



New Spaces for Data and People – 30 years of Fraunhofer ISST

Annual report 2022

30

Introduction



Dear readers,

Research needs a broad perspective. It must deal with the current challenges and work out the best solution for the future. In order to be able to fulfill this mission, good working conditions are needed that literally offer space for creativity and open the view for new perspectives. We are very pleased that we have been able to experience such an environment with vision in real terms in our new building, the so-called “lighthouse” in the digital quarter of Dortmund’s river port, for a few months now. Our Speicherstraße space is a location that offers the capacities and attractiveness we need to be positioned as an institute for the future.

But it was not only the move that kept us busy in 2022: This year we also celebrated our institute’s 30th anniversary. We were delighted by the great response from clients, partners and companions at our ceremony under the title “New Spaces for Data and People” on September 8, 2022 at Dortmund U. It was a wonderful day — and after the pandemic years, it was a great feeling to be surrounded by so many people who share the same goals as we do.

Together with these many companions, we were able to drive forward important projects and initiatives last year: Catena-X revolutionizes the way data is being handled in the automotive industry. The Fair Data Space and the Mobility Data Space connect research and mobility data at a new level of quality. Our “Health-X dataLOFT” project sees data from the first and second health sectors combined and made usable for better health care according to Gaia-X standards (see [page 23](#)).

The “Data Spaces Support Centre” (DSSC), whose project office we have the privilege of managing at Fraunhofer ISST, has been bringing the many data space activities at the European level even closer together since the fall of 2022 and making experience available across industries. I cordially invite you to use this center for implementing your own data space projects and for networking. You will find a detailed article about the DSSC on [page 11](#) of this annual report.

At this point, I would like to thank all our partners, clients and networks who have placed their trust in us over the past year and continue to do so. Maybe a look at the following pages of this annual report provides you with inspiration for (further) joint projects. Feel free to contact us. Together, we create innovations from data that sustainably drive digitization in Germany, Europe and the world.

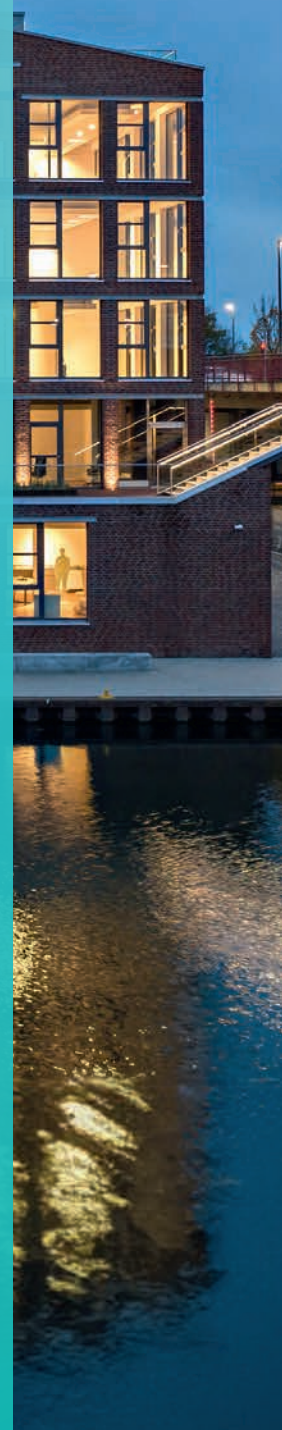
Yours sincerely,

A handwritten signature in blue ink, which appears to read 'Boris Otto'. The signature is fluid and cursive.

Prof. Dr.-Ing. Boris Otto
Institute Director

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Highlights 2022





“New Spaces for Data and People”: A new institute building for the Fraunhofer ISST on its 30th anniversary

DORTMUND. 30 years after the founding of the Fraunhofer Institute for Software and Systems Engineering ISST, the institute will move to a new location in January 2023, the “lighthouse” in the digital quarter currently under construction in Dortmund’s river harbor. Fraunhofer ISST celebrated this twofold reason for joy with a ceremony on September 8, 2022 in the brewing tower of Dortmund U. Gathered under the title “New Spaces for Data and People,” the speakers explained their vision of a social data market economy. Afterwards, the “lighthouse” was inaugurated.

Creating innovations from data is the core mission of the Fraunhofer Institute for Software and Systems Engineering ISST, founded in 1992. For years, Fraunhofer ISST has been one of the pioneers in setting up so-called data spaces. These data spaces enable “data sovereignty.” Individuals as well as businesses should be given the chance to retain control over how their data is used when they share it with others. To do this, technical and regulatory capabilities are being created

to attach terms of use to the data that is shared with others. What sounds very abstract has many advantages in practice: For example, companies that are actually in competition can share data with the same suppliers. Citizens have the opportunity to regulate the use of their data when dealing with public authorities and contractual partners.

150
employees
from Dort-
mund involved
in projects

Welcoming address by the Minister of Science of the state of North Rhine-Westphalia Ina Brandes: Digital spaces with democratic principles

“Each of us is engaging digitally more and more, whether in our private or professional lives,” said Ina Brandes, Minister for Culture and Science of the State of North Rhine-Westphalia. “Data protection and data sovereignty are crucial for the acceptance of digital offerings. Fraunhofer ISST is working with its partners to ensure that these basic democratic principles are implemented better and more securely in the digital world.”

From its Dortmund location, the Fraunhofer ISST's approximately 150 employees are involved in projects throughout Europe and internationally that are aimed at data sovereignty. They are working on the European data infrastructure “Gaia-X” and are in particularly close contact with the International Data Spaces Association, which is also based in Dortmund and aims to build up corporate networks around data spaces. The institute's work focuses on the areas of logistics, data management and healthcare.

Pioneer for sovereign management of data assets

“The design of data spaces has become a key topic for the Fraunhofer-Gesellschaft across all institutes. Fraunhofer ISST is playing a pioneering role here with regard to digital collaboration and sovereign management of data assets,” explained Fraunhofer President Prof. Reimund Neugebauer. “As an important shaper of this initiative, Fraunhofer ISST generates a significant impact internally and externally for our digitization research, which is both a driver and enabler of innovative new business models.

Crucial landmarks here include the essential contributions to the International Data Spaces and the pan-European Gaia-X project.”

Interoperable data spaces as the foundation for urgently needed innovation

Mario Brandenburg, Parliamentary State Secretary at the German Federal Ministry of Education and Research (BMBF), commented: “Data from science and research is the basis of tomorrow's innovations, which we so urgently need. They are also the guarantor of technological sovereignty and therefore an integral part of the German government's data strategy. The BMBF and the Fraunhofer-Gesellschaft — in particular the Fraunhofer Institute for Software and Systems Engineering ISST — have been working together for years on the emergence and further development of interoperable data spaces and data ecosystems. In projects such as the Mobility Data Space, Catena-X or Fair Data Spaces, they experience practical implementation in very different industries. I wish the Fraunhofer ISST the innovative power and commitment for future research questions that the institute demonstrates in the International Data Spaces.”

Living and technological enablement of new work

“We are at a turning point in the digitized society,” said Prof. Dr. Boris Otto, who has been heading the Fraunhofer ISST for the past five years. “From Fraunhofer ISST's point of view, this applies in two dimensions: Technologically, we have ever new possibilities to implement data infrastructures in a controllable and sovereign way in the sense of the users. Organizationally, the last few years of the pandemic have greatly changed digital collaboration at our institute as well. We look forward to continuing to advance ‘New Work’ from the new location in the future — in the way we work as much as in the results of our work.”

In January 2023, the time had finally come and the new building on Speicherstraße could be occupied. Now, “innovations from data” are also among the goods that leave the Port of Dortmund and go out into the world.

Thomas Westphal, mayor of the city of Dortmund, was pleased about the attractive location that could be offered to the institute in Dortmund: "Fraunhofer ISST is a leading software research institute in Germany. The interaction of the strong computer science department at our TU and FH, the research institutes such as the Fraunhofer ISST and the large software companies is creating a major boost for Innovation City Dortmund with attractive training and workplaces in one place.

And our new port district has an anchor with a great reputation."

Following the move from the premises in the Technology Park, which had become far too small, to the "Lighthouse," the scientists now have access to state-of-the-art working conditions on around 3,340 square meters (35,950 square feet) distributed over six floors. The building has already become a landmark visible from afar.

35,950
square feet distributed over **6** floors

Impressions from the celebrations surrounding the 30th anniversary of the Fraunhofer ISST (September 8, 2022)



Institute Director Prof. Boris Otto during his welcoming speech at Dortmunder U
"The most important assets of an organization are its people. They constitute the Institute — the success as well as the fun."
This is how Prof. Dr. Boris Otto, Institute Director of the Fraunhofer ISST, welcomed the guests at the anniversary celebration in the brewing tower of Dortmunder U.

Ina Brandes, Minister for Culture and Science of the State of North Rhine-Westphalia, emphasized in her welcoming address: "The institute is in a brilliant position. A success story can be celebrated here. Let's celebrate, then!"





Fraunhofer Executive Board member Prof. Dr. Axel Müller-Groeling on Fraunhofer ISST: "Data spaces for Fraunhofer itself, data spaces for specific customers, data spaces for many: Fraunhofer ISST excels in all of these areas."

Our mayor of Dortmund, Thomas Westphal, also celebrated with us: "I'm glad that we were able to help a little bit in making sure that Fraunhofer ISST has found a nice new home in the port of Dortmund."



"We are heading a future in which the physical and digital world are intertwined, founded on data, connectivity and intelligence," said Henk Jan Vink, Managing Director "Information and Communication Technology" at TNO.



"We have the standards, the models, the strength": Oliver Ganser, program manager "Data Driven Value Chain" at BMW Group, head of the Catena-X consortium and chairman of the board Catena-X e.V. in his keynote about the Catena-X Automotive Network as a blueprint for the future of the automotive industry.

"It is not enough to accelerate digitization, we must also give it a direction: social and environmental sustainability," said Francesca Bria, president of the Italian National Innovation Fund and member of the board of directors of the Italian public broadcaster RAI, honorary professor at the Institute for Innovation and Public Purpose at UCL in London and member of the high-level roundtable for the New European Bauhaus set up by EU Commission President Ursula von der Leyen.



Following the presentations, the guests took an informative harbor tour to explore the new quarter surrounding the Fraunhofer ISST by ship.





“Data Spaces Support Centre” (DSSC) — Support for sovereign data spaces

The “Data Spaces Support Centre” (DSSC) provides data spaces with an interoperable environment for data exchange and enables the re-use and re-use of data within and between different industries. In doing so, European values are fully respected and thus a major contribution is made to the further digital development of the European economy and society. The project, funded by the European Commission from October 2022 to March 2026 as part of the “Digital Europe Program,” envisages the establishment and operation of a support platform to implement the objectives of the “European Strategy of Data.”

Common standards as a prerequisite for interoperable data spaces

The “Data Spaces Support Centre” explores the needs of data room initiatives across sectors and creates a blueprint for data spaces from common requirements and proven practices. This consists of common building blocks and includes business, legal, operational, technical and social aspects.

The challenge lies in developing common standards for data spaces. Therefore, it is important to work in a collaborative process with all stakeholders and data space initiatives to identify needs and develop common requirements and best practices. This involves analyzing solutions that already exist, integrating solutions that work and identifying where new solutions need to be developed.

Fraunhofer’s role in the “Data Spaces Support Centre”

As consortium leader and with responsibility for overall project management, Fraunhofer ISST has a central role in the DSSC. In addition, Fraunhofer ISST brings extensive experience in the field of data ecosystems to the project. Concrete experiences are the further development of basic components of data spaces as well as the support of the construction of so-called “Building Blocks,” which are then combined in a Data Spaces Blueprint. To integrate the Data Spaces Blueprint and the various Building Blocks, the “Data Spaces Support Centre” will provide various support activities.

Franziska von Scherenberg

“Data Spaces Support Centre” (DSSC)
project office
Phone +49 231 97677-515
franziska.von.scherenberg@isst.
fraunhofer.de



First results of the project keep expectations high

Concrete results of the “Data Spaces Support Centre” are already available:

- a starter kit that provides an overview of necessary resources for creating data spaces,
- a glossary to create a common vocabulary across sectors for the European Data Space landscape and
- a support platform in the form of a web portal that will promote the establishment of shared data spaces and enable the reuse of data across different sectors.

The “Data Spaces Support Centre” will accommodate data space initiatives of any maturity level. There will be a knowledge base and help desk on the platform. In addition, various already developed solutions for data spaces will be offered in the form of toolboxes in the future. The “Data Spaces Support Centre” will be available to assist all stakeholders and data space initiatives with various support services throughout the life of the project.

In addition to Fraunhofer ISST and Fraunhofer FIT, the consortium consists of both the Data Space Business Alliance (BDVA, FIWARE, Gaia-X, IDSA), MyData, European RTOs (Research and Technology Organizations such as VTT, TNO, KU Leuven and the Insight Center),

as well as Capgemini and the think-do-and-connect tank Sitra.

More information about the DSSC and participation opportunities is available on the “Data Spaces Support Centre” website: dssc.eu/.

The sponsoring

- Sponsor: European Union
- Grant Agreement No.: 101083412
- Duration: 10/2022–03/2026



The background features a dark blue field with a complex network of colorful, curved lines in shades of yellow, orange, red, and blue. On the right side, there is a vertical column of binary code (0s and 1s) in various colors, including blue, yellow, and red, set against a dark blue background.

Customized solutions based on industry expertise

Our business units

Fraunhofer ISST 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.



Data Business business unit

New technologies for more value creation from corporate data

Data Business business unit

Fraunhofer ISST leads companies into the market of the future

*The business unit
Data economy on the web:*

*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.

Markus Spiekermann

Head of Department
Data Economy
Phone +49 231 97677-424
markus.spiekermann@isst.
fraunhofer.de



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 central element of the collaboration: agile project development, which allows us to react flexibly to new challenges — e.g., through new requirements from Gaia-X. This ensures that the developed system always meets the latest requirements and also proves itself in practice: also as a basis for new business models.

The GEC Innovation Lab 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,” emphasizes 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.

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 get value from sharing this industry data, it can help ensure our long-term competitiveness.”



Thinking ahead for edge and cloud: Innovation Lab with German Edge Cloud (GEC)

The GEC Innovation Lab — a project of the “Data Economy” department

Infrastructure and data are recombined in increasingly distributed systems and data spaces. This poses new challenges: How do I share data with other participants securely, confidently and in compliance? How can systems be implemented in real time with a low environmental footprint? How can such distributed and heterogeneous systems be controlled and managed as autonomously as possible? These and other questions are addressed by the German Edge Cloud (GEC) and Fraunhofer ISST in their strategic cooperation.

Building on the jointly developed idea for the “GEC Innovation Lab,” teams from both partners work according to a strategic research agenda and within a governance structure. Various agile projects are specified and implemented in order to support the advancing product development of GEC. New solutions in the areas of autonomous edge cloud, data sovereignty and real-time technologies around edge and cloud computing are being developed. Together, the teams identify new trends, develop both suitable technologies and prototypes and transfer

these into practice in a short time. For example, in current initiatives such as “Catena-X” or “Manufacturing-X,” the newly developed edge- and cloud-based processes are helping to securely connect companies in emerging data spaces. GEC has already been able to gain valuable insights through this special collaboration and is looking forward to a long-term productive cooperation and direct exchange between industry and research.

There is already close collaboration between German Edge Cloud (GEC) and various Fraunhofer institutes (including IOSB, ISST, IPT, FOKUS) in the areas of cloud infrastructures, edge platforms, data sovereignty and a variety of use cases and innovations in the field of Industry 4.0. Projects of strategic cooperation are the GAIA-X and International Data Spaces initiatives on the infrastructure level, as well as the "Fraunhofer Edge Cloud" (FEC) project, which is aimed at science and industry with the establishment of a distributed, real-time capable real laboratory. The first step aims to establish a Fraunhofer Edge Cloud or ONCITE OE for around 20 Fraunhofer institutes. The GEC ONCITE solution is based on a highly available and scalable edge cloud technology in the form of a compact data center.

The German Edge Cloud is a specialist for data-sovereign edge and cloud solutions. These are used, among other things, for digitization and IIoT-based process optimization and manufacturing management of the manufacturing industry with the ONCITE Digital Production System. The company develops solutions based on the latest technologies, constantly expands the range of services for its customers and in the process enables networking with the data spaces of the future.



"As a pioneer in the field of edge and cloud technologies, we pave the way for companies into the digital future. In the GEC Innovation Lab, we can develop new ideas around autonomous processes, data sovereignty and real-time technologies and make them market-ready. Fraunhofer ISST supports us with new scientific findings. This combination of research and real-world experience creates a significant competitive advantage for our clients."

Dr. Sebastian Ritz | Managing Director Cloud & Edge |
German Edge Cloud GmbH & Co. KG

OPERATION

DATA FLOW

MRI

Hospital NY 182.23.45.88

Bpm
3

CLUSTER FRACTURE

+	+	+	+
+	+	+	+
+	+	+	+
+	+	+	+

System out F347, P340 - | - | 26



AGE 46

WHT 73 Kg

37.2

Healthcare business unit

Using secure data spaces to drive innovation in medicine

MAIN SCREEN
OXYGENATION



Healthcare business unit

Enabling innovative solutions and services in the healthcare industry with cross-sector data spaces

*The business unit
Healthcare on the internet:*

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



Sebastian Dries, MD

Head of Health Care Department
until 08/31/2023
Phone +49 231 97677-406
sebastian.dries@isst.fraunhofer.de



Anja Burman, M. Sc.

Deputy Head of Department and, from
September 1, 2023, Head of Health
Care Department
Phone +49 231 97677-435
anja.burmann@isst.fraunhofer.de



More 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.

How much time do you spend searching for appropriate care providers and necessary information, not to mention waiting rooms? A doctor's appointment is usually the first step needed for treatment. Tests have to be carried out and findings obtained, Treatments must be planned and carried out, health-related behavior should be adapted.

What if you and everyone involved in your care could share medical information more easily and quickly? in which an app could detect abnormalities even before any symptoms arise. If healthcare professionals could easily gain insight into relevant trajectories and immediately suggest appropriate courses of action? Or a personal digital twin could predict which tailored therapy promises the best success, based on current medical technology and pharmaceutical knowledge? 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? Transparent, data-sovereign, interoperable and federated 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 goal of Fraunhofer ISST is to find better and easier ways to use health data with the respective necessary consents in the health care industry across institutions and to offer data-based services. Not by copying and collecting as much data as possible, but by enabling a purposeful and sovereign exchange of data. The department's teams are exploring a variety of components and services to enable companies to. The focus is on three areas of work in particular:

- The “Personal Data Ecosystems” area deals, among other things, with the handling of personal health data up to and including the digital twin, as well as the management of personal data sovereignty, for example by agreeing to clear conditions of data use and by creating opportunities to carry out desired healthcare transactions with one's own data.
- The “Health Information Exchange” area researches how information — especially in medical documentation — can be exchanged in a standard-compliant and system-compatible manner. This is important for medical procedures to improve treatments or make better use of research data.
- In the area of “Health Applications and Analytics,” user experiences and performance processes are researched that can be further 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. Two major visions are at the forefront:

- “Closed Loop Precision Medicine” will make current knowledge in pharmaceutical drug discovery and medical device research on diagnostic and therapeutic methods available in much shorter time for medical decision support in the care of individual patients. The current process of finalizing medical knowledge about study design and conduct, publications and consensus building on guideline updates will be significantly accelerated on the one hand and optimally personalized on the other through granular consented, purpose-specific data sharing. Stratified or even individualized medicine will become widely available, taking into account many more individual factors than is possible today.
- “Data-Driven Clinical Process Optimization” will enable care providers to continuously improve their processes in an even more targeted and rapid manner. Meta-data from medical records, audit information from medical information systems and medical technology systems and derived information from patterns ranging from text-based information to vital signs are used to understand which processes can be improved and with what potential.



Crucial for innovation success: Trustworthiness and relevance to action

Quite rightly, 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 data is handled, what purposes are being pursued and what they personally gain from it, they will not give their consent. 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 also sees relevance to action as a key element for the success of data-driven health applications: “If I can accomplish something with shared uses of my personal data that benefits me or supports my goals (which may also be aimed at the common good), I embrace the new technology and use it with success and satisfaction.”

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 includes being able to control which decisions are so important that I want to make them myself and which decisions I might want to hand over to a trained system that suggests decisions in my favor," says Sebastian Dries.

An ongoing lighthouse project in this field is the "Health-X dataLOFT," led by Charité and funded by the German Federal Ministry of Economics and Climate Protection, in which Fraunhofer ISST is designing architectures and implementing components to enable citizen-centric and citizen-driven use cases from prevention, care and research in a health ecosystem networked to form a health data space.

Agile teams develop innovations ahead of the curve

The 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. Around 30 scientific employees and almost as many student employees from the fields of medical informatics and other specializations in computer science, biomedical technology, engineering, human medicine and economics and law, organized in agile project teams. 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.



HEALTH-X
dataLOFT



Citizens at the center of health data use: Value-added services from the “Health-X dataLOFT” health data space

Data sovereign, transparent, interoperable and federated applications for health data ecosystems based on Gaia-X principles — a project of the “Healthcare” department

The healthcare of the future will be based on the secure and meaningful networking and use of data. Citizens will be much better able to contribute to good treatment outcomes through informed action, as personal data from the secondary healthcare market (such as activity data collected through end-user devices) gains importance alongside data primarily collected by medical professionals. The aim of the “HEALTH-X dataLOFT” project is to place citizens at the center of the provision, use and control of their own health data within the framework of a health data space. Health data will be made usable according to Gaia-X standards.

Today, data from highly regulated primary care is securely stored in hospitals and physician offices. Due to their particular vulnerability and the low level of digitization in healthcare, they are rarely shared across facilities and sectors and integrated into overarching systems. However, with the German electronic patient record (ePA) and the Medical Informatics Initiative (MII), the Federal Ministry of Health and the Federal Ministry of Research have launched groundbreaking concepts to break the isolation of data and enable linkage.

In the second healthcare market, things are different: Personal health data, such as that collected by the many end-user devices available, is becoming increasingly important. Compared to clinical data, which can often only depict a snapshot, they provide a continuous picture of one's health, such as sleep patterns or exercise intensity. However, the current health tracking providers are often from outside Europe, which makes handling the data massively difficult or even impossible.

Securely connect primary and secondary health data

However, the combination of the more accurate clinical data and the personally generated health data collected on a regular basis holds tremendous potential for improving health care from prevention to intervention to follow-up. The Health-X dataLOFT platform aims to make health data shareable. It will provide legitimized, open and federated access to data based on citizens' decisions, technologically implemented according to Gaia-X standards. This gives citizens access to and control over their personal health data — regardless of where it was collected.

Technologies and architectures for a health data space

The research focus of the Fraunhofer Institute for Software and Systems Engineering ISST in this project is the development of technologies, processes and systems for building the data space and data-centric business solutions based on it. Fraunhofer ISST supports the development of the dataLOFT data space for the first and second healthcare market by developing and extending basic technologies as well as networking architecture layers.

Numerous partners are involved in the project, which is funded by the German Federal Ministry of Economics and Climate Protection: Charité — Universitätsmedizin Berlin (consortium lead), Bundesdruckerei GmbH, Fraunhofer Institute for Software and Systems Engineering ISST, Fraunhofer Institute for Digital Medicine MEVIS, Freie Universität Berlin, Hasso-Plattner-Institut für Digital Engineering GmbH, International Data Spaces e.V., IONOS SE, Medisana Space Technologies GmbH, OFFIS — Institut für Informatik, polypoly Enterprise GmbH, Siemens Healthcare GmbH, SVA System Vertrieb Alexander GmbH, TMF — Technologie- und Methodenplattform für die vernetzte medizinische Forschung e.V., Vilua Healthcare GmbH.

Detailed information on the project, which will run until fall 2024, is available on the website www.health-x.org.



“In HEALTH-X dataLOFT you go from being a simple recipient of services to a determining and active partner. You get sovereignty over your health data and decide what happens to your sensitive data, how it is used and who may use it. Fraunhofer ISST has an important role to play in the technical, Gaia-X-compliant implementation of this requirement in the health IT solution landscape and thus in the reality of healthcare in the future.”

Prof. Dr. Roland Eils, founding director of the “Digital Health” center at the Berlin Institute of Health at Charité University Hospital.

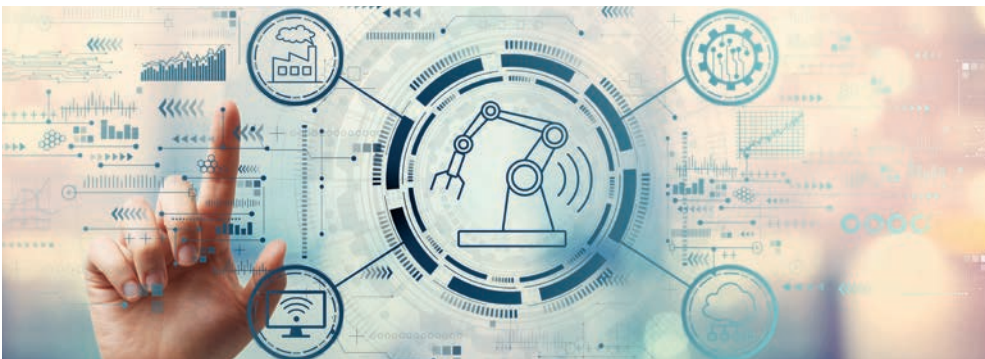


Logistics business unit

Using data as a strategic resource

Logistics business unit

Industry 4.0 ready with qualitative data and sovereign networking



The Logistics business unit on the net:

[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 leveraging it brings clear benefits: streamlined 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 successively improving their value chains and driving digitalization in manufacturing. The most important prerequisite for this: Data must be 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 therefore starts early in the data value chain and supports companies in approaching the management of data in a structured way.

Dr. Jürgen Schmelting

Head of Department
 Logistics
 Phone +49 231 97677-463
juergen.schmelting@isst.fraunhofer.de



In many cases, the potential here has not yet been tapped, so that companies have to correct data in case of acute need or spend time and effort searching for data in the inventory.

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 CO² 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. A lighthouse project in this area is the "Catena-X Automotive Network" which is facilitating the exchange of data between all players in the automotive industry. By sharing data, they can collaborate and provide valuable insights for themselves as well as the overall value creation process.

The question of trust: New technologies ensure safety

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, For optimal results with reliable legal certainty." What sounds like the distant future is already being tested in the [Legal Testbed](#) project.

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.



The conscious handling of data: Data governance as a success factor at KSB SE & Co. KGaA

Establishment of central data management — a project of the “Logistics” department

Data: Every company has it, but very few use it efficiently. But how can data quality be improved and what synergy effects result from this? In the second year of the project with KSB, these organizational questions were answered and the course was set for a formal launch of the new data governance organization.

Continuation of the successful and synergetic cooperation

With the intention of driving forward the digital transformation, a joint preliminary study was carried out by KSB and Fraunhofer ISST on the topic of (master) data management in 2021. A key finding of numerous discussions and analyses in

the company against the background of the current organizational situation at the time was that an increase in data quality can be achieved in particular through active data management.

In order to create the necessary framework conditions for this, the preliminary project concluded with the creation of a road-map in which important milestones and project phases were

defined. The implementation of this roadmap was the focus of the cooperation in 2022. By combining concrete business challenges with the methodological tools of application-oriented research, synergistic potential is leveraged from which KSB will benefit in the long term.

The transformation to a data-driven company

KSB's strategically proclaimed goal is to transform itself into a data-driven company with globally valid data management. To achieve this, the organization focuses on five core content areas:

1. Data strategy

It forms the basis for handling data. The data strategy supports the business strategy and affects all employees.

2. Guidance system

The creation of a key performance indicator system for successive monitoring of data quality and the definition of data responsibilities for the processes under consideration ensure consistent and careful data management.

3. Data governance organization

Only through a dedicated organizational unit with clarified responsibilities and contacts can the introduction of data governance be successful.

4. Data architecture

The data architecture structures the enterprise data in a suitable form and makes it transparent through uniform processes.

5. Project Management Office (PMO)

No project is successful without a committed, collaborative partnership between the employees involved. KSB and Fraunhofer ISST maintain an intensive exchange in an agile environment to ensure project success. The result is target-oriented and individual solutions for complex questions.

The cornerstone for digitization and Industry 4.0

With the introduction of a data governance organization at KSB, the transformation to a data-driven company will not be complete. However, it represents a milestone on which KSB can build follow-up activities after the project ends in December 2023, for example in transferring the guidelines to the globally distributed units of the Group. The results generated in the project are the cornerstone for using data as a strategic resource. They will contribute to the success of another major KSB project in the coming years: the introduction of SAP S/4HANA.

In the long term, the project will enable KSB to transfer the goals achieved to other domains and global corporate units. The good cooperation of the last two years also resulted in a scholarship sponsored by KSB at the Graduate School of Logistics at TU Dortmund University. Within the framework of this fellowship, Fabienne Schnieders, who previously worked on the project for Fraunhofer ISST, will pursue her doctorate on organizational data culture in an application-oriented manner. In short: The collaboration is a complete success — both for KSB, which henceforth considers data a strategic resource and manages it accordingly, and for the employees of our institute, who can transfer their knowledge of theoretical concepts to real-world applications.



“For KSB, as one of the leading manufacturers of pumps, valves and related services, high-quality data forms the basis for efficient and automated processes. Implementing data governance enables us to ensure the quality, integrity and security of our data and thus maximize the efficiency of our operational processes. This also contributes to the satisfaction of our customers. Fraunhofer ISST supports us with sound knowledge of best practices and new approaches from research to build the necessary structures.”

Dr. Stephan Bross, CTO
KSB SE & Co. KGaA



26%

8%

24%



CONNECTION
ANALYSIS
DATA
SEARCHING
VERIFICATION
CODING
SENDING

Our areas of expertise

Gaining a competitive edge through technological know-how

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.



SECTION
YSIS
CHING



Free and open-source software (FOSS)

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

Free and open-source software (FOSS) has established itself as a driver of innovation in the digital economy. FOSS has long offered more than simply a free-of-charge price point: Transparency and openness are driving proliferation, especially for use in dynamic and sovereign data spaces. Companies benefit from FOSS not only as users, but also by providing it and building communities.

Range of services

At Fraunhofer ISST, digital innovations are realized, among other things, through the development and use of FOSS. Collaborative solutions for the implementation of digital ecosystems are created in cooperation with industry and research. FOSS enables the joint development of technologies for sovereign data exchange and makes the development process and source code transparently visible. This transparency and openness combined with a FOSS license not only increases confidence in the technologies, but also enables adaptability and flexibility as needed. However, FOSS also poses significant risks and multiple challenges. An open-source position cannot be revoked and requires careful planning and concrete design along with an open source strategy. The open-source strategy guides the selection of technologies and projects, the sustainable building of open-source communities and includes a suitable open-source business model. This is accompanied by legal aspects and the technical implementation, such as the use of platforms like GitHub and suitable tools.

The range of services offered by Fraunhofer ISST includes both consulting on strategic development and support for practical implementation, as well as the expansion and maintenance of international FOSS projects in particular, with the help of innovative and established tools and methods.



Julia Pampus

Phone +49 231 97677-429
julia.pampus@isst.fraunhofer.de



Anna Maria Schleimer

Phone +49 231 97677-512
anna.schleimer@isst.fraunhofer.de

FOSS development

- Setup and maintenance of FOSS projects
- Accompaniment of the practical implementation with suitable tools and methods for collaborative software development
- Collection and preparation of best practices and tools
- Targeted building of open-source communities
- Focus on an international multi-stakeholder environment

Strategic use of FOSS

- Analysis on the strategic use of FOSS to achieve specific business objectives.
- Design and risk analysis of FOSS activities

Use of FOSS

- Work with FOSS source code
- Selection, deployment and evaluation of usage licenses

Available software/applications

- Eclipse Dataspace Components (software library for building sovereign dataspace), contains among others the Connector component and trusting technologies, as well as an implementation of the IDS¹ Dataspace protocol
- Dataspace Connector (open-source IDS Connector reference implementation)
- IDS Messaging Services (Java library for simplified development of IDS connectors)
- DIVA (Data Inventory and Valuation Approach)
- Nucleus (Java framework for modeling domain models)

Industries

Free and open-source software contributes to solving demanding challenges in various industries. Whether in the domains of mobility, logistics or in the environment of IT services and cloud technologies, FOSS projects offer new design opportunities. New and existing products benefit from the collaborative, transparent FOSS processes and reputation. This is particularly evident in the case of innovation, complex multi-stakeholder software solutions in the area of sovereign data ecosystems.

¹

IDS = International Data Spaces





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

At Fraunhofer ISST, digital innovations are realized, among other things, through the use of state-of-the-art technologies in the development of innovative and forward-looking software solutions. Software engineering is understood as a holistic process and includes requirements analysis, conception, implementation and ensuring high quality standards of software. From deployment monoliths to microservices and highly scalable cloud-native applications, we use a wide variety of architectural approaches in a targeted manner to realize our software solutions. In applied research, we also investigate the integrative solution possibilities of heterogeneous technologies for concrete use cases, for example, for the construction and integration of national infrastructures (telematics infrastructure). We also participate in the development of international infrastructures and data spaces through our participation in the International Data Spaces (IDS) and the Gaia-X initiative.

The range of services offered by Fraunhofer ISST includes technical design, the development of system components, consulting services in the software development process, for example the review of external software architectures or the conformity assessment of infrastructures in the medical field.



Brian-Frederik Jahnke

Phone +49 231 97677-469
brian-frederik.jahnke@isst.fraunhofer.de



Malte Hellmeier

Phone +49 231 97677-464
malte.hellmeier@isst.fraunhofer.de

Technical conception and architecture development

- Development of technical concepts for concrete use cases
- Platform and software architecture development / system design
- Elaboration of standards and specifications
- Training in software architecture and methodical software development

System component development

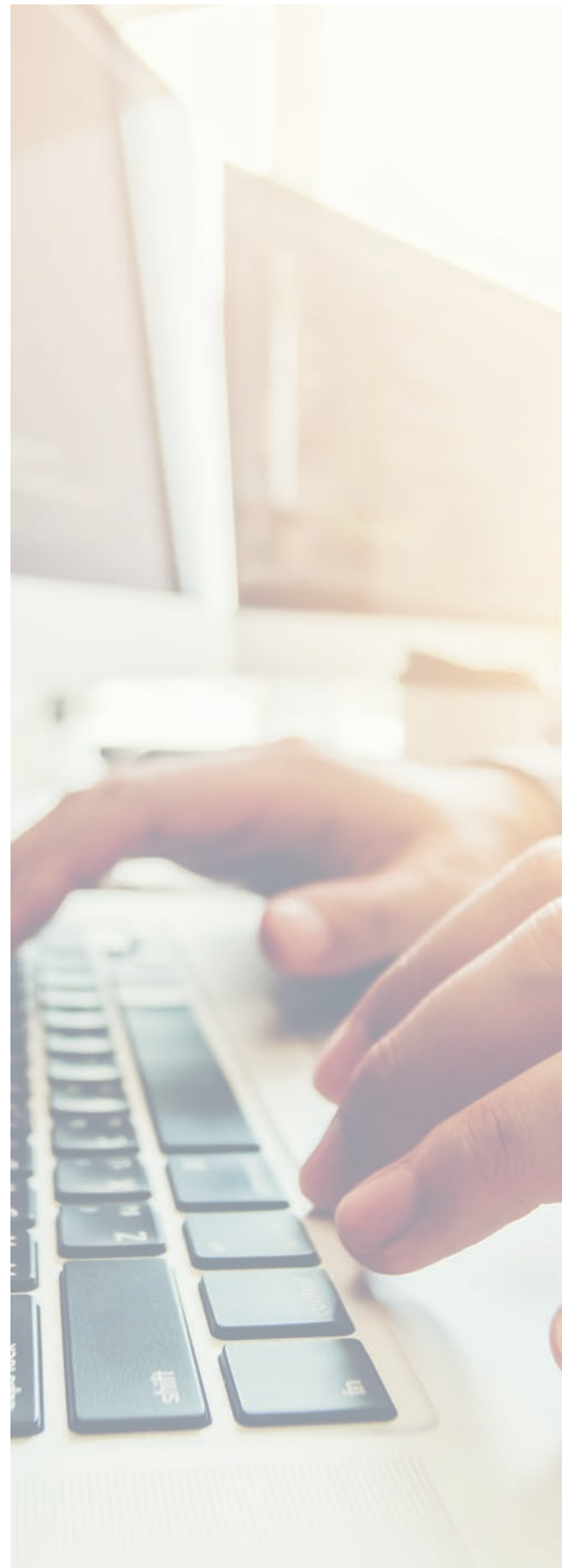
- Realization of prototypes as feasibility study (like rapid prototyping)
- Design and implementation of software infrastructures
- Research-oriented concept implementation

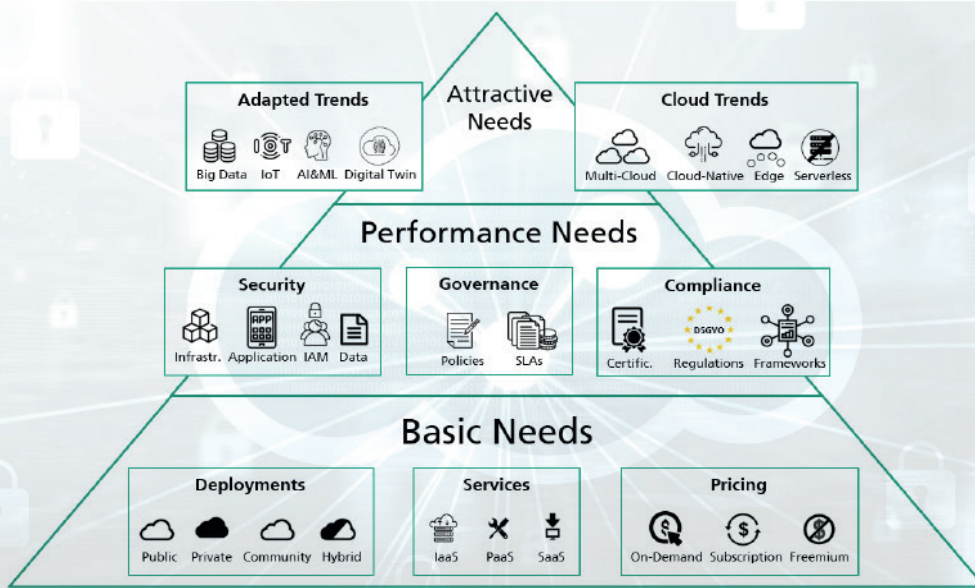
Consulting services in the software development process

- Technology Consulting
- Architecture reviews
- Conformity assessment of infrastructures in the medical field
- Modernization and migration consulting (e.g., in the direction of the cloud)
- Vulnerability and opportunity analysis

Industries

Software engineering contributes to solving demanding challenges in various industries. Whether in the context of logistics, healthcare or data management, our software solutions and consulting services accompany you in your specific use case in your respective domain.





Cloud transformation

Researching trends and developments in cloud transformation, thinking ahead and putting them into practice.

Cloud computing is now used in just about every industry and by companies of varying sizes, as cloud transformation is one of the critical factors in remaining competitive. In view of the strategic importance of cloud computing, Fraunhofer ISST is concerned with the establishment of sovereign cloud infrastructures and current technological and political developments and trends that have a significant influence on the cloud transformation of companies.

Range of services

At Fraunhofer ISST, we develop sovereign cloud infrastructures together with our partners based on standards and initiatives such as Gaia-X or the International Data Spaces Association (IDSA), with a focus on the development of open-source software components. Using microservice architectures with lightweight interfaces and using container technologies, we drive 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. We are also looking at the use of cloud computing in conjunction with other trends such as edge computing, artificial intelligence, the Internet of Things and the digital twin.

Fraunhofer ISST is the neutral, trustworthy and reliable partner for your cloud transformation. Regardless of whether you're just starting out or already in the thick of it. Based on training and feasibility studies, through the development of prototypes as part of a proof-of-concept (PoC), to the actual development of system components, we support you in your cloud transformation: from initial scoping to full implementation.

Fraunhofer ISST's range of services includes data strategy positioning, conducting data assessments, selecting suitable data governance approaches, developing role and process models and implementing data strategy concepts.



Marvin Rosian

Phone +49 231 97677-305
marvin.rosian@isst.fraunhofer.de



Philipp Hagenhoff

Phone +49 231 97677-541
philipp.hagenhoff@isst.fraunhofer.de

Consulting, enterprise labs and system component development

- Building cloud infrastructures and cloud ecosystems, taking into account topics such as
 - Data sovereignty
 - Standards and open-source
 - Compliance
- Design and development of digital platforms based on microservice architectures
- Consulting and workshops on topics such as
 - Cloud native computing
 - Multi cloud computing
 - Edge computing
 - Cloud and artificial intelligence (AI)
 - Cloud and internet of things (IoT)
 - Cloud and digital twin

Industries

The use of cloud computing is suitable for companies of all industries and sizes. Fraunhofer ISST works with SMEs as well as with various large companies on cloud-specific topics and issues. Our partners are spread across a wide range of industries, such as the automotive industry, the construction industry and the pharmaceutical industry.





Illustration: Holistic approach to establishing strategic data management with the toolbox of Fraunhofer ISST

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

At Fraunhofer ISST, the components of strategic data management that ensure success for data-driven innovations are developed. The goal of strategic data management is to introduce and optimize an internal company data organization to realize data democratization. Establishing a data organization increases data quality and usability of AI applications, reduces data search processes and improves the adoption of data applications. Within its framework, the necessary data capabilities are developed, sustainably established and continuously measurable. The basis for data organization is the establishment of a data strategy that defines long-term specifications, such as the prerequisite for participation in data ecosystems or the type of data storage. The data organization is based on these specifications and integrates them into the data governance approaches, which is ensured by means of decentralized and/or centralized corporate units and suitable data roles such as data owners and data stewards. For efficient implementation of the workflows, the concepts are realized in data catalogs and data quality software and rolled out company-wide.

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.



Dr. Hendrik Haße

Phone +49 231 97677-423
hendrik.haße@isst.fraunhofer.de



Nils Jahnke

Phone +49 231 97677-467
nils.jahnke@isst.fraunhofer.de

Data maturity measurement for strategic data management

- Holistic determination of the actual state within a company in the area of data management on the basis of six central building blocks with a total of 26 different characteristics
- Data maturity measurement with the help of expert interviews with selected stakeholders of the respective company as a possible basis for the development of a data governance organization model

Data governance

- Development and selection of a suitable data governance organization model to determine centralized and decentralized responsibilities
- Development and introduction of suitable data roles according to tasks, competencies and responsibilities (AKV principle) in the existing organization
- Process model development based on relevant data capabilities

Data strategy and data culture

- Strategic positioning of data management in the internal and external corporate environment
- Derivation of data capabilities, structured according to technology, organization and people (TOP principle)
- Dovetailing with business strategy by means of data-related target systems, development plan and key performance indicators
- Transformation to a data culture through data awareness workshops, data principles and data literacy building.

Tool landscape

- Assessment and support of the proof-of-concept for the implementation of a data catalog
- Assessment for the selection of suitable data quality software

Industries

Strategic data management contributes to solving demanding challenges in various industries. Whether as a toolbox in automotive manufacturing, as a framework in medical technology or as an organizational model in the transportation sector: Data management as a strategic cornerstone has a positive impact on the introduction of new applications.

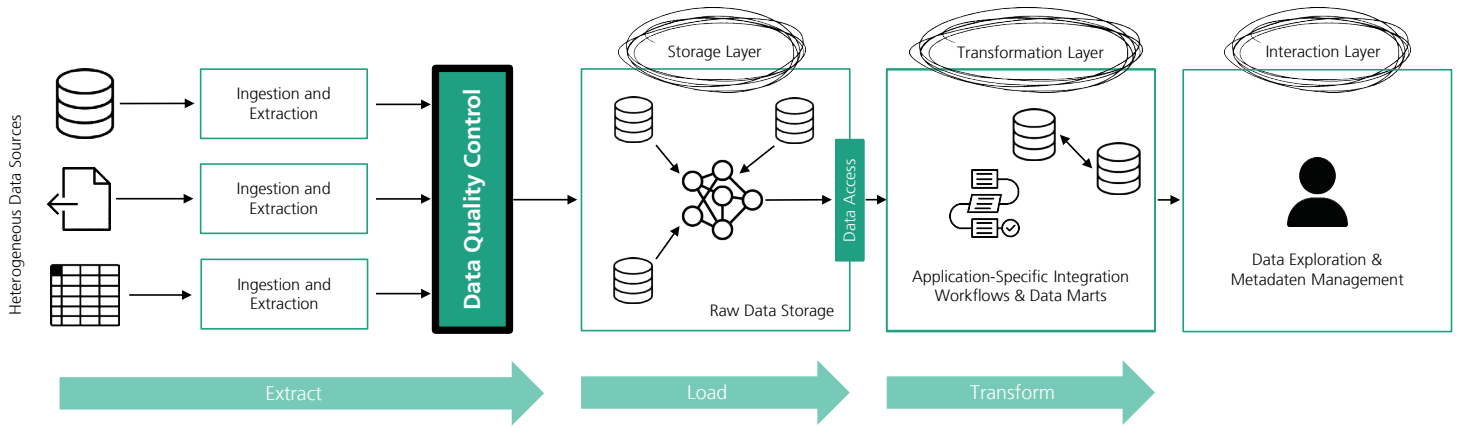


Illustration: Data quality control in data lake architectures

Data science

Harnessing the knowledge that lies within data.

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

Various data science solutions are being developed at Fraunhofer ISST. In doing so, we research and develop AI or ML pipelines (i.e., chained processing steps) for the healthcare, logistics and data science sectors. Depending on the use case, these can be based on different data sources such as biosignals (e.g., measurements using ECG or 3D accelerometers), audio, images, videos, texts or a combination of several data sources. We support our partners along the entire pipeline, from the pre-processing of (raw) data to the selection and training of suitable models as well as their evaluation based on application-specific performance criteria. A special focus is also placed on defining, measuring and improving data quality. For this purpose, we combine various technologies and algorithms from the areas of data profiling, data cleaning, data validation as well as data orchestration in order to enable a holistic view of data quality in the data lifecycle as part of "DataOps."

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.



Jasmin Henze

Phone +49 231 97677-492
jasmin.henze@isst.fraunhofer.de



Marcel Altendeitering

Phone +49 231 97677-461
marcel.altendeitering@isst.fraunhofer.de

Training and evaluation of machine learning (ML) models

- Design of ML-based applications.
- Feature computation using biosignal data (e.g., 3D acceleration, ECG, audio) from the time and frequency domains.
- Selection from different learning approaches, e.g., classical classification methods, deep learning, association analysis, clustering.
- Hyperparameter optimization, evaluation against application-specific performance metrics.

Data profiling

- Automated derivation of metadata from relational datasets using descriptive statistics, correlation analysis, functional dependencies or cluster analysis.
- Automated derivation of metadata from non-relational datasets using dynamic topic models (and related neuro-linguistic programming techniques), concept drift detection, outlier detection with Isolation Forest algorithms and artificial intelligence (AI).
- Storage and management of metadata in a centralized, microservice-oriented data catalog.
- Describe, manage and orchestrate data engineering processes.

Data cleaning and validation

- Assist in the detection of data errors by identifying duplicates, outliers, format violations or rule violations.
- Enable automatic data validation through data quality rules based on association analysis.
- Management of identified errors in a corresponding tool and integration through open interfaces (APIs).

Data quality management

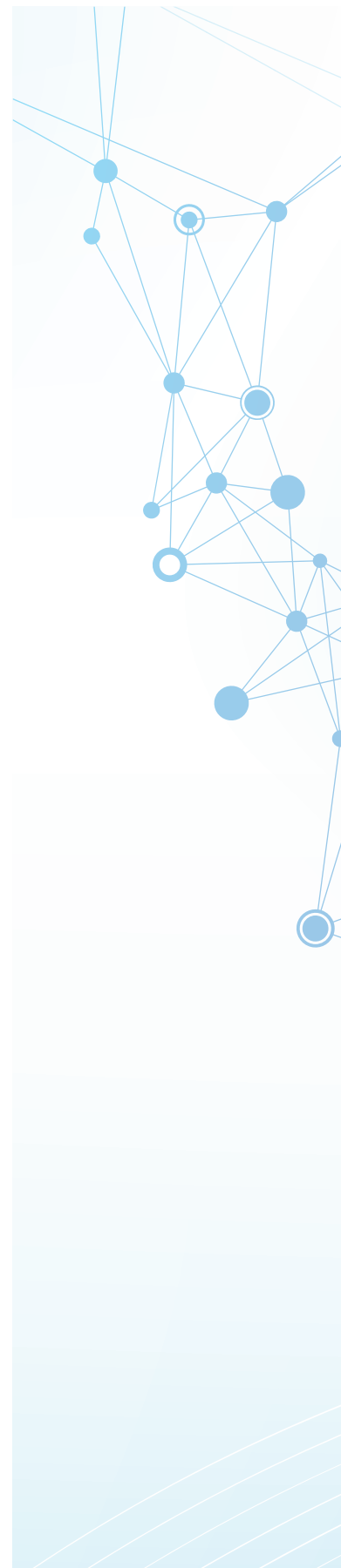
- Further development of existing data engineering processes through the integrative consideration of data quality.
- Integration of data quality as a component in modern system architectures (such as data lakes).
- Develop quality metrics for various data sets and application areas.

Available software/applications

- [DIVA — data catalog](#)

Industries

Data Science contributes to solving demanding challenges in various industries. Whether for urban data management, automated quality control in logistics, disease diagnosis, clinical trial testing in pharmaceuticals or extracting information from documents, the possibilities are limited only by the availability of data.





Data spaces and data ecosystems

Innovative technologies for participation in data ecosystems and for the development of digital products and services.

When it comes to data provisioning, both data producers and data owners often face the risk of losing control and thus the strategic value of their data resources. International Data Spaces address this cross-industry trade-off by enabling data providers to share data while maintaining data sovereignty, always looking at the holistic business model.

Range of services

At Fraunhofer ISST, technologies are being developed on the one hand to ensure data sovereignty and on the other hand technologies to enable standardized data exchange using the Eclipse Dataspace Components (EDC). The EDCs provide the necessary software components to the International Data Spaces and thus allow participation in the corresponding data ecosystems. The technologies developed by Fraunhofer ISST are based on the "Reference Architecture Model" and the certification criteria of the International Data Spaces Association and have been reviewed accordingly. In addition, EDCs also enable participation in the Gaia-X ecosystem by supporting the Gaia-X Trust Framework.

These and many other technologies are the basis for new digital products and services that promise competitive advantages, revenue increases and higher customer loyalty. However, many organizations face significant challenges in successfully developing digital business models. Therefore, in addition to the technological components, the value creation structures of service offerings are being specifically investigated in order to work out clear value propositions for the users of data ecosystems — including suitable revenue models.



Heinrich Pettenpohl

Phone +49 231 97677-321
heinrich.pettenpohl@isst.fraunhofer.de



Dr.-Ing. Can Azkan

Phone +49 231 97677-425
can.azkan@isst.fraunhofer.de

Eclipse dataspace components

- Application and concept development for the use of International Data Spaces
- technical proof of concepts
- Support during implementation in productive use
- joint open-source development of extensions to the EDC
- Development of associated business models
- Support for data sovereignty with the EDC

[See the Eclipse Dataspace Components](#)

[To the Eclipse Dataspace Connector on GitHub](#)

Business models for ecosystems

- Workshops for business model development
- Canvas toolbox for systematic business model development
- Analysis of customer challenges and development of possible solutions
- Observation and analysis of value generation based on the data value chain
- Determine necessary requirements for value delivery
- Analysis of the cost structure and development of suitable value capture models

Industries

Data Spaces technologies are helping to solve demanding challenges in a variety of industries. Whether in the automotive industry with regard to predictive maintenance or supply chains (Catena-X Automotive Network), the mobility of citizens in general (Mobility Data Space), smart cities in particular or data exchange in healthcare or the general integration of citizens in data ecosystems: Fraunhofer ISST is active in all of these industries with the technologies mentioned here.





The Fraunhofer ISST

Sovereign data use in data spaces

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. Researchers explore the **value of and confident use of data** in data spaces for logistics, healthcare and the data economy. They develop solutions for managing data and constructing data architectures.

Fraunhofer ISST plays a **leading role in strategic digital initiatives** in Germany and Europe. Examples are the International Data Spaces Association (IDSA) and Gaia-X, European Association for Data and Cloud AISBL, which aim at cloud and data sovereignty and thus create the basis for a fair data economy in Germany and Europe. Fraunhofer ISST is also a central research partner in the Catena-X Automotive Network, a research project funded by the German Federal Ministry of Economics and Climate Protection with approximately 100 million euros as part of the economic stimulus package.

In this way, the institute creates data spaces for secure and controllable **data use across corporate boundaries** — for Germany, Europe and worldwide — together with its customers and partners from the business community and as an advisor to policymakers.

#InnovationsFromData

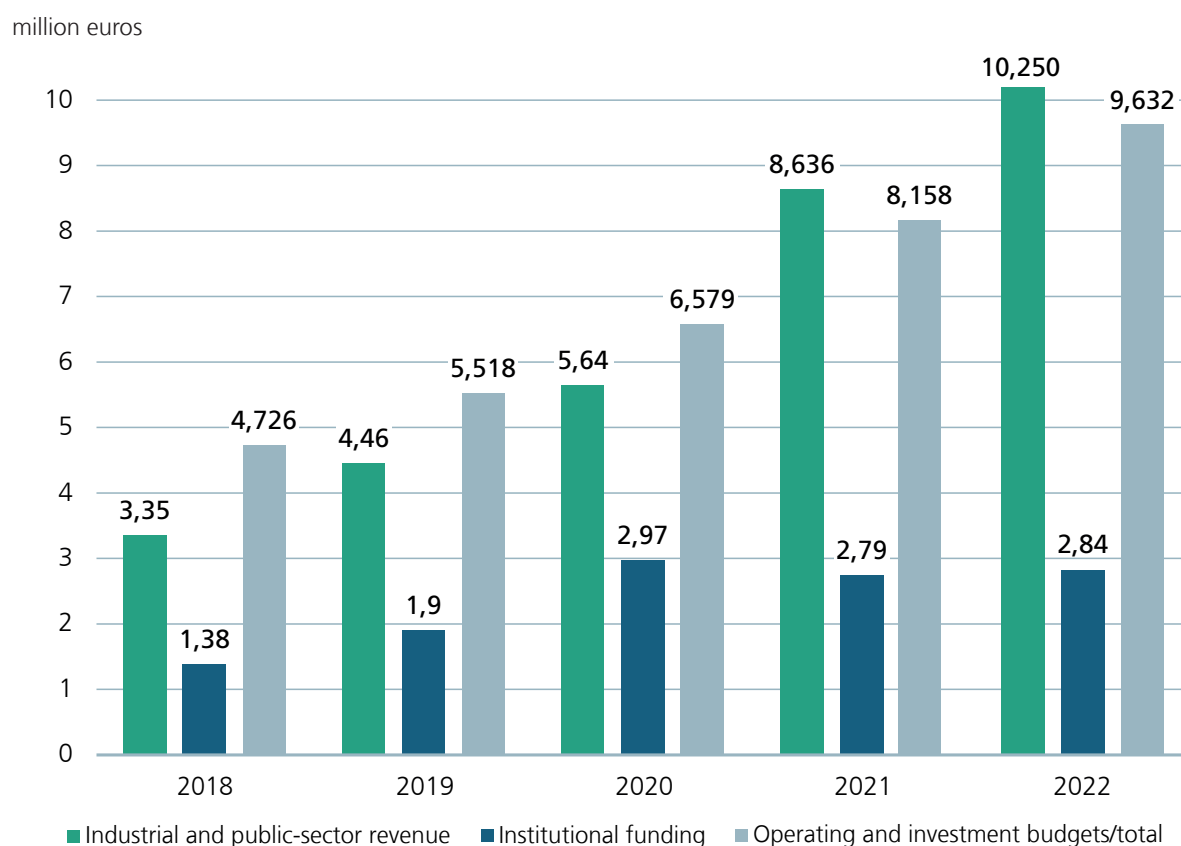
The institute in numbers

On track for growth in headcount and budget

At the end of 2022, there were 140 employees at Fraunhofer ISST (150 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 2022 was approximately 9.632 million euros. Personnel costs accounted for 72 percent of this figure.

In the 2022 financial year, Fraunhofer ISST generated revenue of 10.250 million euros from research and industry. In addition, it received institutional funding from the Fraunhofer-Gesellschaft amounting to 2.84 million euros.





Our culture — #thisISSTunning

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. 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



The institute management

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.

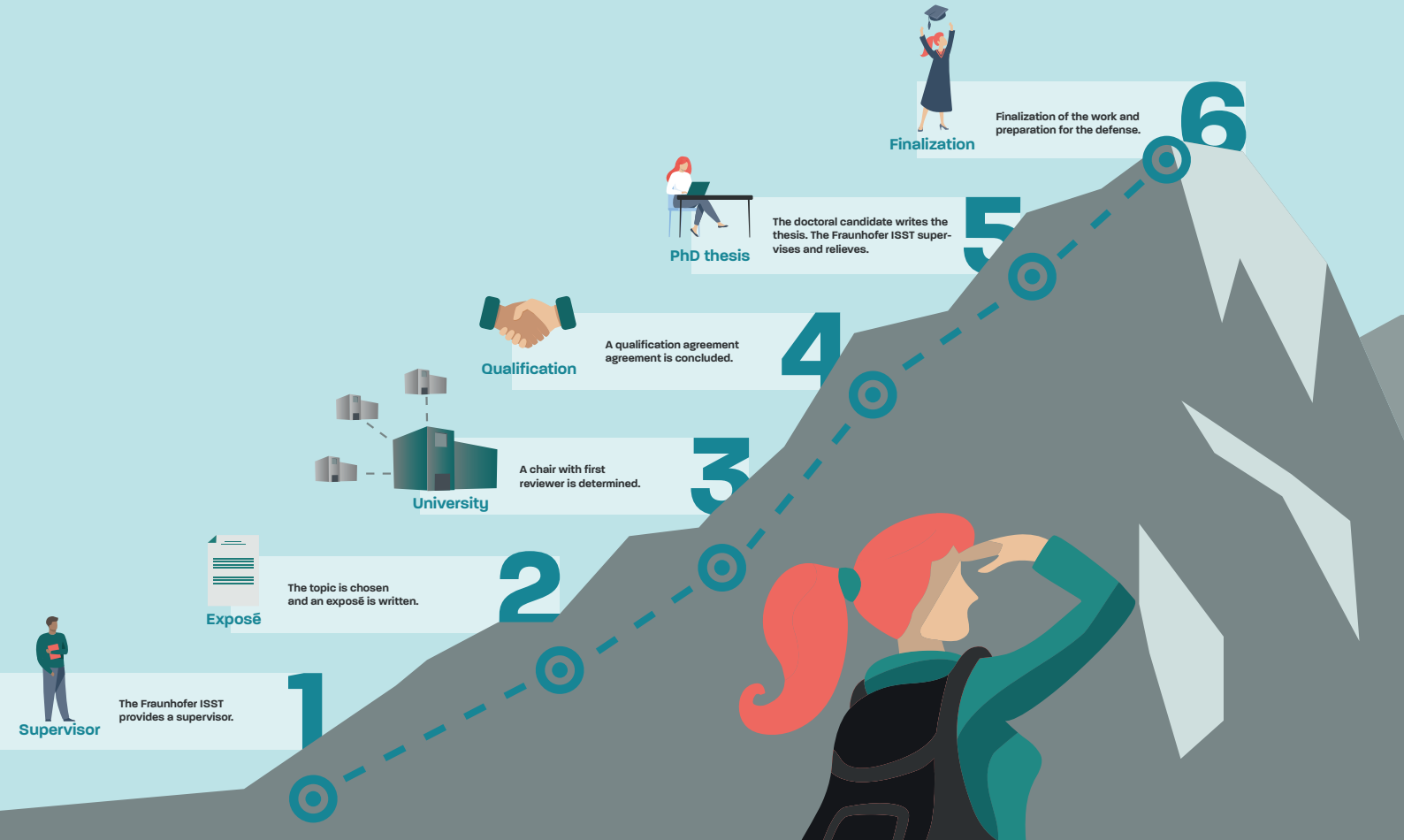
Otto's research focuses on the fields of industrial information management, business and logistics networks and methods for designing digital business solutions.



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

Selected other functions:

- Dortmund University of Technology (Chair of Industrial Information Management)
- International Data Spaces Association (Deputy Chairman of the Board)
- Gaia-X AISBL, European Association for Data and Cloud (Member of the Board of Directors)
- Catena-X Automotive Network e.V. (Deputy Chairman of the Board)
- Fraunhofer ICT Group (Chairman of the Board of Directors)
- Advisory Council for Mobility Data of the Ministry of Transport of the state of Baden-Wuerttemberg (Member)
- Bosch Data Strategy Advisory Board (Member)



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 2022

Dr.-Ing. Hendrik Haße **Design of distributed digital twins**

The goal of Hendrik Haße's dissertation was to develop design principles that support the implementation of distributed digital twins. Distributed digital twins is a concept that allows the sharing of a digital twin in a distributed system. This takes into account the dependence on different levels of cooperation between the actors involved.

The potential applications of distributed digital twins are very diverse and range from the collaborative use of machine data in the context of predictive maintenance to the sovereign use of sensitive patient data.

Supervisor: Prof. Dr. Boris Otto (Dortmund University of Technology + Fraunhofer ISST)



Dr.-Ing. Hendrik Haße

Dr.-Ing. Fabian Bruckner **Programming concepts for the implementation of usage guidelines in industrial data spaces**

In his work, Fabian Bruckner integrates usage control mechanisms directly into a newly developed programming language, thus making a technical contribution to the attainment and preservation of digital sovereignty. Usage control is used here as a central and inseparable part of applications.

The programming language called D° is aimed at the development of data processing applications. Through the use of a so-called host language and various extension options, the programming language can be used in a variety of environments and use cases.

Supervisor: Prof. Dr. Falk Howar (Dortmund University of Technology)



Dr.-Ing. Fabian Bruckner



Ana Garcia Robles
7 Monate

This is a memorable picture and historical moment for #data and #dataspaces in Europe. It talks by itself.. the picture was taken at the #DSSC #DataSpacesSupportCentre kick-off in Brussels (Oct 13). #women #makingthingshappen And this is just a sample...

Clara Pezuela Andreja Lampe Sylvia Ilieva Silvia Castellvi Franziska von Scherenberg Sille Sepp Cristina Brandtstetter Vassilia O. Cristina Sandoval Alonso Marja Pirttivaara Alessandra Perna Heidi Korhonen Natalie Bertels Elora Fernandes Esther Bodil Huyer Martina Barbero Maaria Nuutinen Mirjam Huis in 't Veld Pauline Pirotte Dolores Ordoñez Lucie Kirstein Nuria De Lama Sinna Rissanen Laure Le Bars

Francesco Bonfiglio Lars Nagel Ulrich Ahle Boris Otto Teemu Ropponen Antti 'Jogi' Poikola Hahn Thomas Edward Curry Tuomo Tuikka Henk-Jan Vink Gianfranco Cecconi

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 increased¹. 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. Around Girls Day 2022, our female scientists and students again provided insights into their work to inspire female students to enter applied science.

Not only that, but we have also implemented a range of internal measures: women empowerment workshops, talent development for female employees through Fraunhofer funding programs and a newsletter on equal opportunity issues. The institute-specific target figures for the recruiting rate of women in science introduced in 2021 were followed up in 2022: they are now based on the proportion of women in the degree programs from which we have recruited significant numbers of graduates in the past. In order not to rest on our laurels, these target figures increase from year to year. In order to fill the “leaky pipeline”² at the same time, we at Fraunhofer ISST are not only committed to getting women excited about digitization research, but also to maintaining this enthusiasm.

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.

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

² <https://www.uni-paderborn.de/universitaet/genderportal/gender-glossar/leaky-pipeline>

Anja Burmann

Equal opportunities officer
Phone +49 231 97677-435
anja.burmann@isst.fraunhofer.de



The advisory board

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, entrepre-
 neurship and sustainability

Guido Baranowski
 Founding CEO of TechnologieZentrum Dort-
 mund, Dortmund

Prof. Dr. Svenja Falk
 Managing Director, Accenture Research, Berlin

Dr. Christiane Fricke
 Head of the Non-University Research Organi-
 zations, EU International Affairs Group of the
 Ministry of Culture and Science of the State of
 North Rhine-Westphalia, Düsseldorf

Prof. Dr. Volker Gruhn
 Chair of Software Engineering at the Universi-
 ty of Duisburg-Essen and Chair of the Supervi-
 sory 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, Berlin

Fabian von Kuenheim
 Kuenheim Familiaris GmbH, Stuttgart

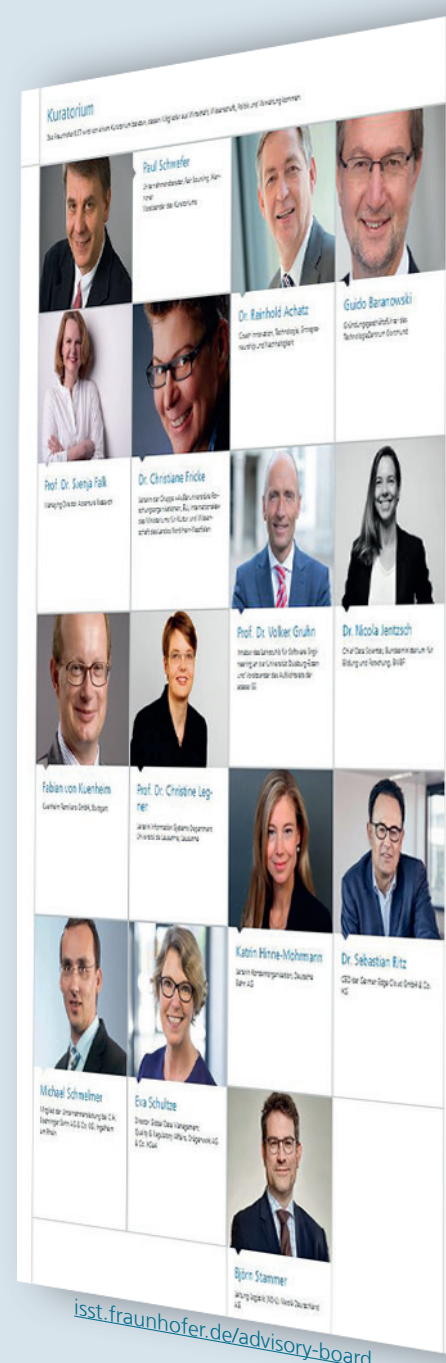
Prof. Dr. Christine Legner
 Head of Information Systems Department
 Université de Lausanne, Lausanne

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, Ingel-
 heim 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



isst.fraunhofer.de/advisory-board



Our networks

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.

Memberships*

- 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)
- Eclipse Foundation
- European Alliance for Industrial Data, Edge and Cloud
- Gaia-X, European Association for Data and Cloud
- HL7 Benutzergruppe in Deutschland e.V. (German HL7 User Group)
- International Data Spaces Association
- MedEcon Ruhr e.V. (Network of the Healthcare Sector in the Ruhr)
- Windo e.V. (Association of Scientific Institutions in Dortmund)

Fraunhofer-Gesellschaft

- Fraunhofer Information and Communication Technology Group (iuk.fraunhofer.de/en.html)
- Working Group Digital Health in the Lead Market Health ([Fraunhofer Group for Health](#))
- Fraunhofer Big Data and Artificial Intelligence Alliance (big-data-ai.fraunhofer.de/en.html)
- Fraunhofer Cluster of Excellence Cognitive Internet Technologies CCIT (cit.fraunhofer.de/en.html)
- Fraunhofer Academy (academy.fraunhofer.de/en.html)

*partly as coordinating institute for the Fraunhofer-Gesellschaft



University Collaborations

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 institute's staff, we invite you to discover what #InnovationsFromData means to us on our website.

Here you will find all information from the presentation of our current research projects and our fields of competence to our publications and press releases — of course always provided with a contact person, so that you can quickly and easily find the right contact to the institute for your request.

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.

Britta Klocke

Deputy Manager
Corporate Communications

Phone +49 231 97677-162
presse@isst.fraunhofer.de

#InnovationsFromData

Follow us on social media Browse on www.isst.fraunhofer.de



Event

“Model of a Fair Data Economy in Germany and Europe — Innovation-oriented Contribution on the Way to Fair Data Economics” Fraunhofer Forum Berlin, March 15, 2022

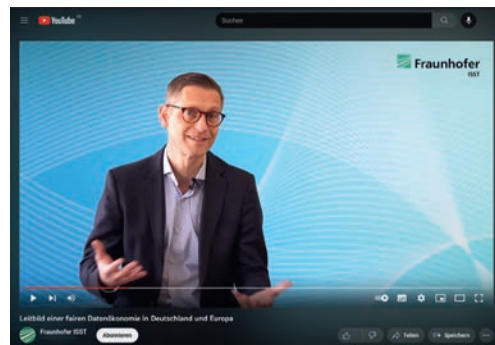
In addition to the celebratory event for the 30th anniversary of the Fraunhofer ISST in September 2022 (see [page 5](#) in this annual report), the innovation-oriented Dialogue on Fair Data Economics of the Fraunhofer ICT Group under the patronage of Federal Research Minister Bettina Stark-Watzinger on March 15, 2022 was another highlight in the Fraunhofer ISST's calendar of events.

Data is the key resource of digital transformation. Various data-economy models are currently emerging around the world, with Germany and Europe focusing their approaches on balancing individual self-determination with society's interest in the use of data. What this means for shaping a data economy according to fair principles was presented and discussed at the event.

In addition to keynotes by Bettina Stark-Watzinger (Federal Minister of Education and Research), Prof. Reimund Neugebauer (President of the Fraunhofer-Gesellschaft), Prof. York

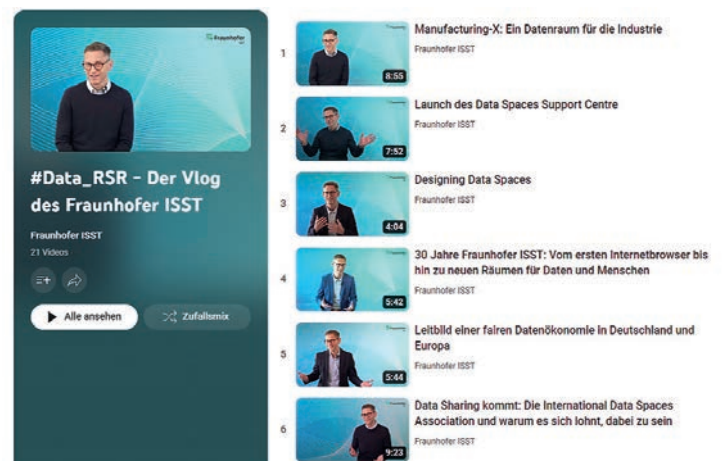
Sure-Vetter (Director of the National Research Data Infrastructure) and Iris Plöger (Member of the BDI Executive Board), Prof. Irene Bertschek (ZEW) and keynote speeches by Prof. Dr.-Ing. Boris Otto, among others, the focus was on a lively exchange with all participants in deep-dive sessions.

Boris Otto also outlines the vision of a fair data economy for Germany and Europe in an edition of his vlog: <https://www.youtube.com/watch?v=GoFRIAVNiPY>



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/news/video/Vlog.html or on our [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.



Social media

Congratulatory campaign #30years30wishes

Under the hashtag #30years30wishes, Fraunhofer ISST asked companions of the institute to send the institute a social media congratulations. These congratulatory remarks were posted throughout 2022 via the institute's Twitter and LinkedIn accounts. Here we show an excerpt from the campaign. We thank all participants for their congratulations.

Fraunhofer ISST @FraunhoferISST · 17. Okt. 2022
»Data Framework« ist ein wichtiger Bestandteil einer innovativen Datenökonomie und -management, um einen souveränen Datenaustausch zu ermöglichen.
Wir bedanken uns bei Eva Schultze von @DraegerNews und freuen uns auf weitere Projekte 🎉
#30years30wishes #30ISSTuning

Fraunhofer ISST @FraunhoferISST · 21. Nov. 2022
Europe's Digital Revolution is majorly impacted by scientists found here at the @FraunhoferISST. We are proud to contribute by creating a #DataEcosystem built for the people of #Europe. Thank you for the lovely wishes, @EdwardACurry 🎉
#30ISSTuning #30years30wishes

Fraunhofer ISST @FraunhoferISST · 18. Aug. 2022
Innovationen für die #Datenwirtschaft, die #Logistik und das Gesundheitswesen nehmen wir auch in Zukunft gerne als Herausforderung an 🙌. Danke an unseren Kurator Prof. Dr. Volker Gruhn VOGRU für die Glückwünsche! @adesso_SE
InnovationsFromData #30ISSTuning #30years30wishes

Fraunhofer ISST @FraunhoferISST · 2. Sep. 2022
We have been working on data driven ecosystems and #InnovationsFromData for 30 years now and @GoogleDE is an essential partner in creating the data infrastructure of the #future! 🙌 Thank you, Dr. Wieland @hoffelder, for the congratulations!
#30years30wishes #30ISSTuning

Fraunhofer ISST @FraunhoferISST · 4. Aug. 2022
Die Zusammenarbeit mit der @TU_Dortmund ist für uns von großer Bedeutung! Gemeinsame Projekte und der Austausch mit Studierenden und Forschenden sind eine Bereicherung für unser Institut. Herzlichen Dank für die Glückwünsche! 🙌
#30years30wishes #30ISSTuning #InnovationsFromData

Fraunhofer ISST @FraunhoferISST · 13. Juli 2022
#Daten sind uns werden immer mehr zum zentralen Erfolgsfaktor für Innovationen. Wir freuen uns auf viele weitere Projekte mit und für die Industrie in #Deutschland und #Europa. Danke, Iris #Ploger, @DerBDI 🎉
#ForwardtotheNew #InnovationsFromData #30years30wishes

Fraunhofer ISST @FraunhoferISST · 6. Juli 2022
Securing the #wellbeing of european citizens through software and system #research is what inspires us here at @FraunhoferISST! We are looking forward to future cooperations with @VTTFinland. Thank you for your kind words, @TuomoTuikka 🎉
#VTTBeyondTheObvious #30years30wishes

Fraunhofer ISST @FraunhoferISST · 22. Juli 2022
A key feature of our applied #Research involves working with companies to improve strategies for #digital services.
We are looking forward to more projects with @iw_koeln and thank you for the good wishes! 🙌
#30years30wishes #InnovationsFromData #30ISSTuning

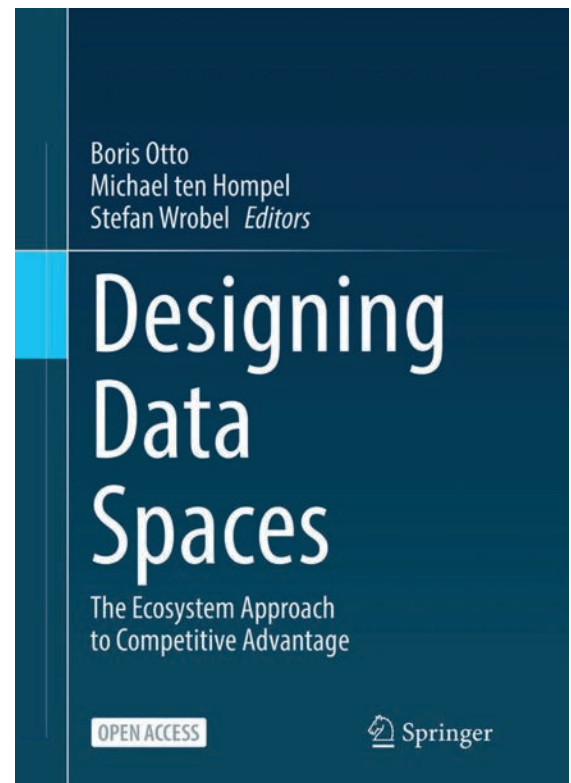
Publication

“Designing Data Spaces — The Ecosystem Approach to Competitive Advantage.”

Published in 2022, this open-access book provides a comprehensive overview of data ecosystems and platform economics, from methodological and technological foundations to reports on practical implementations and applications in various industries.

To this end, the book is divided into four parts: Part I “Foundations and Contexts” provides a general overview of the design, operation and governance of data spaces as well as an introduction to the IDS (International Data Spaces) and GAIA-X projects. Part II “Data Space Technologies” then describes various implementation aspects of IDS and GAIA-X, such as data usage control, the use of blockchain technologies or semantic data integration and interoperability. Part III then describes various “Use Cases and Data Ecosystems” from different application areas such as agriculture, healthcare, industry, energy and mobility. Finally, part IV provides an overview of various “Solutions and Applications,” e.g., with products and experiences from companies such as Google, SAP, Huawei, T-Systems, Innopay and many others.

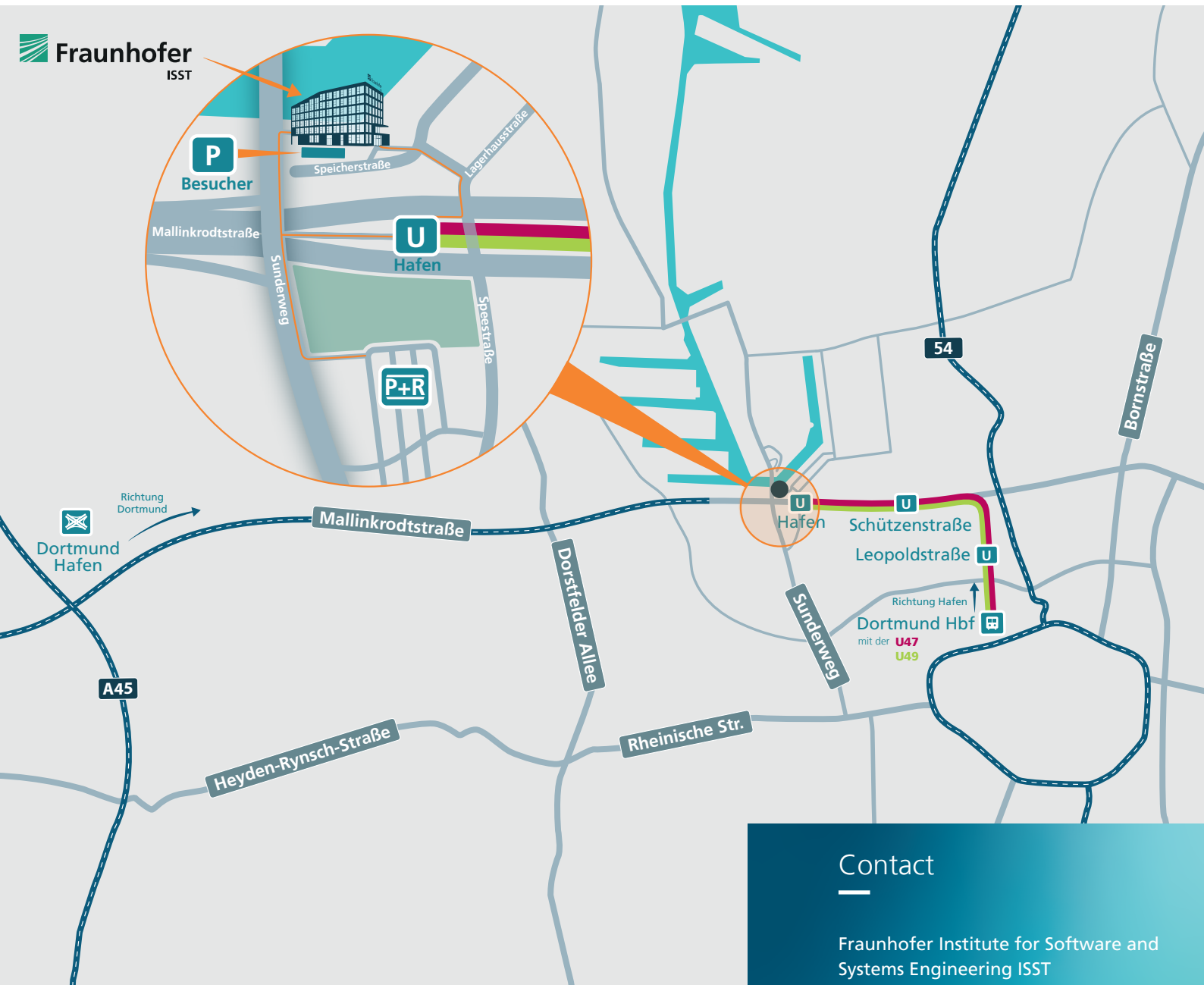
Overall, the book provides industry professionals with a comprehensive overview of the technological and economic aspects of data spaces, based on the International Data Spaces and Gaia-X initiatives. It presents implementations and business cases and gives an outlook on future developments. In doing so, it aims to spread the vision of a social data market economy based on data spaces that embrace trust and data sovereignty.



<https://link.springer.com/book/10.1007/978-3-030-93975-5#toc>

All further information on our publications and the search options in the Fraunhofer database “Publica” can be found at www.isst.fraunhofer.de/publications

Directions and Contact



Contact

Fraunhofer Institute for Software and Systems Engineering ISST

Speicherstraße 6
44147 Dortmund, Germany

Phone +49 231 9 76 77-0
presse@isst.fraunhofer.de
www.isst.fraunhofer.de/en.html

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Institute Director Prof. Dr.-Ing. Boris Otto
Speicherstraße 6
44147 Dortmund, Germany
Phone: +49 2 31 9 76 77 - 0
presse@isst.fraunhofer.de

Editorial team Britta Klocke, Fraunhofer ISST

Photo

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