



From concept to reality:  
How data spaces are created

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Annual Report 2021

# Foreword

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Dear Readers,

Aside from the continuing challenges posed by the coronavirus pandemic, I will remember 2021 as the year in which data spaces took off:

- Take, for example, initiatives such as Catena-X, in which an entire industry is setting out to establish a secure data space across the complete automotive supply chain.
- Then there is the Mobility Data Space, which will enable you to plan and take a trip end to end in future.
- And the open-source community continues to grow, of course, with developments such as the Eclipse Dataspace Connector, laying important foundations for building confidence in data-sharing technologies.

Overall, 2021 was a good year for the data economy and, in turn, for Europe's competitiveness. It was also a great year for Fraunhofer ISST, which has been able to play a key role in the initiatives mentioned above, making a valuable contribution toward a fair data economy guided by European values. The task now is to continue pursuing these positive developments apace and firmly anchor them in the worlds of politics and business. Europe is heading in the right direction on this front with the Gaia-X European Association for Data and Cloud AISBL and the International Data Spaces Association.

And we, too, will carry on contributing to this with our full commitment and dedication. This applies not only to our institute, but also to our new spin-offs: the Data Competence Center for Cities and Regions DKSR GmbH (dksr.city)

and soivity GmbH (soivity.de). We are looking forward to getting to grips with these developments soon at our new institute premises, located in the emerging digital quarter in the Port of Dortmund. However, a more in-depth report will be provided in the 2022 Annual Report.

At this point, I would like to thank all our partners, customers and networks who have placed their trust in us over the past year and continue to do so.

If you are new to us, I hope you will find that the pages that follow contain information that is relevant to you.

We are looking forward to establishing — or continuing to establish — our collaboration with you as a way of creating innovations based on your data.

Yours sincerely,

Prof. Dr.-Ing. Boris Otto,  
Institute Director

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# How sovereign cloud technologies are securing innovative strength in Europe

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Innovations are created from data — and that makes data a hugely valuable resource for value creation in companies. Scientists at Fraunhofer ISST are working together with companies and policymakers to develop data strategies, solutions for data management, and data architectures that will enable companies and individuals to harness the value of data. Their research is helping to drive digital transformation in Germany and Europe, something that is a cornerstone of innovative strength and future competitiveness.

But where did this all start? With machines. Whirring, shiny metallic structures bellowing steam, which heated, shaped and combined all manner of materials, substances and resources with seemingly no effort at all. It was these machines that created innovations and prosperity for the entire world.

The innovation drivers of today no longer smoke, rattle and clatter. They work entirely without smoke or noise, yet with no less revolutionary potential. They are digital data spaces

used to process a whole new kind of commodity — data. And here's the most exciting thing: Unlike physical resources, they cannot be exhausted. On the contrary, they are continuously increasing.

## Growing data volumes present both opportunities and challenges

Each year, more and more data is generated. By 2025, global data output is expected to reach 175 zettabytes — a number with 21 zeros<sup>1</sup>.

**175**  
zettabytes of  
global data  
volume by  
2025



In particular, this includes a growing amount of corporate data in a trend that is being fueled by the rise of IoT applications whose ever-increasing number of devices are steadily producing more and more data. Forecasts predict 50 billion connected devices worldwide by 2030, which would equate to nearly six devices per person<sup>23</sup>. Data can therefore be turned into a central resource for industry and pave the way for innovative digital applications in the healthcare sector, for example. Moreover, data possesses an almost magical quality in that its value increases when it is shared. As an example, when multiple companies — or even supply chains of entire industries — exchange their data, all the stakeholders can use it profitably. What this means is that value creation is becoming increasingly dependent on data spaces — first and foremost, those in the form of cloud technologies. The first step in accommodating this, however, is making those spaces available.

## Companies in Europe need sovereign data infrastructures

The majority of German companies believe that the cloud is set to become the primary technology for data processing, according to findings of a study by the International Data Group (IDC). Out of 200 companies surveyed, 95 percent are already adopting their own cloud strategy to make processes more flexible and agile<sup>4</sup>. The question that remains is whether it is possible to implement data-driven innovations via the cloud.

This continues to pose a real challenge for companies, as they need to be able to process the growing volumes of data efficiently — since data is only useful if its quality is adequate — but they also need to be able to access the data plus exchange it and store it across companies, all while keeping everything secure. Both factors in this puzzle require our economy to have the right infrastructures and processes in place. At present, the leading cloud service providers hail from the USA and Asia rather than the EU.

However, pioneering projects such as Gaia-X, in which Fraunhofer ISST is playing a leading role, are aiming to change this by creating a foundation for sovereign European data spaces, which will in future allow companies to have autonomous control over their data and tap into new business models and potential for optimization. At the same time, these data spaces will provide a counterbalance to the market power exerted by American and Asian providers. All this is designed to ensure that our industry's innovative strength can also bear fruit on EU soil.

## A European cloud landscape underpins a strong economy

Experts are convinced that digital data spaces are set to become the norm. However, it is still up to us to decide how they are structured and whether they adhere to common European values and standards.

1 <https://de.statista.com/statistik/daten/studie/267974/umfrage/prognose-zum-weltweit-generierten-datenvolumen/>

2 <https://www.statista.com/statistics/802690/worldwide-connected-devices-by-access-technology/>

3 Taking into account the predicted population growth (<https://de.statista.com/statistik/daten/studie/1717/umfrage/prognose-zur-entwicklung-der-weltbevoelkerung/>)

4 [https://www.idc.com/getdoc.jsp?containerId=prEUR148293821&utm\\_medium=rss\\_feed&utm\\_source=alert&utm\\_campaign=rss\\_syndication](https://www.idc.com/getdoc.jsp?containerId=prEUR148293821&utm_medium=rss_feed&utm_source=alert&utm_campaign=rss_syndication)

Gaia-X and the International Data Spaces (IDS) initiative are carving out a path as role models in this field. Also recognizing the need for action, the European Commission launched<sup>5</sup> the Digital Decade in 2021 in order to set out goals and targets aimed at advancing digital transformation in every EU country — including the use of cloud services. One of the targets in the plan is for 75 percent of companies to be using cloud services by 2030 — three times as many as today<sup>6</sup>. This ambition underscores the importance of a European cloud infrastructure.



Achieving it will require a common strategy that is adapted to the cloud landscape in the EU. It has what it takes to play a crucial role in strengthening industry in the EU, making supply chains transparent and processes more sustainable.

### Cornerstones for a common social data market economy

How do we create this kind of foundation — one that has the greatest possible impact and, at the same time, protects the interests of all those involved? There is a wide range of aspects that are relevant to achieving success in this area, many of which are already part of the Gaia-X initiative.

The German federal government and the European Commission are pursuing the principle of a fair data economy based on a social data economy that reconciles the interests of the individual data providers with the interests of the community.

<sup>5</sup> [https://ec.europa.eu/commission/presscorner/detail/de/IP\\_21\\_983](https://ec.europa.eu/commission/presscorner/detail/de/IP_21_983)

<sup>6</sup> [https://ec.europa.eu/newsroom/dae/redirection/document/79259\\_S\\_4](https://ec.europa.eu/newsroom/dae/redirection/document/79259_S_4)

The key lies in striking the right balance between data protection and data use. After all, data only generates added value if we can actually use it — for example, in driving innovation in the healthcare sector, ultimately benefiting both companies and patients. Therefore, having autonomous control over data is a central goal of the Gaia-X initiative.

This also includes framework conditions that apply to all providers active in the European single market, which means that Gaia-X is incorporating non-European stakeholders in the standardization process as a way of establishing common standards that are binding for all parties.

Shared infrastructure thrives when it is developed in a transparent and collaborative manner. Using open-source concepts and software is the best approach to achieving this: Having a source code that is visible to all, with traceable algorithms, builds trust and lowers barriers to entry — allowing companies of all sizes to easily access data spaces.

The multi-cloud principle is another key design element in the Gaia-X architecture. It focuses on the interoperability and portability of data and services across cloud providers. This is in keeping with the structure of the data economy in Europe — a federation of different cloud services — and fosters cross-European collaboration.

### Targeted investments and funding

Having the right framework conditions in place is one thing, but implementing them effectively requires investment and EU funding — such as funding from European cloud providers including, in particular, edge cloud services.

The market for these smaller, decentralized providers operating at the fringes of the cloud, so to speak, has yet to fully emerge but already offers good opportunities for the German economy in particular — especially in view of the growing Internet of Things, in which an increasing number of devices are processing more and more data in a decentralized manner.

**By  
2030,**  
75 percent of  
companies will  
be using cloud  
services

As a rule, any form of infrastructure needs a purpose to give cloud providers incentive to invest in the development of standards and open-source technologies. After all, what good is a new highway if it leads to nowhere? This means that Gaia-X-compliant application services also need to be enhanced.

### **A digital mindset as a catalyst for data-driven innovation**

So where do things stand on a national level? Germany's strong industrial sector meets all the basic requirements for developing data-driven innovations and incorporating them into its value chain. For this to happen, the worlds of business, research and politics must work together and take a new approach to bringing projects to life. Today's research and development activities need agile project roadmaps with short feedback loops and flexible project teams. They must be able to react to new requirements at short notice and prevent situations in which the end result is a product that is no longer needed.

Germany is adept at supporting promising companies in the development stage. But what comes after that? The country is home to the largest number of unicorn companies in the EU — referring to start-ups that are valued at over one billion US dollars before they go public. Their investors are mainly from the USA or Asia. To ensure that Germany will be able to benefit from the success of these up-and-coming companies, long-term investments are needed beyond market maturity.

### **Shaping the future at Fraunhofer ISST**

When the innovative spirit of German companies is coupled with low-threshold and secure data spaces, companies can utilize data as a resource profitably and confidently, developing new value-creation models and securing competitive advantages. Fraunhofer ISST is involved in other lighthouse projects based on Gaia-X and IDS — such as Catena-X, a digital ecosystem for the automotive industry, and the Eclipse Dataspace Connector, a European open-source project designed to enable data sharing across multiple clouds.

In fields including healthcare, logistics and general data management, Fraunhofer ISST is contributing its wealth of expertise and experience to support the digital transformation in Germany and the EU, and to establish shared data spaces for ensuring value creation in the future, making it even easier for new innovations to be created from data as we move forward





## Customized solutions based on industry expertise

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### Our business units

Knowledge of industry-specific requirements is essential when designing and operating modern IT infrastructures. Only by drawing on the expertise of various disciplines is it possible to meet the challenges of current development trends.

Fraunhofer ISST therefore groups its competencies into three business units: Logistics, Data Business and Healthcare. With this structure, we can quickly identify suitable solutions for companies to improve their competitiveness and open up new business models.



# SYSTEM OVERVIEW

VER: 5.365.215A

CHARGE 52%  
RECHARGE 121 MW/A  
POWER-EFFICIENCY 100%

STRUCTURAL INTEGRITY 65%  
TEMPERATURE 1501 C  
COOLANT 8-M

SYSTEM STABILITY 40%

## ENERGY READINGS



**How data spaces give rise to new  
business models**

**Business unit: Data Business**

# Business unit: Data Business

## Data as a business asset: How new business models emerge from data sharing in data spaces

*Further information on the Data Business business unit*

[Projects](#)  
[Technologies](#)  
[Publications](#)



The Fraunhofer ISST Data Business business unit develops new technologies to harness the potential of company data. The key to this lies in sovereign data spaces and working in close partnership with companies.

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Industry and business players have now identified the opportunity that data holds as a driver of innovation. It promises new business models, optimized processes and improved decision-making. Simply using internal company data is no longer enough, as the value chains that now extend around the world are too complex. The true added value of data only becomes apparent when companies view it as a business asset and market it to other companies. To draw a parallel, think of a farmer's market where stallholders offer a variety of produce such as apples, eggs or butter — which are then combined at a bakery to make a succulent apple tart.

Trading data also needs suitable marketplaces — and this is where data spaces come in. They form the technological infrastructure, using suitable software architectures and organizational framework conditions. The Data Business business unit at Fraunhofer ISST researches how these data spaces can be set up, and supports technology and service providers in using them as a platform for offering new services

### Innovations emerging through transparent collaboration

What makes the Data Business business unit so special is that its team is always looking to generate and drive new ideas forward. Take, for example, the pioneering work that Fraunhofer ISST is doing in the development and commercial operation of data marketplaces. Acting as a valuable partner, the institute supports major technology providers such as SAP, Microsoft and Huawei, who are all seeking to gain a foothold in this future-oriented market. Together, they develop software and software concepts that make this infrastructure possible in the first place, working on the basis of open-source concepts and a collaborative partnership. "There is a difference between simply publishing your sources on a platform," explains Head of Department Markus Spiekermann, "and working together on a piece of software as a community." It is precisely this community work that is being showcased in the Eclipse Dataspace Connector lighthouse project, in which Fraunhofer ISST is playing a leading role. The aim of the initiative is to develop software that can be made available as a finished product.

## A transparent and agile approach to creating new business models

The open-source approach ensures low entry barriers for companies, giving them easy access to technology — an important factor when it comes to establishing a broad base for data space concepts and, in turn, expanding the market. Another key element of the collaboration lies in agile project development that makes it possible to react flexibly to new challenges — posed by new Gaia-X requirements, for instance. This ensures that the developed system always fulfills the latest demands, performs well in practice and serves as a basis for new business models.

The GEC Innovationlab is a prime example of this. A strategic cooperation between German Edge Cloud (GEC) and Fraunhofer ISST, it launched in May 2021 and involves collaborative teams from both organizations developing new solutions within the areas of autonomous edge clouds, data sovereignty and real-time technologies. Together, they are identifying new trends, developing suitable technologies and prototypes, and rapidly putting them into practice.

## A team with a holistic perspective

This innovative strength is the result of shared expertise. “Applying this expertise to practical solutions requires a combination of business expertise and software engineering,” explains Markus Spiekermann. His department has both, which enables it to take a holistic approach to new solutions. The employees keep up to date with current technologies, trends and requirements — and how feasible all of these are to implement in software form. At the same time, they are able to analyze the benefits of a software component and develop potential business models for technology partners. With this setup, the team is able to provide a broad portfolio for its customers: It researches and designs data-driven business models and cloud-based data spaces, carries out practical software development, and devises individual data management strategies complete with suitable tools for targeted data processing. Particularly in the field of data management, agile teams are advancing new solutions and insights in a multitude of projects. Drawing on this knowledge, the institute advises customers on individual data strategies and supports them in implementing data governance structures and improving their data quality.

It also researches technologies for more efficient data use — one example being the now-completed DIVA (Data Inventory and Valuation Approach) project, a data catalog designed to make searching for and maintaining company data simpler and more efficient.

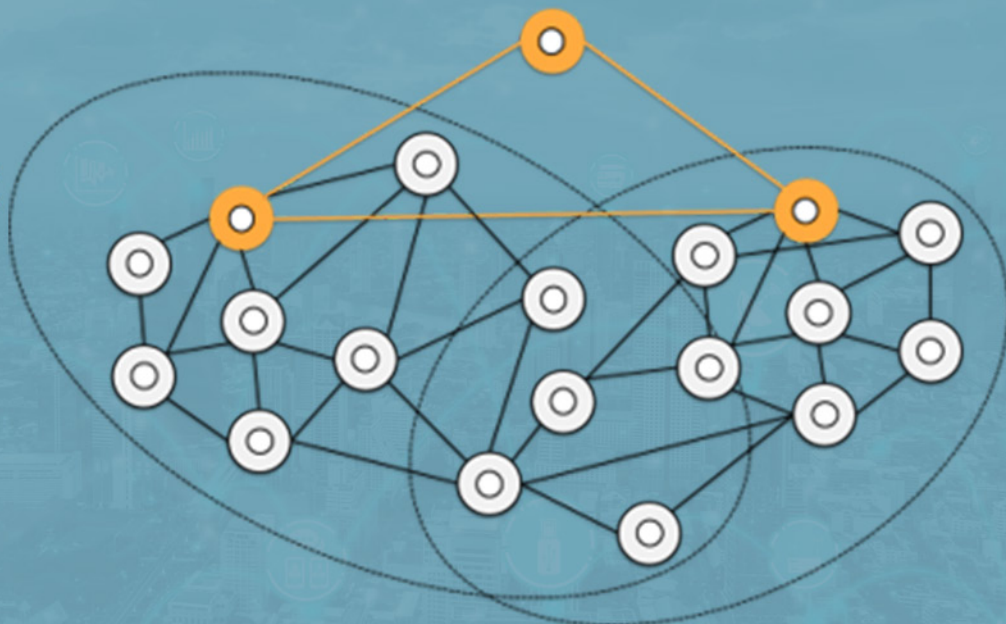
## Technologies with added value for industry and business

Partner companies can benefit from this expertise on several fronts and secure competitive advantages for themselves and their customers into the future. This is because companies that position themselves as pioneers in the provision of secure data spaces have what it takes to tap into new areas of potential for optimization and service packages for its customers. One benefit of data spaces is that a data exchange can be set up just once where possible and then used over and over again. It creates a standardized interface that can be used to trade with not only one company at a time, but several at once. This type of data trading enables companies to gain a transparent overview of entire supply chains and gather insights that are extremely relevant from the perspective of today’s supply bottlenecks and beyond. When companies integrate external data, they can add functionality to existing products or create entirely new products. In the tourism industry, for example, information from different providers — such as weather data, hotel occupancy rates or event companies — could be used to create new information services. It’s all very similar to our apple tart example, in fact.

## Sovereign data spaces reinforce European market leadership

Markus Spiekermann believes the concept of data spaces will definitely gain ground. He predicts that companies will be able to offer and use data with little effort in the future. An ever-increasing number of devices are steadily generating more and more data. This offers huge potential, especially in conjunction with automated processes and the innovations that are based on them. However, Markus Spiekermann sees the initiatives of Fraunhofer ISST as having an even greater impact by helping drive the digital transformation of the economy both in Germany and in Europe as a whole. “We have a strong industrial sector that sets us apart from other countries,” states Spiekermann. “If we can capitalize on sharing this industry data, it can help secure our market leadership in the long term.”

# ECLIPSE DATASPACE CONNECTOR



## Project highlight in Data Business: Eclipse Dataspace Connector

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### Sovereign data spaces created by the community, for the community

It's all about having the right connections — and that's especially true for shared data spaces. The question is, how can companies maintain control over their data? Launched last year under the leadership of Fraunhofer ISST, the Eclipse Dataspace Connector (EDC) is a collaborative lighthouse project that develops suitable software components.

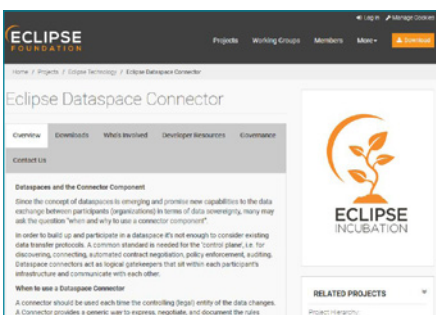
#### **The EDC as a fundamental prerequisite for future value chains**

Other questions that arise in this context are who has access to which data, what conditions this takes place under, and what format is used for safeguarding, negotiation and documentation. The intention is for policy-based data sharing to provide the regulations for this. The technical infrastructure required

to put it into practice is another of the keys to making the use of data spaces attractive for companies — so that they can tap into new data-driven business models and value chains.

The Eclipse Dataspace Connector is the leading open-source solution that does just that, providing control over how data is shared and used, even across multiple clouds.

You can find more information on the EDC and participation opportunities by visiting the Eclipse Dataspace Connector website:



*Eclipse Dataspace Connector — open-source technology for B2B data sharing*

Via the Connector, each company involved in a data exchange can specify itself exactly how the data transfer is to be organized. This ensures that internal specifications and regulations on data sovereignty are complied with in a transparent manner.

### Our opportunity for a global cloud standard to provide data sovereignty

What's really exciting about the Eclipse Dataspace Connector (EDC) project is that it supports both the International Data Spaces standards and the Gaia-X initiative protocols and requirements. At the same time, it is open to further standards: As a global community project, the EDC is not intended to end at the EU's borders, but rather to reach out to all stakeholders in the global economy and establish a common standard for a fair data economy.

With the Data Business business unit leading the way, many major partners — such as Daimler TSS, the BMW Group, Deutsche Telekom, Microsoft, Amazon AWS, SAP, Bosch, HPE, ZF Friedrichshafen, DIO Data Intelligence Offensive and Amadeus — have all teamed up with Fraunhofer ISST. Working as a community of research institutes, technology companies and application developers, they are creating a shared foundation for exchanging data transparently

### A peer-to-many concept that is available to everyone

The aim is to provide scalable solutions that are both enterprise-ready and cloud-ready. These are designed to help companies of all sizes start using data spaces in an uncomplicated and flexible way — be they big players or SMEs. This is the only way to establish complete data chains, which in turn can be used to promote organizational and technological standards or design new service packages.

The Eclipse Dataspace Connector was presented in August 2021 at the Gaia-X Hackathon in Munich. Over the coming year, those with an interest in the project will also have the opportunity to find out more about the EDC at various events — or get involved in the community directly. The EDC initiative is like no other project in the field of data spaces in that it embodies working together on a vast scale to make innovative technologies available to all.



Using secure data spaces to drive  
innovation in medicine

Healthcare business unit

# Healthcare business unit

## Using secure data spaces to drive innovation in healthcare

Further information on the  
Healthcare business unit:

[Projects](#)  
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Increased digitalization in healthcare has the potential to be transformative, provided we make smart use of the available data. The Healthcare business unit at Fraunhofer ISST gives companies and institutions the opportunity to do just that.

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How much time do you spend in doctors' waiting rooms? A doctor's appointment is usually the first step needed for treatment. Tests have to be carried out and findings obtained, all of which takes up valuable time.

But imagine a world in which it was not always necessary to visit your doctor — in which an app could detect abnormalities even before any symptoms arise. Imagine a world in which medical professionals could have a straightforward overview of significant progressions and immediately suggest appropriate courses of action, potentially eliminating the need for further treatment. Or one in which personal digital twin could predict which tailored therapy is likely to deliver the best results. This may sound like a vision of the future, but the Healthcare business unit at Fraunhofer ISST is already paving the way with its research in this area. Ultimately, we could see a healthcare system that makes individual treatments easier and dynamically woven into our everyday lives with greater transparency. This kind of healthcare is based on knowledge and insights obtained through seamless communication between research,

healthcare and pharmaceutical institutions. So what is needed to achieve this? The answer is open data spaces, supported by Fraunhofer ISST, through which health-related data can be used securely.

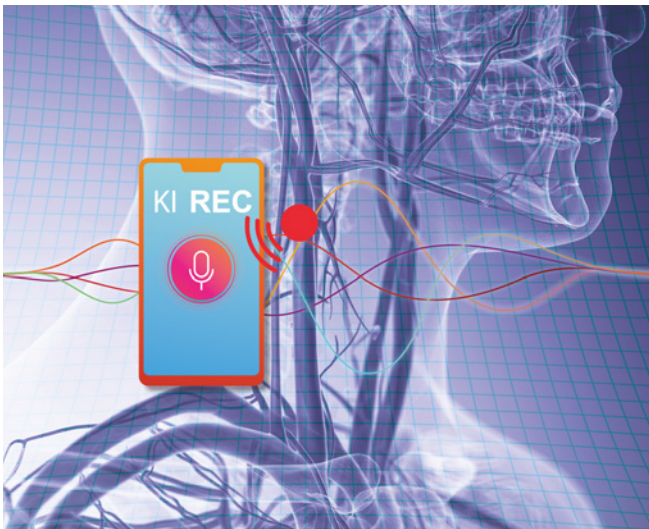
### Fraunhofer ISST enables data-driven applications for improved treatments

The aim of Fraunhofer ISST is to find new ways of using health data efficiently and offering data-based services — not by copying and collecting as much data as possible, but by enabling a purposeful and sovereign exchange of data. The team at the institute is researching a variety of components and services to enable companies to do just that. The focus is on three areas of work in particular:

- The area of personal information management addresses issues such as the handling of personal health data right up to and including the digital twin, as well as the management of personal data sovereignty; for example, by requiring consent to transparent conditions of data use.

- The area of healthcare IT infrastructures researches how information — primarily in medical documentation — can be exchanged in a way that complies with standards and is compatible with systems. This is important for medical documentation as a means of improving treatments and making better use of research data.
- In the area of health applications, research is being conducted into user experiences and service processes that can be developed into digital solutions. These include applications that enhance electronic health records (EHRs), as well as digital health apps.

For Head of Department Dr. med. Sebastian Dries, interaction between all areas of work is essential for developing successful innovations that will benefit solution providers, healthcare providers and individual patients alike. One example of this is creating the ability to hear vascular diseases as part of the Fraunhofer ISST project BodyTune, which is making external audio recordings of blood flow through the carotid artery. AI automatically analyzes these recordings and is designed to identify irregularities based on a personal profile. In future, this could make it possible to detect the risk of patients suffering a stroke or heart attack at an early stage. With this method, long-term analyses of breathing, coughing and swallowing sounds could also be used to warn of potential illnesses. You can find out more by visiting the [BodyTune«-Project page](#) on the Fraunhofer ISST website.



*AI analyzes recordings automatically*

## Consent and trust: two keys to successful innovation

Quite rightly, this type of health data demands special protection, which means that any new technical services have to comply with all existing data protection guidelines. Ensuring this includes obtaining all necessary consents required for processing health-related data. The challenge here lies in offering new applications that are as accessible as possible despite the high level of data protection they require. If users are unsure about how their data is being handled, they will not give their consent and the new system will not be able to work. On the other hand, if they are asked for their consent too often — as is sometimes the case with cookie consent prompts in web browsers — they may become frustrated and be put off using the application.

Sebastian Dries sees consent management as a crucial element in the success of data-driven healthcare applications. One possible solution would be to transfer decisions to a digital representation of yourself — known as an agent — which would make decisions in a (partially) automated way according to what it has learned from the user. This, of course, requires trust — something that the team at Fraunhofer ISST is working to increase by exploring acceptance factors and how they can be combined with technical capabilities.

## Data sovereignty as a competitive advantage

An essential element of this trust is to retain data sovereignty, that is, self-determination over your own data. “This involves being able to control which decisions are of such importance that I wish to make them myself, and which decisions I choose to hand over to an agent who will act in my best interests,” explains Sebastian Dries.

Options for combining data sovereignty and innovative business models successfully are the focus of research in the DaWID project. The aim is to create a data-centered value creation platform for interactive assistance systems, which allows users to have transparent and autonomous control over their data and to understand its value. For companies, this platform forms a basis for new products and services with a competitive edge: Offering users data sovereignty is a way for them to set themselves apart as pioneers in the field.



## Agile teams develop innovations ahead of the curve

Our colleagues in the Healthcare business unit are providing companies with support as they embark on this journey. Even simply the fact that the team has been set up promises a rewarding partnership. With around 50 researchers from the fields of medical informatics, computer science, engineering, biomedical engineering, medicine, economics and law being organized into agile project groups. This taps into an extensive well of expertise for partner companies to access as needed, with the aim of developing healthcare-related, software-based, data-driven innovations in a strategic collaboration. The Enterprise Lab, in which Boehringer Ingelheim Pharma GmbH is involved, demonstrates how it is done: In a collaboration spanning several years and established in response to current challenges, new technical solutions are continually being created in the Lab using an agreed contingent of research and development services. (See page 18 of this Annual Report for more about the Enterprise Lab.)

For Sebastian Dries, what the containment efforts in response to the coronavirus pandemic have shown us is that there is still huge potential for development and innovation in the digital healthcare sector. Data-driven solutions developed by Fraunhofer ISST can help to improve processes in the future and make healthcare as a whole more preventive.





# Project highlight from the healthcare sector: Enterprise Lab involving Fraunhofer ISST and Boehringer Ingelheim Pharma GmbH & Co KG

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## Strategic cooperation that guarantees innovation

Responding quickly to new challenges gives you the edge in the long term. Today, this law of nature rings true in the digital world too — particularly for innovation-driven companies such as Boehringer Ingelheim. Questions regarding internal IT infrastructure or additional customer services that go beyond the pill are becoming increasingly relevant. In response, Fraunhofer ISST has used the Enterprise Lab as a collaborative framework for research into strategic innovation in order to identify quick and flexible solutions to current issues.

### Open collaboration based on partnership

The basis for this research laboratory is an agreed contingent of research and development services that can be accessed over several years as required. Within this framework, relevant

areas of focus are jointly identified and repeatedly developed during regular project meetings. Each new assignment is worked on with an agile approach — by a dedicated project team, staffed on the Fraunhofer side with subject-specific specialists from the three business units. This makes it possible to

act quickly and react quickly to new requirements, while keeping the overall administrative burden to a minimum. At the same time, Boehringer Ingelheim gains access to all core areas of expertise at Fraunhofer ISST and benefits from the extensive knowledge from external experts that the institute has to offer.

### Research at the heart of the Enterprise Lab

Employees working in every Boehringer Ingelheim division have the chance to contribute their ideas in a cross-functional capacity. As a result, the Enterprise Lab acts as a driver of innovation and an engine for new ideas. These ideas and innovations are quickly brought to market as new services or are used to digitally realign internal processes. The close partnership between the two parties ensures that the concepts being researched remain focused on specific goals and fit into Boehringer Ingelheim's systems in practice.

### Launched in 2016, the collaboration has enjoyed considerable success

As an example, the "Smart Panel" project was developed within the framework of the Enterprise Lab in order to optimize the supply of informational data to the chemical tanks at Boehringer Ingelheim. Data that was previously displayed in analog format on the tanks can now be read out using a type of e-reader. As well as making things easier for staff, the validated data increases safety and conserves resources. Working on the external Ilara Health project, the Enterprise Lab developed a solution for a startup in Kenya to upgrade blood measurement devices in clinics. This allows patients' measurement data to be uploaded directly and securely to the cloud, instead of being written down by hand or printed out.

The initiative has been such a success that Fraunhofer ISST and Boehringer Ingelheim are planning to extend their partnership in the Enterprise Lab for a further three years. This means that Fraunhofer ISST is consolidating its role as an enabler for partner companies to penetrate new and innovative business areas.





Industry 4.0 ready with qualitative data and sovereign networking

Logistics business unit

# Logistics business unit

## Industry 4.0 ready with qualitative data and sovereign networking



*Further information on the Logistics business unit:*

[Projects](#)  
[Technologies](#)  
[Publications](#)

**How can data make processes more efficient? The Logistics business unit is providing companies with support in organizing their data and harnessing it as a strategic asset.**

Every company has a treasure trove of data and unlocking this holds clear advantages in the form of lean business processes, greater transparency and lower costs. Where the challenge lies is tapping into the potential of internally generated data. On the path toward Industry 4.0, companies are successfully improving their value chains and driving digitalization in manufacturing. The key to this process is making data available and

usable. This requires a long-term data strategy that defines how data is handled and who is responsible for it. With the right data management, companies can maintain their data more easily, locate it faster and derive meaningful conclusions from what they process. In turn, this provides them with the necessary means to compete globally, respond nimbly to new framework conditions and implement automated and autonomous manufacturing methods. The Fraunhofer ISST Logistics business unit is helping them achieve exactly that.

### Only qualitative data is good data

The Logistics team at Fraunhofer ISST provides companies with support along the entire path of this transformation. To begin with, the organizational foundations for appropriate data management are established. The aim is to find solutions that facilitate data handling within the company in general and prepare data stocks with quality in mind. This step is necessary in order to obtain new findings from the data and thus achieve greater efficiency. At the same time, performing this step serves as a basis for generating more added value later on — for example, through decision support tools. As Head of Department Dr. Jürgen Schmelting puts it: “Even AI algorithms are only as good as the data that feeds into them.” His team is developing suitable applications in this area, even accommodating machines in the manufacturing process that are not yet able to provide data due to their age. This is because the pilot application RIOTANA® enables an existing production line to be upgraded with sensors at low cost.

### Dr. Jürgen Schmelting

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The captured sensor data allows live production monitoring in real time. At the same time, data streams can be analyzed, providing decision-making information for controlling production. With the information gained, users can improve the control and guidance systems in their production processes.

### Data chains provide solutions to global challenges

If data is shared beyond company and sector boundaries, it can add even more value due to the complex value chains that are now home to manufacturing operations and span the entire globe. Certain problems can only be solved by working collaboratively — those that arise in automotive production being one example. Nowadays, it is impossible for one company alone to determine the carbon footprint of a manufactured vehicle, as the product consists of too many different components, manufactured by a wide range of suppliers. In this situation, it is necessary to exchange CO<sub>2</sub> data in order to calculate the actual total value. Germany's Supply Chain Act (Lieferkettengesetz) contains a similar requirement: In order to demonstrate compliance with certain demands (such as a policy of no child labor), a company must have complete transparency in its value creation processes. This requires continuous data chains and secure data spaces in which stakeholders from entire industry sectors can network on an equal footing — from global players to local SMEs. The Fraunhofer ISST Logistics business unit is carrying out pioneering work in developing these data spaces. An example of a lighthouse project in this area is "Catena-X", which is facilitating the exchange of data between all players in the automotive industry. By sharing data, these players can collaborate and gain valuable insights both for themselves and for the entire value creation process.

### New technologies provide security for ensuring trust

Trust is a key factor for success in collaborations with commercial competitors. One significant area in which this has been demonstrated are the past experiences of the Logistics business unit. To overcome the challenge it holds, scientists at Fraunhofer ISST are researching new technologies: The International Data Spaces standard, for example, which was developed with a significant contribution by Fraunhofer ISST, provides companies with a guarantee of secure data transfer as well as sovereignty over their data. To this end, specific terms of use can be attached to the data in order to ensure that the recipient only uses the data in the way intended by the sender. This is similar to a social media notification that is set by default to delete itself after being opened once and cannot be read again. The technology in question creates

the necessary foundation of trust for companies that wish to establish more transparency in production processes across company boundaries.

Dr. Jürgen Schmelting puts it in plain terms: "If we follow Industry 4.0 through to its logical conclusion, the issue of trust becomes particularly relevant. As automation gains momentum, for example — partly in response to the shortage of skilled workers — machines will become so autonomous that it will no longer be people who negotiate contracts, but the machines themselves. Special software components, known as agents, will negotiate autonomously on price, quality and delivery dates, achieving the best possible results with the assurance of legal certainty." While this may sound like the distant future, it is already being put to the test in the Legal Testbed project at Fraunhofer ISST.

### A team of digital natives developing custom-fit solutions

The key to these scientific achievements lies in openness to technology and an understanding of current developments. Employees in the Logistics business unit at Fraunhofer ISST demonstrate both of these qualities, operating in a young team with an in-depth knowledge of current technologies and emerging trends. Moreover, the employees are adept at flexibly integrating these technologies into new projects. This strength allows them to respond individually to each company and develop customized solutions. That's because it is clear that there is no such thing as a universally applicable data strategy — it is always crucial to take specific environmental factors into account. With their combined expertise in industrial engineering and computer science, they are able to provide rapid support to their partners as they move from proposal to project implementation: They analyze processes, identify challenges and provide solutions directly using software prototypes.

Head of Department Dr. Jürgen Schmelting is certain that corporate data management will continue to keep his team busy in the years to come so that the manufacturing landscape can be truly ready for Industry 4.0. The next step will be to implement further services on this basis, such as autonomous decision tools that promise optimized processes and time savings, along similar lines to the Legal Testbed. Our vision of the future is already here, not only networking companies within a single industry, but making multiple data spaces for different industries compatible with one another — a network of networks, so to speak. However, making this happen requires common interfaces and standards to be created..



# Project highlight in Logistics: Catena-X Automotive Network

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## The secure data space for the automotive industry

How do we create continuous data chains for all those involved in an automotive value chain? Together with its partners, Fraunhofer ISST is providing a solution through the Catena-X lighthouse project.

Data spaces and data chains are key components of Industry 4.0, and rely on secure and standardized data exchange. This is precisely the goal that the Catena-X project is pursuing with the automotive industry in mind. It is creating continuous data chains for all stakeholders in the automotive value chain — from global players to upstream suppliers operating as SMEs.

Those involved in the project include automotive manufacturers and suppliers, mechanical and plant engineering companies, software and network partners, as well as research and transfer partners. Their shared goal is to build an open ecosystem based on Gaia-X and the International Data Spaces, and achieve a digitalization breakthrough for an entire industry.

The German Federal Ministry for Economic Affairs and Climate Action is funding the project for a period of three years.

## Collaboratively solving the challenges of today with end-to-end data chains

One specific example illustrates why it is important to involve all players in a value chain. If the carbon footprint associated with manufacturing a vehicle is to be determined, simply extracting data from a single company is not enough<sup>1</sup>. It is quite clear that this calculation needs to be approached collectively, since a car is made from many different components that come from a variety of companies across a range of supply chains. This is where Catena-X comes into play by making it possible to share and process valuable information using a secure and extensive data infrastructure. Catena-X also specifically targets small and medium-sized manufacturing companies with often limited IT resources, as these companies hold the key to the success of the highly scalable network. It is not enough to include only large companies in the network — ultimately, every single player contributes to the solution and in turn benefits from greater transparency and improved management options within their own company.

## The pioneering lighthouse project

Institutions involved in the project as well as other organizations not directly involved are being grouped together in the Catena-X e.V. association, which was founded in parallel to the funding project. In particular, this association addresses standardization issues relating to uniform approaches to digital exchange and sharing of data in the automotive value chain. As a representative of the Fraunhofer-Gesellschaft, Prof. Dr.-Ing. Boris Otto, Institute Director at Fraunhofer ISST, was elected Deputy Chair in March 2021. He is convinced that the project will serve as a real beacon for the automotive industry. Also involved in the project are the founding members ARENA2036, BASF SE, BMW AG, Deutsche Telekom AG, the German Aerospace Center, German Edge Cloud GmbH & Co., Henkel AG & Co. KGaA, ISTOS GmbH, Mercedes-Benz AG, Robert Bosch GmbH, SAP SE, Schaeffler AG, Siemens AG, SupplyOn AG, ZF Friedrichshafen AG, Volkswagen AG and the Fraunhofer-Gesellschaft, plus numerous other partners. Together, they are working on overarching solutions designed to advance digitalization in the European automotive industry. Alongside Gaia-X and the International Data Spaces Association, Catena-X is one of the largest user initiatives dedicated to establishing data spaces for industry and business. Under the leadership of Fraunhofer ISST, the Fraunhofer-Gesellschaft is one of the founding members in all these initiatives

Weitere Informationen:  
<https://catena-x.net/de/>

1

- 1: OEMs have well-established methods for calculating their carbon footprint and have been publishing their results for many years in accordance with international standards such as the GHG Protocol and ISO 14040
- 2: These methods are based on externally recognized product LCAs.
- 3: In today's portfolio mix, with 80 to 90% of carbon emissions coming from the utilization phase and 10 to 20% from the supply chain, the current approach is the perfect combination of cost and benefit.
- 4: Future electrification of the portfolio will radically reduce the overall footprint of OEMs, but will also shift a proportion of carbon emissions from the utilization phase to the supply chain.
- 5: As a result, in the near future it will be necessary to take a more detailed look at carbon emissions in the supply chain. Catena-X can help provide guidance in this process





26%

8%

24%

CONNECTION  
ANALYSIS  
DATA  
SEARCHING  
VERIFICATION  
CODING  
SENDING

# Gaining a competitive edge through technological know-how

## Our areas of expertise

In order to use technology effectively and to the best advantage of their customers, companies need an in-depth understanding of it. Fraunhofer ISST currently focuses on six areas of expertise in which its scientists, drawing on in-depth technological know-how and extensive market knowledge, can provide their customers and partners with the best possible support in shaping future markets.

CONNECTION  
ANALYSIS  
SEARCHING

## Free and open-source software

### Transparent and collaborative software development as an innovation driver for the digital economy and for establishing data spaces.



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Free and open-source software (FOSS) has transformed from a sideshow into a major driver of innovation in the digital economy. FOSS has long offered more than simply a free-of-charge price point: Its transparency, security and participation opportunities are driving uptake, especially when it comes to dynamic, open data spaces and data ecosystems. Companies benefit from FOSS not only as users, but also through participation in or provision of FOSS projects and the establishment of communities. However, FOSS also poses significant risks and multiple challenges.

#### Range of services

Fraunhofer ISST supports organizations in all matters related to FOSS. This includes analyzing the strategic use of FOSS to achieve their specific business goals, planning FOSS activities and conducting a risk analysis of them, putting activities into practice, and continually expanding and providing support for FOSS projects. This includes the targeted development of open-source communities and support for practical implementation using suitable tools and methods for collaborative software development — particularly with a view to an international multi-stakeholder environment.

## Software engineering

### Innovative and pioneering software is developed in close cooperation with research partners.

Given the ever-increasing complexity of modern software solutions, it is essential for scientists to find efficient, structured ways of acquiring knowledge and skills. Where software engineering is concerned, specialist knowledge is acquired and built upon with specific aims in mind. This makes it possible to develop complex, innovative software products that can be successfully transferred to business and industry with a view to the future.

#### Range of services

The range of services offered by Fraunhofer ISST includes technical design, developing system components and providing consulting services during the software development process. For example, the institute offers a review of external software architectures or a conformity assessment of infrastructures in the healthcare sector.



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## Cloud transformation

Here, the focus is on exploring, progressing and putting into practice trends and developments in cloud transformation on a technological and strategic level.



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Together with our partners, we here at Fraunhofer ISST develop sovereign cloud infrastructures based on standards and initiatives such as Gaia-X. Using microservice architectures, we drive forward cloud-native computing in our projects. We also develop solutions to enable the simultaneous use of cloud services from different cloud providers as part of a multi-cloud strategy. Beyond that, we are working on the use of cloud computing in conjunction with other trends such as edge computing or digital twins.

### Range of services

The range of services offered by Fraunhofer ISST includes both technical development and strategic consulting within the scope of cloud transformation for companies. This includes:

- Building cloud infrastructures and cloud ecosystems, while taking into account issues such as data sovereignty, standards, open-source and compliance
- Strategic consulting and workshops on topics such as market analysis and positioning, cloud-native computing and multi-cloud computing

## Strategic data management

### How to become a company that creates value through data.

As data is increasingly being used on a company-wide level, there needs to be a change in the strategy used to handle data. Decisions that are critical for success and automated processes are based on reliable data and structures. Strategic data management develops the necessary structures for organizing data. Strategically positioning data organization makes it possible to align data domains, data roles and data applications with sustainability in mind.

### Range of services

The range of services offered by Fraunhofer ISST includes data strategy positioning, performing data assessments and data organization reviews, selecting suitable data governance approaches, developing role and process models, and even providing support in drawing up a proof of concept for tools.



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## Data science

### Harnessing the knowledge that lies within data.



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Data science makes it possible to extract knowledge and value from data, in turn opening up the possibility of not only gaining new insights and lending support to decision-making processes, but it also optimizing existing processes and developing new and innovative applications.

#### Range of services

The range of services in the area of data science includes both a needs analysis and a gap analysis to identify potential for improvement. It also encompasses architecture and process development, all the way through to creating prototypes for extracting knowledge and value from either existing data or data that is yet to be collected.



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## Data spaces and data ecosystems

### Technologies for building and using data ecosystems, and developing digital products and services.

In the area of expertise that covers data spaces and data ecosystems, technologies are being developed to ensure data sovereignty and standardized data sharing using the Eclipse Dataspace Connector. The Eclipse Dataspace Connector is a software gateway that allows users to participate in data spaces. This area of expertise also supports the creation of entire data spaces, such as the Mobility Data Space — and in addition to the technical dimension, it provides support for companies at the business model level, enabling them to use digital technologies and data to engage in value-creating and profit-generating activities.

#### Range of services

The range of services includes application and concept development for the use of international data spaces, technical proof of concepts, support for implementation in production environments, and collaborative open-source development. We also assist in the development of holistic business models for participating in data ecosystems. This includes everything from idea generation to implementing prototypes of the data-based business models that are created.



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## Our guiding principles — #thisISSTunning

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Successful research and development rely on interdisciplinary and multifaceted partnerships. As an institute of the Fraunhofer-Gesellschaft, we believe it is vitally important to establish an open culture that embodies the following:

- **Enthusiasm:** We believe in what we do. To those who think something can't be done, we say: "Yes, it can." An open atmosphere for discussion and a wide range of further training and career opportunities are important to us.
- **Freedom:** Research demands a high degree of freedom. Broadly speaking, we decide for ourselves what we are working on and ensure a good balance in our professional and private lives.
- **Responsibility:** Freedom is only possible if it is accompanied by a sense of responsibility, and we believe this is true at every single stage of a process.
- **Team:** No single person can do everything. In order to be innovative, we need to work together. As everyone has a vital role

to play, we believe in flat hierarchies and interdisciplinary teams.

- **Diversity:** We don't need to know where someone comes from — we want to know where they are heading.
- **Passion:** Shaping the future at Fraunhofer ISST is more than just a job. It is a deep sense of purpose.
- **Spirit of research:** You can only really change the digital world of tomorrow if you are allowed to think outside the box today. Groundbreaking ideas must be allowed to grow and mature.

Outstanding research needs outstanding employees. For many years now, the Fraunhofer-Gesellschaft has been one of the most popular workplaces among STEM graduates. And at Fraunhofer ISST, we are always on the lookout for new talent.

You can find current vacancies at [www.isst.fraunhofer.de/en/jobs.html](http://www.isst.fraunhofer.de/en/jobs.html)





"My job in three words: innovative, health-related, team-oriented."

Pinar Bisgin  
 Research Fellow in Medical Engineering and Biomedical Engineering at the Fraunhofer Institute for Software and Systems Engineering ISST



As a computer scientist in the Healthcare business unit, Pinar helps ensure that hospital activities are much more patient-centered — [#thisISSTunning!](#) We would like to see more women in STEM careers. [#InnovationsFromdata](#), [@klischeefrei](#) (initiative combating gender stereotypes), [@komm\\_mach\\_mint](#) (organization supporting women in STEM), [@Kompetenz\\_ev](#) (network for technology, diversity and equal opportunities)



## Women at Fraunhofer ISST

### Equal opportunities

In 2021, the Joint Science Conference (Gemeinsame Wissenschaftskonferenz — GWK) reported in a publication titled "Equal Opportunities in Science and Research" that the proportion of female scientists in universities and research institutions has increased<sup>1</sup>. However, the need for action persists: Progress is still slow and the proportion of women falls as the career ladder is ascended.

Fraunhofer ISST is committed to inspiring women to pursue a career in digitalization research and is helping to increase the visibility of female scientists. To take one example, we regularly feature our female employees on our social media channels.

To mark Girls Day 2021, we also highlighted the work of our female scientists and students (see image above).

Not only that, but we have also implemented a range of internal measures: women empowerment workshops, talent development

programs for female employees through Fraunhofer funding programs and a new monthly newsletter on equal opportunity issues.

In 2021, institute-specific targets for the recruitment rate of women in scientific positions were introduced and are now based on the proportion of women in the degree programs from which we have recruited significant numbers of graduates in the past. We are meeting these targets — but we want to do more.

That is why Fraunhofer ISST is remaining committed to inspiring women to undertake digitalization research and to sustaining this interest and enthusiasm in the future.

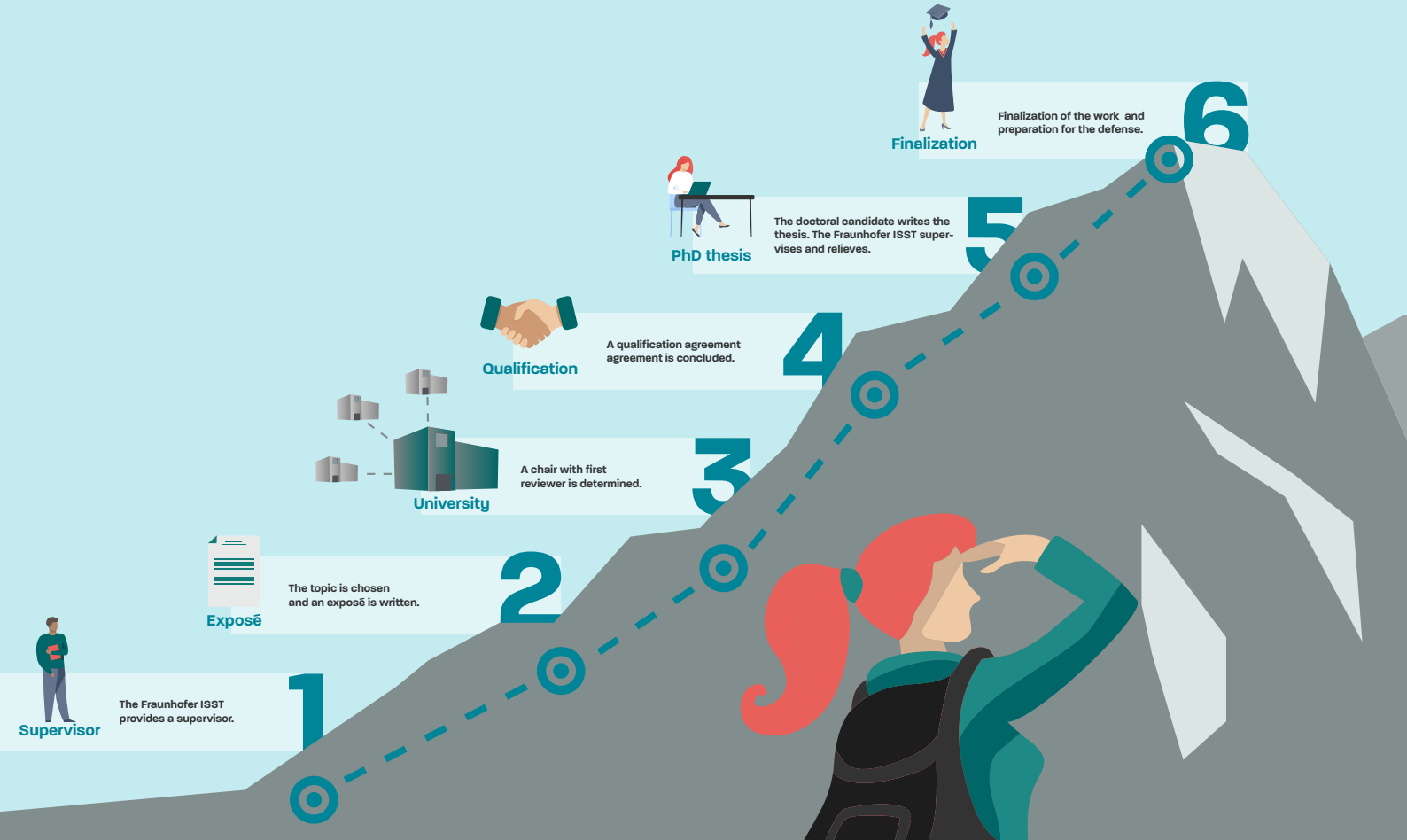
It is important for us to show our appreciation, to increase the diversity of our employees and to nurture talent — regardless of age, gender, nationality, ethnicity, social background, religion, ideology, disability, sexual orientation or identity.

### M. Sc. Anja Burmann

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<sup>1</sup> <https://idw-online.de/de/news778184>



# Studying for a PhD with Fraunhofer ISST

## The Research Schools: Achieving doctoral success together

Aimed at providing support to PhD students, the Research Schools at the Fraunhofer Institute for Software and Systems Engineering ISST are collaborations with professors from TU Dortmund University, Witten/Herdecke University and the University of Koblenz.

At the Research Schools, doctoral students from Fraunhofer ISST work together with those from universities in a mutual dialog-based approach that teaches the basics of scientific research in interdisciplinary groups. The Research Schools span a variety of fields and disciplines: information systems, healthcare and computer science. They aim to not only enhance the scientific quality of dissertations at Fraunhofer ISST and its affiliated universities, but also provide support for strategically publishing findings in publication media that relate to the specialist fields. Hands-on workshops on different scientific subjects are organized in the Research Schools to allow doctoral students to benefit cumulatively from the knowledge they have acquired and share it with one another.

# PhD students 2021

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## Dr.-Ing. Can Azkan

### Design principles for developing industrial data-driven services

In today's digitalized society and economy, data is considered a core resource. Using data efficiently makes it possible to create new data-driven services and innovations, but also poses a number of challenges and hurdles to overcome, particularly for industrial companies. To address existing challenges, this thesis established design principles for developing data-driven services for industry. The intention is to provide business model developers and service designers in companies with support in successfully developing their own data-driven services, allowing them to strengthen their competitive position in the market and increase profit margins through the new digital service business.

Supervisor: Prof. Dr.-Ing. Boris Otto



*Dr.-Ing. Can Azkan      Prof. Dr.-Ing. Boris Otto*

## Dr.-Ing. Sebastian Opiel

### Sharing sensitive data in automotive industry supply networks

Nowadays, a lack of trust expressed toward business partners and the fear of being subject to opportunistic behavior on their part often deter companies from exchanging sensitive information, despite the fact that this information could lead to greater supply network transparency and, in turn, to optimization and efficiency gains in supply network processes. Technologies that can ensure secure data exchange with appropriate usage control exist in the form of the International Data Spaces (IDS) reference architecture. This thesis looked at two partners from the German automotive industry to explore the exchange of sensitive information based on IDS and data usage control within an action design research case study. The results obtained and knowledge gained led to the development of a theory concerning sensitive information exchange.

Supervisor: Prof. Dr.-Ing. Boris Otto



*Dr.-Ing. Sebastian Opiel*





# Our institute

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The Fraunhofer Institute for Software and Systems Engineering ISST works with companies to identify the strategic value of their data and turn it into a useful asset. From data preparation to the development of new business models, we offer complete system solutions for your company.

Our experts research the value of data and its sovereign use in the areas of logistics, healthcare and data business. We develop solutions for managing data and constructing data architectures. Together with our customers and partners from the business community and as consultants to policymakers, we are using our International Data Spaces and Gaia-X initiatives to create a data infrastructure that allows secure data use with control beyond company boundaries — in Germany, in Europe and around the world.

# The institute management

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*Prof. Dr.-Ing. Boris Otto  
Executive Director*

Since 2017, Prof. Dr.-Ing. Boris Otto (born 1971 in Hamburg) has been Institute Director of the Fraunhofer Institute for Software and Systems Engineering ISST in Dortmund and, since 2013, Chair of Industrial Information Management at TU Dortmund University. He is a board member of Gaia-X, the European Association for Data and Cloud, AISBL and the International Data Spaces Association (IDSA), and serves as Chair of the Board of Directors at the Fraunhofer ICT Group.

After studying industrial engineering in Hamburg, Otto gained his doctorate at the University of Stuttgart under Prof. Dr. Hans-Jörg Bullinger, former President of the Fraunhofer-Gesellschaft. He qualified as a professor at the University of St. Gallen's Institute of Information Management, where he founded and managed the Corporate Data Quality competence center. His career path also included PricewaterhouseCoopers, SAP and the Fraunhofer Institute for Industrial Engineering IAO. In addition, Otto was a Research Fellow at the Center for Digital Strategies, Tuck School of Business at Dartmouth College in New Hampshire, USA.

Otto's research focuses on the fields of industrial information management, business and logistics networks, and methods for designing digital business solutions.



*Prof. Dr. Jakob Rehof  
Director*

Until the end of 2021, Prof. Dr. Jakob Rehof assisted him in his role as Institute Director. Prof. Dr. Jakob Rehof (born 1960 in Denmark) was a member of the Fraunhofer ISST institute management since 2006. In addition to a degree in computer science and mathematics from the University of Copenhagen and a doctorate in information science, he holds degrees in classics (Ancient Greek and Latin) and philosophy.

After several years of working in project management at Microsoft Research Labs in Redmond, USA, Rehof took up a role at Fraunhofer ISST with a focus on networked and distributed software systems, cloud computing, software services composition, information logistics, workflow management, and the specification and implementation of business processes. Rehof is Chair of Software Engineering at TU Dortmund University and, through this position, continues to be closely connected to Fraunhofer ISST.

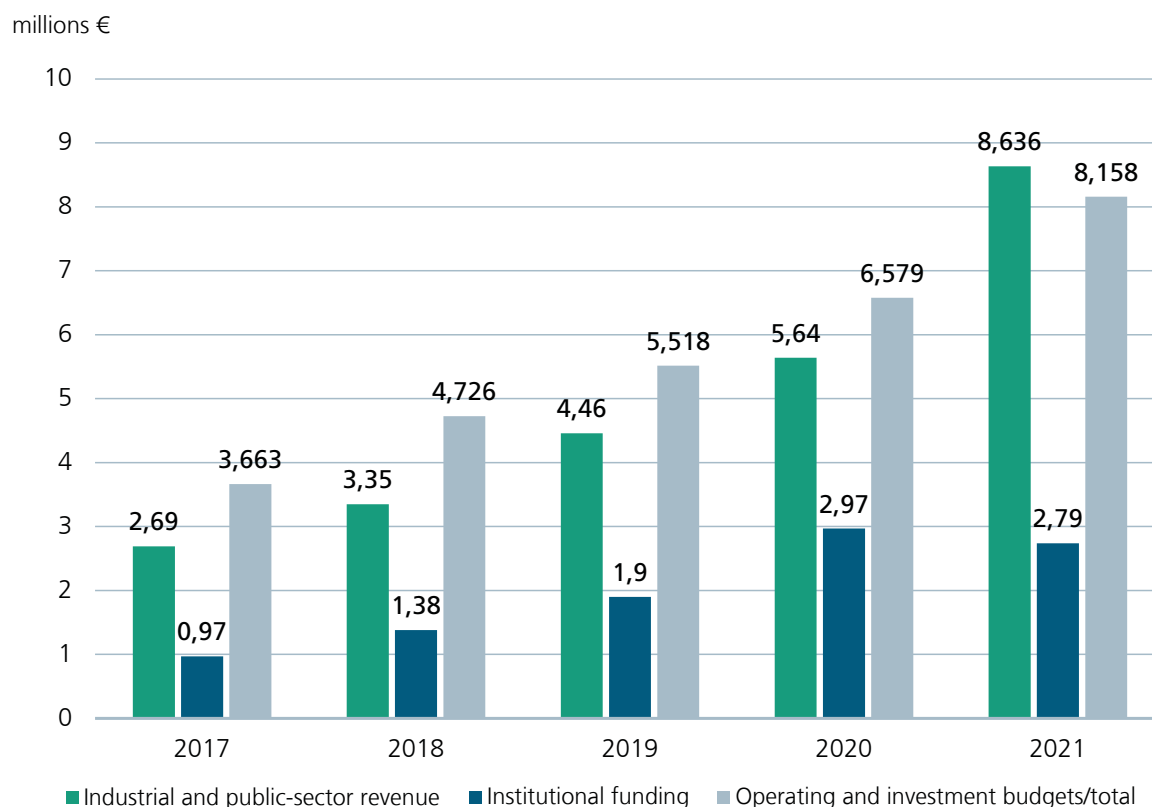
# The institute in numbers

## Facts about Fraunhofer ISST — your partner in the digital transformation of your company.

At the end of 2021, there were 125 employees at Fraunhofer ISST (135 if degree candidates are included). Reflecting one of the key functions of a Fraunhofer institute — to support and train the next generation of scientists — Fraunhofer ISST is home to student employees and trainees alongside its scientists and administrative staff.

The institute receives public funding, known as base funding, that finances pre-competitive research, strategic projects and investments. The total expenditure from the operating and investment budgets in 2021 was approximately 8.158 million euros. Personnel costs accounted for 76 percent of this figure. In the 2021 financial year, Fraunhofer ISST generated revenue of 8.636 million euros from research and industry. In addition, it received institutional funding from the Fraunhofer-Gesellschaft amounting to 2.74 million euros.

As an institute of the Fraunhofer-Gesellschaft with an associated focus on applied research and development, acquiring and executing industrial contracts is a major priority. The positive development of Fraunhofer ISST in this area demonstrates how important the institute's services are to the market. The institute will continue its efforts to sustainably increase the industrial share of financing.





## Strategic development

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**In 2021, as part of a strategic process, Fraunhofer ISST defined the cornerstones of its research agenda for the next five years. The key points are presented here.**

By 2025, it is estimated, 40 billion smart devices will be making our lives easier or production processes more efficient, either in smart homes or in Industry 4.0. Every person will have five devices connected to the internet — generating, analyzing, distributing or using data. Statista estimates the total volume of this data to be 175 zettabytes, or  $1.75 \times 1,023$  bytes. This data is the resource that will create value in the future. According to the EU Commission, the value of the European data economy will exceed 800 billion euros<sup>1</sup> by 2025.

This means that major sections of the future economy will no longer be based on machines for processing steel and iron into products, but instead on software for processing data into digital services. This software will increasingly run on platforms in the cloud — and, as a result, cloud platform providers are set to achieve market values of over one trillion US dollars. Rather than Europe, the leading platform companies are housed in the USA (Amazon, Apple, Google and Microsoft) and China (Alibaba).

This harbors risks for long-term competitiveness and digital sovereignty, as well as the data sovereignty of both individuals and organizations in the European single market. However, it also holds opportunities. If Europe can take control of its own destiny, there is an opportunity to shape a data economy that is based on fundamental European values.

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<sup>1</sup> Statista (2021): Value of the data economy in the European Union (EU) and United Kingdom from 2016 to 2020 and in 2025. <https://www.statista.com/statistics/1134993/value-of-data-economy-eu-uk/> (accessed on August 13, 2021).

## What could a data economy based on European values look like?

1. Firstly, companies must truly embrace data as a strategic resource for economic value creation, not as a by-product of a production process. This means managing data like an asset: that is, based on cost, time and quality criteria. Companies that do not have a firm grip on their internal data resource management will have no chance of succeeding in the data economy.
  2. Secondly, with innovation and value creation increasingly occurring within ecosystems, a balance must be struck between the data owner's fundamental desire for autonomy on the one hand and the ecosystem's legitimate interest in using the data on the other. In today's world, data protection and the free use of data are two opposing extremes that need to be reconciled. Data sovereignty is the key to achieving a social data market economy.
  3. Thirdly, there are two main reasons why the cloud is the standard. As data ecosystems are taking hold, there is a need for an ICT infrastructure that can be used by all members of the ecosystem; in other words, at the center of the ecosystem. Aside from this, cloud computing offers many advantages in terms of flexibility, scalability and lead time compared to on-premise systems.
  4. Fourthly, the cloud landscape of the future will be decentralized and federalized. The Internet of Things is paving the way for a shift of computational power to the edge of the internet. As a result, in the medium term there will be a few providers of large cloud platforms and a much greater number of small and medium-sized edge cloud service providers.
  5. Fifthly, individual data owners will be equipped with technologies that will enable them to regain control over their own data universes — the individual digital twin. Developments such as SOLID and OPA can help change the landscape and shift control away from hyperscale data pools to collaborative and democratic forms of data trusts.
  6. Sixthly, free and open-source software (FOSS) is a key principle for data sovereignty technology.
- To sum up, Europe needs to strive for a future in which data sovereignty is no longer an issue. Why? Because it is easy to implement in all cloud-based services used by individuals and businesses

## As part of the Fraunhofer ICT Group, Fraunhofer ISST is contributing to this vision of the future in three ways:

- **The institute's objective is to provide leadership in organizing and managing communities around roadmaps that culminate in this long-term vision.** A good example of this is found in data spaces, where Fraunhofer ISST coordinates the activities of several Fraunhofer institutes in a portfolio that includes research programs related to IDS and Gaia-X. Beyond that, Fraunhofer ISST also has a leading role in coordinating the activities of communities comprising several external stakeholders (as is the case with the Eclipse Dataspace Connector project).
- **In addition, Fraunhofer ISST creates and manages open-source software programs with the objective of developing innovative solutions and technologies for data sovereignty and data spaces.** This all contributes to the broader roadmaps mentioned above.
- **Finally, Fraunhofer ISST develops core technologies for data spaces and supports companies in their transition to data spaces, plus the construction of data ecosystems based on data-space technology.**

# The advisory board

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Fraunhofer ISST is guided by an advisory board whose members are drawn from the worlds of business, science, politics and administration.

## Paul Schwefer

Management Consultant at Fair Sourcing, Hannover  
Chair of the advisory board

## Dr. Reinhold Achatz

Coach for innovation, technology, entrepreneurship and sustainability

## Guido Baranowski

founding CEO of TechnologieZentrumDortmund, Dortmund

## Prof. Dr. Svenja Falk

Managing Director Accenture Research, Berlin

## Dr. Christiane Fricke

Head of the Non-University Research Organizations, EU International Affairs Group of the Ministry of Culture and Science of the State of North Rhine-Westphalia

## Prof. Dr. Volker Gruhn

Chair of Software Engineering at the University of Duisburg-Essen and Chair of the Supervisory Board of adesso SE, Dortmund

## Katrin Hinne-Mohrmann

Vice President, Practice Transport and Logistics, Deutsche Bahn AG, Berlin

## Dr. Nicola Jentzsch

Consultant, department 112 (fundamental issues concerning digital policy; coordination), German Federal Ministry of Education and Research, BMBF

## Fabian von Kuenheim

Kuenheim Familiaris GmbH, Stuttgart

## Prof. Dr. Christine Legner

Head of the Information Systems Department, University of Lausanne, Lausanne

## Volker Lowitsch

Head of the IT business area at Aachen University Hospital and chair of the Verein Elektronische FallAkte e.V. (Electronic Medical Record Association)

## Dr. Sebastian Ritz

CEO of German Edge Cloud GmbH & Co. KG, Eschborn

## Michael Schmelmer

Member of the Board of Managing Directors at C.H. Boehringer Sohn AG & Co. KG, Ingelheim am Rhein

## Eva Schultze

Director of Global Data Management Quality & Regulatory Affairs, Drägerwerk AG & Co. KGaA, Lübeck

## Björn Stammer

Head of Logistics (ND-L), Nestlé Germany AG, Frankfurt am Main



# Fraunhofer spin-off soivity GmbH

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## Data sovereignty as a managed service for companies

Data spaces are crucibles for innovation — provided there is enough data to serve as a raw material. But how do companies share their data with the outside world and still retain control over it? Launched in 2021, the Fraunhofer spin-off soivity has the perfect solution: a dedicated piece of software that enables companies to exchange data. This allows companies to interact with partners, suppliers and customers in data spaces, safe in the knowledge that their own data is protected and only passed on in accordance with the rules they have set themselves.

### A service that strikes a chord

For the soivity Managing Directors, Sebastian Kleff (CEO) and Dr. Sebastian Opiel (CTO), the challenges facing companies were all too clear. In order to exchange data, companies need easily accessible, technical solutions that function with interoperability — and they need to be able to trust these solutions.

Until now, it has been almost impossible for companies to obtain easy access to the sophisticated technologies required for trustworthy data exchange. Those that do exist are complex and cost-intensive, often involving complicated integration processes and providing only limited data control. As a result, there is currently very little data exchange taking place. In fact,

companies often keep their sensitive data entirely to themselves. This results in missed opportunities for joint innovation and optimized collaboration. The new software-as-a-service solution from soivity addresses precisely these issues.



*Sebastian Kleff, Sebastian Opiel*

### IDS-based data sovereignty and control

soivity delivers one of the world's first services designed to help organizations make extensive use of the technology for International Data Spaces. The software, developed by Fraunhofer in cooperation with more than 130 companies, represents a global standard for the sovereign, interoperable and secure exchange of data. This guarantees that companies can use their data autonomously, with usage controls that are imposed by technology and ensure every company retains data sovereignty. In this way, soivity facilitates a data exchange based on trust that transcends corporate boundaries and enables companies to leverage all their added value as active participants in shared data ecosystems. This in turn creates greater transparency, improves processes and decision-making, and acts as an enabler for new functions or business models.

### Holistic service centered on three pillars

The software solution is aimed at companies of any size or industry. With a connector-as-a-service solution, soivity enables uncomplicated access to data spaces and use cases. Data space operators can also benefit from soivity's expertise by taking advantage of soivity's data space-as-a-service solutions for operating and managing all their IDS shared services. The third pillar of soivity's offering is consulting services. It supports companies in establishing data sovereignty or guides them in implementing potential applications from a technical perspective.

### A driver of innovation with Fraunhofer expertise

soivity was launched in May 2021 as part of the AHEAD program — a Fraunhofer-Gesellschaft program that supports high-tech ventures. CEO Sebastian Kleff and CTO Sebastian Opiel draw on many years of expertise in Fraunhofer research and International Data Spaces, which is complemented by extensive management experience. Together with their team, they aim to bring the soivity solution to a wider range of customers and continuously expand its use. In cooperation with renowned partners and initiatives such as various Fraunhofer institutes, the International Data Spaces Association, Innopay and T-Systems, they want to connect entire industries including supply chains in future and, in so doing, promote innovative collaboration.

**Further information:** [soivity.de](https://soivity.de)





# Our networks

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It is impossible to build data infrastructures acting alone — such developments can only succeed if they are the result of a joint effort involving many different players. Fraunhofer ISST is therefore involved in numerous professional, regional and Fraunhofer-wide networks, allowing it to collaborate and exchange ideas with partners.

## Membership

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- Alumni of Computer Science Dortmund e.V. (AIDO)
- German Association for Information Technology, Telecommunications and New Media (BITKOM e.V.)
- Catena-X, Automotive Network
- Data Competence Center for Cities and Regions (DKSR)
- Gaia-X, European Association for Data and Cloud
- HL7 Benutzergruppe in Deutschland e.V. (German HL7 User Group)
- International Data Spaces Association
- Network of the Healthcare Sector in the Ruhr (MedEcon Ruhr e.V.)
- WINDO e.V.
- Science Forum Ruhr e.V. (Wissenschaftsforum Ruhr e.V.)

## Fraunhofer-Gesellschaft

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- Fraunhofer ICT Group ([iuk.fraunhofer.de/en.html](http://iuk.fraunhofer.de/en.html))
- Fraunhofer Assisted Healthy Living Alliance AAL ([aal.fraunhofer.de/en.html](http://aal.fraunhofer.de/en.html))
- Fraunhofer Cloud Computing Alliance ([cloud.fraunhofer.de/en.html](http://cloud.fraunhofer.de/en.html))
- Fraunhofer Big Data and Artificial Intelligence Alliance ([bigdata-ai.fraunhofer.de/en.html](http://bigdata-ai.fraunhofer.de/en.html))
- Fraunhofer Cluster of Excellence Cognitive Internet Technologies CCIT ([cit.fraunhofer.de/en.html](http://cit.fraunhofer.de/en.html))
- Fraunhofer Academy ([academy.fraunhofer.de/en.html](http://academy.fraunhofer.de/en.html))



## Scientific network

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As an institute of the Fraunhofer-Gesellschaft, we work at the interface between science and industry. Fundamental research at universities gives us valuable input that encourages transfer to industry with a focus on specific applications. The following chairs and professorships form the core of our scientific network:

**Prof. Dr.-Ing. Boris Otto**

Institute Director at the Fraunhofer Institute for Software and Systems Engineering ISST and Chair of Industrial Information Management at TU Dortmund University

**Prof. Dr. Jakob Rehof**

Chair XIV of Software Engineering at TU Dortmund University

**Prof. Dr.-Ing. Jan Cirullies**

Professor of Business Administration, specializing in supply chain management and digital logistics, at Dortmund University of Applied Sciences and Arts, and Head of Data Management in Logistics

**Prof. Dr. Falk Howar**

Professor of Software Engineering at TU Dortmund University

**Prof. Dr. Wolfgang Deiters**

Professor of User-Oriented Health Technologies at the University of Applied Sciences (hsg) Bochum

**Prof. Dr. Jan Jürjens**

Director Research Projects at Fraunhofer ISST and Head of the Institute for Software Engineering at the University of Koblenz

**Prof. Dr.-Ing. Christian Schwede**

Professor of Big Data Analytics at Bielefeld University of Applied Sciences and Head of Artificial Intelligence in Logistics

**Prof. Dr. rer. nat. Sven Meister**

Chair of Health Informatics at Witten/Herdecke University



## Our communication

As an independent research organization with a public mandate, communicating our research findings is vital to us. We are a digitalization institute that offers a variety of ways to access our projects and subject areas, particularly online.

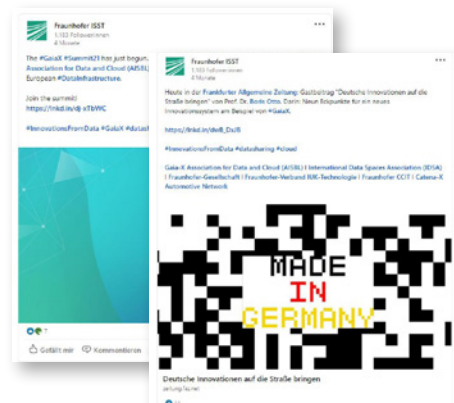
As an institute for applied research, we want to make it possible for you to access our research results easily and transparently. If you would like to learn more about the Fraunhofer Institute for Software and Systems Engineering ISST, its projects in logistics, data business and healthcare, and the team at the institute, we invite you to explore further as outlined below:

#InnovationsFromData: Follow us on social media

@FraunhoferISST



@Fraunhofer ISST



Take a look at [www.isst.fraunhofer.de](http://www.isst.fraunhofer.de)

On our website, you'll find everything you need to know about what #InnovationsFromData means to us — from descriptions of our current research projects and our fields of expertise to our publications and press releases. In every case, we direct you to a point of contact so that you can quickly and easily access the right part of the institute to respond to your inquiry.

Under Press/News, you will also find videos — and much more — in which we aim to present complex research subjects in a manner that is easy to understand.

### Data Researchers Vlog (#Data\_RSR)

Our Institute Director, Prof. Dr.-Ing. Boris Otto, has a vlog entitled Data Researchers Vlog (#Data\_RSR), which can be viewed at [isst.fraunhofer.de/en/vlog](http://isst.fraunhofer.de/en/vlog) or on [Fraunhofer ISST YouTube channel](#) (available with English subtitles). Using this format, Boris Otto regularly sheds light on hot topics in digitalization, providing concise, informative and well-founded insights.

# Our publications

Fraunhofer ISST employees regularly write articles for scientific and specialist journals. We also publish our scientists' conference papers, studies and white papers.

Here is a selection of contributions published in 2021 as part of our institute's own series of ISST Reports or as position papers:



Download position paper:  
[»Data Sovereignty and Data Economy—Two Repulsive Forces?»](#)



Download ISST Report:  
[»Cloud Transformation – Trends and Implications«](#)



Download - ISST-Bericht:  
[»Datenbewertung« Status quo und Anreize der Datenbewertung \(only available in German\)](#)



Download ISST Report:  
[»DataOps for Data Sharing« — Challenges and Requirements for Interorganizational Data Sharing](#)



Download ISST Report:  
[»Data as Taxes«](#)

You can find all other information about our publications and the search options in Fraunhofer's Publica database at [www.isst.fraunhofer.de/publications](http://www.isst.fraunhofer.de/publications)



# Marking its 30th anniversary, Fraunhofer ISST drops anchor at the Port of Dortmund

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**Outlook for 2022: A new building in the Speicherstrasse digital quarter development at the Port of Dortmund is securing growth opportunities for Fraunhofer ISST in an attractive location.**

The new building on Speicherstrasse in the Port of Dortmund can be seen from afar: Flooded with light, spacious and situated in an attractive location directly on the canal, the new Leuchtturm (Lighthouse) office building will be an initial anchor point in the digital quarter development taking shape in the port district. Fraunhofer ISST will be moving into this building from summer 2022, with the official opening due to be celebrated on September 8, 2022 — coinciding with the 30th anniversary of the institute.

Due to the rapid expansion of the institute and the lack of capacity at the existing site in the Dortmund Technology Park, Fraunhofer ISST urgently needed new premises. The city of Dortmund responded and actively supported Fraunhofer ISST in its search for a new location. In its new home at the port, the institute will have around 3,340 m<sup>2</sup> of office space spanning a total of six floors. The building was designed by Höhe

Architekten, based in Stuttgart, and the construction work is being carried out by Hofschröder GmbH & Co. KG, Lingen. Fraunhofer ISST has been granted a lease agreement with a guaranteed purchase option. “The Leuchtturm is giving Fraunhofer ISST the opportunity to grow, something we urgently need as a rapidly expanding institute,” explains Institute Director Prof. Dr.-Ing. Boris Otto.

“We are looking forward to moving into an attractive district that will give rise to many German and European digitalization success stories — driven not only by Fraunhofer ISST, but also by the many partners that will be able to flourish in this digital quarter. From our Dortmund base, we are now in an excellent position to share with the world our ideas and solutions for data sovereignty and the data economy.”

## The perfect symbiosis: Fraunhofer ISST and the Digital Port Speicherstrasse

The research areas and software products provided by the Fraunhofer ISST work in perfect harmony with the Speicherstrasse port district being developed into a digital port. Space for future institute spin-offs will soon be created in the immediate vicinity of the new site. The vision of a hub for creative knowledge and innovation at the port is being met with great interest. As early as 2022, the city is set to make additional areas available for this development with the release of its building plan for the northern section of the Speicherstrasse area. "Dortmund doesn't just have a digital future — it also has a well-established digital tradition," remarks Thomas Westphal, the city's mayor. "This of course includes Fraunhofer ISST as a leading German software institute. I am proud and delighted that we have such a renowned institute in Dortmund and have been able to find it a suitable location. Soon, it will be a visible symbol in the launch of the Speicherstrasse digital quarter."

In addition to Fraunhofer ISST, several new occupants have already been identified for the southern section of the Speicherstrasse planning area, including the City of Dortmund at the Landmarken AG Start-up and Innovation Campus, housing a start-up center for digital solutions. The Academy for Theater and Digitality will also find a new home here for a theater of the future — an innovative fusion of culture and technology that experiments with new forms of expression and narrative possibilities.

It is already clear that the new quarter will offer fantastic opportunities for companies and organizations to inspire one another and collaborate on exciting new ideas and projects. The Speicherstrasse port district is becoming a beacon of North Rhine-Westphalia's innovative strength. Uwe Büscher, Member of the Executive Board of Dortmunder Hafen AG, is among those excited about what this holds: "The anticipated digital competence centers and institutes will complement the industrial base in our region, furthering bolster the future economic success of the Port of Dortmund. This will create a basis from which all companies in the area will benefit."



# Publishing notes

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