FIZ Karlsruhe
Leibniz Institute for Information Infrastructure

ADVANCING SCIENCE

ANNUAL REPORT

20
24

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ANNUAL REPORT

2024

CONTENT

Prof. Dr. Wolfram Horstmann,
President & CEO, FIZ Karlsruhe

Dear readers

The year 2024 was marked by the evaluation that Leibniz institutions must undergo at least every seven years. As a result of close cooperation throughout the institute, we were able to successfully complete all evaluation steps in 2024. I would like to take this opportunity to express my sincere thanks to all employees for their effective commitment. The analyses of the evaluation process have shown us that we can look back on an excellent development and have enormous potential to further expand our roles in information infrastructures. The formal conclusion of this evaluation is expected in summer 2025.

The topic of artificial intelligence (AI) continues to dominate the world of science and information. Thanks to our established IT research in the field of information service engineering, we are ideally equipped to respond to the growing interest in this area. AI is also becoming a hot topic in the field of legal research on intangible property rights, and with the first legal commentary on Creative Commons, we have helped set a milestone for the ever-growing demand for open access to scientific information.

Service development for the »Rechte Gewalt« (»right-wing violence«) topic portal was launched in collaboration with the State Archives of Baden-Württemberg and the Federal Archives. And there are many new developments in patent information for business and science in our partnership with CAS and in our projects. We are also very proud of an international recognition: The French Mathematical Society has awarded zbMATH Open the first »Jean-Pierre Demailly Prize for Open Science in Mathematics«.

We have had an eventful year. I cordially invite you to explore our progress and plans on the following pages. Enjoy reading!

Yours

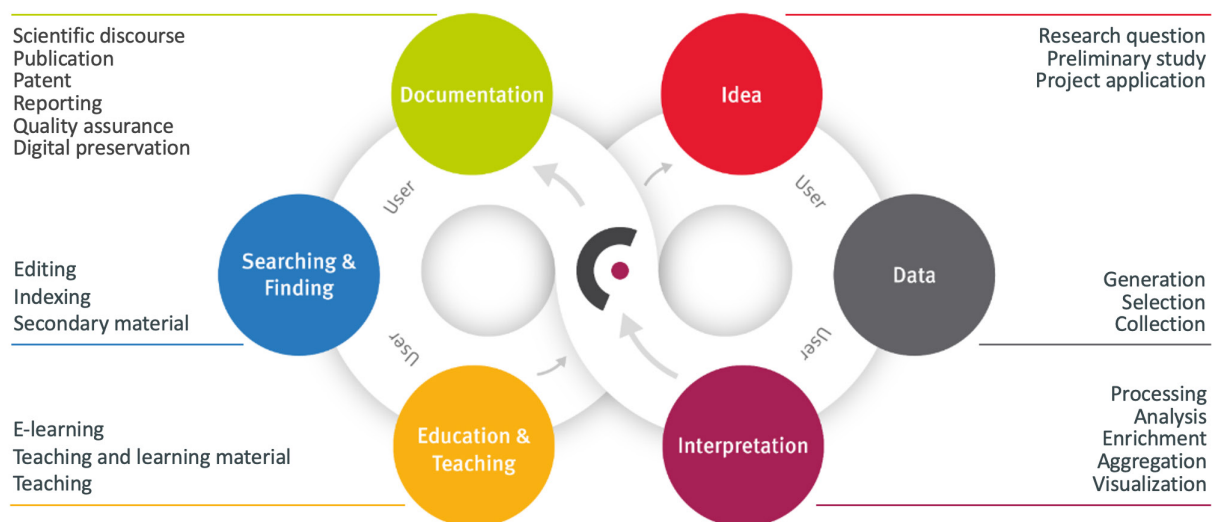President & CEO FIZ Karlsruhe

1

AT A
GLANCE

1.1
MISSION AND
OVERALL CONCEPT

FIZ Karlsruhe – Leibniz Institute for Information Infrastructure GmbH is one of the largest non-university infrastructure facilities for scientific information in Germany. Our statutory mission is:

» ... "to provide science and research with scientific information, to develop corresponding products and services [...] and to make them publicly available.To this end, it [the company] also carries out its own research and development projects. The aim is tostrengthen national and international knowledge transfer and to support innovation and cooperat*ion in science and research*«[*]

We understand »information infrastructure« as the totality of people, processes, and technologies that enable knowledge to be generated, disseminated, and preserved. Therefore, our overall strategy is to support the scientific value creation cycle – from the idea to data and evaluations to the dissemination and enrichment of scientific information (see Fig. 1).

Scientific discourse
Publication
Patent
Reporting
Quality assurance
Digital preservation

Editing
Indexing
Secondary material

E-learning
Teaching and learning material
Teaching

Documentation

Searching & Finding

Education & Teaching

Idea

Data

Interpretation

Research question
Preliminary study
Project application

Generation
Selection
Collection

Processing
Analysis
Enrichment
Aggregation
Visualization

Supporting the entire scientific value creation cycle

[*] Articles of Association of FIZ Karlsruhe, version dated July 28, 2017, Section 2, Paragraph 1.

OUR MISSION STATEMENT

In the course of implementing the
recommendations from the last evaluation,
we developed our mission statement,
consisting of our vision, mission, and values,
in close consultation with our committees.

OUR VISION

»Actors in the science and innovation system have reliable access to all digital information and tools relevant to them at any time and anywhere.«

OUR MISSION
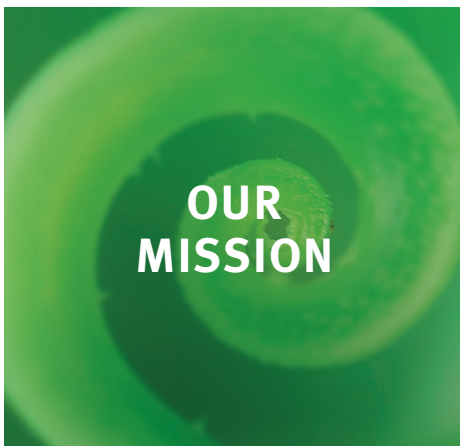
We research, develop, and operate methods, processes, and services for a sustainable information infrastructure.

We offer data, information, knowledge, software, and services via open and legally compliant platforms.

We make them discoverable, accessible, interoperable, and reusable.

We support the value creation process in science and innovation at all levels.

We enable research questions to be answered and new ones to be asked. In doing so, we follow our »Advancing Science« motto.

OUR VALUES
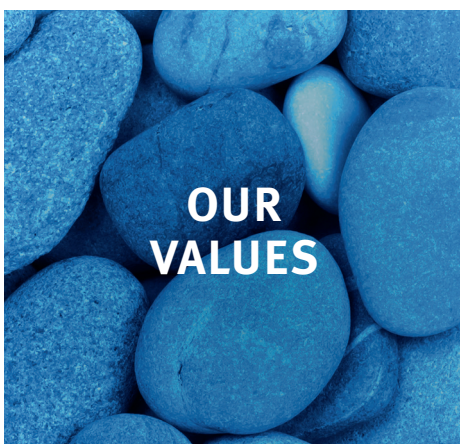
Responsibility
determines our actions both internally and externally.

Respect
means mutual respect and trust, fairness, and recognition.

Integrity
ensures our credibility both within and outside the company.

Quality
is a central aspect of our work.

Openness
characterizes our attitude towards new ideas and those who bring them forward.

OUR STRATEGY

Our overall strategy consists of
six sub-strategies.

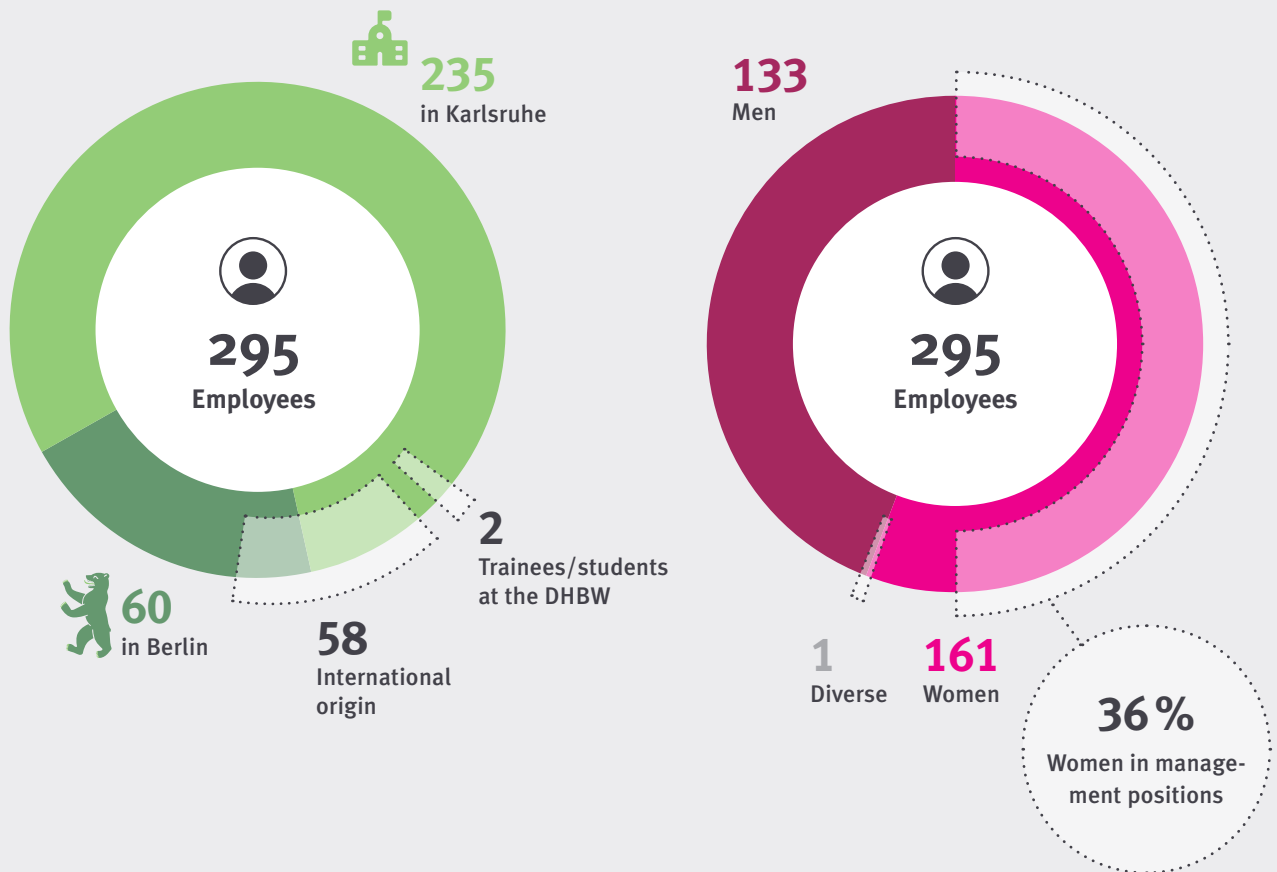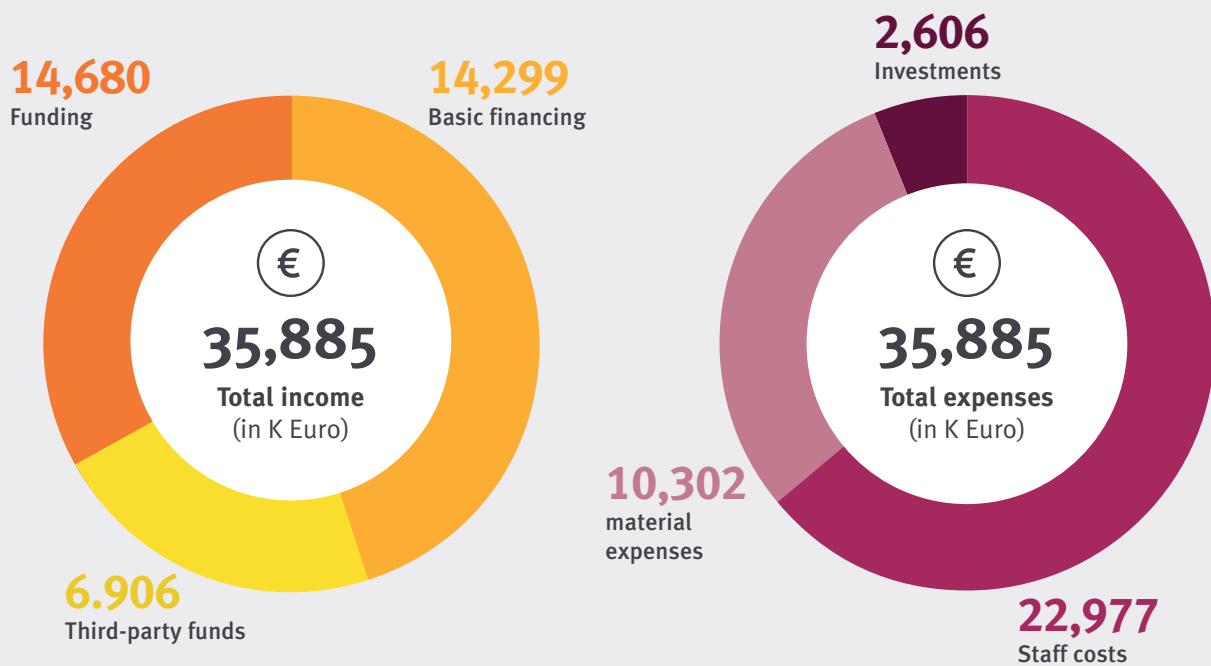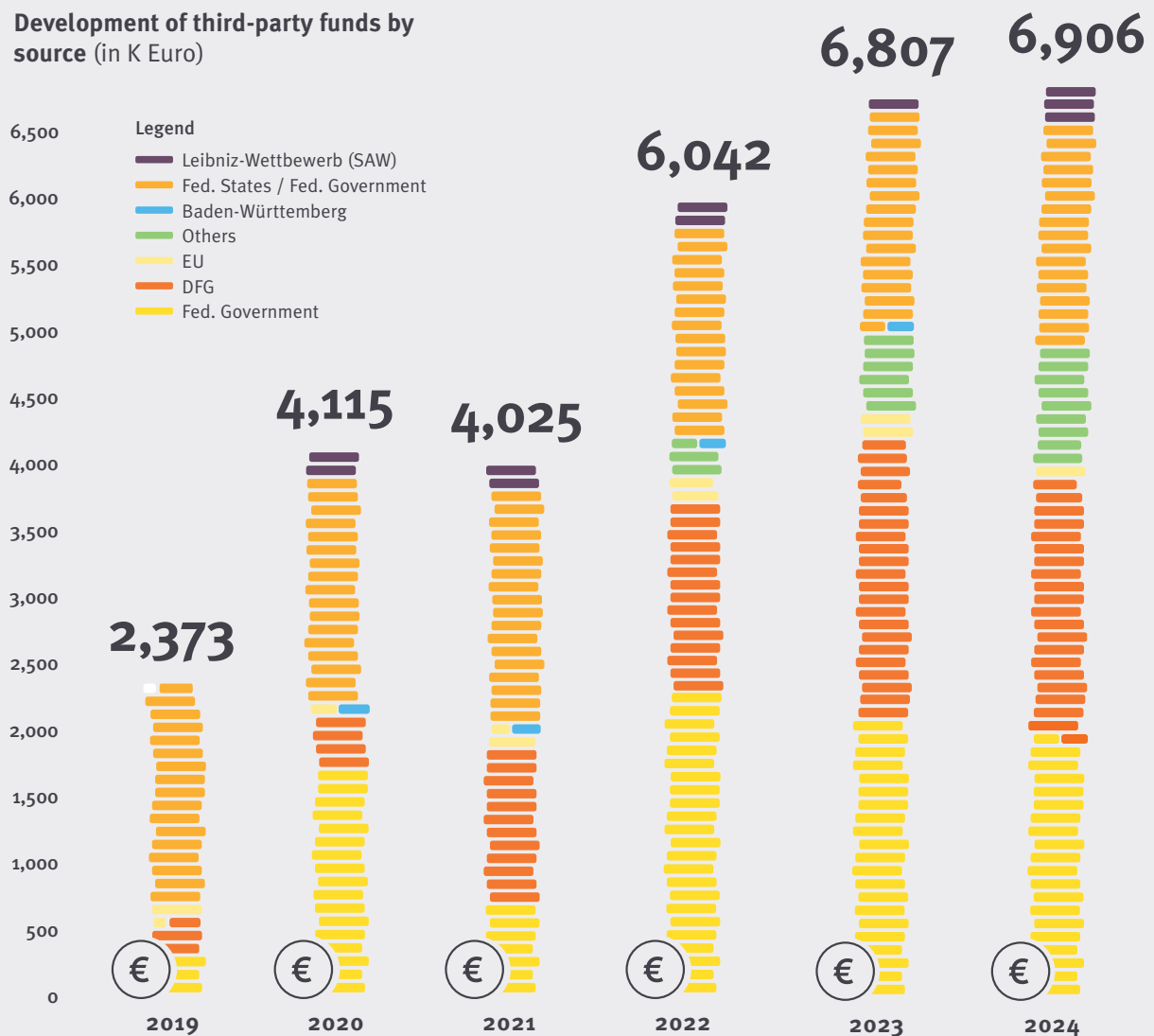|	
PORTFOLIO STRATEGY	We are expanding our portfolio of services to include services for additional scientific fields. We are improving existing services and developing new ones for the retrieval, analysis, and networking of information. We are strengthening the use of patent information in the academic environment through new projects and products.
RESEARCH STRATEGY	We are continuing to expand our research in all areas. This enables us to create innovations for existing and new services. We are strengthening our transfer services and contributing our legal, AI, and IT expertise to the public discourse.
AGILITY STRATEGY	We operate as a flexible and fast-moving organization so that we can respond to the dynamics of our entire environment. We optimize our digitalized processes and make them more adaptable and resilient to new or unplanned developments.
OPENNESS STRATEGY	We are developing our services – taking into account the prevailing conditions – toward open, networked platforms. We are strengthening our open policy (open access/open source/open science) and expanding our science communication.
COOPERATION STRATEGY	We strengthen our networking with partners in science and industry. We enter into new types of cooperation with our existing and future partners and adjust roles and responsibilities as necessary.
SUSTAINABILITY STRATEGY	We are committed to the fundamental principles of sustainability. We handle material and non-material resources responsibly. We consider sustainability in our decision-making processes. We are developing into a climate-neutral institution.

FACTS & FIGURES

STAFF

235 in Karlsruhe

295 Employees

60 in Berlin

58 International origin

2 Trainees/students at the DHBW

133 Men

295 Employees

1 Diverse

161 Women

36 % Women in management positions

SERVICES

105 Publications

65 Participation in conferences and workshops

57 Lectures

41 Courses

26 Third-party funded projects

9 Products

4 Services

FIGURE OF THE YEAR
8
Doctoral candidates

FINANCING 2024

14,680
Funding

14,299
Basic financing

6.906
Third-party funds

35,885
Total income
(in K Euro)

2,606
Investments

10,302
material expenses

22,977
Staff costs

35,885
Total expenses
(in K Euro)

Development of third-party funds by source (in K Euro)

Legend
- Leibniz-Wettbewerb (SAW)
- Fed. States / Fed. Government
- Baden-Württemberg
- Others
- EU
- DFG
- Fed. Government

Year	Value
2019	2,373
2020	4,115
2021	4,025
2022	6,042
2023	6,807
2024	6,906

2

THE INSTITUTE

3.1
ORGANIZATIONAL STRUCTURE

Our institute is undergoing dynamic development. We are strengthening our scientific focus while diversifying our portfolio. Accordingly, we regularly adapt our organizational structure to these internal and external developments.

The work is carried out in four »program units« with the special feature that the Research & Teaching program unit comprises the two areas of Information Service Engineering and Intellectual Property Rights (see organizational chart).

We implement our overall strategy in these areas. Responsibility for this lies with the organizational divisions of the same name:

1   Patent & Scientific Information
Information services to support research, innovation, and patenting processes

2   Subject-Specific Services
Information services for the fields of mathematics, crystallography, and energy

3   e-Research
Infrastructure-oriented services in research data management and the digital humanities

4   Research and teaching
in the fields of data protection, data and copyright law (Intellectual Property Rights) as well as symbolic knowledge representation and machine learning/AI (Information Service Engineering).

The program units are supported by two service units that work across the FIZ to support all activities:

5   IT Systems and Data Networks

6   Administration.

ORGANIZATIONAL CHART

with organizational units and fields of work/research

as of December 2024 / September 2025

Shareholder

Supervisory Board

President & CEO

Executive

Scientific Advisory Board
Prof. Dr. Wolfgang E. Nagel

Scientific Officers
....

Communications
Dr. Babett Bolle

Project Management Office
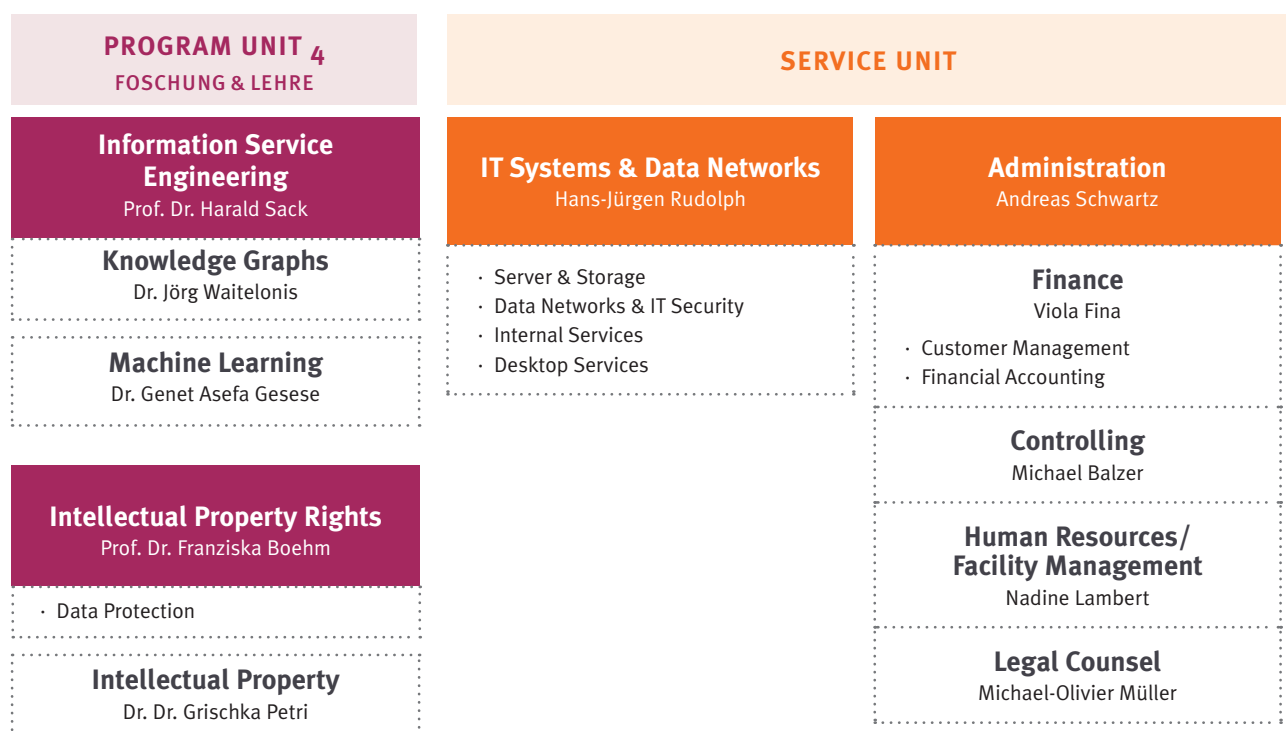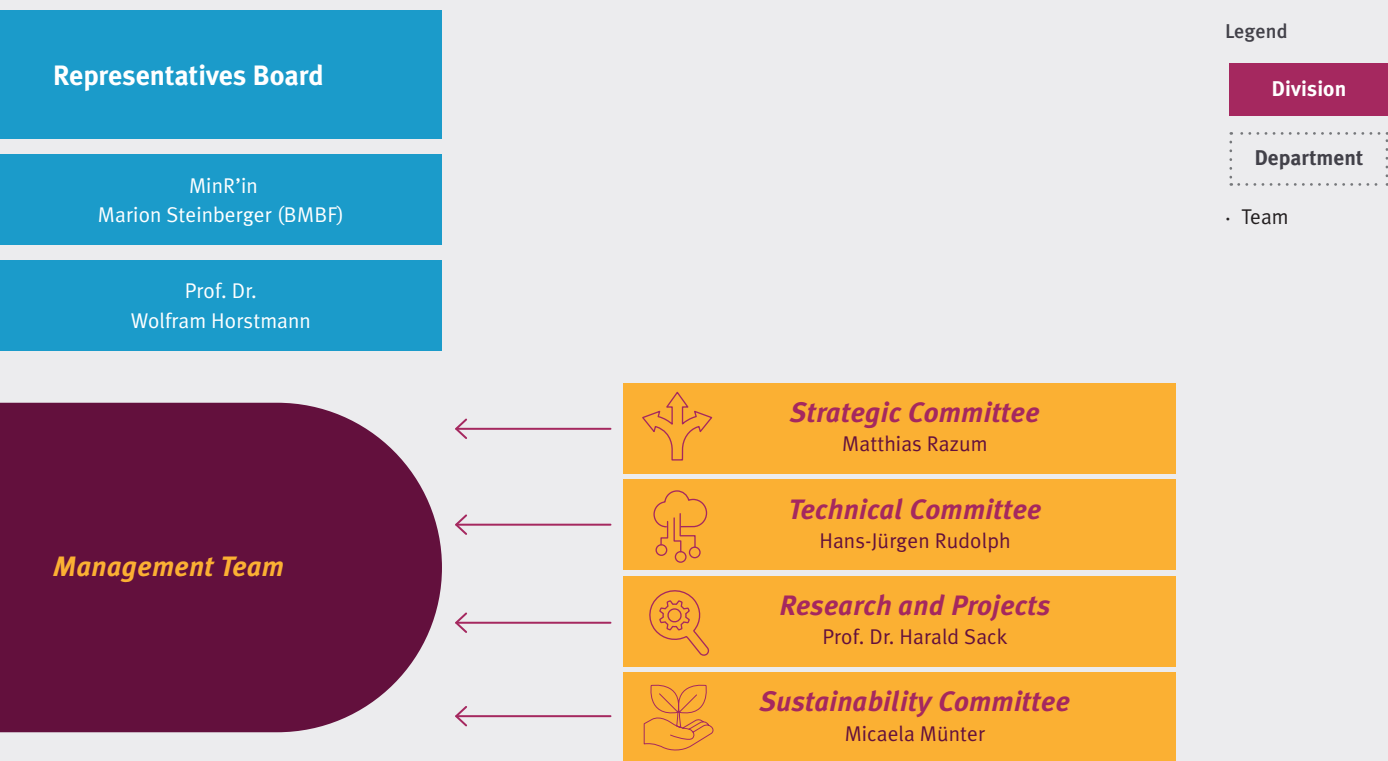Dr. Christiane Noe

Sustainability Officer/CSR
Micaela Münter

Works Council

Representatives
Budget
Data Protection Officer
Equal Rights Representative
Fraud Detection & Prevention
Inclusion Officer
IT Security Officer
Ombudsperson
Sustainability

Internal Audit

PROGRAM UNIT 1	PROGRAM UNIT 2	PROGRAM UNIT 3
Patent & Scientific Information Dr. Rainer Stuike-Prill	**Subject-Specific Services** Silke Rehme	**e-Research** Matthias Razum
Requirements Analysis & Product Management Dr. Birgit Knauer	**Editorial** Silke Rehme (interim.)	**e-Humanities** Frank Schwichtenberg
Data Analysis & Management Martin Hengesbach · Database Development · ETL Development FizPro · Mapping · Database Updates	**Mathematics** Dr. Olaf Teschke · Development & Systems zbMATH Open · Editorial, Data Processing & Indexing	**Research Data** Dr. Felix Bach
Service Development & Operations Dr. Thomas Bausenwein · Cooperative Development · STN Operations · Services & Projects	**Research & Projects Mathematics** Dr. Moritz Schubotz	
Customer Relations & Support Dr. Elke Müller · Helpdesk & Search Service · Customer Agreements · Training & Sales	**Crystallography** Silke Rehme	
Patents4Science Dr. Hidir Aras		

Representatives Board

MinR'in
Marion Steinberger (BMBF)

Prof. Dr.
Wolfram Horstmann

Management Team

Strategic Committee
Matthias Razum

Technical Committee
Hans-Jürgen Rudolph

Research and Projects
Prof. Dr. Harald Sack

Sustainability Committee
Micaela Münter

PROGRAM UNIT 4
FOSCHUNG & LEHRE

Information Service Engineering
Prof. Dr. Harald Sack

Knowledge Graphs
Dr. Jörg Waitelonis

Machine Learning
Dr. Genet Asefa Gesese

Intellectual Property Rights
Prof. Dr. Franziska Boehm

· Data Protection

Intellectual Property
Dr. Dr. Grischka Petri

SERVICE UNIT

IT Systems & Data Networks
Hans-Jürgen Rudolph

· Server & Storage
· Data Networks & IT Security
· Internal Services
· Desktop Services

Administration
Andreas Schwartz

Finance
Viola Fina
· Customer Management
· Financial Accounting

Controlling
Michael Balzer

**Human Resources/
Facility Management**
Nadine Lambert

Legal Counsel
Michael-Olivier Müller

3.2
COMMITTEES

The committees have an advisory function and support the President & CEO and the executive management team in decisions of cross-institutional relevance. They are composed of members from different departments and locations. The four committees currently support the management of FIZ Karlsruhe in all important cross-institutional strategy, planning, and decision-making processes. Their members come from all hierarchical levels. They are thus also an essential element of our participatory management culture.

Strategy Committee

The core task of the Strategy Committee is to present the overall strategy of FIZ Karlsruhe. This includes preparing the content of audits and evaluations, discussing structural adjustments to the program budget and annual report, and discussing institute and area-wide strategic planning instruments. In the reporting year, FIZ Karlsruhe was evaluated by the Leibniz Senate. The committee contributed to the preparation of the written document and the presentations.

Technology Committee

The Technology Committee deals with crossdepartmental IT issues in the overall interest of the institute. In addition to the future use of office software, the use of Apple devices (MacBooks) alongside Windows and Linux was discussed. The conclusion: Apple devices can be approved with central management by suitable mobile device management software.

Research and Projects Committee

The Research and Projects Committee coordinates research strategy, planning, and crossdepartmental networking. Each department provides information on ongoing projects, thereby improving transparency and external communication. The integration of science communication enhances the visibility of research.

Early exchange with the Project Management Office and third-party funding management facilitates planning. Important topics include the internal coordination of NFDI activities and the coordination of cross-consortium tasks in order to leverage synergies. A focus in 2024 was on the finalization of the research strategy for FIZ Karlsruhe.

Sustainability Committee

The Sustainability Committee began its work in January 2024. Its aim is to support and guide the cross-departmental transfer process at FIZ Karlsruhe towards becoming a sustainable institution. The results of the status quo analysis carried out in 2024 provide the basis for further steps: identifying key areas for action, defining sustainability goals, and developing a sustainability concept. In addition, the committee is assisting with the conceptual preparation of reporting and has advised and supported the sustainability officer in the preparation of the first sustainability report for the 2023 fiscal year. The report is available for download on our website.

3.3
COOPERATIONS

To achieve our strategic goals, we maintain numerous cooperative and business relationships with renowned research institutions, internationally important information providers, publishers, and domestic and foreign users in science and industry.


D 240
FI 3
NL 6
PL 5
UK 12
UA 6
USA 26
FR 8
CN 3
JP 3
GR 4
CH 3
AT 4
IT 4

Key
Number of cooperations
● > 20 ● 4–10 ● 2–3 ● 1

4 Continents

32 Countries
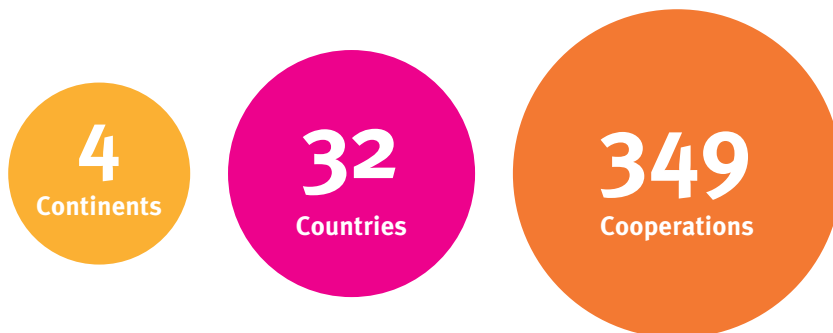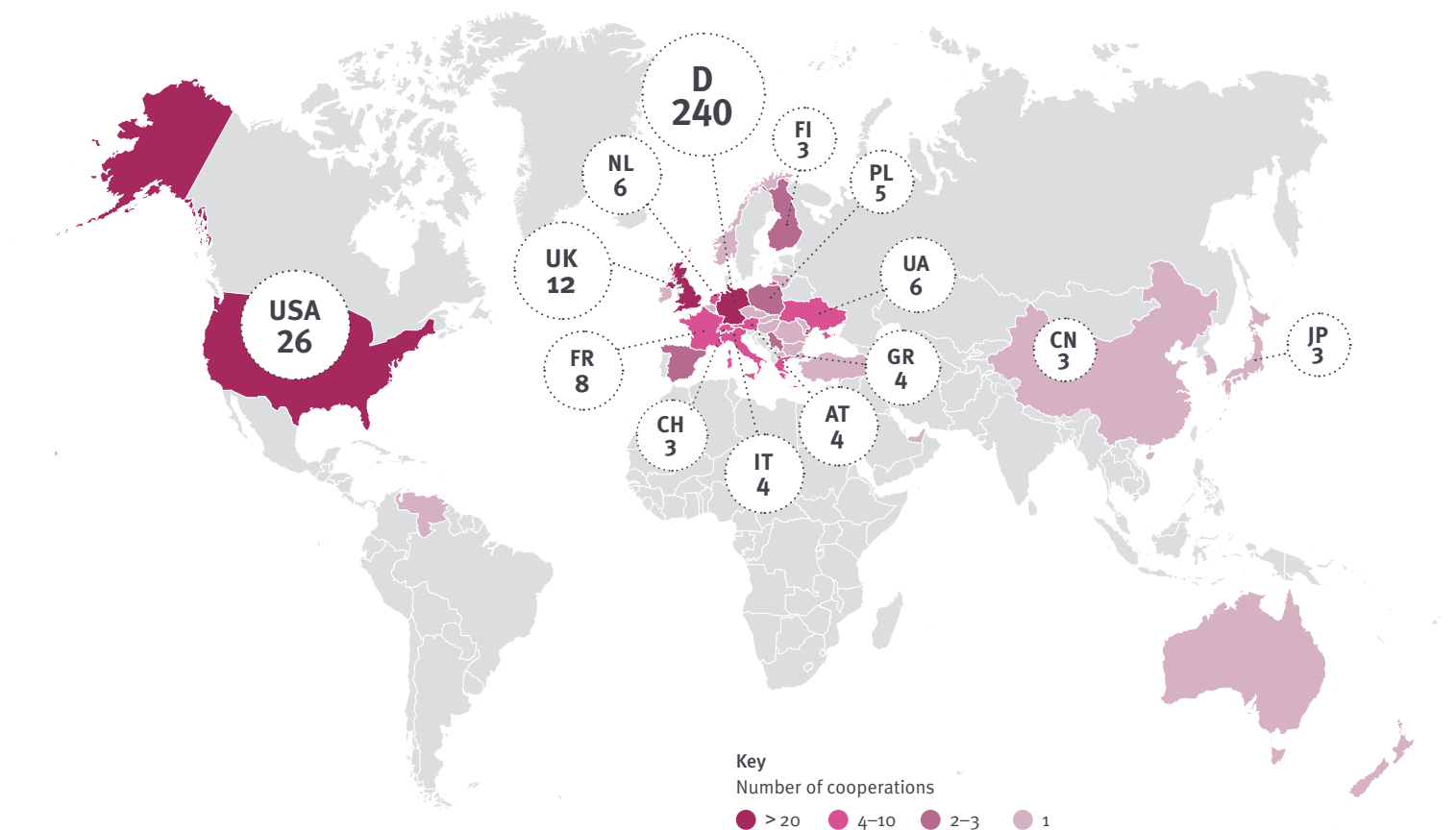
349 Cooperations

In cooperation with universities, non-university research institutions, and scientific societies, we conduct research on current topics related to information infrastructure in research and development projects. Furthermore, we develop and test innovative concepts with the aim of developing new, research-based services for science. We place particular emphasis on transfer in line with the goals of the Leibniz Association and our statutory mission. Our networking is also reflected in the global network of approximately 8,000 reviewers in mathematics and a steadily growing community in the context of the zbMATH Open information service. Activities in the two research areas of Information Service Engineering (ISE) and Intellectual Property Rights (IGR) strengthen cooperation in the scientific field in general, as well as with the Karlsruhe Institute of Technology (KIT), with which the corresponding joint appointments, courses, and projects have been realized.

The following cooperation and business partners are of particular strategic relevance (in alphabetical order):

CAS (CHEMICAL ABSTRACTS SERVICE)
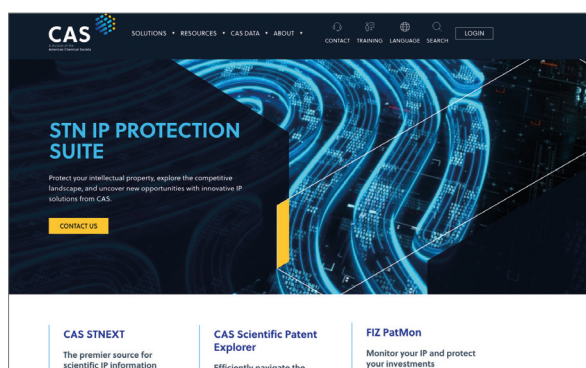
CAS and FIZ Karlsruhe have strategically realigned their partnership, which has been in place since 1984, with a new cooperation agreement at the beginning of 2022 to secure the future of STN and work on joint projects beyond STN. In accordance with the long-term roles and responsibilities agreed upon, CAS will assume commercial responsibility toward customers and database suppliers, while FIZ Karlsruhe will focus on data and product management in the field of scientific and patent information, sales and customer support, and the development of new services based on joint research-related projects.

### GERMAN NATIONAL LIBRARY (DNB)

Together with the DNB (and the Prussian Cultural Heritage Foundation), we operate the German Digital Library (DDB) as part of a trilateral public-public partnership. The aim of the DDB is to provide free access to Germany's cultural and scientific heritage via the Internet. As a central national portal, the DDB aims to link the digital offerings of all German cultural and scientific institutions. In addition, we cooperate in several NFDI consortia (NFDI4Culture, Text+, NFDI4Memory) and in joint DFG projects.

EUROPEAN MATHEMATICAL SOCIETY (EMS)
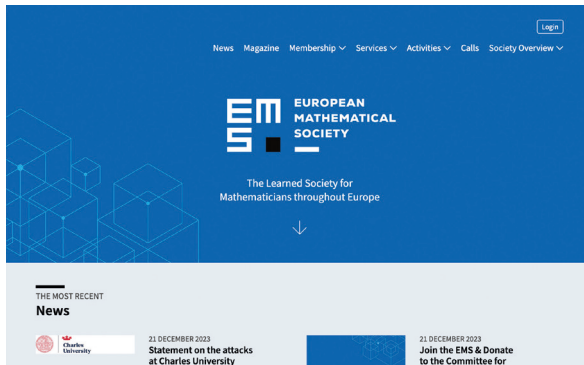
The EMS publishes zbMATH Open in collaboration with FIZ Karlsruhe and the Heidelberg Academy of Sciences. The collaboration with the EMS ensures the quality of the platform, strengthens its roots in the European mathematics community, and promotes its expansion. In addition, this experience is incorporated into the EMS guidelines for scientific publishing. FIZ Karlsruhe also plays a key role in the work of the society through its chairmanship and membership in several EMS committees.

KIT (KARLSRUHE INSTITUTE OF TECHNOLOGY)
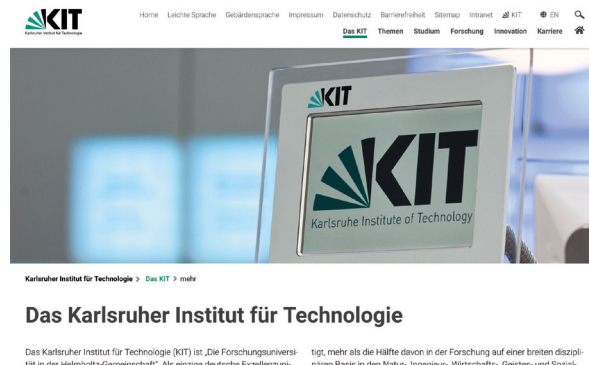
FIZ Karlsruhe and KIT cooperate closely in research and teaching, e.g., through two jointly appointed W3 professorships in ISE and IGR and numerous courses. The collaboration extends to e-research solutions such as RADAR and has been further strengthened through projects and the NFDI. The Leibniz Science Campus DiTraRe will expand the partnership and strengthen Baden-Württemberg as a center of science.

STATE ARCHIVE BADEN-WÜRTTEMBERG (LABW)
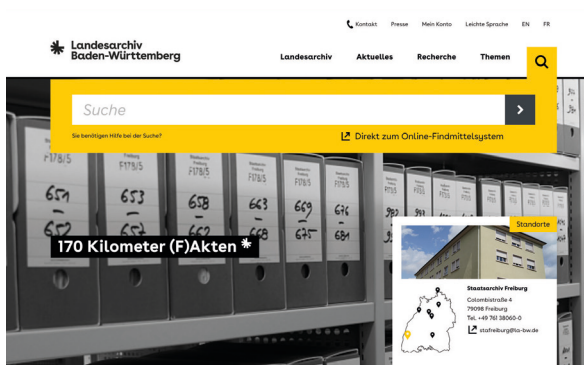
The LABW preserves, catalogs, and utilizes historical and socially significant collections beyond the borders of Baden-Württemberg. For years, it has been cooperating with FIZ Karlsruhe in research and development projects, such as the Archivportal-D, thematic portals on Nazi injustice and right-wing violence, and the development of a new archival information system in a public-private partnership.

PRUSSIAN CULTURAL HERITAGE FOUNDATION (SPK)
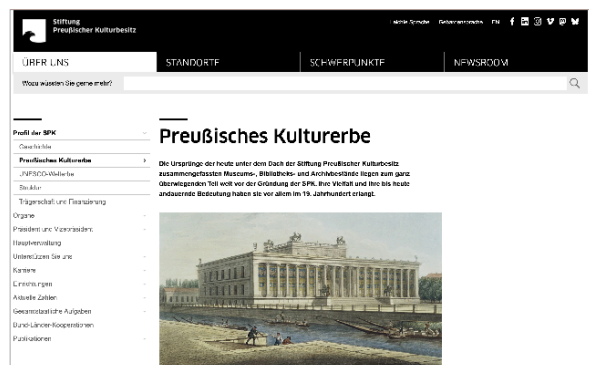
The Prussian Cultural Heritage Foundation (SPK) is one of the largest cultural institutions in the world. In addition to close cooperation and ÖÖP in the DDB, we also work with the SPK in several NFDI consortia and DFG projects. Our new President & CEO, Prof. Horstmann, is also a member of the SPK's General Advisory Board and the Advisory Board of the Berlin State Library.

3.4
CROSS-SECTOR ACTIVITIES

We can only achieve our goal of providing the best possible information infrastructure for research in industry and science by working together with other partners in an (inter)national network. That is why we are involved in cross-disciplinary committees, initiatives, and policy consulting in order to further promote networking – in line with our guiding principle of »Advancing Science«.

NATIONAL RESEARCH DATA INFRASTRUCTURE (NFDI)

The National Research Data Infrastructure (NFDI) systematically catalogs scientific and research data, secures it for the long term, makes it accessible, and connects it (inter)nationally. It was created in a science-led process as a networked structure of subject-oriented consortia. With expertise in our three research-based fields of research data management, knowledge graphs, and law (copyright and data protection law), FIZ Karlsruhe is a partner in nine of the 27 consortia approved by the Joint Science Conference.

Über die Leibniz-Gemeinschaft

LEIBNIZ ASSOCIATION AND SCIENCE SYSTEM

Within the Leibniz Association, we participate in various initiatives to support the strategic goals of the Leibniz Association and advise the Presidium and committees.

INTERNATIONAL ACTIVITIES AND EUROPEAN UNION

At the international level, FIZ Karlsruhe employees are involved in numerous scientific and legal committees and working groups.

3

THE PROGRAM AND SERVICE AREAS

4.1
PATENT & SCIENTIFIC INFORMATION

In the **Patent & Scientific Information (PSI)** program unit,
we develop and operate information services to support research,
innovation, and patenting processes.

Our services include the analysis, structuring, and indexing of information from scientific publications and patents. We also conduct research into new methods of knowledge extraction and networking. We offer scientific and technical consulting to our international customers. Our target groups include companies and research institutions in industry and science.

The range of tasks includes:

- Tasks related to the development and operation of the CAS STNext® information service in cooperation with our US partner CAS, as well as projects for the evaluation and development of new services

- Establishment of an innovative Patents4Science information infrastructure geared toward the scientific use of patents

- Activities in the Bibliometrics Competence Network to establish bibliometric databases and develop bibliometric analysis tools.

<div style="background:#2e2e8f;color:#fff;text-align:center;padding:6px;">STN</div>

STN is a key service of the program unit. Trustworthy, quality-assured information is the basis for business-critical decisions in research, e.g., when it comes to developing new drugs. Patent and information experts in global companies in the chemical, pharmaceutical, and technology industries, in patent law firms, in patent offices, and in research institutions use STN as one of their key sources of knowledge for economically and legally relevant issues.

In our collaboration with CAS on the operation and further development of the STN system, we focus on these three areas:

- Data and product management of scientific and patent information

- Support for customers in EMEA (EMEA Customer Center), also through the search service (CAS IP Service EMEA), support for sales, and

- Development of new services, e.g., research-based R&D projects using AI applications.

»Our innovative information solutions for research and development make knowledge from patents and publications usable.«

Dr. Rainer Stuike-Prill, Vice President Patent & Scientific Information

PATENTS4SCIENCE

In the »Patents4Science« research area, we work on innovative approaches using artificial intelligence (AI) and develop new methods and processes to better semantically extract the knowledge contained in patents and link it to other sources of information, such as scientific literature or subject-specific data. Our goal is to provide researchers in university and non-university environments with simple, efficient, and sustainable access to patent knowledge via dedicated information services.

COMPETENCE NETWORK BIBLIOMETRICS

The third focus of the program unit »Patent & Scientific Information« represents the activities in the Bibliometrics Competence Network (KB). The scientific publication system is one of the central sources through which the dissemination and validation of scientific findings is organized. Bibliometrics uses the information about authors, journals, institutions, sponsors, and topics that is generated during the publication process and transforms it into indicators, structural representations, and key figures.

PATENT & SCIENTIFIC
INFORMATION IN FIGURES

77 Employees

31 Men

46 Women
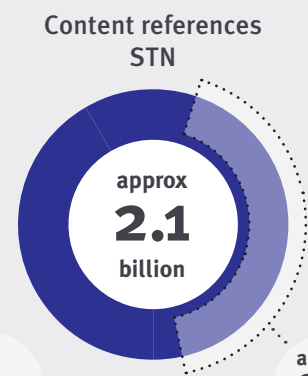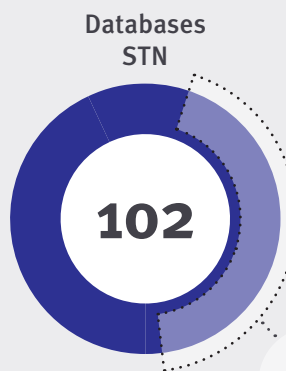
Databases STN
102

57 Databases FIZ Karlsruhe

Content references STN
approx **2.1** billion

approx **840** million
FIZ Karlsruhe

2 Participation in the organization of scientific events

2 Third-party funded projects

1 Product

2 Services

22 Institutions in the Competence Network Bibliometrics

4.2
SUBJECT-SPECIFIC SERVICES

In the **Subject-Specific Services (FS)** program unit, we develop and operate globally recognized information services for the fields of mathematics, crystallography, and energy. To this end, we index and aggregate relevant sources. All services are aimed at scientists in research.

Our two core products are zbMATH Open and ICSD (Inorganic Crystal Structure Database). These are regarded by the respective scientific communities as high-quality, comprehensive, and indispensable sources of knowledge for their research processes.

MATHEMATICS

zbMATH Open is an international, open, and free service for mathematics that provides uninterrupted access to the world's mathematical research literature published since 1868. It contains nearly five million bibliographic entries with reviews or abstracts. In addition to publications, zbMATH Open provides information about authors and their networks, journals and their content focus, software, and references to research data.

CRISTALLOGRAPHY

ICSD is an information service in the field of crystallography with the world's largest database of fully determined inorganic crystal structures (currently 307,000) and complementary simulation and visualization tools. Crystal structures have a significant influence on the physical properties of a compound. Therefore, the further development of the product focused, among other things, on making relevant structures as comprehensive as possible and linking them to external sources that offer additional information on chemical and physical properties.

Another focus of the »Subject-Specific Services« program unit is editorial work. Its core tasks are the procurement, collection, analysis, structuring, standardization, enrichment, and networking of data and information. The expansion of digital workflows and the optimization of existing interfaces for data processing are key tasks.

Other tasks of the program unit include representing the Federal Republic of Germany at the International Atomic Energy Agency (IAEA) for the development of the freely accessible literature database INIS, managing FIZ Karlsruhe's publications, acting as open access officer, including the administration of DEAL contracts, representing FIZ Karlsruhe in various Leibniz committees, statistically evaluating and preparing publication figures for committees, and external relations.

SUBJECT-SPECIFIC SERVICES IN FIGURES

76
Employees

35
Men

41
Women

4
Third-party funded projects

5
Products

36
Publications

Production figures

134,295
zbMATH Open

15,971
ICSD

Access figures

approx **60** million
zbMATH Open

approx **16** million
swMATH

approx **1,3** million
ICSD

»Our quality-assured content supports our research – and vice versa!«

Silke Rehme, Vice President Subject-Specific Services

4.3
E-RESEARCH

In the **e-Research (ER) program unit,** we develop and operate solutions and information infrastructures for various disciplines within the framework of interdisciplinary research projects and commercial tasks.

In the e-Research (ER) program unit, we develop and operate infrastructure-oriented services in research data management and the digital humanities. This is mainly done within the framework of interdisciplinary research projects and commercial contracts. Particularly noteworthy are the German Digital Library (DDB) and the RADAR research data repository as central research infrastructures around which other services are grouped.

Users and cooperation partners include research institutions, universities, memory organizations, scientific societies, and publishers. We offer them consulting, requirements analysis, implementation, and operation of robust and productive e-research solutions from a single source.

DIGITAL HUMANITIES

With the German Digital Library (DDB), FIZ Karlsruhe has been operating the central portal for German cultural and scientific institutions since 2012

and has been responsible for all essential aspects of software development since 2018. The DDB has established a comprehensive network of partnerships with libraries, archives, and museums. From this network, we have worked with various partners over the past few years to develop and successfully implement further projects related to the DDB, such as the Archivportal-D and the German Newspaper Portal. An entire ecosystem of subportals offering sector or topic-specific access is now based on the DDB's shared backend.

With thematic access points such as the portal »Collections from Colonial Contexts« and the »Themenportal rechte Gewalt« (Right-wing Violence Theme Portal) project, we actively support the socio-political goal of highlighting contexts of injustice and strengthening democracy through remembrance culture initiatives.

> **»In interdisciplinary projects, communication with people is sometimes more important than software development. This is challenging but also very satisfying«**
>
> Matthias Razum, Vice President e-Research

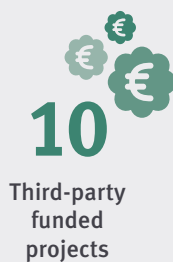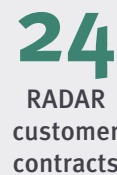## RESEARCH DATA MANAGEMENT AND LONG-TERM ARCHIVING

Our core product here is the generic research data repository RADAR, which is now used by 24 universities and research institutions. We are also establishing a network of related services around RADAR.

With the Leibniz Science Campus »Digital Transformation in Research« (DiTraRe), launched in 2023, we are investigating in four research clusters, together with our Research and Teaching program area and KIT, the effects of the digitization of scientific work in a transdisciplinary way and develop concrete solutions based on use cases from various disciplines. DiTraRe is thus a prime example of the focus of e-Research and the close cooperation with our research units.

In addition, we contribute our expertise to thematically relevant initiatives and working groups, such as the Allianz focus on digitality in science, the Leibniz Association's working group on research data, and the working group on long-term archiving of the NFDI section »Common Infrastructure.«

E-RESEARCH IN FIGURES

35 Employees

22 Men

13 Women

> 55 million
Object references DDB

> 22 million
digital objects DDB

24 RADAR customer contracts

+ 3 NFDI consortia

10 Third-party funded projects

4 Participation in NFDI consortia

3 Products

3 Services

4.4
RESEARCH AND TEACHING

The **Research and Teaching (FUL) program area** comprises the two research units »Information Service Engineering« (ISE) and »Intellectual Property Rights in Distributed Information Infrastructures« (IGR). This involves two joint appointments with KIT to two W3 professorships with the same title.

Through cross-FIZ research, we aim to develop our infrastructure, products, and services beyond the current state of the art, to comprehensively access, analyze, and network research data and knowledge, and to address related legal issues. One focus is on researching and applying new artificial intelligence methods, while another is on policy advice with a focus on data (protection) law. In this way, we are also positioning and profiling ourselves as a leading research institute. The work in the research units reflects the highly dynamic nature of technological development as well as the changing user requirements. This goes hand in hand with our goal to help initiate and shape innovative research topics.

The work program of our ISE and EGR research units is fundamental to their current research groups:

- ISE: Knowledge graphs
- ISE: Machine learning
- IGR: Data protection and data ethics
- IGR: Copyright.

RESEARCH UNIT INFORMATION SERVICE ENGINEERING

One focus of the **Information Service Engineering (ISE)** unit is on semantic technologies, i.e., ontologies and knowledge graphs, which provide a formal representation of the knowledge contained in research data, thus paving the way for the efficient integration of heterogeneous and distributed data sources.

The necessary transformation of existing data sets into an integrative but distributed knowledge graph is supported by the use of deep learning-based knowledge mining technologies, enabling federated exploratory access to these resources.

In addition, opportunities are created to preserve and maintain the data and insights gained in the medium and long term, and to enable their analysis, visualization, and exploration. Dr. Jörg Waitelonis took over as head of the Knowledge Graphs department (ISE-KG) in October 2024.

KNOWLEDGE GRAPHS

 Knowledge graphs are also the focus of the International Semantic Web Research Summer School (ISWS), which has been organized jointly with the University of Bologna since 2018. In 2024, the ISWS was once again successfully held with 60 postgraduate students and 20 supervising international top scientists.

Knowledge graph based information systems

Knowledge graphs (KGs) enable differentiated and convenient access to information content. By linking the information content to the entities contained in the KG (entity linking) and the associated semantic annotation, a dedicated semantic search of this information content can be easily implemented. Semantic search uses the semantic information contained in the KG, e.g., by determining content-related connections, which can in turn be reused in the connected information system.

»Our research on knowledge graphs increases the reliability and traceability of large language models.«

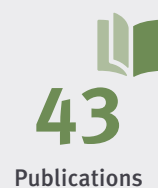Prof. Dr. Harald Sack, Vice President Information Service Engineering

Knowledge graph embeddings

Graph algorithms for statistical analysis of KGs are usually highly complex and therefore difficult to scale. One research approach approximates the structures represented in the graphs by transposing them into a low-dimensional vector space (vector space embedding). Nodes and edges are represented by vectors that retain their semantic properties. This can significantly speed up similarity-based comparisons and retrieval. The research work carried out at ISE focuses on representing the semantics of literals in KGs.

Existing KG embeddings usually treat all nodes of a graph in the same way, whereas (multimodal) literals (typed or untyped, e.g., numbers, typed measurements, natural language texts, images) have their own inherent semantics that have not yet been represented in KG embeddings, or only inadequately. The goal is to improve existing KG embedding methods by incorporating literal semantics. This work is in the field of basic research. Further benefits include qualitative improvements to the methods developed and researched by ISE for semantic and exploratory search as well as for information retrieval.

INFORMATION SERVICE ENGINEERING IN FIGURES

16 Employees

6 Men

10 Women

5 Doctoral candidates

1 Men

4 Women

9 Third-party funded projects

8 Participation in interdisciplinary third-party funded projects

10 Courses

43 Publications

5 Participation in NFDI consortia

RESEARCH UNIT INTELLECTUAL PROPERTY RIGHTS IN DISTRIBUTED INFORMATION INFRASTRUCTURES

The digital transformation poses various social and legal challenges to information infrastructures in the field of research data management. The research topics in the **Intellectual Property Rights in Distributed Information Infrastructures (IGR)** unit focus primarily on data protection, data ethics, copyright, and AI law issues in this context.

These questions vary depending on the date and discipline. For example, the collection and long-term provision of scientific data raises different questions than data on cultural assets, which often involve licensing issues. Data protection issues and data ethics play a major role across the board. Research questions relating to AI law are rapidly increasing and are linked to data law issues. These topics are reflected in research collaborations, publications, and projects.

DATA PROTECTION AND DATA ETHICS

Information infrastructures operate in an increasingly networked digital environment, meaning that the issues to be addressed are also becoming increasingly interconnected and are located at a global rather than a national level. Research data often contains personal or business-related data that is processed in different jurisdictions and is sometimes subject to strict legal restrictions.

However, data and metadata are not always easy to anonymize because they are reusable, interpretable, and, in some cases, identifiable for further research, and context-related information is needed for further analysis of research data.

Data is also increasingly being generated with the help of AI solutions. IGR makes an important contribution to the development of services that cover all phases from data creation to the provision of research data and make the data shareable and reusable for research and beyond (DARIA project). New models, such as data trustees (DROPS project), are intended to remove obstacles in this context.

We support technical projects and services by providing recommendations on the privacy-compliant and privacy-friendly design of new technologies, such as mobile applications and research databases, and give advice on privacy-compliant research activities, e.g., when processing personal data of volunteer test subjects.

RESEARCH DATA AND COPYRIGHT

We analyze copyright regulations and reform developments and derive recommendations for digital science, including its infrastructure facilities. As in previous years, we were present at numerous workshops and conferences in 2024 and gave presentations on copyright issues. The various copyright activities were more closely networked in 2024 in the newly established Copyright Department. This will allow the potential of IGR's involvement in various NFDI consortia to be exploited even more efficiently.

A cross-cutting issue of growing importance is the use of AI techniques in research projects supported by IGR. The EU's AI Regulation came into force in the summer of 2024. Although its legal implications focus on data protection and personality rights, links to copyright law are also currently the subject of heated debate. Furthermore, key copyright issues relating to the use of works in AI have not yet been reviewed by the courts. We are actively involved in the ongoing debate through our lectures, teaching events, and workshops, are preparing further publications, and contribute our expertise to academic working groups and policy advisory bodies.
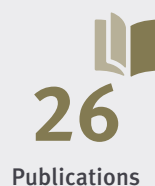
INTELLECTUAL PROPERTY RIGHTS IN FIGURES

17 Employees

8 Men

1 Diverse

8 Women

3 Doctoral candidates

12 Third-party funded projects

27 Courses

26 Publications

6 Participation in interdisciplinary third-party funded projects

6 Participation in NFDI consortia

»We examine legal issues of digitization, for example in connection with transnational data use.«

Prof. Dr. Franziska Boehm, Vice President Intellectual Property Rights

4.5
IT SYSTEMS AND DATA NETWORKS

FIZ Karlsruhe develops innovative information services and operates them in an IT infrastructure in its own data center in Karlsruhe in combination with cloud services. The IT systems and applications form the technical basis for internal purposes, for the operation of »open« and »closed« platforms, and for the implementation of cooperative projects.

The IT Systems and Data Networks (ITS) unit is a service unit that focuses on the strategic goals of FIZ Karlsruhe and provides the necessary IT infrastructure for the operation of workstation, server, storage, and network systems. We operate IT systems and applications based on them in our own data center or as a cloud service. Important aspects of our planning include ensuring IT security, high availability of IT resources, and compliance with regulations. In this way, we make a significant contribution to achieving strategic goals.

Extensive work was required in the area of data networks in particular. Various IT systems had reached the end of their useful life (EOS) and had to be replaced. For example, an outdated firewall from Juniper was shut down and its functionality transferred to modern Check Point systems. Several outdated network systems (Internet gateway, central switches) were shut down and their functi-

onality transferred to modern CISCO systems. One of FIZ Karlsruhe's two Internet connections is provided by the Association to Promote the German Research Network (DFN). Due to changes at the DFN, the connection had to be converted from a port connection to a standard connection.

Throughout the year, security patches had to be installed promptly on various IT systems as soon as security vulnerabilities became known. The access portals for remote access via virtual private networks (VPN) and the Atlassian products for collaboration and software development were particularly affected on multiple occasions. All work had to be carried out during ongoing operations, without test environments, and avoiding major operational disruptions. The conversion to modernize the data center systems for the connection of servers took place at the beginning of 2025. This also involved the dynamization of routing, which

»The extended opening of IT for collaboration and the provision of open data with the maximum possible guarantee of IT security require an adaptation of the operating concepts.«
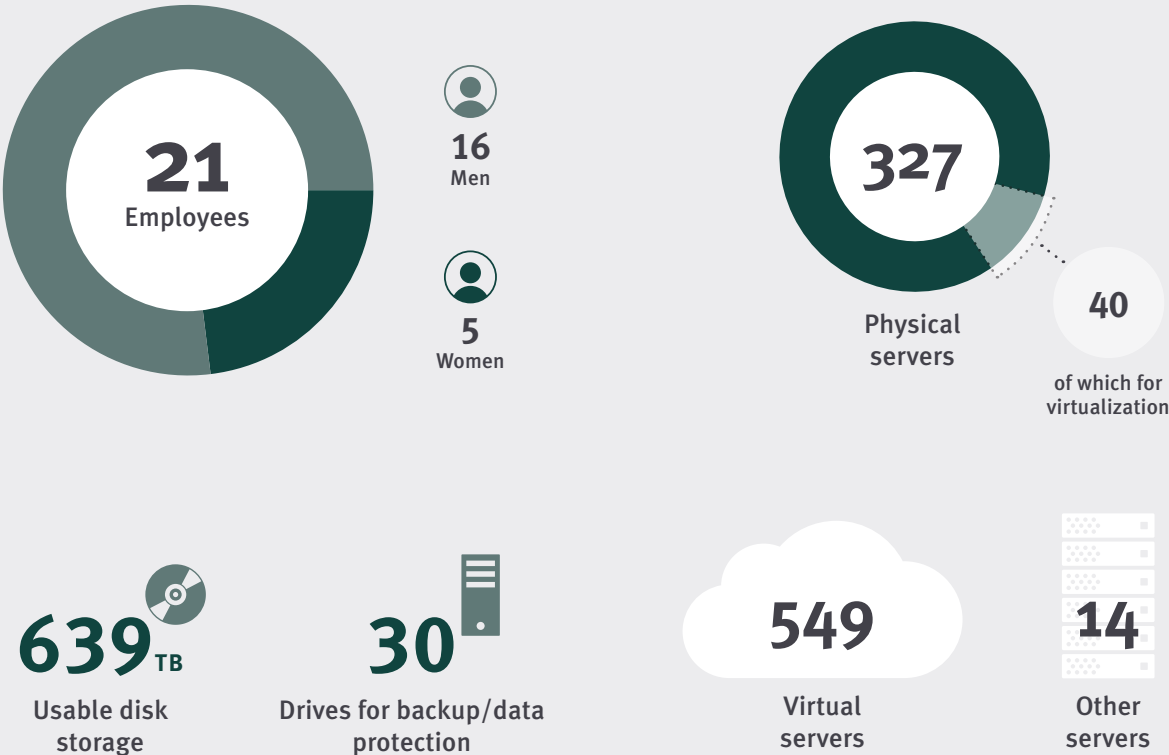
Hans-Jürgen Rudolph, Vice President IT Systems and Data Networks

will simplify network operations and make them more flexible.

The storage capacity of the NetApp storage systems was expanded by installing additional hard drives, and the NetApp operating software »OnTap« was updated. The entire WLAN infrastructure at the Karlsruhe and Berlin locations has been modernized. All WLAN access points have been replaced, and the WLAN management interface has been consolidated for both FIZ locations through a central, cloud-based WLAN management system.

IT SYSTEMS AND DATA NETWORKS IN FIGURES

21 Employees

16 Men

5 Women

327 Physical servers

40 of which for virtualization

639 TB Usable disk storage

30 Drives for backup/data protection

549 Virtual servers

14 Other servers

4.6
ADMINISTRATION

The **Administration (V) service** unit is responsible for finance, controlling, human resources, infrastructure, and legal matters at FIZ Karlsruhe. As administrators, we provide services to all departments and work at all levels of FIZ Karlsruhe.

The ongoing global uncertainties, the stagnating German economy, and persistent price increases also place demands on controlling and budget management. Nevertheless, the stabilization of revenues through our long-term cooperation with CAS, detailed cost monitoring, and our liquidity management have led to planning security and, as a result, a stable economic situation for FIZ Karlsruhe. We are positioning ourselves for the future by converting our ERP system to a cloud-based, process-comprehensive, and uniform solution and by putting out a tender for a new human resources management system. The program budget continues to serve as the central planning instrument for all strategic, contentrelated, and financial planning for the coming year. As part of our goal to create a sustainable building infrastructure we were able to successfully implement further measures: the comprehensive roof renovation of the oldest building on campus, the installation of a photovoltaic system, and the greening of roof areas will lead to further energy savings in the future.

Our Future Work concept, which we understand as »New Hybrid Work«, is an important building block both in attracting qualified specialists and in retaining our employees in the long term. A cornerstone of the concept is the general works agreement (GBV) »Mobile Working (Future Work)«, which has been in place since June 2022.

New spatial concepts for hybrid and modern working at our two locations in Eggenstein-Leopoldshafen and Berlin form another key pillar of the Future Work concept.

New meeting facilities, desk-sharing worksta-tions, and a soundproof room-in-room solution for video conferences are available to employees. The redesign of the kitchenette and the opening of the management rooms on the upper floor of our main building completed the modernization.

In addition to promoting work-life balance, job bike leasing and subsidies for the Deutschland-ticket are further benefits for our employees, among many others.

ADMINISTRATION IN FIGURES

37
Employees

10
Men

27
Women

2
Trainees at the institute

23
New hires at the institute

48
Third-party funded staff at the institute

94
Number of »Deutschlandtickets«

20
Applications for mobile working in other EU countries

28
Leased bicycles at the institute

» **With foresight and innovative strength, we shape administration as a bridge between the challenges of today and the opportunities of tomorrow.«**

Andreas Schwartz, Vice President Administration

LEGAL NOTICES

Annual Report 2024

Mitglied der
Leibniz Gemeinschaft

Zertifikat seit 2016
audit berufundfamilie

Would you like to know more about
FIZ Kalrsruhe and its projects?
Please follow the link:
www.fiz-karlsruhe.de/en/projekte/projekte