

Digitalisation strategy¹ for the higher education sector 2017-2021

¹ Digitalisation refers to the use of technology to innovate, simplify, and improve. It is about offering new and better services that are easy to use, efficient, and reliable. (Digitalisation circular no. H-17/15).

1 Where are we?

Digitalisation has changed all sectors of society and is dramatically changing the way we work, live, communicate, and interact. The opportunities brought about by technological change are affecting everything from infrastructure and administration, learning materials and research data, methods of teaching, learning and assessment in the education sector, and research methods to the very content of education and research, and the way that the higher education sector interacts with society and business. Currently digitalisation and new platforms are of powerful and growing importance for the sector, and in the coming years ICT solutions will have a great impact on education and research. Through digitalisation it will be created opportunities for new and different learning and teaching processes, as well as new forms of organisation and communication. The use of learning analysis, such as to understand students' learning patterns and improve learning processes, is only in its infancy². Research on artificial intelligence and machine learning is continuing to break new ground and may lead to fundamental changes for better or worse. The new and complex information landscape, together with its extensive use of data and technology, poses extensive challenges in terms of ethics, law, and security. Furthermore it places increased demands on ICT skills, accountability, digital judgement, and the ability to source criticism at all levels. In line with the main principles of the government's digitalisation policy, the primary starting point will be the needs of the users.

In order for higher education and research in Norway to leverage the potential of technology to improve student learning, make the range of study options available on a wide scale, and support outstanding research, the focus on use of technology for learning and new knowledge must be elevated to a strategic level at institutions and integrated into all academic and administrative activities. Leveraging the power of digitalisation to bring about change requires governance and management at all levels. The development and use of technology in the sector must therefore be rooted in strategies at both the national and institutional levels.

Higher education institutions (HEIs) possess academic freedom when it comes to education, research and innovation, and have been given more administrative and organisational autonomy than other state bodies. A digitalisation strategy for the sector must take into account that it will apply to academically independent institutions that must be able to brand themselves academically and always have real opportunities to develop and innovate. The digitalisation strategy must clarify how to organise, and promote measures that put the sector in a position to react swiftly to the opportunities and challenges posed by the use of ICT.

² The MOOC Committee's proposal to establish an environment for research-based knowledge development, development work, and knowledge-sharing related to learning analysis was followed up through the establishment of the Centre for the Science of Learning & Technology (SLATE) in 2016 by the Norwegian Ministry of Education and Research with the University of Bergen as the host institution.

The Norwegian higher education sector is at the forefront of co-operation on digital solutions. The sector has effective infrastructure solutions and has developed a number of joint services for administrative tasks, education, and research. Nevertheless, there is significant potential for further efficiencies and improvement in quality by exploiting existing and new ICT solutions.

Studies³ on digitalisation in the education sector that have been conducted at Norwegian universities and university colleges show that digitalisation has been largely governed by individuals and enthusiasts, rather than being rooted in management and in cohesive institutional strategies. Studies also indicate that newly trained teachers have not been given sufficient academic digital skills as part of their basic training⁴. Academic staff in the higher education sector have called for improved skills and support in the use of digital tools. A stronger rooting in management, more shared solutions, and more efficient governance and organisation have also been called for. These challenges were also pointed out by the MOOC Committee⁵. The appointment of a public committee in 2014 to advise on how Norway should approach the rapid emergence of MOOC helped to raise awareness of the potential of digital media and learning methods from a Norwegian perspective, with particular emphasis on increased quality in learning and pedagogical practice. There is reason to believe this situation has changed since 2014. More institutions have adopted their own strategies for digitalisation or incorporated digitalisation goals in new institutional strategies. Digitalisation is being increasingly linked to education quality. There has been an especially high level of activity with regard to the digitalisation of exams. In addition, new digital assessment methods are being developed⁶. With the support of the Norwegian Agency for Digital Learning in Higher Education, several institutions have developed various versions of MOOC – cf. www.mooc.no.

Although effective solutions have been established with regard to the management of the sector's support services and data, there are still many challenges yet to be resolved and opportunities yet to be leveraged. The institutions in the sector continue to perform many tasks in parallel, and the sector has a relatively large number of insourced service providers who do not operate with adequate co-ordination. The sector has long been calling for a cohesive ICT strategy and key decision-making structures that ensure the better and more efficient management of services, data, and related ICT solutions.

³ Norwegian Agency for Digital Learning in Higher Education, *Digital tilstand 2014*, which follows on from corresponding surveys from 2008 and 2011.

⁴ cf. Norwegian Ministry of Education and Research's digitalisation strategy for basic education (2017-2021)

⁵ NOU 2014:5 *MOOC for Norway. New digital learning methods in higher education...* MOOC means "Massive Open Online Courses".

⁶ Both the Norwegian Agency for Digital Learning in Higher Education and SLATE are central to these development efforts.

2 Why a strategy?

In its perspective report,⁷ the government maintains that exploiting the opportunities brought about by technology is a key element of a sustainable public sector. The public sector must facilitate the utilisation of new tools, including digitalisation and the automation of tasks. State enterprises must work systematically to ensure that investments in new digital solutions provide the results expected of them and the realisation of benefits.

Improvements within an individual public sector service will always be the responsibility of the individual institution and sectoral ministry. There is a similar responsibility to embark upon digitalisation measures, decide on the internal prioritisation of competing initiatives, and implement the measures. The sectoral ministries and their underlying entities are also responsible for ensuring that the benefits resulting from digitalisation are followed up and capitalised on.

Similarly, each sector is responsible for using the shared solutions and complying with common frameworks and requirements. The individual institution and sector have a responsibility to create solutions that can be shared with other enterprises and sectors. Consequently, the government expects institutions to endeavour to find solutions together. This requires effective co-ordination and management. State-owned enterprises will be the drivers and adopt a co-ordinating role in efforts to create effective digital solutions across state and municipal sectors.

Even within the higher education sector there is a need to focus more heavily on digitalisation and ICT as key tools in improving interaction, quality, and the relevance of research and higher education, as well as contributing to a more efficient, robust, and well-functioning higher education and research sector. Furthermore there is a need to ensure that the higher education sector is equipped to face the digital challenges of the future, such as those related to the processing of research data.

Digitalisation is not a goal in itself, but it may contribute on achieving the objectives of education and research in a better and more efficient way. Achieving these requires management-rooted organisational development and cultural shift. The institutions' management must, to a greater extent acknowledge the importance of digitalisation in reaching institutional and sectoral goals and take responsibility for seizing opportunities and exploiting the benefits of co-operation both between the institutions themselves/within the sector and together with the various new administrative agencies to ensure effective solutions that benefit students, the labour market, and society.

Well thought-out and well-structured digitalisation strategies are necessary at all levels for ensuring effective interaction of changes in technology, organisation, and practice coherent

⁷ Storting White Paper 29 (2016–2017)

with the objectives of the institution as well as the sector as a whole. Both institutions and administrative agencies should have their own digitalisation strategies. Furthermore, the Norwegian Ministry of Education and Research needs to provide an overall strategic direction for higher education sector efforts relating to digitalisation, by providing clear expectations and visions, by clarifying the distribution of tasks and responsibilities, and by initiating joint measures and initiatives.

Higher education and research is a complex and diverse area, so it is necessary to place the more operational aspects of ICT and digitalisation efforts in the higher education sector in the subordinate administrative agencies and the institutions themselves, individually and jointly. In the ministry's overall digitalisation strategy for the higher education sector, emphasis is placed on defining overall goals and stating the desired direction of development. The strategy must be seen as the first step on the journey and as a basis to be built on as external and internal conditions change. The overall objectives of the sector are stated in the annual budget proposition to the Storting, Prop1 S, and the primary goal of the digitalisation strategy is that digitalisation should help to achieve the primary objectives of the sector. In addition, some of the objectives indicating the direction in which the ministry wants development to head are described. This is followed by a description of the measures considered the most important at the ministerial level for progressing with digitalisation efforts within the higher education sector. Finally, the most important stakeholders and their responsibility for further follow-up and work are described. These tasks and responsibilities are intended to constitute a framework for managing digitalisation in the sector. The development of solutions that meet user needs and utilises available resources in the best possible way requires adequate proximity to users at all levels.

The Norwegian Ministry of Education and Research's overall digitalisation strategy is based on a comprehensive proposal for an ICT strategy, with sub-strategies for education, research, infrastructure, information security, administrative functions, and the organisation of ICT management, prepared by a working group set up by the ministry consisting of representatives from the higher education sector. The Norwegian Ministry of Education and Research's digitalisation strategy for the higher education sector must also be seen in the context of the requirements, guidelines, and recommendations of a number of different reports, white papers, strategies, circulars, and action plans. The most important of these are: NOU 2014:5 *MOOCs for Norway. New digital learning methods in higher education*, Report No. 18 to the Storting (2014-2015) *Konsentrasjon for kvalitet – Strukturreform i universitets- og høyskolesektoren* (structure report), Report No. 16 to the Storting (2016-2017) *Quality Culture in Higher Education* (quality report), Report No. 27 to the Storting (2015-2016) *Digital agenda for Norway – ICT for a simpler everyday life and increased productivity*, Digitalisation circular no. H-17/15, *Nasjonal strategi for informasjonssikkerhet* and *Kunnskapsdepartementets digitaliseringsstrategi for grunnsopplæringen 2017-2021*.

The digitalisation strategy for the higher education sector does not include measures aimed directly at the content and design of courses and research ventures. This will be followed up

as part of the long-term plan for research and education, annual budget propositions, or individual action plans or initiatives.

3 What do we want to achieve?

3.1 Primary goals

The currently applicable sectoral goals for research and higher education, as determined in the annual budget proposition to the Storting Proposition 1 S, will always be the primary goals for digitalisation and ICT in the higher education sector:

- High quality in education and research
- Research and education for welfare, value creation, and adaptation
- Good access to education
- An efficient, diverse, and robust higher education sector and research system

Digitalisation and ICT in the higher education sector must support these goals.

3.1.1 High quality in education and research

The government wants Norwegian education and research environments to be of high quality, and for more Norwegian education and research environments to climb global rankings. The quality report stresses the importance of exploiting digital opportunities so that all students can experience stimulating and varied learning and assessment methods. In addition to academically relevant digital skills, students shall acquire more general ICT skills and digital judgement that are relevant across disciplines. Digitalisation makes it possible to conduct research more efficiently and to create new opportunities to develop methodologies, to co-operate, and for development within existing and new disciplines. In addition digitalisation provides opportunities for sharing research data and results in new ways, while also presenting new challenges for researchers in relation to data security and correct data management.

3.1.2 Research and education for welfare, value creation, and adaptation

The government aims to make Norway one of the most innovative countries in Europe. For this we need education and research that interacts with the outside world and meets the needs of the labour market and society. The potential of digitalisation is vital to conducting research more efficiently, to academic development and to the development of methodologies, and ICT solutions that facilitate seamless co-operation with stakeholders outside of the institutions both nationally and internationally.

3.1.3 Good access to education

The government wants everyone to have access to higher education, regardless of their gender, ethnicity, or social, geographic, or economic background. Education should facilitate good access to labour and skills across Norway. Lifelong learning is important in order to help not only individuals but also society and the labour market at large to adapt and

innovate. Digitalisation expands the opportunities for access to education and for co-operation on the development of relevant courses. New and varied forms of teaching and learning are being used in regular campus-based courses by combining analogue and digital media (blended learning), and new models are being provided for purely online-based studies.

3.1.4 An efficient, diverse, and robust higher education sector

An efficient, diverse, and robust higher education sector and research system will help to achieve the first three goals for the higher education sector in the best possible way. Universities and university colleges manage a significant portion of community funds and must use these resources efficiently and for the benefit of society. The institutions shall develop their brands in line with their strengths and individuality and contribute to high quality and a differentiated sector. Furthermore, they shall meet the needs of society in a variety of areas and help Norway to assert itself internationally as an outstanding knowledge nation. Digitalisation is a tool for making fundamental changes to the processes, content, and forms of work that can put the sector in a better position to achieve the goals of education and research: high quality and relevance, and access to education for all.

3.2 Objectives for the future

Our objectives indicate a direction for the development of sub-strategies and implementation of measures.

3.2.1 Objectives for students

- Students are admitted into an academic community of staff and fellow students in which digital opportunities are exploited as part of active and varied learning and assessment methods, that result in the best possible learning outcomes and provide students with the academic and digital qualifications that they shall acquire within their programmes of study.
- Students can participate in research projects (research-based teaching) and are trained in the use of research tools in order for them to be able to participate in and directly contribute to the research.
- Students are given the opportunity to develop their digital skills, and they are trained in the use of technology that promotes learning and generic skills and makes them aware of the ethical, legal, and security issues that arise through the use of data and digital technology.
- Students have access to a modern, personal learning environment that facilitates individual learning arrangements, efficiency, interaction, and flexibility in their studies.

3.2.2 Objectives for teachers

- Teachers have high levels of digital and pedagogical skills (knowledge of how to use digital tools to promote learning in their subjects), incentives for the academic/pedagogical development of their own teaching, and access to collegial communities and support services for the development of study programmes and to share digital learning resources.
- Teachers have a wide range of applications and digital tools and services that support the implementation of education, from planning, through teaching itself and

interaction with students and colleagues both internally and externally, to the follow-up and evaluation of students at individual and group levels.

- Teachers have the opportunity to receive remuneration (in the form of promotion, qualification, salary) or time to pursue the development of education activities on the basis of documented results in the field of education.

3.2.3 Objectives for researchers

- Researchers have the digital skills needed for the optimal utilisation of ICT in their research in order to carry out their tasks efficiently and exploit the opportunities that digitalisation provides for developing the discipline and processing research data effectively and appropriately.
- Researchers have access to relevant scientific publications, a good overview of relevant researchers, and access to research data for their discipline.
- Researchers have access to a well presented range of applications and services with sufficient resources for storage, calculations, and advanced user support.
- Researchers have access to user-friendly ICT support functions that meet the needs of their day-to-day work in terms of both academic and administrative tasks.
- Researchers have access to infrastructure and tools that enable them to interact effectively with other researchers across sectors, nationally and internationally.
- Researchers use tools for digital interaction in order to work efficiently on projects and in networks, both internally and externally.

3.2.4 Objectives for the management at all levels

- Management leverages the opportunities provided by digitalisation in order to achieve their institutions' goals by including digitalisation in planning and in specific measures and processes.
- Management is aware of their managerial responsibilities and have the skills to lead, motivate, and support the change processes necessary as a result of digitalisation.
- Management leverages the potential of digitalisation to streamline administrative support functions and ensure effective governance.
- Management maintains their institutions' values and interests and follow national policies through systematic efforts to improve information security.
- Management puts in place formalised systems for the documentation of and remuneration of work relating to the development of teaching.
- Management sets goals at a level that makes it possible for academia as a whole, and not just enthusiasts, to embrace the potential of digitalisation for raising the quality of education.
- Management ensures that the systems chosen facilitate interaction internally within the higher education sector, as well as with stakeholders outside the sector.
- Management has easy access to information and decision-making support.

3.2.5 Objectives for the data and infrastructure

- Data is stored once and made available from a single source.
- Data is retrievable, available, interoperable, and reusable in accordance with the FAIR principles.
- Infrastructure is flexible and facilitates mobility and development.
- Cohesive governance and management of information security are fundamental to digitalisation and strategic efforts and superstruct the sector's goals.

3.2.6 Objectives for administrative systems

- All services, information, and communication are digitally available as far as possible.
- Needs, ease of use, and the user experience are key criteria in the realisation of new solutions.
- Administrative workflows and user interfaces are improved and streamlined through standardisation and digitalisation.
- A shared system portfolio has been established to address transversal administrative needs (budget, accounting, payroll, procurement, etc.).
- The potential for automation and self-service is well utilised so that services are perceived as being simple, effective, and user-friendly.

4 General organisational and financial conditions

4.1 General organisational conditions

In order to seize opportunities and address challenges related to digitalisation in the sector, an internal project was established in 2016 with a mandate of assessing the organisation of administrative tasks, joint services, and shared resources in the knowledge sector. Now the organisational project is finished hence the government has decided to establish a new structure with two administrative agencies pertaining to quality development and one administrative agency for services for the institutions. In order to improve the incentives for innovation in education, including through the digitalisation of pedagogical practice, the administration of grants and programmes for the promotion of quality has been combined in a new administrative agency for quality development built around the current Norwegian Centre for International Cooperation in Education (SIU, hereinafter “quality agency S”). The second administrative agency for quality development is built around the current Norwegian Agency for Quality Assurance in Education (NOKUT, hereinafter “quality agency N”) and will also be responsible for control and supervision. Furthermore, a new service agency shall be established with overall administrative responsibility for the field of ICT, as well as responsibility for the delivery of ICT-based services in their own right. Exceptions to this are joint infrastructure tasks and research support services that will continue to be provided by UNINETT, the service agency, and the Norwegian Centre for Research Data (NSD).

The Norwegian Ministry of Education and Research has established an implementation project that will ensure that the government’s and ministry’s decisions in connection with the organisation project are implemented⁸.

⁸ The service agency and administrative agency built around SIU will be established effective 1 January 2018, while the administrative agency built around NOKUT will be established effective 1 July 2018, provided that the necessary legislative amendments are adopted by the Storting. The names of the new agencies will be determined in connection with their establishment.

4.2 General economic conditions

The Norwegian Ministry of Education and Research will continue to contribute to the further improvement and expansion of state instruments for quality development and national infrastructure under the auspices of UNINETT and the service agency (cf. earlier initiatives such as the eCampus programme and cloud technology). The INFRASTRUCTURE scheme of the Research Council of Norway (RCN) could be a relevant source of funding for investments in and upgrades of nationally important ICT research infrastructure.

However, the primary principle for financing ICT infrastructure and services in the higher education sector must be that the institutions (users of the services) pay the cost of performing the tasks.

Digitalisation is not something that comes in addition to normal activities but must be integrated into them. The government has clear expectations that digitalisation will lead to solutions that are more efficient and better meet the needs of users, that realise benefits, and that free up resources that can further support digitalisation in order to improve quality. Consequently, central funding primarily caters for the financing of selected development projects and specific stimulation measures, while running costs for operation, maintenance, and innovation are financed by way of prioritisation within the usual budget frameworks. The government has established a co-financing scheme managed by Agency for Public Management and eGovernment (Difi) for small and medium-sized businesses. State enterprises, including state-owned HEIs, can apply for funding for up to 50% of the project costs. The projects must be socio-economically profitable and provide a solid realisation of benefits.

Management at all levels must take responsibility for making necessary funds available to ensure the implementation of various acquisitions and measures if the digitalisation of higher education is to be successful.

5 How do we get there?

Digitalisation efforts shall support and be part of the overall governance of the higher education sector. This is achieved by way of multi-level strategic governance. The digitalisation strategy shall be revised in accordance with significant changes in general external conditions. The ministry's overall digitalisation strategy will be operationalised through the follow-up of sub-strategies in the fields of research, education, infrastructure, administrative solutions, and information security, as drafted by the higher education sector itself⁹ (cf. chapter 2 above). The sub-strategies shall be followed up as part of a process for

⁹ The proposed sub-strategies are available at:

continuous improvement and shall be revised regularly, and they shall form the basis for the preparation of specific action plans. The most important measures in the sub-strategies are emphasised in this overall strategy. In some areas, there is no complete concordance between the overall strategy and the sub-strategies. This will be improved in the first revision of the sub-strategies.

Each institution will govern its own digitalisation efforts by way of its own goals and strategies adapted to the sub-strategies and overall digitalisation strategy. The relationship between the different governance and strategy levels is illustrated in the figure on page 23.

The service agency and the quality agencies are responsible for drafting, implementing, and developing the sub-strategies in co-operation with the institutions. In relation to the sub-strategy for research, it is important to work closely with the RCN and the entire research sector.

5.1 The government's long-term plan for research and higher education

The government's long-term plan for research and higher education will be revised by the end of 2018. In the process of revising the government's long-term plan for research and higher education, the Norwegian Ministry of Education and Research will, in consultation with other ministries, assess the opportunities and challenges posed by digitalisation and how to best address these in a revised plan.

Responsibility for follow-up: Norwegian Ministry of Education and Research

5.2 Digitalisation for quality in education

The HEIs are themselves responsible for the quality of their education. The measures in the strategy will help to promote digitalisation as an instrument in the institutions' efforts with regard to education quality. The national quality agencies will play important roles in the incentive structure for developing and ensuring this quality together with the institutions.

5.2.1 The development of a national arena for quality in higher education to stimulate knowledge, skills, and innovation in education

The quality report sets the guidelines for a national arena that will help to address the challenges that are of particular importance to quality development:

<https://www.uninett.no/arbeidsgruppe-IKT-strategi>

By establishing a joint national arena for education quality, in which current arrangements and new instruments can be seen in a strategic and academic context, the government will help to [...] mobilise academic environments for the knowledge-based development and innovation of education programmes, as well as for the increasing digitalisation of learning processes. The arena will fund projects that stimulate systematic development efforts that raise the quality of higher education.

By creating a national agency – quality agency S – with overall responsibility for the administration of incentives for quality development, the government will provide a good basis for supporting the institutions' work on digitalisation for increased quality, openness, relevance, and efficiency in education programmes.

Responsibility for follow-up: Norwegian Ministry of Education and Research and quality agency S

5.2.2 Strengthen research on the relationship between quality and changed learning processes based on digitalisation

A solid knowledge base is required on educational activities and outcomes, on the quality of higher education, and on the methods and tools that ensure the best learning environment for students. The government will continue to support the production and dissemination of good research, academic documentation, and experience-based knowledge of technology for learning.

The quality report states measures for improving the knowledge base further through evaluation and research and by developing a quality portal for higher education.

Responsibility for follow-up: Norwegian Ministry of Education and Research, RCN, quality agencies, and HEIs

5.2.3 HEIs define goals and specific measures related to the digitalization of learning processes and the use of new learning methods to raise the quality of higher education

According to the requirements of the quality report all students must come into contact with forms of learning that utilise the potential of digitalisation, and the government expects institutions to elevate the development of digital solutions to a strategic level and to define goals and measures related to the digitalisation of learning processes. The Norwegian Ministry of Education and Research will in the process of central funding set requirements on institutions to define goals and specific measures in relation to the digitalisation of learning processes.

Responsibility for follow-up: Norwegian Ministry of Education and Research and HEIs

5.2.4 Requirements regarding basic pedagogical skills and teaching experience in the appointment of all academic positions, and the gradual increase in teaching skills requirements for senior level positions

Current skills requirements for combined teaching and research positions offer little by way of incentives for the development of teaching skills beyond beginner's level or for the acquisition of skills in using new methods and tools as part of teaching. In its quality report, the government announced that it will set new requirements for pedagogical and academic skills, and set stricter requirements for promotions to professor level.

Responsibility for follow-up: Norwegian Ministry of Education and Research and HEIs

5.2.5 Merit system requirements for professional skills and pedagogical development efforts at all institutions

To stimulate a greater number of teaching initiatives and development efforts, and to help raise the value of education activities, the government is imposing requirements that all institutions establish merit systems for professional skills and pedagogical development efforts within a two-year period.

Responsibility for follow-up: Norwegian Ministry of Education and Research and HEIs

5.2.6 Explore solutions for access to learning resources across educational institutions

Digitalisation makes it possible to exploit the potential for producing, sharing, retrieving, and reusing learning resources. A number of Norwegian institutions have developed and made resources available both for digital content produced in house as well as for content derived from other sources¹⁰. A joint access solution would make possible a central administration of learning resources in order to stimulate the increased production and sharing of learning resources, as well as to make available, open digital learning resources for higher education. The Norwegian Ministry of Education and Research will ask quality agency S and the service agency to explore solutions for access to learning resources across educational institutions.

Responsibility for follow-up: quality agency S, service agency, and HEIs

¹⁰ DelRett, the copyright and education guidance service established by the Norwegian Agency for Digital Learning in Higher Education and the Norwegian Centre for ICT in Education, provides an overview of open learning resources and the licences that may limit their use: <http://delrett.no/artikler/her-finner-du-digitale-undervisningsressurser>

5.3 Digitalisation for a competitive research sector that supports innovation and adaptation

Good digital infrastructure, user support, and modern tools will help attract researchers. The digital infrastructure will be crucial in the development of new and outstanding research and innovation environments.

5.3.1 Strategy for open access to research data

In order to facilitate the sharing and reuse of research data, the Norwegian Ministry of Education and Research is co-ordinating an interministerial initiative to develop a national strategy for the availability and sharing of research data and data for research. A working group has been set up with members from the Norwegian ministries of: finance; trade, industry, and fisheries; labour and social affairs; health and care services; local government and modernisation; and climate and environment, under the leadership of the Norwegian Ministry of Education and Research. The working group takes as its starting point a report prepared by the RCN in 2016 in dialogue with relevant stakeholders and service providers in the research sector. The report was commissioned by the Norwegian Ministry of Education and Research. The strategy will be presented by the end of 2017.

Key issues include archives for research data, the need for data management plans, funding models/principles and cost management, standards for storage systems, and access.

Responsibility for follow-up: Norwegian Ministry of Education and Research

5.3.2 Resources for calculation, analysis, storage, data curation, and communication that enable Norwegian research communities to participate at the front line of international research

It is important to ensure that Norwegian research communities have infrastructures for calculation, analysis, storage, and communication solutions in place that enables them to participate at the front line of international research. It is likely that the cost of both this, advanced user support and data curation¹¹ will increase, and there is a pressing need to develop good models for sustainable, long-term financing of the operations phase of such infrastructures. This is challenging to manage in a system of time-limited project allocations, while data storage requirements may extend long after this period. The costs of operating research data infrastructures involve more than investments in the physical infrastructure. Operating, curation, and access management costs are also involved. Both UNINETT and NSD currently offer services of this type and have the important role of managing and developing them further. These are challenges that will have to be dealt with going forwards. Some of these issues could be addressed as part of efforts relating to the strategy for research data access and sharing.

¹¹ Data curation involves ensuring that a collection of data is up to date, correct, complete, and accessible to users. Curation often involves describing and cataloguing the material and sorting out / removing material/data that no longer needs to be included in the collection.

Responsibility for follow-up: Norwegian Ministry of Education and Research, RCN, service agency, NSD, and UNINETT in co-operation with the HEIs

5.3.3 Digitalisation to facilitate the cost-effective management of research publications

The goal of the government is to make all Norwegian research publications openly available by 2024. Infrastructure and support services should contribute to the low threshold for authors of research publications to make these available under the national principles for open access. The government is facilitating the cost-effective management of research publications by way of the national guidelines for open access for research publications and also by the following measures:

- improving the functionality for depositing articles via the CRISStin system;
- investigating options for the realisation of a national repository;
- contributing to the further development of new and sustainable models for the funding of open-source publishing nationally and internationally; and
- developing indicators and statistics for open access.

Responsibility for follow-up: Norwegian Ministry of Education and Research and the service agency in co-operation with research institutions, research funders and the wider research community

5.4 Digitalisation that improves the conditions for education and research – administration, management, and basic infrastructure

5.4.1 A well-scaled and robust network

A condition of a successful digitalisation strategy is a robust and functional (technical) network. This network, which is the combination of the research network and campus networks linked to national and international traffic exchanges, must be continually developed as a whole and adapted to meet the requirements of increased mobility, new services, growing data volumes, the use of inhouse services (including systems for study and research administration), public cloud infrastructure, and increased criticality.

Responsibility for follow-up: UNINETT, service agency, and the HEIs

5.4.2 ICT solutions based on data sharing

Current ICT solutions for the higher education sector offer too few opportunities for the retrieval and exchange of data between systems. Data is stored in many places and the systems do not communicate with each other effectively enough. The future ICT infrastructure of the higher education sector must: have simple, clear, and standardised interfaces based on the standardisation and harmonisation of data in the sector; possess a high level of availability; and support increased flexibility, modularity, and mobility. The

systems must be compatible and interoperable. Data should be generated/stored once and managed in a single source in order to be reused. Data flow is important not only within each functional area but also between administrative solutions and academic teaching and research systems.

Responsibility for follow-up: service agency, UNINETT, NSD, and the HEIs

5.4.3 Development and increased use of shared services

The primary principle is that support tasks are provided as shared services if it can be documented that this results in increased cost-effectiveness or better services. Attempts shall be made to organise infrastructure and services in addition to academic infrastructure and services (research and education) as shared services to be used by all relevant institutions. Basic ICT services such as hardware, software, networks, facilities, and other key components that support the supply of services to users are currently managed and supplied predominantly locally, despite the lack of demand for local customisation and the huge potential for shared services. Key components include systems for identification and authentication, as well as access to sector-specific data.

Services and infrastructure shall be procured externally when it is cost-effective to do so. In-house development should only take place when the sector's needs are so specialised that commercial solutions lack sufficient functionality or are too expensive. In-house development may also be acceptable when the sector itself requires full control of data pursuant to legislation and regulations or to the need to protect information that is particularly valuable to the institutions. The development of shared solutions should also consider whether solutions can be used in basic education or other areas of the knowledge sector, and in the opposite direction, whether solutions in other areas of the knowledge sector can be used in the higher education sector. Planning should include co-operation with the Norwegian government agency for nursery schools, education, and ICT or other subordinate agencies in the sector.

The service agency, UNINETT, and the HEIs must take joint responsibility for the development of shared services and systems and ensure that these are put into use. The services and systems must be able to communicate with each other. Development must be facilitated across the entire portfolio of support systems, and solutions and expertise should be shared more than they are today – see the box.

Responsibility for follow-up: Norwegian Ministry of Education and Research, service agency, UNINETT, and the HEIs

Boks 5.1 Shared services

Administrative shared services and solutions are currently organised through BOTT co-operation and UNINETT, which co-ordinates the services and solutions used by other HEIs with the exception of the Norwegian School of Economics (NHH) and the Norwegian University of Life Sciences (NMBU). In the area of payroll, the UNINETT portfolio uses payroll services provided by the Norwegian Government Agency for Financial Management (DFØ). DFØ provides payroll and accounting services to government agencies and aims to be the primary provider of these services to most state enterprises. In connection with BOTT's need to renew its solutions, there is a dialogue between BOTT, DFØ, the Norwegian Ministry of Education and Research, and the Norwegian Ministry of Finance to investigate whether DFØ could provide payroll and accounting systems to BOTT more extensively. The primary challenge is determining whether the Norwegian Ministry of Finance and DFØ can develop and invest in solutions that are robust enough to cope with the complexity of HEIs. This process needs to be clarified before additional planning can take place for how the sector's administrative services will be organised and developed within a digital solution framework. At the same time, efforts to develop and utilise existing solutions in the UNINETT portfolio must continue to be followed up until a shared solution for the entire sector as proposed in the structural report has been successfully established.

5.4.4 Harmonisation and streamlining of administrative work processes

Digitalisation is not just about the procurement of computers, software, and other equipment or about replacing existing technology with new ICT systems. The introduction of new ICT technology will always bring about organisational change, in turn resulting in changes to services, processes, and tasks. It is often the case that 20 percent of the process of purchasing new software relates to the actual technology, while the remaining 80 percent relates to organisational change and skills development.

To date, the sector's procurement of ICT solutions has involved the adaptation of the solutions to the customer's work processes. This is a cost driver and requires consultancy support during establishment. Furthermore, subsequent upgrades and maintenance are expensive. Adapting work processes to the supplier's/market's best practice will result in better utilisation of the systems and thus lower costs. If the institutions harmonise their work processes in accordance with best practice, this will avoid adaptation on an institution-by-institution basis, thus simplifying joint operation, management, and user support. It is difficult to provide shared solutions in cases where operational processes are too different, even if it would be more effective to do so.

Administrative processes need to be harmonised in order to introduce effective shared solutions; that is to say, to make work processes at different institutions as similar as

possible. This will require targeted efforts to ensure the effective establishment and management of a common best practice.

Furthermore, the standardisation of work processes is necessary to leverage the opportunities in the field of robotisation and the automation of administrative tasks, which could result in significant benefits in terms of quality and efficiency.

Responsibility for follow-up: service agency and the HEIs

Boks 5.2 Robotisation of administrative tasks

Most organisations have many simple manual processes. Transferring tasks and data are examples of repetitive processes. Organisations accept routine administrative tasks because it is too expensive to change the administrative systems or to ensure integration between different systems. Administrative robots are advanced pieces of software tailored to the automation of simple, repetitive, and routine high-volume tasks. The robots use robot-based process automation (RPA) software, which can perform work processes in the same way as administrators. This means that it is not necessary to develop integrations between the robot solutions and other systems. The robots have general user access and imitate the behaviour of traditional users. They perform tasks much faster than humans, deliver 100% accuracy, are capable of multitasking to a degree that humans can't, and work 24/7. However, RPA solutions are just one step on the journey of robotisation and automation. The development of artificial intelligence and machine learning is advancing rapidly, which means that much more advanced robots which can perform a wider range of support tasks will be developed.

The University of Bergen has implemented solutions with “administrator robots”, and there is an interest in RPA solutions in other parts of the higher education sector.

5.4.5 Provision of study administration solutions, digital learning platforms, and processes for personal learning environments and mobile and dynamic study courses, and their adaptation to greater flexibility in studies

Learning processes are increasingly shifting towards active learning methods and the use of a wider range of learning resources. All students should have access to a modern, personal learning environment with the option of individual learning programmes that facilitate flexible and effective courses of study and collaborative learning in close co-operation with fellow students and teachers. It is important that the development of digital platforms in this area

provides the community needed to achieve cohesive functionality between institutions that facilitates the studying of subjects at several institutions and sharing and utilizing solutions across multiple institutions.

Responsibility for follow-up: quality agency and HEIs in co-operation with quality agency S

5.4.6 Explore how general support and advanced user support for researchers should be addressed

Responsibility for basic ICT support for researchers lies with the institutions. The need for such services is growing rapidly and the Norwegian Ministry of Education and Research will ask the new service agency, in dialogue with higher education sector and research institutions and the RCN, to explore how advanced user support for researchers should be organized. UNINETT and NSD, both of which currently offer services of this type, should be involved.

Responsibility for follow-up: service agency in co-operation with UNINETT and NSD

5.4.7 Improve processes and tools for research administration

The sub-strategy proposal for research presented by the working group appointed by the Norwegian Ministry of Education and Research points to the need for better support systems for research administration. The solutions must provide administrative support for the work processes of research projects from concept to final result and make the integration of Norwegian research within international co-operation as easy as possible. However, as a basis for establishing appropriate support systems, the proposed sub-strategy points to the need for research institutions to individually and jointly identify the needs and solutions currently in use, and to jointly assess suitable tools for planning, reporting, and financial management.

Responsibility for follow-up: service agency, UNINETT, and the HEIs

5.4.8 Explore how authentication and authorisation mechanisms can better facilitate national and international co-operation

UNINETT and the service agency should assess how to support and improve authentication and authorisation mechanisms in the higher education sector to better support national and international cross-sectoral co-operation. The possibility of establishing a shared national user management system for the higher education sector that also contributes to increased co-operation should be considered.

Responsibility for follow-up: UNINETT, service agency, and the HEIs

5.4.9 Licence terms that address national needs

Access to software is an important aspect of the ICT infrastructure for research. In many cases, ICT tools procured by the individual institution only permit research assignments subject to the institution. The HEIs and service agency must ensure that licence agreements for key software for research address national needs for access to the software under the best possible terms, and they must enable smooth co-operation with national and international partners and stakeholders outside the institution.

Responsibility for follow-up: service agency and the HEIs

5.4.10 Targeted consolidation of information security

The Norwegian Ministry of Education and Research has overall responsibility for information security¹² in the higher education sector and will continue to set clear requirements for the institutions and follow these up through governance and supervision. These requirements are based on national regulations and guidelines and must be understood as minimum requirements in relation to information security. The ministry emphasizes the HEIs awareness of the information security as a crucial success factor for their own digitization strategies and strategic initiatives. HEIs are knowledge enterprises whose core activities include the management and processing of information/data. The development of these core activities by way of a strategic focus on digitalisation requires the institutions to actively govern information security and to have their own strategic interest in elevating this beyond the national minimum requirements.

The higher education sector is at the forefront of many areas of information security such as the development of management systems, the organisation of a sectoral response environment, and local incident management. There is still a need for improvements such as the introduction of management systems at the institutional level. The Norwegian Ministry of Education and Research will strengthen the governance of information security at the sectoral level by way of a more suitable framework. The government has also decided to carry out a study of information security in the knowledge sector. The Norwegian Ministry of Education and Research will return to this in more detail.

¹² Information security is usually defined as the ability to prevent, detect, and manage three types of incident:

breach of confidentiality: i.e. unauthorised access to confidential information;

breach of integrity: i.e. the unauthorised or unintended amendment to, damage to, or deletion of information and/or systems; or

breach of availability: i.e. the loss or unavailability of information and/or systems when needed.

Responsibility for follow-up: Norwegian Ministry of Education and Research and all subordinate enterprises in the higher education sector

5.5 Skills development as the basis for digitalisation

Digitalisation for the purpose of quality requires sufficient professional, technical, and administrative knowledge and skills in the systematic use of relevant technological tools.

5.5.1 Strengthen teachers' digital skills to enable them to restructure and develop learning processes based on the opportunities brought about by digitalisation

In order to be able to follow up the government expectation for the institutions to utilize the opportunities offered by digital learning resources, it is a necessity that the teachers have a broadly composed competence of pedagogical, technological and administrative nature. Effective qualitative education supported by ICT must be rooted in the descriptions of learning outcomes and requires clear leadership and a good knowledge of how digitalisation is part of the overall programme design and evaluation methods. The institutions are responsible for prioritising resources for the development of staff skills in the varied use of ICT to promote students' learning (cf. 3.2).

Responsibility for follow-up: HEIs, quality agencies, and the service agency

5.5.2 Strengthen researchers' digital skills in the optimal utilisation of ICT in their research in order that they may carry out their tasks efficiently and exploit the opportunities that digitalisation provides for developing the discipline

The use of ICT is a condition of participation in a modern labour market. Researchers are no exception. It is vital that researchers have adequate digital skills to utilise and develop professional and administrative resources, including project tools that are under constant development. Researchers must also have the skills to use digital solutions to interact effectively with researchers from other institutions, countries, and subjects.

Responsibility for follow-up: HEIs

6 Who is responsible for implementation?

6.1 The Norwegian Ministry of Education and Research

The ministry's overall responsibility covers the entire education and research sector, and the ministry views the digitalisation strategy for the higher education sector as a measure within the overall digitalisation efforts of the education and research sector. This implies that the ministry is responsible for ensuring that the digitalisation strategy for the higher education sector is aligned with other strategies within the ministry's field of responsibility, and that

opportunities for shared solutions and synergies across the various education and research sectors are utilised and shared. This will include services, systems, and skills.

Given the impact of digitalisation on society, it is natural that the governance of ICT and digitalisation is a central element of the Norwegian Ministry of Education and Research's governance, in line with the overall governance of other fundamental and strategic factor inputs and external and internal conditions. Within such governance, it is also natural that risk is managed in the same way as economic risk, compliance risk, and the risk of the inadequate fulfilment of goals. The ministry's governance of digitalisation has become increasingly important in line with the increased importance of ICT in the development of the higher education sector, the extent of the initiatives expressed through the government's ICT policy, and the demands posed by stakeholders with regard to the follow-up of digitalisation and ICT at the sectoral level. However, it is important to involve and cooperate with the users so that dialogue regarding governance is effective in both directions, and ensure that plans, measures, and decisions meet user needs as closely as possible.

In keeping with the recognised framework for ICT governance and management (e.g. ISO/IEC 38500), the ministry's governance of digitalisation will be strategically placed at the governance level, with the higher education sector and the sector's co-operation interfaces used as delimiters. This corresponds to the level of the ministry's state governance and governance dialogue, and primarily involves sector-level goal and performance governance. Other relevant management instruments include incentive schemes and more dialogue and network-oriented forms of governance.

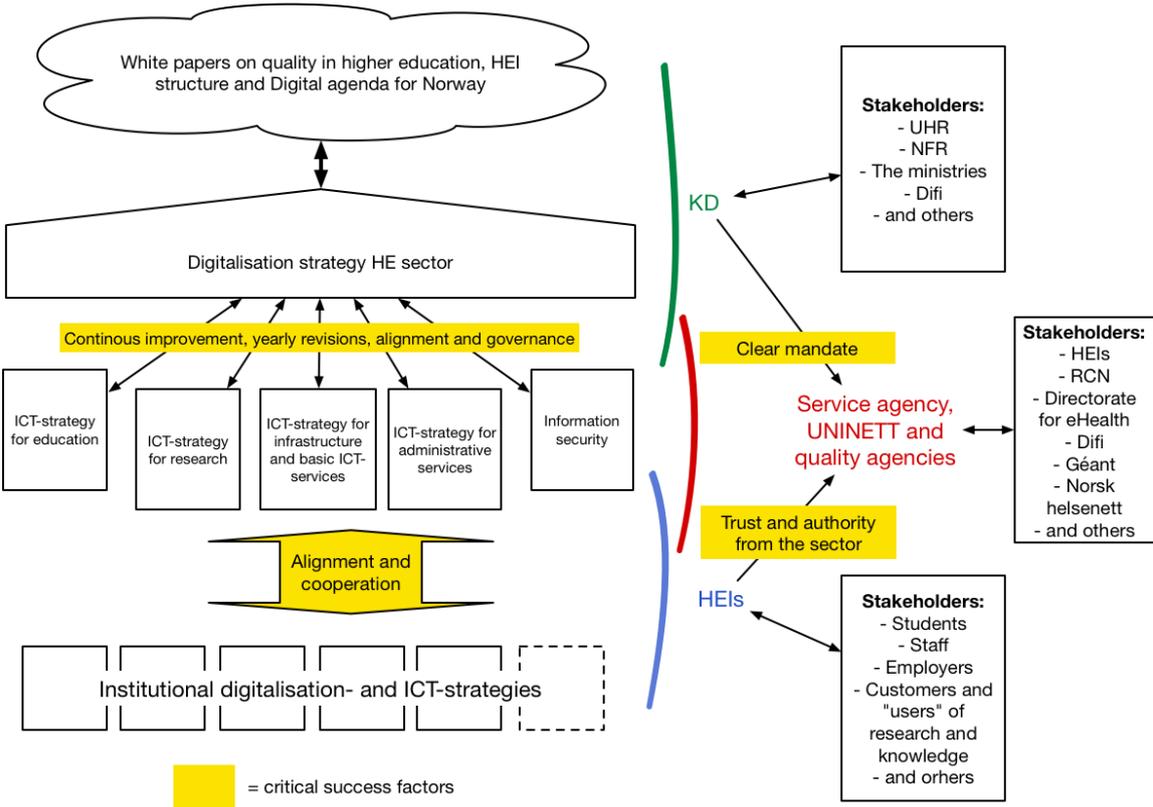
Clear governance does not necessarily mean *more* governance; rather, it means better governance that is rooted in frameworks and strategies. Key elements of governance are the establishment of overall goals and expectations and ensuring the operationalisation, implementation, and delivery of the tasks, plans, and strategies that have been provided. Successful digitalisation hinges on not only top-down governance but also the ability of HEIs, the service agency, quality agencies, and wholly owned limited companies to propose measures, plans, and strategies from the bottom up. Consequently the ministry will invite proposals for measures, plans, and strategies from the whole sector, and it will use these in its overall initiatives, plans, and strategies as well as in the development of policies.

A strengthening of governance is based on the same perspective as the sectoral working group's proposed sub-strategy for education regarding the need to be open to the fact that "*digitalisation can be as much of a game changer as it has been in other sectors*", and on the assumption that the higher education sector is about to reach a higher level of digital maturity. This implies that efforts must be increased based on an understanding of what technology means for the external and internal conditions of the sector, as well as on an understanding of its own potential strategic advantages.

It is difficult to predict the overall impact of society’s digitalisation on the higher education sector and how this will effect governance and structures. Lines of governance and governance structures must be equipped in a way so that they are able to manage rapid shifts in external and internal conditions at the sectoral level in order to address fundamental changes. The governance of digitalisation in the higher education sector is multifaceted, with associated strategies and stakeholders. An illustration of multi-level governance and the relationship with the different strategies has been attempted in the figure below.

A strengthening of the lines of governance requires clear tasks and mandates for the new administrative agencies and may involve changes to the organisation and the capacity of the ministry in this area. An important element of these tasks will be to follow up and develop further the digitalisation strategy and sectoral sub-strategies as part of a continuous improvement process in co-operation with the sector and the ministry. This co-operation can be illustrated in the figure below.

Figure: The relationship between governing documents, management levels, and stakeholders



An important task for the ministry is to ensure transparency for stakeholders. The strategies, depending on their scope and governance levels, will involve different stakeholders.

6.2 Administrative agencies for quality development

Over the years, state instruments have been established to enhance key aspects of the quality of higher education. These include internationalisation, the digitalisation of learning processes, and the development of outstanding education in general. Several national entities are currently responsible for the administration of various programmes and grant schemes for quality enhancement. It is decided to establish two new administrative agencies whose tasks relate to quality development. The new quality agency built around the current SIU (quality agency S) will have overall responsibility for national incentive schemes aimed at quality development in higher education. Combining different incentives to promote a variety of quality-related dimensions of higher education, such as digitalisation, within a joint administrative agency will allow for the instruments to be seen in a context and create a basis for more cohesive and targeted quality development. Although quality agency S shall primarily perform tasks for the ministry, the fulfilment of its tasks must consider a high degree of academic freedom and legitimacy in the sector. The new quality agency built around the current NOKUT (quality agency N) will also perform tasks for the ministry relating to quality development, as well as control, supervisory, and other government tasks, including tasks currently carried out within the ministry.

Although primary responsibility for the administration and delivery of digital solutions has been handed to the service agency, the two quality agencies play key roles in digitalisation efforts related to education and research. Both digital content and the utilisation of digital solutions and resources must be included as criteria in the quality assurance of education programmes. In this respect, quality agency N will play a key role both in terms of the quality assurance of the HEIs' solutions and as a driver and development stakeholder. Quality agency S has an important role in terms of enabling access to and facilitating international co-operation and the utilisation of international resources and solutions in the digitalisation of education and research. Quality agency S shall ensure that the instruments associated with incentive schemes and competition arenas for education are also used to stimulate the digitalisation efforts in education. Good governance and administration of digitalisation efforts require sound knowledge of status, needs, and impact. Responsibility for this must be distributed among the three administrative agencies.

6.3 Service agency

The service agency will be responsible for the tactical and operational administration of ICT and digitalisation at the sectoral level and will be responsible both for implementing and following up the strategies and policies established by the ministry and for implementing and following up sectoral initiatives. Practically this will take place by the development of strategies and proposals by the sector and the administrative agency, either on their own initiative or at the request of the ministry. A fundamental condition for the administration of the service agency is that it has a clear mandate from the ministry to make decisions for the

sector. The greatest opportunities for realising benefits are expected to be found in the co-operation between the service agency and HEIs on shared solutions.

In addition, UNINETT will have specific tasks and roles in the administration of infrastructure services and information security and will constitute a key resource for overall administration tasks in the field of ICT. The distribution of tasks between the service agency and UNINETT must therefore be clarified before the final distribution of tasks and responsibilities can be defined. The ministry will specify which tasks will be delegated to the service agency in greater detail by way of the annual notice of funding, possibly by way of articles of association.

6.4 Higher education institutions

HEIs possess academic freedom when it comes to education, research and innovation. Furthermore they enjoy certain delegated administrative and organisational powers. Still, the state owned HEIs are government agencies, which means that, notwithstanding their academic autonomy, they are subject to the ministry's authority and instruction, and that the responsible minister has overall constitutional responsibility for all activities beyond the academic level. HEIs are responsible for providing the services and for the value creation to be supported by digitalisation, and each institution has a delegated responsibility for its ICT systems and the initiation of digitalisation measures. Institutions are responsible, for example, for information security within their own infrastructure, systems, and services, even when these are outsourced to third parties. The Norwegian Ministry of Education and Research expects HEIs to follow up the measures of the strategy where they are delegated the responsibility to do so, and to make a constructive contribution by way of sharing best practice and co-operating with other HEIs and the new administrative agencies for services and quality regarding the development of shared solutions and infrastructure.

6.5 Stakeholder involvement

There must be sufficient proximity to users at all levels in order to develop solutions that meet user needs and which can best utilise the resources available. In order to safeguard the institutions' needs to be able to contribute as premise provider to the shared solutions that they themselves implement and exploit, an appropriate user organization must be established which implies noticeable user involvement from both institutions of higher education and other users of the services.

In addition to participate in the role of premise provider, user involvement is necessary within the various sub-strategy areas and the operational administration of the various services and solutions. A more detailed solution to this must be developed in co-operation with the HEIs and other users, initially as part of the Norwegian Ministry of Education and Research's implementation project. This will be followed up by the government's decisions regarding the establishment of a new structure by way of two quality agencies and a central administrative agency for services to institutions.

The Norwegian Ministry of Education and Research expects users at various levels to have a reasonable degree of involvement in all digitalisation processes.