



Delft University of Technology

Support for research at TU Delft

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RESEARCH SUPPORT IN THE NETHERLANDS

CURRENT SITUATION



SUMMARY

Researchers at Dutch institutions of higher education are placing ever-growing demands on the field of computing power, networking services and data storage facilities. Access to a high quality, low threshold ICT infrastructure has become a prerequisite to do research. As such, the need for suitable support in order to simplify access for researchers is growing all the time.

Although all universities and research institutions are addressing the issue of research support, each institution is taking an independent approach to the matter. To gain a clearer picture of the different research support options available, SURF approached four institutions: Delft University of Technology (TU Delft), Erasmus University Rotterdam (EUR) and the university medical centres in Leiden (LUMC) and Maastricht (MUMC+). These institutions were asked to answer the following questions:

- What is your vision for research support?
- What e-infrastructure and associated services are available to researchers?
- How is research support organised?
- What are your plans for the (immediate) future?

The report was drawn up as part of the SURF project entitled Support4research. This report is intended to demonstrate how research supporters can organise their support processes and which services, both their own and those supplied by third parties, they can offer.

Based on the descriptions from the institutions, we can conclude that research support is a priority. At each of the four institutions, research support was high on the agenda. No matter how different the organisational measures may be, there is not a single institution which is not focusing on research support. Furthermore, the institutions which co-authored this report are at approximately the same stage of development and implementation and are currently addressing the following topics:

- Putting researchers first
- If and how to centralise support & infrastructure?
- Multidisciplinary approach
- A single point of contact
- Data management and the data lifecycle
- SURF as mediator and coordinator

All of these factors underline SURF's view that research support is considered to be highly relevant within academia.

SURF would like to thank all contributors that took the time to share their vision of how research support could be organised with colleagues. We hope that this report will inspire you when organising your own research support, and that it may contribute to more effective support for the people that need it: researchers.

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1. INTRODUCTION

Researchers at Dutch institutions of higher education are placing ever-growing demands on the field of computing power, networking services and data storage. Access to a high quality, low threshold ICT infrastructure has become a prerequisite. As such, the need for suitable support in order to simplify access for researchers is growing all the time. There is a growing number of employees working in the field of research support: ICT managers, library staff, information managers and research data officers.

Although all universities and research institutions are addressing the issue of research support, each institution is taking an independent approach to the matter. SURF approached four institutions to gain a clearer picture of the different options. Each of these institutions was asked to answer the following questions:

- What is your vision for research support?
- What e-infrastructure and associated services can researchers utilise?
- How is research support organised?
- What are your intentions for the (immediate) future?

What is the purpose of this report?

The study - whose results are detailed in this report - was conducted as part of the Support4research project run by SURF (part of our 'Collaboration on ICT environments for research' innovation programme.). Within this project, SURF looks at how researchers can have their requirements met most effectively. Research support is the basis for all of it. This report is intended to demonstrate how research supporters can organise their support processes and which services, both their own and those supplied by third parties, they can offer. This report offers a number of examples that show how different institutions approach this. For SURF, this helps to determine the key points where we can provide our services.



Which institutions worked with us?

The four institutions which worked with us on this study are Delft University of Technology (TU Delft), Erasmus University Rotterdam (EUR) and the university medical centres in Leiden (LUMC) and Maastricht (MUMC+). All four are true research institutions and pioneers in the area of research support. Together, they provide a representative selection: one technical university, one general university (EUR) and two academic medical centres. They also show the available options for organising research support: at some institutions support is managed centrally, while at others the organisation is in closer proximity to the researchers themselves. This offers a whole range of options.

SURF is aware that this selection meant that a number of other institutions had to be excluded. This includes institutions that have made excellent progress in the area of research support. However, SURF believes that this selection presents a good overall impression of the available options. If, as the result of this report, other institutions feel inspired to share their approach to research support, SURF encourages this by all means. Does your institution have an interesting business case in the field of research support? Please contact Jan Bot (Jan.Bot@surfsara.nl).

How is this report structured?

The report is composed as follows: In chapters 2 to 5 LUMC, EUR, MUMC+ and TU Delft each describe their situation. Each of these four chapters follows the same format. Each chapter contains key figures, the institution's vision regarding research support, an overview of their e-infrastructure, the organisational context, an ideal scenario for research support and a wish list for future development. Chapter 6 contains a summary of the most notable conclusions from the study and of a number of core principles pertaining to the organisation of research support.

2. SUPPORT FOR RESEARCH AT LUMC

LUMC

Number of PhDs

700 (162 awarded in 2014)

Number of students

442 biomedical sciences
2,194 medicine

Scientific publications per year

1,993

Areas of activity

Three core areas:
Patient Care, Teaching
and Research

2.1 Introduction

Leiden University Medical Centre (LUMC) is one of eight university medical centres in the Netherlands and offers patient care, teaching and research as its three core activities. There are 7,000 employees working on these core areas, with interaction between the disciplines.

LUMC pursues several highly fundamental research areas that focus on key life processes. A substantial part of the research at LUMC focuses on the transfer of pure research into applications for patient care (from bench to bedside and vice versa). Broad patient-based research is also carried out within the clinical disciplines. LUMC prioritises the evaluation of the suitability and level of effectiveness of new and existing medical technologies, epidemiological and prescription behaviour, and patient care safety.

Collaborations in the field of research:

ACADEMIC ALLIANCES

- Leiden University
- Leiden Institute for Brain and Cognition (LIBC)
- Holland PTC
- BBMRI and BBMRI-NL
- Parelsnoer Institute
- Centre for Medical Systems Biology (CMSB)
- EUROLIFE
- League of European Research Universities (LERU)

RESEARCH ALLIANCES

- Bio-Science Park
- NeCEN
- NCHA
- TNO
- Top Institute Pharma (TI Pharma)
- Biomedicals Materials Program

TRIPLE HELIX ALLIANCES

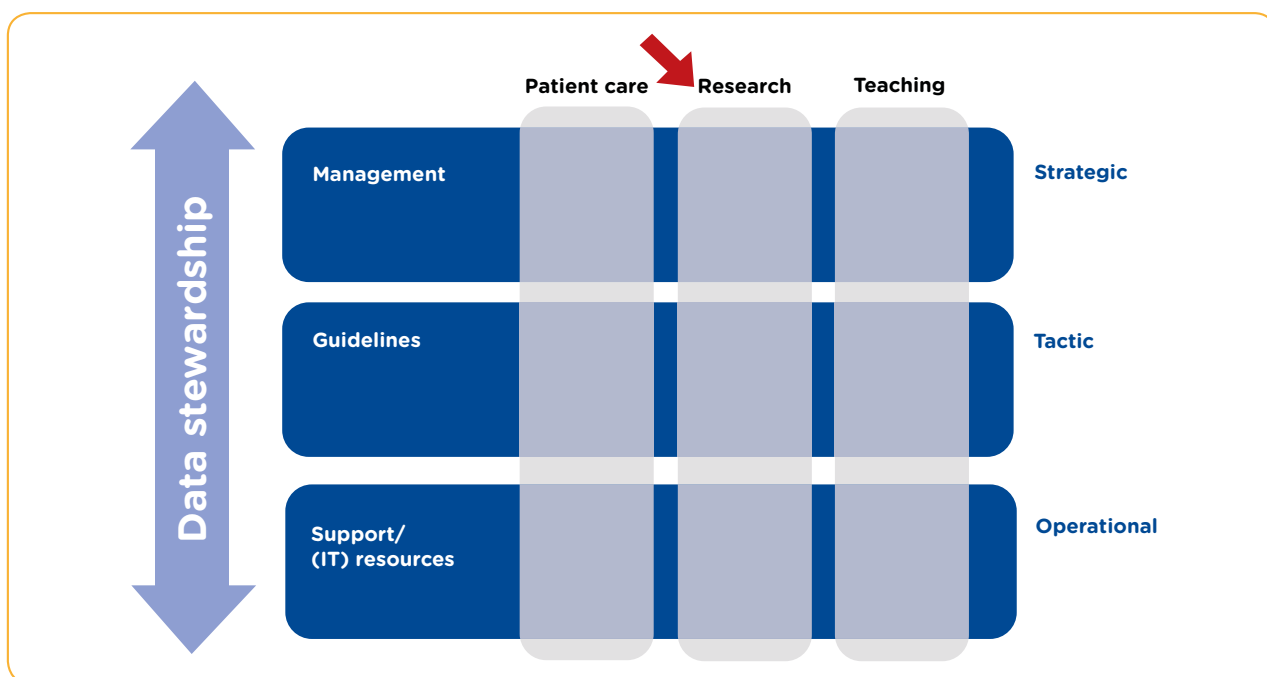
- Medical Delta
- KIC-Health (Innolife)
- Economie071

2.2 Vision for research support

Vision

LUMC works with extremely large and often complex datasets obtained through automated analysis equipment (genome sequencing, proteomics) and imaging (CT, MRI, electron microscopy and digital pathology). These datasets require storage, analysis and processing time (HPC). In addition, the outside world is increasingly placing requirements on how research should be conducted. Research needs to be carried out in a transparent (traceable and reproducible) manner, and data needs to be available for re-use.

Good data is essential for effective research, and legal requirements and rules regarding sources of funding have to be complied with. The introduction of data stewardship forms the basis for this.



LUMC is starting to introduce data stewardship within the field of research

Clearer control and management of data needs to enable implementation at the tactical and operational level. LUMC safeguards this control (governance) in the form of principles at the level of the Board of Directors. The basis for these principles is derived from the data management principles of the University of Leiden. To implement the principles, the right support and IT resources are required. When implementing data stewardship, an important role is assigned to Good Research Practice (GRP) and the FAIR principles. NFU HANDS¹ is responsible for guidelines and support for researchers.

Another important issue is the accessibility of support to researchers. There is plenty of knowledge within LUMC, but it is not easy to track down. A straightforward, approachable help desk specifically for research support would allow researchers to obtain support for all aspects of their research. The help desk should become operational during 2016.

The availability of good data is crucial for much research. Data collected during the care process needs to be re-usable for research. FAIR data is an important guideline in this regard. The introduction of a catalogue will help researchers find and access data.

Another important tool is the E-lab notebook, which ensures that all research in the LUMC laboratories is transparent and reproducible. This constitutes an important step towards meeting the demands of the community and compliance with legal and regulatory requirements.

Furthermore, the HPC environment at LUMC is being updated and expanded. The number of computing units is being expanded and the storage facilities are being replaced. The use of HPC will grow in the next few years, including by external parties.

The outside world has solutions in terms of ICT hardware infrastructure requirements. SURFsara is used to accommodate peak loads in terms of computing capacity. SURFsara is a logical partner for long(er)-term storage as well. When looking at supporting services such as authentication, authorisation and similar, SURFnet is considered to be the logical preferred partner.

Support for researchers is, to a large extent, located in the “Bio-statistics and Bio-computing” technology focus area. The ICT infrastructure falls under the responsibility of the ICT Directorate.

2.3 Organisational guarantees

In 2012, the Management Board had a strategic study conducted. It was titled Research IT. The organisation was asked for input on a number of topics. This led to a broad programme (Research ICT) with twelve projects to be carried out over the period from 2015 to 2018. The projects cover the following subjects:

- Combining methodological research with clinical applications, such as personalized medicine;
- Making research easier to carry out thanks to improved ICT applications and adequate support for researchers;
- Reproducible and transparent research;
- FAIR data and data stewardship.

Research Directorate

The Research Directorate (DO) is responsible for supporting scientific research policies at LUMC. This includes research profiles and organisation, research quality, collaboration, internationalisation, developing talent, integrity and research facilities.

Scientific committee

The Research Directorate supports the scientific committee and provides it with a secretariat. The scientific committee provides opinions on scientific research to the Board of Management both on request and on its own initiative.

Responsibilities of the Scientific Advisory Committee

- Advising the Executive Board about research matters, primarily with a view to promising strategic and subject matter developments.
- Periodically assessing the quality LUMC research, for which the CWTS citation analyses are one of the tools.
- Preselecting and assessing project applications.
- Advising and supporting LUMC researchers and bodies on research matters. The Scientific Advisory Committee specifically helps applicants to prepare and elaborate non-standard applications, such as for personalised support. Individual members of the Scientific Advisory Committee, in particular the Research Committee members who hail from the division in question, provide advice and support, and sessions are organised, such as practice interviews for VIDI and VICI grants

Graduate School (office)

The LUMC Graduate School facilitates admission and registration for future medical and biomedical PhDs.

Funding advice and support

Funding enables LUMC to finance additional research. The Research Directorate distributes relevant funding calls for proposals and provides information about the most significant funds. Further support is offered for some funding, e.g. Horizon2020, strategic collaborative projects (such as *Zwaartekracht*) and the *Vernieuwingsimpuls* (innovative research incentive).

Research support environments

Researchers go to external institutions when they require resources or knowledge that LUMC either does not have or which are only available in a limited supply. The help desk for research support needs to improve access to knowledge and resources in the outside world. Examples include the e-Science centre, BBMRI,

SURFsara etc. Research support needs to act as a hub in relation to the development of internal demand and internal and external supply. This enables individual researchers to determine the availability of internal and external resources for their research.

Research organisation

The organisational structure at LUMC consists of four divisions within which core tasks are carried out. These divisions are supported by directorates like Facilities Management, Communications and ICT. Research is conducted in all the divisions. Patient-related research is primarily conducted in the patient care divisions (1, 2 and 3), while pure research is concentrated within division 4. Division 4 includes both research departments and laboratories. Research itself is organised into research profiles² and is supported by the technology focus areas.

ICT organisation is largely centralised. This applies in particular to the network infrastructure, the data centre and the work stations at which medical applications are provided. Information managers are employed within the divisions and are sometimes supported by consultants. Research departments are home to extensive knowledge within their own departments. The specialist nature of the activities often renders this necessary. The research departments make joint use of general ICT resources such as high performance computing and storage.

2.4 Support scenarios

Ideal circumstances for researchers

Researchers at LUMC receive expert assistance when setting up a new research project. An electronic guide offers assistance with administrative issues and content and keeps researchers informed about legal requirements and LUMC and/or NFU rules. Using the guide enables researchers to quickly get in touch with colleagues about methodologies, power analysis, data management, data storage, etc.

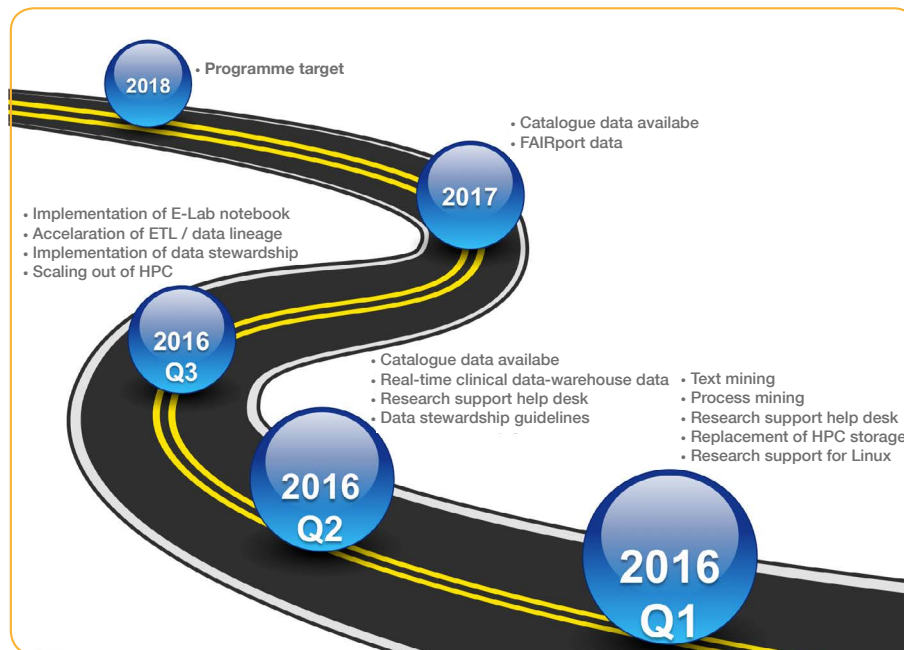
Researchers no longer need to spend time ensuring the mandatory level of quality required by the ICT systems under GPR. The standard ICT research environment at LUMC enables data to be stored safely, efficiently and on a long-term basis. This infrastructure can be used to easily escalate calculations (such as to SURFsara), make use of high performance computing, or access disk space if a lot of storage is required temporarily.

The doctor has a system enabling them to directly import or add research data. A research nurse can safely collect and review data in this system. Every user of this system is able to run their analyses (extraction), and all source and analytical data can be archived on a long-term basis.

It is simple for researchers at LUMC to find datasets for their own research. The central LUMC research registration system uses a catalogue to provide a rapid overview of all the datasets available within LUMC. On completion of the research, datasets are stored on a long-term basis.

2.5 Roadmap

The Research ICT programme is taking place from 2015 to 2018. Twelve projects have been set out in this programme as a means of achieving the following results:



2.6 Current situation of e-infrastructure and support

COMPUTING SERVICES	
Number of clusters within the institution	One cluster (managed by Human Genetics, close collaboration with ICT)
Total scope of computing power	600 cores (to be expanded to 1,000 in 2016)
Acquisition of computing services	Connection to SURFnet E-LAN so that peak loads can be accommodated by the SURFsara cloud.
STORAGE	
Capacity of centrally provided bulk storage	600 TB connected to the cluster
Capacity of centrally provided archives	1 PB long term and cost-effective storage
Externally purchased storage services	None
NETWORK	
Routed capacity (external)	10 Gbit/s
MSP capacity	Total capacity of 10 Gbit/s can be freely shared across configurable fibre optic connections.
AUTHENTICATION & AUTHORISATION INFRASTRUCTURE	
Connected to SURFconext Federation	Yes, but facilitating this on the cluster is also desired, as is the option to change authorisation via group memberships

The central ICT department at LUMC works closely with the various research groups. However, there is still much work to do and on many fronts. The contrast between patient care and research plays a part in this: on the one hand, there is a need to work as safely (and therefore restrictively) and reliably as possible (for patient care), while on the other hand there is a need for maximum flexibility (for the purpose of research). The e-infrastructure for research within LUMC occupies the middle ground between the two.

High performance computing

The Human Genetics department has a well set-up high performance computing cluster. This cluster has around 600 computing units³ and 600 TB rapid storage. This cluster is used widely across LUMC. Other LUMC departments can use this cluster on the basis of participation, which means that these departments make the budget available to add further workstations. As a result, the size of this cluster has grown considerably, while other computer clusters within LUMC have shrunk in size. This cluster is used for both clinical and research purposes.

A few years ago, there were still three to five departments within LUMC with their own clusters. By 2015 there was only a single HPC cluster remaining.

The capacity and support for the LUMC HPC cluster have a magnetic effect. All the inputs for HPC computing are concentrated on this cluster. Within the Research ICT programme, we are now looking at how the management thereof can be professionalised and its continuity guaranteed. Collaboration between ICT and bio-information specialists is required in order to gain maximum benefit from each other's knowledge.

Storage

The HPC environment is linked to fast storage with a capacity of approximately 600 TB. This storage is only intended for the period during which researchers process the data. Additionally, cost-effective storage of 1 PB is available for longer term and ongoing research that does not need computing power. The aim is to keep the internal cost of this storage below 80 euros per terabyte per year. To keep better control over the data, consideration is being given to rebilling HPC storage costs to users. The idea behind this is to encourage researchers not to make unnecessary copies and to manage their data with more awareness. The central ICT department manages the storage.

Network infrastructure

The network infrastructure is continually being adapted to meet research requirements more effectively. This is always done while making sure to maintain the secure and reliable provision of information for patient care. The ICT infrastructure for research is not connected to the patient care infrastructure. Much more flexibility can be offered across both the resource network and research network. This model will be upheld. The most important challenge is to set up authentication and authorisation. The flexibility in these networks allows for non-standard workstation installations (hardware and software) and access through firewalls.

In 2014, the internet connection was upgraded to 10 Gbit/s. In 2015, the first steps were made towards installing a 100 Gbit/s backbone.

Data stewardship

It is extremely important to have good quality data available for research purposes. Data re-use, data collection, data analysis and ETL processes require tooling and data governance and management in order to manage and control the data in accordance with collaborative approaches, agreements and working practices. The Handbook for Natural Adequate Data Stewardship (HANDS) is being developed under the NFU programme Data4lifesciences. LUMC coordinates the setup of its own processes with this data stewardship. Another important development is the introduction of data management at the University of Leiden, which forms the basis for the management and control of data generated in research projects at LUMC.

Knowledge, support and multidisciplinary collaboration

Although there is a lot of knowledge within LUMC, it is often restricted to a specific area of knowledge or technology. This means that there are many different points of contact and help desks, but no sense of coherence to any of it. This makes it difficult for researchers to find the right information, leading to frustration on the part of researchers and a risk of research being executed without maximum effectiveness.

The following help desks and contact points are available:

- Study Setup Help Desk
- Sequencing Analysis Support Core (SASC)
- Leiden Genome Centre for Technology (LGTC)
- Bio-informatics Centre of Expertise (BCE)
- Statistics
- BI Unit (Business Intelligence)
- GRP
- Medical Operations Research
- ICT service desk

The philosophy is that existing help desks are entitled to remain in place, but that collaboration must be improved. Researchers must be able to ask questions at a single point of contact. This point of contact must also ensure that the researcher receives a response to their question.

Training and education

Training and education for researchers is largely outsourced by LUMC to Boerhaave Cie. This falls under the Directorate for Teaching and Training.

1) *NFU HANDS:*

<http://data4lifesciences.nl/hands/handbook-for-adequate-natural-data-stewardship/>

2) *LUMC research profiles: <https://www.lumc.nl/research/medical-research-profiles/>*

3) *In 2016 growing to approx. 1,000*

3. SUPPORT FOR RESEARCH AT EUR

EUR

(figures: 2014)

Scientific staf

2,823

Number of academic staff

478

Number of PhDs

349

Number of students

25,000

Number of auxiliary staff

978 (of whom 252 are for ICT)

Scientific publications per year

5,495, plus 931 subject publications

Areas of activity

Impact and relevance

3.1 Introduction

Brief description of the institute

Founded in 1913, Erasmus University Rotterdam (EUR) is ranked third among universities in the Netherlands and 72nd in the World University Rankings published by The Times. EUR's scientific research is rooted in international research networks and is strongly socially oriented. Research at Erasmus University Rotterdam is multidisciplinary in style, and focuses on the following disciplines:

- health: from molecules to humans to society
- welfare: sustainable economic growth
- management: the organisation of companies and society
- culture: media, happiness and identity in modern urban society

In 2014, EUR participated in 56 research projects under the EU's Seventh Framework Programme. The Erasmus Medical Centre (Erasmus MC) is among the

ten best medical institutions in Europe (QS World University Ranking 2014). It participated in 165 of the European Commission's FP7 projects. For the EU's new

Horizon 2020 Programme, EUR submitted 224 research proposals in 2014, of which 135 were for the Erasmus MC. Around 21% of the proposals were accepted, a score that is far above both the European and the Dutch average.

3.2 Vision for research support

The aim of research support can be derived from the aims formulated for research in the EUR's strategic plan (www.eur.nl/fileadmin/ASSETS/smc/mt/EUR_Strategie_2018_UK.pdf) for 2014-2018. Research support is established in order to provide support for studies that involve international collaboration, seek to make a scientific impact, and are socially relevant. This calls for efforts to maintain scientific integrity, support international collaboration and disseminate research results. In addition, research must comply with legal requirements, codes of conduct and demands from those who finance the research. The contracts between research partners (both public and private) also need to be fulfilled.

Research support is provided as an embedded, integral service throughout the course of the research cycle. Research support needs to provide researchers with freedom by relieving them of all tasks other than the research itself by optimising the allocation of research funds and simplifying research tasks. With regard to the latter, suitable infrastructure, software and tooling are utilised and policies and guidelines are developed where required. Finally, support is increasingly being offered for accessing, aggregating and combining and analysing data.

Vision

Relieving researchers of this burden can only be achieved with effective cooperation and by taking the needs of researchers and the research process as the starting point. The EUR frameworks are systematically involved and provide the central services with guidelines and contracts in order to give researchers the necessary clarity (see the references at the end of this chapter for more information). The faculty's research support service is the first point of contact for researchers. This service helps researchers on the basis of thorough knowledge of the research discipline, the type of research and strong relationships with researchers. People help each other to resolve issues within the faculty research support network. When necessary, faculty research support escalates rapidly to include the relevant services at the university. This means cooperation with the Erasmus Data Services Centre, the University Library, the University IT Services Support Centre, Legal Affairs and Academic Affairs. There are a number of bodies (Collegiate Group for Research Support (*Collegiaal Overleg Onderzoeksonder-*

steuning), the Research Directors' group, the deans' committee and the RM group) where the different parties agree on structures with one other.

Depending on their question, researchers may seek support from faculty support or central support. The faculty research support staff and demand managers keep a record of which services and products are needed. This leads to solutions for individual researchers, a faculty or research group, multiple faculties or research groups (at university-wide or inter-university level).

Research support at EUR is organised around the following topics (see also the website 'Research Matters': www.eur.nl/researchmatters/training_support/)

- Funding (including grant support) and prestige
- Publishing and impact
- Research data management
- Open access
- Training and support (e-learning modules, workshops and manuals): www.eur.nl/ub/en/trainingsupportportal_en
- Research information system

The following organisations provide specific customised services within research support

- The Erasmus Behavioural Lab: www.irim.eur.nl/research-support/erasmus-behavioural-lab-eb/
- The Erasmus Data Service Centre: www.eur.nl/ub/en/edsc/
- Academic Services, University Library

The Erasmus MC is currently reorganising research IT by setting up the Storage, Compute & Services Group. This group will set up support and services, including storage and computing capacity (approx. 600 cores, 4+ TB memory, 2 PB storage, 2 PB tape archive). This infrastructure will become available at Erasmus MC in 2016. Detailed arrangements about access to these services are currently being agreed.

Organisational guarantees

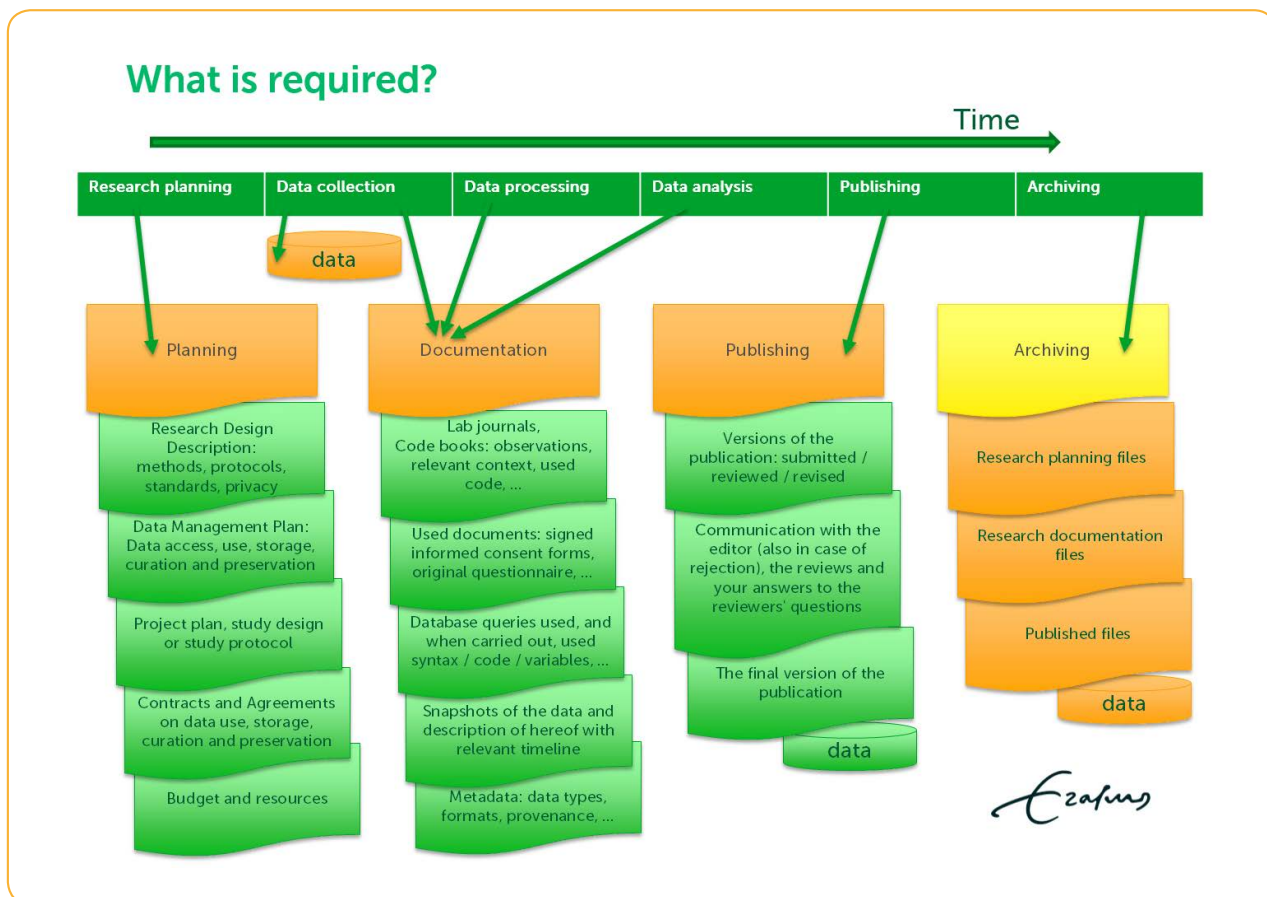
The Executive Board has set out its vision for research support in the strategy for the EUR. The tasks are distributed across the directorates for Academic Affairs (research policy), Legal Affairs (policy, guidelines and contracts), University Library (research data management, grant support, impact measurement, training), ICT (processes, services and infra) and ERBS (valorisation). A vice-rector is responsible for managing the content of research support. The following administrative staff are responsible for various aspects of this vision:

- Supply management: Data Protection Administrator
- Integrity Officer
- Chief Information Security Officer
- Data Librarian
- Bibliometric Practitioner

To support large-scale research demands, a review process has been set up under the name FLAT check. The financial, legal, administrative and technical aspects of requests from researchers are evaluated under this process.

Example: RDM

The aspects able to be provided by the various central services and faculty support team are presented for RDM. The plan shows the phases of research where documentation is required at the minimum. The plan is part of the EUR RDM baseline protocol. This is currently a policy document in the management decision-making process.

**(Inter)national examples**

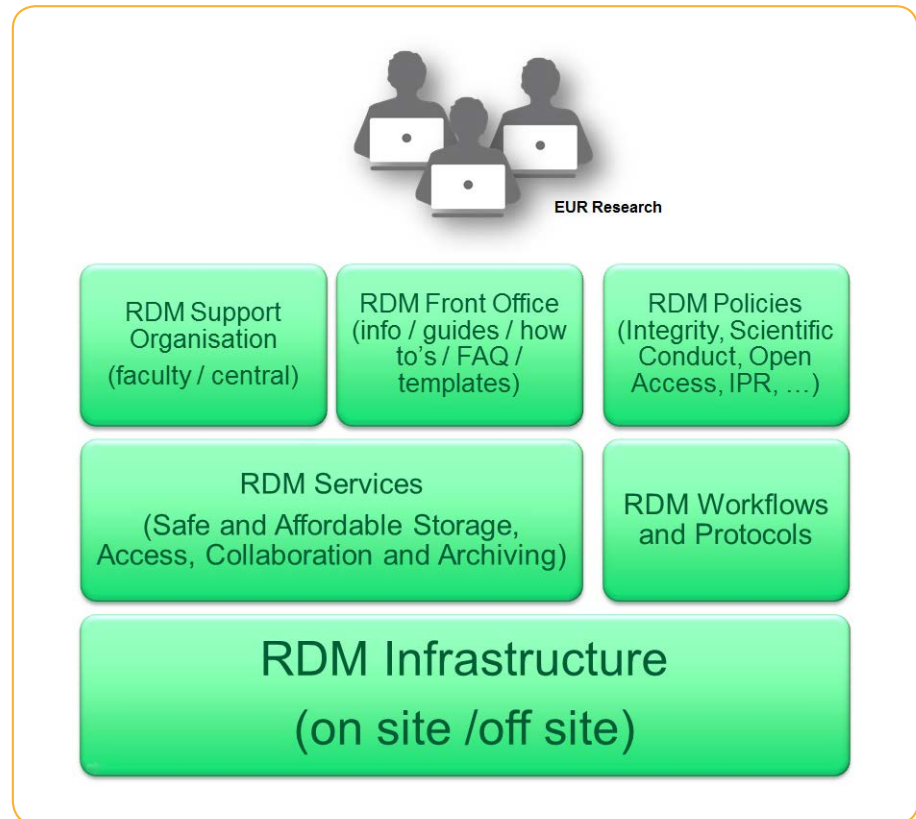
The EUR draws inspiration from the following examples of research support:

- DCC (www.dcc.ac.uk/)
- ANDS (www.ands.org.au/)
- CERN (<http://home.web.cern.ch/>)
- DANS (www.dans.knaw.nl/nl)
- UCL (<https://www.ucl.ac.uk/>)
- Harvard, Cambridge and Oxford
- Dutch universities, where RUG plays a pioneering role both on the legal front and in the field of research IT,

Two RDM maturity models provided inspiration: The Australian National Data Service (ANDS): <http://ands.org.au/guides/dmframework/dmf-capability-maturity-guide.html> and the extended version of ICPSR, a department at the Institute for Social Research of the University of Michigan: <http://rdm.ischool.syr.edu/xwiki/bin/view/CMM+for+RDM/WebHome>.

Research support environments

For researchers, research support starts in the faculty. See below for the support model for research data management:



3.3 Support scenario

The Erasmus Data Service Centre (EDSC) is the most important starting point for researchers and students for support for data-intensive research. The EDSC helps researchers to select relevant databases and offers training in the use of financial and social sciences databases (for example CBS, Bloomberg, Wharton). The EDSC staff provides support when selecting the correct data and when downloading and merging the data. The EDSC also provides services in the areas of data curation, data storage and data archiving, and more generally in drawing up data management plans. In 2014, a total of 29 workshops were organised and 752 people were helped individually.

When providing support in the area of research data management, the following key questions are of key importance:

1. Is the research is being carried out as a national or international partnership? (important due to differences in legislation)
2. Is this a collaboration between academic institutions or a public-private initiative? (important because of different interests)
3. Is sensitive or confidential data being used as part of the research? (important due to privacy laws)
4. Does the research provide information or products that will be available through open access, valorised or both? (important due to legal consequences arising from different interests)

5. Is infrastructure required for the processing, analysis and storage of data beyond that which is usually found in the workplace? (important due to the technical and legal consequences relating to outsourcing and privacy)
6. Is there likely to be manual data processing using software or is it automated based on scripts? (important due to the technical and legal consequences of outsourcing and privacy)

We can see that there are general research support requirements in conjunction with submitting research proposals, legal aspects of the research (IPR, copyright, contracts) and support for data aggregation and analysis.

3.4 Current situation of e-infrastructure and support

E-infrastructure

The faculties themselves do not have any research e-infrastructure; they acquire these services from DANS and SURF. EUR facilitates and supports this access.

COMPUTING SERVICES	
Number of clusters within the institution	No HPC computing services, but there are RDS clusters and VMWare
Total scope of computing power	-
Third-party clusters within the institution	-
Acquisition of computing services	-
STORAGE	
Capacity of centrally provided bulk storage	300 TB and scalable
Capacity of centrally provided archives	100 TB and scalable
Externally purchased storage services	SURFdrive
NETWORK	
Routed capacity (external)	Now: 10 Gbit/s + 1 Gbit/s (back-up) Future (mid-2016): 2x 10 Gbit/s
MSP capacity	None
AUTHENTICATION & AUTHORISATION INFRASTRUCTURE	
Connected to SURFconext Federation	Yes
Other AAI supplier	No

RDM services support the following research scenarios:

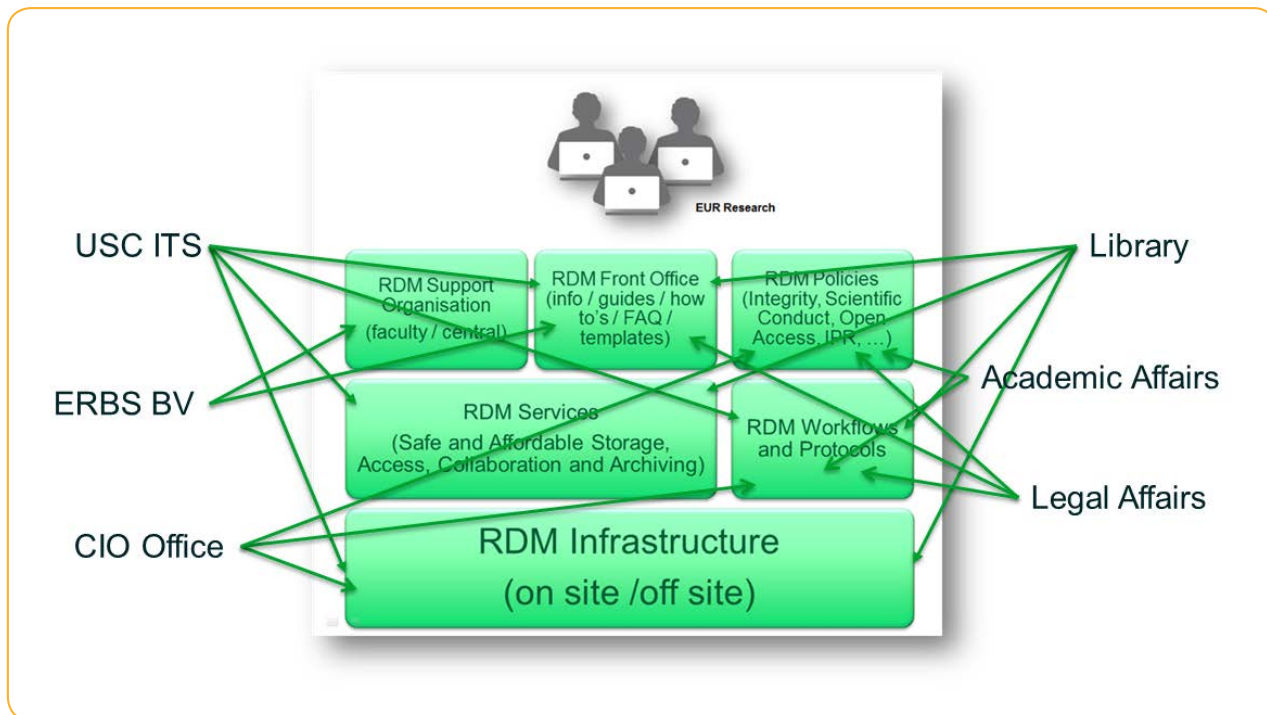
(META)DATA STORAGE AND BACK-UP FACILITY SCENARIOS	CURRENT SERVICES FOR THE EUR
1 For daily practice with data	@wEURk workplace and network storage
2 For daily practice with large datasets	@wEURk workplace and network storage
3 For daily practice in collaboration with researchers from other universities	SURFdrive Dutch cloud service for safe and secure file sharing
4 For daily practice in collaboration with researchers from other universities	DANS Dataverse Dutch web based service for storing and accessing live datasets
5 For daily practice (calculation) in collaboration with researchers from other universities	SURFsara Dutch based High Performance Computing services.
6 For VSNU required long term storage of data and datasets	DANS EASY Dutch web based dataset archiving service

Relationship with SURF for research support

EUR uses a number of SURF services alongside the normal acquisition of infrastructure and software licences: SURFdrive and SURFsara (the computing cluster LISA, HPC Cloud and Cartesius). Within EUR, the University Service Centre for IT Services (USC ITS) provides technical support, while the University Library provides functional support. In a similar way, EUR purchases services from DANS (Dataverse and DANS EASY).

Organising support

The University Library is responsible for training and advice with regard to research data management. Academic Services provides research impact studies, instructions and programmes for data management. The University Library is jointly responsible with USC ITS for providing services for secure storage, archiving and retention of research data. Erasmus Research & Business Support (ERBS) BV focuses on the valorisation of research. Legal Affairs is responsible for the legal aspects of research (such as contracts and ownership of data). Academic Affairs is responsible for policy and guidelines in the field of research. The CIO Office is responsible for the architecture of the EUR infrastructure and related services along with the design of the associated processes.



New roles within the organisation

The Executive Board has appointed a Research vice-rector who is to coordinate research support within EUR. New roles are being created at the University Library and in the faculties: data stewards, data librarians, bibliometric researchers and legal advisers. Faculties are also appointing legal advisers to draw up the various contracts and agreements. If the European privacy directive comes into force, EUR will also appoint a data protection officer. The role of the Chief Information Security Officer has grown over the last few years.

Training and education

The University Library provides a portfolio of short videos, sample contracts and explanatory texts. These modules cover elements within the research cycle (explore, search, evaluate, manage, integrity, publish). They can also be used individually. For more information, consult the training and support portal:

www.eur.nl/researchmatters/training_support/

3.5 Points of interest

1. Integrate the research support services in a way researchers can easily use them because they match the different research workflows.
2. Providing support during research projects (especially support during data creation and analysis) is still not up to par. Aspects to consider include robust and trustworthy infrastructure, easy to use collaborative platforms, tailored-to-research-IT-support, metadata schemas (for machine access, a prerequisite for FAIR data (<https://www.force11.org/group/fairgroup/fairprinciples>)), support of specialist software, algorithms and queries (eg. versioning, maintenance). It requires advanced cooperation between the various service providers and governance of this collaborative research support.
3. The different guidelines, protocols, workflows and model clauses still remain to be defined in contracts and agreements yet, while at the same time the legal context itself changes steadily. For instance in the case of data protection and privacy. Adequate training and awareness programs (message: what are the relevant issues for you and where to get support to solve them) are needed to facilitate researchers.

All institutions are addressing more or less the same topics. This is why it seems obvious that we should not only be collaborating within the institutions with the parties listed above, but working more efficiently between institutions, SIGs, specific working groups and service providers like SURF and RDNL wherever possible. The National Coordination Point for Research Data Management (VSNU / SURF) can play an important role in this respect.

3.6 References

For more information about the policy frameworks, see for example: Regulations governing the use of internet and IT facilities for staff members at Erasmus University Rotterdam (effective 1 September 2015).

This policy contains statements on many topics closely related to RDM, including the following:

- protecting personal data processed at EUR, e.g. that of EUR staff members, students and parents;
- protecting confidential information, i.e. that of EUR, EUR staff members and students;
- protecting the intellectual property rights of EUR and third parties, including respecting licence agreements that apply at EUR.

For EUR policies related to research, see also:

www.eur.nl/researchmatters/rdm/rdm_policy/

4. SUPPORT FOR RESEARCH AT MUMC+

MUMC+

Scientific staff

1,290

Number of academic staff

173

Number of PhDs

772

Number of students

4,507

Number of auxiliary staff

594

Scientific publications

per year

2,114

4.1 Introduction

Maastricht University Medical Centre+ (MUMC+) is a collaborative association between Academic Hospital Maastricht (azM) and the Faculty of Health, Medicine and Life Sciences (FHML) at Maastricht University (UM). MUMC+ is renowned for its focus on prevention; this is why there is a '+' behind its initials. MUMC+ not only looks at restoring the health of patients, but at supporting and promoting health in general. In addition to top clinical and top referral patient care, the core activities of MUMC+ are scientific research and teaching/training. MUMC+ is known for its multi-disciplinary and problem-oriented approach. MUMC+ has 715 beds, around 7,000 employees and 4,000 students. The strategy at MUMC+ is set out in the paper Strategy for Healthy Living 2020: www.mumc.nl/sites/default/files/gezond_leven_strategie_2020.pdf (source: www.gezondidee.mumc.nl/gezond-leven).

4.2 Vision for research support

The vision at MUMC+

Thanks to rapid advances in the field of IT, researchers are increasingly looking for professional support for their research. In addition, there is an increasing number of requirements to comply with in conjunction with legislation and sources of funding. When applying for funding, it is now essential to provide a data paragraph or data management plan (DMP). The integrity of scientific data is always under the spotlight. Scientific research must provide FAIR data (Findable, Accessible, Interoperable, Re-usable). The data also needs to be able to be replicated from source back to raw data and should be available in order to verify the research. The aim is to re-use data more frequently. This also means more standardisation (e.g. HL7CDA, SNOMED CT in the clinic).

In the face of more and more requirements, researchers are increasingly calling for the establishment and development of professional support departments within their own organisation. Alongside support for data management, there is also a demand for a professional data centre. This would be a data centre where data is managed securely (in environments with multiple certification) and safeguarded by means of a governance structure. In the next few years, MUMC+ wants to define this data centre more thoroughly, including research infrastructure and architecture.

The future: a single help desk to facilitate research

MUMC+ wants to set up a professional research facilitation department or institute over the next five years. This would be a department where all researchers can find answers to their questions and fosters successful collaboration. By offering central support for data management and data storage, researchers will be able to focus on their primary activities: collecting, analysing and processing research data. Findings from other research colleagues become available through best practices. MUMC+ is also looking at collaboration with regard to the provision of support from outside the institution, e.g. PSI, CTMM TraIT, SURF, NFU, etc.

MUMC+ has drawn up plans for research infrastructure that supports the various technological applications and facilitates smart data management in a secure environment. The Research IT project group is creating an inventory of requirements from scientists and clinicians in the field of IT infrastructure for research and personalised medicine. MUMC+ is working on the development of highly secure, sustainable and scalable IT infrastructure as part of three pilot projects. A data centre is being set up with the task of providing secure data storage and guaranteeing secure data access to (privacy-sensitive) research data.

Research support environments

MUMC+ has advanced technology available for both patient care and research. However, the infrastructure has not yet been sufficiently integrated. This means that the infrastructure cannot be fully exploited. Therefore, MUMC+ wants to develop integrated infrastructure for 'shared resources' for patient care, research and teaching. As such, the current reality of 'decentralised, unless' is being transformed into 'centralised, unless'.

(Inter)national examples

MUMC+ gains inspiration from the following examples:

- E-science
- CTMM-TraIT
- Data4lifescience
- Parelsnoer
- BBMRI
- Ernst-Moritz-Arndt-Universität Greifswald [AnMor]
- Charité - Universitätsmedizin Berlin

Support scenarios

Ideal circumstances for researchers

Researchers at MUMC+ receive expert help. It starts with formulating a data management plan (DMP), which helps to coordinate all aspects of research data management - including data handling - during and after the completion of a research project. It also helps when calculating the research budget. The focus is on reproducible, verifiable data which is accessible and may be available for reuse, including for studies in other research domains. Research datasets linked to publications that meet all applicable requirements of the funding body, legislation and the organisation itself (code of conduct). When drawing up a DMP, attention is also paid to aspects such as the use of validated surveys, standards, metadata, pseudonymisation, anonymisation and informed consent.

The available Research IT infrastructure is certified and provides data management tools of a sufficiently high standard to deliver this. Support with data collection, clean-up, management, analysis and archiving is also available as a matter of course. Research data is stored separately to privacy-sensitive data. With the right approvals, it is also possible to pseudonymise data twice and link to external sources and research.

The processes regarding informed consent have penetrated through to the very roots of the organisation. This helps to improve the (re)-usability of the data. The entire Research IT infrastructure is set up around the FAIR principle, open access, working with big data and readiness for the rapidly emerging technologies related to eHealth.

4.3 Current e-infrastructure and support situation

COMPUTING SERVICES	
Number of clusters within the institution	Two (of which one is centrally managed)
Total scope of computing power	17,348 cores
Third-party clusters within the institution	One life science grid cluster
Acquisition of computing services	Yes, the M4I institute has an agreement with Jülich regarding the use of the JURECA cluster; Jülich Supercomputing Centre (JSC) cores: 45,216
STORAGE	
Capacity of centrally provided bulk storage	1 PB
Capacity of centrally provided archives	None, but in the plan for 2016
Externally purchased storage services	Hospital purchases external storage
NETWORK	
Routed capacity (external)	10 Gbit/s
MSP capacity	10 Gbit/s
AUTHENTICATION & AUTHORISATION INFRASTRUCTURE	
Connected to SURFconext	Yes

E-infrastructure

- Networks;
- Life Science Grid (LSG) via SURF; MUMC+ uses this to expand its computing capacity for peak loads;
- A number of researchers have their own decentralised/dedicated computing capacity;
- A number of researchers use (inter)national computing capacity.

Storage

- Researchers can make use of general storage solutions within azM and UM;
- There is a central scalable research storage cluster;
- A large number of researchers have decentralised data storage facilities;
- A number of researchers use (inter)national facilities for data storage.

One point of concern is the cost of data storage, especially in the context of changing requirements for retention periods.

Bandwidth

The internal networks and connectivity with external networks offer restricted performance only. Upgrading is necessary, but it is not yet clear where we need to begin or what the costs will be.

Firewalls, authentication and authorisation

MUMC+ still uses two separate Microsoft active directories, and there is no central solution for the multiple Linux environments. Regular use is made of SURFconext. Single sign-on implementations occur sporadically and are only focused on internal services.

Organising support

There are system engineers and information managers working in the faculty and in the units responsible for results. In the research departments, it is often colleagues who provide support (for content). In addition, a number of specific support departments specialise in the research process.

The following support departments are active within MUMC+:

- **MEMIC**, the centre for data and information management, facilitates the entire process of data collection, information management and knowledge discovery. MEMIC is a source of content expertise in the area of data management, and acts an intermediary between researchers and IT. MEMIC has provided support in the preparation of data management plans (DMP) since 2015; see <http://memicmaastricht.nl/>.
- **CTCM**, the Clinical Trial Center Maastricht, is a partner for clinical research. CTCM provides professional support for people-based research. See www.ctcm.nl/.
- **MIT**, the Staff Directorate for Medical Instrumentation and Information Technology, facilitates the organisation of azM with regard to management and innovation in the field of IT and medical equipment.
- **ICTS**, the ICT Service Centre for UM, is responsible for the ICT infrastructure of Maastricht University.
- **UB**, the University Library of Maastricht University. The university libraries are always seeking more ways to facilitate support for research. Since February 2015, the programme manager for research support at Maastricht UB has been the Chairman of the Netherlands Dataverse Network (DDN) Advisory Council.

Collaboration (internal/external)

Researchers work in close cooperation, especially in (inter)national groups. Within MUMC+, an increasing amount of inter-faculty research is being undertaken. There is also plenty of collaboration on multi-centre research projects outside the researchers' own organisations.

Training and education

Alongside training in epidemiology and statistics, training that deals with data management and data integrity during research would be beneficial at UMC. Effective data management is more than just using a particular tool or facility. Only good quality, reliable data is suitable for re-use.

4.4 Agenda for research support

The ICT services at MUMC+ are distributed across several organisations and struggle with a relative degree of obscurity. In addition, users consider the threshold to be too high when seeking practical information. Many researchers therefore arrange for their own support.

Collaboration is essential. This includes beyond the boundaries of one's own institution, such as the following:

- Archiving: SURF
- National Trusted Third Party (TTP): investigate whether a national professional TTP for research by UMCs needs to be created

If we want to share data with one other, this requires the harmonisation of processes and IT systems. Transparency is required here, so that we can share information and learn from best practices.

We link all of the support organisations to one another by creating a support community and channelling research queries. Every linked institute appoints an information manager who acts as an intermediary between the internal organisation and external providers.

Other points of interest:

- **Codes of conduct and laws and regulations.** We draw on the knowledge of the Legal Affairs department at the UM. Researchers have to comply with various codes of conduct and laws and regulations for practising science (VSNU, WMO, WBGO, CBP) and for storing and using personal data, for example in an EPD (electronic patient dossier).
- **Data ownership.** Researchers often wonder who the owner is of the data collected for a particular research project. Under the scope of the Database Act, the researcher is the producer of the database. In the future, ownership will need to be clarified. This topic is probably also on the agenda at other UMCs.
- **EU legislation.** Scientific research is governed by EU legislation. The EU promotes (H2020) measures to make both data and scientific articles available. For this, attention needs to be paid to the exchange of personal data across national borders.
- **Own research codes** (plus retention periods). Both the UM and MUMC+ have their own research codes. The retention periods vary. MUMC+ and researchers follow the stricter research code of Maastricht UMC+ (see brochure on MUMC+ research code: http://crispmaastricht.nl/?page_id=401)
- The **Netherlands Code of Conduct for Practising Science** (*Nederlandse Gedragscode Wetenschapsbeoefening*) (VSNU) sets out five principles: Honesty and carefulness, trustworthiness, accountability, lack of bias, independence and responsibility.
- **UM Data Management Code of Conduct.** Researchers must ensure that their research data is sufficiently defined, archived and made available for other researchers. This must be done using (infrastructural) resources over a sufficient period of time (minimum ten years after the last publication).
- **Privacy.** When collecting or re-using data, the privacy of the respondents must be protected. Researchers must document the process so that it can be replicated. The approval of the owner of the data is required for the re-use and/or combination of data sets.
- **GCP.** MUMC+ endeavours to ensure that all researchers obtain the certificate of Good Clinical Practice (GCP). This also applies to data managers for the support departments.
- **Standards and validated questionnaires.** To increase the ability to exchange and link data, more work needs to be done with standards (for example HL7). In addition, preference needs to be given to validated questionnaires.
- **Biobanks and images.** The Biobank has its own data management infrastructure; this is actually a type of long-term archive. There are separate requirements and storage options for stored images. We need to study these more closely.

5. SUPPORT FOR RESEARCH AT TU DELFT

TU DELFT

(Organisation in 2014)

Scientific staff

2,700

Number of academic staff members

270

Number PhD students

991, of which 25% are women

Number of doctorates awarded

371

Number of students

19,600

Scientific publications

5,139 of which 24% are open access publications

Number of auxiliary staff

738

Areas of activity

Research priorities from disciplines in science, engineering and design with a connection to social issues:

- health
- energy
- globalisation
- infrastructures and mobility

5.1 Introduction

TU Delft offers the widest range of engineering sciences in the Netherlands. Scientists work and think in a multi-disciplinary environment that combines science, design and engineering. These three approaches are present in different ratios across eight faculties. The student population is growing fast: In 2014 there were 19,613 students and nearly 2,700 scientific staff associated with the TU Delft. Scientists are carrying out groundbreaking technical/scientific research at an international level. TU Delft supports a number of (rapidly growing) areas by (virtually) bundling research capacity in a number of university-wide institutions: the Climate Institute, Process Technology Institute, Robotics Institute, Transport Institute, TU Delft Safety & Security Institute DSys, Space Institute, Sports Engineering Institute, and Wind Energy Institute (DUWIND).

TU Delft links its scientific profile and social position by organising the potential of its research into what are called Delft research-based initiatives. These initiatives engage with major issues in society: health, energy, globalisation and infrastructures and mobility. Each of the Delft research-based initiatives seeks to make a scientific contribution to finding solutions for issues in society through multidisciplinary collaboration. In addition, TU Delft invests in substantial participation in the top sectors.

TU Delft develops strong alliances with other leading universities on the basis of academic research. Examples of this are alliances with the University of Leiden and Erasmus University, the 3TU.Federation and the European Idea League. TU Delft is represented in European university networks, as well as the European Universities Association (EUA) and the Conference of European Schools for Advanced Engineering Education and Research (CESAER).

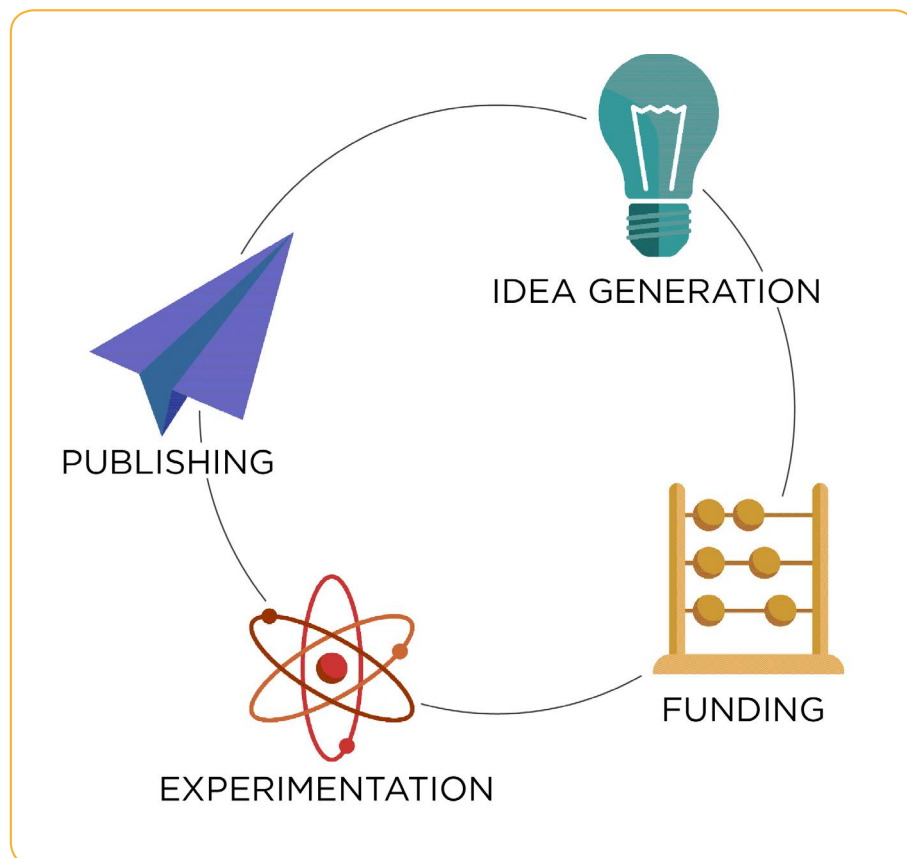
5.2 Vision for research support

The scientific world is evolving rapidly. Researchers are becoming more demanding about all aspects of the research process. Today's researchers want efficient, excellent basic processes and innovative and flexible customisation. This includes a need for centralised and integrated provision of support.

How can institutions and their university services assist researchers as effectively as possible? All university services at TU Delft strive to provide excellent support for the university's mission. To do so, the university services have set out the following goal: to provide a single integrated service from all the different support services – a one-stop shop for all research-related support questions. This enables researchers to go to a single location with their questions. They therefore do not need to spend time learning about the structure of the various services. A common approach enables university services to support researchers through all phases of the research process, from funding to publication. This means that researchers benefit in terms of time, personal availability and quality in their research.

The research lifecycle serves as the guiding principle for research support at TU Delft (Research Support Services in UK Universities, RIN report, October 2010). This cycle consists of four phases:

1. idea discovery: the development of new ideas, projects and proposals;
2. funding: seeking and securing funding;
3. experimentation: experimentation and carrying out the research;
4. dissemination: publishing research findings and ensuring scientific, social and economic valorisation.



The model helps to keep the focus on the research process and makes it possible to link activities and trends to it. This also helps the library or university services to develop new products. Good IT infrastructure is crucial for most of the activities in the four stages.

International inspiration

The idea of integrated research support is inspired by a number of English-speaking universities, including Queensland, Brisbane, Oxford, Warwick and Sydney (www.library.uq.edu.au/research-support, www.admin.ox.ac.uk/researchsupport/, www2.warwick.ac.uk/services/rss/, www.sydney.edu.au/research.html).

A comparison with the approach taken by these universities highlights those services which could be better supported at TU Delft, e.g. internal funding referrals, research profile management, explicitly specifying ethical aspects, research contracts, costing and pricing, and measuring the impact of the research and trends in scientific publications.

In developing its model for research support, TU Delft reviewed international developments and, more importantly, consulted its own users. To gain insight into the actual requirements of science, design and engineering researchers, the TU Delft Library conducted a requirements survey among the target group. The survey revealed that Delft researchers require a clear overview of the support services via an online portal. They also need personal contact. This applies to all fields of research. Research support was redesigned on the basis of this study.

Support scenarios

Making research data available to reviewers and researchers

John-Alan Pascoe, doctoral student at the Faculty of Aerospace Engineering at TU Delft: "It is a major benefit to be able to upload my research data to the 3TU.Datacentre as soon as I have submitted a publication to a publisher. This publication refers to a dataset that has been given a digital object identifier (DOI). That means that the reviewer can browse the dataset when assessing the article."

Direct link to datasets

When Pascoe uploads the data to the data archive at 3TU.Datacentre, the datasets are allocated a DOI. This makes it possible to refer to the data and track its usage. Once the research data has been uploaded to 3TU.Datacentre, John-Alan can refer to it in the publication that he submitted to the journal *Engineering Fracture Mechanics*. This then enables the reviewer for that publication to view the dataset when they are reviewing the article.

The process from laptop to the 3TU.Datacentre

Pascoe selected both the raw data (fracture length, power and movement) and the derived data (such as the rate at which tensile energy is released) used in his article for publication. He converted the data into standard exchangeable file formats with clear headers and added information about the data. Then he uploaded the data to the 3TU.Datacentre and was given a DOI. After that, he was able to link the data to the publication he submitted to *Engineering Fracture Mechanics*.

5.3 Current research support and e-infrastructure

Research Support@TU Delft is a catalogue of nearly one hundred services sorted according to the phase in the research lifecycle. It is effectively a one-stop shop where researchers can ask all their questions about research support. The user can choose from a list of user actions in the sequence of research activities. The most important access route to the portal (researchsupport.tudelft.nl) is the 'guide' that takes the place of a search engine. The portal includes all the services available from each of the support services at the university. The sub-organisation offering the service only becomes apparent after locating it. The portal also refers to tools from suppliers or other institutions.

The screenshot shows the TU Delft Research Support Portal. The header includes the TU Delft logo and the text 'RESEARCH SUPPORT PORTAL'. Below the header is a search bar with the text 'I am looking for' and a magnifying glass icon. The main content area is divided into a grid of categories: IDEA GENERATION, FUNDING, EXPERIMENTATION, and PUBLISHING. Each category has a corresponding icon and a list of services. The 'Make your Data Management Plan' section is expanded, showing detailed text about data management plans and a list of links.

Category	Service	Details
IDEA GENERATION	Online collaboration	Make your Data Management Plan
	Manage & archive your research data	Set-up a Data Lab
FUNDING	Get technical and laboratory support	Do it yourself - store your datasets
	Get ICT support	Do it together - store data collections
EXPERIMENTATION	Organising events	Obtain a DOI for your datasets
	Advice on patents	Publish your data in a data journal
PUBLISHING		

Make your Data Management Plan

Why? A data management plan will help you to properly manage your data for your own use and reduces the risk of data loss or of the threats to data through software obsolescence over time. A data management plan describes data generated or used for a given project and states how that data will be created, managed, stored, accessed, and shared during and after a research project.

Moreover, many research funders (like Horizon 2020, NWO, etc.) expect you to comply with their requirements for formal management and sharing of your research results. You are asked to provide a data paragraph along with your proposal. When your project is granted you will need to provide a full data management plan as an early deliverable.

Download a Data Management Plan Template using the LINKS below.

LINKS **CONTACT** **COMMENTS** **HIDE**

- Data Management Plan Template
- Guidelines on Data Management in Horizon 2020
- Guidelines on Open Access to Scientific Publications and Research Data in Horizon 2020
- More Information on Data Management Plan

Organisation of support: the library and university service

Research support in Delft has been designed by the library as a one-stop shop. Research support is intended to be a cross-domain programme. Together with Strategic Development, the TU Delft Library is the driving force behind the creation and ongoing development of research support.

The **Research Support** department has eight staff members (7.0 FTEs), including an information specialist, library specialist, project manager, information analyst and publishing advisor. They focus primarily on services at the stages of idea generation and publication, for example literature searches, bibliometric analysis, impact analysis, sources and locating experts. In collaboration with the Education Support team, they offer 'information and data skills' training courses and workshops for PhD candidates from the Graduate School.

The **Research Data Services** department has 10 FTEs and handles all aspects relating to research data management, production of research data, publication and archiving. Managing the data is very important for both researchers and the institution. Research Data Services helps researchers to comply with the requirements of the institute and the parties that fund research, and links publications to the underlying data. The department provides support for data management, offers training and support and a platform for finding, storing and publishing data. Each dataset is provided with one or more persistent identifiers. TU Delft Library handles the issue of Digital Object Identifiers (DOIs) in the Netherlands for DataCite Netherlands (<http://datacite.tudelft.nl/info/home/>). As well as datasets, there are also publications in the TU Delft Repository which are assigned a DOI. To be able to provide this service, new posts have been created such as data officer, data librarian and data steward.

Within the faculties, the Faculty Information Managers are the first point of contact for ICT-related support.

The **University service** (UD) is responsible for providing services to students, employees and other stakeholders. The UD employees work within ten areas of expertise: Legal Services, Strategic Development Directorate, Facilities Management and Fixed Assets (FMVG), Finance, Human Resources (HR), Information & Communication Technology (ICT), Communications Directorate, Teaching and Student Affairs (CSA, International Office), TU Delft Library, Service for Electronic & Mechanical Development (DEMO). Research specific services within the UD can be found on the Research Support Portal. The responsibility for providing services and keeping the information about services up to date lies with the relevant part of the UD.

E-infrastructure: ICT locations for research

COMPUTING SERVICES	
Number of clusters within the institution	7 managed centrally
Total scope of computing power	5,674 cores
Third-party clusters within the institution	-
Acquisition of computing services	SURFsara
STORAGE	
Capacity of centrally provided bulk storage	1 PB
Capacity of centrally provided archives	-
Externally purchased storage services	SURFdrive, Microsoft Azure, DataVerseNL (Vancis)
NETWORK	
Routed capacity (external)	10 Gbit/s
MSP capacity	-
AUTHENTICATION & AUTHORISATION INFRASTRUCTURE (AAI)	
Connected to SURFconext Federation	Yes
Other AAI supplier	No

ICT support is explicitly or implicitly present during all research phases. The research groups want both standard solutions and extensive flexibility. As ICT is an essential component of research support, there will be closer collaboration with ICT in the future. The Library and ICT will be working together in various areas of research support, such as Virtual Research Environments (VREs).

Network infrastructure

TU Delft's network consists of a core network of 10 Gbit/s with a redundant 10 Gbit/s link to SURFnet. The connection to the buildings is currently 2 Gbit/s; this will be upgraded to 20 Gbit/s in 2016. The connections in the buildings will be increased from 1 to 10 Gbit/s where possible. All terminals are now frequently 100 Mbit/s and will grow to 1 Gbit/s. There is a single physical network for all data. If data needs to be separated for research or teaching purposes, further fibre optic cables are added to the existing physical infrastructure. Central authentication infrastructure is available for authorisation purposes.

Computing and storage

High performance computers are available for the faculties and departments and are managed centrally. We also use external computing capacity at SURFsara. Storage management is managed centrally by the ICT department. In addition, a large number of researchers have decentralised data storage. Some researchers use advanced international data storage facilities: discipline-specific data repositories or data archives.

Data repository

Together with two other technical universities, Delft has been part of the 3TU Datacentre since 2007 (<http://datacentrum.3tu.nl>) as front-office, back-office and developer. This data centre offers long-term archives for research data, permanent access to this data, and the resources to allow its re-use. The DOIs that are assigned to every dataset makes it easy to refer to them.

3TU.Datacentre currently offers space for thousands of datasets. At the end of 2015, there were 6,567 stored datasets with a total volume of approximately 25 TB. For very large datasets (multiple TBs), researchers are passed on, for example, to SURFsara. 3TU.Datacentre collaborates with DANS and SURFsara in Research Data Netherlands (RDNL).

Training and education

Within the Graduate School, young researchers and PhD candidates are given training, courses and workshops about information and data skills offered by the library. The Valorisation Center at TU Delft offers advice and workshops for researchers who want to submit research proposals.

TU Delft offers the Essentials4Data Support course together with DANS, SURFsara and 3TU.Datacentre (RDNL). The essential components for this area are covered in this course. Following the course, the students will have received an overview of the phases of scientific research data during its lifecycle.

5.4 Agenda for research support

In future, research support must connect more effectively with the other directorates in Delft (UD) and ensure the portal has the right approach and visibility. If there are services beyond the scope of the university, special interest groups (SIGs) can be used to take an inventory of them.

Closer collaboration can be sought with institutions like SURF in future. If the services offered by SURF were offered via the research lifecycle at TU Delft, both parties could work together in the field of research support.

Over the next few years, attention will be given to the ongoing development of the one-stop shop and new forms of support. A number of projects have been defined with regard to the following topics:

- publishing services
- research visibility & impact
- metrics for research assessment
- open science
- virtual research environments
- virtual assistant technology
- internationalisation

Top of the agenda for TU Delft is Open Science. Open Science is an overarching term for: open research (open access to publications and research data), open & online education and open ICT. TU Delft wants to share its scientific output with the community as openly and transparently as possible: Open Science is the right way to do this. TU Delft is drawing up guidelines with all the information that researchers need to make research future-proof.

5.5 References

- Research Support Services in UK Universities, RIN report, October 2010:
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- www.admin.ox.ac.uk/researchsupport/
- www2.warwick.ac.uk/services/ris/
- www.sydney.edu.au/research.html
- www.researchsupport.tudelft.nl
- <http://datacentrum.3tu.nl>
- <http://datacite.tudelft.nl/info/home/>

6. CONCLUSIONS: RESEARCH SUPPORT IS ON THE RISE

In this report, two universities and two university medical centres have detailed how they organise their research support. If there is one conclusion we can draw from the case studies from the four institutions, it is surely this: *research support is a priority*. At each of the four institutions, research support was high on the agenda. No matter how different the organisational measures may be, there is not a single institution which is not focusing on research support. Most institutions are also at approximately the same stage of development and implementation. This underlines SURF's vision that research support is considered to be highly relevant within academia.

Putting researchers first

No matter how differently the institutions may organise research support, the researchers are always at the heart of it. The institutions are well aware of the importance of research, and each institution wants to assist and aid researchers as much as possible. EUR, for example, explicitly states that simplifying life for researchers can only be achieved under good conditions and by starting from the needs of researchers and the research process. TU Delft asks the key question as to how the institution and its services can assist researchers most effectively. TU Delft is seeking a solution here through integrated provision from the various service providers.

Centralised or decentralised?

The most important question that the four institutions are wrestling with is: what should we do from a central location and what should we decentralise? This discussion works at different levels, in the first instance within the universities: it is a question of distributing labour, expertise and infrastructure between faculties and the central services. However, the discussion is also taking place at a national level: what would an institution wish to retain control of and what work is easier to allocate to institutions such as SURF? Finally, this discussion can also take place at international level, for example when considering the development of computing resources in a European context.

Evaluating what work should be carried out in specific locations will be different for each university. As is clear from this report, it has much to do with the character of the university. A technical university such as TU Delft will be more inclined to develop and provide its own services in the area of e-infrastructure. The scale of the institution also plays a part in this. An institution with 15,000 researchers is more likely to be able to organise computing facilities and data storage in-house. On the other hand, collecting research data is often something that is actually better organised at national level, because this simplifies access to data – especially from an international perspective.

There are also differences in the departments or services that act as the coordinator or driver when organising research support. At TU Delft and EUR, support is located with and organised by the library. At MUMC+, it is the business department that drives it. At EUR, the Erasmus Data Service Centre (EDSC) is the most important starting point for researchers and students looking for support for data-intensive research. At LUMC, the Research Directorate (DO) is responsible for supporting policy in the area of scientific research.

Multidisciplinary approach

Not only have the institutions described to us how things stand at present, but all four described their ideal research support scenario. A multi-disciplinary approach scores highly here. The institutions all agree that the multi-disciplinary aspect is necessary if good support for researchers is to be provided. As an institution, one needs to have advisors with knowledge of different computing methodologies and clusters, who know where to best store data and who can provide expert advice. When researchers have a particular research goal and datasets that they wish to share, the research support staff must be able to advise them on the best approach.

Another important point when considering the ideal scenario is a realistic definition of your own level of ambition. For institutions where research support has been implemented successfully, serious thought was initially given to the services offered by the institution itself. The institutions in this report all carried out a sound analysis of what they can provide in the way of technology and expertise, but also clearly state what they cannot offer. It is clear that the central ICT department takes control here without this control involving any form of compulsion. ICT takes responsibility and delivers services, but ultimately leaves researchers to make their own choices.

A single point of contact

Researchers need to know exactly where to go within the institution for what they want. At present, this is often fragmented. Apart from the choice of whether support is provided centrally or at faculty level, researchers need to know where to go to receive answers to questions about, for example, computing resources or data storage. As such, it is more about communication and organisation than technology. A visible help desk and clear procedures are essential in this context. It may be supported by a range of services and technical platforms both within and outside the institution.

For many institutions in this report, a central help desk of this kind is high on their list of priorities. LUMC, for example, states that there is plenty of knowledge available, but it is not easy to track down. LUMC is aiming to provide 'a clear and easily approachable help desk for research support'; the institution is also considering the formulation of an electronic guide that supports researchers and informs them about legal requirements and rules. MUMC+ wants to set up a professional research facilitation department or institute over the next five years. And TU Delft states the need for 'a centralised and integrated provision of support in the form of a one-stop shop.'

The primary location where researchers go for information needs to be within their own institution. The advisors who work there clearly need to be well trained and in a position to enable researchers to rapidly access the relevant infrastructures. They need to be able to transfer researchers to the organisations which are best placed to answer their questions.

Data management and the data lifecycle

A final issue is the status of data management within research support. Different institutions give the data lifecycle a central role within their research support structure. For example, when applying for funding within MUMC+, researchers must submit a data paragraph or a data management plan (DMP).

When discussing data management, various institutions mentioned the FAIR data principles, namely guidelines on managing data to make it Findable, Accessible, Interoperable and Re-usable. MUMC+ states that the data also needs to be able to be replicated from source to raw data and available for verification of the research. And the importance of Good Research Practice (GPR) is underlined by various institutions.

SURF as mediator and coordinator

The institutions all agree on the importance of national e-infrastructure. This is a pre-requisite for being able to (continue to) carry out high-end research. Although users of large-scale computing power are well aware of SURF, it is also important to keep informing smaller-scale researchers about different ways to conduct research. This can lead to different, more effective research results.

Most institutions list the services that they purchase. For example, EUR not only utilises the usual providers of infrastructure and software licences, but also uses SURFdrive and SURFsara (LISA, HPC Cloud and Cartesius). TU Delft believes that there can be closer collaboration with SURF in future: 'If the services offered by SURF were offered via the research lifecycle at the TU Delft, both parties could work together in the field of research support.'

Finally, SURF can play a role in the development of research support because SURF is in constant dialogue with the institutions. If the same questions keep being asked, this may lead to the development of services at national level. SURF also considers itself responsible for bringing together research support staff and the ICT departments involved in supporting research. Above all, SURF can serve as a mediator and coordinator. SURF will also play this role in the field of data management: VSNU has asked SURF to set up a national coordination point for research data management.

COLOPHON

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SURF is the collaborative ICT
organisation for Dutch education
and research. SURF offers
students, lecturers and scientists
in the Netherlands access to the
best possible internet and ICT
facilities.

The SURF logo consists of the word "SURF" in a bold, white, sans-serif font, centered within a black, rounded rectangular shape. The shape has a small tail extending downwards and to the right, resembling a speech bubble or a stylized drop.