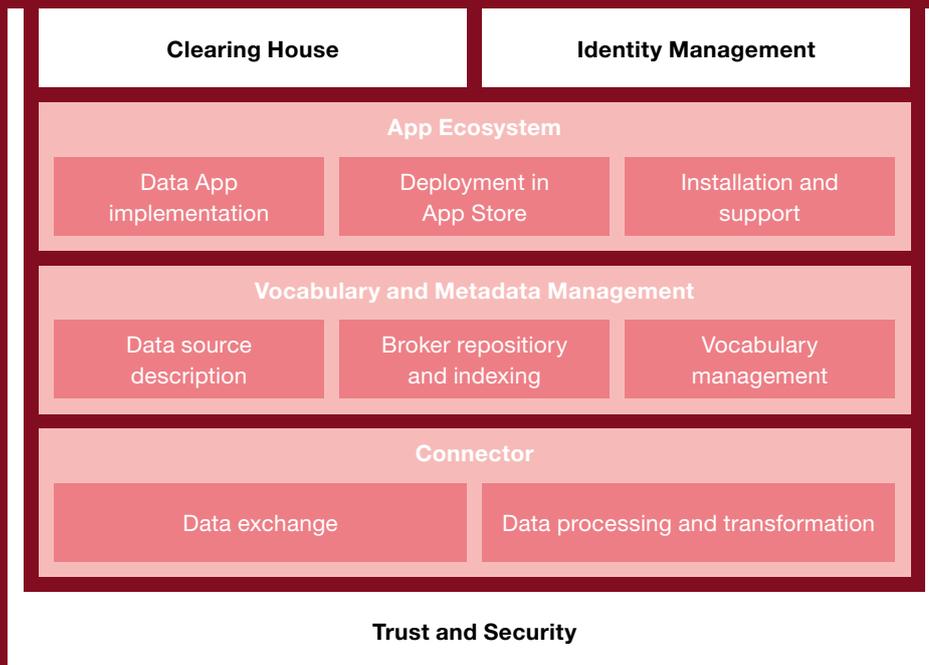
The architecture of Industrial Data Space describes, in a model, all the components that are needed to exchange data securely and combine it simply in an ecosystem.

It is subdivided into four sub-architectures:

- Governance architecture: it determines the rules of the game and regulates, for example, the visibility of data sources, data quality and consideration of data in terms of value.
- Security architecture: it guarantees the secure exchange of data, identification of anomalies and data protection.
- Technical and functional software architecture: it designates and describes the software components of Industrial Data Space, including the Industrial Data Space connector, an app store for data services for Industrial Data Space and components for both registering and certifying data services and sources.
- Technical architecture: it comprises the technologies necessary for piloting the other three sub-architectures in the use cases.

The reference architecture model and the description of these sub-architectures are open and can be taken up and implemented by third parties.

**Fig. 17 Functional architecture**



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### Success factors and obstacles (spontaneous opinions)

**Tab. 1 Spontaneous opinions about Industrial Data Space – positive and ambivalent examples**

<p>High relevance of the topic, the basic idea</p>	<ul style="list-style-type: none"> <li>• “this is one of the future topics we have to face up to”</li> <li>• “at first glance, I like the idea, however, I will have to look into it more closely”</li> <li>• “find the idea very interesting and am curious how the implementation is planned”</li> <li>• “like the approach”, “very reasonable”, “sounds very interesting”</li> <li>• “is a big step in the right direction”</li> <li>• “the basic idea is good and important”</li> <li>• “find the basic idea very interesting, the point is particularly appealing that you remain the data owner and do not lose control, however, I am aware that it is important to secure and protect your own infrastructure better”</li> <li>• “at first glance the idea is not bad, however, the project requires extensive advertising”</li> </ul>
<p>Data security through decentralised data storage</p>	<ul style="list-style-type: none"> <li>• “it is particularly interesting that it is decentral, we keep the sovereignty over our data”</li> <li>• “interesting, you should definitely decentralise the data access points to create a peer-to-peer network”</li> <li>• “a peer-to-peer network is a better alternative to a cloud”</li> <li>• “compared to an open cloud I like this approach very much to exchange data with other companies”</li> <li>• “allows a secure exchange of data”</li> <li>• “the idea is good, with many advantages like for example secure data exchange”</li> <li>• “I ask myself how this is supposed to work, if it isn’t solved by clouds, but it is very interesting anyway”</li> <li>• “this approach could help to reduce problems during data exchange”</li> </ul>
<p>New opportunities for cross-company cooperation</p>	<ul style="list-style-type: none"> <li>• “generally, I like the idea as it would allow a new and more efficient form of exchanging data between different companies where everybody can benefit”</li> <li>• “I believe this is basically a new way to exchange data interactively that can be used by several parties, therefore I consider the approach quite positive”</li> <li>• “the idea is good as it allows more efficient working in many areas and improves the cooperation between different companies”</li> </ul>
<p>Feasibility for their own company</p>	<ul style="list-style-type: none"> <li>• “I can well imagine implementing this”</li> <li>• “could work well”, “I can imagine using it”, “can well imagine participating”</li> <li>• “makes a good impression, I think we could use it. Here, it is virtually done by hand but that would strongly increase acceptance if it is neutral and you know that the data cannot be removed and used by third parties”</li> </ul>

**Tab. 2 Spontaneous opinions on Industrial Data Space – negative and ambivalent examples**

Missing USP, no new value/no use value expected	<ul style="list-style-type: none"> <li>• “not interesting for our company as we already exchange data with other companies and don’t need a new model”</li> <li>• “sounds interesting to me, however, the novelty is a little lacking as such initiatives already exist”</li> <li>• “the approach would not be of any benefit to our company”</li> <li>• “data exchange takes place already”</li> </ul>
Assumed inapplicability for their own company	<ul style="list-style-type: none"> <li>• “personally, I reject this, we are a small company, this topic is for large companies, it is irrelevant for small companies”</li> <li>• “for our company it is not really target-oriented as we work in logistics and as a real estate services provider in the building industry and therefore rely less on data networks”</li> <li>• “I am not yet sure whether the approach is applicable for us”</li> <li>• “worried that this project is quite difficult to implement for medium-sized companies as these already have difficulties to comply with baseline security in the IT area”</li> <li>• “we lack the structures”</li> <li>• “is not relevant for our company”</li> <li>• “too specific”, “is not suitable for us”</li> </ul>
Reservations, uncertainty, inability to imagine it	<ul style="list-style-type: none"> <li>• “that is always difficult, as long as the data are really safe I consider the approach really helpful, however, the question remains whether data protection is always guaranteed”</li> <li>• “however heretical this may sound: lots of text, this makes me nervous”</li> <li>• “it lacks a user interface, therefore, how will it be implemented technically?”</li> </ul>

### **Advantages and disadvantages of Industrial Data Space**

After reading the concept template during the placement interview, the respondents mainly stated three issues as advantages of Industrial Data Space<sup>6</sup>: increased data security (46%), improved quality of data exchange (35%) and optimised process and cost structures (14%). In addition, 9% of the respondents named other advantages such as that the idea was jointly supported by the worlds of politics, business and research. Some 20% of the respondents could not see any noteworthy advantages of Industrial Data Space.

**Tab. 3 Advantages of Industrial Data Space, example aspects**

<b>Increasing data security</b>	<ul style="list-style-type: none"> <li>• Secure connections, confidence in architecture</li> <li>• Shared connection without a cloud is more secure</li> <li>• Data sovereignty, keeps control over own data</li> <li>• Peer-to-peer connections</li> <li>• Internal connection, therefore no access from outside</li> <li>• Closed user circle, participants are all known</li> <li>• Better data protection, joint data protection rules</li> <li>• Controlled, legally regulated exchange</li> <li>• Security leads to more participants</li> </ul>
<b>Improving the quality of data exchange</b>	<ul style="list-style-type: none"> <li>• Better (data) communication</li> <li>• Simpler data exchange</li> <li>• Access to bigger amounts of data, more information (international)</li> <li>• Real-time data</li> <li>• Exchange with customers and suppliers</li> <li>• Standardised, unique exchange, certified</li> <li>• More transparency, better overview</li> <li>• Opportunities to compare with others</li> <li>• Data quality becomes better</li> </ul>
<b>Optimising the process and cost structures</b>	<ul style="list-style-type: none"> <li>• More efficient work</li> <li>• Higher efficiency and better quality of work</li> <li>• Standardised processes</li> <li>• Potential for cost savings</li> <li>• Added value for the company</li> </ul>

The following disadvantages were actively mentioned<sup>7</sup>: mainly security risks (29%) and too high a complexity coupled with respective structural requirements and costs (27%). Moreover, 15% of the respondents actively mentioned more issues that made them doubt the concept and 37% didn't see any disadvantages at first glance.

<sup>6</sup> These are answers to an open question, i.e., the respondents actively expressed opinions immediately after reading the concept and didn't react to specified indications.

<sup>7</sup> i.e., actively, without having been given specifications.

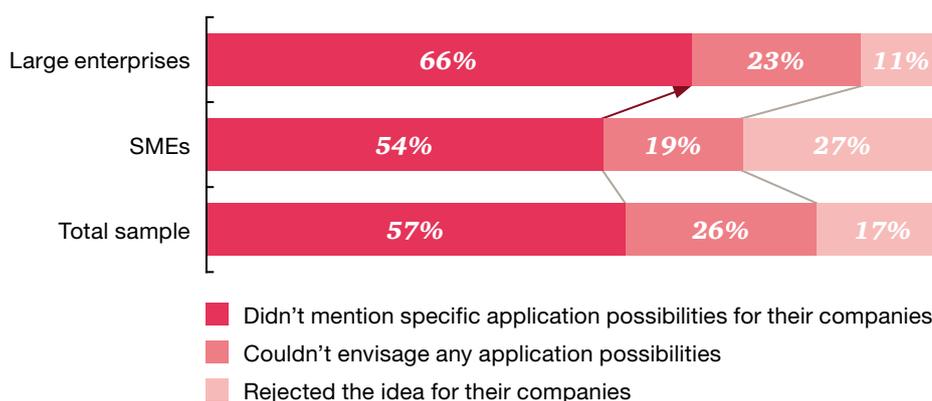
**Tab. 4 Disadvantages of Industrial Data Space, example aspects**

<b>Security risks</b>	<ul style="list-style-type: none"> <li>• Loss of own data sovereignty, autonomy</li> <li>• General mistrust (towards such projects/developers)</li> <li>• Risk that promises regarding data security are not kept</li> <li>• Own company becomes too transparent for competitors</li> <li>• Loss of control because data leaves the company</li> </ul>
<b>Complexity and the structural effort and costs this will lead to</b>	<ul style="list-style-type: none"> <li>• Becomes too complicated, too much effort, particularly for small companies</li> <li>• Too difficult to bring several companies together</li> <li>• Too many different technical conditions</li> <li>• Not compatible with other systems (including cloud systems)</li> <li>• Seems to be construed</li> <li>• Cost factor for these structures, cost risks too high</li> </ul>
<b>Further disadvantages and doubts</b>	<ul style="list-style-type: none"> <li>• Too general, unspecific, has to be tailored more accurately</li> <li>• Doubts about data quality</li> <li>• Unclear who will take part, which companies will participate in general</li> <li>• There are similar products comparable with cloud solutions</li> <li>• It does not give us the needed benefit</li> </ul>

**Possible applications in the company and specific application ideas**

More than half the respondents (57%) could actively envisage application possibilities for Industrial Data Space in their own companies after placement. But large enterprises seem to envisage examples of applications far more often than SMEs. Whereas two out of three respondents from large enterprises could think of example applications, it was only about every second colleague from SMEs.

**Fig. 18 Designation of specific application possibilities for Industrial Data Space in companies**



A total of 36 respondents, 30 of whom were from SMEs, rejected the idea of Industrial Data Space for their companies (“not applicable for us”, “we would not use it”).

A total of 55 company representatives, 43 of whom were from SMEs, couldn’t envisage any application possibilities for their companies.

The remaining 119 respondents mentioned 157 possible applications for their companies, consequently about 1.3 applications on average per company for Industrial Data Space.

**Tab. 5 Possible applications for Industrial Data Space in companies, examples**

	<p>Improvements in areas with high security levels</p>	<ul style="list-style-type: none"> <li>• Improvement of data exchange, of networking in security areas</li> <li>• Certification, standardisation of data exchange processes</li> <li>• Data communication in closed systems, limited participation</li> </ul>
	<p>More efficiency in data sharing (more target-oriented, faster retrieval)</p>	<ul style="list-style-type: none"> <li>• Digital provision of results of data faster</li> <li>• Data access in real time</li> <li>• Specific retrieval of data</li> <li>• Specific retrieval of bigger amounts of data</li> </ul>
	<p>Utilisation in procurement, sales, accounting</p>	<ul style="list-style-type: none"> <li>• Marketing, sales, exchange of sales data</li> <li>• When ordering, for ordering processes</li> <li>• Invoice data, price lists, in accounting</li> <li>• Optimisation of processes through access to customer data</li> </ul>
	<p>Improvement of customer and supplier communication, logistics</p>	<ul style="list-style-type: none"> <li>• Regulated data exchange with customers and suppliers</li> <li>• Improvement of communication with customers</li> <li>• For improving logistics (goods in and goods out)</li> </ul>
	<p>Utilisation in manufacturing, maintenance, R&amp;D</p>	<ul style="list-style-type: none"> <li>• In manufacturing technology, in production processes</li> <li>• Checking external machines, remote maintenance</li> <li>• Utilisation in the area of R&amp;D</li> <li>• Improved project processing, checking project data</li> </ul>
	<p>Strategy development</p>	<ul style="list-style-type: none"> <li>• Joint pool of statistics, surveys, market reviews</li> <li>• Optimisation of offers and further development of products according to evaluations of customer data</li> </ul>

After reading the test concept in the placement interview, 75% of the respondents were interested in receiving more detailed information about Industrial Data Space for their companies. A few days later, they received the whitepaper, and 70% of the company representatives agreed to a follow-up telephone interview a few weeks later to see the extent to which the material attracted their and their colleagues' attention in the company. The 84 follow-up interviews revealed more insights into the internal company reactions to the ideas, and specific application ideas for Industrial Data Space were collected from the companies. These application ideas were partly followed up on in short exploration interviews.

**Tab. 6 Specific ideas for applications for Industrial Data Space in companies**

Customer communication, customer retention (14 entries)	<ul style="list-style-type: none"> <li>• The entire communication with our customers, therefore the entire data exchange could be shifted there decentrally</li> <li>• Information to consolidate and optimise processes for faster deliveries and pick-ups, faster and decentral access to functional areas like customer service</li> <li>• Customer management and order tracking, e.g., how can we evaluate data from companies that were our customers in the past and make new, more suitable offers to them</li> <li>• Data exchange between customers and us as suppliers, show all services in the business process directly in IDS</li> <li>• Data exchange between customers and suppliers, in particular for real-time data with high security relevance</li> <li>• It only makes sense for us if our customers are active on that platform as well and that gives us the possibility for closer customer relations</li> <li>• To contact the customer through the portal and show that we are more developed by means of digitisation</li> <li>• Creates confidence in customer and supplier relations, e.g., if we have to take over their planning or warehousing</li> <li>• Has potential, if we pass on our know-how to companies in industries we advise</li> </ul>
Cooperation with external project partners with the same updated project status (13 entries)	<ul style="list-style-type: none"> <li>• Data exchange with other transport companies across all modes of transport such as trucks, ships, planes, etc</li> <li>• Data management in R&amp;D projects</li> </ul>

*“There is an interest, for example, in extending the utilisation of renewable energies. We could use traffic data and power companies’ data (they would have to provide these data, of course) to find out how much renewable energy is supplied and how much is available. Everything could be displayed on monitors and in the history to show to what extent utilisation increases and how energy prices depend on it. Based on that, service offers could be generated. Each owner of an e-charging station in the region could communicate their capacities to this IDS portal, and we could show the extent to which the expansion of e-charging stations is taking place and in which regions more expansion is needed.”*

Public sector

*“We work a lot with building data, i.e., BIM data. Different data could be provided for the project partners, for example data for the construction, data for maintenance and data for facility management. All participants receive data from a constantly updated data source. Previously, it was a little more complicated as information came from different trades with various update levels, which could cause breaks in the information flow.”*

Building industry

**Project status, Research & Development (13 entries)**

- We work a lot with customer data and research results – up to now, data exchange with customers has been very inconvenient or only possible in a “bilateral” way; in IDS we could authorise all relevant partners to get data access and everybody could access the same version of that data
- As a research institution in urban development/urban design we could include different departments, offices and institutions in the entire planning
- Communication between project partners in large-scale projects and model simulation in real time
- Cooperate with suppliers and general contractors (EPC) so there is a platform where all updated information merge
- Cross-institutional cooperation in the area of R&D (Automotive)
- As a research service provider, we cooperate with companies in projects; instead of providing results and process descriptions via e-mail or using our own tools, this could easily be disseminated by IDS – cooperation in one project would be easier as everybody would have the same data basis

**Communication in manufacturing and getting right into the supply chain (12 entries)**

- If our customer and suppliers participate in IDS, I could imagine that product-relevant data and purchasing orders could be processed faster via this portal than in the conventional way
- Exchanging product specifications with suppliers in automated manufacturing
- More efficiency for the supply chains and materials flow
- If it is about networking different machines
- Warehousing, real-time retrieval at subcontractors
- Improving customer and supplier relations
- If we as a device manufacturer require certain “standard parts” that many companies could produce, we could enter our specification at the portal by means of a configurator – possible suppliers could access these data and make an offer: better competitiveness and bigger market transparency would be achieved – as a result we could access new suppliers

**Cross-institutional benchmarking and big data analyses (12 entries)**

- It would be interesting to receive analysis data for classifications with respect to other companies such as social media marketing data – in return, these companies would receive our marketing data (of course, all anonymous)
- Key figures comparison with other companies, e.g., sales data
- Data exchange with other companies with reference to procurement data, to use them company-wide. There is not yet a team in our company that is actually looking into this topic
- Horizontal networking with other companies
- If everybody provides their (anonymised) structural data, these can then be analysed and help to think about economic development in the region and to draw strategic conclusions
- In the area of health insurance and medicine, information about patients is interesting for everybody – physicians, medical insurance, environmental authorities, businesses ... provide information for all in a detailed and controlled way and create added value as a result
- Big stakeholders have plenty of customer data that they can evaluate and conduct big data analyses with as well – small retailers have not got these possibilities, simply because they don't have such huge amounts of data. However, if procurement associations in Germany participate in IDS and everybody uploaded their anonymised data, then everybody could access them, big data analyses could be conducted predictively, something which would not be possible on an individual data basis.

*“We are consultants and reliant on real estate market data and transaction volume data. Exchanging data with other companies from the same industry has mostly been something we have rejected until now. Anonymous data and data sovereignty of the concept would help to increase the readiness to participate and provide anonymised data in different asset classes from different areas. All these market data can help us to offer better consulting services to our customers and to substantiate them not only qualitatively but also quantitatively with market data. Generally, a transparent market leads to more investors and higher investments than a non-transparent market.”*

Financial sector

**Specific, pooled and fast procurement of addresses and people, invoicing, event organisation, vocational and continuing training, external trainings, coaching (11 entries)**

- Searching for information about specific topics in databases, you don't have to google, it is safer and more efficient
- Exchanging address data with publishers, sharing data with business partners and subcontractors so that all participate in the big picture
- Exchanging with suppliers and project partners if necessary, agreements with respect to data procurement, positive cost effects
- Very interesting for our training measures for our members/ employees
- Secure exchange of personal data and training materials
- For training and education, industry information pooled simply
- Information about innovations at subcontractors to enable real-time information for all participants – here, to be able to provide data in a target-oriented and selected way
- Organising training with extended exchange of participant-related data and knowledge levels of all involved
- As consulting engineers, direct data exchange with customers

*“We plan large-scale events for companies. Up to now, all the planning and communication with the different companies has been done via e-mail or via individual platforms, which takes a lot of time and effort. If you could now exchange all the data like address and payment data via a joint portal, you could accelerate all processes and, presumably, cost advantages will arise.”*

Communication/advertisement industry

*“When it comes to optimising accounting procedures, everybody has their own agenda, or you end up working very inconveniently with Excel charts; e.g., we have written our own tools for various application scenarios in our company. I could imagine providing this information or all the tools on our platform for selected participants in the region. Maybe for money. Or maybe we can even become a service provider for accounting purposes for others.”*

Technology centre

*“Digitisation means more data are available for advanced analytics now. As far as I’m concerned, you might as well evaluate the effect of solar radiation or humidity on buildings. But the basic question is, as always: can I make better decisions for my investments with the help of this extended data basis?”*

Financial sector

### **Expected improvements with Industrial Data Space**

It is clear that most company representatives who have been more sustainably involved in the idea of Industrial Data Space in the course of the interviews mainly expect improvements to the security architecture in comparison to conventional platforms (open-source structures, clear liability regulations, decentral data management and controlled data exposure).

In addition to having decentral data management, open-source structures would also help Industrial Data Space contrast strongly with conventional platforms, as a head of department from a mechanical engineering company stated in the briefings: “In software development there is a lot of investment in open-source developments. The source code of software is revealed. Everybody can look at the source code and understand what is happening. This transparency is a trust building measure as well. By comparison, large IT companies offer source codes that are not transparent and it is not possible to check whether the authorities are constantly eavesdropping. If something is free of charge for you, then you are not the customer. That is why there is some suspicion with regard to the big commercial data platforms or search engines. For the companies it is all about getting down to the nitty-gritty, to the key competencies and their key know-how. ... If I had to weigh up the choices, then open source – if done well – would be a clean solution in my opinion, despite possible hacker attacks, because it is more reasonable than any non-transparent source codes. These aren’t beyond hackers either. And it is not only hackers who are slaving away at open source but IT specialists are also looking for security lapses and reporting them, hoping to gain a reputation and new jobs as a result.” But open source is not undisputed in companies. It is more accredited to universities, it is simply a gateway for wise guys and partisans and therefore not really the sort of solution we need, is what one managing director of a medium-sized logistics company expressed in the briefing.

The 84 follow-up interviews revealed that Industrial Data Space is not only expected to deliver improvements with regard to security architecture when compared to conventional platforms. The majority of respondents also expect improvements with regard to creative aspects. The overwhelming majority believe that more added value can be created for their own company with Industrial Data Space than with conventional platforms and that Industrial Data Space will help to a greater extent than conventional platforms when it comes to deploying business models and product innovations, including aspects that we couldn’t possibly envisage in advance.

The respondents in the follow-up interviews have the lowest confidence when it comes to the impact the idea can have. Only about half the respondents think that Industrial Data Space will be in a better position than conventional platforms to include all necessary players in the project and to reach the critical mass needed for exchange to become interesting.

**Fig. 19 Expected improvements through Industrial Data Space**

Basis: Follow-up interviews, n = 84

Industrial Data Space will make a valuable contribution due to the fact that ...



*“For smaller companies it is certainly interesting and means progress if there is an attractive alternative offer. But it is only interesting if getting started isn't too expensive and doesn't involve too much effort.”*

Head of Technology Development in a mechanical engineering company

### **Success factors and requirements for the future design**

One important success factor is quickly identified: the initial hurdle needs to be as low as possible so that as many companies as possible participate. If it is going to work, Industrial Data Space would need “quick successes and many companies that participate”, as the head of department from one technology company stated in the briefings. So, it mainly needs to be made easily accessible for the small and medium-sized companies: “I need a sort of freemium, otherwise it won’t work nowadays.”

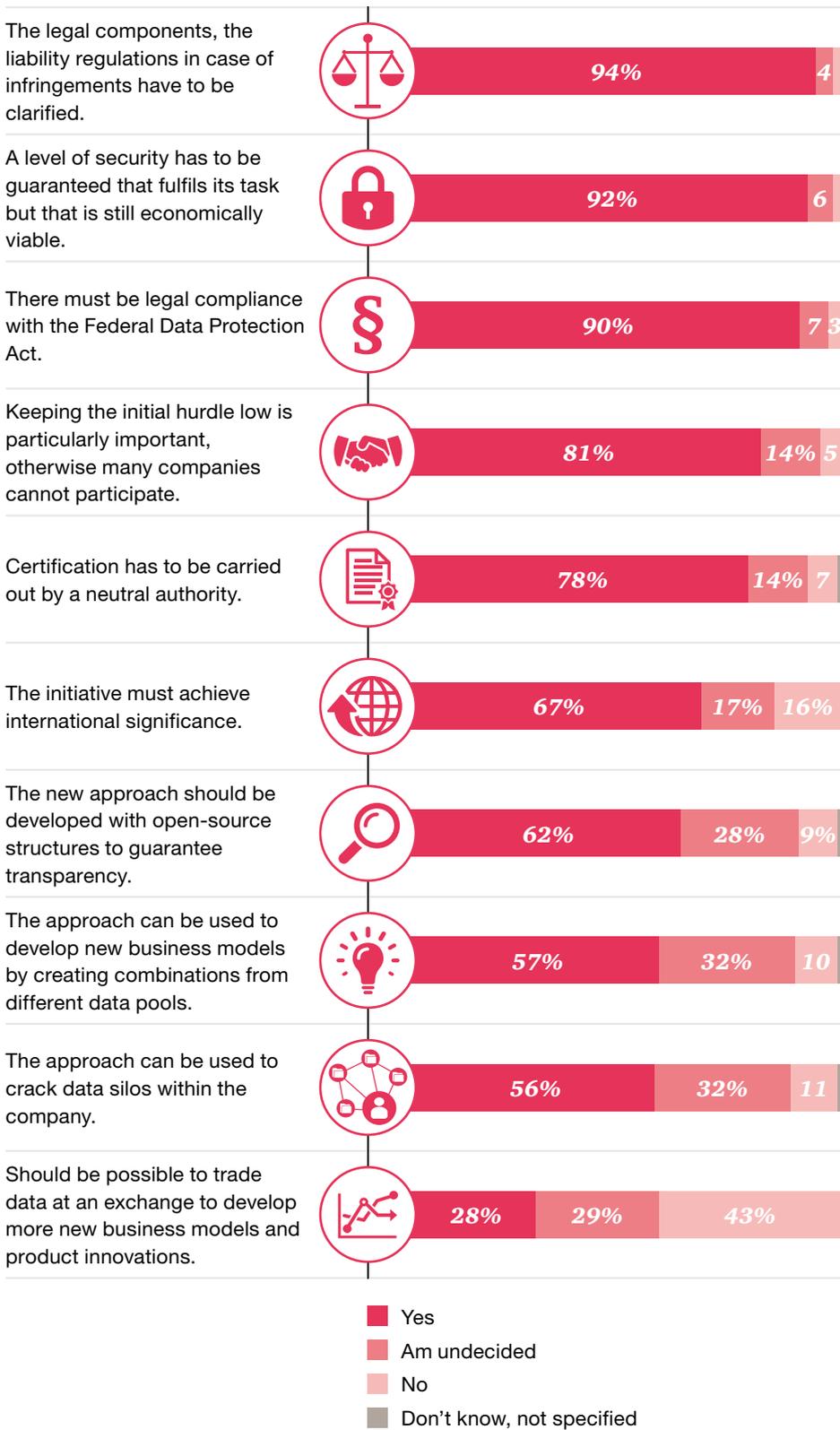
Because participation is only interesting for most companies “if our customers and suppliers are involved”, we have to consider that implementation needs to be fast and relatively simultaneous for all the relevant players throughout a complete industry or interconnected environments like customer–supplier structures. One industry could start to pool all objects and create a certain level of coverage, as suggested by the head of department in the financial sector. If everybody contributes consistently according to certain requirements, there would be better input and better forecasts. This all requires the participation of the entire industry. “It would certainly foster professionalism in the industry. ... One might agree on a better industrial standard for data to be used for profitability calculations and could then measure one’s own assumptions against the industry benchmark. Major investment decisions might then be based on a comprehensive analysis process.”

*“To achieve quantifiable added value it is a prerequisite for me that all my customers and suppliers are involved.”*

Executive in a mechanical engineering company

That there are clear liability regulations is even more important for the company representatives from SMEs than for their colleagues from large enterprises (96% versus 89%). Open-source structures are, however, more of an asset from the point of view of the respondents from the larger companies (68%) rather than the smaller companies (60%). The respondents from large enterprises believe more often than their colleagues from SMEs (70% versus 51%) that the new approach seems suitable for cracking data silos. However, cracking data silos might be more of an issue in the larger enterprises than in SMEs.

**Fig. 20 Success factors for Industrial Data Space**



*“There is no such thing as absolute data security, but you can try to build up a maximum of data security and to get as close as possible to full security. But it can become inefficient if it is pushed too far. Nuclear power plants and planes are not secure either, but we still use nuclear power plants and we fly.”*

Executive from a technology company

## **E Conclusion**

Data exchange is deemed a “big topic” – but what does that mean exactly? And what else needs to be done? This study gets to the bottom of these questions. It is about challenging and validating an approach developed jointly by the worlds of business, science and politics.

### ***Cross-industry data exchange is of strategic significance***

This “big topic” can now be expressed in terms of numbers with this study: two out of three companies exchange higher-value data that definitively contribute to added value regularly or even comprehensively, well above and beyond the level of e-mail correspondence. The results of the study support the relevance of the discussion about the chances and opportunities of cross-industry data exchange in the participating companies being of significant strategic value.

It shows that the people responsible for digitisation, but also those responsible for company strategy and management, are looking into this topic intensively. The study also demonstrates that only about half of the companies (47%) in the survey have a digitisation strategy – SMEs in particular have some reservations about digitisation.

### ***Classic data exchange is on the move***

Data exchange is obviously the basis for the added-value processes of today. Yet, this mainly refers to data exchange between customers and suppliers. These classic established applications will not be sufficient for the future requirements and needs of SMEs and large enterprises. Already now, three quarters of all study participants assume that the need for exchanging data with other companies will increase in the next five years. So, the ability to break down the barriers for data exchange and to tread new paths will become a key differentiator for companies. The next possible benefits could be the development of new business models or reducing time-to-market in addition to the undisputed ideas of optimisation and efficiency.

### ***The hurdles and success factors for a new solution for cross-company data exchange***

Companies are subjected to a certain ambivalence between the desired increase in data exchange needed to achieve the next level of utilisation on the one hand and open questions and reservations about data exchange on the other hand. The majority of the respondents said the reasons for the relatively small amounts of cross-company data exchange were due to the anxiety caused by the lack of clear liability regulations in case of infringements, non-existing data sovereignty and the unavoidability of exposing business secrets.

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The majority of respondents, however, clearly see big opportunities through expanding cross-company data exchange. Some 75% of the respondents evaluate the opportunities for improving customer relations, customer contacts and service as very big or big. More than two thirds of the respondents consider optimising both the company processes and the supply chain to be (very) big opportunities.

### ***Industrial Data Space as a joint initiative***

With Industrial Data Space as a conceptual approach for the joint utilisation of data and also as a technical architecture with infrastructural character for data interoperability, there is now – driven by science, business and politics – a tool available to utilise the above-mentioned opportunities and to face up to the worries of businesses. This approach should not only guarantee lower entry hurdles for small and medium-sized enterprises (SMEs), but should also help with the development of entirely new business models in addition to the above-mentioned opportunities for increasing efficiency.

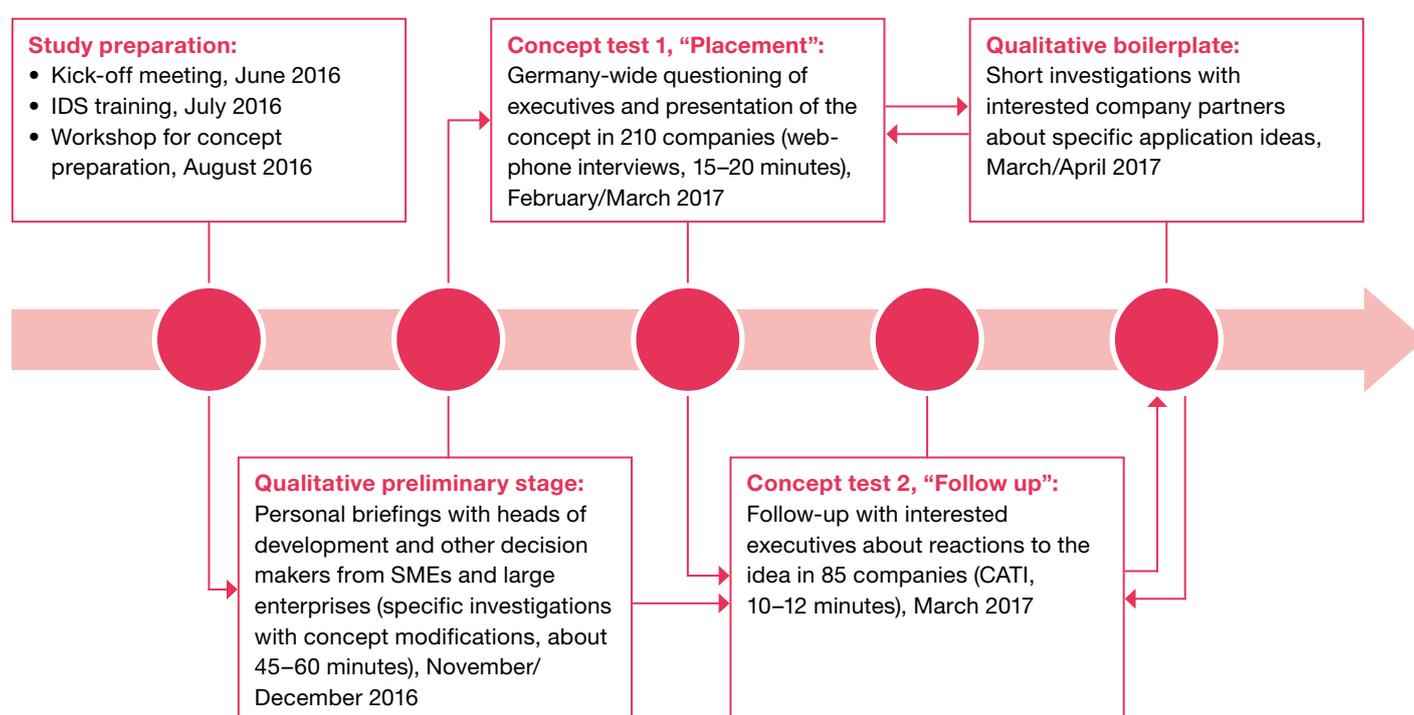
There is nothing stopping this from being adopted throughout the world – although key functions still have to be implemented and the user base will have to be expanded at cross-industry level with a particular focus on establishing standards. Open-source structures, clear liability regulations, decentral data storage and controlled data exposure are success factors that still have to be worked out and all stakeholders will have to help increase the awareness of both small and large companies with regard to which potentials digitisation and cross-company data exchange can offer and which positive and negative effects this topic can have for a company's competitiveness.

## F About the procedure

### Overall concept of the study

This investigation is not just another telephone survey of companies but is a complex combination of several procedures and investigations that supplement, support but also monitor each other.

Fig. 21 Architecture of the overall study on Industrial Data Space



**Preliminary stage:** In order to prepare the contents of the company survey together with the target group, several personal 50-minute briefings were conducted with executives from larger and medium-sized companies throughout Germany in November and December 2016. These detailed exploration interviews were conducted on the basis of a guideline; in the later part of the interview the concept of Industrial Data Space was introduced, evaluated and modified together with the discussion partners. Based on these preparatory discussions, both the questionnaire for the telephone company survey and the test concept for discussing the idea of Industrial Data Space were developed.

**Placement:** From February 9th to March 13th 2017, executives from 210 companies and institutions from throughout Germany were questioned by telephone on the basis of a semi-structured questionnaire. The target persons were managers and people responsible for company development or for digital strategies. This webphone survey was intended to reveal a picture of the extent to which data are already used and shared at a cross-company level. In the second part of the interview spontaneous reactions to the concept of Industrial Data Space were collected. To do so, the study participants had to access a website which presented a simplified test concept for Industrial Data Space.

The interviews were conducted in two waves by a professional market research institute guaranteeing data security and anonymity. After reading the test concept in the placement interview, 75% of the respondents were interested in receiving more detailed information about Industrial Data Space for their company. A few days later, they were sent the whitepaper. About two out of three company representatives had also agreed to take part in a follow-up telephone interview after a couple of weeks to see the extent to which the material had met with their and their colleagues' interest in the company and had been discussed.

**Follow-up interview:** About two to four weeks after the placement the telephone follow-up interviews were conducted. They were executed from March 9th up to and including April 3rd 2017 on the basis of a structured questionnaire (in nine cases this was done online because the target person was difficult to get on the phone). During the phone calls possible examples of specific applications for Industrial Data Space in companies were collected.

**Short explorations:** Particularly interesting application ideas from the follow-up interviews were pursued again in the short individual discussions in an anonymous and qualitative way.

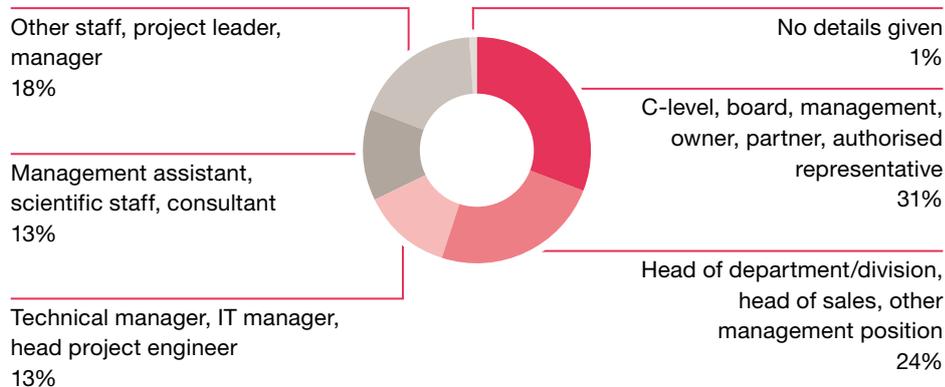
### ***The respondents in the placement interviews***

Seven out of ten participants were people in executive roles (68%), either management or technical management; they were area managers or heads of departments or in other leading positions who were responsible for the company or technology development or for digital strategies. In 38% of the medium-sized companies, members of the boards or management or shareholders and owners themselves agreed to be respondents for this project.



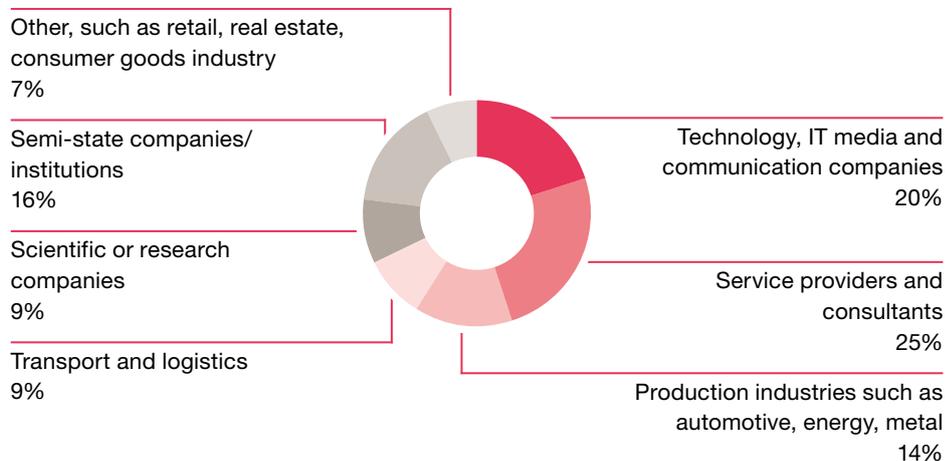
**Whitepaper Industrial Data Space for dispatch after positioning interviews**

**Fig. 22 Role/position of subject**



About every third respondent is a member of the 50-plus generation, and every fifth is younger than 35 years. Some 12% of the respondents are women. Every fourth company in the sample is a large company with more than 500 permanent employees in Germany. Of the 53 large companies in the sample every second employs even more than 2,000 people in Germany. The respondent companies and institutions are mostly from the technology and communication industry; many service and research companies and semi-governmental institutions are also represented here. The cross-industry address list was supplied by the customer.

**Fig. 23 Sectors of companies in the survey**



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### **About PwC**

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***We advise companies  
on how to become data  
economy ready and how  
to develop use cases for  
the industrial data space.***



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**About the Industrial Data Space Association**

The Industrial Data Space Association is a user association representing the interests of more than 70 international companies and institutions. In particular, the association identifies, analyses and evaluates the requirements companies have for Industrial Data Space and helps to develop the reference architecture model. It is in close and direct dialogue with the representatives of the BMBF research project.

At the end of 2014, the Industrial Data Space initiative was set up jointly by the business, political and research communities in Germany and ever since it has been pursuing its objective of establishing development and utilisation at both European and international levels.

The eponymous Fraunhofer-Gesellschaft research project, which is sponsored by the Federal Ministry of Education and Research (BMBF), aims to develop a reference architecture model for Industrial Data Space and to pilot it in selected use cases.

Currently, Industrial Data Space is being used and put into practice in 18 use cases by companies which include Audi, Bosch, Boehringer Ingelheim, thyssenkrupp, Salzgitter, Schaeffler and Sick.

[www.industrialdataspace.org](http://www.industrialdataspace.org)



