# DRIVING INNOVATION TOGETHER

## SURF STRATEGIC PLAN 2019-2022

SURF

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# Preface

I am proud to invite you to read the SURF Strategic Plan for 2019-2022. "What are the strategic ambitions, topics and goals of the SURF cooperative for the next four years?" The Strategic Plan provides the answer to this question. The three pillars of education, research and cooperative facilities form the core themes that run through it.

The course is set using this SURF Strategic Plan, and it forms the basis for collaboration between the SURF organisation and its members. There are more than 100 SURF member institutions, including MBO (vocational education and training) institutes, universities of applied sciences, research universities, university medical centres and research institutions in the Netherlands. Together we form the SURF cooperative. The Strategic Plan is drawn up in collaboration with our members and stakeholders.

By way of interviews and dialogues, we discussed a number of different topics with our members and stakeholders. The educational and (applied) research institutions collaborate within SURF to accelerate on a number of fronts: making education more flexible using digital (open) teaching materials and the secure use of study data, the growing role that data plays in the research life-cycle and the requirements placed on it. In addition, the role of the ICT teams, research and education support and the library at the institutions is also changing in the context of this progress. Digital technology, meanwhile, is developing at lightning speed and is international by nature. This increases the significance of the question of which technologies we select for education and research. How do we implement tomorrow's technology in a smart way, and are we the owners or more the users? What requirements do we place on vendors? And which smart ICT professionals will provide the technological applications of the future? These questions lead to a variety of dilemmas and challenges: what rate of change can we handle, what should we select and how can we pull together in the same direction? It is important here to make choices with an eye on the different sectors, while attaching enough weight to collective interests. Because at the end of the day this is a cooperative and it is important that we never lose sight of that. This will sometimes result in trial and error.

Sustainable collaboration is important in order to turn our ambitions and goals into reality. We want to continue pooling our forces. This makes us able to respond more rapidly and more effectively to radical changes and challenges. This will enable us to seize the opportunities offered by digitalisation in education and research more rapidly. The SURF Strategic Plan provides a direction. The content and the pace will require conviction and commitment. Only then can we, as a cooperative, take large strides towards improving the quality and flexibility of education, research and the best use of ICT. We want to achieve things tomorrow that were impossible yesterday and today.

I warmly thank everyone who has contributed to the creation of this edition of the SURF Strategic Plan for their input.

On behalf of the SURF Board,

Erik Fledderus (*Director General of SURF*)

# Summary

The SURF cooperative works with over 100 education and research institutions in the Netherlands to fully utilise the opportunities of digitalisation. The Netherlands faces major challenges in the areas of education and research.

Collaboration and combining our forces is the best strategy for dealing with these developments and challenges and achieving our goal: improved and more flexible education and research. An institution working alone will not succeed in this. The SURF Strategic Plan 2019-2022 has therefore been created in collaboration with our members and stakeholders. In the period 2017-2018 various interviews and discussions were held on a number of issues. The results of this consultation formed the basis of this SURF Strategic Plan.

The Strategic Plan sets out the ambitions and plans of the SURF cooperative for the period 2019-2022. This means that the Strategic Plan acts as a compass to guide the SURF cooperative. In the two-year plans, we work out in detail how SURF, together with its members, will achieve its goals. Here is a summary, based on the three selected fields of work.

## Education

The SURF Strategic Plan defines the context in this domain for the educational activities within SURF, links that to the "Acceleration plan for innovation in education through ICT", and sets out which accelerations SURF will be focussing on implementing. The following subjects are covered:

- **More flexible education**
  Our rapidly changing world needs students who practise lifelong learning. That requires providing flexible education options that give students greater freedom of choice and variety when designing and following through on their own education.

- **More diverse teaching resources**
  SURF wants to create a model that makes varied (open) digital study materials available, on terms that are favourable for students, lecturers, institutions and publishers. Students will be able to study without time and location constraints when they have access to a wider choice of study materials that match their own preferences at anytime and anywhere.

- **Utilising study data**
  As students are learning more and more online, more data will become available which will offer insights into the study process and will help both students and lecturers. Suppliers who offer digital learning environments, for example, or publishers who offer learning methods can make use of the study data in their products.

## Research

SURF provides a context for research activities, linking back to the ambitions of the "National Plan Open Science". The following subjects are covered:

- **Unlimited access**
  SURF wants researchers to have unlimited and user-friendly access to secure and well-integrated data, computing and network facilities.

- **Stimulating open science**
  In order to ensure that researchers in the Netherlands exploit the opportunities of open science to the fullest, SURF is making the ICT and research infrastructures in the Netherlands suitable and attractive for open science. We are reinforcing the Netherlands' leading position in the field of open science, and enhancing our reputation as a modern research and pioneering country. Institutions and researchers in the Netherlands are enjoying the fruits of this open research climate.

## Cooperative facilities

Acceleration in the above domains leads – in discussion with members – to updating the cooperative facilities. Within this domain the following topics are covered:

- **World-class facilities**
  The ICT infrastructure must deliver on the national ambitions in the area of scientific research infrastructures and educational facilities. We lay the foundations for a network, computing and data infrastructure at an internationally competitive level.

- **On campus**
  Users expect all services to ultimately be made available independent of time, place and device. Over the next few years an integrated vision will be developed for digital "campus" facilities that will be linked into our activities in this field.

- **Security in a digital world**
  All users of our facilities must have the necessary awareness and knowledge in the area of security risks, privacy and laws and regulations. Joint agreements and frameworks of standards in the area of information security and privacy are critical for this. Institutions need to be able to protect themselves against all forms of cyber crime, and be able to recover from insecure situations and incidents.

- **Focus on users**
  The range of services is available through SURF at one location, together with objective information about the services. SURF provides students, researchers, lecturers and employees with a good user experience (simple, fast, effective, reliable) when accessing and using the centrally organised and decentralised supplied products and (cloud) services. Congruence in the provision of cooperative facilities, functionality, the prerequisites and simplicity of use require excellent organisation.

## Portfolio development

SURF is working on an integrated services portfolio of cooperative facilities, including further development using an architecture. The main focus is taking a cooperative approach and collaborating with the decision-makers at members in the areas of ICT, education and research. The result is a shared view that defines the extent to which a collective facility can be provided that meets the wishes and needs of the members. Some outcomes will be less relevant in the short-term for part of the members. In such situations, several members collaborate as pioneers on a solution that has the potential to grow into a solution for the whole cooperative.

## Support base for collaboration

An important consideration here is to seek and find a balance among the varying needs of the members. This means that new forms of discussion, decision-making and relationship management are needed to ensure that the benefits of collaboration can actually be achieved. The Board of SURF is currently working on specific proposals in this area.

In addition to consultation and decision-making at board level (Members' Council), the institutions also exercise their influence. The Coordinating SURF Contacts (CSCs) are key to this process, through, among others, their participation in the SURF Portfolio Advisory Committee (SPA). The SPA provides input to the consultations between CSC chairmen and the Board of SURF on the components and rates of the portfolio of activities.

Four years is a long time, during which new insights and selected approaches can mature, knowledge can expand and solutions can be found that were previously unimaginable. Myriad opportunities exist for members of the cooperative to improve education and research in the Netherlands to the top level through innovative use of ICT. SURF is ready for the future, and by pursuing innovation, SURF can influence the future. SURF does so in collaboration within the cooperative while focusing on differences and levels of involvement in our environment. SURF is looking forward to the future with confidence!

# 1 Ready for the future

The SURF cooperative is comprised of the members and the SURF organisation itself. By working together within SURF, the members define a strategy for responding effectively to fast and far-reaching changes and capitalising on opportunities. Combining the strengths of the individual institutions and taking a joint approach allows significant progress to be made.

SURF offers students, lecturers, researchers and staff a safe digital environment that enables them to perform at their best. By offering advanced, integrated & user-friendly ICT facilities, SURF aims to ensure that the Netherlands is, and remains to be an attractive place to study and work for talented individuals from both the Netherlands and abroad. We exploit new digital opportunities and anticipate the disruptive impact the can materialise and security risks associated with these developments. SURF explores the requirements and opportunities, develops a shared vision and invests in the innovation and knowledge that must be developed and applied.

SURF guides the collaboration and innovation process and provides the infrastructure and services. In recent years, we have demonstrated that this model works well: it allows us to work together proactively on the development and application of new opportunities.

As a collaborative organisation in the field of education and research in the Netherlands, we have played a vital role for more than 30 years. Research Universities, Universities of Applied Sciences, Senior Secondary Vocational Education (MBO) Institutions, University Medical Centres and Research Institutions together form a community of some 1.4 million users who learn from each other within the SURF cooperative and join forces to work on common interests. This intensive collaboration has ensured that Dutch education and research has access to a high-quality ICT infrastructure and state-of-the-art ICT facilities. This makes the Netherlands attractive to students, lecturers and researchers from both the Netherlands and abroad. Together, the institutions and SURF are therefore in an excellent position to meet future challenges.

Our collaboration is not confined to the cooperative itself – it also includes national and international partners, in both the non-profit sector and business community.

**Reading Guide**

Chapter 2 describes the main challenges facing education and research and SURF's vision for meeting these challenges through collaboration in the field of innovation, services and knowledge sharing.

Chapter 3 outlines the agenda for the forthcoming period for education, research and cooperative facilities. In each of these three areas we describe what is happening, what we want to achieve and how we plan to achieve it.

Chapters 4 and 5 look at SURF's role and ways of working, and a final brief section explains how the Agenda was drawn up.

# 2 Developments and vision

# 2.1 Digitalisation

Digitalisation offers opportunities to do things today, that only yesterday we thought were impossible. It improves access to education and research. Digitalisation also means, however, that we can do less and less without ICT, and it makes us more vulnerable to the consequences of ICT failures.
The misuse or abuse of ICT, whether it be for commercial or political reasons, has major consequences for the development, privacy and freedom of citizens. People who cannot access or who are unable to keep up with developments in the digital world have a serious problem: an ever-increasing part of the world passes them by.

The huge potential of, and our high level of dependence on digitalisation creates a huge requirement for ICT expertise and talent. The availability of ICT expertise is an essential prerequisite for any organisation; a lack of it jeopardises its quality and survival. Education and research institutions also need to anticipate the impact of digitalisation on the primary process, and this requires us to make effective use of the scarce ICT talent in our sector.

Research universities and universities of applied sciences are working together to lead the world in creating effective links between digital technology and people and their societies[1]. Senior secondary vocational education providers are working on a similar agenda. Digitalisation creates new services, new players and new rules. The market is constantly changing, and education and research with it. When new opportunities arise, new ways of working emerge and new parties become involved: as consumers, suppliers or both. Digital technology often makes the delivery and purchase of products and services better, faster, more direct and more transparent and enables automation and the use of alternative routes. This requires institutions to reflect on their educational offering, their teaching methods and their research process. It also requires SURF to reflect on service development, including the delivery process.

New developments that will change education and research are gathering pace: big data, cloud services, exascale computing, biometrics, digital research environments and workspaces, the Internet of Things, artificial intelligence, blockchain, quantum computing, robotics, virtual reality, etc. The processing and analysis of data is becoming more important and adds value (including commercial value): access to data and the results of analyses will determine the extent to which you can be a leader in education and research. Clearly, the growing importance of, and use of data requires a focus on ethics, privacy and security.

The Netherlands Organisation for Scientific Research (NWO) has produced an advisory report[2] for the government on the national digital infrastructure for scientific research. This explicitly states that if the Netherlands is to remain a leading knowledge economy, structural investments must be made in the national digital infrastructure.

In our digitalised world, major players such as search platforms, social networks and online suppliers collect important data and provide access to it (for commercial gain). If access to, and the ownership of data and research results are in the hands of commercial players, this threatens the independence and autonomy of researchers, lecturers and students. SURF sees it as its role, together with its members and umbrella organisations, and assisted by the government, to develop policy and take action in this context.

1 http://vsnu.nl/files/documenten/Publicaties/VSNU_De_Digitale_Samenleving.pdf
2 https://www.nwo.nl/documents/ew/adviesrapport-nationale-digitale-infrastructuur-juni-2017

# 2.2 Internationalisation

Education and research activities take place in an international context and require an open exchange of information. SURF guarantees that researchers and students can learn, work and collaborate at an international level. Dutch researchers are increasingly using large scientific research infrastructures that make use of both national and international ICT infrastructures. They share, analyse and publish each other's data and make use of each other's computing and storage facilities. The European Commission's vision on access, collaboration and shared use is encapsulated in the European Open Science Cloud (EOSC)[3]. A shared vision has also been developed at a national level. The Netherlands Association of Universities of Applied Sciences and the Association of Universities in the Netherlands (VSNU) describe the Netherlands as "the country to be" when it comes to acquiring, developing and communicating knowledge[4].

Access to international knowledge sources and information systems is also crucial for education. Lecturers want to collaborate internationally and share learning materials beyond the boundaries of the institutions, and students want to take advantage of international courses to give them a global perspective during their studies. This is only possible if infrastructures are interconnected. Dutch and foreign students who want to study flexibly, require institutions to give them access to tools and learning platforms, academic progress and records at an international level.

SURF's members benefit from an international infrastructure that is forward-looking, open and transparent. European partnerships such as Knowledge Exchange[5] and organisations such as GEANT[6], PRACE[7], EGI[8], EUDAT[9] and EuroHPC[10] help to realise these ambitions in the fields of education, research and infrastructure.

Together we discover and explore how digitalisation and internationalisation can benefit education and research.

## 2.3 Driving innovation together

Digitalisation and internationalisation create more opportunities but, at the same time, they make things more complicated. Not only in terms of technology, but also because they confront us with social and ethical challenges.

Since SURF was first set up, cooperation has proved the best strategy for dealing with these developments and challenges. Together we discover and explore how digitalisation and internationalisation can benefit education and research. We identify the requirements of institutions and users and anticipate aspects that impact on privacy.

By pooling our resources in the cooperative, we work together to ensure that Dutch education and research is facilitated to the full, with an ICT infrastructure and service offering that enables institutions and users to carry out their activities in the best possible way. Together we monitor developments in technology, trends and the requirements and wishes of institutions and users. This is then converted into an ambitious shared innovation agenda which serves as a base for new knowledge and service developments, which is the core of our vision.

In today's networked society, we are dependent not only on digitalisation but also, more particularly, on each other. Data can only be re-used effectively if good data management is practised by others; student mobility is only possible if different administrations work with standardised data, and international ICT infrastructures can only be secure if all parties adhere to agreed protocols. This dependency applies not only to institutions, researchers, lecturers and students but also to infrastructure providers, market players and governments. Collaboration is the best way to turn dependency into strength.

Improving education and research, training, retaining and attracting talent, responding to international developments and continuous innovation are challenges that institutions can address by pooling their brainpower and resources. This way SURF can achieve results that transcend the potential of individual institutions.

In short, SURF's raison d'être is: *driving innovation together!*

3 **http://ec.europa.eu/research/openscience/index.cfm?pg=open-science-cloud**
4 **http://www.verenigingenhogescholen.nl/themas/internationalisering**
5 **http://www.knowledge-exchange.info/**
6 **https://www.geant.org/**
7 **http://www.prace-ri.eu/**
8 **http://www.egi.eu/**
9 **https://www.eudat.eu/news/eudat-sets-up-new-ltd-company-to-sustain-its-activities-services**
10 **https://ec.europa.eu/digital-single-market/en/news/high-performance-computing-and-eurohpc-initiative-qa**

# 3 Agenda for 2019-2022

SURF's Multiannual Agenda focuses on three areas: education, research and cooperative facilities. We are addressing the challenges in these areas together.

Education and research are interdependent in several ways. Without one, the other cannot develop: education trains researchers andresearch helps education to improve. They are also linked in the institutions, with both of them having a similar need for an open and transparent ICT infrastructure and cooperative facilities. Both need to collaborate to be able to use digitalisation and internationalisation to improve quality.

The SURF cooperative aims to do more than simply facilitate its members. It wants to help attract and retain talent, strengthen the Dutch knowledge economy and minimise the environmental impact of the use of ICT.

In this chapter, we set out the themes for the next four years, the challenges we face, the ambitions we have and the goals we want to achieve for the three pillars of education, research and cooperative facilities. Given the four-year time frame, this will inevitably be a broad overview. What exactly SURF plans to do in 2019 and subsequent years will be described in detail annually in a two-year plan.

# 3.1 Education

Developments in technology are changing the content of professions: existing professions are disappearing and new ones are emerging. This has a major impact on students, lecturers and the educational process. Lifelong learning is important if we are to keep pace with the changing labour market.

Students are demanding more flexibility in their education, so they can combine their studies, work and private life and study at different institutions. Technology can help make education more accessible and more personalised. Digitalisation can also help improve the quality of education. Delivering on these promises will require a significant effort. Together with the Netherlands Association of Universities of Applied Sciences and VSNU, SURF has drawn up the Acceleration Agenda for Innovation in Education; a similar initiative is being developed in the senior secondary vocational education sector. The priorities here are: improved alignment with the labour market, making education more flexible and using technology to enable smarter and more effective learning. Under the SURF Multiannual Agenda, knowledge and digital infrastructures are developed and scaled up, thereby enabling members to realise the ambitions of the Acceleration Agenda. In addition, new technical opportunities that look beyond this are being explored and developed.

## 3.1.1 More flexible education

### What do we want to achieve?

Our fast-changing world requires students who learn on a lifelong basis. This calls for a more flexible educational offering that offers students greater freedom of choice when putting together their study programme and more variety in terms of (micro) certification and that provides for a wide range of digital study material. Students must also be able to study and sit assessments anytime and anywhere. These opportunities help create a varied educational offer in which everyone feels at home, with equal access for a wide variety of students.

### What are we going to do?

If students are to be able to study in any location, ideally, they will be uniquely identifiable across institutions. That way, different institutions can be certain that they are dealing with the same student. This requires specific technical conditions and legal and administrative agreements. We are working on a badge infrastructure to enable micro-credentialing with digital certification. To give students an overview of the courses offered by all institutions, we will produce a single course prospectus, which, thanks to the use of standards for describing the curriculum, will incorporate the course prospectuses of the institutions. Exchangeable student data, academic results, timetable data and course information are a stepping stone to the sharing of data with other study programmes and institutions. That's why we are working on the development and application of architectural principles and standards.

## 3.1.2 Wider range of learning materials

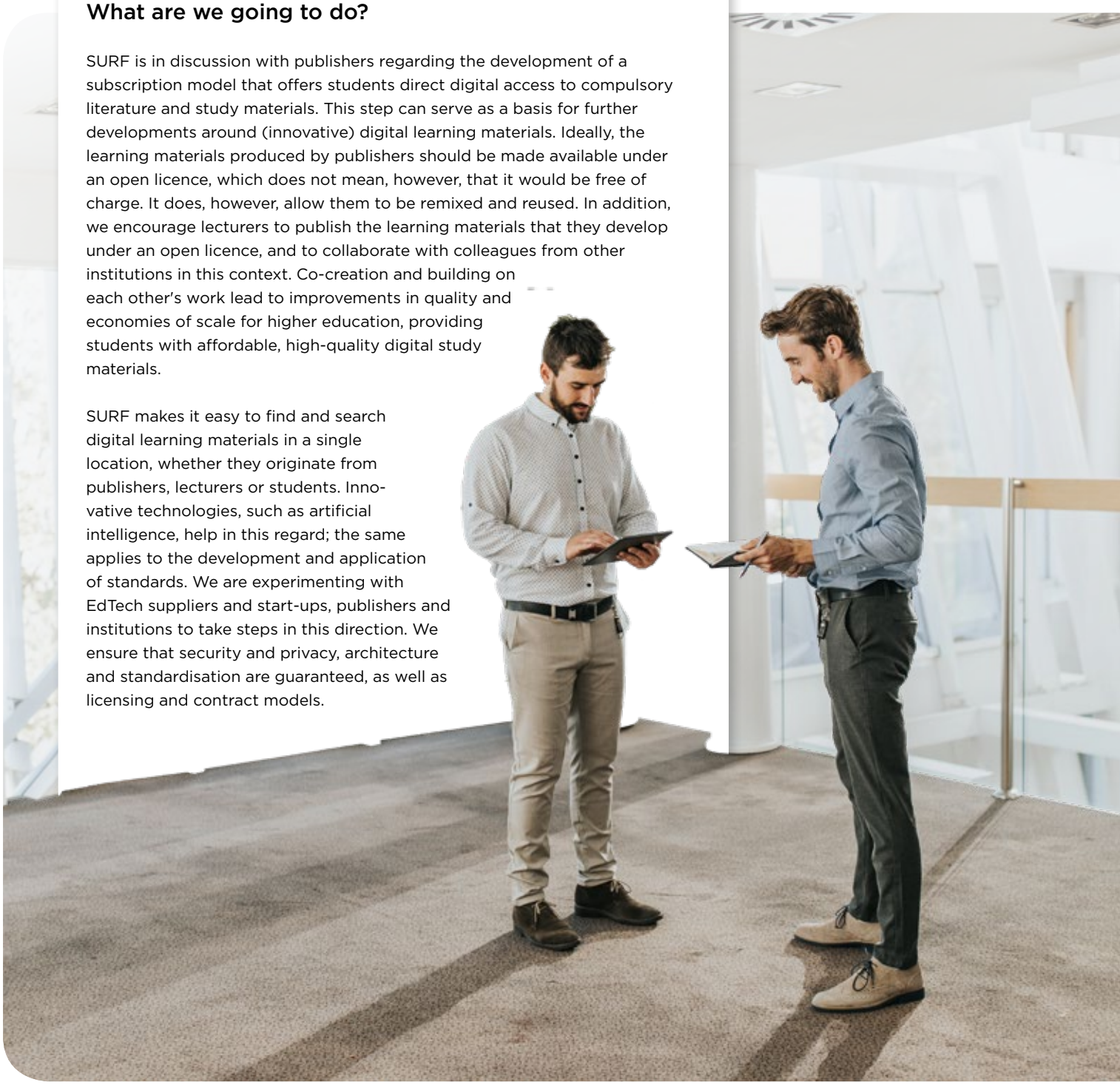
### What do we want to achieve?

We want to create a model that can make a wide range of (open) digital study materials available, under conditions that are favourable to students, lecturers, institutions and publishers alike. It is easier for students to study whenever and wherever they want if they always have access to their learning materials and in any location. A wider range of study materials allows students to choose materials that match their own preferences. If lecturers develop learning materials together, the volume of material available will increase.

### What are we going to do?

SURF is in discussion with publishers regarding the development of a subscription model that offers students direct digital access to compulsory literature and study materials. This step can serve as a basis for further developments around (innovative) digital learning materials. Ideally, the learning materials produced by publishers should be made available under an open licence, which does not mean, however, that it would be free of charge. It does, however, allow them to be remixed and reused. In addition, we encourage lecturers to publish the learning materials that they develop under an open licence, and to collaborate with colleagues from other institutions in this context. Co-creation and building on each other's work lead to improvements in quality and economies of scale for higher education, providing students with affordable, high-quality digital study materials.

SURF makes it easy to find and search digital learning materials in a single location, whether they originate from publishers, lecturers or students. Innovative technologies, such as artificial intelligence, help in this regard; the same applies to the development and application of standards. We are experimenting with EdTech suppliers and start-ups, publishers and institutions to take steps in this direction. We ensure that security and privacy, architecture and standardisation are guaranteed, as well as licensing and contract models.



## 3.1.3 Use of study data

### What do we want to achieve?

As students learn more and more online, data is becoming increasingly available. This data provides insights around academic progress and is useful for students and lecturers. Suppliers of digital learning environments, for example, or publishers that offer learning methods use this academic data in their products. But students don't learn in just one environment. To obtain effective insights around academic progress, data from different sources must be combined, which at the moment, is often not possible. In addition, the education sector wants to be in control of the ownership of the data and the analyses that are carried out.

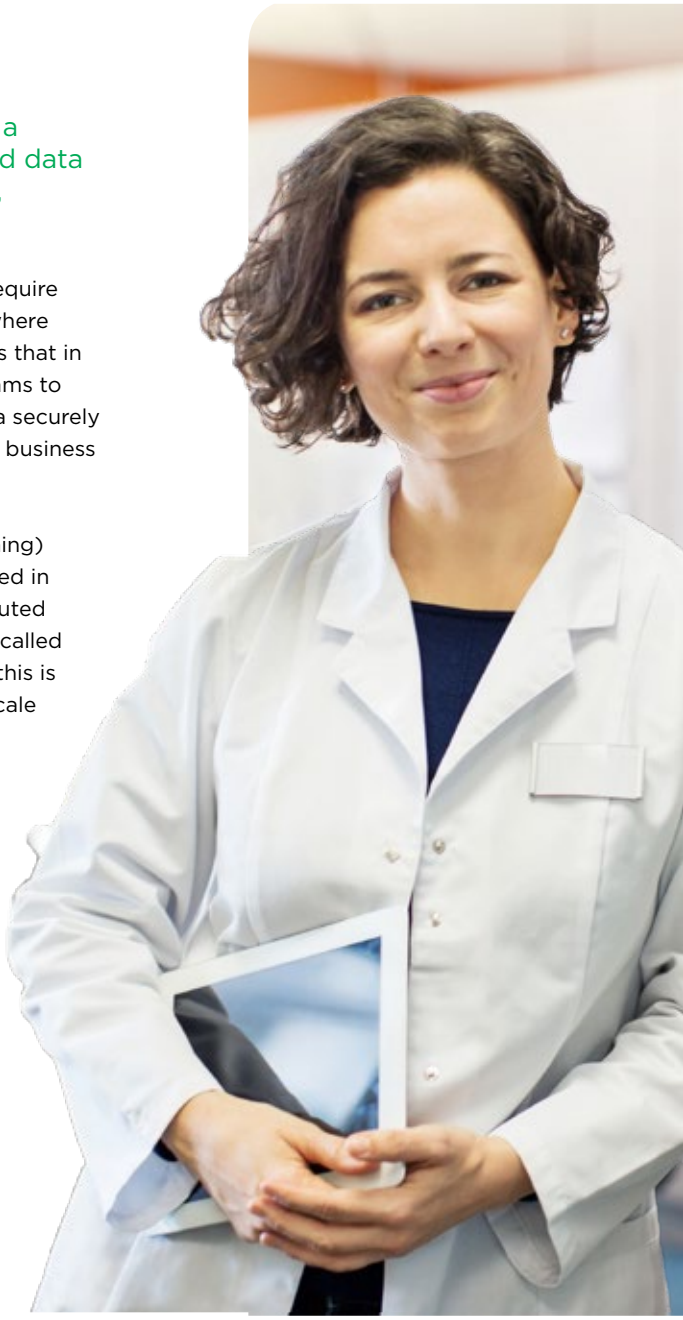
### What are we going to do?

Together, we ensure that student data and user privacy are treated with care. SURF is developing a safe and reliable infrastructure for academic data in which students' privacy is paramount. By managing data, the higher education sector can keep control of the ownership of the data and the analyses. SURF and its members are investigating several different scenarios: from fully centralised storage (e.g. at SURF) to fully decentralised storage (at the institution itself). The ability to link data from different systems easily is a prerequisite in all scenarios; as a result, exchange standards play a crucial role. In addition, we provide a safe experimental environment that enables lecturers to apply learning analytics in education in an accessible way.

SURF is developing a safe and reliable infra-structure for academic data in which students' privacy is paramount.

# 3.2 Research

Research is increasingly based on processing and sharing of a vast quantity and variety of mainly geographically distributed data that is experiencing exponential growth such as; simulations, experiments and observations (digital data generators).



Future research questions and complex social challenges will increasingly require a multidisciplinary approach with diverse and complex workflows. When, where and how data is generated, shared and processed will be crucial. This means that in a growing number of fields researchers need computing power and algorithms to simulate, model and process data, and infrastructure and tools to share data securely and transport data quickly. Collaboration with the non-profit sector and the business community is also becoming increasingly important in this context.

The development of new methods of data analysis (including machine learning) and data use will have a major impact on how scientific research is conducted in the future. This will lead to applications and workflows that use both distributed and centralised data sources and processing facilities, which will require so-called converged infrastructures, both distributed and centralised. An example of this is an architecture that supports combined large-scale simulations and large-scale data analytics and machine learning.

Currently, researchers look for solutions for data, computing and networking facilities independently of each other, which they generally find in their own national or international partnerships. This may not always provide appropriate solutions and may be inefficient. The institution's own facilities often make it impossible to share the research data safely.

Together with the Netherlands Organisation for Scientific Research (NWO), the Royal Netherlands Academy of Arts and Sciences (KNAW), the Association of Universities in the Netherlands (VSNU), the Netherlands Association of Universities of Applied Sciences and the Netherlands Federation of University Medical Centres (NFU), SURF endorses the National Plan for Open Science. Our aim is to make all research data suitable for reuse and all research results available as open access publications.

## 3.2.1 Unlimited access

### What do we want to achieve?

Researchers must be able to collect, share, process and analyse data. They must also be able to store this data safely for long periods of time. We want researchers to have unlimited, user-friendly access to secure and well-integrated data, computing and networking facilities.

### What are we going to do?

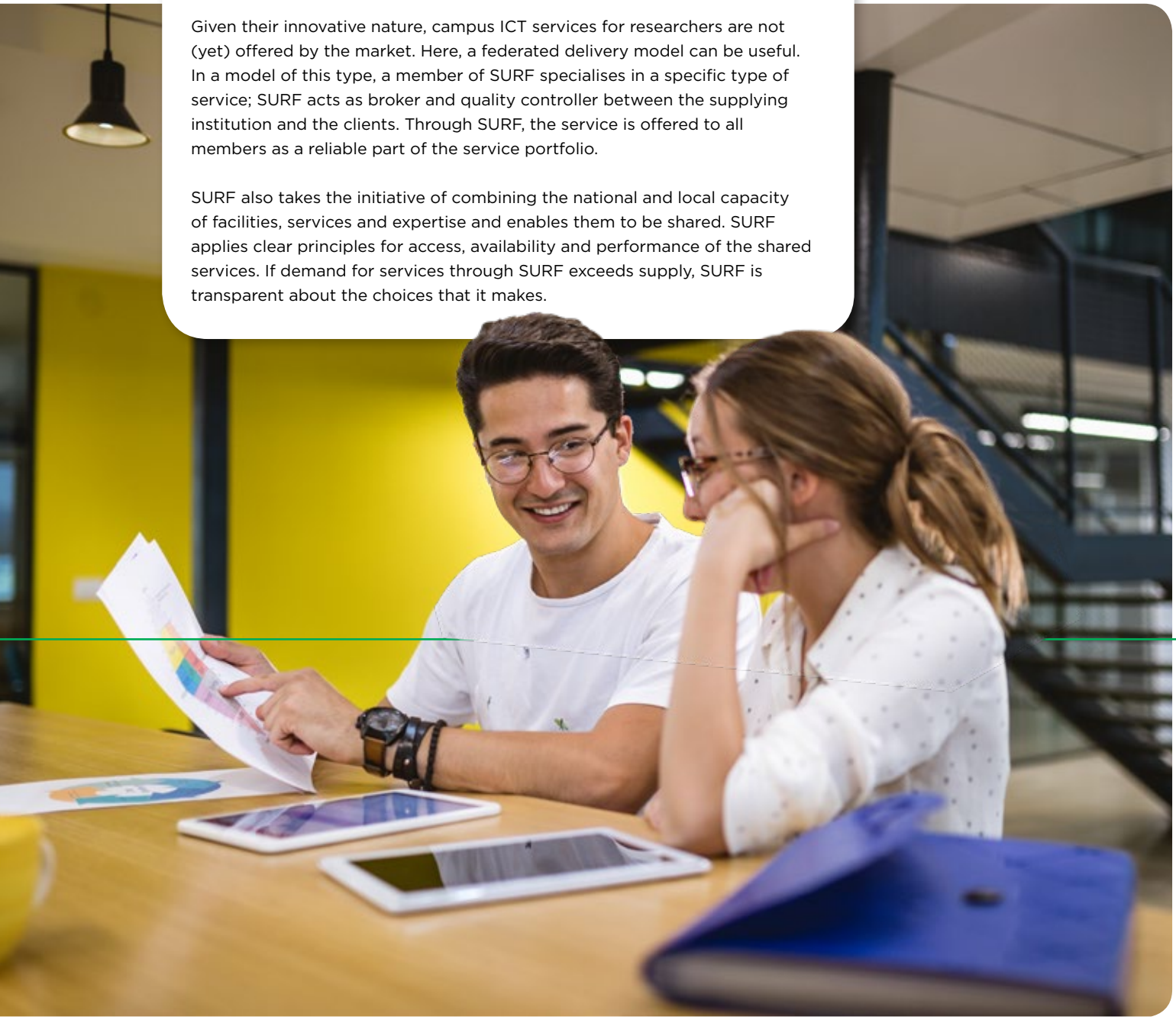
In order to achieve this unlimited access to research facilities, SURF is working on coordinating technology, organisation and resources, through intensive collaboration with NLeScience Center and DANS, for example. We combine research facilities and expertise from the institutions, research partners, SURF and the cloud into new generations of converged and shared-infrastructures with local and central nodes. This enables us to offer →

optimal availability, access and support to an excellent national/international ICT infrastructure, amongst other things through Virtual Research Environments, i.e. online environments in which researchers can collaborate on research projects.

SURF is taking a leading role in organising a federated network of local, national and European facilities. In conjunction with research communities such as Health-RI[12] and research supporters, SURF is working on appropriate shared infrastructure solutions for services, data and tools to provide optimal support for a broad spectrum of research domains. It is essential for Dutch researchers that we endorse the roadmap of the European Strategy Forum on Research Infrastructures (ESFRI) and form part of the European Open Science Cloud (EOSC).

Given their innovative nature, campus ICT services for researchers are not (yet) offered by the market. Here, a federated delivery model can be useful. In a model of this type, a member of SURF specialises in a specific type of service; SURF acts as broker and quality controller between the supplying institution and the clients. Through SURF, the service is offered to all members as a reliable part of the service portfolio.

SURF also takes the initiative of combining the national and local capacity of facilities, services and expertise and enables them to be shared. SURF applies clear principles for access, availability and performance of the shared services. If demand for services through SURF exceeds supply, SURF is transparent about the choices that it makes.



12 https://www.health-ri.org/

### 3.2.2 Driver of open science

#### What do we want to achieve?

We want researchers in the Netherlands to exploit the potential of open science to the full. Open science is research in an open, data-driven, digital environment. With this in mind, we are making the ICT and research infrastructures in the Netherlands suitable for and conducive to open science. We are strengthening the Netherlands' leading position in the field of open science, thereby enhancing our reputation as a modern research-oriented nation that acts as a role model for others. Institutions and researchers in the Netherlands are reaping the rewards of this open research climate.

#### What are we going to do?

SURF drives the open science agenda at all levels, giving institutions and researchers the opportunity to put open science into practice and encouraging them to do so.

SURF promotes open access publication by monitoring developments in the field of open access and making international comparisons; e.g. the increase in the number of publications and how they are funded. In addition, we investigate barriers to open research. We give researchers a clear overview of the options for doing open research and the financial consequences of doing so. Furthermore, we explore opportunities for career paths that are essential for achieving open science (also for data engineers).

We work with institutions to combine Dutch infrastructures for the reuse and sharing of data. The key focus here is the FAIR data principles[13] (Findable, Accessible, Interoperable and Reusable). Together with partners such as DANS, DTL and NLeSC, SURF has set up a GoFAIR data office that coordinates and promotes implementation of the FAIR principles in the Netherlands. Over the next few years, SURF will work with these partners and the research domains on standardisation, which will make it easier to make research data suitable for reuse.

In Europe, open science is promoted and supported by the European Open Science Cloud (EOSC) and in order to provide Dutch researchers and research communities with easy access to this cloud, SURF is participating in various EU EOSC projects.

We work with institutions to combine Dutch infrastructures for the reuse and sharing of data.

13 https://www.force11.org/group/fairgroup/fairprinciples

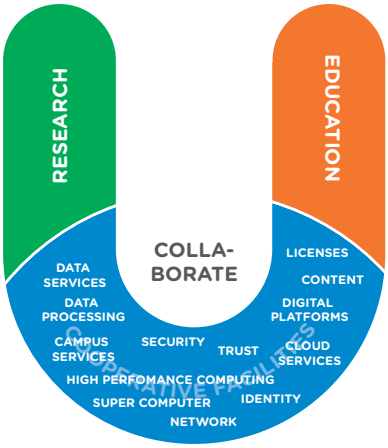
# 3.3 Cooperative facilities

SURF provides cooperative facilities to meet the needs of its members. Wherever possible, SURF's services are provided on a cooperative-wide basis. The diversity of our members regularly requires us to work with specific user groups, such as research communities, to develop solutions for broad applications.

SURF's offering covers a broad range of services: from physical facilities such as the national supercomputer, network connections and data storage to support processes such as procurement and contract management. SURF offers a wealth of knowledge, innovation and services in areas such as networks, identity, high-performance computing, research data management, data analytics and machine learning, digital commerce, security, privacy and the cloud. SURF also guarantees compliant procurement for its members and provides contract management, digital distribution platforms and user support. Cooperative facilities are constantly refined based on user requirements and technological developments.

## Integrated services

All facilities are set up in response to the challenges and needs of education (see Section 3.1) and research (see Section 3.2). Each service has a roadmap: an improvement and development path to the future. In addition, we ensure the necessary interconnection and coordination between the facilities, so that they can be used easily, effectively and coherently from the perspective of the user and the institution, even beyond national borders. The strength of SURF lies in the fact that we operate at the centre of this arena. In this position, we can ensure that the innovation and the development path of the services, including the relationship between them (functional and international), always matches the needs of the target group. In addition, we can offer insights around the opportunities and risks of technology. SURF can supply integrated facilities and its members benefit from this.




## In conjunction with, yet distinct from the market

SURF challenges the market to develop innovative solutions that specifically address the requirements of education and research institutions. One of the ways we do this is by exploring new technologies and implementing proof-of-concepts in conjunction with market partners and institutions via the SURF Open Innovation Lab. Through our own innovation agenda, we constantly develop services with added value that are unique on the market. By pooling the demand from institutions, we can negotiate a favourable price, the best conditions and the highest quality. SURF's products and services fulfil the functional requirements of members, are distinct from what is offered on the existing market, meet stringent privacy and information security requirements and comply with applicable laws and regulations.

## Attractive result

SURF's role in this context varies and is dependent on demand, supply on the market and the maturity of the technology. The result is an extensive portfolio of continuously innovative integrated facilities and ICT infrastructure, which makes our sector attractive to students, lecturers, researchers and staff.

### 3.3.1 World-class facilities

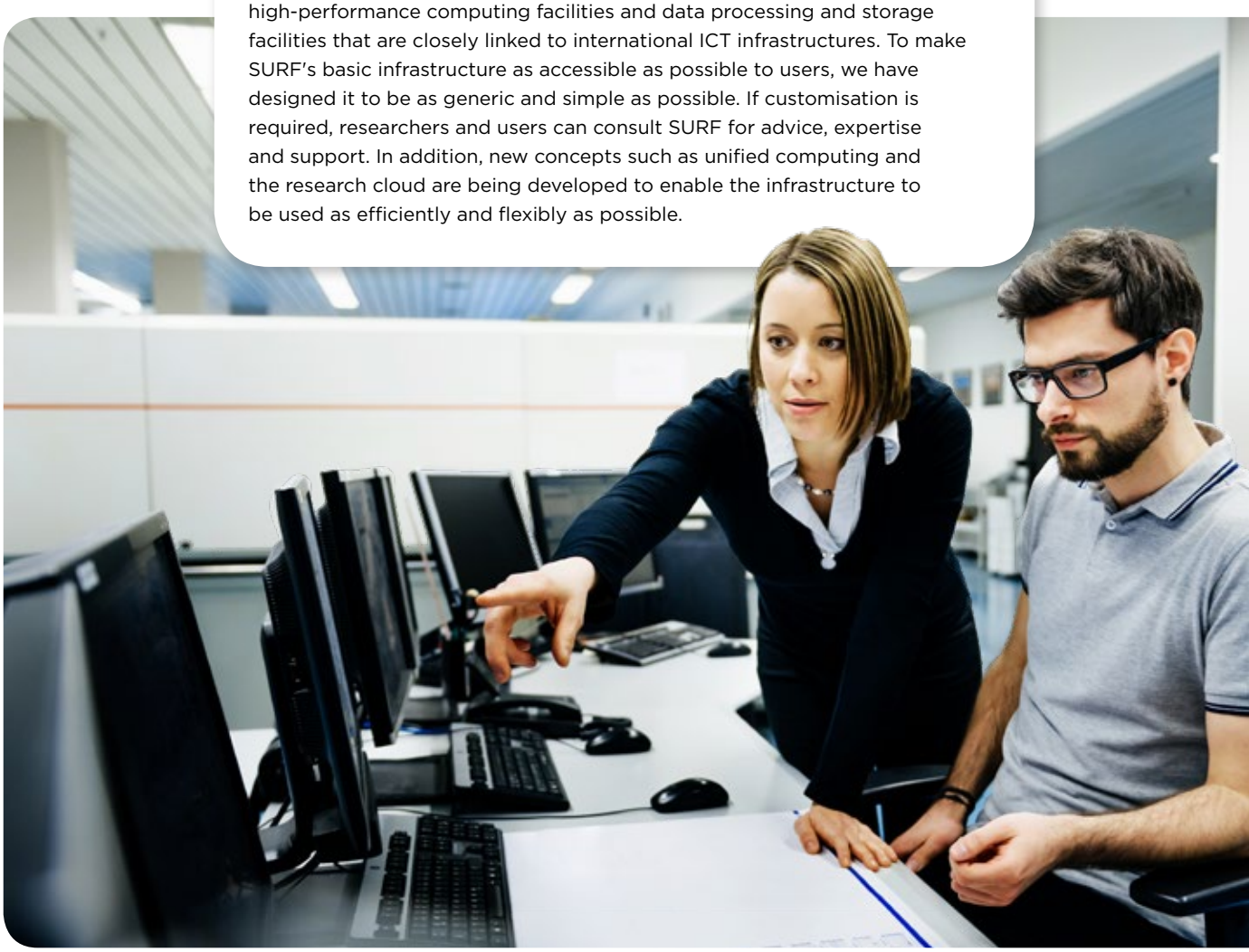
The requirements and ambitions of SURF's members in the field of education and research require a robust ICT infrastructure. By pooling resources in the Netherlands, SURF can offer its members a reliable, advanced network for all their connectivity needs. This network provides access to unique facilities for the storage and processing of educational and research data, high-performance computing facilities and federated identity management. The facilities also connect users with global scientific tools, with (commercial) providers and with SURF's services.

#### What do we want to achieve?

ICT infrastructure must meet national ambitions in terms of scientific research infrastructures and educational facilities. We set the bar for the network, computing and data infrastructure at an internationally competitive level. Network connectivity forms the basis for the development of, and access to integrated high-performance computing and data storage environments; this connectivity combines very high bandwidths with a high degree of availability. Reliable storage and seamless access to data is crucial in both the education and research sectors.

#### What are we going to do?

SURF's network offers optimum access to the national/international ICT infrastructure for educational and research applications. SURF provides high-performance computing facilities and data processing and storage facilities that are closely linked to international ICT infrastructures. To make SURF's basic infrastructure as accessible as possible to users, we have designed it to be as generic and simple as possible. If customisation is required, researchers and users can consult SURF for advice, expertise and support. In addition, new concepts such as unified computing and the research cloud are being developed to enable the infrastructure to be used as efficiently and flexibly as possible.



### 3.3.2 On campus

SURF's members are becoming ICT governance organisations. In other words, institutions are managing less operational ICT themselves, and they expect SURF to adjust its services accordingly. This gives institutions more scope to focus on innovation of their core tasks: education and research. It is also a solution to the scarcity of ICT expertise that institutions are increasingly struggling with, and has the potential to make our sector more efficient. At the same time, technologies like virtualisation have the potential to make existing campus functionalities scalable, more efficient and flexible.

#### What do we want to achieve?

Users expect that, ultimately, all services will be available anytime, anywhere and on any device. SURF is working on this objective. The aim is to ensure that users in this new world remain supplier-independent. This in particular, applies to applications and content. SURF translates innovative concepts into unique and competitive types of services, including business models. The aim is to make a real difference: innovation must lead to significant progress in terms of performance, cost reduction or the scale on which the service can be used. Wherever possible, we do this in collaboration with other innovation hubs such as public knowledge institutions, commercial players, suppliers and international organisations.

#### What are we going to do?

In order to provide researchers, lecturers, students and staff with first-class campus ICT facilities, over the next few years SURF and its members will develop a vision for the future of the campus. In parallel with this, SURF will develop campus ICT services where required. In this context, we will expressly look for opportunities to develop innovative types of services through a "system leap".

SURFcumulus and SURFwireless are examples of SURF's campus ICT services. These services show that institutions can already choose to play the role of ICT manager, with SURF providing the institution's data centre and wireless network. New concepts that offer scalable ICT functions in a highly efficient and integrated way are being deployed. This provides the potential to support the fixed network too and to open-up computing or storage services to users.

For researchers, this also means being able to share access to research tools, local ICT facilities and data outside of the campus, as part of a national or international ICT infrastructure.

SURF translates innovative concepts into unique and competitive types of services, including business models.

### 3.3.3 Secure in a digital world

For education and research institutions, a freely accessible and open environment is essential. Simple, safe and reliable data sharing is the basis of collaboration. We must protect ourselves against attacks on ICT infrastructures and against the misuse, hijacking or destruction of data and information. Vulnerabilities and risks must be identified. We must, however, be able to react appropriately if something does happen.

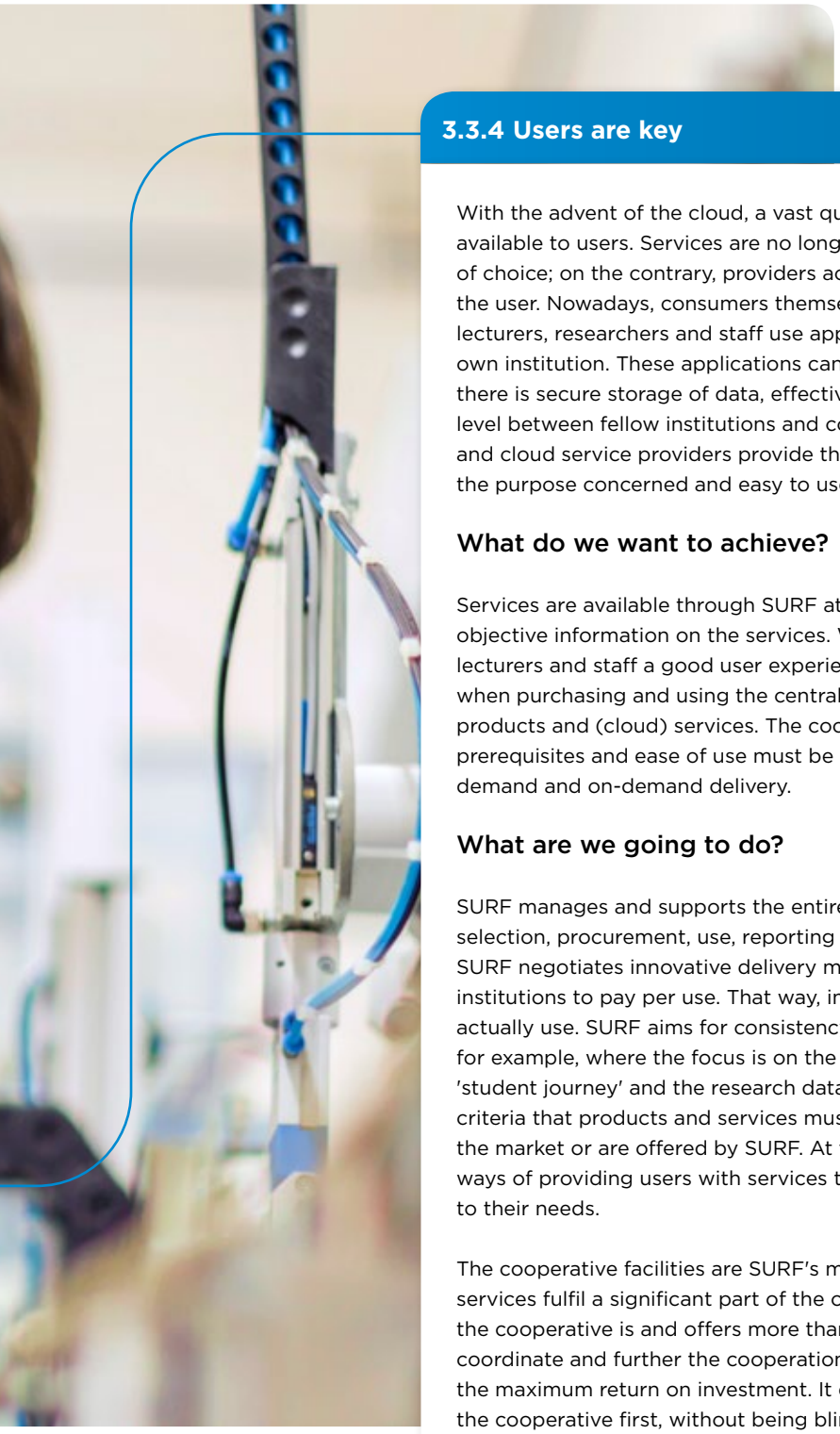
#### What do we want to achieve?

All users of our facilities must have adequate awareness and understanding of security risks, privacy, legislation and regulations. Joint agreements and standards frameworks in the field of information security and privacy are crucial. Institutions must be able to protect themselves against any form of cyber-crime and to recover quickly from unsafe situations, security breaches and incidents.

#### What are we going to do?

SURF is working on the resilience of the community by increasing knowledge and awareness of cyber-crime and of legislation and regulations on data use, privacy and security. SURF helps institutions implement their own security campaigns and initiates audits and crisis exercises. SURF makes first-class security services available to protect the core tasks of the institutions. These services guarantee the availability, reliability and integrity of the information management system. SURF is exploring the potential of new technologies and is working to proactively protect our infrastructure and data against every threat. We actively cooperate with initiatives such as the Integrated Secure Higher Education (IVHO) programme.

The focus is on user demand
and on- demand delivery.



### 3.3.4 Users are key

With the advent of the cloud, a vast quantity of online services are readily available to users. Services are no longer offered centrally with no freedom of choice; on the contrary, providers actively strive to consider the wishes of the user. Nowadays, consumers themselves search for a service. Students, lecturers, researchers and staff use applications that are not offered by their own institution. These applications can only be used easily and effectively if there is secure storage of data, effective collaboration at product and service level between fellow institutions and compatibility between services. SURF and cloud service providers provide the services, which must be suitable for the purpose concerned and easy to use.

#### What do we want to achieve?

Services are available through SURF at a single location, together with objective information on the services. We offer students, researchers, lecturers and staff a good user experience (quick, easy, effective & reliable) when purchasing and using the centrally organised but de-centrally delivered products and (cloud) services. The cooperative facilities, functionalities, prerequisites and ease of use must be excellent. The focus is on user demand and on-demand delivery.

#### What are we going to do?

SURF manages and supports the entire chain from requirement, selection, procurement, use, reporting and invoicing of digital services. SURF negotiates innovative delivery models with suppliers that enable institutions to pay per use. That way, institutions only pay for what they actually use. SURF aims for consistency in its services, through SURFconext for example, where the focus is on the overall user experience. We map the 'student journey' and the research data life cycle to define the specific criteria that products and services must meet, whether they come from the market or are offered by SURF. At the same time, we explore new ways of providing users with services that are tailored even more closely to their needs.

The cooperative facilities are SURF's most tangible products. These services fulfil a significant part of the cooperative's objectives. However, the cooperative is and offers more than that. SURF's role and aim is to coordinate and further the cooperation between its members and to achieve the maximum return on investment. It does this by putting the interests of the cooperative first, without being blinkered, and by anticipating change with a consistent methodology for making choices. The cooperative also does this (as indicated in the following pages) by focusing attentively and ambitiously on continuous innovation, high-quality services, knowledge-building and a sustainable world.

# 4 The role of SURF

SURF has been the collaborative organisation for education and research in the Netherlands for decades. The common goal is to improve the quality and flexibility of education and research through the optimal use of ICT. In this chapter we explain how SURF operates as an organisation of and for its members and outline the strategies and methods we use to achieve our objectives.

# 4.1 This is SURF

### 4.1.1 Within the cooperative

The Dutch education and research sectors work together on ICT issues within the SURF cooperative. The members choose to work together because joint investments and joint efforts offer greater opportunities for achieving their objectives. SURF acts as initiator, coordinator, supplier and manager. SURF's approach is designed to maximise the Dutch education and research sector's understanding of ICT and its ability to use ICT effectively. We do this by focusing on knowledge, innovation and services. SURF sets the agenda and priorities.

### 4.1.2 Outside the cooperative

SURF's vision is an Internet that is as open, accessible and reliable as possible, where researchers, students, lecturers and staff can work safely and freely. In order to achieve this, SURF participates in public debate and in consultations on behalf of its members. The new opportunities opened up by ICT developments sometimes involve social issues. SURF organises the debate around these issues. As a result, the positions adopted by SURF – as expert organisation or representative of the Netherlands – are transparent and have been validated. SURF enters into partnerships that help protect the Internet against cyber-crime and safeguard the fundamental rights of users, such as privacy, accessibility and freedom of choice. SURF makes knowledge and expertise available and provides services to other organisations, such as ministries, if this helps it achieve its vision. That way, principles that have been developed within SURF find their way into other fields.

### 4.1.3 Dutch interest

SURF influences international developments and monitors the interests of the Netherlands. SURF sees promotion of the knowledge economy as its secondary task. In other words, keeping an eye out for opportunities for government, business and industry and the non-profit and not-for-profit sector. SURF is working with national and international market players to set up the national ICT infrastructure and promotes public-private partnerships. By working in this way for and with Dutch education and research, the cooperative serves a greater Dutch interest.

The members choose to work together because joint investments and joint efforts offer greater opportunities for achieving their objectives.

# 4.2 Anticipating change

Members' needs are influenced by the major changes associated with digitalisation and internationalisation. SURF anticipates this and helps members respond to changing and growing demand. This is reflected in a broad and flexible range of services and an appropriate innovation portfolio.

As a result of the success of cooperation at the interface between education, research and ICT, senior secondary vocational education providers have also joined SURF. This strengthens the cooperative and enables it to respond more effectively to demand. With a larger support base, SURF carries more weight when taking a stand; more clients improves its buying power in tenders; and more members also contribute more knowledge. However, this growth also means that we must plot our course even more carefully and ensure that the selection process remains transparent, and make even more effort to stay close to our members.

### 4.2.1 Taking both common interests and individual identity into account

Institutions, umbrella organisations and the government are turning to SURF for an increasingly broad range of services because of its knowledge, services and unique position in education and research. The demand for services is widening: the use of technology requires ever greater coordination between infrastructure and user processes, data and procurement regulations have become more stringent and complex. The services SURF provides are growing in line with the impact of digitalisation.

Developments in ICT give rise to a complex range of challenges, and the diversity of the members makes decision-making more complex. The needs of the members often coincide, but their individuality and differences call for more than a one-size-fits-all approach. Collaboration within the cooperative only adds value if the joint effort offers advantages, and if it also takes into account the differences between the members in terms of pace, strategy and priorities.

If both the common interests and the individual identity of the members are to be taken into account, constant interaction is required between the institutions and SURF around key developments, complex choices and the services to be provided. Sharing knowledge, visions and ideas at a substantive and administrative level ensures a mutual understanding and provides insights around the common interests. This benefits the formal decision-making process in the Members' Council. Intensive interaction with users during the development and evaluation of services ensures that services are fully in line with requirements.

The Coordinating SURF Contacts (CSCs) lead the way in contacts with institutions at all levels. SURF takes the initiative with technical and organisational frameworks (e.g. portfolio management).

### 4.2.2 Making informed choices

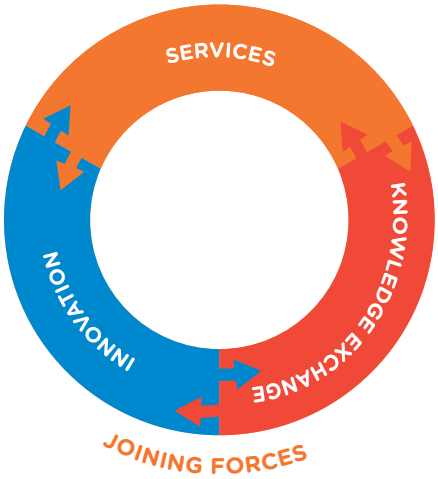
A transparent, consistent methodology is required to consider both the common ground between and the individual identity of our members in a decisive and effective way. In so doing, the cooperative can make balanced, transparent choices around innovation and service development within SURF. In other words, we take the time to listen to all views and opinions and we base our decisions on shared principles.

The first principle is that we focus primarily on a cooperative-wide approach. This is explored through administrative consultation and sector-by-sector assessment. The result is a shared insight into the extent to which the needs of the members can be met through a collective solution.

The second principle is that there are challenges which, for various reasons, affect only some of the members. In these situations, collective action offers no added value and the members concerned will come up with a solution together. This is conducted in such a way that these solutions can ultimately be of benefit to the entire cooperative. Guided by these two principles, SURF and its members set up a process for substantive and administrative interaction. Transparent, in-depth discussions will help to ensure that as many solutions as possible are developed in partnership.

## 4.3 SURF's approach works

Education and research institutions are working together within SURF on state-of-the-art digital facilities for advanced research and education. The members of the cooperative work to improve the quality and flexibility of education and research. SURF's approach clearly works: we do this through our core activities (innovation, services and knowledge exchange) and by working closely with all parties involved.



### 4.3.1 Continuous innovation

SURF experiments with new technologies, concepts and forms of collaboration. We invest structurally in continuous innovation to enable Dutch education and research to benefit from the advantages and potential of the latest ICT developments. Together with institutions and businesses, we explore new concepts, which we test through proof-of-concepts in the SURF Open Innovation Lab. We act as a testing ground for pilots of new applications with large user groups. If successful, they are scaled up to profitable services.

Innovation is a long process: innovations may fail, and it can take between two to five years before successful concepts can be used on a large scale. That is why we drive innovation together with the institutions and partners in public-private partnerships, thereby enabling our members to be global leaders.

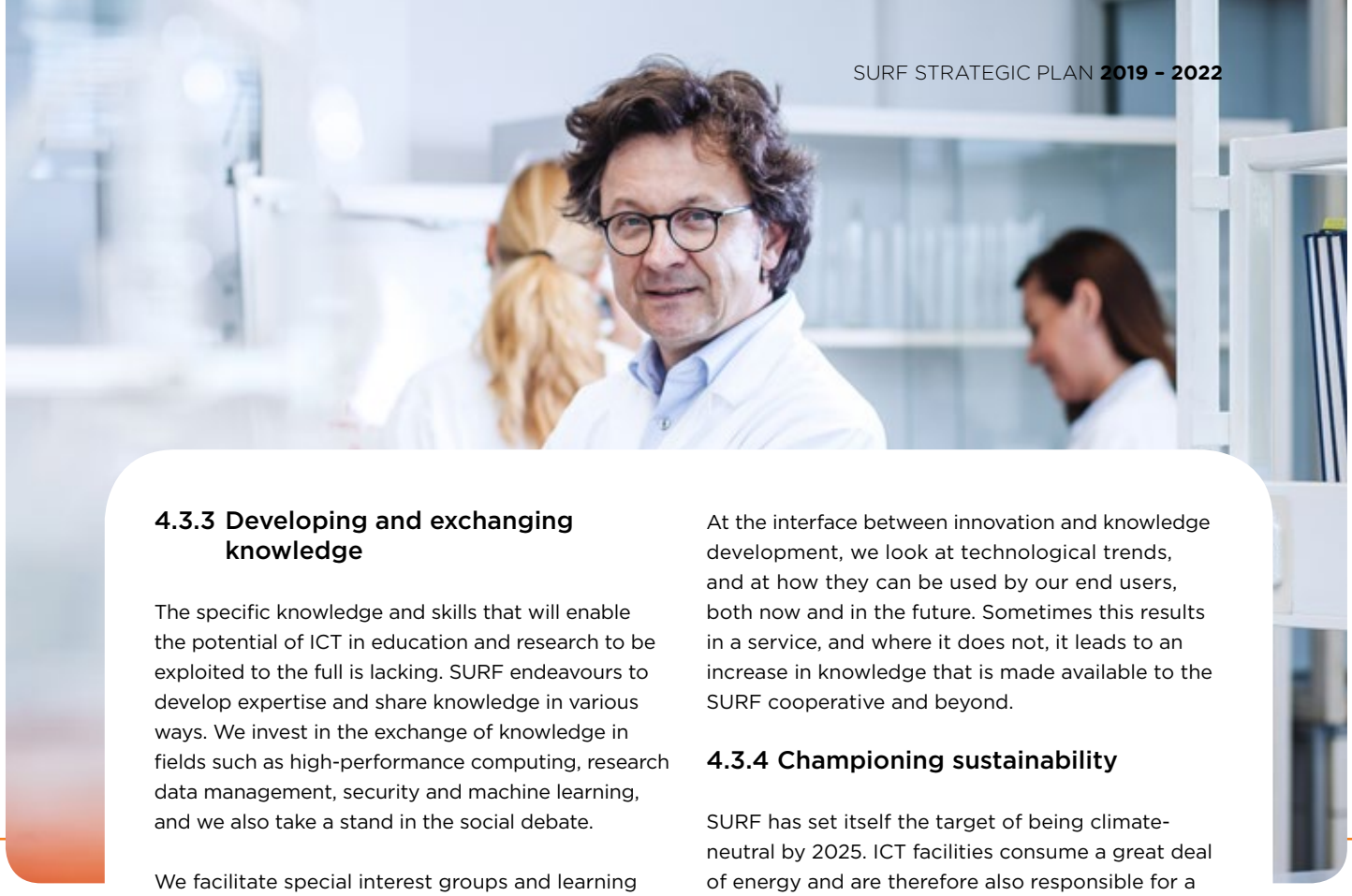
### 4.3.2 High-quality services

SURF is the strategic partner of research and education in the Netherlands and supplies an innovative portfolio of knowledge and services that sets it apart from the market. In many cases, SURF's innovations result in unique types of services and expertise. We encourage market players to tailor their services to the needs of our members. This results in services that add value for the research and education community. Prime examples of this are SURF's HPC facilities, eduroam and SURFconext. We aim to make SURF's services accessible and predictable for users, by seamlessly integrating the cooperative facilities, for example.

SURF actively focuses on architecture governance (cohesion between business processes, functionality, applications and technical infrastructure), resilience (information security, privacy by design), accessibility (open standards, open access), and compliance with laws and regulations, compliant procurement and knowledge transfer to other public sectors such as government, healthcare and primary and secondary education in particular. In addition to guaranteeing the compliant procurement of ICT facilities for its members, SURF also achieves economies of scale wherever possible through close cooperation with the intended clients.

When developing services, SURF works closely with its members to ensure that SURF's services seamlessly meet the requirements and wishes of institutions and users. Users have significant influence over and insights into the (further) development of services. Wherever possible, we affiliate our services with national and international initiatives which carries more weight with market players. Innovation and services go hand in hand; our service portfolio is never complete.

When developing services, SURF works closely with its members to ensure that SURF's services seamlessly meet the requirements and wishes of institutions and users.



### 4.3.3 Developing and exchanging knowledge

The specific knowledge and skills that will enable the potential of ICT in education and research to be exploited to the full is lacking. SURF endeavours to develop expertise and share knowledge in various ways. We invest in the exchange of knowledge in fields such as high-performance computing, research data management, security and machine learning, and we also take a stand in the social debate.

We facilitate special interest groups and learning communities, in which experts from institutions jointly build up knowledge around specific issues. SURFacademy offers a wide range of training courses to disseminate the knowledge of experts from institutions and SURF across the cooperative. We offer practical guidance on tendering and the compliant procurement of ICT facilities and content, for example.

We also work with public and private partners to develop and share knowledge. The Netherlands eScience Centre is a collaboration between the Netherlands Organisation for Scientific Research (NWO) and SURF. The National Coordination Point for Research Data Management is an initiative of VSNU and SURF in close cooperation and coordination with RDNL, 4TU and DANS. These initiatives promote the acquisition of knowledge around multidisciplinary research collaboration and research data management. In conjunction with market players and within Support4Research, we are developing training courses that are accessible to all members, e.g. on cloud services and sourcing strategies.

At the interface between innovation and knowledge development, we look at technological trends, and at how they can be used by our end users, both now and in the future. Sometimes this results in a service, and where it does not, it leads to an increase in knowledge that is made available to the SURF cooperative and beyond.

### 4.3.4 Championing sustainability

SURF has set itself the target of being climate-neutral by 2025. ICT facilities consume a great deal of energy and are therefore also responsible for a significant proportion of CO2 emissions. SURF and the institutions are taking responsibility for reducing energy consumption and for corporate social responsibility.

In its role as pioneer, SURF is championing sustainable, circular ICT. Through our knowledge, expertise and e-infrastructure, we also want to use the added value that we can have for society by having input on urgent social issues and working in accordance with the UN's Sustainable Development Goals. Wherever possible, we raise awareness of corporate social responsibility and sustainability issues. Within the cooperative, we share and develop knowledge around energy efficiency and the sustainable disposal of electronic waste. Sustainability is central to the development, procurement and delivery of services, and, with innovative ICT applications, we are accelerating the transition to a sustainable, circular digital economy. As an employer, SURF takes an inclusive approach and has a sustainable HR policy with permanent employment contracts and a focus on development, motivation and diversity.

## 4.4 Funding

The available funds are allocated based on two-year plans. The (business) continuity of the cooperative is a prerequisite, so large fluctuations in the annual budgets are avoided.

### 4.4.1 Revenues

If the ambitions of this Multiannual Agenda, in terms of innovation, services and knowledge sharing, are to be fulfilled, adequate financial resources are essential. In this context we apply the principle

that, wherever possible, services should be financed through charges, fixed fees and external contributions. We regularly discuss the development of the service portfolio, delivery models and charges and external contributions from institutions and partners within the SURF Portfolio Advisory Committee. We will continue the 2018 experiment of having a development budget so we can respond quickly to demand in the forthcoming multiannual period. We anticipate that the growing demand for services from and through SURF will result in an increase in turnover.

### 4.4.2 Structural funding

We use structural funds from the government to finance activities, facilities and innovation, including transparent access, which is difficult or impossible for individual users, projects and institutions to afford. Combining these investments also enables us to 'do more with less': effective use of public money.

In addition to structural funds, in recent years SURF has received occasional contributions from the government to make up for a growing deficit.

The ICT advisory report on the national digital infrastructure for research has resulted in an increased structural contribution of twenty million euro from the Ministry of Education, Culture and Science. At the time of writing, how this additional annual amount will be distributed and the conditions that will be attached to it are not yet known; all we know is that a substantial part of it will go to SURF. In addition, NLeSC can also expect an increase in its budget following NWO's (Netherlands Organisation for Scientific Research) advisory report on ICT.

### 4.4.3 Investing in the basics

In consultation with the Ministry of Education, Culture and Science and NWO, we reach agreements on the deployment of additional funds. For part of the budget, this relates to how access to SURF's facilities is regulated based on the structural funds. This is closely linked to the way in which SURF plans to deploy the structural funds:

- Upgrading of the (national) core infrastructure: computing, data, network and security facilities.
- Enhancing SURF's expertise and keeping an eye out for new developments and open innovation.
- Supporting education and research: SURF's contribution to the NLeScience Center and the Acceleration Agenda for innovation in education.

We will always explain the distribution of resources in the two-year/annual plans and submit this to the Members' Council.

## 4.5 Finally

In this Multiannual Agenda SURF sets out the cooperative's ambitions and plans for the period 2019-2022. The agenda covers a period in which digitalisation will have a major impact on society, in a world in which global ICT-related developments will put our standards and values to the test. The challenges facing us, the education and research community in the Netherlands, are significant.

Four years is a long period of time, in which new insights and models can mature, knowledge can grow and solutions that were previously unthinkable can be found. There will be countless opportunities for the members of the cooperative to raise the level of education and research in the Netherlands to the highest level through innovative use of ICT.

We are ready for the future, and by driving innovation we influence the future. We do this collaboratively within the cooperative, taking into account our differences and engaging with our stakeholders. We look forward to our future with confidence!

# Sources of information

This document is based largely on interviews, meetings, working dinners with directors, CIOs, researchers and educational experts from institutions, umbrella organisations and other organisations in the field of ICT and innovation, meetings of Coordinating SURF Contacts, vision documents and action plans from SURF and related organisations.

# Colofon

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## Driving innovation together

Universities, colleges, vocational institutions, research institutes and University Medical Centers work within SURF to it facilities and innovations. With the aim of better and more flexible education and research. We do this by delivering the best possible digital services, knowledge sharing and to encourage exchange and especially by constantly keep innovating! This we contribute to a strong and sustainable Dutch knowledge economy.

SURF