

University of Helsinki

Digital research university

University of Helsinki Digitalisation Programme:
Roadmap for 2018–2020 and vision for 2024

Digitalisation programme working group
15.2.2018

Table of contents

Summary of recommendations by the working group for the 2018–2020 period.....	2
1 Introduction	4
2 Digitalisation Programme vision for 2024	5
3 Development targets for 2018–2020	6
A Studying and teaching	6
A1 The digital leap in education.....	7
A2 Student progress monitoring system and software academy.....	10
A3 Master’s thesis progress monitoring system.....	11
A4 Digital self-assessment	12
B Research	15
B1 Open access publishing	15
B2 Open data	17
B3 Helsinki Centre for Data Science HiData	19
B4 Digital humanities HELDIG	20
B5 Virtual desktop infrastructure (VDI).....	22
C Comprehensive projects.....	25
C1 Website and digital communications.....	25
C2 Smart campus.....	28
4 Proposal for the organisation and project management of digitalisation development	29
APPENDICES:.....	31
APPENDIX D1: Digitalisation in the strategy of the University of Helsinki.....	31
APPENDIX D2: Report on the current state of digital development.....	33
APPENDIX D3: Previous digitalisation working groups	40
APPENDIX D4: Estimates on costs and phases	42

Digital research university

University of Helsinki Digitalisation Programme: Roadmap for 2018–2020 and vision for 2024

Summary of recommendations by the working group for the 2018–2020 period

1. The Digital Leap in Education project will be advanced in accordance with the prior project plan. The digital leap is tied to the management of degree programmes, the development of facilities, communications and the openness of teaching.
2. A system for monitoring students' progress will be introduced and offered to degree programmes. It will be developed further on the basis of feedback, extending its use to all campuses.
3. The progress of master's theses will be digitally monitored. A specific tool will be piloted and further developed on the basis of feedback.
4. A digital assessment model based on self-assessment will be developed for large-scale courses. An experiment on substituting traditional final examinations with self-assessment will be conducted.
5. The share of peer-reviewed articles and conference publications published openly within the University community (self-archiving included) will be increased to no less than 70% (currently 20%) by 2020.
6. Support services for data intensive research will be increased, with the objective of creating a research data infrastructure of an international standard.
7. The Helsinki Centre for Data Science HiData will provide a platform for Finnish and international collaboration, while serving as an interface between the University and business life. The goal is to enable the reception and research-related utilisation of extensive research datasets created by universities and businesses.
8. HELDIG will support the University's digital leap through new infrastructures. The objective is to become a leader in digital humanities with the help of, among others, the CLARIN and DARIAH infrastructures.
9. A virtual desktop infrastructure (VDI) will be introduced. A significant part of shared desktops will start using virtual desktop technology.
10. The University's website will be assessed and user-tested by target groups, followed by necessary improvements. The search feature will be improved.
11. There will be a transition to smart campuses, to work facilities supported by technology and artificial intelligence where studying, teaching, research and everyday life on campus are supported by wireless technology and the internet of things, new forms of interaction, such as mobile smart devices and large displays shared by several users, artificial intelligence in support of learning, as well as indoor positioning services.
12. A steering group for digitalisation will be established to coordinate and prioritise the development of digitalisation projects. This development will be carried out from the

perspective of the University's enterprise architecture, or the development of services and processes, with consideration given to the effects and benefits of its implementation to the operations of the entire University. The mission, division of duties and compositions of the Centre for Information Technology Board, the Enterprise Architecture Board and the potential digitalisation steering group must be thought through, planned and prepared as a single entity.

13. Central procedures included in the digital roadmap will be conceived as projects.

1 Introduction

The objective of the University of Helsinki Digitalisation Programme is a *digital research university comprised of smart campuses*. In such a university, relevant information is accessible with just a couple of clicks, no matter whether the individual looking for the information is a student, a researcher, an administrative official or someone outside the University community. In a digital research university, teaching materials are in electronic form, and instruction founded on contact teaching is supported by digital collaboration tools that apply artificial intelligence. Research source material and results are openly available through a digital forum. A digital university is based on a uniform, easy-to-use platform and a smart digital environment where studies, research and work are interactive, inspiring, open, visible, productive and effective.

The goal-oriented development of a digital work environment requires clear and prioritised contributions to the development of skills and services, as well as the digital and physical environment. Implementing digitalisation in a comprehensive manner requires the creation of a roadmap for the coordinated implementation of, thus far, partly fragmented projects and for a direction for new innovations. The University of Helsinki Digitalisation Programme strives to clarify the University's strategy as regards digitalisation and communicate the link between related objectives and strategy to the organisation. Below is a list of suggested measures for attaining the strategic objectives, as well as milestones that can be used to measure the progress of the roadmap.

In the coming years, digitalisation will alter the operational environment of the University. It is linked with several megatrends, such as artificial intelligence and the revolution of work. In accordance with its strategy for the 2017–2020 period, the University of Helsinki wishes to serve as a forerunner and courageous experimenter in digitalisation.

On 24 August 2017, the rector appointed a planning group to prepare a plan for implementing digitalisation at the University of Helsinki. The group's mission was to prepare the University of Helsinki Digitalisation Programme for 2018–2020 and a vision for 2024. The programme was to describe and schedule the implementation of development targets and measures related to digitalisation presented in the strategy, their cost effects included. As per a decision on focus areas for 2018 made by the Board of the University, special attention was to be given to the use of digital tools plan, to be attached to the strategy policy programme for 2018.

The planning group was comprised of the following members:

- Vice-Rector Jouko Väänänen, chair
- Student Pia-Leena Heikkilä
- Professor Eero Hyvönen
- Director Jaakko Kurhila
- Senior Advisor Eeva Nyrövaara
- University Lecturer Johanna Rämö
- Chief Information Officer Ilkka Siissalo
- Professor Sasu Tarkoma
- University Librarian Kimmo Tuominen
- Head of IT Management Merja Eklin, secretary

The planning group convened six times (15 September 2017, 26 September 2017, 27 October 2017, 24 November 2017, 20 December 2017 and 8 January 2018). In addition, a digital workshop for the senior management of the University was organised (21 November 2017).

An internal workgroup platform on Flamma (<https://workgroups.helsinki.fi/display/HYDV>) was used for the group's activities.

The planning group defined the University's digital development on the basis of its core duties: studies, teaching, research and support services. The group's final report, as well as the related recommendations and policy definitions observe these focus areas. The report also supports the development targets presented in the report on the current state of digital development (Appendix D2) and the reports by earlier working groups related to digitalisation, the working group for the digital work environment and the working group for the principles of digital publishing (Appendix D3). These reports have not been duplicated in this report.

2 Digitalisation Programme vision for 2024

- The University of Helsinki is a pioneer in the utilisation of technology in the campus environment, employing the smart campus concept on all four campuses. At a smart campus, information can be accessed even without a single click.
- A tool for monitoring students' study paths has gained a permanent status as part of the productive management of degree programmes.
- At the University of Helsinki, teaching is "only two clicks away" from anyone. Furthermore, degree programmes are showcased individually online.
- The progress of University degree theses and doctoral dissertations is monitored with the standard tools used by degree programmes, and all theses and dissertations are openly published through the eThesis service of the HELDA publication archive.
- For the purposes of self-assessment by students, degree programmes have an advanced digital and research-based tool that can be used to substitute for traditional examinations. The digital assessment of academic performance supports lifelong learning and the development of study skills.
- The University of Helsinki is an international forerunner in open access scientific publishing, as evidenced by the number of published peer-reviewed articles and conference publications, a value annually monitored and benchmarked.
- The University of Helsinki is an internationally recognised institution, as well as a desired partner among leading research universities as a producer and user of open research data and datasets. The University observes the principle according to which legal access to data in practice means actual access (FAIR principles).

- The University has an IT infrastructure that enables diverse digitalisation based on the utilisation of public and private cloud services, as well as specific solutions required by top-level research.
- The University's data science centre (HiData) is the most impressive of its kind in the Nordic countries. The utilisation of new digital methods and the study of digitalisation (HELDIG) are an established part of research activities at the University of Helsinki and an important component of faculty teaching programmes.
- Virtual desktops (VDI) are available to both students and staff.
- Platforms for open access publishing, scientific knowledge and communication tools comprise a compatible and easy-to-use whole.

3 Development targets for 2018–2020

The Digitalisation Programme for 2018–2020 has been categorised in observance of the University's core duties. To start with, there are development targets related to studying and teaching. They will be followed by targets related to research. Finally, some development targets concerned with the University's operational area as a whole will be examined.

It is noteworthy that other projects related to digitalisation are also ongoing at the University, particularly in the administration. Among these are the introduction of the SISU system at the Student Register, the technical redesign of the Flamma intranet, the redesign and merging of the SAP systems, the change of the operational planning system, the introduction of a new SAP budgeting system, the replacement of the library system of the University libraries, the LUOMUS biodiversity register and other digital datasets, as well as some twenty individual development projects at the National Library of Finland concerned with the systems of the National Digital Library. The National Library plays a significant role in building a digital infrastructure for research centred on Finnish society and culture. The Language Centre is participating in the DIGIJOJOU project of twelve universities of applied science/universities, funded by the Ministry of Education and Culture, and the nationwide FINELC 2digi project, which are also developing the digitalisation of language instruction. All of the above are currently ongoing, fully funded projects that will not be examined further in this programme.

A Studying and teaching

Digitalisation and the internet have revolutionised studying. Before the introduction of the internet, attendance at lectures and examinations in person was compulsory. Today, anyone with an internet connection has the opportunity to study and even complete a degree online. At the University of Helsinki and other top universities, however, contact teaching will remain the foundation for all instruction. At the same time, digitalisation and the internet will supplement contact teaching in

unprecedented ways. Studying will become increasingly rich, multidisciplinary and inspiring. Students will graduate faster, and they will gain better career qualifications.

A1 The digital leap in education

The digital leap in education will be developed from the student perspective to achieve a sensible and modern learning experience. The leap will not be developed as a separate process; instead it will be intertwined with the management of degree programmes, facility development, communications (marketing and student recruitment), as well as the openness of teaching (increasing the accessibility of courses and the openness of study material).

Funding for the digital leap has been agreed upon for 2017–2020. The intention is to take the “leap” in all bachelor’s and master’s programmes. During 2017, the first steps were taken in the bachelor’s programmes, from which the first 15 digital leap project targets were chosen. Altogether €1 million in funding was distributed among them, with an additional €200,000 directed at a facility development sub-project. The projects were intentionally targeted at programmes in varying states of digital preparedness. Thus, experiences of the digital leap can be shared widely within the University of Helsinki. All funded projects are required to share their experiences in joint seminars on the digital leap.

Due to differences between degree programmes, the plans and the level of ambition included in the leap taken vary greatly from programme to programme. Further information on the project is available on the blog¹ (in Finnish only).

Projects commenced in 2017 and their direction:

- Bachelor’s Programme in Biology
 - Further development of the Pinkka biodiversity environment
 - Preliminary examinations and weekly assignments online
 - Flipped classroom: videos and podcasts
- Bachelor’s Programme in Veterinary Medicine
 - Flipped classroom: preliminary material
 - Vertical integration and accessibility of studies
 - Teacher training and national teaching material exchange
- Bachelor’s Programme in Physical Sciences
 - Automatically assessed assignments
 - Short instruction videos
 - Encouragement of teachers to experiment with digitalisation
- Study Module on Management and Leadership
 - The first course in the study module on management and leadership is available to all, or scalable without an upper limit.
- Bachelor’s Programme in Educational Sciences
 - Distribution of existing skills through open Digitori events promoting digital services and phenomena
 - Equipment and software purchases

¹ <http://blogs.helsinki.fi/digiloikka/projekti/>

Digitalisation Programme

- Development of the working group for the implementation of digital teaching
- Bachelor's Programme in Languages
 - Courses offered online partly or in their entirety
 - Increase in the amount and accessibility of digital data
 - Development of teacher qualifications through peer networks and mentoring
- Degree Programme in Medicine
 - Pilot of a digital examination system (the open source Abitti system)
- Bachelor's Programme in Forest Sciences
 - Production of mixed reality content for courses
- Bachelor of Laws Degree Programme
 - Pedagogically founded development of online studying (team- and problem-based learning)
 - Distance teaching at Vaasa
- Bachelor's Programme in Social Research
 - Shareable and enrichable videos
 - Online group work and examinations for courses
 - Online collection and analysis of data
- Bachelor's Programme in Art Studies
 - Student portfolio incorporated into studies
 - Data distribution online, as a showcase to attract prospective students
- Bachelor's Programme in Theology and Religious Studies
 - Online courses (ten) for basic and intermediate studies
 - Production of digital material for theological language courses
 - On-site support for faculty teachers
 - Organisation of digitalisation meetings for faculty teachers
- Bachelor's Programme in Computer Science
 - New massive online open courses, or MOOCs (artificial intelligence, data security, full-stack development)
 - Development of adaptive course material
 - Development of the TestMyCode service to serve other units
- Bachelor's Programme in Environmental and Food Economics
 - MOOC in environmental economics
 - Utilisation of digitalisation beyond the ground level in all courses of the programme
 - Support for teachers
- Bachelor's Programme in Environmental Sciences
 - Development of digital guidance
 - Production of video material
 - A model for turning traditional courses into online courses, as well as three sample courses

Digital leap in education in 2018–2020

The digitalisation projects for 2018 were chosen in November 2017. Altogether 16 projects were chosen, with €1 million granted in funding. In 2018, the same principles will be observed as in 2017, except that development scheduling (in other words, budgeting) will be based on the academic year, not the calendar year.

Digitalisation Programme

In three of the programmes granted funding for 2018, the new Open University track, or an admissions process based on studies at the Open University, will be introduced in addition to or in support of certificate-based admissions.

During 2019 and 2020, the digital leap will be taken by the rest of the bachelor's and master's programmes prepared to do so. The basic principles of the project will remain unchanged. As project-specific funding decreases, the emphasis will be put on cooperation and the reuse of skills gained in previously funded projects. The annual funding will be €1 million.

Projects commenced in 2018:

- Licentiate Programme in Veterinary Medicine
- Bachelor's Programme in Philosophy
- Master's Programme in Genetics and Molecular Biosciences
- Bachelor's Programme in Geosciences
- Master's Programme in History
- Bachelor's Programme in Social Sciences (in Swedish)
- Bachelor's Programme in Cultural Studies
- Bachelor's Programme in Cultural Heritage
- Master's Programme in Translation and Interpretation
- Bachelor's and Master's Programmes in Agricultural Sciences
- Master's Programme in Social Sciences (in Swedish)
- Bachelor's Programme in Mathematical Sciences
- Bachelor's and Master's Programmes for Teachers of Mathematics, Physics and Chemistry
- Bachelor's Programme in Molecular Biosciences
- Bachelor's Programmes in Psychology and Logopedics, and the Master's Programme in Translational Medicine
- Master's Programme in Environmental Change and Global Sustainability (ECGS)

Vision for the digital leap in education in 2024

In 2024, teaching at the University of Helsinki is "only two clicks away" from anyone. Most bachelor's programmes and strategically selected master's programmes have showcases online through which interested individuals can familiarise themselves with teaching and studying at the University of Helsinki, as well as get their first taste of studying (non-degree studies).

Digital solutions are founded on university pedagogy, guaranteeing the flexibility required by students.

Existing structures (including facilities and the academic affairs administration) support the organisation of teaching. The teaching includes courses that can be started and completed at any time. An increasing share of teaching is organised in cooperation with parties from outside the University. Many of these courses are intensive in nature and scheduled primarily outside the teaching periods, which means that more courses are available throughout the year.

A2 Student progress monitoring system and software academy

The system for monitoring student progress analyses academic affairs administration data and produces reports for the purpose of degree programme development. The system analyses study paths and identifies potential bottlenecks in the paths and degree programmes, thus enhancing their operations. The system has been piloted on Kumpula Campus, particularly at the Department of Computer Science.

Its development is conducted by the software development academy TOSKA at the Department of Computer Science. The academy's purpose is to provide the best programmers of the Department's degree programmes with a software development environment where they will be sufficiently challenged and able to develop their programming skills in the right kind of software production environment. With good systematic steering and coordination, the project will be able to produce and maintain professional software. In order to maintain a level of expertise for all products included in the project portfolio, new members will be recruited in a controlled cycle: one new student member will be enrolled in the TOSKA project every three months (1 March, 1 June, 1 September and 1 December). They will be offered a part-time (50%) contract for one year. Currently, TOSKA's software portfolio includes software developed at the Department of Computer Science for the academic affairs administration, which in the future will also be available to other degree programmes. In addition to TOSKA, the University also has other software development projects and teams, such as the OHTU team at the IT Centre, the application development team at Education Services, the University's Drupal development team and design team, and the development team for the new Flamma.

Student progress monitoring system and software academy in 2018–2020

During 2018, the aim is to expand the monitoring system pilot project to the Bachelor's Programme in Environmental and Food Economics at Viikki Campus, followed by expansion throughout the University. For the purposes of this extended pilot, interfaces in the academic affairs administration system will be made available in such a manner that the monitoring system will have access to the student and study data of the relevant faculty. At this juncture, a new user profile will be created in the monitoring system, through which only the student and study data in question can be accessed. For this purpose, a fixed IP address will be reserved at Kumpula to be used from Viikki through the VPN portal.

The system will be recoded utilising current technology, which will be used for the long-term implementation of support and maintenance (including various user profiles and Shibboleth authentication), with consideration given to comments submitted during the pilot. At the same time, new, straightforward surveys will be conducted 1) to assess in advance students' credit accumulation (important for the monitoring of the number of students completing at least 55 credits in one academic year, a factor impacting University funding) and 2) to examine the distribution of credit accumulation within a degree programme (the absolute number of credits and their distribution between students of the programme and students from other programmes). The new student progress monitoring system will be audited after its completion during spring 2018. Once it has passed the auditing process, all student and study data of the University of Helsinki in the academic affairs administration system will be made available to the monitoring system. At this

point, new degree programmes will be enrolled in the pilot. Their experiences will be recorded, errors will be fixed, and the software will be tailored to meet the requirements. During autumn 2018, the system will be ready for use by all degree programme steering groups for monitoring study-related data.

During 2019, when the new student progress monitoring system has already been in use for some time, a survey targeted at degree programmes will be conducted to gather feedback on the system's functionality and use. Based on the feedback, operations will be developed to better serve the requirements of student data monitoring. The responsibility for maintaining the monitoring system will remain with the TOSKA project, which will rotate student programmers in a controlled manner to continuously include both experienced and novice members in the group.

Vision for the student progress monitoring system and the software academy in 2024

In 2024, the system has established itself as the standard tool for monitoring degree programme studies. The development of new tools has been added to the TOSKA portfolio, while the maintenance of the monitoring system has been transferred to the University's Teaching and Learning Services.

Milestones for the student progress monitoring system:

2018	In the autumn, the student progress monitoring system is ready for use by degree programme steering groups for monitoring study-related data.
2019	Feedback from degree programmes and a plan for the further development of the system
2020	The student progress monitoring system is in large-scale use on the four campuses, and the responsibility for its maintenance has been transferred to the Teaching and Learning Services of the University of Helsinki.

A3 Master's thesis progress monitoring system

The master's thesis progress monitoring system has been developed at the Department of Computer Science for the administration of the master's thesis writing process. The system will automatically transmit all email messages between persons concerned with the process, monitor its scheduling and compile documents related to theses to be approved at assessment council meetings into single entities. Through the system, theses will also be archived in the eThesis service. The monitoring system Thessa is already available for the supervision and monitoring of dissertation work.

Master's thesis progress monitoring system in 2018–2020

The monitoring system for Master's thesis progress will be piloted in the disciplines of mathematics and chemistry in early 2018 when a new version of the system becomes available. During 2018, several new features will be implemented in the system:

Digitalisation Programme

- Thesis agreements will be made through and stored in the monitoring system.
- A tool for drafting programme-specific master's thesis grading instructions will be developed.
- A "light" version of the master's thesis progress monitoring system will also be developed (to include only the stage following the examination, similar to the current system in eThesis).
- Explicit actor roles and storage of all process-related documents

After preliminary experiences have been compiled from the pilot project participants and after amendments have been made, the system will be audited during late spring 2018, after which it will be ready for wider use at the University of Helsinki.

During 2019, new features will be implemented. Among these is a tool that can be used by outsiders to submit suggestions on master's thesis topics to certain programmes. Coordinating professors must approve these suggestions before they are made available to students.

In late 2019, a survey will be conducted among participating degree programmes to collect feedback on the functionality and use of the system. Based on the feedback, the system's functionality will be developed to better support various master's thesis administration processes. The responsibility for maintaining the monitoring system will remain with the TOSKA project, which will implement student programmer rotation in a manner that continuously includes both experienced and novice members in the group.

Vision for the master's thesis progress monitoring system in 2024

In 2024, the master's thesis progress monitoring system is a standard tool used by degree programmes. Since the development of new tools has been added to the TOSKA portfolio, the maintenance of the monitoring system may have been transferred to the University's Teaching and Learning Services.

Milestones for the master's thesis progress monitoring system:

2018	The master's thesis progress monitoring system is ready for large-scale use and compatible with the eThesis service.
2019	Updating of the monitoring system is based on feedback, including new functions, such as the reception of master's thesis topic suggestions.
2020	The master's thesis progress monitoring system is in large-scale use.

A4 Digital self-assessment

For large-scale courses, a digital self-assessment (DISA) model will be created. In the model, students will practice assessing their own competence, an important skill in later studies and professional life. Self-assessment will substitute traditional final examinations, saving the time and expense spent on drafting, organising and grading examinations. In the DISA model, self-assessment

and its comparison to the students' completed work will be automatically carried out with a specific tool, making the model scalable for large student groups. The model was created in cooperation by the Department of Mathematics and Statistics, the Centre for University Teaching and Learning HYPE, and the Department of Education. Its development is based on research.

According to research, the impact of assessment on students is great. Thus, a significant impact on students' skills can be gained by influencing the assessment itself. Even though the diversification of learning assessment methods is a strategic goal for the University, the assessment methods currently in use are mostly very traditional. Therefore, it is important to provide teachers with easy-to-use tools for renewing the assessment culture.

In the DISA model, students themselves will grade their performance at the end of a course. Self-assessment is based on strictly defined learning outcomes. To prevent cheating, an automated, intelligent system will compare grades based on self-assessment with the work completed by the student during the course. Self-assessment will be practised throughout the course, and students will be provided feedback on their assessment skills. The pedagogical development of the DISA model has already begun, with pilot projects conducted in 2017 in three courses in mathematics and biological and environmental sciences (70–400 students). According to research conducted during the pilot courses, students participating in the DISA model are increasingly motivated to learn and are committed to studying, believe in their skills, utilise the strategies of deep learning and study for themselves, not for the examination. In autumn 2017, a comparative study was conducted where the course grade for one half of the students was based on self-assessment, the other on a traditional examination. A comprehensive research dataset was compiled, serving as the primary foundation for the further development of the model.

Digital self-assessment in 2018–2020

The research findings gained so far on the DISA model will be analysed, published and presented at international conferences. New pilot courses will be organised in several faculties, while the model will be developed with the help of research data to suit different disciplines. During 2018, the development of a digital self-assessment tool for general use will also commence in cooperation with the software development academy TOSKA at the Department of Computer Science. In 2019 and 2020, the focus will be on developing the DISA model in such a manner that teachers of various disciplines will be able to easily utilise it in teaching. The model's pedagogical principles will be shaped into a generalised form, while the development of the assessment tool will be completed. Research on the model will continue, as will communication on the project through the publication of scientific articles and presentations at conferences and other events.

The implementation and study of the DISA model will require doctoral students from several faculties to coordinate the research and to support the teachers of the pilot courses, as well as a research assistant to support them.

Vision for digital self-assessment in 2024

Digitalisation Programme

In 2024, the project has resulted in a cost-effective research-based assessment tool, through which degree programmes can ensure support for students' skills and progress. With the help of the assessment model, students are increasingly aware of their own skills and able to systematically develop them. The model supports students' motivation and study strategies.

- Students of the University regularly practise self-assessment, for which the DISA model provides an easy-to-use tool.
- The University of Helsinki is known for the systematic and research-based use of self-assessment.
- The DISA model is used also by other Finnish and international universities.
- Through teacher and continuing education, a new kind of assessment culture is gaining ground in the school world as well.

Mileposts for digital self-assessment:

2018	A self-assessment tool has been developed for the DISA model, which has been piloted in several faculties.
2019	New, ground-breaking scientific knowledge has been produced on the impact of assessment in different disciplines, to be used in the development of the DISA model.
2020	A new kind of assessment culture has gained footing at the University of Helsinki: self-assessment and the DISA tool are used in several faculties of the University.

Cost estimates for projects related to studying and teaching:

Expenses (costs)	2018	2019	2020
Digital leap in education	€1,100,000	€1,100,000	€1,100,000
Student progress monitoring system and software academy	€90,000	€60,000	€60,000
Master's thesis progress monitoring system	€65,000	€40,000	€40,000
Digital self-assessment DISA	€110,000	€105,000	€105,000
Total	€1,365,000	€1,305,000	€1,305,000

B Research

The publication of research results has been completely revolutionised by digitalisation. Even though the traditional publishing culture remains strong, an open access publishing practice is already employed by many disciplines. Research findings are published on open forums, accessible to all. As copies of books made by individual users are “freely” available online, we now have the possibility of accessing extremely extensive literary sources through a single computer and an internet connection. Research results and textbooks can be browsed on a computer effortlessly and, increasingly, free of charge.

Another significant manner in which digitalisation has altered the conduct of research is the increasing availability of reference material in digital form. This has enabled, among other things, entirely new kinds of digital research in the humanities.

B1 Open access publishing

The EU, the Ministry of Education and Culture, the Academy of Finland, as well as the University of Helsinki have made a commitment to open access publishing. There are several obstacles to achieving this objective, all of which will not be solved through the University's activities. Our scientific community does, however, share a wide-ranging consensus on the great benefits of open access. Through its Digitalisation Programme, the University of Helsinki strives to establish its status as a pioneer in open access publishing. In addition to investments, this requires a change of attitude among the researchers of the University.

Open access publishing in 2018–2020

The number of self-archived publications will be significantly increased in relation to the total number of scientific publications by the University. The share of open access peer-reviewed articles and conference publications (in 2016, approximately 25%, or 1,704 articles) will be increased in such a manner that by 2020, no less than 70% of all peer-reviewed articles and conference publications (publication types A1–A4 of the Ministry of Education and Culture) written by members of the University community will be published openly (self-archiving included).

The self-archiving process will be clarified in such a manner that meeting the requirements of open access will be as easy as possible for researchers. All researchers will be provided with ORCID IDs. Furthermore, the use of altmetric attention services (PlumX, Altmetrics, Kudos) will be increased. Open access learning material (MOOCs, ResearchGuide) will be developed. Open access teaching and support for teaching provided to doctoral schools will be increased. A plan for marketing and communications will be drafted, to be implemented through the University's communication channels.

The total cost of scientific publishing will be controlled, while improving the awareness of the total costs related to open access publishing throughout the University (expenses will be calculated annually). The costs of open access publishing will be kept as low as possible for members of the

Digitalisation Programme

University community. Aalto University is currently reimbursing article processing charges (APC), partly in a centralised manner. At the University of Helsinki, centralised funding facilitates better monitoring of total APC costs and the systematic use of APC discounts negotiated by the library, clarifying work processes and promoting the encouragement of researchers towards openness. Researchers will be instructed and advised on publication fees and direct open access publishing (including new agreements for Springer, Wiley, Elsevier and Taylor & Francis), along with licensing and copyright matters.

Up-to-date metrics and visualisation services will be implemented in the reporting system. In addition to the Helda publication archive, bibliometric indicators (Scopus, Web of Science), as well as altmetric indicators on the impact of open access publishing (PlumX, Altmetrics) will be integrated into the service.

A representative research portal service, based on data from the TUHAT database, among others, will be implemented, through which researchers/research groups/communities/units will be able to publish and share their data on various online services. The service will be integrated with the Think Open entity and altmetric services. Nationwide development work will be utilised and its results processed further.

A service platform for open access publishing (by Ubiquity Press, to be purchased during the first half of 2018) will be introduced, through which the Helsinki University Press operations will be implemented. The user interface of the publication archive Helda will be redesigned and brought up to date. The Open Journal System will be utilised in the open access publishing of journals/series.

Vision for open access publishing in 2024

In 2024, the University of Helsinki is an international forerunner in open access scientific publishing. The University facilitates the immediate transition to open access scientific publishing, making research data freely accessible on the internet right after publication. The University has strengthened its role as a publisher of open scientific data through its own publication channels, particularly the Helsinki University Press. Open access publishing increases innovations and financial activity, while providing the research conducted at the University with increasing attention and a citation advantage that can be bibliometrically measured. Open access publishing is also considered part of the implementation of the University's social responsibility. The overall costs for open access publishing are in control, and its progress is easy to monitor through the publication data portal. Researchers and students have excellent proficiency in open access publishing, and related support services are easily available as a comprehensive whole. The practice of open access publishing is a natural part of the processes of studying and research work. The culture of openness prevalent at the University extends to learning materials, as well as theses and dissertations. All master's theses and doctoral dissertations are openly published. Data mining is possible (without a separate fee or licenses) in all datasets legally purchased to be used at the University ("the right to read is the right to mine").

Milestones for open access publishing:

2018	The Helsinki University Press launches its operations (the first entirely open books will be published, in addition to which at least two open access journals are established/opened by utilising the publishing platform service).
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	The concept plan for the research portal service is completed.
	A communication campaign, part of the Open Scholarship project, promoting openness is carried out on all campuses, including OS workshops. The goal is to provide more than 60% of researchers working under the auspices of the University of Helsinki with ORCID identification that is linked with the TUHAT database.
	A centralised funding service for open access publishing has been established and introduced.
2019	A redesigned and updated open access guide is made available in the LibGuides environment; a MOOC on open access is made available.
	A training package on open access and open science for doctoral schools is completed; training is provided at all doctoral schools.
	The first version of the research portal service is completed late in the year; the integration of altmetric tools with the service begins.
2020	Up-to-date metrics and visualisation services for publishing have been implemented in the reporting system.
	By 2020, 70% of articles published by members of the University community are freely available (Ministry of Education and Culture publication types A1–A4). Ninety per cent of researchers at the University of Helsinki have ORCID IDs. Altmetric services are in production use. The Helsinki University Press publishes ten research monographs or collected works and five to seven journals.
	Digitisation of all University of Helsinki collections serving as the research infrastructure is part of the routine administration of collections, while the digitisation rate of collections has doubled from 2018.
	The impact of the centralised funding service for open access publishing has been analysed and its funding established.

B2 Open data

In line with open access publishing, open data is the objective of both decision-makers and scholars, regardless of various obstacles in the way. Open data and open access publishing together are also part of the broader concept of citizen science that is gaining traction and which is supported by the University of Helsinki. Open data is linked with legal and logistical issues, but significant steps forward can still be taken.

Open data in 2018–2020

A research data infrastructure will guarantee preconditions for the open conduct of research and data sharing. The infrastructure includes solutions and equipment environments for managing, archiving, storing and accessing research data and datasets, as well as related maintenance, development and guidance services. Datasets produced at the University will be available through the Think Open portal. The development project ensures that the University will maintain its international competitiveness in matters related to research data, fulfil its contractual obligations to the Ministry of Education and Culture (promotion of open science, open data) and achieve its goals in increasing international research funding. The responsibility for implementing the project is shared by Research Services, the Helsinki University Library and the IT Centre. Communications and Community Relations will participate in the development of services (Think Open). The

infrastructure will be developed in cooperation with data sciences (HiData) and digital humanities (HELDIG). In addition to the current services, those developed by Finnish (CSC) and international parties will be utilised.

Vision for open data in 2024

In 2024, the University of Helsinki is an internationally recognised active party, as well as a desired partner among leading research universities as a producer and user of open research data and datasets. Datasets produced at the University are openly accessible, easily available and used globally in research, innovation and development activities.

In order to fulfil this vision

- The University has a research data infrastructure of an international standard, as well as a modern IT infrastructure, both of which provide researchers with a seamless and fully resourced equipment and service entity enabling the smooth production, utilisation, sharing and accessing of data and methods.
- The processes and datasets related to research are digitally managed with applicable data systems.

Milestones for open data:

2018	The organisation of the DataSupport service into three disciplinary teams has been consolidated. The teams are able to meet customer demand and independently develop their activities from the perspective of field-specific requirements.
	DataSupport guidance has started using a support ticket system. This requires the creation of a joint operational model for two units (the Helsinki University Library and the IT Centre) and the introduction of a service queue. Indicator: The number of submitted questions, response times and an even distribution between respondents
	The first services included in the updated research data infrastructure (MILDRED) are launched.
2019	Support services provided to open science trainers by DataSupport have been consolidated. Indicator: Half of the University's degree programmes include teaching in the basics of data management.
	Data agent network activities are consolidated. Indicator: Each faculty has a dedicated data agent.
	The research data infrastructure has partly been integrated with the services of the European Open Science Cloud EOSC (through EUDAT).
2019 continued	Support services for data intensive research are in use.
	The storage service for confidential data is in use/production and meets the requirements of the EU General Data Protection Regulation (GDPR).
	Support services for data intensive research are in use.
2020	Solutions that support research data services are in use throughout the University (laboratory data systems, an agreement portal).

B3 Helsinki Centre for Data Science HiData

The Helsinki Centre for Data Science HiData will provide a platform for Finnish and international collaboration, while serving as an interface between the University and business life. The goal is to enable the reception and research-related utilisation of extensive research datasets created by universities and businesses.

In recent years, data science has become a central theme in both universities and business life. Data science is built on methods originating from computer science, mathematics and statistics, developed in a cross- and multidisciplinary environment. Data science is a central area in the University's profiling initiative. The Helsinki Centre for Data Science HiData, launched in winter 2017, brings scholars and teachers of data science together. HiData will provide a platform for Finnish and international collaboration, while serving as an interface between the University and business life.

Research in data science requires computing resources and a storage capacity for research data on the petabyte level. In addition to computing and storage resources, processes are needed for the reception, protection and accessing of research data. The goal is to enable the reception and research-related utilisation of extensive research datasets created by universities and businesses in accordance with data security and protection requirements.

The computing infrastructure will be based on a modern cloud computing environment where scientific computing is carried out in a decentralised environment with virtual machines. Future data analysis methods founded on artificial intelligence require the utilisation of GPU computing. The toolbox for data science includes a wide spectrum of software, of which Apache Spark, Stan, R, Caffe2 and TensorFlow are among the most significant.

The University of Helsinki is a pioneer in data science, developing new methods in scalable data analytics. A research data infrastructure enables the introduction of new methods and supports their accessibility.

HiData in 2018–2020

In 2018 and 2019, a pilot project on data science will be carried out based on the research data infrastructure of the University, as well as the infrastructure and services provided by CSC. The goal is to enable the utilisation of both open and protected data in research and teaching related to data science.

In 2019, a toolbox founded on data science will be defined and introduced. Solutions in methodological development will be widely utilised in research, with the goal to pilot and introduce new methods.

Vision for HiData in 2024

In 2024, the University has the number one data science research centre in the Nordic countries (HiData), enabling extensive open data research supported by the University's research data infrastructure and the infrastructure and processes provided by CSC.

Digitalisation Programme

The infrastructure enables the utilisation, merging and expansion of research data produced by universities and businesses in a secure manner in accordance with data protection requirements.

Milestones for HiData:

2018	A data science pilot project enables the utilisation of both open and protected data, founded on the existing research data infrastructure that is currently being further developed.
2019	A data science toolbox is defined and introduced; a trial environment for new methods.
2020	The data science platform and toolbox are in large-scale use, applying both known and new methods.

B4 Digital humanities HELDIG

A central goal for the Helsinki Centre for Digital Humanities HELDIG is to support the University's digital leap through new infrastructures. This work is conducted both in Finland and as part of an international network. The goal is to become a leader in digital humanities with the help of, among others, the CLARIN and DARIAH infrastructures. The intention is to also include the Digital Research Infrastructure for Arts and Humanities (DARIAH) in the next roadmap for the Academy of Finland.

Digital humanities: HELDIG in 2018–2020

To consolidate the field, the Department of Digital Humanities was established at the Faculty of Arts, launching its operations on 1 January 2018. In the future, the entire Department staff (approximately 60 individuals), the HELDIG professors at seven faculties and other staff hired through the programme will have a double affiliation with HELDIG and another unit.

Through its network model, HELDIG operations will transcend both faculty and university boundaries: research collaboration with Aalto University is active, while joint teaching with the University of the Arts is being introduced. Many parties outside the university world, including libraries, museums, archives and media businesses, participate in and guide HELDIG's operations. They have an essential role as owners of research data and problems, as well as experts in their field.

The goal is to make HELDIG a leading international party in the field by the end of its PROF12 funding period, in 2020, with an active master's programme and significantly widespread utilisation of digital methods among researchers and students. Simultaneously, cooperation with universities, museums, libraries, archives and active parties in the media in the Helsinki Metropolitan Area has become an important factor. HELDIG serves as a force unifying activities in digital humanities in the entire Helsinki Metropolitan Area, representing them in international research communities.

A central concrete goal for HELDIG is to support the University's digital leap through new infrastructures. This work is conducted both in Finland and as part of an international network, particularly within the EU. The University of Helsinki is already a strong player in the field of language technology, and the Faculty of Arts is currently managing Finnish activities in CLARIN, the European

Digitalisation Programme

Research Infrastructure for Language Resources and Technology under the EU. The goal is to gain a corresponding leadership position in digital humanities in the EU's DARIAH (Digital Research Infrastructure for Arts and Humanities) project. A new focus area is the technologies of linked open data, ontology services and the Semantic Web, in whose development and nationwide adoption Finland has been a global forerunner based on long-standing cooperation between the University of Helsinki and Aalto University. The intention is to include the new infrastructure in the next roadmap for the Academy of Finland, while HELDIG will become Finland's representative in the EU's DARIAH project.

Digital humanities: Vision for HELDIG in 2024

In 2024, the utilisation of new digital methods and the study of digitalisation are an established part of research activities at the University of Helsinki and an important component of faculty teaching programmes. In addition to pursuing minor subject studies in the field, specialisation is possible also through an international master's programme. Doctoral dissertations in the field are being completed in increasing numbers.

The quick rise in the significance of digital humanities in the information society is evident in increased and new types of research funding in the budgets of HELDIG-affiliated faculties.

Digital methods and related expertise, however, require constant reform and contributions to the field, since their pace of change is unprecedented. The World Wide Web, for example, was invented only a little over 20 years ago. Has any other human innovation changed the world as quickly, as much and as profoundly? Therefore, an agile institution expanding the boundaries of the university organisation and traditional practices such as HELDIG are required also in future.

Milestones for HELDIG:

2018	All new HELDIG professors have been appointed, and the centre's activities are launched in full.
	Activities in the DARIAH infrastructure begin in at least two working groups with the status of a cooperating partner.
	A plan for the future role of the University of Helsinki and Finland is completed as part of the EU's DESIR project.
	The transfer and development begin for the DH infrastructure, as well as its maintenance on the Data Finland platform and the CSC cloud service.
	The development of interactive MOOC-type teaching material related to the infrastructure begins in cooperation with Aalto University.
2019	HELDIG's DH infrastructure is included in the Academy of Finland roadmap.
	Piloting the infrastructure in large-scale projects of cultural linked data begins.
	HELDIG's activities are consolidated and highly international.
2019 continued	HELDIG's infrastructure and teaching materials are also used by international partners.
2020	The operations of the DH infrastructure and the use of related teaching materials are consolidated.

	HELDIG starts to coordinate Finland's role in the DARIAH ERIC project, while long-term external funding for the work is secured after the pilot funding provided by the University of Helsinki.
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B5 Virtual desktop infrastructure (VDI)

In addition to indirect cost benefits, virtual desktops provide students, staff and visitors with an opportunity to use their personal devices in a significantly broader manner for utilising services in the University's workstation environment. These devices can include University workstations, as well as the personal computers, tables and smart phones of staff, students and visitors.

Through the virtual desktop infrastructure, direct savings can be gained in the maintenance of the University's workstation environment. Indirectly, using this technology will lay the ground for savings throughout the University in, for example, energy consumption, service availability and the enhanced use of facilities through improvements in working habits and the preconditions for telecommuting. Furthermore, making the technology widely available enables increasingly diverse and effective use of IT classrooms, while special workstation needs at the University can be fulfilled in a cost-effective manner. The direct savings gained by the introduction of VDI technology will be balanced by increased technology-related licensing and maintenance costs. In recent years, these costs have decreased, but current costs are at a level where they will cancel out the potential savings enabled by technology. Today, the overall cost benefits created by technology are gained through the capitalisation of indirect cost effects.

VDI technology is a technical solution where the processing power used by users, the entire operating system and software environment, as well as all the personal files and desktops of users are accessed through a cloud and/or the IT Centre server room, from a server to a window that can be opened on any device (desktop computers, tablets or even smart phones) anywhere via a network connection. The technology known as VDI has many advantages. Users have a familiar environment with them at all times, while storage space and processing power can be offered and also quickly increased at any time. The system also suits data content requiring strict protections, since the system can restrict users' access to data stored on the virtual desktop. Furthermore, virtual desktops can be isolated within the same network in such a manner that they will be entirely invisible to each other.

Practical examples on the utilisation of a VDI environment include

- Student workstations: The actual device may be an inexpensive or a very old device whose performance capacity and files are located in a server. All students' virtual desktops can be clones of a single installation, reducing maintenance demands to a fraction compared to traditional classrooms.
- High-performance workstations for scientific computing: At times, research groups wish to purchase an extremely powerful computing server for the purposes of certain tasks that require heavy computing. Instead of purchasing a device for their specific use, they can be provided predetermined computing and storage capacity in the VDI environment. This will become available more quickly than a dedicated server, and there will be no separate maintenance requirements. In the event the original requirement estimate turns out to be too low or if the changing needs of the research in question so demand, capacity can be easily increased "with the push of a button".

- Limiting access to confidential data: Statistics Finland, for example, manages datasets containing extremely sensitive personal data to which certain researchers need access regardless of their physical location. For this purpose, a separate virtual secure desktop, including an entire operating environment, has been implemented to access such confidential data. In this type of environment, the transferability of data outside the environment can also be controlled. Researchers, however, will be able to independently use the environment regardless of their physical location.
- Quick installation in a classroom: At times and for the purposes of certain courses, a certain application or operating environment needs to be installed in a whole classroom-full of devices. Such an installation on a device-by-device basis is very slow, but through a VDI solution, an identical, specific environment can be provided for dozens of devices simultaneously.

Virtual desktop environment in 2018–2020

The virtual desktop environment has been tested and implemented at the IT Centre for a couple of years now with mostly positive experiences. For now, however, there have been only a handful of users. On the negative side, some software providers (e.g., Adobe, certain scientific software) either prohibit the provision of their software in VDI environments or demand untenable licensing fees for such use. Another target for criticism has been the “lightweight” nature of the test devices provided by the IT Centre, as well as their insufficient memory and/or hard drive capacity. Primarily, these are nothing more than questions of requirements and costs.

For students, there are currently both Windows 7 and Ubuntu Linux 16 workstations available at the University’s computer laboratories. The University’s current agreement with Microsoft does not cover students’ virtual desktop use outside the University at, for example, home or a café. To enable student use also outside University facilities or with students’ personal devices, an annual contribution of approximately €190,000 for license purchases is required. For Linux use, there are no corresponding restrictions.

During 2017, the University’s VDI infrastructure was expanded, and the number of available licenses was doubled (currently 500). In addition, CUDA computing capacity, which is in demand in particular in artificial intelligence research and data analysis, was acquired, with licenses and support fees included. This helps in the quick provision of the computing capacity required in research and teaching. In order to increase the University’s overall computing capacity, the incorporation of the existing computing cluster capacity into the joint batch processing system, thus increasing the efficiency of the current capacity, is under consideration.

For 2018–2020, the following environment expansion measures have been planned:

- A hundred new licences for virtual desktop use will be purchased.
- Virtual desktop use will be extended to all student-related use at the University (400 new VDI licenses).
- Students will be provided with an opportunity to access Windows virtual desktops also outside the University on their personal devices. (The Linux VDI is already free of charge and available to anyone. In the University’s internal network, a Windows desktop can already be shared without a fee, but not on devices for personal or home use.)

Digitalisation Programme

- Instead of new PCs, obsolete computers at computer laboratories will be replaced with inexpensive VDI terminals that will display the VDI desktop without the ability for heavy data processing. (Replacing conventional computers with VDI terminals will significantly reduce energy consumption [by approximately 80–90%.])
- An online service will be developed through which research groups will be able to specify and order immediately available virtual desktop solutions for their heavy computing or sensitive data requirements.
- Other virtual desktop configurations, such as an administrative workstation and the Windows 10 virtual desktop, will be implemented.
- A terminal management system will be acquired or implemented through independent programming work or in cooperation with other Finnish universities and institutions of higher education.
- The potential benefits of virtualised applications will be investigated. A virtual desktop may be too heavy a solution for certain needs. In these cases, the virtualisation of individual applications could be more appropriate.

Vision for virtual desktop services in 2024

In 2024, VDI use is routine among both students and staff. The majority of software licensed by the University is available only through VDI desktops. Users have access to “almost unlimited” storage space for their files, while working is entirely independent of physical location or the device used.

University VDI desktops can be provided to research collaboration partners and other external parties in a flexible and quick manner, enabling access through appropriate usernames and passwords to precisely the software and files they need. File sharing among members of the University community is transparent and automatic. Licensing problems have been solved. The concept of “bring your own device” has become reality.

Milestones for VDI:

2018	Based on the successful pilot stage last year, use is expanded. All or at least 80% of students' computer laboratories and shared workstations will be modified to use VDI technology, considerably reducing the need for maintenance and installation work.
	A ready-to-use tool for researchers is available that can be used to order an appropriate virtual desktop for a computing environment or data storage.
2019	All University users have access to all personal and familiar software on any device, home computers included.
2020	The large-scale replacement of laptops used by University administration with virtual desktops begins.

Cost estimates for projects related to research:

Expenses (costs)	2018	2019	2020
Storage and saving solutions	€156,000	€171,250	€173,750
Data access solutions	€140,000	€140,000	€140,000
Advisory services for researchers	€292,500	€465,000	€465,000
Development projects supporting data services	€222,000	€428,000	€500,500
Open access publishing	€930,000	€925,000	€1,165,000
HiData	€60,000	€60,000	€60,000
HELDIG	€180,000	€180,000	€180,000
Virtual desktop (VDI)	€437,000	€394,000	€394,000
Total	€2,417,500	€2,763,250	€3,078,250

C Comprehensive projects

Two projects concerned with the entire University community will be included in the Digitalisation Programme: the University website and digital communications, and the smart campus.

C1 Website and digital communications

The website of the University of Helsinki is a broad entity comprised of various contents and services that are supplemented by social media, as well as other digital channels and services. The website will continue to serve as a content hub that provides international visibility to research, teaching and social interaction. The international reputation and digital impact of the University will be enhanced, as the website content will be available on multiple channels, optimised for search engines. To the University community, Helsinki.fi must provide an easy-to-use platform for science, research, teaching and interaction content, as well as partnerships.

As regards services on social media, the University of Helsinki strives to be the Finnish university with the largest international impact. This will be achieved through the utilisation of the University's own media, scientific and recruitment content, as well as the development of the customer service conducted in social media. This requires University-level investments in social media services and digital marketing. The impact of the social method will be measured with analytics and competitor comparisons.

Digitalisation Programme

Website and digital communications in 2018–2020

The Helsinki.fi website will combine the University's content into entities serving various interest groups across organisational boundaries (such as the degree finder, research and a media channel). Strategic and innovative content concepts are being created, such as Think Open, a service promoting the University's open data and code, and Think Education (under development), a corresponding service for teaching.

International student and researcher recruitment will be supported by methods of digital marketing and content development. The University's expertise and experts will be easier to find than today (the expert search project).

Digital media is attracting new audiences into the University's sphere of influence. Visibility in search engines is supported through search engine optimisation and marketing. Opportunities for automated marketing and personification will be utilised in the targeting and distribution of content and services.

Development work and planning will be guided by user experiences and analytics. DigiHub will serve as the collaboration platform for the University's product development teams and external partners.

The technical architecture of the website will be redesigned as microservice architecture, a Drupal 8 production environment and a cloud service platform defined in cooperation with the IT Centre.

The search feature will be improved. Technologically, the feature will be supplemented by third-party applications in areas such as personification, analytics and quality control.

Vision for the website and digital communications in 2024

The vision for the University's website and digital communications in 2024 is *"Knowledge as common capital and a driving force for the future"*.

The digitalisation of communications and marketing helps turn the University's knowledge into global capital. Helsinki.fi provides an authentic student experience, while serving as a service pathway from applicants to students and a destination for lifelong development. Platforms for open access publishing, scientific knowledge and communication tools comprise a compatible whole.

The content and services on the Helsinki.fi website are provided to interest groups and customers through their preferred digital channels and services in situations and on the platforms and devices suitable to them.

New digital opportunities – such as artificial intelligence and automation, augmented and virtual reality, and third-party applications – are utilised in an increasingly agile manner by reforming practices. Artificial intelligence and automation are used in targeting communications, service bots and website production.

Milestones for the website and digital communications:

2018	The share of international visitors has increased to 30% from the previous year.
	In Finland, the number of new visitors has increased 20% from the previous year.
	The number of Drupal websites used by research groups has increased to 200 (by 50%).
	The University's website has been assessed and user-tested by target groups, in addition to which required improvements have been carried out.
2019	Of all traffic on the website, international visitors constitute a share of 25%, while the share of new Finnish visitors is 50% of the total number of visitors.
	Users assess the user experience on Helsinki.fi as good (the base level is based on the user testing conducted in 2018).
	The number of international visitors has increased 20% from the previous year.
	In Finland, the number of new visitors has increased 20% from the previous year.
2020	Of all traffic on the website, international visitors constitute a share of 35%.
	The website has been transferred to the Drupal 8 environment.
	The international reputation indicator, set in 2019, indicates a strengthening reputation.
	The number of international visitors has increased 20% from the previous year.
	In Finland, the number of new visitors has increased 20% from the previous year.

Cost estimates for the website and digital communications:

Expenses (costs)	2018	2019	2020
Projects: Expert directory and event calendar	€180,000	€130,000	
Concept development: Think Open 2.0, further development of educational offerings, international recruitment, statistics on display and responsive statistics	€180,000	€150,000	€130,000
Content development and the website: Disciplines, ranking site, teaching and science content, recruitment content, new website	€150,000	€150,000	€150,000
Quality control and social media: Accessibility directive, search engine marketing and discoverability, targeting services, quality control and social media management applications	€140,000	€140,000	€140,000
Technology and architecture: Drupal 8 implementation (+1 person-year/IT Centre), cloud service implementation and infra maintenance,	€310,000	€310,000	€310,000

search feature, personification, analytics and quality control, GDPR/data security, microservice architecture implementation			
Total for the website and digital communications	€960,000	€880,000	€730,000

C2 Smart campus

A smart campus (or ubicampus) is an extensive entity comprised of new, developing digital services that support teaching, research and everyday life on campus. Key factors include wireless technologies and the internet of things, new modes of interaction, such as mobile smart devices and large displays shared by several users, artificial intelligence that supports learning, as well as indoor positioning services. The smart campus is in continuous development, with both students and teachers taking advantage of its digital and open interfaces in the development of new applications and services. Perspectives related to privacy, as well as data protection, will be taken into consideration in the implementation of the smart campus.

The smart campus in 2018–2020

In 2018, a smart campus pilot project will be carried out at the Kumpula Campus. Facilities will be redesigned as a modern work environment where lighting, large displays, the monitoring of available workstations and other functions will be taken into consideration during the planning stage. Based on experiences gained from the pilot, the next stage of the smart campus project will be planned, where the pilot will be extended to other buildings and campuses.

At the first stage, the focus will be on supplementing and planning the smart campus concept. The architecture must enable data collection and sharing (positioning, sensors, displays, etc.). This also includes interfaces and their use. This engine will provide a foundation for living lab activities where the campus comprises a laboratory for the introduction and evaluation of new services.

Preliminary features at the first stage:

- Interactive smart displays and applications: the wireless transfer of presentations and documents to smart displays
- Positioning of available workstations
- Indoor/outdoor air quality
- Smart lighting/facility customisation with mobile devices

In 2019, the smart campus pilot will be expanded by opening developer interfaces to assignments and hackathon events. Making central interfaces available to application developers is among the project's goals. This way, students and researchers will be able to innovate and develop new applications. Based on the experiences gained during the first stage of the pilot, the next stages of the smart campus project will be planned to expand the pilot elsewhere on the Kumpula Campus and to utilise technology also on other campuses.

Preliminary features at the second stage:

- Indoor positioning (Bluetooth beacon) and mobile positioning

Digitalisation Programme

- Mobile map service
- Opportunity to locate staff (on campus/in the office)
- Radar view: tailoring academic content, notifications
- Augmented reality applications through the radar view: academic content on a map/through augmented reality visualisation
- Smart campus hackathon/MOOC course

Vision for the smart campus in 2024

In 2024, the University of Helsinki is a pioneer in the utilisation of technology in the campus environment, employing the smart campus concept on all four campuses. Work facilities supported by new technology enable flexible activities where the facilities adapt to the wishes and settings of users. Finding and reserving available work and meeting spaces are easy. Documents and presentations can be easily transferred to smart displays, providing interaction opportunities for larger groups as well. The smart campus has facilitated the creation of new applications and services, supporting the emergence of a new kind of digital learning environment. The augmented reality radar view for academic content is one example of the innovations brought about by the smart campus. This application makes it possible to look for and examine academic content in the campus environment through augmented reality.

Milestones for the smart campus:

2018	The smart campus pilot project is ongoing at Kumpula Campus, including feedback collection.
2019	The pilot is expanded and interfaces are made available at hackathons. Augmented reality application
2020	The smart campus concept is in large-scale use on campuses.

Cost estimates for the smart campus project:

Expenses (costs)	2018	2019	2020
Smart campus	€90,000	€60,000	€60,000

4 Proposal for the organisation and project management of digitalisation development

Digitalisation applies to all operations of the University. It will change the nature of operations in a way that will enable new kinds of content. The coordination of an activity with such a broad scope

and impact is challenging. There is a danger that the progress of digitalisation will vary too much between different operational fields, which will lead to ineffectiveness and poor service experiences, further leading to only a partial fulfilment of the potential of digitalisation.

The IT Centre has a key role in IT collaboration between European universities. BenchEIT (<http://www.eunis.org/task-forces/benchmarking/>), a working group under the EUNIS (European University Information Systems) organisation, annually collects key data from the IT sector of more than 60 European universities in order to help university IT management to analyse and develop the activities of their organisation. This forum can also serve as a discussion channel for matters concerned with the organisational management of digitalisation programmes.

Proposal:

1. Digitalisation has a University-level steering group coordinating and prioritising digitalisation projects at the University of Helsinki. The mission, division of duties and compositions of the Centre for Information Technology Board, the Enterprise Architecture Board and the potential digitalisation steering group must be thoroughly considered, planned and prepared as a consistent entity.
2. A digital leap project for monitoring and assessing studies (OPSA) will be established, through which A2, A3 and A4 will be implemented. Separately agreed funding will be appointed for project implementation.
3. A digital leap project for research and publishing (TUJU) will be established, through which B1, B2, B3 and B4 will be implemented. The duration of the project is from 2018 to 2020. Separately agreed funding will be appointed for project implementation.
4. A digital leap project for infrastructure (INDI) will be established, through which B5 and various infrastructure development projects that are ongoing or under development will be implemented (see Appendix D2). The duration of the project is from 2018 to 2020. Separately agreed funding will be appointed for project implementation.
5. A smart campus project (UBI) will be established, through which C2 will be implemented. The duration of the project is from 2018 to 2020. Separately agreed funding will be appointed for project implementation.

APPENDICES:

APPENDIX D1: Digitalisation in the strategy of the University of Helsinki

The University of Helsinki's vision for 2025 has been encapsulated in the expression *a global force – together*. The University is building a better world based on sustainable development by assuming an increasingly prominent role in solving global problems. Multidisciplinary research, teaching and learning of a high standard produce new knowledge and knowhow for the benefit of all of humanity. A pioneering approach, an attentive and proactive attitude, fresh thinking and creative interaction will strengthen the status of the University of Helsinki among the best universities in the world.

This vision will be realised through increasingly close collaboration with both established and new Finnish and international partners and stakeholders. By doing things together, our impact is greater than by going at it alone.

To fulfil its vision, the University of Helsinki has chosen three strategic objectives for the 2017–2020 period:

- 1) *A creative and international environment for learning and top-level research*
- 2) *Focus on the student*
- 3) *Resources for reform*

These strategic objectives and specific development targets have been compiled in the strategy map below.



Under the development target “Focus on the student”, the digitalisation of learning environments is one of three measures. However, since digitalisation is a central part of almost all measures related to strategy, it is relevant to nearly all of the strategic themes. Recruitment, for example, requires competitive digital communications, while basic research requires digital source material. Open digital publishing and data are the founding pillars of open science. Particularly in the humanities, the creation of digital research infrastructures is becoming increasingly common. Furthermore, degrees can only be competitive if the University is a forerunner in the creation of digital learning environments. Interaction and learning in a scientific community are increasingly based on the contemporary utilisation of digital tools. Digital communications is also part of an open operational culture. Lastly, the quick development of information technology, including the introduction of artificial intelligence, requires the development of staff skills in order to make the most of new opportunities.

The Board of the University has already approved the following digitalisation measures for 2018, echoing the proposals of this working group:

A digitalisation roadmap supporting digital development will be drafted for 2018–2020, as well as a vision for 2024.

The Digital Leap in Education project and the introduction of the SISU data system of the academic affairs administration will continue. The SISU system will be integrated with other teaching and study services, as well as the teaching planning and facility reservation system in such a manner that all services will be available through a single source. The system for monitoring student progress will be modernised. A tool for managing master’s thesis processes will be developed. An assessment model for courses based on digital self-assessment will be developed on the basis of research.

The smart campus is an entity comprised of developing digital services that support teaching, research and everyday life on campus. On the smart campus, students and teachers utilise digital and open interfaces in the development of new applications and services.

The University promotes open access scientific publishing to make research freely available immediately after publication. The self-archiving process will be clarified in such a manner that meeting the requirements of open access will be as easy as possible for researchers. Open access learning material (MOOCs, ResearchGuide) will be developed. Open access teaching and teaching support provided to doctoral schools will be increased. Datasets produced at the University will be made available through the open Think Open science portal.

As a result of the MILDRED project and its sub-projects, the University will provide university research groups with storage space and guidance as an infrastructure service for storing, managing, sharing and publishing potentially extensive open datasets.

The Helsinki Centre for Data Science HiData will provide a platform for Finnish and international collaboration, while serving as an interface between the University and business life. The goal is to enable the reception and research-related utilisation of extensive research datasets created by universities and businesses.

A central goal for the Helsinki Centre for Digital Humanities HELDIG is to support the University's digital leap through new infrastructures. This work is conducted both in Finland and as part of an international network. The goal is to become a leader in digital humanities with the help of, among others, the CLARIN and DARIAH infrastructures. The intention is to also include the Digital Research Infrastructure for Arts and Humanities (DARIAH) in the next roadmap for the Academy of Finland.

The redesign of the University's Flamma intranet will commence, and its search features will be improved. The redesign of the University's public website will continue in order to convey a high-quality image of the University and to provide easy access to its data. Opportunities in digital marketing and search engine optimisation will be utilised.

The use of virtual desktop technology (VDI) will be expanded. Thus, the files, software and desktops used by members of the University community will be available through a cloud service regardless of location or the device used.

APPENDIX D2: Report on the current state of digital development

During spring and early autumn 2017, a small working group compiled a report to gain a better overall view of the completed, ongoing and planned digitalisation projects at the University. The group was comprised of Ilkka Siissalo and Merja Eklín from IT Management and Antti Savolainen from Administrative Services. The work was implemented as interviews and by subsequently requesting written feedback from interviewees. Altogether 20 individuals nominated by sector directors were interviewed by the group.

As seen below, digitalisation is spreading throughout the University of Helsinki at great speed.

General observations

A remarkable number of projects related to digitalisation are ongoing at the University, even though they have not necessarily been perceived as falling under the term digitalisation. In many cases, the individuals in charge of these projects are profound experts of their own, often very narrow specialist fields. Their interest is focused on only one or a handful of projects. Before this report, very few had an overall view of all of the activities related to digitalisation, let alone had the opportunity to carry out project prioritisation, scheduling and management by taking this view into consideration. Even the completed report only provides a snapshot of a quickly changing situation. In several conversations, the need for University-level management of the Digitalisation Programme, some centralised resourcing and a project office was brought up – one or two persons who would constantly monitor the status of various projects.

In development work, the first cautious steps are only now being taken towards joint development transcending unit boundaries. One gratifying example of this is the DigiHub activities begun at the City Centre Campus where software developers, project managers and researchers working under different projects and units conduct their work in the same facilities with the same tools while teaching each other. However, there are still too many isolated pockets of software and service development at the University.

The development of digitalisation does not, however, begin and end with software development. Many universities are far ahead of the University of Helsinki in areas such as mobile services, distance examinations and studies, the provision of online-based study modules, as well as the redesign of physical work facilities to better support contemporary digital studying and teaching. In traditional auditoriums, there are not enough electric plugs for dozens or hundreds of laptops. Correspondingly, researchers nowadays often use free online services targeted at consumers when, for example, writing co-authored publications, even though the features and safety of these tools are often questionable. At the moment, services such as Google are often the best option.

One of the biggest challenges in the near future will be the improvement of the digital skills level of the University community. This applies particularly to senior staff with long careers at the University. Depending on the field, many young students have acquired these skills already in childhood, but in the current situation where digital services are quickly gaining ground, many scholars from earlier generations find themselves in trouble – without necessarily recognising their need for help. Courses and more comprehensive instructions, as well as labour-intensive hands-on guidance are needed. This requirement is bolstered by new legislation, among others the new EU General Data Protection Regulation. All staff members should be made aware of its basic requirements.

University operations are changing at rather a fast pace. Among the reforms are degree programmes subject to tuition fees for international students, which requires contributions to digital communications and marketing, as well as many types of online-based student guidance, often across distances. The University's reputation will be increasingly determined also on the basis of the University's visibility on search engines, social media and other online services. As a generalisation, it can be said that research results that are not easy to find online in an understandable form will not be overly helpful in improving the University's reputation. The management of the University is also changing. In many international universities, the utilisation of various data analytics and prognoses, and the digital formulation of "what if" scenarios have been taken much further than in any institutions of higher education in Finland.

Digitalisation trends at other universities

Savings have often been the starting point for digitalisation. This perspective has given rise, among other things, to the MOOC boom, particularly in the United States. Studying is also becoming fragmented: no longer will all students complete entire degrees, but some will complete a single course or a study module, after which they will be awarded a certificate which demonstrates their qualifications. This will lead to a significant increase in studying independent of place and time, which decreases the need for traditional mass lectures. Facility costs will be reduced, but the need for designing online courses will increase tremendously. In many universities, it is already part of the routine to record all lectures or equivalent teaching events and offer them online as videos or corresponding material. For the time being, our capacity for this is very limited.

Self-service based on digital tools is quickly increasing in society overall. For universities, this means that both science and teaching should be visibly displayed online in an accessible form. Administrative services, in particular, will be based on self-service. Telecommuting, distance learning, distance examinations and distance research are all becoming increasingly common, introducing an enormous need for growth in digital communications, not only regarding email, but also various groupwork and video conference solutions. Today, members of the University

community – be they administration officials, researchers or students – most often store the data they use on a personal computer, but in the coming years all data will be stored in cloud services, making all datasets, software and services available around the clock regardless of devices, location and time.

Ongoing digitalisation projects at the University of Helsinki

The focus of ongoing projects is clearly on the development of services related to teaching and the administration of academic affairs. Research infrastructure projects are typically more fragmented in nature. Open science and related publishing, be it the publication of raw data or academic articles, has started off well. In this area, the University of Helsinki is clearly the leading active party in Finland. Another area receiving considerable attention at the University of Helsinki is the digitalisation of administration.

1. Research services

Current development in the research sector can be categorised as follows:

Digital services for research conduct

- Digital publishing services, service centre for open access publishing
- Development of the research data infrastructure (the MILDRED project): Management, storage, saving and access solutions for research data and datasets, including equipment environments and maintenance, development and guidance services
- Computing services for research, development projects for virtual research environments (VDI environments)

Development of expertise in open science and data management

- Students' digital skills online course (ongoing)
- Open science in bachelor's and master's programmes (a pilot will start in spring 2018)
- Researcher training begun as part of the MILDRED project entity

Furthermore, areas to be developed next in the research sector have been identified:

Digitalisation of research support and administrative processes

- New agreement portal (preliminary report completed in 2017)
- Development of reporting and analytics (partly in production)
- Electronic laboratory data systems, laboratory journals, etc.

Specification of new/upcoming service requirements

- Research Data Management agents
- Data anonymisation and pseudonymisation services, required by the new EU General Data Protection Regulation
- Machine learning, data mining and artificial intelligence; support for data-intensive research

Fourteen ongoing projects of significance were identified in the research sector.

2. Teaching and student services

The digital leap in education is currently the most significant contribution to the digitalisation of the academic affairs sector. Eventually, all degree programmes will participate in the digital leap through the transmission of practices and benefits related to digital development between programmes. The digital leap includes the development of pedagogy, examination practices and the skills of both staff and students. A small share of the leap is concerned with facility-related development.

Current development categories in the digitalisation of the education sector:

Pedagogical development

- Diversification of assessment practices through digital measures, for example, a peer-assessment tool on Moodle
- A “flipped classroom” supported by video recordings and digital learning material
- MOOCs and other open teaching, open learning material: Mooc.fi, MOOC as a pathway to the University (computer science), business collaboration concerning MOOCs
- The digital leap in education

UniHow is the University's proprietary feedback and reflection application whose logic and content is based on Finnish and international research in university pedagogy. The Centre for University Teaching and Learning HYPE is in charge of the development and operations of UniHow at the University. Through UniHow, data concerned with students' experiences of studying and the learning environment can be used in various ways: as a support for studies and the teaching provided by teachers (digital tutor), in developing the quality of teaching in degree programmes (reporting tool) and as research data (a research instrument). UniHow includes several products based on the same logic, usable by different target groups in different contexts. UniHow has also been linked with the systems of academic affairs administration.

Development of academic affairs administration

- Digitalisation of the examination process; the digital Examinarium system where students can complete examinations at any time in an examination space and Moodle examinations
- Improvement of student instructions and communications
- Development of student admissions, for example, MOOC as a pathway to the University

Mobile services for students and teachers (continuation of the introduction of the teaching systems project DOO)

- Personified services for daily use
- Notifications and reminders from background systems to mobile devices
- Times, locations, registration, reminders and notifications for teaching from other systems
- The services will be based on data from the basic register (SISU) developed for the academic affairs administration, enabling new services to be built upon it.

Facilities for digital teaching and learning

- Virtual environments, shared, open, easy-to-use basic practices, such as sharing material
- Physical facility solutions that support interaction and enable the utilisation of teaching technology in teaching and learning situations

Skills development

- ICT driving license for students (new) that will ensure sufficient orientation for first-year students
- Shared, easy-to-use tools, training for pedagogical use
- Training and support for all providers of teaching; everyone is expected to utilise the tools.
- Research on data produced by digital platforms and research to support teaching and learning, such as the analysis of study data (the first pilot of the system for monitoring student progress ZZ-2017) and the analysis of MOOC data

Seventeen ongoing projects were identified in the education sector, the largest of which have annual budgets of over €1 million. Further details are available in the working group's PowerPoint presentation.

3. Communications and community relations

Communications and community relations categorises its ongoing digitalisation projects as follows:

Content first and strong reputation

- User experience and its monitoring to guide product and content development
- Helsinki.fi for combining content across organisational boundaries
- Strategic and innovative content concepts (Think Open, Think Education)
- Digital media to attract new audiences into the University's sphere of influence
- Support for international student and researcher recruitment through digital marketing
- Easy access to the University's expertise and experts

Engaged partners, customer-oriented services

- Internationalisation of alumni activities and fundraising through digitalisation
- Service channels, support for self-service and automation
- Introduction of automation and personification to the targeting and distribution of content and services
- Introduction of the CRM system

Full potential of digitalisation

- Participation in the service design of DigiHub and the implementation of the digital roadmap
- Changes in communications because of digital technology and artificial intelligence -> piloting, reform of operational procedures
- Emphasis on key themes, increasing researchers' reach through search engines
- Visibility of the University's visual brand; all other websites to be redesigned to match the University's image

Constructive community

- Flamma project -> new communications practices, promoting the digitalisation of work
- Strategic reform projects as a communications focus -> support for change management
- Senior management, researchers and experts to have an impact through social media

Eight ongoing projects were identified in the communications and social interaction sector.

4. Management and operational planning

The digitalisation projects ongoing in the field of management and operational planning have been categorised as follows:

Agile operational planning

- Genuine introduction of rolling planning; in practice, this means the large-scale introduction of the new operations management system. This work is already ongoing.
- Systematic monitoring of units' status -> specified objectives; the goal is to compile the status of various units in relation to their objectives with the help of the new operations management system in an increasingly easy manner. Part of an ongoing project

The right information at the right time and in the right place

- Up-to-date information for unit directors and the University's senior management. In practice, this means portals personified for individual users and improved analysis reports. The procurement and introduction of a new analysis tool is ongoing.

Strengthening openness and transparency, as well as communality

- Various online discussion communities; new tools for communal communications, such as the My Teaching portal, will be provided for ongoing projects. The pilot stage is ongoing.
- Focus on the availability and protection of data; currently ongoing is a stage where data protection and the observance of the EU's new General Data Protection Regulation in administrative systems are being verified one system at a time. The first improvement projects have already commenced.

Management of core information

- At the moment, terminology is still partly inconsistent, and the same content is being entered multiple times through different channels. The planning of information architecture, part of the enterprise architecture project, is ongoing. The goal is to standardise information, define the sources of core information and divide the responsibilities related to the accuracy of core information among the relevant individuals.

Five significant ongoing projects were identified in the field of management and operational planning.

5. Organisational support services and infrastructure

In the field of support services and infrastructure improvements, the ongoing work has been categorised as follows:

Digital environment

- Adaptable University facility solutions support the progress of digitalisation; facilities corresponding with the notion of "a Minervatori for the future" are being planned in a joint project by the IT Centre, the Library, and Facility and Property Services. The pilot stage is ongoing.

Digitalisation Programme

- Innovation platforms that support development, such as the smart campus, DigiHub and Meilahti. Some of these projects are only at the idea level; others are operational.
- An effective IT network and a comprehensive wireless network; the renewal of the University's grid is close to completion, and approximately 200 base stations for the wireless network are being installed annually.
- Easy-to-use and safe storage space for research data; currently, guidance is already available, while storage space providers chosen through competitive bidding are available for those requiring space. The aim is to make storage space acquisition proactive.
- Extending the use of virtual desktops (VDI). A small-scale pilot has been completed where the idea was proven to be functional. Extending its use throughout the University requires additional funding.
- Workstation 2020 project: the environment, safety solutions, software for general use, pre-installation, acquisition, and the installation and uninstallation of devices will be defined for the standard workstation used in 2020. The project is close to completion.

Digital competence

- Development of and support for digital skills, ICT courses supporting basic skills in digitalisation for the entire University; the redesign of the online course for students is ongoing. For staff, the only relevant course available is concerned with data protection, while a more extensive "driver's license" is for the moment only at a preparatory stage.

Practices and procedures

- Agile methods for implementing development projects; the pilot has been completed, and the methods are in use in certain development projects.
- Enterprise architecture and process work are ongoing. In the teaching sector, the work is well underway, but in the area of information architecture, it is only at the first stages.
- Comprehensive framework agreements to facilitate development activities have been completed.
- The utilisation of cloud services and other services by service providers (e.g., CSC); a handful of pilots are ongoing. Oodi's successor SISU will be developed by Funidata Oy; the project is ongoing.
- Development across organisational boundaries, utilisation of external expertise, openness; these will be tested in the ongoing DigiHub project.
- System procurement expertise will be centralised. The recruitment of a new legal counsel for procurements is ongoing.

Tools

- Digital administrative services (SAP Fiori, digital records management); projects are ongoing.
- The usability and compatibility of tools, as well as related user support are ongoing, as part of the ongoing projects stated above.

Twelve ongoing projects were identified in the area of support services and infrastructure; one of them was over €1 million, and four were €500,000 to 1 million in scope.

APPENDIX D3: Previous digitalisation working groups

The current working group has predecessors whose work laid a good foundation to build on.

Working group for the digital work environment

On 13 March 2015, the rector appointed a group to define and develop practices related to the digital work environment. The group's composition: Anna Mauranen (chair), Merja Eklin, Jaana Ihalainen, Päivi Karimäki-Suvanto, Sari Koski-Kotiranta, Jaakko Kurhila, Eeva Nyrövaara, Anne Rautanen, Susanna Rautio, Opri Salminen, Sari Timonen and Kimmo Vehkalahti, as well as Minna Frimodig and Jere Majava serving as secretaries. The group submitted its final report on 19 August 2016.²

Below is a summary of the recommendations and policy definitions by the group chaired by Anna Mauranen.

Digital vision: *Communality – openness – culture of experimentation*. Digital learning culture as the focus of changing and communal teaching. Digitalisation facilitates communal learning, the openness and transparency of teaching and learning materials, interaction, continuous development and redesign, while being an inspiration to try new things.

Skills development: Students' skills and tools for using digital teaching and studying environments will be ensured to be sufficient, as will the skills and tools of the University staff for using digital teaching, studying and working environments.

Development of services: Accessible centralised services will be developed, while a culture of experimentation for pioneers will be fostered. New basic systems and service concepts for the planning of teaching and academic affairs administration will be introduced in all degree programmes. The diverse utilisation of digital tools and their development in teaching will be supported. New digital assessment practices, such as applied distance and home examinations, will be promoted. Open online courses will be utilised in student recruitment. Open forums and material will be utilised and produced in teaching, learning and research.

Development of the physical and digital environment: The development will be implemented by engaging students and by improving facilities to support digital and communal work. Various seminar and classroom facilities will be made openly available as learning spaces outside examination periods and teaching.

In accordance with the group's recommendations, the Digital Leap in Education project for 2017–2020 was established on 23 November 2016 with the following objectives: The implementation of the digital leap at the University will be carried out as projects similar to those of the Big Wheel degree programme reform. The project will support the pedagogically sensible utilisation of digitalisation in the teaching and learning of new degree programmes. Contributions to the digital

² <https://flamma.helsinki.fi/content/res/pri/HY356243> (in Finnish only)

leap in education (including the courses serving as student recruitment channels) will also contribute to international visibility and the recruitment of the best students.

Timetable: The project will be carried out from 2017 to 2020, starting in the beginning of 2017. Degree programmes will be engaged gradually so that by the end of 2020 all programmes will have at some point received support and funding for implementing the digital leap. In 2017, ten bachelor's programmes will be chosen for the project, and in 2018, another ten along with ten master's programmes. In addition to supporting the degree programmes, the project will focus on the systematic development of the University's teaching and learning facilities.

Implementation: The project will be divided into sub-projects, of which the most central are (1) the development of and support for the degree programmes' open and flexible curricula and teaching arrangements; (2) the modernisation of learning facilities; (3) the further development of data systems for teaching and studying.

Organisation: The Digital Leap in Education project is managed by the University's Academic Affairs Council and Vice-Rector Keijo Hämäläinen.³ A project group will be established for the purposes of the planning, implementation and coordination of the project. All essential participants (including University Services, the IT Centre, Facility and Property Services, the Centre for University Teaching and Learning HYPE) will commit to collaborating on and achieving the joint objectives while complying with and prioritising related guidelines. The fulfilment of these guidelines will be monitored by the project group, while assessment goals and indicators will be set for the realisation of the digital leap. Students will also be engaged in the planning, implementation and assessment of the project. The central responsibility for implementation lies with the degree programmes and faculties.

Costs, 2017: (1) €20,000 of digitalisation funding for each degree programme for, among other things, increasing the number of available online courses and video production; (2) content development support for online courses, three content developers (each approximately €60,000); (3) targeting degree programme teaching resources to the project (compensation for teaching, 10 x €60,000); (4) facility development and equipment, including (video) technology.

Cost estimate for 2018–2020: 2018: 10 bachelor's programmes + 10 master's programmes + facility development and equipment, €1.1 million. 2019: 12 bachelor's programmes + 20 master's programmes + facility development and equipment, €1.1 million. 2020: 30 master's programmes, €1.1 million

Working group for the principles of digital publishing

Appointed by the rector (Rector's Decision 129/2016) and chaired by Vice-Rector Anna Mauranen, a group focused on the principles of digital publishing conducted its work during spring 2017, drafting a proposal on the principles and guidelines of digital publishing at the University. The report is divided into policy proposals and measure recommendations. The policy section of the report has been confirmed as a Rector's Decision (509/2017) and has been reiterated in the principles of open publishing: <https://www.helsinki.fi/en/research/principles-of-open-publishing>.

³ Later Vice-Rector Sari Lindblom.

The starting point for the principles of open publishing at the University is that all publications produced at the University are openly available and self-archived in the University's publication archive HELDA. Comprehensive self-archiving of publications in HELDA ensures that the University's research activities are documented, as well as preserved and available for further use in the long term. The University does not recommend what is known as hybrid publishing, but there may be grounds for its use for the time being if it facilitates the move towards entirely open publishing. Master's theses, licentiate theses and doctoral dissertations completed at the University of Helsinki will be comprehensively published in the University's open digital archive HELDA (eThesis). The University requires that researchers start using ORCID IDs, include the identifier in their Tuhat profile and use it in scientific publications and other datasets produced by them. Further use of scientific publications must not be needlessly restricted, while the terms of use will be clearly displayed.

The University recommends using a current version of a standard form machine-readable CC BY license from the Creative Commons license family. This recommendation applies also to theses and dissertations.

In the measures section of the report, the group proposes the establishment of a body similar to the digitalisation steering group. Its objective would be, among other things, to steer the progress and completion of goals and projects that facilitate digitalisation at the University.

APPENDIX D4: Estimates on costs and phases

This is the group's outlook in the event all projects are carried out. The University of Helsinki will prioritise projects belonging to the digital roadmap during spring 2018.

This is the group's outlook in the event all projects will be carried out. Projects falling under the scope of the digitalisation roadmap will be prioritised by					
Development targets, expenses (costs)		2018	2019	2020	Total
	Measures	€4,832,500	€5,008,250	€5,173,250	€15,014,000
	Digitalisation of studying and teaching	€1,365,000	€1,305,000	€1,305,000	€3,975,000
	Digital leap in education	€1,100,000	€1,100,000	€1,100,000	€3,300,000
	System for monitoring study progress (Oodi machine)	€90,000	€60,000	€60,000	€210,000
	new technology	€80,000	€60,000	€60,000	
	auditing	€10,000			
	System for monitoring master's thesis progress (Grappa)	€65,000	€40,000	€40,000	€145,000
	implementation of new features	€60,000	€40,000	€40,000	
	auditing	€5,000			
	Digital self-assessment (DISA)	€110,000	€105,000	€105,000	€320,000
	implementation of the technical tool	€20,000	€15,000	€15,000	
	two doctoral students and one research assistant	€90,000	€90,000	€90,000	
	Digitalisation of research	€2,417,500	€2,763,250	€3,078,250	€8,259,000
	Open access publishing	€930,000	€925,000	€1,165,000	€3,020,000
	Open Scholarship	€230,000			€230,000
	annual expenses	€50,000			
	three full-time equivalents	€180,000			
	Open access publishing carried out by large publishers	€300,000	€500,000	€800,000	€1,600,000
	Analytics, metrics and visualisation services for publications		€25,000	€25,000	€50,000
	Research portal service	€50,000	€50,000	€50,000	€150,000
	planning	€50,000			
	implementation and depreciations		€50,000	€50,000	
	Development of publishing, publishing platforms and archive	€350,000	€350,000	€290,000	€990,000
	Gaudeamus	€250,000	€250,000	€190,000	
	platform	€40,000	€40,000	€40,000	
	one full-time equivalent	€60,000	€60,000	€60,000	
	Storage and saving solutions	€156,000	€171,250	€173,750	€501,000
	Service for confidential data	€91,000	€106,250	€108,750	€306,000
	annual expenses	€25,000	€25,000	€25,000	
	investment depreciations	€7,500	€16,250	€18,750	
	one IT full-time equivalent = €65,000	€58,500	€65,000	€65,000	
	Productisation of MILDRED services	€65,000	€65,000	€65,000	€195,000
	one IT full-time equivalent = €65,000	€65,000	€65,000	€65,000	
	Data access solutions	€140,000	€140,000	€140,000	€420,000
	Development of the Think Open website	€72,000	€72,000	€72,000	€216,000
	development costs, calculated as annual expenses	€60,000	€60,000	€60,000	
	one full-time equivalent at another sector (TUTTO or Library) = €60,000	€12,000	€12,000	€12,000	
	Development of the data sharing service	€68,000	€68,000	€68,000	€204,000
	EUDAT fees, estimate (annual fee)	€55,000	€55,000	€55,000	
	one IT full-time equivalent = €65,000	€13,000	€13,000	€13,000	
	Guidance services for researchers	€92,500	€465,000	€465,000	€1,222,500
	Data support service	€180,000	€255,000	€255,000	€690,000
	investment depreciations, activation at the beginning of 2019		€15,000	€15,000	
	one full-time equivalent at another sector (Library) : €60,000	€180,000	€240,000	€240,000	
	Digitalisation of IT services	€112,500	€145,000	€145,000	€402,500
	annual expenses	€15,000	€15,000	€15,000	
	investment depreciations, activation at the beginning of 2020				
	one IT full-time equivalent = €65,000	€97,500	€130,000	€130,000	
	Support for data intensive research		€65,000	€65,000	€130,000
	investment depreciations, activation at the end of 2020				
	one IT full-time equivalent = €65,000		€65,000	€65,000	
	Development projects supporting data services	€22,000	€428,000	€500,500	€1,150,500
	Digitalisation of IT infrastructure	€180,000	€160,000	€232,500	€572,500
	annual expenses	€50,000	€30,000	€30,000	
	investment depreciations, activation at the end of 2019			€72,500	
	one IT full-time equivalent = €65,000	€130,000	€130,000	€130,000	
	Digital laboratory data systems	€30,000	€200,000	€200,000	€430,000
	annual expenses (€400/user, 500 users)		€200,000	€200,000	
	competitive bidding and procurement project	€30,000			
	Agreement portal	€12,000	€68,000	€68,000	€148,000
	annual expenses (support fees, etc.)		€16,000	€16,000	
	investment depreciations, activation at the beginning of 2019		€40,000	€40,000	
	one full-time equivalent at another sector (TUTTO) = €60,000	€12,000	€12,000	€12,000	
	HiData	€60,000	€60,000	€60,000	€180,000
	Data science platform, one full-time equivalent for a coordinator	€60,000	€60,000	€60,000	
	Data science platform toolbox, included in the previous column				
	HELDIG	€180,000	€180,000	€180,000	€540,000
	Infrastructure for linked open semantic data and ontologies: artificial intelligence	€120,000	€120,000	€120,000	
	Toolbox and teaching material (MOOC), for linked open data: full-time equivalent	€60,000	€60,000	€60,000	
	Virtual desktop (VDI)	€437,000	€394,000	€394,000	€1,225,000
	annual expenses, including MS licenses	€405,000	€362,000	€362,000	
	investment depreciations	€32,000	€32,000	€32,000	
	Comprehensive projects	€1,050,000	€940,000	€990,000	€2,780,000
	Website and digital communications	€960,000	€880,000	€730,000	€2,570,000
	Projects: expert directory and event calendar	€180,000	€130,000		
	Concept development: Think Open 2.0, further development of educational offerings, international recruitment, statistics on display and responsive statistics	€180,000	€150,000	€130,000	
	Content development and the website: disciplines, ranking sites, teaching and science content, recruitment content, the new website	€150,000	€150,000	€150,000	
	Quality control and social media: accessibility directive, search engine marketing and discoverability, targeting services, quality control and social media management applications	€140,000	€140,000	€140,000	
	Technology and architecture: Drupal 8 implementation (one full-time equivalent at IT Centre), cloud service implementation and infra maintenance, search service, GDPR/data protection, microservice architecture implementation	€310,000	€310,000	€310,000	
	Ubicampus	€90,000	€60,000	€60,000	€210,000
	equipment	€30,000			
	HCI course (Professor Giulio Jacucci)				
	pilot at the Kumpula Campus				
	one full-time equivalent for a coordinator	€60,000	€60,000	€60,000	

	2018	2019	2020
Measures	21,0	20,6	20,6
Digitalisation of studying and teaching	2,0	2,0	2,0
Digital leap in education			
System for monitoring study progress (Oodi machine)			
new technology			
auditing			
System for monitoring master's thesis progress (Grappa)			
implementation of new features			
auditing			
Digital self-assessment (DISA)	2,0	2,0	2,0
implementation of the technical tool			
two doctoral students and one research assistant	2,0	2,0	2,0
Digitalisation or research	17,0	16,6	16,6
Open access publishing	4,0	1,0	1,0
Open Scholarship	3,0		
annual expenses			
three full-time equivalents	3,0		
Open access publishing carried out by large publishers			
Analytics, metrics and visualisation services for publications			
Research portal service	0,0		0,0
planning			
implementation and depreciations			
Development of publishing, publishing platforms and archive	1,0	1,0	1,0
Gaudeamus			
platform			
one full-time equivalent	1,0	1,0	1,0
Storage and saving solutions	1,9	2,0	2,0
Service for confidential data	0,9	1,0	1,0
annual expenses			
investment depreciations			
one full-time equivalent at IT Services = €65,000	0,9	1,0	1,0
Productisation of MILDRED services	1,0	1,0	1,0
one full-time equivalent at IT Services = €65,000	1,0	1,0	1,0
Data access solutions	0,4	0,4	0,4
Development of the Think Open website	0,2	0,2	0,2
development costs, calculated as annual expenses			
one full-time equivalent at another unit (TUTTO or Library) = €60,000	0,2	0,2	0,2
Development of the data sharing service	0,2	0,2	0,2
EUDAT fees, estimate (annual fee)			
one full-time equivalent at IT Services = €65,000	0,2	0,2	0,2
Guidance services for researchers	4,5	7,0	7,0
Data support service	3,0	4,0	4,0
investment depreciations, activation at the beginning of 2019			
one full-time equivalent at another unit (Library) : €60,000	3,0	4,0	4,0
Digitalisation of IT services	1,5	2,0	2,0
annual expenses			
investment depreciations, activation at the beginning of 2020			
one full-time equivalent at IT Services = €65,000	1,5	2,0	2,0
Support for data intensive research		1,0	1,0
investment depreciations, activation at the end of 2020			
one full-time equivalent at IT Services = €65,000		1,0	1,0
Development projects supporting data services	2,2	2,2	2,2
Digitalisation of IT infrastructure	2,0	2,0	2,0
annual expenses			
investment depreciations, activation at the end of 2019			
one full-time equivalent at IT Services = €65,000	2,0	2,0	2,0
Digital laboratory data systems			
annual expenses (€400/user, 500 users)			
competitive bidding and procurement project			
Agreement portal	0,2	0,2	0,2
annual expenses (support fees, etc.)			
investment depreciations, activation at the beginning of 2019			
one full-time equivalent at another unit (TUTTO) = €60,000	0,2	0,2	0,2
HiData	1,0	1,0	1,0
Data science platform, one full-time equivalent for a coordinator	1,0	1,0	1,0
Data science platform toolbox, included in the previous column			
HELDIG	3,0	3,0	3,0
Infrastructure for linked open semantic data and ontologies: artificial intelligence	2,0	2,0	2,0
Toolbox and teaching material (MOOC), for linked open data: full-time equivalent	1,0	1,0	1,0
Virtual desktop (VDI)			
annual expenses, including MS licenses			
investment depreciations			
Comprehensive projects	2,0	2,0	2,0
Website	1,0	1,0	1,0
Projects: expert directory and event calendar			
Concept development: Think Open 2.0, further development of educational offerings, international recruitment, statistics on display and responsive statistics			
Content development and the website: disciplines, ranking sites, teaching and science content, recruitment content, the new website			
Quality control and social media: accessibility directive, search engine marketing and discoverability, targeting services, quality control and social media management applications			
Technology and architecture: Drupal 8 implementation (one full-time equivalent at IT Centre), cloud service implementation and infrastructure maintenance, search service, GDPR/data protection, microservice architecture implementation	1,0	1,0	1,0
Ubicampus	1,0	1,0	1,0
equipment			
HCI course (Professor Giulio Jacucci)			
pilot at the Kumpula Campus			
one full-time equivalent for a coordinator	1,0	1,0	1,0

Development targets and stages		2018		2019		2020		colour codes
	Measures	spring	autumn	spring	autumn	spring	autumn	
Digital leap in education								pilot, development, implementation
System for monitoring study progress (Oodi machine)								further development, expansion
System for monitoring master's thesis progress (Grappa)								maintenance
Digital self-assessment (DISA)								
Open access publishing								
Open Scholarship								
Open access publishing carried out by large publishers								
Analytics, metrics and visualisation services for publications								
Research portal service								
Development of publishing, publishing platforms and archive								
Storage and saving solutions								
Service for confidential data								
Productisation of MILDRED services								
Data access solutions								
Development of the Think Open website								
Development of the data sharing service								
Guidance services for researchers								
Data support service								
Digitalisation of IT services								
Support for data intensive research								
Development projects supporting data services								
Digitalisation of IT infrastructure								
Digital laboratory data systems								
Agreement portal								
HiData								
Data science platform								
Data science platform toolbox								
HELDIG								
Infrastructure for linked open semantic data and ontologies: artificial intelligence, two full-time equivalents								
Toolbox and teaching material (MOOC), for linked open data: full-time equivalent								
Virtual desktop (VDI)								
Website and digital communications								
Projects								
Expert directory								
Event calendar								
Concept development								
Think Open 2.0								
Further development of educational offerings								
International recruitment								
Statistics on display and responsive statistics								
Content development and the website								
Disciplines, ranking sites, teaching and science content, recruitment								
Media concept and newsletters								
Video communications and infographics								
Unit and research group websites								
Quality control and social media								
Technology and architecture								
Ubicampus								