

Airlift Crystallizer

Feed Vessel

Make-up V

Annual Report 2017

TU Delft Annual Report 2017

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In many ways, 2017 was dedicated to 'open'. Open, online education once again occupied a prominent place on the agenda. More than a million participants from around the world have now followed one or more of our many massive open online courses (MOOCs). With these and other forms of online education, we are seeking to share our knowledge and teach the world, while also enhancing the quality of education for our own students. One remarkable result in this regard is the Virtual Exchange Programme – a TU Delft initiative that makes it possible for students to follow and earn credits for MOOCs at renowned universities within and outside of Europe.

We also embrace Open Science. For example, we encourage Open Access publication, in line with the Ministry's objectives. In the reporting year, this applied to more than half of all academic publications, indicating that we are well on our way to achieving (or even exceeding) the governmental objective of 60% in 2018. Open Science involves more than only Open Access publication. It also includes promoting transparency and reproducibility in scientific research. The appointment of special Data Stewards in several faculties has set out a path to this end, which will be continued in 2018.

In light of the continuously advancing digitisation throughout the world, an increasingly important role is being played by software that, in many cases, is designed and developed at universities of technology. In this context as well, TU Delft upholds the principles of open development, thereby ensuring that the outcomes of research will be transparent, shareable and as free as possible of licensing costs, to the benefit of society. Efforts to this end in the past year included the establishment of a community for producers and users of Open Source software. In addition, a consortium headed by TU Delft was awarded a European grant of €7.6 million for the development of open-source robot software. Within the ROSIN project (ROS Industrial quality-assured robot software components), researchers will be cooperating with companies to develop software for smart industrial robots.

Even as digitisation and the internet facilitate the distribution of knowledge, we open our physical campus to other parties. From greater diversity in the range of hospitality options offered, to the provision of a living-lab environment, our campus is increasingly becoming a UniverCity: a place in which high-level education and research are paired with enterprise and innovation. One important step in this development is the covenant that we have signed with the Municipality of Delft, which aims to strengthen the connection between the university community and the city. Together, we are building an optimal ecosystem for knowledge-intensive enterprise, while ensuring that the societal impact of our research will be noticeable within the city.

In 2017, we also drafted our new strategic plan for the years 2018-2024. We did this as part of an open process, in which all stakeholders had the opportunity to participate in the discussion. More than 600 people took advantage of this opportunity, including students, doctoral candidates, academic (and other) staff members, alumni, contacts in the business community and organisations within the regional and academic network. Created in this manner, the Strategic Framework for 2018-2024 provides a guideline for the future. This future will definitely look different in terms of administration: 2017 was the last administrative year for Rector Magnificus Karel Luyben and Vice President for Education & Operations Anka Mulder. Both Luyben and Mulder have been great advocates of Open Science and Education, and we will definitely continue along the path that they have set out. What will 2018 hold for us? One thing is certain: armed with a new strategy, also in the coming year we will be open to change and development.

The Executive Board of Delft University of Technology

Report of the Supervisory Board

In 2017, the Supervisory Board was made up of the following members:

- Drs. Ir. J. van der Veer, president, former CEO of Shell (appointed until 1 July 2021, second term)
- Prof. D.D. Breimer, vice-president, former Rector Magnificus/President of the Leiden University Executive Board (appointed until 1 May 2017, third term)
- Ir. L.C.Q.M. Smits van Oyen MBA, director and major shareholder of healthcare companies, ICT and tourism sectors (appointed until 1 January 2021, second term)
- Drs. C.G. Gehrels, member who enjoys the confidentiality of the employee and student participation bodies, European director of Big Urban Clients Arcadis (appointed until 1 June 2019, first term)
- Drs. G. de Zoeten RC, CFO LeasePlan Corporation N.V. (appointed until 1 May 2020, first term)
- Prof. L.L.G. Soete, former Rector Magnificus of Maastricht University, honorary professor in the School of Business and Economics at Maastricht University and UNI-MERIT professorial fellow (appointed from 1 May 2017 until 1 May 2021, first term)

Vision and strategy

2017 was the last year in which the Supervisory Board used 'Roadmap TU Delft 2020' as a guideline for its supervisory duties relating to the strategic course of the university. On 30 October 2017, the Supervisory Board approved a new strategic plan for the 2018-2024 period: 'Impact for a better society, TU Delft Strategic Framework 2018-2024'. In the path leading up to its approval, the Supervisory Board was closely involved in all relevant phases of the preparation of this plan.

The Board has been informed of initiatives or invitations to strategic cooperation with fellow institutions or institutes within and outside the country. At the local level, the Board is involved in the development of TU Delft's strategic cooperation with the Municipality of Delft. The Municipality and TU Delft have signed a covenant to this end. The agreements made within this context will be elaborated in the coming years. Regionally, the partnership with Leiden University and Erasmus University Rotterdam, known as the LDE partnership, is of great importance to TU Delft. To this end, the Board has regular contact with the Supervisory Boards of these two universities, also in combination with the Executive Boards. At the national level, TU Delft has a partnership with Eindhoven University of Technology, the University of Twente and Wageningen University: the 4TU.Federation. The presidents of all Supervisory Boards of universities in the Netherlands meet twice a year to discuss national developments relating to the regulation of higher education. The Minister of Education, Culture and Sciences attends one of these meetings each year.

The Supervisory Board is actively involved in the developments in the field of education. Matters such as new degree programmes, the relocation of degree programmes, the possible introduction of a cap on student intake for certain programmes, and quality-assurance policy are closely monitored. Accreditation and re-accreditation processes for the degree programmes and research visitations are also regularly discussed with the Board. The Supervisory Board is informed on a quarterly basis about the strategy and developments of TU Delft with regard to online education, the development and sharing of MOOCs – in which TU Delft is leading the way internationally – and the Extension School. In 2017, the education vision was reformulated within the framework of the new strategic plan. Another important development for TU Delft was receiving the Institutional Quality Assurance Audit. The Board and its individual members contributed to both these developments.

The real-estate issues of TU Delft are discussed in the meeting of the Supervisory Board each quarter, and further decisions are made if necessary. Throughout 2017, the Supervisory Board paid close attention to the preparations for updating the campus strategy and its financing.

Administration and Management

On 30 April 2017, the Supervisory Board adopted a new university governance model for TU Delft. The Supervisory Board engaged in a consultative and informative exchange of thoughts about this proposal with the Executive Board, the Deans of the faculties, the Council of Professors and the Directors of the University Services in the period from December 2016 through March 2017. In addition, the Supervisory Board submitted the proposal to both the Works Council and the Student Council for advice, in accordance with Article 25e of the Works Council Act and the Enhanced Governance Powers (Educational Institutions) Act. The new model that took effect on 1 January 2018 provides for an Executive Board consisting of three members: Rector Magnificus/President of the Executive Board, Vice-Rector Magnificus/Vice-President for Education, as well as the Vice-President of the Executive Board and a Vice-President for Operations.

In 2017, the Supervisory Board held four regular meetings with the Executive Board and four meetings without the Executive Board. In addition, two strategy meetings were held, during which a number of strategic issues were discussed in detail with the Executive Board. Examples in this regard include the intake, progress and outflow of academic talent, the university's community involvement, the real-estate strategy and, obviously, the aforementioned governance model that has been developed and the new strategic plan for 2018-2024 'Impact for a better society', along with its implementation.

The Board has three committees: the Remuneration and Appointment Committee, the Audit Committee, and the Teaching and Research Quality Assurance Committee (KOO). In 2017, the Audit Committee met three times, the Teaching and Research Quality Assurance Committee met only once, due to the replacement of committee members. In May 2017, members of this last committee held an extensive discussion with the international panel that issued recommendations to the Accreditation Organisation of the Netherlands & Flanders (NVAO) with regard to granting the Institutional Quality Assurance Audit (ITK) to TU Delft. On 7 September 2017, the NVAO decided to grant an Institutional Quality Assurance Audit to Delft University of Technology. The decision will remain in force through 20 November 2023. 'This test has established that the internal quality assurance system and the culture of quality together ensure the realisation of the university's own vision on education'. The Supervisory Board is highly satisfied with this assessment.

Supervisory Boards must also monitor compliance with legislation and regulations by the board. To enable the Supervisory Board to perform this supervisory task properly, subjects including actual or anticipated amendments to the law, activities in the field of academic integrity, the Code of Ethics, Safety and Security, and information Security are discussed with the Board on a regular basis. Every six months, the Supervisory Board discusses an overview of current legislative developments relating to higher education and research.

The Supervisory Board once again visited a number of faculties and service departments in 2017. Every quarter, an overview of activities is compiled for the Board. The overview contains notable achievements, subjects and developments relating to all organisational units, faculties and departments. Individual members of the Supervisory Board engage in irregular informal consultation with managers from the

various components of the University Services. The president of the Supervisory Board engages in frequent informal consultation with members of the Executive Board, and particularly with the president.

The Supervisory Board has been informed of the university's alumni policy. Developments in the study associations and student associations, as well as reports on them, are discussed and explained in a few meetings.

Personnel and internal affairs

On 1 January 2018, TU Delft bid farewell to two members of the Executive Board: Rector Magnificus Prof. Karel Luyben and Vice President Education & Operations Drs. Anka Mulder. As a result of the introduction of the new governance model, the Supervisory Board appointed Prof. Tim van der Hagen – who was appointed President of the Executive Board in 2016 – to the position of Rector Magnificus/President of the Executive Board with effect from 1 January 2018. In late 2017, the Supervisory Board began recruitment for a Vice-President for Operations, in accordance with the new governance model. The Board appointed Drs. Nicoly Vermeulen to fill this position as of 1 January 2018. After Anka Mulder gave notice that she would be leaving TU Delft as of 1 January 2018, recruitment also began for a Vice-Rector Magnificus/Vice-President for Education. This vacancy was filled in February 2018. As of 1 March 2018, Prof. Rob Mudde will assume this position. In 2017, the Remuneration and Appointments Committee again conducted annual appraisal interviews with the individual members of the Executive Board, as well as two exit interviews.

Effective 1 January 2017, the Minister of Education, Culture and Science reappointed Ir. Laetitia Smits van Oyen as member of the Supervisory Board for a second four-year term. Effective 1 May 2017, the Minister appointed Prof. Luc Soete to succeed Prof. Douwe Breimer for a first term, until 1 May 2021. On 1 July 2017, the President of the Supervisory Board, Drs. Ir. Jeroen van der Veer was also re-appointed for four years. Prior to the submission of these nominations to the Minister, the employee and student participation bodies were consulted, in accordance with the relevant provisions in the Works Council Act and the Enhanced Governance Powers (Educational Institutions) Act. On 21 June 2017, the Supervisory Board bid farewell to its respected member, Prof. Douwe Breimer, who had served on the Supervisory Board for ten years. The Board is most grateful to him for his expert contributions and commitment.

In accordance with Article 4 of the TU Delft Supervisory Board Regulations, the Board is responsible for determining the quality of its own performance. To this end, the Supervisory Board discusses its own performance as well as that of the individual members, and the associated consequences, each year without the presence of the Executive Board. The self-evaluation was completed at the beginning of 2017 on the basis of a questionnaire filled in by all members beforehand. The Supervisory Board also evaluated its president under the supervision of the vice-president.

Finances and operational management

Audit Committee

The Audit Committee met three times in 2017. Examples of important agenda items were major investment projects (primarily in real estate), including the funding of these investments. Further items discussed included the reports, the annual audit plan and the planning and results of activities relating to the Internal Audit, Risk & Compliance, information security and, obviously, the financial results and cash flow. Also on the agenda were the discussion of the 2016 audit report, the 2017 management letter and the associated improvement initiatives, and the 2018 budget. The 2016 audit report and the 2017 management letter were discussed in the presence of the external auditor.

Supervisory Board

In its meeting on 19 May 2017, the Supervisory Board approved the 2016 Annual Report and the Financial Statements; in its meeting on 13 December 2017 the Board approved the Budget for 2018. During its meetings in 2017, the Board focused much of its attention on the financial position of TU Delft, prepared by the Audit Committee (see previous). At each meeting, Finance presented a controller letter containing the results for the previous quarter. The Supervisory Board concludes that the financial position of TU Delft is healthy and that control processes are in order.

Employee participation

The Higher Education and Research Act (WHW) lays down the independent right to direct consultation between staff representatives and the Supervisory Board, the right to nominate one of the members of the Board and advisory powers for the profiling of the Board members. The Supervisory Board and the representative bodies have made procedural agreements concerning these matters. One of the members of the Supervisory Board has conducted informal discussions with the confidential committee of the Works Council and the Student Council on several occasions. In addition, several members of the Supervisory Board attended meetings of the Works Council and the Student Council.

In conclusion

TU Delft's policy regarding the salary of the administrators and supervisors is in line with the Senior Officials in the Public and Semi-Public Sector (Standards for Remuneration) Act (WNT) and with the agreements made with the Ministry of Education, Culture and Science.

In its own opinion, the Supervisory Board once again performed its task in accordance with the governance code in 2017. The Supervisory Board also honoured the principle of independence in 2017.

Finally, the Supervisory Board would like to thank TU Delft and its administrators for their constructive cooperation.



Education	
Intake of new Bachelor's students:	3518 students
Intake of new Master's students:	1770 students
Intake into the bridging programme:	231 students
Total number of Bachelor's students:	12.464
Total number of Master's students:	10.758
Total number of students in the bridging programme:	472
Positive Binding Recommendation on Continuation of Studies in the 1st year:	73%
Bachelor's degrees:	2254
Master's degrees:	3137
PDEng degrees:	22
Research	
Number of peer-reviewed publications:	3.117
Whereof Open Access publications:	52,2%
Number of doctoral candidates *	2799
Number of doctorates:	359
PhD pass rate within five years:	45%
Staff	
Academic Staff (WP), total **	3063 FTE
Whereof permanent Faculty+	920,6 FTE
Whereof Postdocs	477,1 FTE
Administrative and support staff (OBP), including student assistants, total	2125 FTE
Financial matters	
Government funding	464,5 M€
Indirect funding	52,5 M€
Contract funding	143,2 M€

NOTE: For additional figures, see:
www.tudelft.nl/en/about-tu-delft/facts-and-figures/

* This refers to the number of people following doctoral programmes at TU Delft, regardless of whether they have been appointed and/or funded by TU Delft.

** This refers to the number of FTE with a job description that falls within the job category of academic staff. It includes the following job descriptions: full professor, assistant/associate professor, other academic staff, doctoral candidate and design student.

1

TU Delft

1.1 Institutional profile

With approximately 23,500 students and 5,200 staff, TU Delft is the largest university of technology in the Netherlands. The university covers virtually the entire spectrum of engineering sciences, divided across 40 departments in 8 faculties, and it offers an equally broad, high-quality array of degree programmes and unique facilities. The mission of the university is to contribute to solving global challenges by educating new generations of socially responsible engineers and expanding the frontiers of the engineering sciences.

Research, education and valorisation

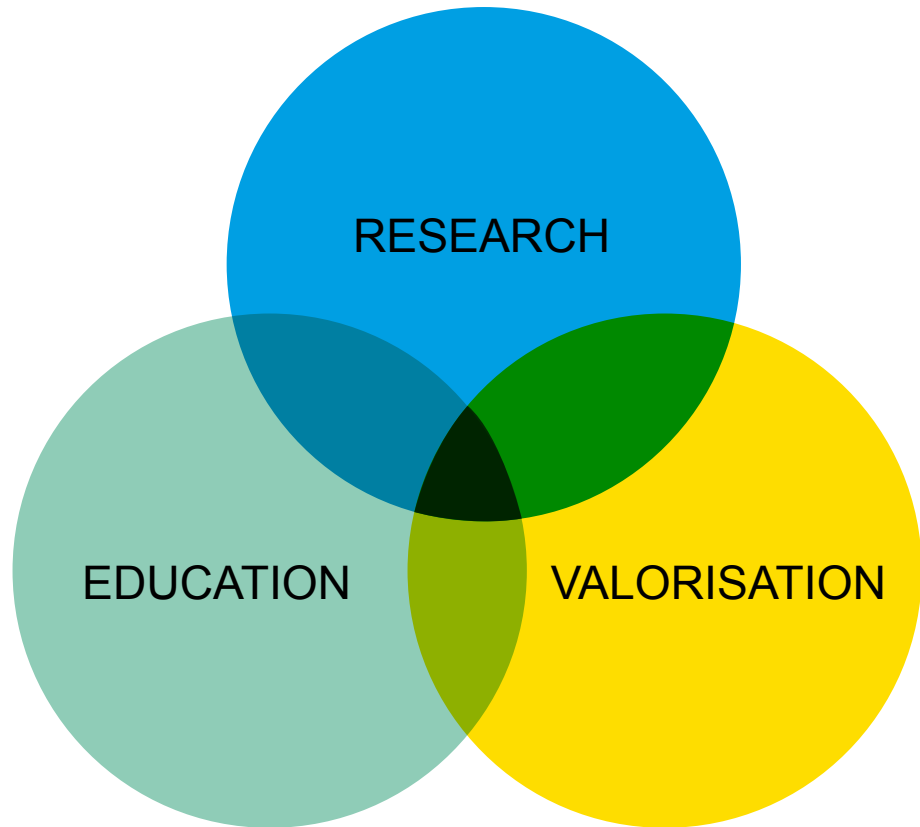
The quality of research and innovation across the university at was once again very high in 2017. From a strong tradition for over 175 years in the field of civil engineering, we have developed our research portfolio into a broad array of research areas. Currently, we contribute recognised global research leadership in fields as diverse as quantum-nano, bio-nano, maritime technology, architecture, transport, water management, aerospace technology and robotics. In 2017, TU Delft once again performed well in the international rankings. Today it is the highest-ranking university in the Netherlands, and among the world's top 20 universities of technology (THE & QS). We also boast an active startup ecosystem and according to Reuters, we are among the top 10 most innovative universities in Europe. In addition, our educational approach and the extra-curricular activities that we offer students have proved to be highly successful this year. In 2017, the Accreditation Organisation of the Netherlands & Flanders (NVAO) concluded that TU Delft has a strong quality culture and stated that our record of accreditation is impressive: all Bachelor's and Master's degree programmes were positively assessed during the period under review (2012-2016). TU Delft has no difficulty attracting qualified students, and the proportion of women students increased once again in 2017. The number of online students has been increasing for several years. In 2016, we welcomed our millionth MOOC registration and, by the end of 2017, there were nearly 1.7 million. Our graduates find work easily after completing their studies and are valued by employers for their disciplinary knowledge, (cooperative) skills and 'can-do' attitude.

Impact for a better society

One important characteristic of TU Delft is that we not only strive to be good at what we do, but also that we want to be good for something. At TU Delft, we strive to balance our pursuit of world-class academic excellence and providing high-quality education on the one hand, and providing expert-solutions to societal problems on the other hand. Although this appears to be a dichotomy, that is not necessarily the case. Again in 2017, we have demonstrated in a variety of areas that societal impact and academic excellence can be mutually reinforcing. 'Living labs', ground-breaking initiatives in which we play a key role – including the Institute for Advanced Metropolitan Solutions (AMS) and Medical Delta – offer many possibilities for making education and research integral elements of working to address societal challenges. In these and other areas, teams within the university are developing new strategic partnerships with other universities and with civic and private sector partners. In the process, we make good use of the complementarity of the universities in the region through the LDE alliance, and carefully coordinate with the other technical universities in the Netherlands within the 4TU.Federation.

Interconnectedness of research, education and valorisation

At TU Delft, research, education and valorisation cannot be considered in isolation. On the contrary; these cornerstones enhance one another. The technical and scientific knowledge acquired through our research activities feeds naturally into education and knowledge valorisation at TU Delft. Equally, interaction with inquisitive and critical students, businesses and government agencies also results in new and unexpected research questions. Research, education and knowledge valorisation inspire one another.



More than 600 people are working together to build a new strategic plan for TU Delft



In 2017, TU Delft worked to develop a new strategic plan for the 2018-2024 period. Throughout the year, there was intensive interaction with regard to the new strategy amongst all stakeholders, including students, doctoral candidates, academic (and other) staff members, Departmental Directors, Deans, Directors, the Council of Professors, the Supervisory Board, alumni, relations in the business community and organisations in the regional and academic network. The process was supervised by Prof. Tim van der Hagen, President of the Executive Board.

TU Delft mission

- We perform world-class research by combining science, engineering and design in a socially responsible manner. Thus, we advance and share the benefits of technology.
- We develop and enhance the expertise of tomorrow's engineering leaders and educate professional, high-level and responsible engineers throughout their careers.
- We help to develop and deliver technology-driven, innovative solutions to societal problems through collaborations with leading national and international partners whilst being firmly rooted in Delft.
- We continuously improve our collective effectiveness, performance and organisational resilience through the principles and practice of professionalism, collaboration and openness.

TU Delft values

Diversity
Integrity
Respect
Engagement
Courage
Trust

1.2 Strategic priorities

In 2017, efforts within TU Delft were devoted to developing a new strategic plan for the next six years: the Strategic Framework for 2018-2024. A common thread throughout this framework is formed by four major principles that we aim to develop further in the years ahead: Excellence, Impact, Involvement and Openness. These characteristics are reflected in all of our core activities, which can be subdivided into four operational areas: Students & Education; Research & Innovation; People & Community; and Campus & Services. The four basic principles are linked to the operational areas in the following matrix. This table is not intended to provide a complete overview of the Strategic Framework, but aims to give an impression of the way in which the various elements are related and how, collectively, they map our vision on the future. The Strategic Framework is available at www.tudelft.nl/en/about-tu-delft/strategy/.

Strategy on one page

	Excellence	Impact	Engagement	Openness
Students & Education	We strengthen our ambitious study culture that is characterised by substance, challenges and academic breadth.	We prepare students for solving societal challenges and educate tomorrow's responsible leaders in science, engineering, design and innovation.	We invest in lifelong learning, offering a relevant portfolio in a global environment.	We promote and facilitate Open Education. We strengthen online education.
Research & Innovation	We strive to increase the number of scientific focal points.	We make a significant contribution to the solution of societal challenges by combining science, technology and design in a responsible manner.	We promote outreach to the wider (local) public; we strengthen global engagement via joint research initiatives.	We promote and facilitate Open Science and Open Innovation. We increase the number of large-scale public-private partnerships.
People & Community	We challenge our students and staff to get the best out of themselves and provide them with the necessary support to do so.	We support students and staff members to co-create and deliver solutions to community concerns.	We create stronger engagement with our alumni and people from the surrounding area; together, we build a 'TU Delft community for life'.	We are convinced of the importance of diversity, as a cornerstone for innovation. We aim to integrate internationalisation in all our core activities.
Campus & Services	We develop excellent, user-friendly and efficient services.	We develop the campus as a multi-partner 'Living Lab' in which education, research and innovation contribute to solving societal challenges.	We gear our facilities and services to our aim to make a sustainable and responsible contribution to the region, the Netherlands and the world.	We develop our campus in such a way that we are more welcoming to interested people from the near surroundings.

Pre-investment for the student loan system

TU Delft continuously invests in the quality of its education. Examples include the construction of 'Pulse', the new education building, and the digital learning environment 'Brightspace'. Since 2015, in anticipation of investment opportunities that will be created by the introduction of the student loan system, TU Delft has also been investing an additional €6 M annually in education quality. These pre-investments relate to faculty initiatives for additional capacity for education and educational support, staff training and development, more and higher-quality study workplaces, and sustainable innovations in education. Beginning in 2017, the Executive Board increased the pre-investment budget with an additional €2 M, to reach a structural total of €8 M per year. This investment policy has the support of the representative bodies. The following table includes the investments across the period from 2015 through 2017, along with the planned investments for 2018, in accordance with the topics from the Common Higher Education Agenda, the Dutch National Student Association (ISO), the Dutch Student Union (LSVb), the Netherlands Association of Universities of Applied Sciences (VH) and the Association of Universities in the Netherlands (VSNU).

Expenditures for the Student Loans (Higher Education) Act, by investment category – relative distribution:

Investment category	2015	2016	2017	2018 Budget
1. More intensive, smaller-scale teaching	19%	77%	88%	89%
2. More and better guidance of students	0%	8%	6%	4%
3. Focus on talent development: within and outside the degree programme	0%	6%	0%	4%
4. Suitable and high-quality teaching facilities	47%	1%	0%	1%
5. Further professional development for teaching staff	33%	9%	7%	3%
TOTAL:	100%	100%	100%	100%

1.3 Management and Organisation

The Delft University of Technology is an institution governed by public law, in accordance with the Higher Education and Scientific Research Act (WHW). Its main tasks are to provide university education, to perform scientific research, to transfer knowledge to society and to promote a sense of social responsibility. The university is designated as an Institution for General Benefit (ANBI). The main administrative structure of TU Delft is established in the WHW and in the Executive and Management Regulations (BBR) and the Mandate Regulations – which are based on the WHW, all in accordance with the VSNU Code of Good University Governance. TU Delft distinguishes three administrative layers: the Executive Board, the faculties and the academic departments. These three administrative levels are subject to the principle of integrated management: the Executive Board, the deans, and the departmental directors are responsible for both the primary process and support processes. All support services are grouped in University Services.

Organisational structure

Supervisory Board

The Executive Board is accountable to the Supervisory Board (RvT) appointed by the Minister of Education, Culture and Science. The Supervisory Board supervises the tasks carried out and the exercising of powers by the Executive Board and has a number of duties set down by law.

Executive Board

The Executive Board is the highest-ranking administrative body of TU Delft, and is charged with the governance and management of the university. The members of the Executive Board are appointed by the Supervisory Board. The decision-making process adhered to by the Executive Board is based on the collegial principle, in which the Rector Magnificus/President is first amongst equals and bears final legal responsibility for the decision-making process.

Faculties

There are eight faculties at TU Delft. The university's primary tasks – academic research, teaching and the valorisation of research, as described in the Higher Education and Research Act – are carried out by the faculties. For an overview of the academic departments in each faculty, see Appendix 1.

University Services

University Services provides services for the primary processes in the organisation, organises the administrative processes, and coordinates central policy processes. This means that University Services has many internal and external stakeholders. From a financial and administrative perspective, the University Services are headed by the Vice-President for Operations, member of the Executive Board.

Consultative Structures

Operational Committee

The Operational Committee is a consultative body that consists of the members of the Executive Board and the deans of the eight faculties. Within the Operational Committee, the Executive Board consults with the Deans every three weeks on matters of importance to the entire university. This relates partly to the specific interests of the faculties and is aimed at improving unity and the development of the university as an institution.

Board for Doctorates

The Board for Doctorates consists of the Rector Magnificus (chair), the Pro Vice Rector (vice-chair) and the deans of the faculties (or a professor from the faculty nominated by the dean). A university's Board for Doctorates is authorised to grant the title of Doctor on the basis of a defence of a doctoral dissertation. The legal provisions concerning the Board for Doctorates are set down in the Higher Education and Research Act.

Council of Professors

The Council of Professors consists of a panel of experienced professors employed at TU Delft. The Council of Professors provides both solicited and unsolicited advice to the Executive Board on TU Delft as 'academic institution'.

Representative Bodies

TU Delft has a number of consultation bodies as set down by law, with which the Executive Board conducts formal consultations. TU Delft has a shared consultation procedure, which involves the Works Council (WC) and the Student Council (SC). The members of the Works Council and the Student Council meet in the General Assembly of Councils (GV).

Works Council

Depending on the number of eligible voters, the Works Council consists of up to 25 members, who are elected for a period of three years. In 2017, the Works Council had 23 members. The members of the Personnel Committee are elected simultaneously with the Works Council. The Works Council has the right to be informed, the right to appeal and the right to initiate, in addition to having advisory powers on specific topics (as in the recruitment and selection of members of the Executive Board) or right of approval. In principle, consultations are held on every matter concerning TU Delft, or where they must be held in accordance with the Works Councils Act.

Student Council

The Student Council has 10 members, which are elected for a period of one year. Based on the Higher Education and Scientific Research Act (WHW) and the Student Council Regulations, the Student Council has the right to be informed, the right to appeal and the right to initiate, in addition to having advisory powers on specific topics (as in the recruitment and selection of members of the Executive Board) or right of approval.

General Assembly of Councils

The members of the Works Council and the Student Council together constitute the General Assembly of Councils (GV). The General Assembly of Councils has the right of approval in several areas. The General Assembly of Councils also has the right to nominate one Supervisory Board member who enjoys the particular confidence of the consultation bodies.

Personnel Committees

The Works Council has nine Personnel Committees – one in each faculty and one in University Services. The Personnel Committees hold consultations with the dean of the faculty in question or the administrator of University Services. The Works Council Act specifies the topics for which the Personnel Committees have the right of approval, advisory powers and the right to be informed.

Faculty Student Councils

There is a Faculty Student Council in each faculty. The Faculty Student Councils have the right to be informed and to initiate, and – in specific areas – advisory powers or the right of approval. The Faculty Student Councils hold consultations with the Dean of the faculty in question.

Boards of Studies

Each programme has its own Board of Studies. Students and tutors from the programme in question are represented on the boards. The Higher Education and Research Act gives specific powers to the Boards of Studies, including the power to issue recommendations on the Teaching and Examination Regulations, annually assessing how those matters are carried out, and providing broad advice on said matters to the management of the degree programme in question. Since the passing of the Enhanced Governance Powers (Educational Institutions) Act (2016) into law, the position of the Boards of Studies has been strengthened: as well as being advisory bodies, they now also qualify as participation bodies with the right to approve certain parts of the Teaching and Examination Regulations.

In addition to the employee and student representative bodies, there are the four unions that are represented in the Local Consultation Body (VLO): FNV Overheid, CNV Publieke Zaak, AC-HOP and CMHF. These unions consult with the Executive Board in the Local Consultation Body (VLO) on issues relating to working conditions and the legal status of staff members that must be arranged within TU Delft, based on the Collective Labour Agreement for Universities in the Netherlands (CAO-NU).

Anniversary: 175th anniversary of TU Delft



In 2017, TU Delft celebrated its 175th anniversary. To mark the occasion, for 175 days life at TU Delft revolved around the theme 'Technology for Life', and various activities were organised on campus and in the city of Delft for students, staff members and alumni, as well as businesses and residents of Delft. Examples included an anniversary edition of the TU Delft Research Exhibition, various exhibitions, a film festival, symposiums and a birthday party with cake for all staff members.

Overview of faculty's and deans

Faculty	Dean
Architecture and the Built Environment (ABE)	Prof. P.J. Russell
Civil Engineering and Geosciences (CEG)	Prof.dr.ir. B.M. Geerken
Electrical Engineering, Mathematics and Computer Science (EEMCS)	Prof.dr. J.A.J. Schmitz
Industrial Design Engineering (IDE)	Prof.ir. M.A. Voûte
Aerospace Engineering (AE)	Prof.dr. H.G.C. Werij
Technology, Policy and Management (TPM)	Prof.dr.ir. J.W.F. Wamelink
Applied Sciences (AS)	Prof.dr.ir. L.J. van Vliet
Mechanical, Maritime and Materials Engineering (3mE)	Prof.dr. T.S. Baller

Executive Board 2017

President of the Executive Board

Prof.dr.ir. Tim van der Hagen



- Strategy and policy of the institution
- Promotion of the external network
- Public affairs and Communications
- Real Estate
- Financial strategy
- Human Resources
- Legal Affairs

Rector Magnificus (also Vice-President)

Prof.ir. K.Ch. A.M. Luyben



- The academic direction of the university in education and research
- The appointment of full professors and key academic positions
- Research
- Valorisation
- Library

Vice-President for Education and Operations

Drs. J.L. Mulder



- Education
- Administrator of University Services
- Student affairs
- Operations
- ICT
- Facility Management

Executive Board 2018

Rector Magnificus / President Executive Board

Prof.dr.ir. Tim van der Hagen



- General administrative coordination
- Strategy and policy of the institution
- Research and valorisation strategy
- Appointment of key academic positions
- Strategic partnerships
- Public affairs
- Communication and Alumni strategy
- Safety

Vice President Operations

Drs. Nicolij Vermeulen MBA



- Financial Economic policy
- Administrator of University Services
- Human Resources
- Campus & Real Estate
- Information policy & Business Intelligence
- Facility Management
- Legal Affairs
- ICT
- Holding

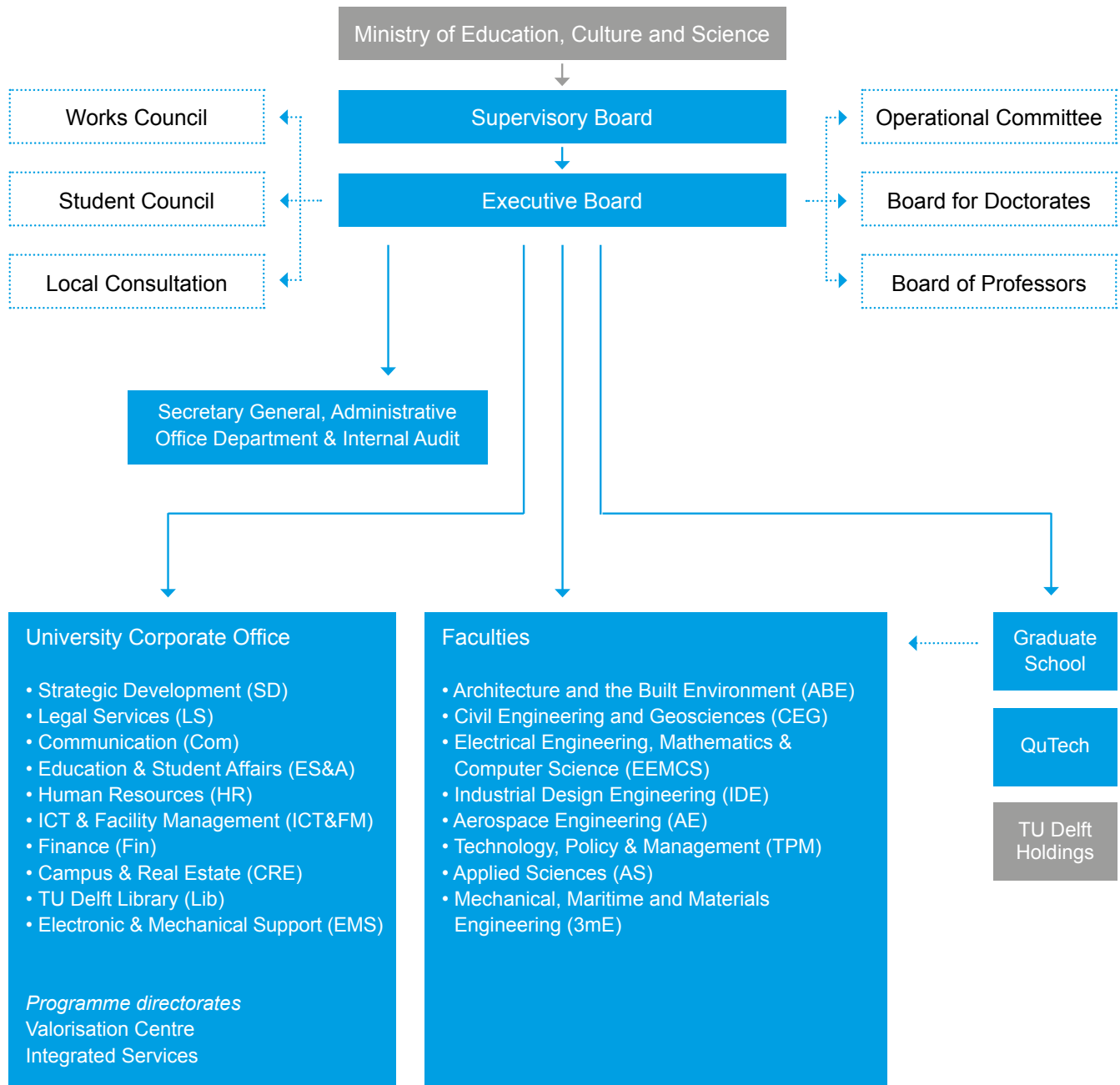
Vice Rector Magnificus / Vice-Chair Executive Board

Prof.dr. Rob F. Mudde



- Education strategy and policy
- Student affairs
- Open Science
- TU Delft Extension School
- TU Delft Graduate School
- Strategic partnerships education
- Diversity policy
- ICT & Education

Organogram TU Delft





2.1 Introduction

TU Delft trains students to be optimally prepared to contribute to the solution of current and future problems in society. Our curriculum centres on the 'T-shaped profile', which allows our students to acquire thorough, in-depth expert knowledge, while becoming familiar with other fields and building competence in the application of technical knowledge in the 'real' world. Education and research are closely intertwined throughout the curriculum. In this way, we ensure that our graduates can start their professional careers with knowledge of the newest research results within their fields, along with state-of-the-art developments in engineering. In addition, TU Delft offers students the opportunity to develop themselves outside of the curriculum. There is an active student community that organises many social and cultural activities, and there are challenging student projects, including the DREAM teams and the Energy Club. Our approach to teaching has proved to be highly successful: the number of students at TU Delft grew again this year. In 2017, the Accreditation Organisation of the Netherlands & Flanders (NVAO) concluded that TU Delft has a strong culture of quality, referring to our service record as impressive in terms of accreditation. All Bachelor's and Master's degree programmes received positive assessments in the period in question (2012-2016; see Section 2.4).

The strong position of our teaching is no cause for complacency. Rather, we aim to achieve a culture that is all about improvement. This ambition will be elaborated further as we develop the new TU Delft strategic plan (the Strategic Framework for 2018-2024) and the new Vision on Education. One important element in this regard is that we aim to assign a central role to innovation and experimentation in our teaching and degree programmes. One way to do this could involve offering various types of teaching, including online and campus-based teaching, along with education in '21st-century skills', which will provide students with a solid basis for successful careers in a rapidly changing digital society. In the coming years, we also aim to reinforce a culture in which there is greater appreciation for and recognition of teaching, and in which our academic staff members have the opportunity to excel in the field of teaching, educational leadership and/or educational research. The opening of the new Teaching Lab on our campus this year, and the cooperation in the field of educational research and professional development for lecturers in the 4TU.Centre for Engineering Education and the LDE Centre for Education and Learning, fit well with this ambition (see Section 2.6).

The scope of our educational mission goes beyond the students on our campus. The newly developed vision on education and the new strategic plan explicitly state that our mission will include the continuous education of our graduates and other working professionals. With this mission, we can meet the ever-changing knowledge demands of our alumni and engineers. To this end, the range of teaching offered to professionals will be extended. The range of digital courses has also been increased once again. As of the end of 2017, more than 1.1 million students from all over the world had registered for open and online courses at TU Delft (see Section 2.3).

2.2 Brief overview of education

Bachelor's and Master's education

TU Delft offers 16 different Bachelor's degree programmes. Four of these programmes are joint-degree programmes within the cooperation between the Leiden University, Delft University of Technology and Erasmus University Rotterdam (LDE). All the degree programmes offered are recorded in the Register of TU Delft study programmes for the relevant academic year, which is available on the website www.tudelft.nl. Four of the Bachelor's degree programmes are now offered in English: Aerospace Engineering, Applied Earth Sciences, Nanobiology and, starting in the 2017-2018 academic year, the Bachelor's degree programme in Computer Science and Engineering. As of September 2017, TU Delft offers 35 master's degree programmes taught in English, including two post-Master's degree programmes and four joint-degree programmes with other institutions in the Netherlands. Eight Master's degree programmes involve participation in double/multiple-degree cooperation with foreign institutions, including three with grants from the EU Erasmus+ programme.

Admission

Admission to the Bachelor's degree programmes is established by law.

Numerus Fixus

In the 2017-2018 academic year, four degree programmes were subject to a numerus fixus: Industrial Design, Nanobiology, Aerospace Engineering and Clinical Technology.

Intake and student population

The growth in the number of Bachelor's students at TU Delft seen in previous years is continuing. Intake increased from 3,264 in 2016 to 3,518 in 2017 (+8%). As of 1 December 2017, the total number of BSc students was 12,464. This is an increase of 5% over the previous year (11,890). The external intake of Master's students (i.e. students registering at TU Delft for the first time) increased from 1,583 to 1,770 (+12%). The population of Master's students kept growing: last year, the number of Master's students as of 1 December was 10,087. This year, the number increased by 7%, to 10,758. For an overview of the student population for each study phase, see Figure 1.

Proportion of female students

The percentage of women in the Bachelor's population increased from 25.9% to 26.2%. The percentage of women in the Master's population increased from 28.0% to 28.7%.

Proportion of foreign students

In 2016, the population of foreign students was 4,193 and, in 2017, it was 4,744, representing an increase of 13%.

Drop-out

The drop-out rate in the first year of the Bachelor's programme remained stable at around 17%. Immediately after the review of the Bachelor's curriculum, the internal-switch rate increased from 8% to 11%, but it has since declined again to 9.5%.

Degree certificates

A total of 2,254 Bachelor's degree certificates were awarded in the 2016/2017 academic year. This represents an increase of 13% compared to the previous year. The number of Master's degree certificates rose from 2,671 in 2015/2016 to 3,137 in 2016/2017: an increase of 17%.

Pass rates

The pass rate in the Bachelor's degree programmes after four years has increased sharply since 2006, as a result of the curriculum review in the Bachelor's programme and the binding recommendation on the continuation of studies. For developments in the pass rates in Bachelor's degree programmes, see Figure 2.

PhD candidates

The intake of doctoral candidates decreased from 550 to 521 (-5%). The population increased from 2,719 to 2,799 (+3%). There were 359 defence ceremonies. For a breakdown of the PhD population by female doctoral candidates and doctoral candidates of foreign nationality, see Figure 3.

Special edition of the design competition for students of Mechanical Engineering

In June 2017, the old market square in Delft served as the stage for the annual design competition for first-year students of Mechanical Engineering. It was a special edition of the competition, as part of the TU Delft anniversary (with the theme of 'Technology for life') and the outcome of a collaboration between TU Delft and the Municipality of Delft in the project 'Zichtbaarheid techniek in de stad' (Visibility of technology in the city). Throughout the day, the competitions drew a large audience, and at the end of the day Mayor Marja van Bijsterveldt awarded the prizes.



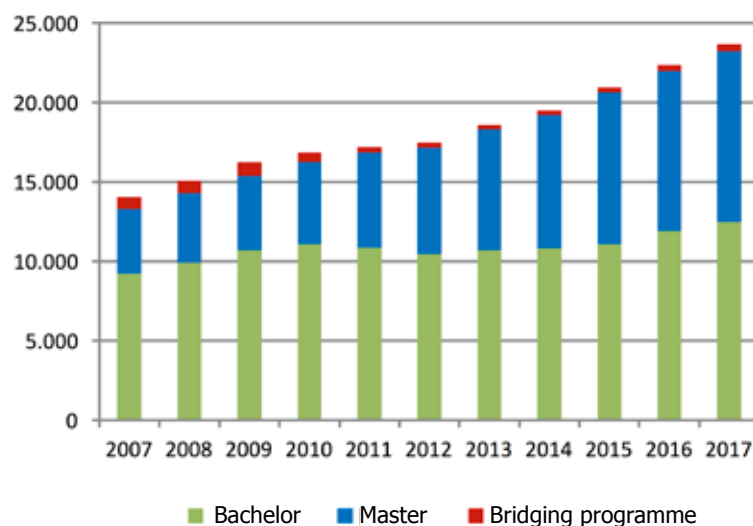


Figure 1: Student population for each study phase.

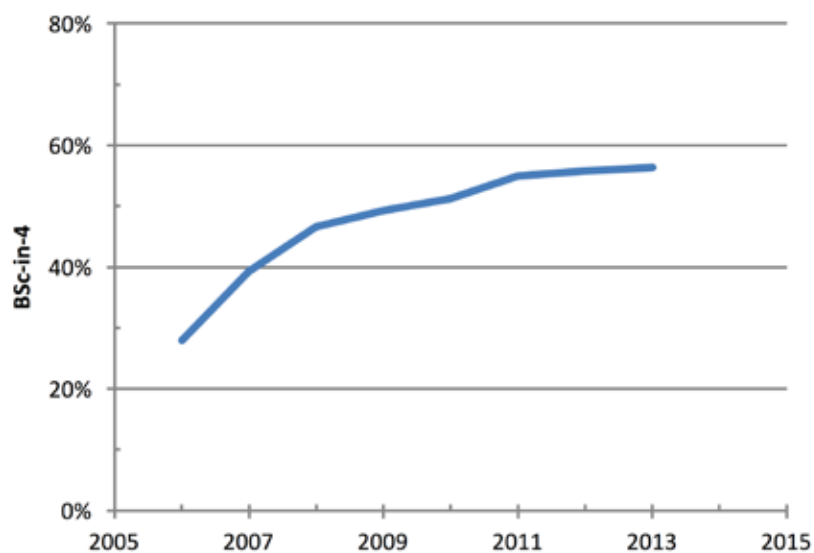


Figure 2: Pass rates in the Bachelor's degree programmes.

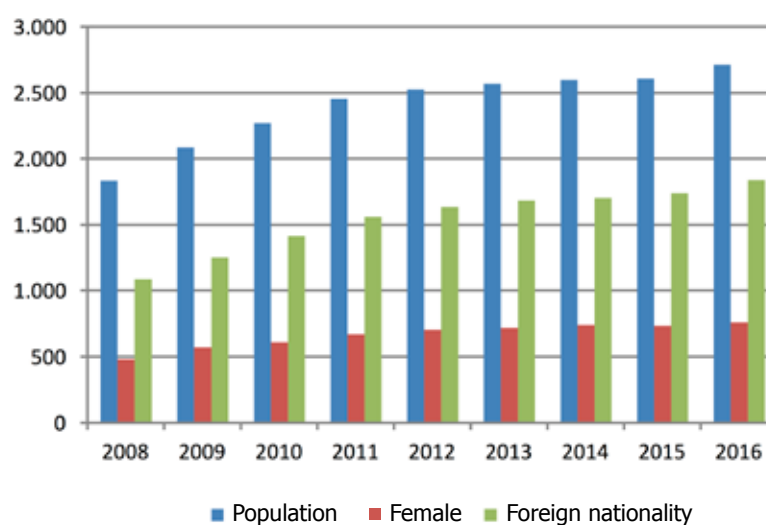


Figure 3: Population of PhD students: number of female PhD students and PhD students of foreign nationality.

2.3 Developments in education

Bachelor's Review

In March 2017, an advisory report was presented, with the evaluation of the Study Success programme. The results of the evaluation demonstrated that all faculties had put in a great deal of work and that improvements could be identified most notably in the structure of the Bachelor's degree programmes. To date, the increase in the standard for the Binding Recommendation on Continuation of Studies (BSA) has had the most visible effect on pass rates in the BSc programme (see also Section 2.4: Working on Study Success).

Doctoral candidates/Graduate school

There is an extensive array of training opportunities for doctoral candidates. The Doctoral Education programme offers doctoral candidates a wide range of courses and activities in terms of transferable, research-related and discipline-related skills. The opportunities relating to transferable skills include attention to introduction to the Doctoral programme, career development, ethics and integrity, and teaching skills. The skills in the other categories are acquired in part through the ordinary practice of research or in specialised courses. Each doctoral candidate is required to earn at least 15 GS credits in each category of skills. Doctoral candidates have assessed the quality of the training offered with an average score of 8.3 on a 10-point scale.

Professional education

The portfolio of online (and other) courses for working professionals was extended in the past year. The range now consists of 24 courses, and 13 more are currently being developed. In the past year, additional attention has been given to bundling courses and developing short programmes for professionals. This will improve our ability to respond to the need for professional training and enrich the learning experience offered. Collaboration with the business community is of great importance in this regard, for purposes of obtaining recommendations, as well as to allow the co-creation of content and teaching methods. In addition to the courses that are developed especially for professionals, TU Delft offers 13 online academic courses, primarily in the area of Aerospace Engineering.

Educative module experiment

In September 2017, the first eight students started working with the educative module at TU Delft. The 'Educative module experiment', which runs through June 2019, is intended to increase the number of university graduates qualified to teach in secondary education. In the experiment, students follow a programme comparable to that followed by students with a minor in Education and, upon completion, they receive a certificate for a limited grade-two teaching qualification.

Internationalisation

The number of international Bachelor's and Master's students has increased again. In September, 1707 foreign students of nearly 90 different nationalities registered for degree programmes at TU Delft. In the past year, new exchange agreements have been concluded with nine universities in the United States, Australia and China. The number of exchange students wishing to come to TU Delft is increasing steadily, as is the number of places available with our foreign partners for TU Delft students going on exchange abroad.

Digital education

TU Delft is internationally recognised as playing a leading role in the field of open and online education. Our ambition is to share our knowledge with the world and to improve the quality of our online and campus education through the use of digital

teaching methods. At the end of 2017, 70 MOOCs (massive open online courses) were available through EdX, with a total of nearly 1.7 million registrations in MOOCs from more than 1.1 million participants from all over the world. For developments in the number of MOOC registrations, see Figure 4. TU Delft is the initiator of a pilot project in which students can earn credits for following a limited number of MOOCs from TU Delft or one of the partner institutions in the pilot project. In December 2017, TU Delft signed a covenant with eight partner universities in Australia, Europe and the US that are affiliated with edX, in order to form a global alliance (see also Page 35). Parallel to this covenant, TU Delft also participated in a European alliance in which credits for MOOCs could be exchanged. In contrast to regular exchange, there is no need for students to travel in this case. They take the partner university's examination online or in a controlled physical examination location at their own universities. This is a new approach to internationalisation, which gives students easier access to expertise and courses at renowned universities throughout the world.

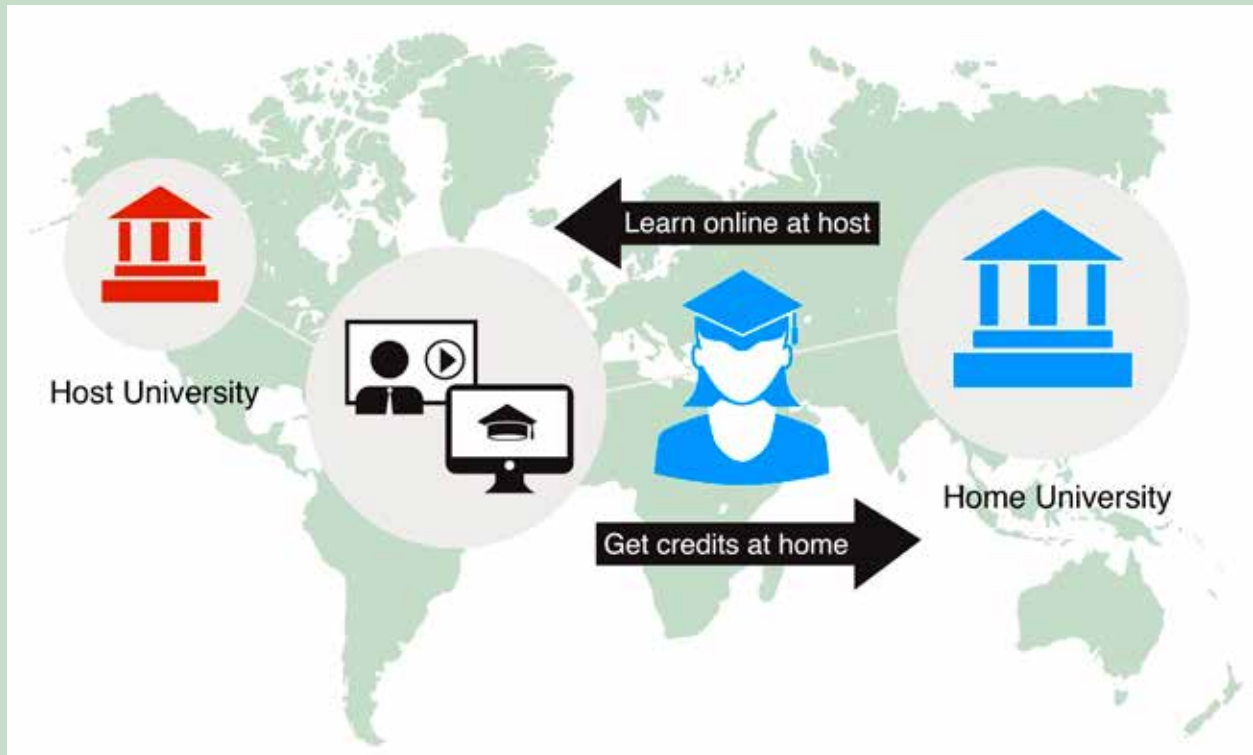
TU Delft encourages lecturers to publish their teaching materials under an open licence. OpenCourseWare (OCW) is high-quality, university-level course material that is published online and freely accessible. We receive a great deal of feedback showing that other universities also use materials from TU Delft. The publication of Open Course Ware responds to a growing need, while also contributing to our mission to teach the world.

In 2017, the Blackboard digital learning environment was replaced by a new system known as Brightspace. The migration of more than 3,000 courses, 23,000 students and 1,600 lecturers proceeded successfully. The faculty of Industrial Design Engineering was migrated as a pilot in February 2017, after which the rest of the faculties transferred in September. As a result, for the coming years TU Delft will be equipped with an innovative digital learning environment that is optimally suited to motivational teaching and the university's ambitions in terms of the digitisation of teaching.

In 2016, we started working with the European project in the field of Learning Analytics (STELA). In 2017, this resulted in a policy framework for clarifying to researchers, lecturers and students what is and what is not allowed in the use of Learning Analytics. This is now being developed into a policy plan.

This year as well, TU Delft received several distinctions for its open education, including the Best Practice Initiative Award for a paper on its pedagogical model for online learning ('Online Learning Experience', EDEN Conference) and an Open MOOC Award for the Pre-University Calculus MOOC (Open Education Global Conference).

Start of Global Virtual Exchange: Take online courses at nine leading universities



At the initiative of TU Delft, a partnership between nine leading universities in the field of virtual exchange was launched in December. The partnership offers students the opportunity to take and earn credits for online electives from affiliated universities. This provides students with a broader selection of courses and the opportunity to study at other universities. The partnership also provides an additional connection between the online educational activities of the Delft Extension School and the regular degree programmes. The partner universities at which online courses can be taken are Adelaide University, Australian National University, Ecole Polytechnique Fédérale de Lausanne, The Hong Kong University of Science and Technology, Leiden University, Rice University, University of Queensland and Wageningen University and Research.

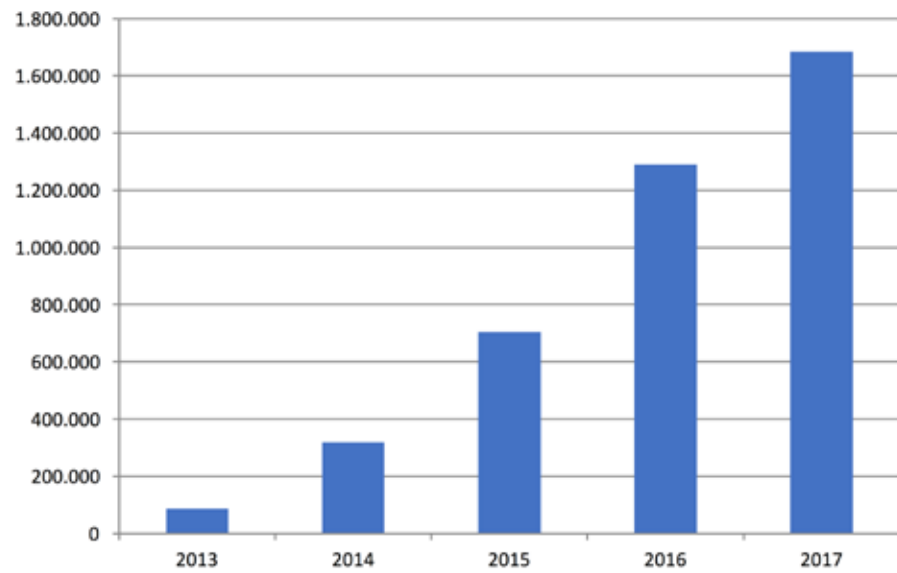


Figure 4: Number of registrations for MOOCs.

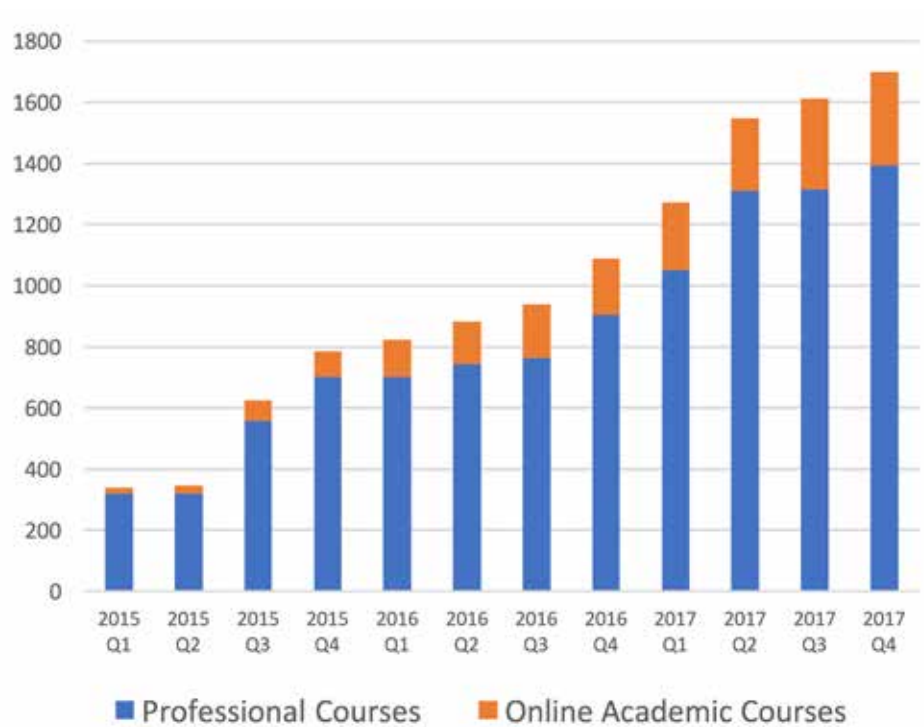


Figure 5: Number of registrations for paid online education.

2.4 Quality of education

Quality assurance for degree programmes

In 2017, for the second time, TU Delft received a positive assessment from the Accreditation Organisation of the Netherlands & Flanders (NVAO) on the educational quality assurance system based on the Institutional Assessment of Quality Assurance (ITK). This resulted in the extension of the ITK until November 2023. The international panel of peers complimented TU Delft on its culture of quality and the underlying quality system, and it was impressed by the university's open and online education initiatives – an area in which TU Delft can be regarded as 'world-class', according to the panel. To arrive at its conclusion, the panel used a self-evaluation report with supporting documents, and it spoke with around 150 stakeholders in 19 sessions at TU Delft. Participants in these sessions ranged from students and lecturers to alumni and representatives of the professional field.

In addition to the institutional assessment, the NVAO assessed individual degree programmes. In 2017, three Bachelor's degree programmes and seven Master's degree programmes received re-accreditation from the NVAO. Eighteen scores of 'good' were assigned on the standards. Four programmes received a final assessment of 'good', and the others were assessed as satisfactory. New programmes were accredited through the New Degree Programme Test. The joint MSc degree in Technical Medicine with Erasmus University Rotterdam and Leiden University passed this test and was launched in September 2017. TU Delft is the coordinating university for this programme. As of September 2017, a joint MSc programme in Metropolitan Analysis, Design and Engineering was launched with Wageningen University, which serves as the coordinating university. The New Degree Programme Test was passed conditionally. By February 2019, it must be demonstrated that the conditions have been met.

The programmes in Aerospace Engineering (BSc and MSc), the BSc in Industrial Design Engineering, the MSc in Design for Interaction, the MSc in Integrated Product Design, the MSc in Strategic Product Design, the BSc in Applied Mathematics and the MSc in Applied Mathematics conducted an internal audit in 2017, in accordance with the TU Delft Education Quality Plan.

Evaluation of the Study Success Project

In 2011, TU Delft launched the Study Success Project with the aim of improving the study success rate of its students. In 2017, the Evaluation Committee for the Study Success Project presented its thematic internal audit 'Onderwijssucces, van structuur naar cultuur' (Educational success: From structure to culture). The evaluation committee concluded that a great deal of work had been done in all faculties and that the structure of the Bachelor's degree programmes had been positively reviewed in its full breadth. The committee was of the opinion that too little progress has been made in such areas as study mentality, study behaviour, study load (and perceptions thereof), 'studiability', community building, didactics and lecturer attitudes. In the evaluation report, the evaluation committee made 15 recommendations relating to the topic of study success. The most significant message in this regard is that the good work begun in the Study Success Project should be continued and kept on the agenda, but that the focus should shift from structure and organisation to didactics and culture. Educational renewal seems to have resulted in a different type of lecturer: a responsible and coordinating type of lecturer who provides didactic and organisational leadership, in addition to substantive leadership. This has implications for the TU Delft HR policy.

2017 National Student Survey

In the 2017 National Student Survey, students once again rated the programmes with scores well exceeding 4 (on a scale of 5). These scores are based on the responses of students on various criteria: appreciation of the programme in general, the general atmosphere in the programme and whether they would recommend the programme. Student appreciation clearly increases on the topics of testing and assessment; internships and programme; and information facilities. Although students continue to rate the study load less positively than the national average, a slight increase in their appreciation can be observed. This is largely due to the significantly higher appreciation for 'study load distribution across the academic year'. These are also topics to which TU Delft has been devoting efforts in recent years in order to achieve improvement.

Development of lecturer quality

This year, a Teaching Lab was opened on the campus. It serves as the physical location of the Teaching Academy – the community of TU Delft lecturers. Within the Teaching Academy, educational developments are brought together, and cooperation and innovation in education are encouraged. To this end, the Teaching Lab provides lecturers with testing and collaboration environments for educational experiments and space for engaging in discussions or initiating educational projects with each other. The Teaching Lab also serves as a relaxed meeting place, with many overarching educational events being organised here, including the annual Education Day and interfaculty consultations.

Boards of Examiners and Boards of Studies

Boards of Examiners are structured per faculty, often with sub-committees for each degree programme. Only the joint-degree programmes have a separate Board of Examiners, with members from the relevant institutions/faculties. There are more than 30 Boards of Studies at TU Delft. The university has made a guide available for Boards of Studies. If a joint-degree programme includes elections, all of the local Boards of Studies follow an appointment procedure that ensures input from students and lecturers. Information sessions are organised for the chairs of the Boards of Studies, in order to provide them with further information on legislative changes concerning the position of Boards of Studies and the practical implications of these changes.

Excellence

The TU Delft policy of excellence aims to provide students of above-average talent with additional challenges. TU Delft offers the best-performing students various options both within and outside the degree programmes, such as Cum Laude regulations, double-degree programmes, MSc scholarships and Honours Programmes. In addition, some students devote themselves to administrative activities for study associations or community student initiatives. In 2017, 170 Bachelor programme students entered the Delft Honours programme. Within the programme, students follow faculty modules and projects worth 15 EC, and 5 EC within the interdisciplinary programme. In addition, honours students participate in the many activities organised by the Honours programme management, such as a networking day, a study trip and various lunchtime and evening lectures. There are also opportunities for following honours education abroad.

Extracurricular student projects

TU Delft attaches considerable importance to extracurricular student projects, facilitating them by providing student teams with a well-equipped workplace, known as the D:DREAM Hall. D:DREAM stands for Delft Dream Realisation of Extremely Advanced Machines. More than 400 students participate in one of the 12 DREAM teams. The students achieve top-level performance, learn to work in interdisciplinary

teams, manage projects, learn to collaborate with businesses, build and test their own designs. In 2017, teams worked on projects including the Solar Challenge (a solar car race through Australia); a Hyperloop, in which items are sent through vacuum tubes at high speed; an exoskeleton that allows people with spinal-cord injuries to walk again; muscle-powered submarines; hydrogen-powered race cars; vehicles that can drive around the world on about 10 litres of fuel; and bicycles that can go faster than many urban cars.

2.5 Support

Preparatory activities

In the process of establishing links between pre-university education and TU Delft, the focus is on teachers as well as on school students. Throughout the education chain, attention is devoted to introductions to science and technology. In 2017, the financial support provided by the regional secondary-to-university cooperation was elaborated further through support from the Bètasteunpunt Zuid-Holland (particularly for secondary-school teachers). The Science Centre and the Communication department focus primarily on secondary-school students and their parents. In this regard, the Wetenschapsknooppunt Zuid-Holland (South-Holland Science Centre) plays an important role for primary education, particularly with regard to continued education for secondary-school teachers. The pre-university talent programmes 'Junior TU Delft' and 'Math & Science Classes' are available to students in the fifth year of pre-university education who are looking for a real challenge. In addition, online trial studying is available for eight Bachelor's degree programmes.

Opening of TU Delft Teaching Lab



The TU Delft Teaching Lab held a festive opening ceremony in September 2017. The Teaching Lab is the physical location of the Teaching Academy – the community of TU Delft lecturers. Within the Teaching Academy, educational developments are brought together, and cooperation and innovation in education are encouraged. To this end, the Teaching Lab provides lecturers with testing and collaborative environments for educational experiments and space for entering discussions or initiating educational projects. The Teaching Lab also serves as a relaxed meeting place, with many overarching educational events being organised here.

World Championship for the TU Delft Solar Team



In October 2017, the TU Delft student team Nuon Solar Team won the Bridgestone World Solar Challenge for the seventh time. The event is the biennial 3,000-kilometre solar race that goes right across Australia. After five days, the TU Delft student team finished first, with a two-hour lead over the University of Michigan.

Bachelor's information

Secondary-school students are increasingly preferring to use information for prospective students at the times and locations that suit them (anytime, anywhere). TU Delft responds to these preferences by increasingly offering informational activities online, in addition to those offered on the campus. In the introduction of the new website, extensive attention was paid to the online informational activities. Nevertheless, attendance at the open days continues to increase. In late 2017, a record number of interested parties attended the open days: 7,000 secondary-school students, representing an increase of about 15% over the attendance in 2016. In order to continue to provide a representative campus experience to secondary-school students despite these large numbers, it was decided to organise additional campus tours. Every Friday afternoon, secondary-school students can take tours of the campus, led by TU Delft students.

Master's information

Potential Master's students are increasingly focusing less on institutions, gravitating more towards specific degree programmes and specialisations. They tend to select programmes at universities that have a good reputation and that are best suited to their prior education, their interests and, most importantly, their ambitions. Given that a large

share of Master's students come into contact with TU Delft through informal channels, we are moving in the direction of a network approach to recruitment. To this end, we have initiated a programme in which we help potential students to come into contact with our exchange students and international alumni.

Additional support and guidance during the degree programme

In addition to the support provided in the faculties by academic counsellors, mentors, internship coordinators and international coordinators, all students have access to the support and guidance provided by Career & Counselling Services. While individual students are welcome here, they can also make use of the wide range of workshops and training courses focusing on effective studying, personal support, programme selection and career planning. Examples include smarter ways to prepare for exams, studying with dyslexia and thinking constructively when dealing with fear of failure. Within the framework of professionalising the support provided, in the spring a week of masterclasses was provided for all academic counsellors. In cooperation with a number of academic counsellors, this has since led to a professionalisation process for academic counsellors within the context of the LDE network.

Studying with a disability

An estimated percentage between eleven to fourteen of all students at TU Delft have a disability. These students are at high risk of incurring study delays or dropping out. The Study Buddy Project provides one-on-one guidance for students with disabilities or chronic illnesses by matching students with 'study buddies'. In 2017, many students took advantage of the opportunity to have a Study Buddy. One major addition to the support is the collaboration between Career & Counselling Services and the Municipality of Delft, with the goal of providing a good transition to the labour market for graduates with disabilities.

Choosing and switching degree programmes within TU Delft

During their studies, students may have doubts or need to make choices (e.g. relating to a BSA). Workshops on making choices and switching degree programme are offered by way of support. Master's Choice workshops are offered as well.

Scholarships for international Master's students

In 2017, several scholarships were used to encourage international student mobility in the Master's programme. The Justus & Louise van Effen Scholarship Fund provided full scholarships to 24 international students, while the Delft Global Initiative awarded its first four scholarships to excellent students from Sub-Saharan Africa. Moreover, TU Delft recruited international talent through a combination of full and partial faculty scholarships. A gift to the University Fund made five scholarships available to women from Sub-Saharan Africa for taking a Master's degree programme at TU Delft in 2018.

Support for doctoral candidates

The support for doctoral candidates through Career Centre has been expanded further. Doctoral candidates make good use of the services of the PhD psychologist, which allows effective prevention in the advisory programmes for individual doctoral candidates. To provide further support for the proper functioning of doctoral candidates, the TU Delft Health Coach programme has also been made available to doctoral candidates. The three groups of doctoral candidates that participated in this programme in 2017 expressed great appreciation for it.

2.6 Educational cooperation

Leiden – Delft – Erasmus Strategic Alliance:

In September 2017, two new LDE degree programmes were launched: the joint Master's degree programme in Technical Medicine (TU Delft, ErasmusMC, LUMC) and the LDE minor in 'Geo-Resources for the future'. In September, the first degree certificates were awarded for the joint Master's programme in Nanobiology (TU Delft, Erasmus), the joint Bachelor's degree programme in Clinical Technology (TU Delft, ErasmusMC, LUMC) and the LDE Master's specialisation in the Governance of Migration and Diversity. In February, the first students in the Netherlands received their Master of Science degree certificates from the Executive Master's programme in Cyber Security (Leiden University, TU Delft, The Hague University of Applied Sciences). Within the LDE context, TU Delft also participates in the Centre for Education and Learning (CEL). In this partnership, which focuses on quality improvement in academic education, the partners cooperate in the area of research on higher education, professional development for lecturers and educational innovation, with a particular focus on online and blended learning. As of September 2017, Timo Kos, the Director of Education and Student Affairs, was appointed director of the CEL.

Education from the 4TU.Federation

As a basis for the educational cooperation between the four universities in the 4TU.Federation, a course was set in 2017 to achieve a combination of online and face-to-face (blended) education. The mathematics lecturers of the four institutions have started a major joint project in which the first-year mathematics courses, bridging education and other components are digitised. The 4TU.Centre for Engineering Education (CEE) is complementary to the aforementioned LDE Centre for Education & Learning. The CEE plays an important role in the educational cooperation between the four universities of technology, focusing primarily on optimising education in the engineering sciences. Evidence that the innovation activities in engineering education are also highly rated abroad is reflected in the appointment of Aldert Kamp (head of the CEE for TU Delft) as the global director of the CDIO worldwide university network for engineering education in June 2017.

Collaboration with universities of applied sciences

Within the framework of regional collaboration, TU has signed a covenant with The Hague University of Applied Sciences, the Rotterdam University of Applied Sciences and InHolland Delft. The covenant is aimed primarily at providing continued education and inspiration to teachers in secondary education, as well as to lecturers in applied professional or university education. In addition, efforts were started to expand collaboration concerning the intake and mobility of graduates of universities of applied sciences to TU Delft, as well as the improved opportunities for TU Delft students to transfer to universities of applied sciences. Through the Bètasteunpunt Zuid-Holland, regional cooperation has been expanded to include secondary schools, which primarily make use of the opportunities for continued education for teachers.

2.7 After graduation

Preparation for a career

Students and doctoral candidates who have questions about their career prospects can visit the TU Delft Career Centre, which works in close cooperation with the Alumni Office, the business community and the Municipality of Delft. The services provided focus especially on helping talented international students find their way from TU Delft to the Dutch labour market. We have also seen a substantial increase in the percentage of these students succeeding in finding positions on the Dutch labour

markets. One of the projects developed especially for this target group involves making videos available of international alumni who have already made successful career steps. A new online portal has been launched that provides companies located (or hoping to be located) in the Delft area with access to TU Delft talent.

Alumni

Alumni constitute an important network for the development of the university. The objective of the alumni programme entitled 'TU Delft for Life' is to build a valuable mutual relationship between TU Delft and its alumni, with alumni being part of a community of people who are able to look back on their time at TU Delft with pleasure and who are proud of their alma mater and the role that TU Delft plays in society. In addition to contact information for alumni, we will be registering more information (e.g. special areas of interest), so that alumni can be involved in alumni activities in a more targeted manner. Starting this year, alumni are given access to an online alumni platform: the 'TUDelftforLife.nl' community. They can use this platform for such purposes as finding interesting events or looking up their classmates. We are also working to offer alumni discounts for online professional education.

Students build exoskeleton



This year, the TU Delft student team 'Project MARCH' constructed a new exoskeleton: the MARCH II. An exoskeleton is a supporting frame that is worn outside the body. With this new advance in medical technology, the students are aiming to help paraplegics to perform their day-to-day activities again. In addition to unveiling the new design, the team highlighted the importance of this technological development during the design presentation, which was attended by Martin van Rijn, former State Secretary of the Ministry of Health, Welfare and Sport. In October, the team participated in the Cybathlon Experience, a competition for bionic para-athletes in Germany. Project MARCH came second in the competition, in which both academic and commercial teams participated.





3.1 Introduction

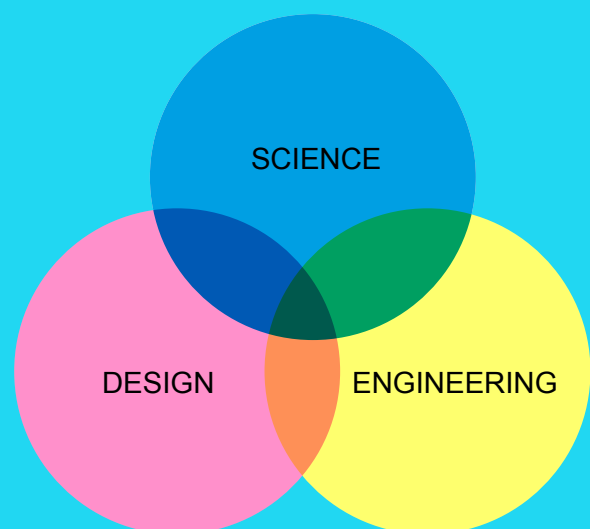
TU Delft has a broad research portfolio and conducts globally recognised research in fields as diverse as quantum-nano, bio-nano, maritime technology, architecture, transport, water management, aerospace technology and robotics. Also, TU Delft is one of the 10 most innovative universities in Europe according to Reuters (see Section 3.3).

The strong position of the research conducted at TU Delft is accompanied by efforts to increase our societal impact by providing knowledge-intensive, technology-driven solutions to societal problems. There does not have to be a dichotomy between conducting high-level scientific research and having an impact on a better society. In fact, at TU Delft, research goes hand in hand with valorisation (i.e. the utilisation of scientific knowledge in society). Our ambition as an organisation is that we not only strive to be good at what we do, but also that we want to be good for something. We aim to systematically connect our research with challenges in society and to enter into sustainable public-private partnerships. In 2017, we took major steps in this direction. For example, under the leadership of Prof. Dogterom, researchers in the Dutch research consortium BaSyC have joined forces to develop a synthetic cell (see Section 3.2), TU Delft researcher Dr. Lhermitte generated worldwide media attention through a number of Twitter messages about the crack he discovered in the Petermann glacier in Greenland (see Section 3.3), and the ROSIN consortium developed open source robot software under the leadership of Prof. Wisse (see Section 3.6); all of these are examples of science with high relevance and a substantial societal impact. TU Delft is also committed to promoting entrepreneurship, 'Open Science' and 'Open Innovation'. For TU Delft, 2017 was the 'Year of Open' (see Section 3.2).

Research at TU Delft is conducted in close collaboration with leading Dutch and international universities and via prominent collaborative partnerships, including the Amsterdam Institute for Advanced Metropolitan Solutions, the QuTech quantum institute, Medical Delta and RoboValley.

Cornerstones of our research: Science, engineering and design

Science, engineering and design: these are the cornerstones of the research conducted at TU Delft. Although the emphasis placed on each of these aspects can vary per field, the research profile of TU Delft as a whole is characterised by a combination of these three mutually reinforcing approaches. The integration of science, engineering and design already begins with the design of a research project, and continues throughout the research process, up to the potential implementation of its outcomes. This integration is also reflected in the education programme, particularly within the minors and Master's degree programmes.



Overview of TU Delft faculties and their scientific focus areas

Faculty	Scientific focus areas
Architecture and the Built Environment (ABE)	Architecture Urbanism Management in the Built Environment Research for the Built Environment Architectural Engineering & Technology
Civil Engineering and Geosciences (CEG)	Structural Engineering Geoscience & Remote Sensing Transport & Planning Hydraulic Engineering Geoscience & Engineering Water Management
Electrical Engineering, Mathematics & Computer Science (EEMCS)	Software and Computer Technology Intelligent Systems Applied Mathematics Microelectronics Quantum and Computer Engineering Electrical Sustainable Energy
Industrial Design Engineering (IDE)	Design Engineering Product Innovation Management Industrial Design
Aerospace Engineering (AE)	Aerodynamics, Wind Energy, Flight Performance and Propulsion Aerospace Structures & Materials Control and Operations Space Engineering
Technology, Policy & Management (TPM)	Multi Actor Systems Values, Technology and Innovation Engineering Systems and Services
Applied Sciences (AS)	Bionanoscience Imaging Physics Biotechnology Quantum Nanoscience Chemical Engineering Radiation Science & Technology
Mechanical, Maritime and Materials Engineering (3mE)	Process and Energy Biomechanical Engineering Cognitive Robotics Precision and Microsystems Engineering Materials Science and Engineering Maritime and Transport Technology Systems and Control

3.2 2017: “Year of Open”

The year 2017 at TU Delft was dedicated to Open Science, with the motto “Year of Open”. Throughout the year, activities were organized in order to exhibit why TU Delft attaches so much importance to Open Science. The umbrella concept of Open Science encompasses a broad array of things, including Open Access publications, good research data management, open peer review, open teaching materials and open source software.

One important aspect of Open Science is improving the transparency and reproducibility of research. TU Delft aims to provide scientists with strategies for locating funding and support in the area of Open Science. New developments in 2017 included the recruitment of Data Stewards for the Faculties of Aerospace Engineering, Civil Engineering and Geosciences, and Electrical Engineering, Mathematics and Computer Science. In 2018, the other five faculties will follow their example. These Data Stewards are disciplinary experts embedded within the faculties, who serve as the first point of contact for questions concerning the planning of data management, as well as on the back-up, organisation, description and publication of research data. They also help researchers to meet the requirements of research funders and academic journals.

Another remarkable activity in 2017 was the start of a community for producers and users of Open Source software by the ICT department and the TU Delft Library. The goal is to use input from scientists to arrive at policies that do justice to their scientific interests and efforts.

Open Access Monitor 2017

For TU Delft, it is important that research results are freely accessible online as much as possible. To this end, researchers are encouraged to publish as Open Access. In 2017, TU Delft researchers published more than 52% of their peer-reviewed articles Open Access, see also Figure 6. These articles were published on the platforms of the publishers, or an author's version was made available via the TU Delft Repository. In 2016, the share of Open Access published articles was 44%: so this is substantial increase. The absolute number of Open Access published articles has increased from 1304 in 2016 to 1635 in 2017. This indicates that TU Delft is well on its way towards the national objective formulated for next year by the Ministry of Education, Culture and Science: 60% Open Access in 2018.

Within the framework of the Association of Universities in The Netherlands (VSNU), the universities have decided not to renew contracts with major publishers unless they allow Open Access publishing at no additional cost to researchers. On behalf of TU Delft, the President of the Executive Board, Tim van der Hagen, joined the VSNU's three-person Open Access negotiation team in 2017. In 2018, he will lead the team that will start negotiations with Elsevier.

TU Delft provides a wide range of support to researchers in the process of Open Access publishing: as a participant in the national Open Access agreements with publishers, through bilateral publishers' contracts and as the manager of the TU Delft Open Access Fund. Established in 2008, the latter fund is available to researchers to cover at least part of the costs charged by some platforms for Open Access publishing. If Open Access publishing is not an option on a publisher's platform, researchers post the definitive authors' versions of their manuscripts in the TU Delft Repository.

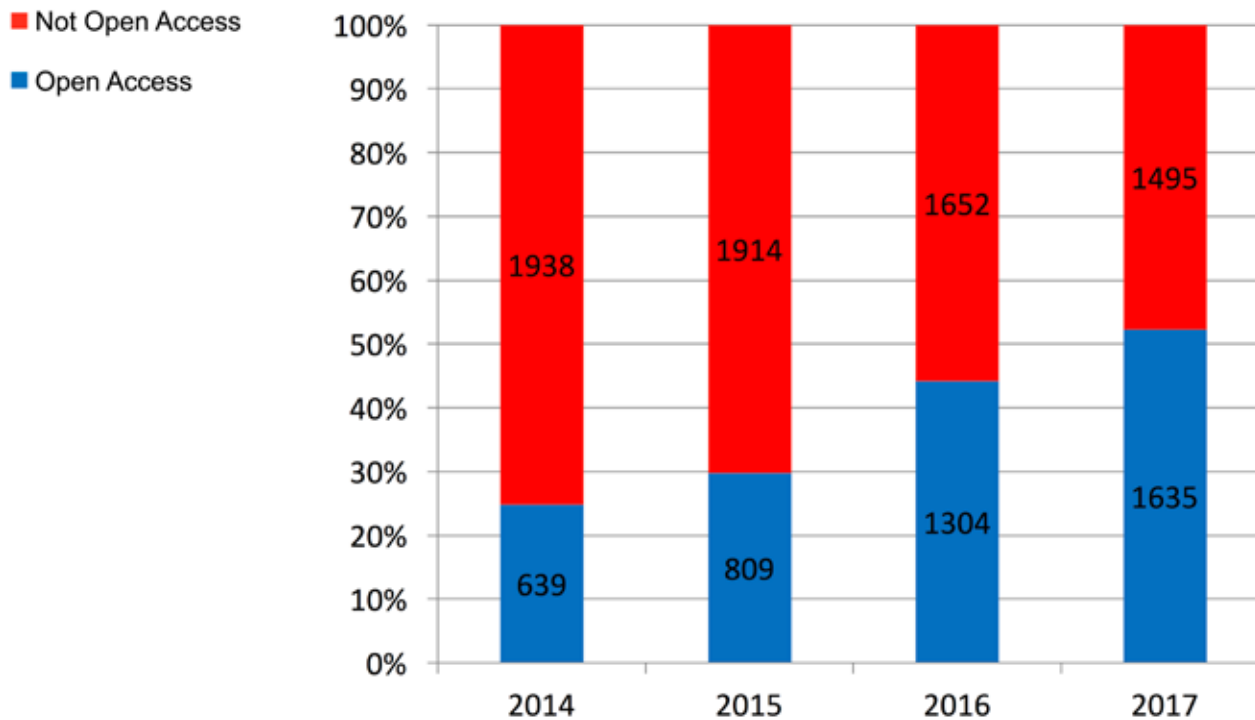


Figure 6: Overview of peer-reviewed articles that are/are not published Open Access.

3.3 Research collaboration

One important ambition of TU Delft involves increasing its societal impact by offering knowledge-intensive, technology-driven solutions to societal problems. These solutions are rooted in ground-breaking research, ensuring that TU Delft remains a step ahead of the industry and its competition, and possesses unique expertise to be an attractive collaboration partner. For its research, TU Delft takes inspiration from questions that arise in society: from minor problems that we all face on a daily basis, to major societal challenges that require global solutions. The research questions that emerge from them are often so complex that they can only be answered by joining forces and collaborating from within a variety of disciplines. Researchers at TU Delft also collaborate frequently with colleagues from the industry and with societal partners.

TU Delft makes the link between its scientific profile and its position in society explicit by consistently arranging its vast research potential to address major societal challenges. This is done in consideration of national research priorities, as formulated in the Dutch National Research Agenda or the Top Sector policy, as well as international research priorities, including the EU Horizon 2020 programme and the UN Sustainable Development Goals.

The thematic collaboration takes on a variety of forms, depending on where the necessary expertise can be found: across faculties, regionally, nationally and internationally. For example, regional collaboration includes partners such as the Reinier de Graaf hospital, The Hague University of Applied Sciences, local governments and, more systematically, as part of the LDE alliance with Erasmus University Rotterdam and Leiden University. On a national level, TU Delft collaborates with the other three universities of technology in the Netherlands within the 4TU. Federation and via the national research schools. International collaboration takes place amongst others via joint worldwide research initiatives, through innovation

programmes such as the Amsterdam Institute for Advanced Metropolitan Solutions, and with major (inter)national companies such as the QuTech quantum institute.

Cross-faculty collaboration

Delft Research-Based Initiatives

Health, energy, globalisation, and infrastructure & mobility are major themes in today's society. It was for this reason that TU Delft established Delft Research-based Initiatives (DRIs) in these four areas, see Figure 7. These virtual, multidisciplinary partnerships between various TU Delft faculties contribute to solving the societal issues addressed within these four themes. The DRIs engage with government and businesses, identify important opportunities and actively showcase innovative science. Several highlights from 2017 are discussed below.

Delft Research-based Initiatives (DRIs)				
	Energy	Deltas, Infrastructures & Mobility	Health	Global
Objective	Energy innovation for sustainable energy provision	Vital Infrastructures for Water Safety and Smart Mobility	Technological research for medical and health care innovations	Science and Technology for Global Development
Research themes	Wind and solar energy Smart energy networks (Chemical) storage Energy efficiency in design, industry and the built environment Geo-energy/heat	Urban infrastructures Airport of the future Urbanising Deltas	Medical imaging & Image guided medicine Interventions & Care Targeted molecular technology Vitality	Water Urbanisation Healthcare Energy Disaster resilience and response

Figure 7: Overview of the Delft Research-based Initiatives (DRIs) and their focus

Delft Deltas, Infrastructures & Mobility Initiative (DIMI)

In 2017, as part of the DIMI 'Highway & City' project, and in collaboration with the Royal Institute off Dutch Architects (BNA), the possibilities for improving the relationship between motorways and cities were investigated. The quality of life, accessibility and use of space in a future with automated transport were examined. The project has been followed closely by the Government Adviser on Infrastructure and the City. Currently, a follow-up study, 'City of the Future', is being prepared together with the BNA, the Ministry of Infrastructure and Water Management and the municipalities of The Hague, Rotterdam, Amsterdam, Utrecht and Eindhoven. For further information, see: www.tudelft.nl/infrastructures.

Delft Energy Initiative

The Delft Energy Initiative investigates the complex system changes associated with the energy transition. In the past year, multidisciplinary research teams from TU Delft worked on the topics of energy storage and conversion ('e-refinery'), smart energy networks and digitisation, the integration of solar energy systems and heat in the built environment, and wind energy. Social innovation is the connecting thread throughout this research, given that a base of support is just as important as the actual technology. Energy researchers at TU Delft will therefore continue to profile themselves according to these research themes. For further information, see: www.tudelft.nl/energy.

Delft Global Initiative

Developing an inexpensive optical instrument that anyone can use to analyse a blood sample and diagnose malaria in an early stage: in a Delft Global Research Fellowship, ir. Agbana and his multidisciplinary team are taking on this challenge, in collaboration with a clinical professor from Nigeria and the Leiden University Medical Centre. In the first phase of the project, a smartphone was transformed into an inexpensive, user-friendly microscope. This project received the Silver Edmund Optics Educational Award and the Medical Delta Young Talent Award. For further information, see: www.tudelft.nl/global.

Delft Health Initiative

The Delft Health Initiative is a node at which scientific knowledge about medical technology meets societal demands in the field of health care. Nice examples from 2017 include the construction of a synthetic cell, research on CRISPR systems in bacteria and how they resist viruses, an exoskeleton built by students that allows paraplegics to walk again, and research on self-folding objects that could result in improvements of bone transplants. For further information, see: www.tudelft.nl/health.

TU Delft Institutes

The TU Delft Institutes bundle the research capacity of TU Delft in university-wide partnerships in twelve specific fields of research, many of which are relatively young. This virtual clustering of high-quality research capacity enhances the university's visibility within this field of research and positions TU Delft optimally to join (international) consortiums and networks, and to be attractive to scientific talent. In 2017, two new institutes were established: the TU Delft Design for Values Institute and, in collaboration with TNO, the Dutch Optics Centre. An overview of the topics on which the various institutes focus is provided in Figure 8. Various highlights from 2017 are discussed below. Additional information on the activities of the TU Delft Institutes is available through www.tudelft.nl/research.

TU Delft Bioengineering Institute

On 16 March 2017, the 166th anniversary of the TU Delft microbiologist prof. Beijerinck, nine scientists from the faculties 3ME, CEG, EEMCS and AS organised the second edition of TU Delft BioDay. Two hundred participants came to the Science Centre for this networking event, to catch a glimpse of the enormous potential that TU Delft has in the area of biological engineering. A special feature of BioDay 2017 was the presentation of projects that emerged from BioDate 2015, an initiative in which scientists from various departments set up and supervised multidisciplinary master's projects.

TU Delft Climate Institute

A highlight was the worldwide media attention attracted by Dr. Lhermitte. In April 2017, he tweeted that, using the Sentinel 1 satellite, he had discovered a crack in the

Petermann glacier in Greenland. The head of polar research at NASA read about this in the *Washington Post* and notified his researchers – who were flying over Greenland at that time – of the discovery. Their 3D images of the glacier indicated that a large iceberg was in danger of breaking off. *The Daily Mail*, CNN and other media sources reported extensively on this series of findings.

TU Delft Computational Science and Engineering Institute (DCSE)

On 23 May, scientists, doctoral candidates and the industry celebrated the start of DCSE during the successful Kick-off event “Future Computing”. DCSE is a platform for collaboration and knowledge exchange, building a bridge between industry and academia. Scientists from TU Munich and Stanford University and partners from Shell and MARIN gave presentations, and participating research groups presented poster pitches. Highlight was a demonstration of the smallest supercomputer in the Netherlands: the “Little Green Machine II”.

TU Delft Design for Values Institute

The Design for Values Institute developed the MOOD (Massive Open Online Deliberation) tool for open participative deliberation, that supports the value-development process. Identifying and understanding each other's values is crucial in multi-stakeholder, multidisciplinary and cross-cultural settings. In June 2017, MOOD was used in Rotterdam for the G1000 citizen summit, where 1500 residents of Rotterdam were asked to think about the city's future. Together, they identified the common values of Rotterdam and generated more than 100 plans for the city.

Dutch Optics Centre

Established in 2017, the Dutch Optics Centre (DOC) is an initiative of TNO and TU Delft, making it the first hybrid institute of TU Delft. The goal is to collaborate with partners to conduct research on application-based techniques for the optics industry in the Netherlands. These industrial partners look for solutions to advanced optomechanical problems at knowledge institutions, which will lead to collaboration in research projects. In collaboration with TNO, the DOC also encourages developmental projects and commercially oriented projects.

TU Delft Process Technology Institute (DPTI)

In 2017, DPTI has further developed the multidisciplinary e-Refinery programme. This programme investigates technology for the electro-catalytic production of basic chemicals and fuels. That is crucial for the transition of the energy and chemical sector from fossil fuels to renewable resources and electricity. Within this framework, the first national symposium on e-Refinery was organised in 2017. The fifth anniversary of the DPTI was celebrated in May, with the Van 't Hoff Lecture by prof. Arnold (California Institute of Technology).

TU Delft Robotics Institute

The European ‘Factory in a Day’ project was successfully completed in late 2017. This TU Delft-led project was followed up by ROSIN (ROS-Industrial quality-assured robot software components): a major European open source robot software project. Half of the €7.6 million project budget consists of funds made available to (industrial) parties wishing to collaborate on applications. The German company Ensensio GmbH and the Dutch company Robot Care Systems received the first ROSIN grants in 2017.

TU Delft Safety and Security Institute

In 2017, the TU Delft Safety and Security Institute (DSyS) conducted a university-wide inventory of sensor technologies for monitoring preventive and repressive measures in the safety chain. A selection of innovative technologies was tested during evacuation drills in faculty buildings, among others to analyse the movements of people. In this

way, researchers and support services jointly collect 'living lab' data that will enable the evidence-based evaluation of an evacuation.

TU Delft Space Institute

In 2017, the NASA space agency decided to conduct a mission involving the measurement of radiation between stars using Dutch Far-Infrared cameras. TU Delft and the Dutch institute SRON are developing the most important detector technology, and lead the Dutch part of the project. Known as GUSTO (Galactic/Extragalactic UDLB Spectroscopic Terahertz Observatory), this balloon telescope mission investigates the stellar life cycle: from molecular clouds, through the birth and evolution of stars, to the gas clouds of dying stars. The launch of GUSTO is scheduled for 2021 in Antarctica.

TU Delft Sports Engineering Institute

Further improvements in aerodynamics for professional racing cyclists: this was the reason for Team Sunweb to collaborate with scientists from the Sports Engineering Institute to establish an improved cycling suit. This resulted in a new aerodynamic time trial suit for Tom Dumoulin. A 3D mannequin of Dumoulin was printed, based on a body scan. The air resistance of this mannequin, dressed in a different cycling suit each time, was measured and optimised in the Delft wind tunnel. In 2017, Dumoulin became the first Dutch person ever to win the *Giro d'Italia*.

TU Delft Transport Institute

On 27 June, minister Schultz van Haegen opened the Researchlab Automated Driving Delft (RADD) in The Green Village. The RADD is an open-air field lab for automated driving. With these efforts, the TU Delft Transport Institute is working to strengthen empirical research on urban passenger mobility and freight transport, collaborating with public and private partners on the Urban Mobility Observatory. In this facility, research is conducted on coordinated driving, automated transport, bicycle-traffic management, the direction of pedestrian traffic, the improvement of public transport and the optimisation of (intermodal) freight transport.

TU Delft Wind Energy Institute (DUWIND)

On 11 October 2017, the first results of the EUROS (Excellence in Uncertainty Reduction of Offshore Wind Systems) programme were presented. This scientific research programme was funded by industry and government. In the course of five years, eleven scientists (including seven from TU Delft) will be developing instruments and models that serve as supplements to existing design and planning software. This enables rapid market implementation. Three universities, five research institutes and seven industrial partners contribute to an integral approach towards cost-reduction in wind energy, which is unequalled in the sector.

TU Delft Institutes			
Name Institute	Focus	Start	Faculties
Bioengineering	Biomass based products Environmental bioengineering Bioengineering for health	2016	AS, CEG, EEMCS, 3mE
Climate	Urban Climate Ice and Sea-level Change Water Cycle (Engineering the) Radiation Balance	2012	CEG, EEMCS, TPM, AE, ABE (AS, 3mE)
Computational Science & Engineering (DSCE)	Dynamics Structures Solids Socioeconomics & Life	2016	EEMCS, CEG, AS, 3mE, AE, TPM
Design for Values (DDFV)	Responsible innovation Incorporation of values in technology by design Resolving conflicts between values Assessment of design for values	2017	TPM, ABE, EEMCS, IDE
Optics Centre (DOC)	Spectrometry Imaging Metrology	2017	AS, 3mE, AE (partner: TNO)
Process Technology (DPTI)	Biochemical process engineering Process intensification Process technology for advanced materials	2012	AS, 3mE
Robotics	Swarm robotics Robots that work Interactive robots	2012	TPM, AE, IDE, EEMCS, 3mE, ABE
Safety & Security (DSyS)	Occupational- and structural safety Crisis management after safety and security incidents Physical- and cyber security Situational awareness for safety and security	2013	EEMCS, CEG, AS, ABE, TPM, 3mE, AE
Space (DSI)	Sensing from space Space robotics Distributed space systems	2015	AE, AS, EEMCS, CEG, 3mE
Sports Engineering	Aero- and hydrodynamics Biomechanics, materials and human / material interaction Measurement, feedback and simulation Motivation Sports infrastructures and facilities	2014	3mE, IDE, AE, EEMCS, ABE
Transport	Coordinated, cooperative and automated transport Urban mobility & active modes Transport policy & behaviour Logistics & freight transport Railways	2012	CEG, EEMCS, TPM, 3mE
Wind Energy (DUWIND)	Social responsible innovation System integration Wind farm design and asset management Wind turbine design Airborne Wind Energy	2012	AE, CEG, EEMCS, 3mE, TPM, AS

Figure 8: Overview of TU Delft Institutes

Regional, national and international collaboration

Research in context of the 4TU.Federation

Since Wageningen University joined the 4TU.Federation in 2016, the new activity plan has been dedicated to collaboration and synergy with Wageningen. In 2017, the choice was made to design future activities more thematically. In the autumn, 4TU. issued a call for proposals, with 'High tech for a sustainable future' as overarching theme. Until mid-January 2018, consortiums of scientists from three or four universities of technology can submit proposals for research programmes addressing one or more of the following seven themes: High tech to feed the world (1), Sensing Science & Technology (2), Robotics (3), Health & Vitality (4), Resilience (5), Advanced Materials (6) or Energy Conversion & Storage (7). Early 2018, the programme proposals that will receive funding for the period 2018-2021 will be selected.

Research in context of the LDE alliance

As part of the collaboration with Leiden University and Erasmus University Rotterdam (LDE), 20 postdocs were selected within the LEaDing Fellows Programme. The universities, the LUMC and the ErasmusMC offer postdoc positions in one of these five knowledge institutions to 90 young scientists from all over the world, who recently

Glass bridge on the campus



As a construction material, glass is just as suitable as concrete or steel. To prove it, Prof. Nijssen, Ir. Snijder, Smits MSc and Ir. Bristogianni built a glass bridge on the campus in 2017. The bridge, which consists of lattice work with glass diagonals, now forms the entrance to The Green Village from the Mekelweg (see also [page 58-60](#)): Collaboration in field labs). Because people tend not to trust the strength of glass, the bridge was tested in May by 80 dancing and stomping students. The bridge passed the test with flying colours. A new variant of the bridge will be developed in 2018: a fully glass bridge that consists of S-shaped glass building blocks. The special shape of the building blocks holds them in place without the need to use glue or cement.

obtained their doctoral degrees. In 2017, the Centre for BOLD Cities received funding from the Start Impulse of the Dutch National Research Agenda for the 'Big Data for Youth Policy' project, as well as a grant from the Netherlands Organisation for Health Research and Development (ZonMW) for a project on the use and linkage of data to develop personalised labour-market reintegration programmes. On 22 June, horticultural entrepreneurs, students and scientists in Berkel and Rodenrijs kicked off the Centre for Sustainability's third Circular Innovation Hub: the Greenport Hub. In this facility, scientists, students and societal stakeholders collaborate on developing sustainable innovations. The Centre for Global Heritage and Development received a KIEM grant for a project to produce 3D scans and prints from the moulds of clay tablets with cuneiform writing that were destroyed in or stolen from the museum in Raqqa (Northern Syria). In November, the Centre for Frugal Innovation in Africa organised an international conference on "Frugal Innovation for Sustainable Global Development". In response to the Dutch National Research Agenda, via the VSNU the universities have collectively proposed to join forces concerning the theme "Digital Society", with the aim of making the Netherlands a frontrunner in the creation of good connections between digital technology, people and society, and to invest in innovative research.

Research schools

A research school brings together the research and the education of researchers in a given scientific area. The school contributes to the national coordination of research programmes within specific disciplines, and it plays a particularly important role in providing the 'third part' of the doctoral programme: professional skills. In 2017, TU Delft was the coordinating university of five research schools. For the 2015-2017 period, TU Delft has made separate multi-year financial agreements with each of these research schools.

	ABE	CEG	EEMCS	IDE	AE	TPM	AS	3mE
Advanced School for Computing & Imaging (ASCI)	-	-	Coordinator	-	-	-	X	-
Centre for Technical Geoscience (CTG)	-	Coordinator	-	-	-	-	-	-
Dutch Institute of Systems and Control (DISC)	-	-	X	-	-	-	-	Coordinator
J.M. Burgerscentrum – Research School for Fluid Mechanics (JMBC)	-	X	X	-	X	-	X	Coordinator
Transport Infrastructure and Logistics (TRAIL)	-	Coordinator	X	-	X	X	-	X

In addition, TU Delft participated in the following research schools:

- Casimir Research School;
- Graduate School on Engineering Mechanics (EM);
- Institute for Programming research and Algorithmics (IPA);
- Netherlands Graduate School of Urban and Regional Research (NETHUR);
- Netherlands Institute for Catalysis Research (NIOK);
- Netherlands Institute of Government (NIG);
- Research School Process Technology (OSPT);
- Dutch Research School of Philosophy (OZSW);
- Netherlands Research School for Information and Knowledge Systems (SIKS);
- Netherlands Graduate Research School of Science, Technology and Modern Culture (WTMC).

Joint worldwide research initiatives

For its worldwide engagement portfolio, TU Delft is continually developing joint research initiatives and related networks. The focus of these efforts lies beyond Europe on Brazil, China, India and Sub-Saharan Africa. The Executive Board has appointed prominent academics as TU Delft Ambassadors for these areas. In these regions, there is momentum for developing collaboration in the area of science, industrial innovation and education. These regions also offer opportunities for frugal and reverse innovation, which can contribute to societal challenges such as the UN Sustainable Development Goals.

The BE-Basic TU Delft Brazil initiative, which focuses on the development of a biobased economy (BBE), has received 17 M€ in funding since 2012. In that time, 24 joint research projects and 20 joint doctoral projects have been launched. In projects relating to biokerosene, biobased chemicals and sustainable biobased chains, several researchers have recently received their doctoral degrees, joint post-doctoral courses and a MOOC have been developed, a design competition involving entrepreneurship has been organised, and roadmaps for public-private collaboration on BBE have been developed. The academics promote sustainable innovations and influence policy around the world with leading reports.

In 2017, researchers in a collaborative initiative of TU Delft and Guangzhou received joint funding from the NWO and the National Natural Science Foundation of China for the development of sustainable and smart urban systems. The rapid increase in polluting substances emitted by industrial plants in Guangzhou is causing concern. The greatest problem the industry faces is the safe and effective removal of waste water, sludge and by-products. The goal of the research project is to convert local waste products and industrial residuals into environmentally friendly, high-quality alternative construction materials. At present, an engineer, four doctoral candidates and four Master's students are working on the project.

Collaboration in field labs

TU Delft initiates and implements projects and programmes that are geared to accelerating innovation and bringing knowledge to the market. Efforts to this end include the organisation of living labs for testing and demonstrating innovations, with spin-offs and start-ups often playing an important role. In 2017, TU Delft ended in eighth place in Reuter's ranking of Europe's most innovative universities.

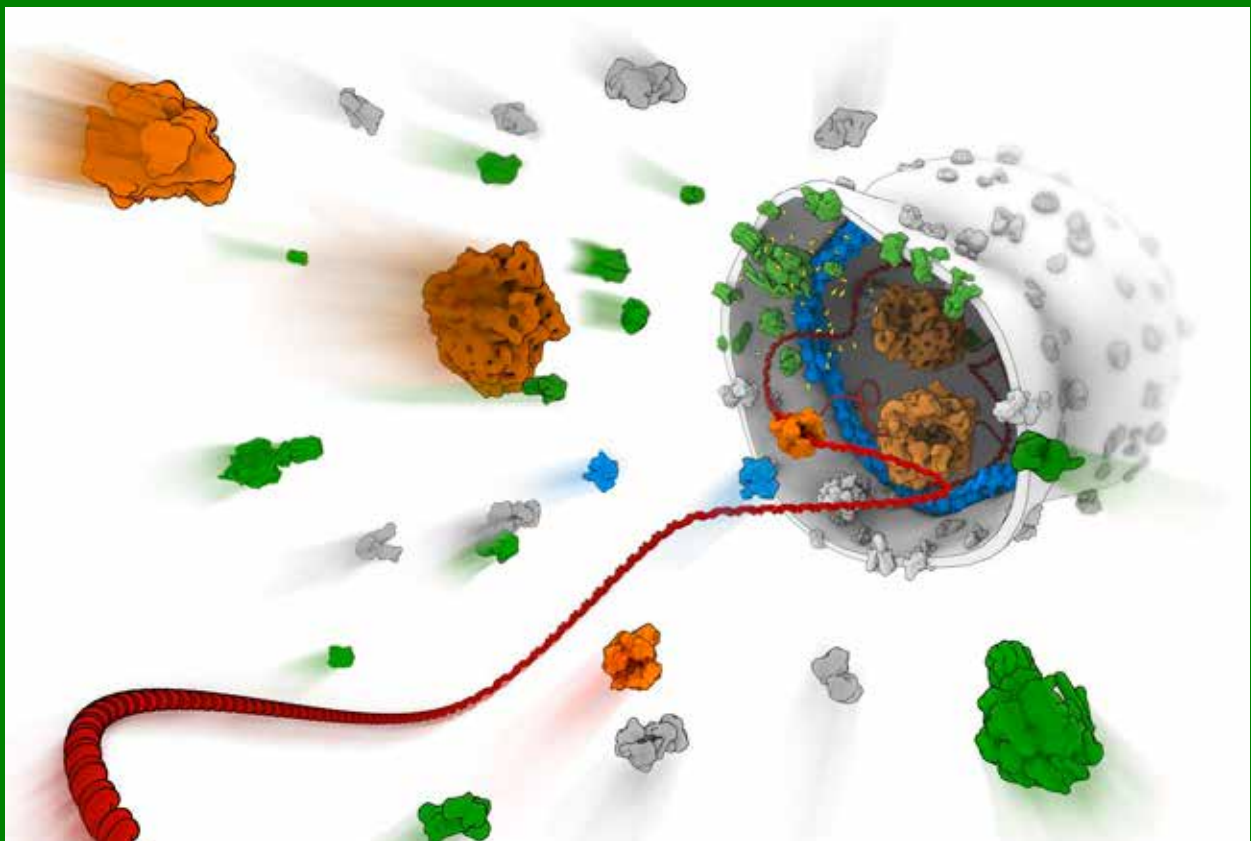
In the same year, EFRO funding was allocated for two new field labs that will be launched in 2018. The Fieldlab Unmanned Valley Valkenburg will be a field lab for the

use of drones (unmanned aerial vehicles) for many useful applications. The second field lab is the Composite Automation Development Centre (CADC), a field lab for the automation of the production of composites that are increasingly being applied in various markets and that must be produced more quickly and less expensively.

The Green Village

The Green Village on the TU Delft campus is a field lab for sustainable innovation. The aim is to shorten the time it takes to translate scientific research into applications for society. To this end, the Green Village focuses on technologies that have an impact on people's physical environment, such as sustainable energy, water, circularity and mobility. Following a long period of preparation, the use and visibility of The Green Village increased sharply in mid-2017. Various research and innovation projects have found their way to the facility's grounds, including a glass bridge from the faculties

Dutch researchers build synthetic cell



Constructing a synthetic biological cell is one of the greatest scientific challenges of the 21st century. An extensive body of knowledge exists on the molecular building blocks that form the basis of life, but the manner in which they work together to make life possible is not yet understood. For this reason, researchers in the Dutch research consortium BaSyC (Building a Synthetic Cell), which is led by Prof. Dogterom, are bringing together their knowledge of chemistry, physics and biology to build a synthetic cell. This is being done from the bottom up, by combining biomolecular building blocks to form an autonomous cell – one that can sustain itself, grow and divide. For this effort, the consortium received an allocation of nearly €19 million from the Gravitation programme of the Ministry of Education, Culture and Science. The research partners will themselves be funding the remaining €6 million of the €25 plus million that the research programme will cost. A fundamental understanding of life within a cell will bring huge scientific rewards. At the same time, it will raise philosophical and ethical questions as to how society can best utilise this new understanding and potential.

of Architecture and the Built Environment and Civil Engineering, AquaBattery's BlueBattery project and the Researchlab Automated Driving Delft. The Office Lab and the Living Lab were also opened in 2017. The people who live and work there serve as test subjects in various experimental projects. They share the first user experiences with the researchers and entrepreneurs. In the second half of the year, projects in The Green Village attracted more than 5000 visitors, ranging from scientists and entrepreneurs to civil servants and residents. In addition, two large Green Deal workshops were held: one on circularity in the field of construction (in collaboration with the NEN and the Ministry of Infrastructure and Water Management) and one on the renovation of residential neighbourhoods (in collaboration with the Province of Zuid-Holland, Alliander and the 'Agenda for the Construction Industry'). With the Green Deal Green Village, participating governmental and other organisations devote efforts to eliminating legislative and regulatory obstacles that stand in the way of scaling up innovative solutions.

AMS Institute

The AMS Institute is an ambitious international research institute that focuses on urban innovation. The institute was established in 2014 by TU Delft, Wageningen University and the Massachusetts Institute of Technology, commissioned by the City of Amsterdam. With a focus on urban issues such as water, energy, waste, food, data and mobility, innovative solutions are being sought for challenges that cities around the world are facing, through studies, experiments and living labs in the Amsterdam metropolitan region. Since its establishment, the AMS Institute has been working on more than 70 projects, in collaboration with knowledge institutions, businesses, the public sector and citizens to realise a united, circular and vital city. In the past three years, the current AMS Research and Valorisation programme has evolved to reach a total value of €40 M. Together with Research and Valorisation, the Education and Value platforms form the three pillars of the institute. The Master's programme in Metropolitan Analysis Design and Engineering (MSc MADE) – an innovative Master's programme focusing on metropolitan issues – was launched in 2017. In late August, the MIT Senseable City Lab provided a demonstration of the autonomous Roboats to 30 interested parties in Amsterdam. The project involves intensive collaboration with the City of Amsterdam, Waternet, TU Delft and Wageningen University. The REPAiR H2020 project was started in 2017 with a Peri Urban Living Lab in the Amsterdam metropolitan region for the purpose of analysing circular-economy challenges and developing solutions on a metropolitan scale.

Delta Technology & Water (VPdelta) valorisation programme

The VPdelta programme was established by scientists, entrepreneurs and local governments in order to develop innovative delta-management solutions. VPdelta creates field labs in which innovative concepts are tested, improved and demonstrated. Again in 2017, extensive efforts were devoted to encouraging and accelerating innovations. Many foreign delegations visited the Flood Proof Holland living lab, in which entrepreneurs demonstrated their innovations. In addition, a new field lab was opened in 2017: The WaterStraat. The first innovations were installed in this field lab, in which climate-adaptation solutions are tested. Examples include roads with water-permeable pavement, water buffers built under dwellings, smart rain barrels placed against façades and water-storage facilities on roofs. VPdelta is also active outside the Netherlands. In 2017, VPdelta and eight start-ups left on a water mission to Cape Town, in order to discuss opportunities for solving local water problems. In addition, VPdelta and nine start-ups went to Southeast Asia to experiment with 'smart information solutions' and how these innovative measuring solutions could be of value in that region.

Alliances with businesses

Research conducted at TU Delft is responding to a trend in which public funding is increasingly requiring matching efforts from the business community. In 2017, considerable attention was devoted to the Top Sector policy and the further expansion of partnerships with large innovative enterprises, as well as with small and medium-sized enterprises (SME). Various collaborations with SME have been set up in our field labs, RoboValley, The Green Village and the YES!Delft incubator.

Throughout 2017, extensive efforts were devoted to the new structure and framework agreement of the Materials Innovation Institute (M2i). The greatest share of the materials research at TU Delft is funded through M2i. One additional major project in collaboration with Tata Steel will be carried out directly under this agreement.

Through the TU Delft Industry Partnership Programme (TIPP), TU Delft will use the PPP Allowance (formerly the Top Consortium for Knowledge and Innovation or TKI allowance) to fund a second PhD position, if a business provides all the funding for the first PhD position. The TIPP focuses on strengthening collaboration with new or existing companies, in addition to encouraging business-based thinking within TU Delft. In 2017, the TIPP was successfully continued, and it led to the appointment of new doctoral candidates and projects with new foreign parties. In this way, 18 PhD tracks were created in 2017 through contracts with Airbus, KPN, Honda and Renault.

The number of foreign companies involved in the research conducted at TU Delft has increased steadily in the past three years. More than 40% of all contract research now comes from outside the Netherlands. To showcase the research conducted at TU Delft and to support the construction of strategic relationships, a major Research Exhibition was organised in 2017, in which 175 projects were exhibited. This event resulted in a large number of new connections that could be converted into new projects.

3.4 Research facilities

State-of-the-art research facilities are essential to TU Delft in order to attract scientific talent, conduct groundbreaking research and train the next generation of engineers. Research facilities are costly, and government funding for these purposes is limited. Increasing national collaboration is therefore needed, amongst others via grants that are made available by the Netherlands Organisation for Scientific Research (NWO).

National Roadmap Large-Scale Research Infrastructure

This Roadmap identifies research infrastructure of national importance with an investment need in the coming five to ten years. In 2017, NWO issued a call for proposals of 110 M€ for the funding of a number of these facilities. Scientists from TU Delft are participating in seven research facilities for which investment funds have been requested in this round. The proposals include an expansion of the measuring network for atmospheric research and an upgrade for the NanoLab facilities. The proposals to be honoured will be announced in 2018.

Investment Grant NWO Large

The Investment Grant NWO Large is intended to encourage investments in scientifically innovative equipment or data collections of (inter)national interest. It involves investments of 1.5 M€ or more. In 2017, following an internal preregistration procedure, TU Delft scientists submitted three proposals for the Investment Grant NWO Large. The proposals involve a coastline observatory, an urban mobility observatory and an upgrade of the towing tank for maritime research.

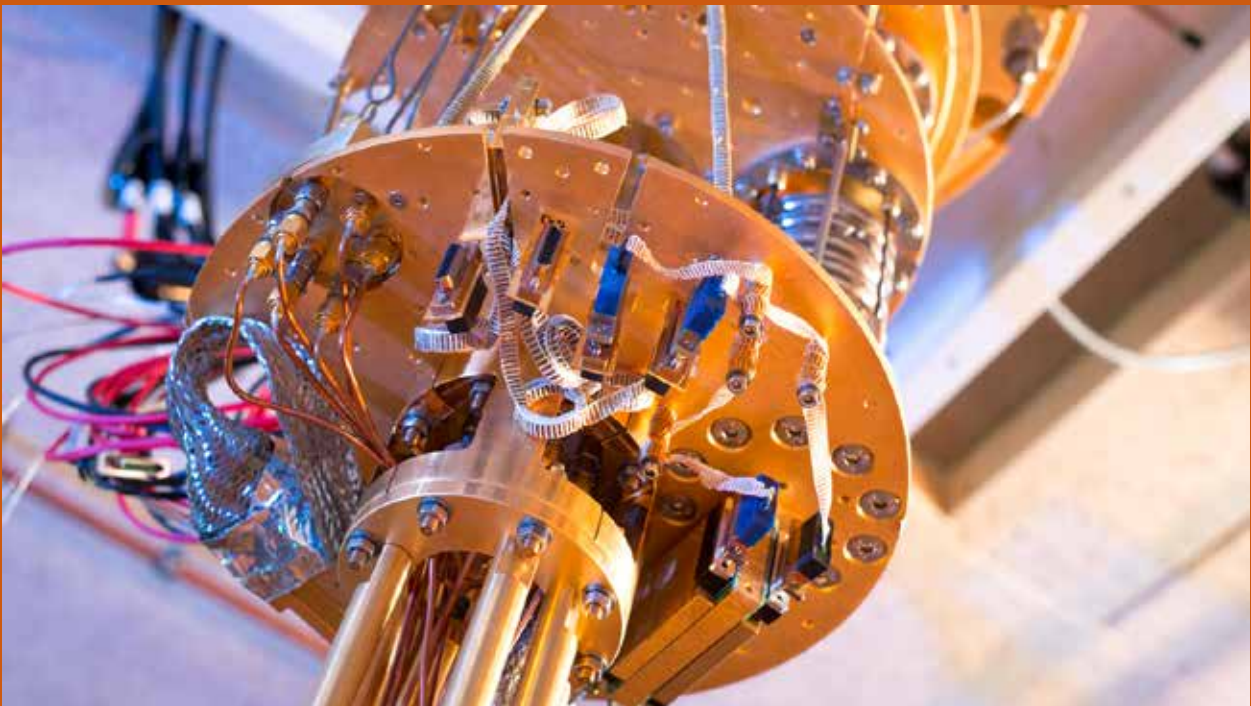
Future Fund Credit for Research Facilities

Through the Future Fund Credit for Research Facilities, the Ministry of Economic Affairs provides loans for the construction and exploitation of state-of-the-art research facilities. In 2017, TU Delft decided to return the previously allocated Future Fund Credit allocations for the Flex200 and Delft Geothermal projects to the Ministry. Because the loan did not provide a risk-bearing function, the financial benefits were minimal in relation to the administrative burden. TU Delft is still participating in a Future Fund Credit led by the University of Twente. Appropriate agreements were made with them, such that TU Delft's portion of the credit will remain unused.

RID - OYSTER

Within the framework of the OYSTER (Optimized Yield – for Science, Technology & Education – of Radiation) programme, the Reactor Institute Delft (RID) is working hard on expanding and modifying the infrastructure (cold source in the reactor, instruments and facilities). This will improve the RID's ability to meet the demands of the scientific

QuTech – Foundations of future technology



The computers and the internet of the future will be based on the laws of quantum mechanics. To make this happen, scientists from several faculties are collaborating closely with specialised engineers from TNO in QuTech. Successful collaborations also exist with companies (e.g. Intel and Microsoft), involving the combination of knowledge and expertise. The results of this multidisciplinary collaboration include a new method for checking quantum bits. Large numbers of quantum bits can be driven efficiently by stacking them in smaller numbers. By combining technological challenges and fundamental questions, the scientists hope to use 'qubits' to improve the understanding of materials. For example, they have developed an artificial material for studying quantum behaviour on a small scale. An interceptable quantum internet will require reliable connections. This year, a QuTech team succeeded in combining weak connections to create a strong quantum-entangled link. This method can be applied directly to add new links to a network.

world, industry and society with regard to healthcare, sustainable energy and materials. Part of the OYSTER programme is the cold 'neutron source' in the reactor. In late 2017, the construction of the CNS cooling building was started, in which cooling units will be installed that can cool neutrons to the extremely low temperature of -250°C. This will vastly improve the usability of the neutron tools. One tool that has already been realised within the OYSTER programme is PEARL, a neutron diffractometer that is used primarily for research on materials for sustainable energy production. It is attracting increasing numbers of users from science and industry, for example for research on new generations of batteries and magnetic cooling materials.

3.5 Research quality

Quality assurance and organisation

All research units at TU Delft are assessed once every six years by an independent, international committee, in order to evaluate the quality of the research and identify possible areas for improvement. The assessments are conducted in accordance with the Standard Evaluation Protocol (SEP) 2015-2021, which is established by the Royal Netherlands Academy of Arts and Sciences (KNAW), the Netherlands Organisation for Scientific Research (NWO) and the Association of Universities in the Netherlands (VSNU).

In October 2017, the Executive Board (EB) adopted the 'TU Delft Research Assessments Protocol', which describes the roles and responsibilities of all TU Delft actors within the SEP. At TU Delft, assessments are conducted as much as possible in a benchmark with comparable research at another Dutch or foreign university. TU Delft aims for a score in the range 1 ('world leading/excellent') to 2 ('very good') on the criteria 'research quality', 'relevance to society' and 'viability'. The committee bases its findings on a self evaluation report that is written by the departments concerned, as well as on the knowledge acquired during a site visit. The reports of the inspection committees are published on <https://www.tudelft.nl/en/research/organisation/quality-assurance/>, as is the 'position document' in which the EB reacts to the committee's findings. The findings are then discussed by the Operational Committee and used to refine the faculty strategy and long-term planning.

Research assessments in 2017

Two site visits took place in 2017: in March, for the stand-alone assessment of Technology, Policy and Management (TPM), and in December, for the national Electrical Engineering assessment with the University of Twente and Eindhoven University of Technology. The committee's report on TPM was published in May: in general, the 'research quality' was evaluated as 'very good', and in some areas even as 'world leading'. The 'viability' of the research was also considered to be 'very good'. The report on Electrical Engineering is expected in early 2018. Also, in early 2017 the assessment reports of Architecture and the Built Environment and Applied Physics were published. The committee assessed the quality of the research conducted within the Faculty of Architecture and the Built Environment as 'very high' and its relevance to society as 'world leading/excellent'. Both the 'scientific quality' and the 'relevance to society' of the research conducted at Applied Physics were rated largely as 'world leading/excellent'. The plan of approach for the assessment of Civil Engineering was approved in late 2017. The site visit is scheduled for early 2018, the committee's report is expected later in the year.

Rankings

Several organisations try to provide insight into the relative quality of universities via international rankings. Such rankings do not provide an objective picture of the performance of universities, because they are based on subjective choices of indicators, definitions and weighting factors and are subject to methodological shortcomings. Nevertheless, these rankings give a rough indication of the relative performance of TU Delft as a whole, or with regard to a specific discipline. Based on its position in the various rankings, especially those in the field of Engineering and Technology, it can be concluded that TU Delft is among the top universities in Europe and in the world. TU Delft uses international rankings as part of its recruitment and internationalisation policy in an appropriate manner. For the international positioning of TU Delft, the results of the rankings listed below are particularly important, see also Figures 9-11.

QS World University Ranking

In 2017, TU Delft rose in the QS World University Ranking for the seventh year in a row and currently occupies the 54th place (62nd in 2016). In the Netherlands, TU Delft now ranks first. The ranking is based on a combination of six indicators: academic reputation, employer reputation, faculty/student ratio, citation per faculty, international faculty ratio and international student ratio. In addition, TU Delft was in the top 25 of five subject rankings, and was ranked 20th in the broader research field of Engineering and Technology.

Academic Ranking of World Universities (Shanghai Ranking)

In the 2017 Shanghai Ranking, TU Delft occupies a shared position of 151-200 (the same as 2016). The ranking is compiled methodologically based on the number of Nobel prizes awarded to staff members and alumni, the number of highly cited researchers, the number of articles published and the number of articles published in Nature and Science. In the 52 published subject rankings, TU Delft was ranked in 31 subjects, in the top 50 for 13 subjects and in the top 5 for four subjects.

Times Higher Education World University Ranking (THE Ranking)

In 2017, TU Delft occupies the 63rd place in the global rankings of universities, the World Rankings of Times Higher Education magazine. Last year, the university occupied the 59th place. This makes TU Delft the second Dutch university in the list. In the 'THE World Reputation Rankings', TU Delft occupies a position between 51st and 60th place, as it did in 2016. In the more specialised 'THE Top 100 Engineering and Technology' ranking, TU Delft occupies the 18th place.

CWTS Leiden Ranking

The 2017 CWTS Leiden ranking describes the scientific impact of more than 900 (previously 750) leading universities throughout the world based on bibliometric data. In the category of 'All Sciences', TU Delft occupies the 44th place, with 1.9% of all TU Delft publications in the most quoted 1% of publications (the 'PP top 1%'). Of all TU Delft publications, 14.4% are in the top 10% most cited publications, earning it the 67th place in the PP top 10%. For collaboration with the industry, TU Delft is in 18th place, with 9.7% of its publications written in collaboration with the industry.

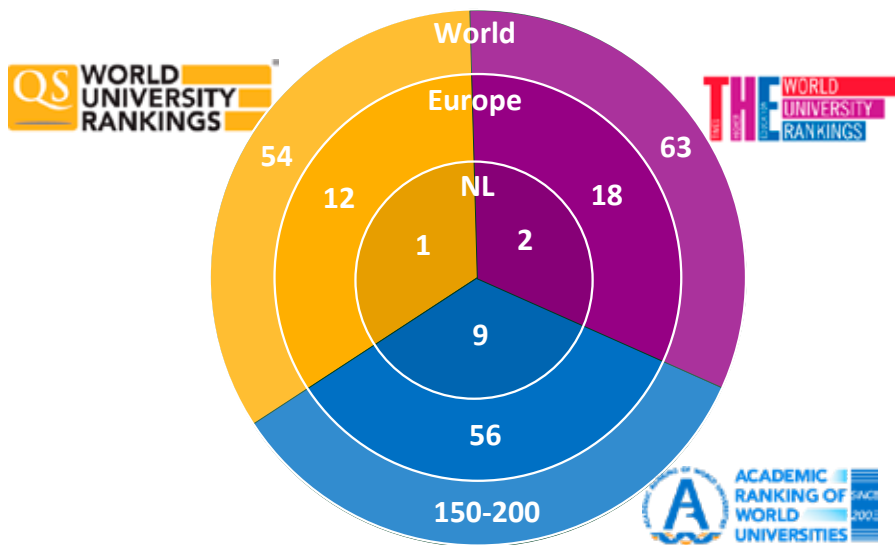


Figure 9: Position TU Delft in World University Rankings

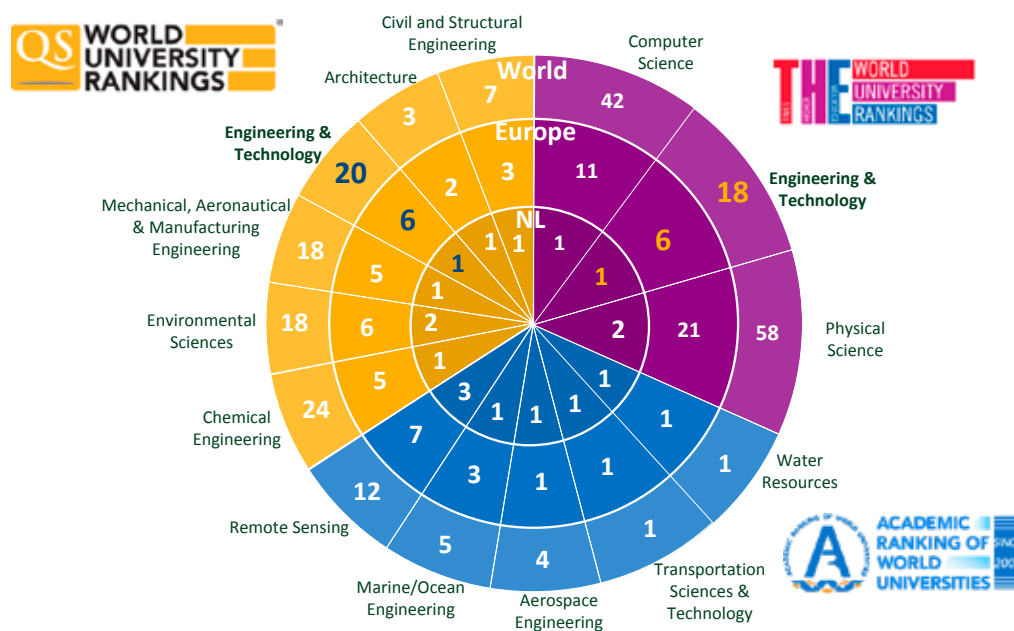


Figure 10: Position TU Delft in Subject Rankings

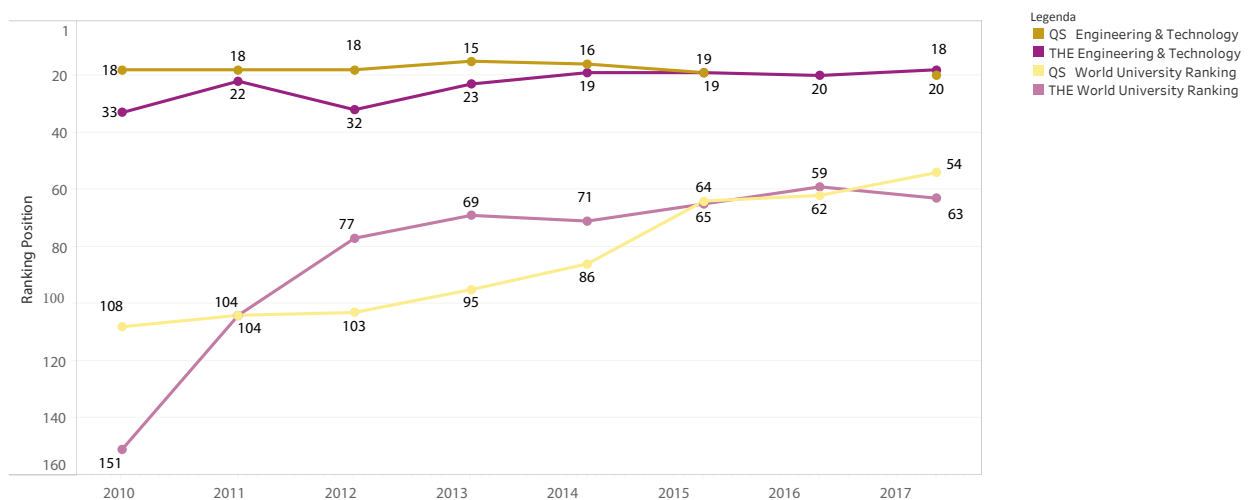


Figure 11: Position of TU Delft in the QS and Times Higher Education Ranking, the World University Rankings and the Engineering & Technology Rankings respectively

3.6 Research funding

This section includes several examples of research projects that were awarded funding in 2017 from Dutch or European sources, or from grants or contract research. These funds are classified as income from indirect or contract funding.

Income from government funding 2017	464,5 M€
Income from indirect funding 2017	52,5 M€
Income from contract funding 2017	143,2 M€

Funding from sources in the Netherlands

In 2017, TU Delft scored well in terms of NWO grants. The Public-Private Partnership Allowance from the Ministry of Economic Affairs is becoming an increasingly important source of funding for TU Delft.

NWO grants

Innovative Research Incentives Scheme grants and the Rubicon programme

The NWO Innovative Research Incentives Scheme provides personal grants to talented researchers for the purpose of ground-breaking research on topics of their own choosing. There are three types of funding: 1) Veni (€250,000), 2) Vidi (€800,000), 3) Vici (€1.5 million). In 2017, 14 researchers from TU Delft received NWO grants as part of the Innovative Research Incentives programme. The NWO Rubicon programme provides researchers who recently completed their doctorates the opportunity to conduct research at a leading research institute abroad, in the country of their choice. Four scientists from TU Delft received Rubicon grants in 2017. A list of grants awarded through the Innovative Research Incentives Scheme and the Rubicon programme is provided in Appendix 2.

Gravitation programmes

In 2017, the NWO awarded funding to six gravitation programmes. Scientists from TU Delft are participating in three proposals.

- Prof. M. Dogterom (AS) is coordinating the programme BaSyC-Building a Synthetic Cell;
- Prof. P.M. Sarro (EEMCS) participates in the proposal Netherlands-Organ-on-a-Chip-Initiative which is coordinated by the LUMC;
- Prof. R. Hanson and Dr. S.D.C. Wehner (both AS) participate in the QuSoft-programme which is coordinated by the Centrum Wiskunde & Informatica (CWI).

Perspective programmes

In November, NWO awarded three perspective programmes to scientists from TU Delft. This programme provides large consortia of companies and knowledge institutions with the opportunity to conduct large-scale research programmes. The coordinating universities and awarded initiatives are as follows:

- Prof. F.C.T. Van de Helm (3mE) - Citius Altius Sanius - Injury-free exercise for everyone;
- Prof. I.N. Richardson (3mE) - Additive Manufacturing for Extra Large Metal Components (AiM2XL);
- Prof. H.P. Urbach (AS) - Lensless Imaging of 3D Nanostructures with Soft X-Rays (LINX).

Take Off

The NWO Take Off programme provides resources for the early-stage funding of innovative enterprise and entrepreneurship in universities. Applications for Take Off funding can be submitted for Phase 1 (feasibility study, €40,000) and Phase 2 (early-phase track, risk-bearing monetary loan of €250,000). In 2017, 19 Take-Off feasibility studies were awarded to TU Delft researchers. Eleven entrepreneurs were granted early-phase trajectory funding based on research conducted at TU Delft. A list of awards for the feasibility study (Phase 1) of the Take Off programme is included in Appendix 2.

Other NWO awards

In 2017, seven TU Delft scientists received awards within the open-technology programme of NWO. These awards make it possible to conduct research on scientific and technological themes of the scientists' own choosing. Prof. R.L. Lagendijk (EEMCS) received an award of €2.5 M in 2017, within the framework of a national programme on Responsible Value Creation with Big Data.

Top Sectors

TU Delft has remained active in the Top Sectors of Water, Chemistry, Energy, High-Tech Systems and Materials (HTSM) and the Creative Industry. NWO's 'top sector'-related call for proposals yielded more than 40 projects in top sectors including Water and the Creative Industry.

Public-Private Partnership Allowance (PPP allowance)

The PPP Allowance is a financial resource relating to the Top Sectors, and is awarded on top of direct investment by businesses in public research activities. TU Delft received a PPP allowance of €2 M for seven projects within the top sector HTSM. Within these projects, the business community is contributing an additional €2 M. The projects are being conducted in the faculties 3mE, AS, EEMCS and AE, in collaboration with the companies Jeol, ImplantCast, Océ, Zodiac Aerospace, Thales and Fokker. In addition, the TNW faculty received a PPP Allowance of €700,000 within the Chemistry top sector. These funds are being used for new PDEng positions, as well as for a collaborative project with Arkema. In the latter project, Arkema is investing an additional €480,000. The Biotechnology department of the AS faculty received a PPP Allowance of more than €730,000 within the PPP Biobased Industries programme for its research collaboration with Heineken. Heineken is investing €3 M of its own funds in the project. TU Delft is still entitled to more than €7 M in PPP Allowance funding within the top sectors HTSM, Chemistry, Energy and the Creative Industry. It is currently developing new projects within this context, with an equivalent share of private funding.

European funding

In its 2012-2018 strategic plan, TU Delft acknowledges the existence of major opportunities through 2020 for the funding and development of research groups through the European Union's Horizon2020 Framework Programme. Funding through this programme has proved to be necessary, given the limited nature of the Top Sector policy and the discontinuation of the Economic Structure Enhancement Fund (FES). Successes in the Seventh Framework Programme (FP7, the precursor to H2020) turned out to be a solid foundation for acquiring Horizon2020 funding.

The European Commission (EC) completed the interim evaluation of Horizon2020 in 2017. This evaluation also serves as the starting point for the design phase for the next Framework Programme. The EC report LAB-FAB-APP on maximising the impact of EU research-and-innovation programmes will serve as a directive for the future of

EU funding. TU Delft has great ambitions with regard to FP9 (the Ninth Framework Programme, successor to Horizon2020). An internal evaluation shows that TU Delft receives high scores on the acquisition of EU funding in the area of Excellent Science, including funding from the European Research Council (ERC) and the Marie Skłodowska Curie Actions (MSCA). The results further indicate that TU Delft is often chosen to be in charge of the coordination of project consortia. With regard to the acquisition of EU funding, TU Delft ranks in the top 10 at the EU level, and in first place for the Netherlands.

Themes	Under contract or under negotiation	Volume of projects under contract (Euro)
Excellent Science (ERC, MSCA, FET, Res. Infra)	117	86.042.918
Societal Challenges	64	28.636.314
LEIT	19	11.625.076
JTIs (SESAR, Clean Sky 2)	22	7.115.790
Cross cutting	2	2.964.056
EURATOM	6	2.394.541
Science with and for society	2	627.745
Spreading Excellence/ Widening	1	162.120
Fast Track to Innovation	1	160.714
TOTAAL	234	139.729.274*

Figure 12: Overview of results EU research funding 2017

* The data in this table is excluding EIT contracts and regional funding (EFRO, InterREG, etc.)

Management of large-scale EU projects

The large-scale EU projects coordinated by TU Delft include ROSIN and TWIGA.

ROSIN

ROS-Industrial quality-assured robot software components develops open-source robot software. Half of the budget is available for industrial (or other) parties wishing to contribute to the development of applications. This brings smart industrial robots within reach for companies. Each group of European parties (companies and institutions) can come forward with a good idea for a 'Focused Technical Project' or a new educational activity for ROSIN. A budget of €7.6 M has been allocated for ROSIN through the Horizon2020 programme.

TWIGA

Transforming Weather and Water Data Into Value-added Information Services for Sustainable Growth in Africa (TWIGA) aims to develop, use and demonstrate a number of technologies for interoperable and efficient in-situ observation systems in Africa. These in-situ observation systems will form the backbone of an infrastructure that allows the storage of earth-observation data. This will create additional information facilities that can be used to address social challenges including the impact of climate change and shortages of water energy and food, in addition to realising economic growth in Africa and Europe. A budget of €4.9 M has been allocated for TWIGA through the Horizon2020 programme.

Providing the proper support requires specialisation in specific European subsidies. For example, in 2017, additional attention was devoted to the Knowledge Innovation Communities (KIC) of the European Institute for Innovation and Technology.

Fall asleep with Somnox



Somnox, a start-up of four former students of TU Delft, is ready to go to market, following extensive testing. Somnox is a robot that helps people with sleeping problems. By recording the user's breathing pattern and through a simulated breathing rhythm, soothing sounds and affection, Somnox helps the user to calm down and fall asleep. On 14 November, Somnox appeared on Kickstarter, a platform where start-ups can set up crowd-funding campaigns. The students behind Somnox, who are from different faculties at TU Delft, came up with the idea for the sleep robot during the interdisciplinary minor in Robotics. The Faculty of Industrial Design Engineering's Startup Voucher made it possible to create the first prototypes of Somnox in 2015. Through the campaign on Kickstarter, Somnox has now raised funds to start the actual production. The first sleep robots have also been pre-ordered through Kickstarter.

3.7 Valorisation indicators 2017

The Dutch universities formulated their valorisation objectives in their performance agreements with the Ministry of Education, Culture and Science in 2012. Following on from this, each university has developed its own valorisation indicators to measure performance. The following valorisation indicators were established in 2015, along with the other Dutch universities of technology, and they have been published in the annual report since 2016. This set of indicators provides a quantitative overview of the valorisation activities TU Delft. Qualitative images are available at the TU Delft website and in the Home of Innovation Magazine: www.tudelft.nl/en/technology-transfer/.

Proportion of funding	
Government funding	464,5 M€
Indirect funding	52,5 M€
Contract funding	142,2 M€
Internships and graduation projects for non- university institutions	
Master	825
PDEng	21
Co-publications with companies	
CWTS Leiden Ranking – University Industry Co-publications	#18
Proportion of publications with one or more companies as co-author	9,7%
Intellectual property	
Number of invention disclosures	103
Number of patent applications	52
Number of transfers	14
Number of transfers	11
Business activity	
TU Delft spin-off with TU Delft IP	7
Startups - TU Delft founded, without TU Delft IP	16
Startups - by third parties, with TU Delft IP	0
Ancillary activities	
ber of professors with non-academic ancillary acitvities	141
Entrepreneurship education	
Entrepreneurschip minors (30 EC)	122 students / 3660 EC
Additional Entrepreneurship courses (5-8 EC each)	269 students / 1517 EC
Total EC entrepreneurship education	391 students / 5177 EC
Alumni careers	
Percentage of alumni employed by non-academic organisations	81,8%

Developing the airport of the future



Innovation Airport is a university-wide initiative aimed at creating and developing innovative concepts and sub-concepts for airports. This is achieved by encouraging knowledge exchange and collaboration between all faculties, industry, government and research partners. Innovative and interdisciplinary research projects are set up jointly in living-lab environments. Innovation Airport collaborates closely with partners, including the Schiphol Group and NACO. A living lab was started at Rotterdam The Hague Airport, where research work and new concepts can be tested and developed further. Since the lab was established, multiple research and education projects focusing on efficiency, safety, baggage and emergencies have been linked to it. The research programme will be expanded in 2018, and efforts will be devoted to establishing an 'Airport Industry Chair'.

Intellectual Property

Scientific research often results in new technological processes, findings and designs. Intellectual Property (IP) rights play an important role in the effective exploitation of these innovations. TU Delft guides researchers in the establishment, management and marketing of patents, in addition to providing legal and other types of advice, information and support for business development with regard to licences and national or international contracts, including software and mark/model registration.

Patents

A selection of patents is available at the website patent.tudelft.nl. In 2017, 103 inventions were reported internally, and 52 new patent applications were submitted. In addition, 19 contracts were concluded on the basis of one or more patents from the TU Delft patent portfolio, and 24 patents were commercialised. The following are examples of the use of Intellectual Property this year.

Transfers

As part of the renewed collaboration with Royal HaskoningDHV (RHDHV) relating to the NEREDA waste-water purification technology, four patents involving the extraction of valuable biopolymers from organic sludge were transferred. The reprocessing and use of these biopolymers are a central element of a TIPP¹ project aimed at the development of the value chain. These biopolymers are expected to give rise to a new generation of 'green engineering building blocks' in many areas of application. The NEREDA technology was developed by TU Delft, and it is exploited by RHDHV.

Licences

TU Delft has concluded a licence agreement with NGCM B.V. for the exploitation of a mix of biopolymers and nano-clay as a 'curing compound' for concrete. It can significantly extend the lifespan of the concrete, thereby having a major positive impact on the reduction of CO₂ emissions. In Delft, the construction of the new parking garage for the Reinier de Graaf Hospital was treated with this product, much to the satisfaction of those concerned.

Entrepreneurship

In the past year, the Delft Centre for Entrepreneurship worked on the further development of entrepreneurship education for TU Delft. These efforts consisted primarily of the further development of a thematic programme of entrepreneurship education for Master's students and improving the alignment between these types of programmes and the technical disciplines within the faculties. There are currently two programmes, with the themes 'Entrepreneurship in a Digital Society' and 'Entrepreneurship in the Health Sector'. The two other themes, 'Entrepreneurship in Emerging and Developing Countries' and 'Entrepreneurship for a Sustainable Society' are under development, and they will be explored as supplementary topics in the coming year. Each thematic programme consists of a basic course in entrepreneurship, a Business Development Lab and an entrepreneurship-related elective module (5 credits each). This is followed by the possibility of adding an entrepreneurship-related elaboration to the Master's thesis, for which the student can receive an endorsement.

This thematisation is supported by the development of online content through Massive Open Online Courses and other media. For example, in the past year, the MOOC on 'Entrepreneurship for Engineers' was offered within the 4TU framework, while the MOOC on 'Entrepreneurship for Global Challenges in Emerging Markets' will start in 2018. In addition to the development of online content, the DCE builds substantive knowledge on entrepreneurship within the various themes. Research on the start-ups and the organisations that facilitate start-ups will contribute to the further expansion of expertise in these themes, thereby enhancing the relevance and currency of education.

¹ For additional information on the TIPP, see Section 3.2.4 on 'Collaboration with companies'.



4

People & Organisation

4.1 Introduction

People are central to TU Delft. They are the alpha and omega of everything we do. That is why we find it so important to attract people who fit at TU Delft and match our ambitions. We were strongly committed to this goal again in 2017. For our academic staff, we further enlarge the possibilities to pursue a variety of career paths linked to the various goals and values of TU Delft: research, education and innovation. Also for our support staff, we will further expand the options for personal and professional development aimed at sustainable employability. Openness and diversity are our guiding principles in this regard (see Section 4.3). In 2017, we devoted considerable effort to recruiting more women, particularly through the Delft Technology Fellowship programme, which offers high-profile tenure-track positions to top female scientists. Currently, women form 25% of our academic staff (including doctoral candidates), and we are committed to further increase this percentage in the coming years. We also have been actively enhancing and extending our international profile and presence. This has resulted in an increased number of international students (20%) and academic staff (54%).

To provide optimal support to our people, one of our priorities is to improve the quality of our professional services. The aim is to provide our customers – students, staff members and external clients – with a clear point of contact. This ‘one-stop shop’ for all requests should be simple and effective, but equally important is the personal touch. This year, initial steps were taken to establish ‘integrated services’, to which people can turn with all requests for support services (see Section 4.2).

Another important challenge lying ahead of us involves the redevelopment of our campus. This redevelopment has been necessitated by the technical state of the buildings and the increasing numbers of students. A large number of renovations and new construction projects were carried out in 2017, including the energy-neutral Pulse and Echo buildings, which were specially designed for state-of-the-art teaching (see Section 4.7). Our vision is that of a ‘Delft UniverCity’ that enhances cooperation between the University and our surroundings in order to foster economic, social and technological innovation as drivers for building a smart, sustainable and inclusive society. In this regard, we signed a covenant with the City of Delft in 2017, thereby joining forces on matters such as mobility, urban planning, accommodation for international staff, students and companies as well as strengthening the existing movement towards more societal involvement (see Section 4.10).

In our research and education at TU Delft, we collaborate with partners from all around the world, as well as with partners much closer to home – the Province of Zuid-Holland, the Port of Rotterdam, the Metropolitan Region Rotterdam The Hague (MRDH), the Economic Board Zuid-Holland (EBZ) and the InnovationQuarter, as well as our academic colleagues at The Hague University of Applied Sciences, InHolland and our LDE partners in Leiden and Rotterdam (see Section 4.10). ‘Coming together’ is an important principle at TU Delft. We will need all of these partners in order to achieve our ambition to have ‘impact for a better society’ in the coming years.

4.2 Organisational developments and personnel changes

Organisational developments

On 30 April 2017, the Supervisory Board decided to change the TU Delft governance model effective 1 January 2018. From this date, the position of Rector Magnificus will be combined with the role of President of the Executive Board. The new model provides for an Executive Board consisting of three members: a Rector Magnificus/ Executive Board President, a Vice-Rector Magnificus/Vice-President for Education (and vice-chair of the Executive Board) and a Vice-President for Operations. Strategic considerations underlying the decision to adjust the administrative model include the rise in student numbers, TU Delft's complex real-estate challenges, the provision of transparent management of the support services and boosting international recognisability. The Board took this decision after consultation with the Executive Board, the Council of Professors, the Deans of the Faculties and the Directors of the University Services. The Supervisory Board formally requested advice from the combined Participation bodies (Works Council/Student Council), partly in view of the Enhanced Governance Powers (Educational Institutions) Act, and they issued a positive recommendation on this matter. On 17 November, the Supervisory Board announced that Nicolay Vermeulen would be appointed Vice-President for Operations (VPO) in the Executive Board as of 1 January 2018.

Employee survey

A university-wide employee survey – the TU Delft Employee Monitor – was conducted in late January 2017. This survey addressed issues including employees' perceptions of their work, as well as work load, vitality and internal support. Almost half of all employees (45%) responded to this request to contribute ideas on these important themes. Employees gave TU Delft a score of 7.8 (out of 10) as an employer and a score of 7.4 for working at TU Delft. Employees see TU Delft as a safe campus, with enthusiastic employees who have an international orientation and support the ambitions of TU Delft. The survey also identified several points of concern. For example, some members of the academic staff reported experiencing work pressure that was higher than desirable, while interpersonal relations within the university continue to require attention and the climate conditions in a number of workspaces are in need of improvement. The survey outcomes led the steering group to start a collaboration with the 'work pressure' working group in order to create a University Plan of Action describing a 'six-point plan' for a culture of good health and safety. This plan has been submitted to the participation bodies for consent.

Integrated Services

In a rapidly changing world, TU Delft wants to maintain its leading position in education and research. This will call for a high level of quality on the part of the University Services. In addition, demand is increasing for integrated, cross-departmental services: a 'one-stop shop' for services. An Integrated Services programme was started in 2017, with the ambition to start using the Integrated Services matrix organisation on 1 January 2018. The departments of FMRE, Finance, E&SA and HR participated in the pilot. The desired outcome of the Integrated Services programme is a higher level of quality in services, as measured in terms of effectiveness and cost reduction. Effectiveness refers to such aspects as a good customer experience; quick, expert service; and simplicity of control, using integrated dashboards and reports. It should be expressed in the optimisation of various processes, in the yield on investments in technology and systems and in the use of best practices.

Personnel changes

Anka Mulder leaves TU Delft

On 2 October, it was announced that Anka Mulder would be resigning as Vice-President for Education & Operations (VPEO) with effect from 1 January 2018. She will continue her career as President of the Executive Board of Saxion University of Applied Sciences. Anka Mulder took office as the VPEO of TU Delft on 1 April 2013.

Luc Soete becomes new member of the Supervisory Board

With effect from 1 May 2017, Prof. Luc Soete was appointed as a member of the Supervisory Board by the Minister of Education, Culture and Science. Luc Soete was Rector Magnificus of Maastricht University from 2012 to 2016.

Dean appointments

The Executive Board appointed three new Deans in 2017. With effect from 1 January, Prof. Lucas van Vliet was appointed as Dean of the Faculty of Applied Sciences, where he had served as interim Dean since 1 May 2016. With effect from 1 December, Prof. Hans Wamelink was appointed as Dean of the Faculty of Technology, Policy and Management (TPM). With effect from 1 June, Prof. Henri Werij was appointed as Dean of the Faculty of Aerospace Engineering (AE).

4.3 Diversity & inclusion

One of the five core objectives of the HR strategy is to develop a talent pool that is as diverse as possible. At TU Delft, we believe it is very important to have an organisational culture in which a wide variety of talented individuals feel at home and are able to fulfil their potential. TU Delft is keen to reflect society, and is therefore actively committed to diversity in the broadest sense of the word. This means that our policy focuses on stimulating diversity in aspects ranging from age, ethnicity and gender to less obvious ones such as social background and sexual orientation. In 2008, TU Delft was the first university to sign the 'Talent to the Top' Charter, an initiative of the Dutch government and the Social and Economic Council of the Netherlands (SER). Professor Rinze Benedictus (AE) was appointed Diversity Officer at TU Delft in September 2017.

National Network of Diversity Officers

TU Delft participates in the regular meetings of the national Diversity Officers, in which knowledge and expertise is shared with regard to diversity and inclusion. Joint initiatives are started as well, as was the case with last year's guest lecture by Professor Estela Bensimon of the University of Southern California on inclusiveness, how it leads to better performance, what approach works to increase inclusiveness and the results that it yields.

Tech@workplace pride

To draw attention to lesbian, gay, bisexual, transgender and intersex (LGBTI) role models in a technological environment, TU Delft organised a pride event in Delft on 15 May 2017, in cooperation with Workplace Pride. Staff members and former students shared stories about their experience of coming out as LGBTI in a technological environment: what is to be expected and what the environment can do to promote a sense of inclusion.

Coming Out Day

On 11 October 2017, staff members and students celebrated Coming Out Day on the TU Delft campus by attending a lunchtime lecture and joining a parade. Coming Out

Day is intended to emphasise that people should be able to be themselves throughout the year, as an encouragement to various groups, including lesbian, gay, bisexual, transgender and intersexual (LGBTI) people.

Training programme: 'Awareness in selection processes'

A higher level of inclusiveness in the recruitment and selection of staff members and students is among the objectives of the Diversity & Inclusion programme. To this end, all selection committees for professor appointments and the committees involved in the Delft Female Fellowship have received training in the inclusive recruitment and selection of scientific talent. Attention to mechanisms for inclusive recruitment and selection were embedded in the programmes on offer and the appointment policy at TU Delft.

2017 Delft Technology Fellowship

The third Delft Technology Fellowship recruitment round was held in the autumn of 2017. The aim of this programme is to increase the number of top female scientists.

2017 Westerdijk Talent Grant

In early 2017, Minister Bussemaker announced the allocation of €5 million for the appointment of 100 additional women professors at the Dutch universities. TU Delft was asked to appoint six women as professors in the period from 10 February 2017 to 10 February 2018 – the 'Westerdijk Year'. The EB has decided to allocate the €50,000

Workplace Pride Leadership Award for EB member Anka Mulder



In 2017, Anka Mulder, Vice-President for Education and Operations, received the leadership award from Workplace Pride in the category of 'most effective ally'. She was praised for her efforts to bring more women students and scientists to TU Delft. She has spoken out in public about the necessity of diversity in the workplace, in addition to promoting such activities as Coming Out Day. The systematic attention that has been drawn to these matters has resulted in the incorporation of diversity and inclusion into the university agenda.

grant made available by the Minister to all women appointed as professors at TU Delft in the period from 10 February 2017 to 10 February 2018. If more than six women are appointed, TU Delft will fund this from its own resources.

4.4 Integrity

Human Research Ethics Committee (HREC)

In 2017, the interfaculty HREC discussed more than 200 proposals for research involving human subjects, an increase of around 70% compared to 2016. This increase can be attributed to greater awareness and stricter regulations from the EU for subsidised projects. In the future, we will be working closely with the Data Stewards faculty to expand the guarantee of privacy and 'informed consent', partly within the framework of the new privacy legislation (the EU General Data Protection Regulation). In addition, faculties will be assigned responsibility for student research projects involving human subjects. Preparations to this end were made in 2017.

Integrity Coordination Group

The Integrity Coordination Group (CI) ensures continuing attention to the topic of integrity and the Code of Ethics on the part of staff members, doctoral candidates and students. In cooperation with the departments of HR and E&SA, integrity and ethics are addressed in the introduction programmes for staff members and doctoral candidates, as well as for students during Welcoming Week ('Owee'). Current staff members are also requested to attend to these matters, through target groups including the Departmental Directors and Directors of Education. Ethics has also been incorporated into the Bachelor's degree programme teaching, as well as in the Master's degree programme (starting with the 2018/2019 academic year).

4.5 Legal matters

Letters of objection and appeal

Any student or employee of TU Delft may file a complaint or an appeal against the university's decisions. The Executive Board makes a decision on objections after receiving advice from the Objections Committee for employees and other matters, or from the Student Affairs Committee. Students may submit letters of objection regarding rejections on the basis of the Graduation Support Scheme (RAS), as well as objections regarding enrolment, unenrolment or tuition fees. The letters of objection from employees concern legal status. Appeals from students and external students concerning the binding recommendation on the continuation of studies, exams, fraud, etc., are handled by the Examination Appeals Board in accordance with Article 7.60 of the Higher Education and Research Act. Based on the Doctoral Regulations 2014, doctoral candidates are able to field objections to decisions by or on behalf of the Board for Doctorates. Figure 13 displays the numbers of objections and appeals settled (84 and 145, respectively) in 2017, broken down by category and decision type. The number of cases submitted to the Examination Appeals Board has increased steadily (145 in 2017 compared to 115 in 2016, 97 in 2015 and 83 in 2014). One important reason is the continuing increase in foreign students lodging appeals against rejected applications for admission to the Master's degree programme (95 appeals in 2017 compared to 73 in 2016, 54 in 2015 and 33 in 2014). Many foreign students register at more than one university. In some cases it was no longer necessary to proceed with an appeal. This partly explains the large number of Examination Appeals Board cases that are withdrawn. The stricter procedure for amicable settlement is also a factor in

the large number of appeals that are withdrawn. The number of student cases remains more or less stable. The number of employee cases is stable as well, albeit with minor shifts in the categories of cases. In 2016, there were no cases involving dismissal or job appraisal, while there were respectively five and one cases in 2017.

Complaints

Academic integrity

A case submitted in late 2016 was dismissed by the EB, after the LOWI had issued a ruling: the complaint was largely inadmissible and, on one point, unfounded. With regard to a complaint from 2015, which was retained as it was still being processed by another university, a request was made in late 2017 to process this case at TU Delft. Two complaints were submitted in 2017, one of which was withdrawn and the other is still being processed.

Inappropriate Conduct

The Complaints Committee for Inappropriate Conduct (KOG) did not receive any complaints in 2017. The last complaint handled by the Complaints Committee for Inappropriate Behaviour (KOG) dates from 2014 and was submitted in 2013.

Other complaints

Legal Affairs received two complaints in 2017, both of which have been withdrawn.

Decision Category	Founded	Unfounded	Inadmissible	Withdrawn	Total
EAB (student)	7	16	1	121	145
Doctoral candidates	0	0	0	1	1
Student	7	25	13	18	63
Dismissal (employee)	0	2	0	3	5
Job evaluation (employee)	0	0	0	1	1
Remaining (employee)	0	3	0	8	11
Remaining, FOI	1	2	0	0	3
Total	15	48	14	152	229

Figure 13: Number of settled objections and appeals in 2017

Regulations

The Higher Education and Scientific Research Act (WHW)

Provisions in this law, which took effect on 1 September 2017, include more facilitation of joint education with foreign institutions. The current TU Delft practice involving the use of model partnership agreements will be continued. The new legal provision that 'mutual terms' can be used with regard to tuition fees for student exchanges will make such collaboration easier. The law also introduces the possibility of expanding the *ius promovendi*.

Expansion of the *ius promovendi*; changes to the Doctoral Regulations

The aforementioned legislation has made it possible to grant the *ius promovendi* to staff members with earned doctorates (other than professors) who the Board for Doctorates have deemed to possess sufficient competence, thus allowing them to act as promotor. It has been decided that associate professors can be nominated for the *ius promovendi*, as long as they meet certain criteria. The Deans nominated candidates to the Board for Doctorates, which decided to grant the *ius promovendi* to more than 170 associate professors. As of 1 January 2018, they will be able to act as promotor. The expansion of the *ius promovendi* made it necessary to amend the Doctoral Regulations and the associated Implementation Decree. The Board for Doctorates amended these two regulations on other points as well and readopted it with effect from 1 January 2018. Other amendments include: a procedure for continuing the *ius promovendi* of a professor after dismissal, subject to approval by the Board for Doctorates; multiple promotor for doctoral candidates; broadening the definition of who may be designated as a mediator in case of dispute; and a more general (gender-neutral) dress code for the doctoral defence ceremony. The 'Guidelines' for Joint Doctorates and the associated model contracts have been amended as well.

Revision of the model Faculty Regulations

The model Faculty Regulations have been revised, with the following as new elements: the establishment of the Graduate School, the appointment of an external member to the Board of Examiners and the new position of the Board of Studies, which entails aspects including a member-appointment procedure by the Dean, with extensive input from students. Department-related provisions were also revised to bring them in line with the 'Principal Investigator' model that is used in practice, with an important role for all permanently appointed members of the academic staff, and not only professors. The eight faculty regulations were approved by the EB.

RAS and the TU Delft Profiling Fund Scheme

The Graduation Support Scheme (Regeling afstudeersteun; RAS) has been changed for the 2017/2018 academic year with regard to the support component for students with unforeseen circumstances (e.g. illness, family circumstances). This change is the first to be part of a thorough review of the RAS as of 2018/2019, which will then be referred to as the new 'Profiling Fund' regulations. The current RAS will expire with effect from 2018/2019. One important change is that associations and organisations will be required to submit an application for recognition for a period of three years in order to be eligible for support from the Profiling Fund. In addition, budgetary provisions have been refined, and there is room for new initiatives.

4.6 Safety

TU Delft is committed to providing a pleasant, safe and secure environment in which to work and study. Safety and Security is an approach for managing all incidents and safety risks. Each year, TU Delft compiles a Safety Profile and a Progress Report. The TU Delft safety-risk level is decreasing gradually, reflecting national trends in this area. With regard to campus-related design safety, a programme has been started with Facility Management & Real Estate (FMRE) to organise safety in relation to campus development at an early stage. The main focus areas and activities in 2017 were:

Crisis training

Crisis-management training courses are offered throughout the university. In addition, the first step was taken towards setting up a 24/7 first-response team, in line with the Central Crisis Organisation.

Safety abroad

Work has begun on an integrated safety policy design for external mobility for students and staff members. In the process, we are considering the proactive policy (who is going where, how safe is it and whom should we notify if the country of residence has become unsafe) that will apply to all students, as well as the reactive policy that is initiated in case of emergencies and calamities abroad. A special safety policy and a training cycle have been designed for the DREAM teams. In response to a safety inspection at TU Delft project sites in India and Kenya, a project has been launched that involves the inclusion of safety criteria in agreements with foreign institutions. In all, 496 students (in many cases, students travelling to dangerous areas) have taken a training course.

Awareness

An e-learning module has been developed within the framework of the Campus Safety Knowledge project. This module provides new staff members and students with a light-hearted presentation of a large amount of safety topics. In February, an awareness campaign entitled 'Everyone can help' was held, with the focus on maintaining a clean and liveable campus environment and drawing more attention to digital security. The campaign also focused on fire-hazard situations and escape routes during 'Peak Month September'.

Nucleaire security

In consultation with the government and on an ongoing basis, the university monitors and optimises nuclear safety (e.g. within the framework of the OYSTER project of the Reactor Institute Delft [RID] and for the Holland PTC proton clinic).

Research

TU Delft attaches great importance to having a safe study and work climate for students and staff members. To this end, the causes and facts of safety (and other) incidents are investigated, as are suspected inappropriate conduct or other undesirable behaviour. Nine investigations have been conducted, leading to specific measures in some cases.

4.7 Campus and real estate

Campus developments

The TU Delft is working to build an affordable 'living campus', in accordance with its real-estate strategy. A campus with outstanding facilities set within a challenging, inspiring and pleasant environment. To this end, TU Delft is overhauling its campus,

focusing on sustainability and improved utilisation of existing spaces, in order to add quality to new forms of education and research. In addition, TU Delft will leave a number of buildings (or parts thereof), thereby reducing the total number of square metres. The TU Delft campus will provide an even greener and pleasant park-like environment for studying, working and relaxing. An updated real-estate strategy will be adopted to bring the ambitions for a high-quality campus in line with current developments (e.g. the growing number of students and staff members), developments relating to research and their financial implications. Projects are defined and carried out within five campus area developments, thereby allowing comprehensive considerations to be made, from TU North down to the central area and TU South. In all, 90 projects were developed or carried out in 2017. Together, these projects will run through 2025.

Classrooms

To accommodate the increase in the number of students and the resulting pressure on classroom space, it has been decided to develop a second teaching building in addition to the Pulse interfaculty teaching building. Named Echo, this building offers space for 1340 teaching spaces in various forms, 300 study places and a food-service facility. Education is constantly evolving. TU Delft aims to support and encourage lecturers to reflect this. To this end, the Teaching Lab has been realised (see also page 39). In addition to new construction, improvements are made at the level of the existing lecture halls. Starting in 2016, and spread over several years, dozens of classrooms are being equipped with new audio-visual systems, ICT systems and, if necessary, new furnishings. More than 40 lecture halls were renovated in 2017. The number of study places is also being increased throughout the campus.

Accommodations for the faculties of EEMCS and AS

In late 2015, the Executive Board decided that the high-rise building would no longer be used to house the Faculty of Electrical Engineering, Mathematics and Computer Science (EEMCS). In 2017, projects were carried out to accommodate the users of the high-rise building in other buildings. For example, in late 2017, the Mathematics and Computer Science departments were relocated to the office building on Van Mourik Broekmanweg, which had been renovated for this purpose. In this building, considerable attention was paid to the need for privacy and concentration, as well as to encouraging contact and interaction between users, research groups and departments. A part of the Faculty of Applied Sciences is accommodated in buildings that are at the end of their technical and operational lifespan. In 2017, the EB took a range of decisions allowing for the further development of Campus South, thereby locating all departments of the Faculty of Applied Sciences closer to each other to fulfil a long-cherished dream of the faculty. The partnership between TU Delft and TNO for the development of quantum technology – QuTech – is also included in this area development. The new construction will be located in close proximity to the Reactor Institute Delft (RID) and the faculty's other new buildings, which have already been completed: Applied Sciences South (TNW-Zuid). Construction on the new building for the Catalysis Lab was also started in 2017. In addition to facilitating collaboration within Applied Sciences, these developments are bringing more life to the area. This will be beneficial for TU Delft, as well as for the further development of the Science Park and the recruitment of additional companies.

Laboratories

In 2017, the Executive Board decided to continue the renovation of the Electrical Sustainable Power Laboratory (ESP Lab). The ESP Lab is unique throughout the world. This large, modern, dynamic and efficiently combined laboratory serves the Department of Electrical Sustainable Energy (ESE) in the Faculty of Applied Sciences. The Van Leeuwenhoek Laboratory for Advanced Imaging Research (VLLAIR) was completed for Applied Sciences in 2017 as well. This lab contributes significantly to the

development of innovative microscopes and other imaging tools, thereby rendering a major contribution to international research. In 2017, the EB also made the provisional decision to add two new classrooms: one cleanroom facility on Campus South (which is essential for the Faculty of Applied Sciences and which can be used by local businesses) and one cleanroom mid-Campus (a new facility for the Faculty of EEMCS; previously housed at the Else Kooi Lab). The demands and conditions emerging from the various types of research were so varied that they could not be combined.

Science Park

The valorisation of knowledge is one of the university's core activities. To this end, it is important for the university to be surrounded by an ecosystem of knowledge and economics, in which science and the business community work together. Physical proximity can add value. To facilitate the emergence of such an ecosystem, a unifying Science Park organisation was launched in 2017, operating between the departments of FMRE and Valorisation.

The location of businesses on the campus to the south of Kruithuisweg is proceeding more slowly than expected. In 2017, it became obvious that, for various reasons, the proposition did not meet the needs of the businesses. Opportunities for stronger positioning were identified based on interviews with companies located at the Science Park and elsewhere, along with market analysis, reference study and a second opinion. These opportunities will be translated into a new development framework and a strategy for marketing and communication. The TU Delft's intention to reinforce the academic axis around the Kluuverpark provides an additional stimulus to this end.

Every effort is being made to accommodate companies in existing properties on the campus. The Microsoft QFab Delft is being developed in the Applied Sciences faculty building as part of the partnership agreement with Microsoft. Several companies are located in RoboValley, while some have been housed in YES!Delft Labs due to a lack of space elsewhere. The Applikon Biotechnology company has expanded its existing location on the campus.

Sustainable accessibility

The number of students, scientists, visitors and staff members at the university and the established businesses is growing. The maintenance of accessibility and traffic safety on the campus is an important condition for large-scale renovation and development. The principles established in 2017 to underpin the vision on mobility can serve as an important guideline in this regard. Consistent with the ambition of TU Delft ('impact for a better society'), considerable attention is being devoted to the theme of sustainability in traffic and transport. The aim is to reduce vehicle mobility by 10%. In the coming years, we will be investing in the concentration of parking spaces in order to reduce parking pressure and create space for an attractive campus and for expanding the cycling and pedestrian network.

The redevelopment of Leeghwaterstraat was completed in 2017. In this project, the underground infrastructure (cables, pipes and sewer system) were completely renovated, and the street was redeveloped as a cycling street, where cars are guests. This is also intended to contribute to the dispersion of cycling flows from the city to the campus. The construction of Coffee & Bikes was also started in 2017: an above-ground bicycle-parking facility with bicycle-repair shop. In collaboration with the Municipality of Delft, a pilot parking-regulation scheme was launched at the car park of the Faculty of Architecture and the Built Environment, in order to gain insight into the parking needs on campus, current usage and the effects of parking regulations. The first results are expected in early 2018.

Sports & Culture and food service

In accordance with the catering vision – healthy and varied food and beverages of good quality, and taking various budgets into account – TU Delft is shifting to a broader and more international product range, with more food-service suppliers spread across the campus. This will range from Food Markets and unstaffed coffee corners to Food & Beverage corners in the faculties. The tender for a new catering contractor was in late 2017, and the contract is expected to be awarded to the new party by early 2018. Space is also available for food-service establishments on campus under the management of external developers. For example, a SPAR University and several restaurants have been opened under the student-housing facility on Stieltjesweg.

The number of visits to Sports & Culture (S&C) has increased substantially in recent years, and it is continuing to grow. TU Delft is therefore expanding S&C with various new rooms, facilities, multifunctional classrooms and office space. Construction on the new structures connecting the various buildings and components made steady progress in 2017. In addition to the physical connection between the buildings, the future programming and activities will be better integrated. Along with the new construction, the existing complex is receiving a sustainable facelift. Multiple rooms, facilities and expansions were completed in 2017. The food-service facility 'Het Café' was thoroughly expanded and renovated, and it soon attracted many visitors.

Student housing

The growth in the number of students (and particularly international students) has created the need for a structural accommodations solution. TU Delft does not invest in dwellings, but is dependent on development partners for its housing activities. In 2017, the student housing on Stieltjesweg mid-Campus was completed, the former Deltares office was repurposed and a student housing tower was constructed next to it.

New maintenance strategy

The EB has agreed to streamlining the maintenance strategy to bring it more in line with the real-estate strategy by creating a differentiation in the level of maintenance for the various types of buildings. In addition, the number of parties in the tender for the maintenance contracts has been reduced to two. Together, they are responsible for the maintenance and operational performance of all buildings on campus. The Applied Sciences building is ahead in this regard, having received its own maintenance combination with a long-term contract upon completion. For the staff members of Management and Maintenance, the new maintenance strategy will entail a new way of working. Instead of operational management, the staff members will assess the contractors based on pre-specified requirements. Changes will also be noticeable in the faculties. In 2017, intensive preparations were made for this transition, which will take up a total of four years.

Facility Management to ICT

In late 2017, it was decided that the Facility Management (FM) department will become part of the ICT department. In the new set-up, ICT and FM will be able to collaborate within a single directorate as they work to improve the integration of services offered to all users. The new Campus and Real Estate department will also be able to focus fully on the complex real-estate challenges facing the university in the years ahead.

Work in progress on campus

In 2017, a great deal of work and construction took place on campus.





4.8 Sustainability

The Sustainability Meeting was established in 2017 in order to achieve the sustainability objectives. In this body, frameworks are constructed for developments and projects, options are weighed, schedules of requirements and designs are tested, and sustainable innovations are encouraged. It is gaining an increasingly important role within the department of Real Estate. The effects are already visible. One example is the former TNO building on Van Mourik Broekmanweg, which is now being used by Mathematics and Computer Science (EEMCS). Here it was determined how the existing building's energy performance could be improved in a short time. In the new Echo teaching building, the focus is on energy neutrality and the sustainable development of the surrounding area.

TU Delft Green Office

The main tasks of the Green Office include providing support to making the campus more sustainable, as well as involving education and research activities in this effort. The living-Lab approach definitely gives TU Delft an edge over other universities. At the request of the International Sustainable Campus Network, the Green Office (in cooperation with MIT and other parties) helped to establish an approach for an internationally usable framework for effectively positioning university stakeholders for Campus as a Living Lab. This framework will be tested in Delft and other locations. In the coming year, the new Green Office student board, which took office on 1 September 2017, will be devoting explicit attention to improving the visibility of the TU Delft Green Office, particularly amongst students.

TU Delft in 22nd place in the UI GreenMetric ranking

In 2017, the sustainability developments taking place at TU Delft were reported to the UI GreenMetric World University ranking, a sustainability ranking system for universities from countries around the world. This resulted in the university ranking 22nd among the 619 participating universities. Sustainable applications are a precondition for the large-scale renovation of our campus, and the primary objective is CO₂ neutrality. Ways in which we are working to achieve this include reducing energy usage, using sustainable sources of energy, re-using materials and becoming independent of gas.

Pulse

Construction work on the energy-neutral teaching building began in 2017. The building was equipped with 750 m² of solar panels, in combination with underground geothermal storage and a triple-glazed façade. The various spaces in Pulse are ventilated, lighted, cooled and heated by an intelligent usage-based building-management system. The façade openings are designed to take optimal advantage of daylight. This reduces the need for artificial lighting, thereby also reducing energy consumption. Mobile telephones, laptops and LED lighting are DC-powered. The majority of the power needed will soon be generated by the solar panels installed on the roof of the new building. This DC grid type is unique in the field of utility construction. An important engineering role is reserved for the DC systems, Energy Conversion and Storage research group in the EEMCS faculty.

Wind energy

Reducing campus CO₂ emissions for TU Delft's energy supply is one important track in the TU Delft sustainability approach. Beginning in January 2017, TU Delft has been purchasing only sustainable electricity generated in the Netherlands: wind energy from one of six wind turbines in Eneco's Luchterduinen offshore wind park off the Dutch coast. Wind energy comprises more than 70% of TU Delft's electricity consumption, thereby reducing CO₂ emissions by 60%. The TU Delft objective for 2020 (-50% in CO₂ emissions) has already been achieved. At present, 36% of our energy demand

will be generated sustainably. This also exceeds the 2020 objective of 25%. Besides the purchased wind energy, TU Delft will be using electricity from its own low-energy CHP plant as well as a small amount generated by the large solar PV plant on the roof of the TU Delft campus. Because the electricity is generated in the Netherlands, it is actually green energy, rather than grey energy 'greened' by certificates.

LED lighting

Within the framework of the long-term agreements with the government concerning energy efficiency, the lighting on campus – both inside and outside buildings - will consist entirely of LED lights. This transition is already under way, and LED lighting has been installed in many locations in 2017. Where possible, existing fixtures have been converted instead of being replaced. This prevents a waste stream with a negative environmental impact from the manufacture of new fixtures. Part of the LED lighting that has been installed was produced in a socially sustainable manner by people with poor job prospects.

Water Resource Management

One part of the large-scale Leeghwaterstraat reconstruction included the replacement of the sewer system, which optimised the water resource management in the mid-western part of the campus, taking into account heavy rainfall, which is becoming more common due to climate change.

Reuse of demolition material

Buildings 44 (on Rotterdamseweg) and 96 (behind the CEG faculty) have been demolished. The resulting demolition material was used in the construction of temporary car parks on campus.

Future projects

For future projects, a specific TU Delft Energy-neutral Building Standard is being compiled, and special assessment methods are being integrated in order to determine the sustainability performance of buildings (BREEAM-NL-procedures).

Regional development and international collaboration

On 8 December, TU Delft became a signatory of the covenant for the Zuid-Holland Green Hydrogen Economy: Energy Island Goeree-Overflakkee (H2G-O) field lab. In combination with the Haven Industrial Complex, provincial sustainability developments are providing great connecting opportunities with education and research at TU Delft, which will be receiving further attention in the coming time.

4.9 Holdings: TU Delft Services BV and TU Delft Enterprises

TU Delft has two subholdings: Delft Enterprises and TU Delft Services. The TU Delft Holdings contribute to the realisation of the university's objectives insofar as their implementation occurs through its own legal entities.

TU Delft Services

The activities of TU Delft Services B.V. (TDHS) support the activities of TU Delft that best match a limited company structure or other private entity. Tax reasons, risk management and control can be decisive in TU Delft's choice to place activities in an entity under TDHS. TDHS sets up and manages the entities with the help of the Finance and Legal Services departments. The EB of TU Delft supervises the implementation of TDHS's policy. Entities of the TDHS include the HollandPTC proton clinic, the Bioprocess Pilot Facility (BPF), the YES!Delft incubator, and FlexDelft, TU Delft's internal payroll & secondment agency.

These are entities for which there is no exit strategy. The Bijlboegfonds Fund and M2I Foundation were added in 2017:

Bijlboegfonds Fund

The reserves that stakeholders have designated as Bijlboegfonds ('axe bow fund') can be used to make payments at the request of TU Delft for purposes of research at TU Delft in the field of maritime engineering. TU Delft is the owner of the Bijlboeg patent. A licensing agreement between TU Delft and Damen Shipyards B.V. for the use of the patent has been in place since 2008. Revenues from the licence (€50K for each sale of a ship with the 'Bijlboeg') are paid into a bank account that was managed by Damen Shipyards B.V. through mid-2017. At Damen's request, TDHS has now assumed the management of this fund.

M2I Foundation

The Materials Innovation Institute (M2I) was an independent institute whose goal is to continue and expand support for defining and managing materials science research projects between industry and universities, including Tata Steel, SKF, Fokker and DAF. The discontinuation of the bridging financing from the government for the M2I organisation led to unacceptable strain on the financial situation. For this reason, the M2I Executive Board decided in late 2016 not to continue the organisation in the same manner, exploring options for safeguarding the activities. The results of this decision included downsizing of the organisation, after which M2I was incorporated into TDHS, following approval by the EB in late 2017.

TU Delft Enterprises

TU Delft Enterprises B.V. (DE) is TU Delft's holding company. It invests in start-up companies based on TU Delft knowledge in exchange for an equity interest. The investment can be in the form of financial and/or non-financial contributions from DE or TU Delft, including expertise, intellectual property rights, facilities, support and (limited) start-up capital. As a shareholder, DE is actively involved in the start-ups. The DE philosophy is to connect innovation (promising ideas from TU Delft) to entrepreneurship (talented students and staff members) and funding (e.g. the UNIQ 'proof-of-concept' fund) in order to bring valuable knowledge from the university to market. In doing so, DE contributes to achieving TU Delft's valorisation objectives. It holds the shares in TU Delft spin-out companies. By late 2017, DE owned shares in 55 companies. In 2017, the participation involved 10 companies: Aerovinci, Birds.AI, Springscan, Vertigo, Field Factors, BIOND Solutions, Curatio, Caribu, Nub Systems, and GBM works. These companies were established based on knowledge development from five of the eight faculties at TU Delft. Several of their companies were based on patents. Some companies are located in the YES!Delft incubator, others at RoboValley, the Construction Campus or Unmanned Valley in Valkenburg. The shares in Lacquey were sold in 2017. The 'exit moment' is determined at the point where a company is operating completely independently, such that there is no longer any clear advantage from the perspective of TU Delft.

The structure of DE includes a Board of Supervisors. In 2017, there was a change in the members of this Board: Willem te Beest was succeeded by Rogier Stevens.

4.10 Administrative collaboration

TU Delft plays an active role in various forums in the region, the Netherlands and other parts of the world. As a provider of high-level education and research solutions to societal problems, we demonstrate the possibility of pairing societal impact and high-level scientific achievements. Strategic partnerships with other universities and various societal partners were also developed and expanded in 2017.

Regional collaboration

For example, TU Delft is an active partner with entities including the Economic Board Zuid-Holland (EBZ), which is also known as the 'board of boards' – an organisation in which companies, economic clusters, knowledge institutions, institutes of vocational education, local and regional governments come to the table to join forces in terms of knowledge, networks and administration. The joint ambition is to promote economic growth and employment in Zuid-Holland. In this regard, the EBZ focuses on initiatives within the following research priorities; Port in Transition; Feeding and Greening Megacities; Life Sciences and Health; Cybersecurity, and Smart Industry. Rector Magnificus Karel Luyben is a member of the executive committee of the EBZ. In addition, within the InnovationQuarter development company, we are collaborating on societal challenges and the reinforcement of the innovative capacity of Zuid-Holland.

Collaborating with the Municipality of Delft

To strengthen the collaboration between the Municipality of Delft and TU Delft, a covenant was signed in 2016 and further elaborated in 2017. In 2017, TU Delft and the Municipality of Delft agreed to three thematic recommendations and the associated collaborative agendas. The three themes represent the major common interests of TU Delft and the Municipality of Delft, in order to pursue a strong city-university combination. For example, the theme 'City as Campus, Campus as City' addresses issues including physical accessibility, the transformation of the university area in relation to the city, zoning plans and area development. The second theme,



TU Delft and the Municipality of Delft present collaborative agendas

In September 2017, in a joint meeting of the TU Delft EB and the Delft municipal executive, an agreement was created for three thematic recommendations and the associated collaborative agendas, which are part of the covenant between TU Delft and municipality. The recommendations outline a future vision for the collaboration and plans for realising this vision.

'Ecosystem of Knowledge and Economics', focuses on collaboration in order to retain and reinforce knowledge-intensive industry for the city. Finally, the recommendation on the 'university community, city and residents' aims to bring talent and knowledge together to benefit the broader society of Delft. The realisation of a structurally strong and internationally competitive city-university combination calls for a strong connection between the university community and the local society. TU Delft and the municipality have expressed the ambition to work together to strengthen community engagement, with the goal of strengthening the university community's societal impact on the local society, reducing the current dichotomy in the city and increasing stability and vitality. This will enhance the city's attractiveness to both current and new residents, scientists and companies.

City Deal on Education

In 2017, TU Delft signed the City Deal on Education, along with university cities, the Network of Knowledge Cities (in Dutch, *Netwerk Kennis Steden*, or NKS), universities and other institutes of higher education, the Ministries of the Interior and of Education Culture and Science, the Association of Universities in the Netherlands (VSNU) and the Association of Universities of Applied Sciences. The City Deal on Education is intended to create momentum in addressing societal issues that face cities through the large-scale involvement of researchers, lecturers and students. The cities, knowledge institutions and other partners involved regard this initiative as a form of knowledge utilisation and as a way of presenting the city to students as a learning environment. Central features of this City Deal include talent development, entrepreneurship and the promotion of community involvement.

4TU.

The 4TU.Federation is the partnership of the four universities of technology in Delft, Eindhoven, Twente and Wageningen. Since Wageningen joined in 2016, intensive joint efforts have included searching for solutions to address the inadequate funding of technical and scientific programmes. In the time leading up to the elections for the House of Representatives in March 2017, extensive talks were held with staff members from the ministries responsible (Education, Culture and Science; and Economic Affairs), as well as with members of the various political parties and representatives of the business community. The coalition agreement presented in October included a provision that the system for funding higher education would be reviewed during the coming term of office, with specific attention to technical programmes.

LDE

Leiden University, TU Delft and Erasmus University Rotterdam have a strategic alliance in which they collaborate in the areas of education, research and valorisation. The LDE strategy process was started in the summer of 2017. By mid-2018, it is expected to generate a new LDE strategy for 2019-2024. In the autumn, initial efforts were made on the evaluation of the LDE centres, which will take place in the spring of 2018. With effect from September 2017, the LDE Steering Committee appointed Timo Kos, Director of Education and Student Affairs at TU Delft, as director of the Leiden-Delft-Erasmus Centre for Education and Learning. In September, 17 new trainees started the two-year LDE management-trainee programme.

European university networks

TU Delft is an active member of a number of European university networks with the aim of seeking out best practices for the diversity of organisational and management issues within today's modern universities. In addition to being a founding member, TU Delft is a highly active member of the Conference of European Schools for Advanced Engineering Education and Research (CESAER), an international non-profit association of 51 prominent European universities of technology and institutes

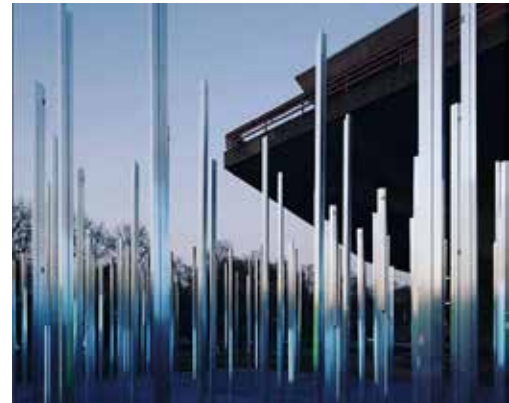
of technology in 26 European countries. Rector Magnificus Karel Luyben was the president of CESAER from 2014 through 2017.

The IDEA League is a strategic collaboration between five leading European universities of technology: TU Delft, RWTH Aachen, ETH Zurich, Chalmers University and Politecnico di Milano. In October 2017, TU Delft welcomed the alumni of the IDEA League universities for a networking event on the campus. The partner universities of the IDEA League invited their alumni who are currently living in the Netherlands to this event.

The university is also a member of the European Universities Association (EUA). The Bachelor's and Master's degree programmes and students benefit from TU Delft's participation in programmes such as the Global Engineering and Education Exchange (GlobalE3) and UNITECH. In addition, TU Delft is an active member of the European Society for Engineering Education (SEFI), the largest network of institutions of engineering education in Europe.

#tudelft

TU Delft as seen through the eyes of students, staff members and visitors:
a selection of #tudelft on Instagram in 2017.





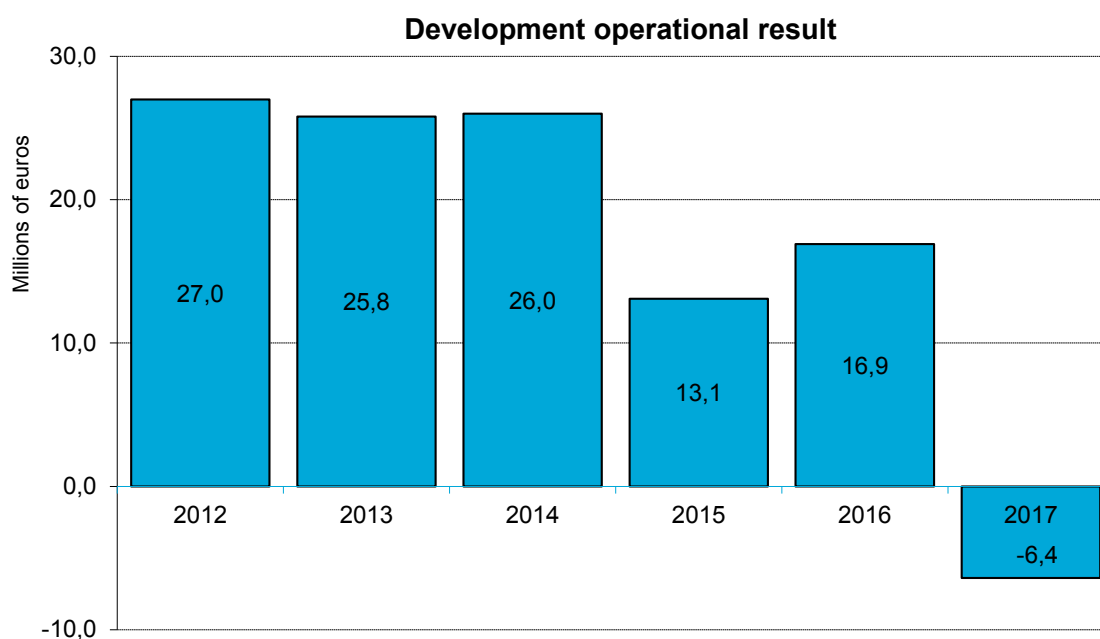
5.1 Financial developments

The financial context within which TU Delft operates is characterised by decreasing government funding, increasing numbers of students, a growing number of societal (and other) tasks for the university, and the need for real-estate innovation, which are adding to the financial pressure.

The financial policy is aimed at achieving a high level of transparency, responsibility and financial management, in order to protect the financial health of the institution in a structural way. It is monitored according to a number of common key indicators.

In 2017, TU Delft achieved a result of $\text{--}/\text{--}$ €4.7 million, compared with a budgeted result of $\text{--}/\text{--}$ €7.9 million. In the long term, the operating result will take account of the increased accommodation expenses resulting from necessary campus investment and maintenance. The expected long term financial position is discussed in more detail in the continuity section.

The annual financial results of TU Delft are often influenced by exceptional events, which result in incidental result effects. A balanced comparison of annual results and the associated activities requires the operational result to be taken into account. It forms the primary base for financial guidance, not including these exceptional items. One exceptional item was processed in the negative result for 2017: a one-off receivable from the Tax and Customs Administration to the amount of €1.7 million. It concerned energy taxes that had been calculated based on an improper graduated scale in past years, which had led to excessive payments amounting to €1.7 million. The operational result for 2017 amounted to $\text{--}/\text{--}$ €6.4 million. In the table below, this result is compared to the operational results of previous years. The declining trend shown in this table is expected to be carried over into the results for the next few years. This trend is discussed in greater detail in the continuity section.



Pre-investment for the student loan system

In 2017, a sum of €8 million was made available to the faculties for pre-investment ahead of the introduction of the student loan system. These resources were used to improve the quality of education. Actual expenditure of the available resources in 2017 amounted to €7.3 million. The sum of €0.7 million that was not spent remains earmarked and available for the intended purposes. Plans are being developed for expenditures in the short term, focusing on proposals from students. Additional information on the expenditure of these resources is provided in Section 1.2 of this report.

Gravitation programmes

At the end of 2012, the Ministry of Education, Culture and Science approved an application for the 'Frontiers of Nanoscience' (Nanofront) proposal as part of its 'Gravitation' (Zwaartekracht) programme. A total sum of €37.0 million was awarded to the entire consortium for the 2012-2021 period. In 2017, a sum of €19.2 million was awarded to the proposal entitled Building a Synthetic Cell for the 2017-2026 period. Given the fact that the cash flow from the government contribution is not equal to the expenditure, €12.4 million (2016: €7.4 million) of the amount received was shown in the balance sheet at the end of 2017. The expenditure proceeds in line with internal plans and as coordinated with the ministry.

Treasury Policy & Investment, Loan and Derivatives Regulations

TU Delft carries out its treasury transactions in accordance with the TU Delft treasury charter. The treasury policy focuses mainly on identifying – and, where necessary, covering – risk relating to temporary surplus liquid assets, and maximising the interest earned on these. The content of the treasury charter was amended in accordance with the Investment, Loan and Derivatives Regulations for Educational and Research Institutions 2016, which were finalised by the Ministry on 6 June 2016. Due to the fact that transparent separation of temporary surplus liquid assets cannot be made uniform, TU Delft has chosen not to make any distinction between public and private resources in its financial accounting. The private resources that have been allocated to the specific affiliated and consolidated legal entities of TU Delft are an exception.

All temporary liquidity surplus stemming from the core activities of education, research and knowledge valorisation at TU Delft are public funds and are invested by TU Delft in savings products at various Dutch commercial banks with at least an A rating. The total balance of liquid assets is available in the short term (within 30 days) and is invested in the most risk-adverse and flexible manner possible. Optimisation of interest is pursued within this framework.

The Faculty of Electrical Engineering, Mathematics and Computer Science (EEMCS) has a research group known as the Delft Blockchain Lab (DBL), which focuses on research and education in the field of blockchain technology. Within this framework, it participates in the national partnership known as the Dutch Blockchain Coalition. To enable the investigation of the technology underlying the blockchain, TU Delft has been holding a limited number of bitcoins as of the balance date. Given the high volatility of this cryptocurrency, the bitcoins are valued based on their purchase price.

TU Delft issues loans exclusively to legal entities that have close ties to the university or one of its core tasks (e.g. student associations and TU Delft Services B.V.). The loans issued are included by balance date under the heading of financial fixed assets. In 2015, in order to sharply reduce substantial financial risks, TU Delft concluded a number of forward exchange contracts that relate directly to future funding that will be received from external parties in a foreign currency (USD). Such forward exchange contracts are concluded only if a number of criteria have been met. It is particularly

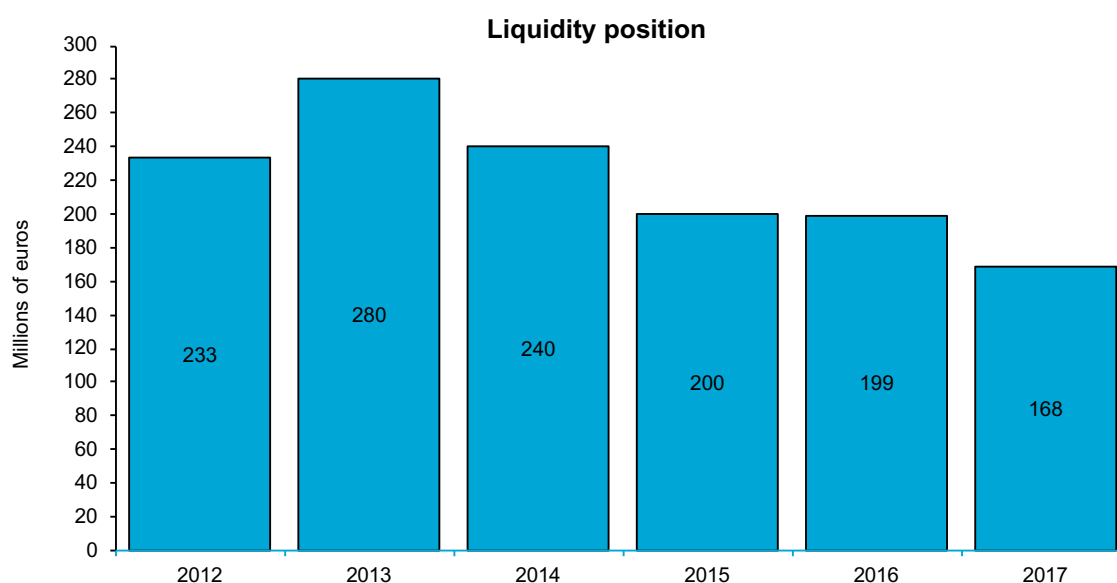
important that there is certainty regarding the actual receipt of the funding and the dates on which it will be received, and that these funds are spent in Euros in their entirety. For its financial statements, TU Delft applies cost-price hedge accounting, in accordance with Guideline 290 of the Annual Reporting Guidelines. The foreign exchange position and strategy are evaluated periodically.

Securities amounting to a total of €20.9 million on the balance date are accounted for in the 2017 financial statements. These investments involve private resources belonging to the following consolidated legal entities included in the TU Delft financial statements: the Stichting Justus & Louise van Effen Fonds, Stichting Nanoscience TU Delft and Stichting Het Lammingsfonds. These legal entities have their own financial administrations, receive no public funds, and therefore do not fall under the Investment, Loan and Derivatives Regulations for Educational and Research Institutions 2016 issued by the Ministry of Education, Culture and Science. The full securities portfolios of these consolidated legal entities have been transferred to external asset managers, with the asset management tying in with the objective of the legal entities and the long-term investment horizon. In concrete terms, this results in securities portfolios that are managed by external asset managers with a risk profile that can generally be regarded as neutral.

5.2 Liquidity position

At the end of 2017, the liquidity position of TU Delft was €168.3 million (€198.8 million at the end of 2016). In recent years, TU Delft has saved substantially in order to invest in new education and research facilities. These new investments triggered a decreasing trend in the liquidity position in recent years, which is expected to continue in the years ahead.

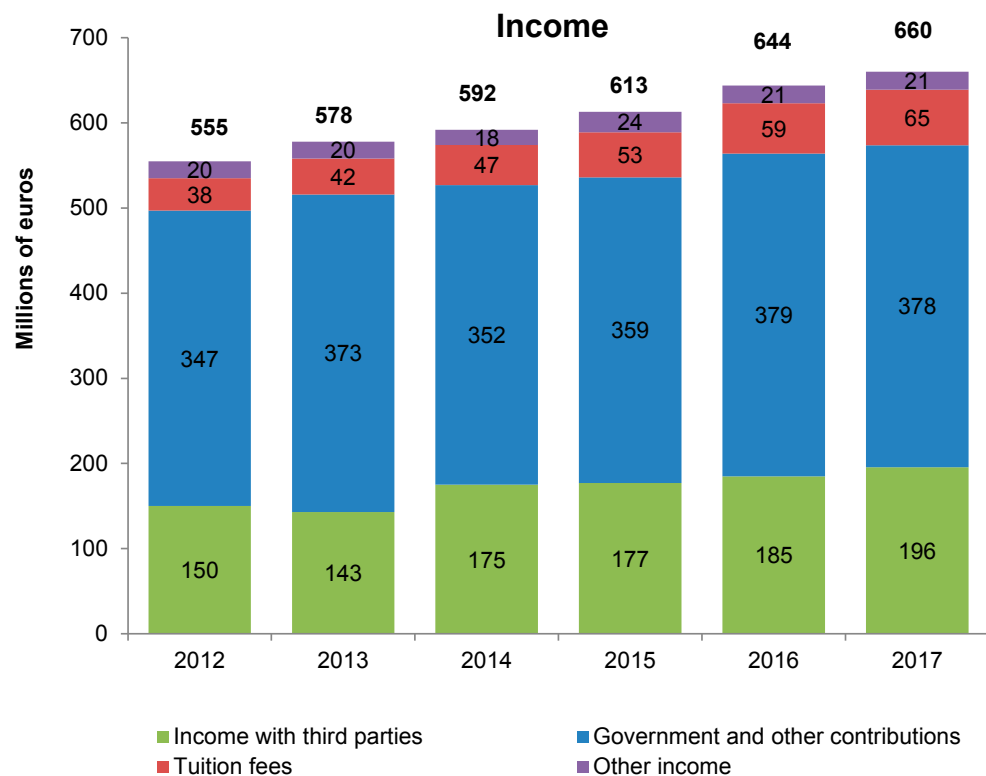
The liquidity position at year-end 2017 includes the sum of €14.7 million (2016: €29.1 million) in advance payments received for coordination activities. These amounts do not actually belong to TU Delft, and must be passed on to other participants in indirect and contract funding projects.



The surplus of liquid assets at the end of 2017 is temporary and necessary to fund the real-estate strategy, innovation in education and research, and the appointment of new staff as a result of increasing student numbers in the coming years. The long-term financial estimate drawn up at year-end 2017 shows that the liquidity position will diminish in the coming years and that external funding will be required in the foreseeable future as a result. TU Delft intends to obtain the necessary external funding by borrowing from the Ministry of Finance. The financial position in the longer term is discussed in more detail in the continuity section.

5.3 Income analysis

Total income (excluding financial income and the result from participating interests) in 2017 increased by €15.8 million to a level of €660.2 million. The chart below shows the development of income for the 2012-2017 period.

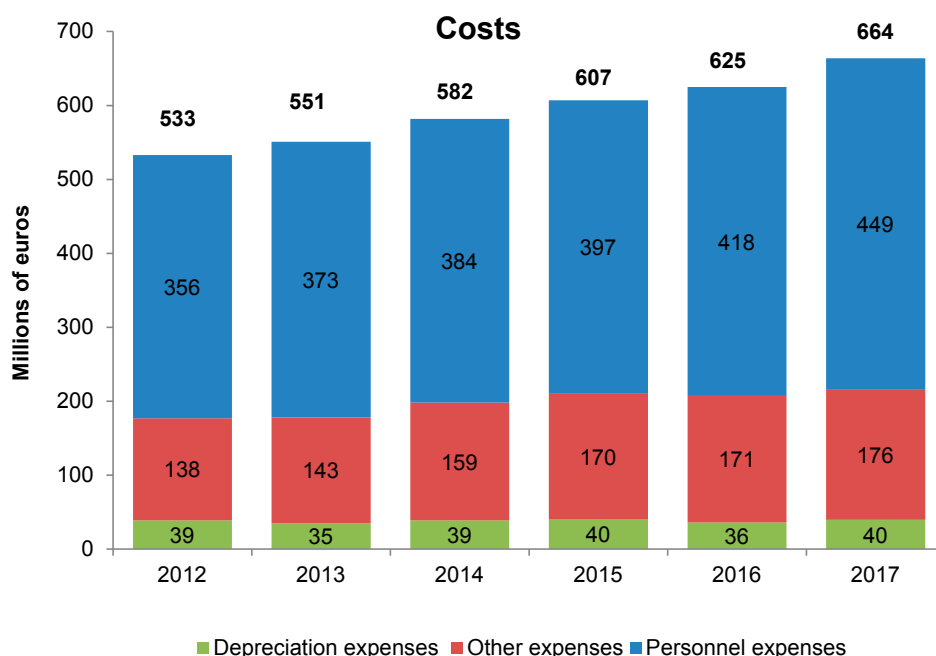


Government and other contributions decreased slightly (by €0.6 million) to €378.0 million in 2017. Income from projects in collaboration with third parties increased by €10.9 million to reach €195.7 million in 2017, reflecting the upward trend seen in recent years.

The tuition fees realised in 2017 amounted to €65.1 million, compared to €59.4 million in 2016. This was due to the increase in the student population. About 10% of all students paid the institutional rate, with about 90% paying the statutory rate.

5.4 Expenditure analysis

Total expenses, excluding financial income and expenses, increased by €38.9 million to €664.0 million in 2017. Personnel expenses increased by €30.2 million, while depreciation expenses increased by €3.4 million. Other expenses (including accommodation expenses) increased by €5.3 million to €175.8 million.



Personnel expenses

A breakdown of personnel expenses results in the following overall picture:

Personnel expenses		
in million €	2016	2017
Internal personnel expenses	339,9	361,2
Third-party personnel	52,5	63,3
Change in provisions	8,4	5,6
Other personnel expenses	17,6	18,4
Total	418,4	448,5

University personnel expenses

At the end of 2017, the institution's staff amounted to a total of 5.188 FTE, representing an increase of 249 FTE compared to year-end 2016. Academic staff increased by 184 FTE, from 2.879 FTE in 2016 to 3.063 FTE in 2017. Administrative and support staff increased by 65 FTE, from 2.060 FTE in 2016 to 2.125 FTE in 2017.

The increase in academic staff is partly due to pre-investments in anticipation of the student loan system, which were mainly made to permanently expand the number of teaching staff. There was also a substantial increase (+119 FTE) in the number of temporary academic staff (researchers and PhD candidates). The FTE increase in these job groups is directly related to increased benefits from projects with third parties.

The FTE increase in the administrative and support staff is largely the result of the formation of a robust real-estate organisation and the expansion of university services. The increase in total university personnel expenses from €339.9 million to €361.2 million is due to the increased number of FTE and the salary increase of 1.4% with effect from 1 January 2017, as specified in the Collective Labour Agreement.

Third-party personnel expenses

There was an increase in hiring of third-party personnel in 2017 compared to 2016. The specification is as follows:

Third-party personnel		
<i>in millions of euros</i>	2016	2017
Education (hiring of full professors & guest lecturers)	3,9	2,2
Temporary agency workers	9,3	10,1
Payment for services rendered by third parties	22,8	29,5
Travel and accommodation expenses of third parties	2,6	3,0
Government funding for personnel of third parties	38,6	44,8
Contract and indirect funding for personnel of third parties	13,9	18,5
Total	52,5	63,3

Depreciation

Depreciation increased by €3.4 million to €39.6 million. Of this total, €1.6 million consists of depreciation in buildings and grounds, while €1.8 million reflects an increase in depreciation of equipment and inventory.

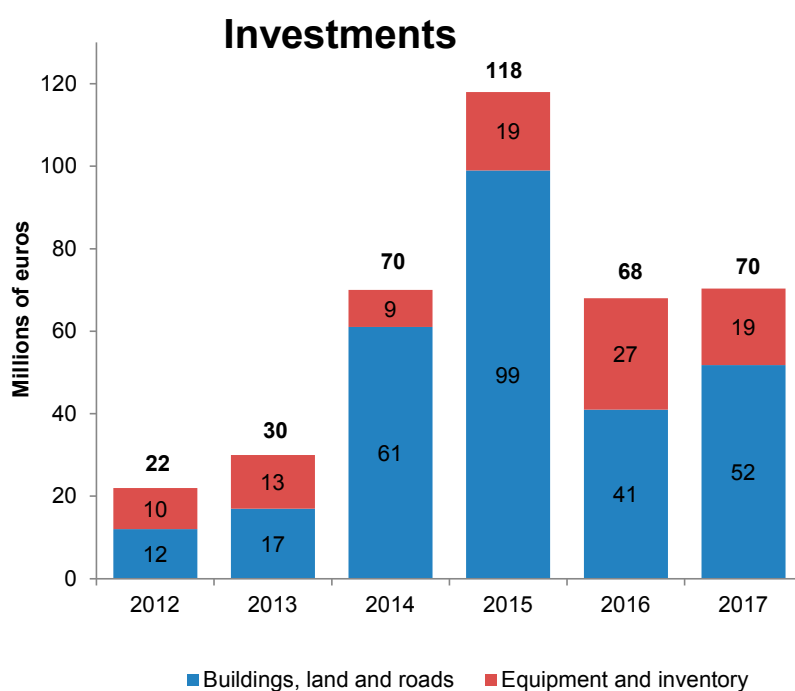
Other expenses (including accommodation expenses)

Other expenses (including accommodation expenses) in 2017 increased by €5.3 million in comparison with 2016. Accommodation expenses decreased slightly (-/- € 0.6 million), while other expenses increased by €5.9 million, including a higher allocation to student facilities (+ €1.0 million) and higher costs for equipment and inventory (+ €2.2 million).

5.5 Investments

Total investments increased in 2017 compared to 2016. Investments in buildings, land and roads increased from €40.5 million to €51.8 million. The most important investments in 2017 involved the expansion of Sports & Culture, the redevelopment of Leeghwaterstraat, the Pulse teaching building and the relocation of the Electrical Engineering faculty to Van Mourik Broekmanweg. Investments in equipment and inventory decreased from €27.3 million to €18.6 million. The total investment level in 2017 amounted to €70.4 million.

The chart below shows the investments for the 2012-2017 period. The 2010 to 2013 period was used to develop and prepare the real-estate work programme. Therefore, a deliberate decision was made to invest less at the time. The effect of the implementation of the real-estate programme is visible from 2014 onwards. The peak in 2015 can be explained by the investment of €61.7 in the new construction for the Faculty of Applied Sciences.



5.6 Provisions

millions of euros	year end 2016	changes 2017			year end 2017
		allocation	release	withdrawal	
Staff provisions	28,5	7,9	2,3	5,9	28,2
Student provisions	1,5	2,7	0,0	2,1	2,1
Other provisions	32,0	8,3	0,0	9,2	31,1
Total	61,9	18,8	2,3	17,1	61,4

The total provisions decreased in 2017 by € 0.5 million from €61.9 million at the start of the year to €61.4 million at the end of the year. The amounts for personnel and other facilities are decreasing. Student facilities are increasing. Further details are provided in the following paragraph (on the Profiling Fund).

Profiling Fund

The aforementioned student facilities relate to the Profiling Fund. Through the Profiling Fund, certain students can apply for financial support if they experience delays in the progress of their studies due to special circumstances. In 2017, payments made from the Profiling Fund totalled €2,057 thousand. The payments are shown in the table below, by type:

2017	Type of payment	
Total realised	exceptional circumstances	administrative duties
k€ 2.057	k€ 1.198	k€ 859

In 2017, Profiling Fund payments were made to a total of 1,797 students. The number of grant months paid out was 5,512, an average of 3.1 months per student in 2017. Payments for exceptional circumstances were set at € 290.68 per month, and payments for administration were set at € 261.61 per month.

The table below shows payments made, specified for EU and non-EU students:

2017	EU	non-EU	Total
Number of students	1315	482	1797
Total amount RAS	k€ 1.170	k€ 887	k€ 2.057

During the academic year 2016/2017, 1518 Profiling Fund applications were submitted. Of these applications, 678 concerned exceptional circumstances, while 840 concerned administrative duties. Applications and actual payments do not necessarily occur in the same accounting year. This is taken into account in the forming of the provision. The applications and the number of months allocated are specified in the tables below:

Applications Profiling fund 2016/2017 exceptional circumstances

Files						Months			
2016/2017	applications	granted	DUO	TUD	rejected	under consideration	months allocated	months DUO	months TUD
Illness	520	473	311	162	7	40	6.539	5.320	1.219
Family circumstances	58	51	11	40	4	3	368	165	203
Handicap	11	10	8	2	0	1	120	96	24
Educational ascendancy	77	72	1	71	3	2	198	12	186
Topsports	12	12	4	8	0	0	184	85	99
Pregnancy	0	0	0	0	0	0	0	0	0
Total	678	618	335	283	14	46	7.409	5.678	1.731

Applications Profiling fund 2016/2017 administrative duties

Files				Months	
2016/2017	applications	granted	rejected	under consideration	months allocated
Box 1 (social associations)	227	197	30	0	805
Box 2a (student associations)	281	263	17	1	938
Box 2b (societies)	0	0	0	0	0
Box 3 (sports en culture)	121	113	8	0	423
Box 4 (governance and interests)	134	110	18	6	315
Box 5 (projects)	77	67	9	1	478
Total	840	750	82	8	2.959

5.7 Capital position

In comparison to 2016, the university's equity capital decreased by €4.7 million to €378.4 million, due to the negative result in 2017. Of this total, €4.4 million will be withdrawn from the general reserve. On balance, an amount of €1.1 million was withdrawn from the special-purpose reserve and an amount of €0.8 million was added to special-purpose funds.

5.8 Financial key indicators

Financial key indicators	in millions of euros				
	2017	2016	2015	2014	2013
Income	660,2	644,4	612,8	591,6	578,2
Government and other contributions	378,0	378,6	358,6	352,3	373,6
Work with third parties	195,7	184,8	177,1	175,4	143,2
Expenditure	664,0	625,1	606,7	582,0	551,1
Financial income and expenditure	0,7	0,3	1,5	3,7	4,4
Result	-4,7	19,5	5,8	12,1	31,2
Depreciation on fixed assets	39,6	36,3	39,9	38,7	34,7
Investments in fixed assets	70,4	67,7	117,6	70,2	29,6
Net cash flow	-30,5	-0,1	-40,2	-39,6	47,1
Liquidity position	168,3	198,8	199,8	240,0	279,7
Fixed assets	476,3	447,1	419,1	334,0	313,5
Working capital	-57,4	-23,2	-20,2	53,8	61,0
Equity capital	378,4	383,1	363,6	357,9	345,8
Provisions	61,4	61,9	57,6	52,9	50,9

Ratios						
	Standard Ministry ECS	2017	2016	2015	2014	2013
Total income growth	n.v.t.	+2,5%	+5,2%	+3,6%	+2,3%	+4,2%
Work with third parties growth	n.v.t.	+5,9%	+7,0%	+2,5%	+22,5%	-4,5%
Total expenditure growth	n.v.t.	+6,2%	+3,0%	+3,9%	+5,6%	+3,4%
Government contribution/total income	n.v.t.	57,3%	58,8%	58,6%	59,6%	64,6%
Work with third parties/total income	n.v.t.	29,7%	29,8%	29,3%	29,6%	24,8%
Personnel expenses/total expenses	n.v.t.	67,8%	66,9%	64,8%	66,1%	67,7%
Solvency ratio	30,0%	46,4%	47,5%	47,9%	49,4%	47,2%
Current ratio	0,5	0,9	1,0	1,0	1,2	1,2

The solvency ratio (equity capital / total capital) meets the standards of the Ministry of Education, Culture and Science (at least 30%). The current ratio of 0.9 also does not exceed the applicable lower limit of 0.5.

5.9 Summarised financial statements

Consolidated balance sheet as at 31 December 2017

Amounts in thousands of euros (after processing the result appropriation proposal).

Assets				
	2017		2016	
	k€	%	k€	%
Fixed assets				
Intangible fixed assets	0	0	0	0
Tangible fixed assets	463.904	57	433.522	53
Financial fixed assets	12.396	1	13.604	2
	476.300	58	447.126	55
Current assets				
Inventories	401	0	396	0
Receivables	150.326	18	139.953	17
Securities	20.942	3	21.140	3
Cash and cash equivalent	168.302	21	198.794	25
	339.971	42	360.283	45
Total assets	816.271	100	807.409	100
Liabilities				
	2017		2016	
	k€	%	k€	%
Equity capital	378.438	46	383.108	47
Provisions	61.397	8	61.915	8
Long-term liabilities	0	0	0	0
Current liabilities	376.436	46	362.386	45
Total liabilities	816.271	100	807.409	100

Consolidated statement of income and expenditure 2017

	Budget		
<i>Amounts in thousands of euros</i>	2017	2016	2017
Income			
Government contribution	377.968	378.549	370.700
Other government contributions and subsidies	63	13	0
Tuition and examination fee	65.142	59.442	63.700
Revenues from work with third parties	195.708	192.329	180.187
Other income	21.282	14.053	24.683
Total revenues	660.163	644.386	639.270
Expenditure			
Personnel expenses	448.533	418.377	423.936
Depreciation	39.648	36.287	41.513
Accommodation costs	65.483	66.084	66.468
Other expenses	110.294	104.363	114.562
Total expenses	663.958	625.111	646.479
Balance of income and expenditure	-3.795	19.275	-7.209
Financial income and expenditure	717	272	-731
Result	-3.078	19.547	-7.940
Taxes	-53	-5	0
Result from participating interests and value adjustments to financial fixed assets	-1.540	-56	0
Result after taxes	-4.671	19.486	-7.940
Third-party interest in consolidated parties	-56	-4	0
Net result	-4.727	19.482	-7.940

5.10 Rights and obligations not included in the balance sheet

Technopolis

Under the name of Technopolis, the TU South area will be transformed into an international Research & Development park, which will also accommodate knowledge-intensive companies and start-ups. The first phase of the real estate development for this project is expected to last 20 years. This project will not lead to financial obligations for TU Delft for the time being.

Reactor Institute Delft

TU Delft is the licence holder of the Reactor Institute Delft (RID), in accordance with Section 15b of the Nuclear Energy Act. As of 1 April 2011, an amendment to the Nuclear Energy Act took effect, which (among other things) obliges licence holders of nuclear plants and reactors to provide financial security for the costs related to the shut-down and dismantling of the nuclear plant or reactor by the licence holder. For

the purpose of this financial security, three buildings of TU Delft have been secured by a mortgage. At the end of 2017, a provision of €17.6 million for the future dismantling of the RID was included in the financial statements, to which an annual allocation will be made, proportional to the period of use. An extended lifespan of the RID as a result of the Oyster investment project will lead to new amounts of radioactive waste, for which TU Delft will have to make new agreements with the Central Organisation for Radioactive Waste (COVRA) concerning the processing and storage of this radioactive waste, because this quantity cannot be covered by the current agreement. In collaboration with several other parties including EPZ (Borssele nuclear power plant), TU Delft is currently in talks with COVRA about a new basic customer agreement. This will contain agreements on TU Delft's share in the funding of the necessary expansion of the storage capacity at COVRA.

Asbestos

TU Delft has included a provision for asbestos removal whereby the amount is based on an inventory of the whole TU campus, with costs calculated per building on the basis of empirical data for each type of asbestos. The total estimated cost for the whole TU campus is nominally calculated at €27.0 million. Actual expenditure relating to asbestos depends on the coordination of asbestos removal with demolition and renovation programmes that are still at the decision-making stage. The facility included is for expenditure expected in the 2018 financial year only.

Investment obligation

At the end of the fiscal year, TU Delft had outstanding investment obligations equivalent to € 21.1 million.

Mapper Lithography Holding B.V.

Until the end of 2016, TU Delft had a conversion agreement with Mapper Lithography Holding B.V. In accordance with this agreement, the services from TU Delft were converted into shares in Mapper Lithography Holding B.V. With effect from 1 January 2017, this conversion agreement was discontinued, and said company now has a normal creditor status. The TU Delft equity interest in Mapper Lithography Holding B.V. was 1.3% at the end of 2017 (2016: 5.5%).

Guarantee for Technology Promotion Foundation

For the operation of Stichting Techniek Promotie ('Technology Promotion Foundation'), it has been agreed that a guarantee amounting to €300,000 will be made from the funds of the 4TU. Technology Sector Plan, to be distributed evenly among three of the four institutions (TU Delft, TU Eindhoven and the University of Twente). In 2014, TU Delft paid the €100,000 guarantee to the financial management foundation of the 4TU.Federation.

Forward exchange contract

In order to sharply reduce financial risks, TU Delft has concluded a number of forward exchange contracts that relate directly to future funding that will be received from external parties in US dollars. This is in accordance with the TU Delft treasury charter. The total value of the hedged item was 13.9 million US dollars at the end of 2017 (2016: USD 20.3), corresponding to the contribution from external parties laid down contractually. These future incoming funds will be received from 2018 to 2020. The value adjustment of the transactions of the hedged items amounted to + €767,000 at year-end 2017 (2016: -/- €834,000). For its financial statements, TU Delft applies cost-price hedge accounting, in accordance with Guideline 290 of the Annual Reporting Guidelines. The foreign exchange position and strategy are evaluated periodically.

Guarantee for HollandPTC

TU Delft is a guarantor for one-third of the actual loans granted to HollandPTC BV by the European Investment Bank (EIB). In the guarantee agreement, each shareholder acts as a guarantor for 33.33% of the outstanding obligations (interest and repayments). This entails a maximum of €38.5 million per shareholder. HollandPTC BV and TU Delft have made agreements for the fee for TU Delft's issuing the guarantee to the EIB. At year-end 2017, HollandPTC had taken out a total of €60.5 million in loans from the EIB. This corresponds to €20.2 million in guarantees per shareholder.

Quantum Technology (QuTech)

TU Delft, the Minister of Economic Affairs, the Minister of Education, Culture and Science, the Netherlands Organisation for Applied Scientific Research (TNO), the Netherlands Organisation for Scientific Research (NWO) and Stichting TKI HTSM (Top Consortium for Knowledge and Innovation - High Tech Systems and Materials sector) have agreed upon a covenant on strategic partnership in the field of quantum technology (QuTech). The covenant is valid until 1 July 2025. The resulting financial obligation for TU Delft is an in-kind contribution of €3 million per year and a cash contribution of €2 million per year.

5.11 Explanatory notes to the consolidated balance sheet and statement of income and expenditure

Activities

On the basis of Section 1.2 of Book 2 of the Dutch Civil Code and Section 1.8 of the Higher Education and Research Act (WHW), Delft University of Technology has been granted legal personality. The statutory duty of the university is described in Section 1.3.1 of the WHW: Universities are responsible for providing university education and conducting scientific research. In any case they provide initial degree programmes in university education, conduct scientific research, train scientific researchers and technical designers and transfer knowledge for the benefit of society.

Continuity

The accounting policies and determination of profit/loss used in these financial statements are based on the assumption of continuity of the institution.

Consolidation

The consolidation incorporates the financial data of the institution, its group companies and other institutes of which it has dominant control or which are under its central management. Group companies are legal entities over which the institution can exercise dominant control, directly or indirectly, due to the fact that it holds the majority of the voting rights or can control the financial and operational activities in any other way. Potential voting rights that can directly be exercised on the balance sheet date are also taken into account. The group is headed by TU Delft in Delft. The financial statements of the institute are included in the consolidated financial statements of TU Delft in Delft. The group companies and other legal entities over which the institution can exercise dominant control or which are under its central management are fully consolidated. The third-party interest in the group equity and the group result is stated separately. Participating interests over which no ultimate control can be exercised (associates) are not included in the consolidation. In the event of an interest in a joint venture, the relevant interest is proportionally consolidated. A joint venture is deemed to exist if, as a result of a collaboration agreement, the control is exercised jointly by the participants. Intercompany transactions, intercompany profits and mutual claims and debts between group companies and other consolidated legal entities are

eliminated, insofar as the results have not been realised through transactions with third parties outside the group. Unrealised losses on intercompany transactions are also eliminated unless there is an impairment. Accounting policies of group companies and other consolidated legal entities have, where needed, been amended in order to conform with the current accounting policies for the group. Along with associates, several participating interests which are individually and jointly of immaterial significance are not included in the consolidation.

Affiliated parties

All legal entities over which dominant control, joint control or significant influence can be exercised are considered affiliated parties. Legal entities which can exercise dominant control are also considered to be affiliated parties. The members of the Board under the articles of association, other key officials in the institution's management and close relatives are also affiliated parties. Significant transactions with affiliated parties are clarified insofar as they have not been concluded under normal market conditions. In this respect, the nature and size of the transaction are clarified, as well as other information that is needed to provide insight. For an overview of affiliated parties, see Model E: Affiliated parties in this annual financial report.

Acquisitions and divestments of group companies

With effect from the acquisition date, the results and the identifiable assets and liabilities of the acquired institution are included in the consolidated financial statements. The acquisition date is the date from which dominant control can be exercised over the institution concerned. The acquisition price is the sum of money (or equivalent) agreed for the acquisition of the institution, plus any directly allocatable costs. If the acquisition price is higher than the net fair value of the identifiable assets and liabilities, the excess amount will be capitalised as goodwill under intangible fixed assets. If the acquisition price is lower than the net fair value of the identifiable assets and liabilities, the difference (negative goodwill) will be recorded under accrued liabilities. The companies involved in the consolidation will remain in the consolidation until they are sold; deconsolidation takes place when decisive control is transferred.

Cash flow statement

The cash flow statement has been drawn up according to the indirect method. The cash in the cash flow statement consists of the liquid assets, with the exception of deposits with a term of more than three months. Cash flows in foreign currencies have been converted at an estimated average rate. Receipts and expenses on account of interest and received dividends have been included in the cash flow from operational activities. The acquired financial interests have been included in the cash flow from investment activities.

Estimates

In order to be able to apply the policies and rules for preparing the financial statements, the management of the institution must form an opinion on various matters, and the management must make estimates which can be essential for the amounts included in the financial statements. If necessary for providing the insight required in Book 2, Section 362, paragraph 1 of the Dutch Civil Code, the nature of these opinions and estimates, including the corresponding assumptions, has been included in the notes to the relevant items of the financial statements. The method used for valuation of balance sheet projects and the associated revenue recognition was further refined in 2015. This change in accounting estimates is due to the altered accrual method of the implementation costs to subsidy projects. The altered accrual method involves the use of hourly rates based on absorption costing as well as the full allocation of the time spent. The revenue from the subsidy projects is allocated to the years in line with the development of the implementation costs. This altered method therefore influences

the revenue recognition of the subsidy projects. TU Delft is embarking on an extensive investment programme for renewal of its educational and research facilities. A decision to sell off or demolish a building has consequences for the valuation of these existing buildings. The estimated depreciation periods for a number of buildings were shortened as a result. According to the most recent plans in 2016, the CEG building will remain in use until at least 2026. As a result, the depreciation periods were extended in 2016 (after being shortened in 2014). Depreciation costs in 2016 and further are therefore reduced. The value of the impact of the revised depreciation periods in 2016 is €2,600 thousand.

5.12 Accounting policies for the valuation of assets and liabilities

General

The consolidated financial statements have been drawn up in accordance with the provisions of the Annual Reporting Regulations for Education, Part 9, Book 2 of the Dutch Civil Code, and Section 660 of the Annual Reporting Guidelines and the authoritative statements in the other sections of the Annual Reporting Guidelines, issued by the Council for Annual Reporting, and with the provisions of the Senior Officials in the Public and Semi-Public Sector (Standards for Remuneration) Act (WNT). Assets and liabilities are generally stated at their acquisition or manufacturing price or current value. If no specific accounting policy is given, valuation is based on the acquisition price. References are included in the balance sheet, the statement of income and expenditure and the cash flow statement. These references refer to the explanatory notes. The financial statements are presented in Euros and in thousands, unless stated otherwise.

Comparison with previous reporting year

The accounting policies and determination of profit/loss have not changed compared to the previous reporting year.

Intangible fixed assets

Intangible fixed assets are stated at their acquisition price including directly allocatable costs, less straight-line depreciation throughout the expected useful life. Impairments expected at the balance sheet date have been taken into account. For an explanation on how to determine whether an intangible fixed asset concerns an impairment, refer to the section: Impairments of fixed assets.

Tangible fixed assets

Buildings and land are stated at their acquisition price, including additional costs or the manufacturing price less straight-line depreciation throughout the estimated useful life. Land is not depreciated. Impairments expected at the balance sheet date have been taken into account. For an explanation on how to determine whether a tangible fixed asset concerns an impairment, refer to the paragraph below: Impairments of fixed assets. Other fixed assets are stated at their acquisition or manufacturing price value including directly allocable costs, less straight-line depreciation throughout the expected useful life. Impairments expected at the balance sheet date have been taken into account. For an explanation on how to determine whether a tangible fixed asset concerns an impairment, refer to the paragraph below: Impairments of fixed assets. The manufacturing price consists of the acquisition price of raw materials and consumables including additional (installation) costs which can be attributed directly to the manufacture. If a considerable amount of time is needed to prepare for manufacture, the interest costs are also included in the manufacturing price. Investments in indirect

and contract funding projects are capitalised in the year of purchase and are directly and fully part of the cost of the project. Investments in equipment and inventory of less than €12,500, as well as expenditure on books and artworks, are directly accounted for in the statement of income and expenditure.

Financial fixed assets

Participating interests

Participating interests in which significant influence can be exercised are valued according to the equity accounting method (net asset value method). When 20% or more of the voting rights can be exercised, it may be assumed that there is significant influence.

The net asset value is calculated according to the accounting policies that apply for these financial statements; for participating interests about which insufficient details are available for adjustment to these policies, the accounting policies of the participating interest concerned are used. If, according to the net asset value, the valuation of a participating interest is negative, it is set at zero. If and to the extent that the institution guarantees in whole or in part the liabilities of the participating interest, or has the firm intention of enabling the participating interest to settle its debts, a provision is created for this. The initial valuation of purchased participating interests is based on the fair value of the identifiable assets and liabilities at the time of acquisition. For the subsequent valuation, the accounting policies that apply to these financial statements are applied, based on the values of the initial valuation. The result is recorded as the amount by which the book value of the participating interest has changed since the previous financial statements as a consequence of the result achieved by the participating interest. Participating interests in which no significant influence can be exercised are stated at their acquisition price. If there is a permanent impairment, valuation takes place at the realisable value; downward valuation changes are charged to the statement of income and expenditure. The participations of Delft Enterprises B.V. are stated at cost or lower market value. An exit strategy is maintained for the participations. The policy is that the participation will be disposed of in due course (the aim is a period between five and ten years).

Receivables from participating interests

Receivables included under financial fixed assets are initially stated at fair value after deduction of transaction costs (if tangible). These receivables are subsequently stated at amortised cost, taking into account any depreciation.

Securities

Securities are initially stated at fair value. The participations of Delft Enterprises B.V. are stated at cost or lower market value.

Other receivables

Other receivables entered under financial fixed assets include loans granted and other receivables. These receivables are initially stated at fair value. These loans and bonds are stated at amortised cost. Impairments are deducted from the amortised cost and directly accounted for in the statement of income and expenditure.

Impairments of fixed assets

At every balance sheet date, the institution assesses whether there are indications that a fixed asset is subject to an impairment. If such indications exist, the realisable value of the asset is determined. If it is not possible to determine the realisable value for the individual asset, the realisable value of the cash flow-generating unit to which the asset belongs is determined. An impairment exists if the book value of an asset is

higher than the realisable value; the realisable value is the higher of the net realisable value and the value in use. An impairment loss is recorded directly as an expense in the statement of income and expenditure while reducing the book value of the asset concerned. If it is established that a previously recorded impairment no longer exists or has decreased, the increased book value of the asset concerned is set no higher than the book value that would have been determined if no impairment had been recorded for the asset.

Inventories

Inventories are valued at cost or acquisition price according to the FIFO (first in, first out) method or net realisable value, whichever is lower. The net realisable value is the estimated selling price less directly allocable selling expenses. The unsaleability of the inventories is taken into account when determining the net realisable value.

The Faculty of Electrical Engineering, Mathematics and Computer Science (EEMCS) has a disciplinary research group known as the Delft Blockchain Lab (DBL), which focuses on research and education in the field of blockchain technology. Within this framework, it participates in the national partnership known as the Dutch Blockchain Coalition. To allow the investigation this blockchain, TU Delft holds a limited number of Bitcoins. Given the high volatility of this cryptocurrency, they are valued according to their purchase price.

Receivables

Receivables are initially stated at the fair value of the consideration. Trade receivables are subsequently stated at amortised cost. Provisions for bad debts are deducted from the book value of the receivable. The balance from projects arising from work with third parties leads to a receivable or a debt on the balance sheet. Projects with prepaid expenses that exceed the instalments invoiced in advance are included under receivables. Projects with instalments invoiced in advance that exceed the prepaid expenses are included under liabilities. Any provision deemed necessary for a project arising from work performed with third parties is deducted from the receivable. The method used for valuation of balance sheet projects and for the matching of revenues and costs has been further refined since 2014.

Securities

Securities that are part of the trading book are stated at fair value. Changes in value are directly accounted for in the statement of income and expenditure. Securities that are part of the current assets have a term of less than one year.

Liquid assets

Liquid assets consist of cash, bank balances and deposits with a term of less than twelve months. Current account debts with banks are included under current liabilities. Liquid assets are stated at face value.

Equity capital

The equity capital consists of general reserves and special-purpose reserves and/or funds for special purposes. The special-purpose reserves are reserves with a more restricted disbursement of funds, with the restriction imposed by the Board. The funds for special purposes are reserves with a more restricted disbursement of funds, with the restriction imposed by third parties.

Third-party interests

Third-party interests as part of the group equity are stated at the amount of the net interest in the net assets of the group companies concerned.

Where the group company concerned has a negative net asset value, the negative

value together with any further losses is not charged to third-party interests, unless the third-party shareholders have a constructive obligation and are able to bear the losses. As soon as the net asset value of the group companies becomes positive once again, results are allocated to third-party interests.

Facilities

General

Provisions are formed for legally enforceable or actual liabilities that exist at the balance sheet date, and for which an outflow of resources is likely to be necessary, the amount of which can be reliably estimated.

Provisions are stated at the best estimate of the amounts necessary to settle the liabilities at the balance sheet date. Other provisions are stated at the nominal value of the expenditure expected to be required to settle the liabilities, unless otherwise stated. If a third party is expected to pay the liabilities and if it is highly likely that this payment will be received upon settlement of the liability, this payment will be included as an asset on the balance sheet.

Provision for long-service awards

The provision for long-service awards is included at the cash value of the expected payments in the course of the employment. The expected salary increases and the likelihood to stay are taken into account in the calculation of the provision. In calculating the current value, a discount rate of 1.5% has been applied (2016: 1.5%).

Sewer system provision

In calculating the sewer-system provision, a discount rate of 1.5% has been applied (2016: 1.5%).

Other provisions

Other provisions are stated at face value of the expenditure deemed necessary for the settlement of the provision.

Current liabilities

Current liabilities are initially stated at fair value. Current liabilities are subsequently stated at amortised cost, being the amount received taking into account premiums or discounts and after deduction of transaction costs. This is usually the face value.

Leasing

The institution may have lease contracts for which many of the advantages and disadvantages of ownership do not lie with the institution. These lease contracts are recorded as operational leasing. Lease payments are included in the statement of income and expenditure on a linear basis for the duration of the contract, taking into account the payments received from the lessor.

Financial instruments and risk management

Financial instruments comprise investments in shares and bonds, trade and other receivables, cash, loans and other financing obligations, trade and other payables. Financial instruments are initially stated at fair value. Financial instruments that are not part of the trading book are stated at amortised cost on the basis of the effective interest method, less impairment losses.

Currency risk

The institution operates primarily in the Netherlands. The currency risk for the institution relates mainly to positions and future transactions in US dollars. Based on a risk analysis, the Board of the institution has determined that some of these currency risks are to be covered. Forward exchange contracts are used for this purpose.

Interest rate risk and cash flow risk

The institution runs an interest rate risk on the interest-bearing receivables (primarily under financial fixed assets, securities and liquid assets) and interest-bearing long-term and short-term liabilities (including debts to credit institutions).

Credit risk

The institution does not have any significant concentrations of credit risk.

5.13 Accounting policies for determination of the result

General

Income and expenditure are allocated to the year to which they apply. Profits are only included insofar as they have been realised at the balance sheet date. Losses and risks originating before the end of the reporting year are observed, provided that they have become known before the financial statements are adopted.

Government contributions

Government contributions are recognised as revenue in the statement of income and expenditure in the year to which the allocation applies.

Other government contributions and subsidies

Operating subsidies are recognised as revenue in the statement of income and expenditure in the year in which the subsidised costs were incurred or revenue was lost, or when a subsidised operating deficit occurred. The revenue is recognised if it is likely to be received and the institution can demonstrate the conditions for receipt. Subsidies related to investments in tangible fixed assets are deducted from the asset concerned and included as part of the depreciation in the statement of income and expenditure or deferred as amounts received in advance.

Project revenues and project costs

For projects of which the result can be reliably determined, the project costs and the project revenues will be recorded as net turnover and costs in the statement of income and expenditure in proportion to the achievements as of the balance sheet date.

The progress of the achievements is determined on the basis of the project costs up to the balance sheet date in proportion to the estimated total project costs. If the result on the balance sheet date cannot be reliably estimated, the revenues will be recorded as net turnover in the statement of income and expenditure up to the amount of the incurred project costs. The result is determined as the difference between project revenues and project costs. Project revenues are the contractually agreed revenues and the revenues from additional and less work, claims and reimbursements, if and to the extent that it is probable that these will be realised and that these can reliably be determined. Project costs are the costs directly related to the project, the costs that are generally attributed to project activities and can be attributed to the project, and other costs contractually attributable to the commissioning party. If the total project costs are likely to exceed the total project revenues, the expected losses will be immediately included in the statement of income and expenditure. For TU Delft, project revenues constitute a structural contribution to the financial result, and the university has a wide variety of types of arrangements. The agreed project conditions serve as guidelines for determining the result.

Revenue recognition

Rendering services

Revenues from the provision of services are accrued in proportion to the services delivered, based on the services rendered up to the balance sheet date in proportion to the total services to be rendered.

Gifts

Income received in the form of goods or services is stated at fair value.

Other income

Other income comprises income from rental, sale, secondment, contribution by third parties and other income.

Depreciation of intangible and tangible fixed assets

Intangible and tangible fixed assets are depreciated from the month following the date of first use over the expected future useful life of the asset. Land is not depreciated. If there is a change in the estimate of the future useful life, the future depreciations are adjusted accordingly. Book profits and losses from the non-recurring sale of material fixed assets are included in the statement of income and expenditure.

Employee benefits

Periodic remuneration

Wages, salaries and social security contributions are included in the statement of income and expenditure on the basis of employment conditions insofar as they are payable to employees or the tax authorities.

Pensions

The institution has a pension scheme with ABP Pension Fund. This pension scheme is subject to the provisions of the Dutch Pensions Act, and contributions are paid by the institution on a compulsory or contractual basis. ABP bases the pensionable salary on the average wages during an employee's working career. ABP tries to raise the pensions each year by the average wage increase in the government and education sectors. If the coverage ratio is less than 110%, no indexation takes place. The contributions are stated as personnel costs when they become payable. Prepaid contributions are included as prepayments if these result in a repayment or a reduction in future payments. Contributions that have not yet been paid are included in the balance sheet as current liabilities. As of 31 December 2017, the policy funding ratio of the ABP Pension Fund is 101.5%.

Exceptional items

Exceptional items are income or expenditure arising from events or transactions that are part of the ordinary operations but which, for the purpose of comparison, are explained separately on the basis of the nature, scope or non-recurring nature of the item.

Financial income and expenditure

Interest income and interest expenses

Interest income and interest expenses are included on a time-proportionate basis, taking into account the effective interest rate of the respective assets and liabilities.

Exchange differences

Exchange differences arising in connection with the settlement or translation of monetary items are recorded in the statement of income and expenditure in the period in which they arise. Transactions in foreign currency carried out during the reporting period are included in the financial statements at the exchange rate applying on the transaction date.

Taxes

Tax on the result is calculated on the result before tax in the statement of income and expenditure, taking into account the available, tax-offsettable losses from previous financial years (unless these are included in deferred tax assets) and exempt profit components and after the addition of non-deductible expenses. Due account is also taken of changes that occur in the deferred tax assets and deferred tax liabilities in respect of changes in the applicable tax rate.

Result from participating interests

The result from participating interests is the amount by which the book value of the participating interest has changed since the previous financial statements as a consequence of the result achieved by the participating interest, insofar as this is attributed to the institution.

5.14 Remuneration of the Executive Board and Supervisory Board

The remuneration of the individual members of the Executive Board and the Supervisory Board was in line with the accountability obligation arising from the Annual Reporting Regulations for Education and was as follows:

Executive Board:

	Prof.dr.ir. T.H.J.J. van der Hagen	Prof.ir. K.Ch.A.M. Luyben	Mw. Drs. J.L. Mulder
Function data	President	Rector Magnificus	Vice President for Education & Operations
Commencement and end date of employment 2017	01/01 –31/12*	01/01 - 31/12	01/01 - 31/12
Part-time factor (FTE)	1,0	1,0	1,0
Former top official?	no	no	no
(Fictitious) employment?	yes	yes	yes
Remuneration			
Remuneration plus taxable expense allowances	€ 162.341	€ 203.120	€ 200.040
Employment benefits	€ 18.659	€ 18.792	€ 18.437
Subtotal	€ 181.000	€ 221.912	€ 218.477
Individually applicable remuneration maximum	€ 181.000	€ 181.000	€ 181.000
-/- Unduly paid amount	N.a.	€ 0	€ 0
Total remuneration	€ 181.000	€ 221.912	€ 218.477
Reason why the exceedance is permitted or not	N.a.	The remuneration is in accordance with contracts agreed in the past and in accordance with the transitional provisions of the WNT.	The remuneration is in accordance with contracts agreed in the past and in accordance with the transitional provisions of the WNT.
Data 2016			
Commencement and end date of employment 2016	01/05 - 31/12	01/01 - 31/12	01/01 - 31/12
Part-time factor (FTE)	1,0	1,0	1,0
Remuneration plus taxable expense allowances	€ 108.892	€ 195.603	€ 187.429
Employment benefits	€ 10.846	€ 16.341	€ 15.718
Total remuneration 2016	€ 119.738	€ 211.944	€ 203.147

* : still employed at year-end 2017

Supervisory Board:

	Drs.ir. J. van der Veer	Prof. dr. D.D. Breimer	Drs. J.C.M. Schönfeld	Mw. ir. L.C.Q.M. Smits van Oyen MBA	Drs. G. de Zoeten	Mw. Drs. C.G. Gehrels	Prof.dr. L.L.G. Soete
Function data	President	Member	Member	Member	Member	Member	Member
Commencement and end date of employment 2017	01/01 - 31/12*	01/01 - 01/05	N.v.t.	01/01 - 31/12*	01/01 - 31/12*	01/01 - 31/12*	01/05 - 31/12*
Remuneration							
Remuneration	€ 20.850	€ 4.767	€ 0	€ 14.300	€ 14.300	€ 14.300	€ 9.533
Individually applicable remuneration maximum	€ 27.150	€ 6.033	€ 0	€ 18.100	€ 18.100	€ 18.100	€ 12.067
-/- Unduly paid amount	N.v.t.	N.v.t.	N.v.t.	N.v.t.	N.v.t.	N.v.t.	N.v.t.
Total remuneration	€ 20.850	€ 4.767	€ 0	€ 14.300	€ 14.300	€ 14.300	€ 9.533
Reason why the exceedance is permitted or not	N.v.t.	N.v.t.	N.v.t.	N.v.t.	N.v.t.	N.v.t.	N.v.t.
Data 2016							
Commencement and end date of employment 2016	01/01 - 31/12*	01/01 - 31/12*	01/01 - 01/05	01/01 - 31/12	01/05 - 31/12	01/01 - 31/12	N.v.t.
Remuneration plus taxable expense allowances	€ 20.850	€ 17.757	€ 4.767	€ 14.300	€ 9.533	€ 14.300	N.v.t.
Employment benefits	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Total remuneration 2016	€ 20.850	€ 17.757	€ 4.767	€ 14.300	€ 9.533	€ 14.300	N.v.t.

* : appointment period continues to future year

5.15 Expenses claimed by Executive Board members

The table below shows the expenses claimed by the Executive Board members, in accordance with the format prescribed by the State Secretary. The State Secretary defines expense claims as reimbursements for expenses incurred or services rendered, for which the individual administrators submitted expense claims to TU Delft. The expenses charged by TU Delft on behalf of the members of the Executive Board in 2017 are presented in the 'by invoice' column.

Overview of all expenses incurred by TU Delft on behalf of the members of the Executive Board in 2017.

Prof.dr.ir. T.H.J.J. van der Hagen	by declaration	by invoice	total
Travel expenses within the Netherlands	€ 0	€ 19.607	€ 19.607
Travel expenses outside the Netherlands	€ 362	€ 7.584	€ 7.946
Representation expenses	€ 0	€ 382	€ 382
Other expenses	€ 0	€ 0	€ 0
	€ 362	€ 27.573	€ 27.935

Prof.ir. K.Ch.A.M. Luyben	by declaration	by invoice	total
Travel expenses within the Netherlands	€ 0	€ 27.976	€ 27.976
Travel expenses outside the Netherlands	€ 1.642	€ 6.865	€ 8.507
Representation expenses	€ 99	€ 288	€ 387
Other expenses	€ 0	€ 0	€ 0
	€ 1.741	€ 35.129	€ 36.870

Mw. Drs. J.L. Mulder	by declaration	by invoice	total
Travel expenses within the Netherlands	€ 0	€ 8.007	€ 8.007
Travel expenses outside the Netherlands	€ 724	€ 10.427	€ 11.151
Representation expenses	€ 29	€ 282	€ 311
Other expenses	€ 0	€ 459	€ 459
	€ 753	€ 19.175	€ 19.928

Total	€ 2.856	€ 81.877	€ 84.733
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5.16 Board statement

The Executive Board hereby confirms (in accordance with Article 31, paragraph 1a of the Annual Reporting Guideline for Higher Education and Scientific Research) that all known details relevant to the audit report on the financial statements and the funding data were made available to the auditor of the institution. The Executive Board also declares that it was not involved in irregularities as referred to in the aforementioned Article 31, paragraph 1a.

5.17 Audit report of the independent accountant

To: the Executive Board of Delft University of Technology

Report on the summary financial statements 2017

Our opinion

In our opinion, the accompanying summary financial statements 2017 of Technische Universiteit Delft ('The Company'), are consistent, in all material respects, with the audited financial statements, in accordance with the basis described in the notes.

The summary financial statements

The Company's summary financial statements, derived from the audited financial statements 2017, comprise:

- the summary consolidated statement of the financial position as at 31 December 2017;
- the summary consolidated income statement for the year then ended; and
- the related notes to the summary financial statements.

The summary financial statements do not contain all of the disclosures required by Part 9 of Book 2 of the Dutch Civil Code and the Regeling jaarverslaggeving onderwijs. Reading the summary financial statements, therefore, is not a substitute for reading the audited financial statements of Technische Universiteit Delft and the auditor's report thereon.

The audited financial statements and the summary financial statements do not reflect the events that occurred subsequent to the date of our report on the audited financial statements.

The audited financial statements and our auditor's report thereon

We expressed an unmodified audit opinion on the audited financial statements in our report dated 25 May 2018. The report also includes the communication of key audit matters. Key audit matters are those matters that, in our professional judgment, were of most significance in our audit of the audited financial statements of the current period.

Responsibilities of management for the summary financial statements

Management is responsible for the preparation of the summary financial statements in accordance with the basis described in the notes.

Auditor's responsibility

Our responsibility is to express an opinion on whether the summary financial statements are consistent, in all material respects, with the audited statutory financial statements based on our procedures, which we conducted in accordance with Dutch Law, including the Dutch Standard 810 'Engagements to report on summary financial statements'

Amsterdam, 1 October 2018

PricewaterhouseCoopers Accountants N.V.

Original has been signed by R. Goldstein RA





6

Continuity section

6.1 Introduction

In accordance with the requirements of the Annual Reporting Regulations for Education (RJO), this section provides insight into the proposed policy in the coming years, along with the expected consequences for the financial position of TU Delft. The data are derived from the 2018 TU Delft budget, as approved in the meeting of the Supervisory Board on 13 December 2017.

A Dataset

6.2 Long-Term Budget (Part A2)

One important challenge is to maintain the financial health of TU Delft in the coming years. Although the financial position is currently good, financial pressure is increasing due to government funding cuts, increases in the numbers of students, expansion in the number of societal (and other) tasks to be managed by the university, and the innovations needed in the area of real estate. Taking responsibility, a high level of transparency and good financial management are essential in this regard. TU Delft observes strict financial standards for various ratios, including solvency, the current ratio, the leverage ratio and the interest-coverage ratio.

Following several years with positive operational results, 2017 closed with a result of -/- €4.7 million (budget -/- €7.9 million). A result of -/- €10.9 million has been budgeted for 2018, and negative operational results are expected for subsequent years as well. The number of students at TU Delft is increasing more rapidly than previously anticipated. This is affecting the need for study facilities and other facilities, as well as staff capacity. Since 2016, a large number of real-estate projects have been started within the framework of the long-term real-estate strategy. The pattern of increasing student numbers and the campus-development investments that it requires will continue in the coming years, having an increasingly negative effect on operations.

Long-term financial estimates are compiled twice each year. The real-estate plans are adjusted based on developments in the number of students. The process also considers the estimated staffing numbers and expenses, the government contribution and tuition fees. To keep the real-estate work programme fundable and affordable for the coming years (2018-2022), it will be necessary to look at possibilities for generating additional revenues, and it may be necessary to carry out operational measures. The major projects in the programme are sequentially phased, which means that timely adjustments can be made if risks arise.

The presented long-term budget is based on the numbers at the time of the budget approved by the Supervisory Board in December 2017.

Key points of the 2018 budget

Staff numbers will increase in 2018, primarily in the categories of teaching staff and support staff. The staffing increase is in line with the increase in the number of students. The creation of a robust real-estate organisation to prepare for and support the real-estate projects in the coming years will also require additional capacity.

In 2018, the focus will be on continuing the implementation of the real-estate strategy and the related administrative aspects. Staff intake in relation to increases in student numbers will be closely monitored. The challenge will be to make timely adjustments that will enable TU Delft to continue operating in sufficient financial health, without compromising on quality.

Special non-recurring costs and tied budget for real-estate maintenance

The budget includes a number of non-recurring accommodation costs. Amounting to €4.0 million, these costs include the costs of demolition, operational costs from projects and consultancy costs. A conditional budget of 6.3 million euros for real-estate maintenance has not yet been taken into account. It is a tied budget, because this part of the maintenance work is included in the plans but has not yet been budgeted. A formal decision on the actual implementation will be taken in the course of 2018. Faculties have the option of including incidental plans within the reserve policy. Within this framework, a total of €5.4 million has been included in the faculty budgets.

Investments

Investments of €81 million have been taken into account. The investments concern a large number of ongoing projects and new projects to be started, including the PULSE teaching building, the 'ESP Lab', the high-pressure catalysis lab, the upgrade and open space of Sports & Culture, and various functional user requirements. In addition to the real-estate investment, investments will also be made in equipment and inventory. This includes investments in food-service facilities, investments in the area of ICT, investments in research equipment (in the faculties) and the furnishing of teaching rooms.

Student Loan System

With effect from 2016, the Executive Board made available a budget of 6.0 million Euros on a structural basis for pre-investment in anticipation of the introduction of the Student Loan System. As of 2017, this pre-investment is increased on a structural basis to €8.0 million per year. The distribution of the €8 million allocated to the faculties in the 2017 budget round remains unchanged, since it will be mainly used to finance long-term plans.

Multi annual budget

An overview of the budget for the period 2018 to 2022 is shown opposite. The effects of wage and price adjustments and the possible compensation from the Ministry of Education, Culture and Science are disregarded in this composition, and the 2018 price level has therefore been used for the 2019-2022 period. The pre-investment in anticipation of the student loan system is €8.0 million per year with effect from 2017, and this is the amount budgeted for the years 2018-2022.

Negative operational results are expected for the coming five years. In 2019, the result will incidentally be influenced by non-recurring accommodation costs, due to the proposed removal of the Biotechnology, Kramers Lab and Yellow Chemistry buildings. It should be noted that the financial consequences of the real-estate strategy will not yet reach their full expression in this planning period, given that some important projects will not be completed until after 2022. Maintaining the fundability and affordability of the investment plan as a whole will require searching for possibilities to generate additional revenues.

Based on the currently expected development of the government contribution and tuition fees, it will not be possible to fund the increasing costs without intervention, and this will lead to negative operating results in the coming years. In cooperation with 4TU, it has been indicated to the Ministry for Education, Culture and Science that variations in income (government contribution and tuition fees) mean that there is not sufficient funding to cover rising indirect accommodation costs or direct personnel costs. The Ministry of Education, Culture and Science is currently investigating the funding of universities and universities of applied science. The funding study focuses specifically on the technical programmes.

Multi-annual budget

Amounts in millions of euros	actual 2017	budget 2018	budget 2019	budget 2020	budget 2021	budget 2022
Income						
Government contribution (including other government contributions and subsidies)	378	383	386	388	393	397
Tuition and examination fees	65	70	76	76	77	78
Revenues from work with third parties	196	197	197	197	197	197
Other income	21	24	24	24	24	24
Total revenues	660	674	683	685	691	697
Expenditure						
Personnel expenses	449	451	456	460	462	464
Depreciation	40	42	40	47	51	55
Accommodation costs	65	62	68	53	58	57
Other expenses	110	128	128	128	128	128
Total expenses	664	683	692	688	698	705
Balance of income and expenditure	-4	-9	-9	-3	-7	-8
Financial income and expenditure	1	1	1	0	-2	-5
Result	-3	-8	-8	-3	-10	-13
Result from participating interests and value adjustments to financial fixed assets	-2	-2	-2	0	0	0
Result before taxes	-5	-11	-10	-3	-10	-13
Taxes	0	0	0	0	0	0
Result after taxes	-5	-11	-10	-3	-10	-13
Third-party interest in consolidated parties	0	0	0	0	0	0
Net result	-5	-11	-10	-3	-10	-13

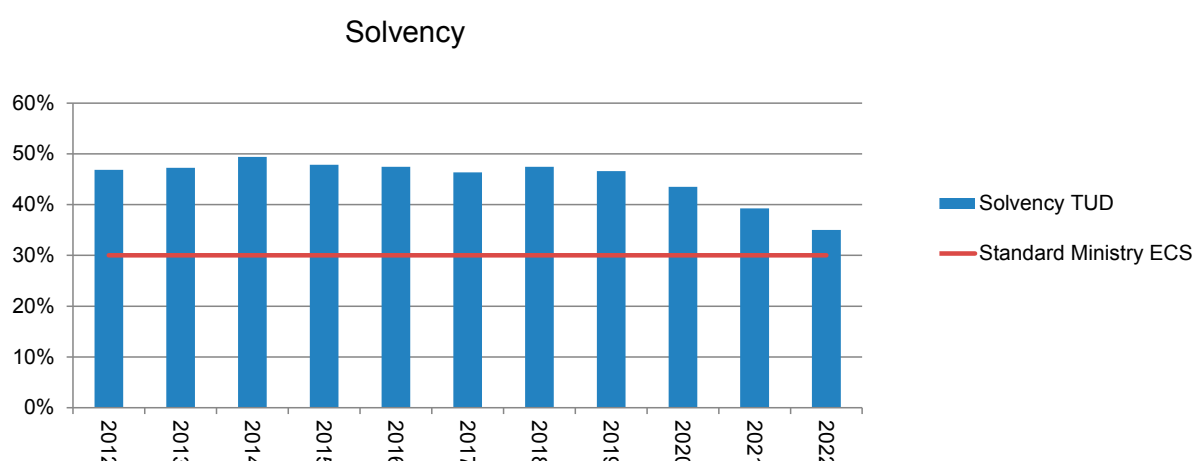
The following balance sheet shows the budget for the 2018-2022 period:

Multi-annual budget balance sheet						
Assets	actual 2017	budget 2018	budget 2019	budget 2020	budget 2021	budget 2022
	M€	M€	M€	M€	M€	M€
Fixed assets						
Intangible fixed assets	0	0	0	0	0	0
Tangible fixed assets	464	509	586	645	712	781
Financial fixed assets	12	15	15	16	16	17
	476	523	601	660	728	798
Current assets						
Inventories	0	0	0	0	0	0
Receivables	150	106	104	102	99	99
Securities	21	21	21	21	21	21
Cash and cash equivalents	168	139	55	49	48	50
	340	266	181	172	169	171
Total assets	816	790	782	832	897	968
Liabilities						
	actual 2017	budget 2018	budget 2019	budget 2020	budget 2021	budget 2022
	M€	M€	M€	M€	M€	M€
Equity capital						
General reserve	355	351	341	338	329	316
Special-purpose reserve	-3	-3	-3	-3	-3	-3
Fund for special purposes	26	26	26	26	26	26
	378	374	364	361	352	339
Provisions	61	56	58	61	64	67
Long-term liabilities	0	0	0	50	122	203
Current liabilities	376	360	360	360	360	360
Total liabilities	816	790	782	832	897	968
	46%	47%	47%	43%	39%	35%
	0,9	0,7	0,5	0,5	0,5	0,5

Investments in campus development will result in an increase in tangible fixed assets in the coming years. On the other hand, it will also result in decreasing liquid assets. This trend will continue and will lead to TU Delft having to borrow money from 2020 onwards. There will then no longer be a surplus of financial resources. Liquid assets are shown in the chart below.



Solvency will decrease as a result of negative operating results in the coming years but, as the chart shows, it will remain above the standard of 30% set by the Ministry of Education, Culture and Science.



6.3 Developments in key indicators (Part A1)

Expected staff numbers

The table below shows the expected development of the FTE numbers. A distinction is made between the job groups 'academic staff', 'administrative and support staff' and 'student assistants'. The classifications in this system are different from the format prescribed in the letter from the Ministry of Education, Culture and Science, but they are in line with the system generally used at TU Delft. The FTE numbers are based on the numbers realised at the end of 2017 and averages from the budget approved by the Supervisory Board in December 2017 for the following years.

In 2017, teaching-staff appointments were less than expected. It is difficult to find high-quality staff members, particularly in the current market conditions. Teaching-staff appointments are expected to increase through 2019, after which they will stabilise.

An increase in administrative and support staff can be seen in 2018, due largely to the establishment of a good real-estate organisation, with a view to real-estate investment plans for the coming years.

FTE development							
	Actual	Budget	Budget	Budget	Budget	Budget	Budget
	2017 (year-end)	2018 (year-end)	2018 (average)	2019 (average)	2020 (average)	2021 (average)	2022 (average)
Academic staff (WP)	3.063	3035	3053	3121	3122	3146	3157
<i>Professor, university professor, university teacher, teacher</i>	<i>1.174</i>	<i>1254</i>	<i>1238</i>	<i>1262</i>	<i>1258</i>	<i>1255</i>	<i>1250</i>
<i>Researcher, PhD students, other scientific personnel</i>	<i>1.889</i>	<i>1781</i>	<i>1815</i>	<i>1859</i>	<i>1864</i>	<i>1891</i>	<i>1907</i>
Administrative and support staff (OBP)	2086	2146	2150	2154	2154	2155	2153
SA	39	41	40	47	41	41	41
Total	5188	5222	5243	5322	5317	5342	5351

Expected student numbers

The number of students at TU Delft is expected to exceed 25,000 by 2022. Previously, it was assumed that the student numbers would reach the 25,000 level by 2025. This indicates that the increase is occurring more rapidly than expected. The estimate shown below for the period to 2022 was compiled when the budget was approved in December 2017.

	2017	2018	2019	2020	2021	2022
student numbers	22.500	23.500	23.900	24.400	24.900	25.300

B Other reports

6.4 Report on the presence and operation of the internal risk management and control system (Part B1)

The internal risk-management system within TU Delft specifically addresses the reality of the university organisation. Inspired by the COSO framework and Simons' 'Levers of Control', a specific frame of reference was created for the design of management control and risk management within a university context. The pragmatic interpretation and application of these models has been shown to best match the complex organisational context.

Nature of the university organisation

The university is characterised by the decentralised organisation of science, with a high level of autonomy for scientists and faculties. The university's primary tasks – academic research and teaching, and the valorisation of research, as described in the Higher Education and Research Act (WHW) – are carried out by the faculties. Moreover, universities are open network organisations. The academic staff is connected to global academic networks and thereby also to the social and economic environment. Because of these complex networks, coordination and decision-making processes within the university are complicated. Furthermore, universities are largely publicly financed organisations that are required to give proper account of their actions.

Broad control instruments

To achieve the proper planning and accountability within this complex organisation, it is essential that the many internal processes which keep the university in operation are well controlled. By virtue of the university's organisational character, TU Delft devotes attention to both hard management instruments (e.g. rules and monitoring reports) and soft management aspects (e.g. shared values and dialogue). To this end, the management instruments are organised into four groups:

- Culture, behaviour and integrity

What core values are part of the culture of the organisation? One example is delivering high academic quality in view of academic integrity.

- Communication

What strategic plans, risks, opportunities, uncertainties and global developments are discussed in various formal and informal meetings?

- Policy and regulations

What policy guidelines and regulations are in place to assess activities and to avoid risks?

- Monitoring and reporting

What quantitative and qualitative administrative information and information systems are used to monitor the progress and effectiveness of the strategic plans? Are we on the right track or are adjustments necessary?

Planning and evaluation cycle

The TU Delft internal risk management and control system is an ongoing process, which also has a place within the planning and evaluation cycle (P&E cycle). The P&E cycle consists of the cycle of administrative consultation between the Executive Board, the Dean and the management teams of the faculties and the University Services. It is a framework that enables the administration and management of the university to formulate strategic and derived policy objectives, to identify risks, to monitor processes and to adjust them in a timely manner. Within the P&E cycle, the strategic planning and internal process management is analysed and discussed from the four aforementioned perspectives. It is a structured working method, supported by a system of instruments, systems and agreements, and driven by values, standards and regulations aimed at the realisation of the strategic objectives.

Decentralised risk management and control

In addition to the central risk management and the continuous dialogue in the P&E cycle, risk management tools (including risk matrices) are used in several relevant supporting domains for the systematic monitoring of risks and special developments.

Specific bodies

Internal Audit

Internal Audit is an independent and objective function that delivers added value by carrying out audits and advisory assignments in a consistent and structured manner through assurance (providing certainty) and advice (making recommendations suggesting actions for improvement). The services of Internal Audit are intended for internal use within TU Delft, focusing on operations. Assurance and advice are directed towards governance, risk management and internal planning and management with regard to operations and IT. Internal Audit supports the Executive Board, the Deans and the directors of TU Delft by providing them with analyses, findings, evaluations, assessments and recommendations concerning the activities that have been investigated. In doing so, Internal Audit plays an important supporting role for the Executive Board, the management and the Deans of TU Delft, helping them to be in control in implementing, improving and accounting for their activities.

Audit Committee

The Audit Committee of the Supervisory Board monitors the TU Delft risk management and control system. In addition, the committee conducts a risk analysis each year, based on the input from the P&E cycle. The outcomes of these analyses are discussed with the Executive Board in the annual strategy meeting.

External accountant

The external accountant is an important link in the internal risk-management and control system. The audit report of the external accountant is intended to assess the legitimacy of the financial statement and whether it provides a true and fair view of the financial situation. The certainty that the external accountant provides with this report is important to the discharge procedure, and it supports the Supervisory Board in exercising its responsibility. In addition to the audit report, the external accountant provides an accountant's report and a report of interim findings. In these documents, the external accountant reports independently on the quality of the internal management and provides recommendations for improvements to be made. As a basis for the audit of the financial statements, the external accountant conducts an annual risk analysis, in dialogue with TU Delft. The external accountant consults periodically with the Audit Committee of the Supervisory Board, the Executive Board, Internal Audit and the Finance department.

Changes and ambitions for the risk management and control system

In April 2017, the Supervisory Board decided to change the TU Delft governance model effective from 1 January 2018. In this new 'combination model', the position of Rector Magnificus will be combined with the role of President of the Executive Board. It also provides for the positions of a Vice-President for Education & International Affairs and a Vice-President for Operations (COO). The administrative reform was partly motivated by the increasing importance of and attention for internal management. In view of the complexity and long turnaround time of the university's real-estate assignment, the associated risks for the university, and the need to retain the priority of the primary processes, the Supervisory Board considered it desirable to design the inherent weight and complexity of the portfolio in such a way that internal operations demand the full attention and care of a single Board member: the new position of a Vice-President for Operations enables this.

The Strategic Framework 2018-2024 also includes the ambition to develop a risk and compliance policy, in which risks at various organisational levels and for various risk categories are identified, managed and monitored in a more systematic manner, with the aim to responsibly address risks and opportunities in the realisation of the institution's objectives. In this risk management method, risks are assessed for likelihood of occurrence, as well as for the impact that they would have if they were to occur. This makes it possible to ensure that the risk management measures to be taken will be as appropriate as possible.

6.5 Description of the most important risks and uncertainties (Part B2)

In 2017, efforts within TU Delft were devoted to developing a new strategic plan for the coming 2018-2024 period: the Strategic Framework 2018-2024. Within this framework, a SWOT analysis was conducted for each of the four operational areas into which we have subdivided the core activities of TU Delft: students and education; research and innovation; people and community; and campus and services. The SWOT analyses were prepared based on a broad series of interviews and discussion sessions with internal and external stakeholders.

The threats reported in those SWOT analyses have been included in the schedule below. Measures for managing these threats have been included in the new strategic plan, as well as in the schedule below. The Strategic Framework 2018-2024, including the complete SWOT analyses, is available at www.tudelft.nl/en/about-tu-delft/strategy.

Risk area	Risk	Management measure
Students & Education	Too low staff-student ratio	TU Delft intends to better control student growth and at the same time acquire more financial resources to attract academic staff.
Students & Education	Unbalanced student growth, and limited legal possibilities to select students	TU Delft strives for a valuable diversity of students and a good balance between Dutch and international students. The quality of our education is leading herein.
Students & Education	Uncertainty in funding model (performance agreements, study advance, etc.)	TU Delft strives to be better prepared for upcoming developments in the field of Higher Education by improving the information provision.
Research & Innovation	Decrease of 1st money stream, and growing dependence on 2nd and 3rd money stream	TU Delft strives to maintain a high standard of transparency, accountability, and financial control in the coming years. To this end, we ensure strict financial guidelines are respected, such as the solvency ratio, 'current ratio', debt service coverage ratio and leverage ratio.
Research & Innovation	Strong, global competition	TU Delft aims to increase the number of internationally recognised and impactful areas of research strength.
Research & Innovation	Declining appreciation for science in society	At TU Delft we strive to connect our research more systematically to societal challenges and to make this more visible to the outside world. Students and staff members are encouraged to engage with public and private partners and to co-create and deliver multi-faceted solutions to community concerns.

People & Community	High workload and increased pressure for greater cost-effectiveness both for staff and students	At TU Delft we value a variety of career paths for our academic staff that each in its own way contributes to the various goals and values of TU Delft. We give students the opportunity to realise their ambitions in a longer period, provided they spend their time in a valuable manner.
People & Community	Strong international competition for academic talent	TU Delft will implement a focused strategy for academic recruitment, talent management and personal career. We aim to both attract (potential) figureheads in (upcoming) scientific fields, as well as support our own excellent researchers in developing as such.
Campus & Services	High maintenance costs for estate in the coming years	TU Delft will develop a policy that aims to make effective and efficient use of space, energy, equipment and materials. We discard outdated and obsolete buildings.
Campus & Services	High reserves for re-development campus present wrong image of financial position of TU Delft	TU Delft strives for a reserve policy that is as stringent as possible. In addition, we are transparent about the real estate challenges and related financial policy, to correct a possibly distorted picture.
Campus & Services	In the coming years, it is necessary for TU Delft to make large long-term campus investments. Uncertainties, e.g. student numbers, entail an investment risk	TU Delft's starting point is to invest in buildings in such a way that they are adaptable to future developments in education and research, both in size and quality.

6.6 Report of the supervisory body (Part B3)

The report by the Supervisory Board can be found on page 11 of this report.



Appendix 1

FACULTIES AND DEPARTMENTS (overview on 31 December 2017)

FACULTY OF ARCHITECTURE AND THE BUILT ENVIRONMENT (ABE)	
Department	Chair
Architecture	Prof. dr. T.L.P. (Tom) Avermaete
Architectural Engineering + Technology	Prof. dr. ir. A.A.J.F. (Andy) van den Dobbelaere
Management in the Built Environment	Prof.dr. ir. V.H. (Vincent) Gruijs
Urbanism	Prof. V. (Vincent) Nadin
OTB – Research for the Built Environment	Dr.ir. M.J. (Machiel) van Dorst
FACULTY OF CIVIL ENGINEERING AND GEOSCIENCES (CEG)	
Department	Chair
Structural Engineering	Prof. dr. ir. J.G. (Jan) Rots
Transport & Planning	Prof. dr. ir. B. (Bart) van Arem
Geoscience & Engineering	Prof. dr. ir. J.D. (Jan Dirk) Jansen
Geoscience & Remote Sensing	Prof. dr. ir. H.W.J. (Herman) Russchenberg
Hydraulic Engineering	Prof.dr.ir. W.S.J. (Wim) Uijttewaal
Water Management	Prof. dr. ir. L.C. (Luuk) Rietveld
FACULTY OF ELECTRICAL ENGINEERING, MATHEMATICS AND COMPUTER SCIENCE (EEMCS)	
Department	Chair
Software Technology	Prof. dr. A. (Arie) van Deursen
Microelectronics	Prof. dr. K.A.A. (Kofi) Makinwa
Electrical Sustainable Energy	Prof. dr. ir. M. (Miro) Zeman
Intelligent Systems	Prof. dr. ir. R. (Inald) Lagendijk
Applied Mathematics	Prof. dr. Ir. G. (Geurt) Jongbloed
Quantum & Computer Engineering	Prof. dr. Ir. K. (Koen) Bertels
FACULTY OF INDUSTRIAL DESIGN ENGINEERING (IDE)	
Department	Chair
Design Engineering	Prof. dr. P. (Peter) Vink
Industrial Design	Prof.dr.ir. R.H.M. (Richard) Goossens
Product Innovation Management	Prof. dr. H.J. (Erik Jan) Hultink
FACULTY OF AEROSPACE ENGINEERING (AE)	
Department	Chair
Aerodynamics, Wind Energy, Flight Performance and Propulsion	Prof. dr. F. (Fulvio) Scarano
Control and Operations	Prof. dr. ir. M. (Max) Mulder
Aerospace Structures & Materials	Prof. dr. ir. R. (Rinze) Benedictus
Space Engineering	Prof. dr. E.K.A. (Eberhard) Gill

FACULTY OF TECHNOLOGY, POLICY AND MANAGEMENT (TPM)	
Department	Chair
Multi Actor Systems	Prof. mr. Dr. J.A. (Hans) de Bruijn
Engineering Systems and Services	Prof. dr. ir. P.M. (Paulien) Herder
Values, Technology and Innovation	Prof.dr.ir I.R. (Ibo) van de Poel
FACULTY OF APPLIED SCIENCES (AS)	
Department	Chair
Bionanoscience	Prof. dr. M.(Marileen) Dogterom
Biotechnology	Prof. dr. I.W.C.E. (Isabel) Arends
Chemical Engineering	Prof.dr.ir. M.T. (Michiel) Kreutzer
Imaging Physics	Prof.dr. R.F. (Rob) Mudde
Quantum Nanoscience	Prof. dr. L. (Kobus) Kuipers
Radiation Science & Technology	Prof. dr. H.T. (Bert) Wolterbeek
FACULTY OF MECHANICAL, MARITIME AND MATERIALS ENGINEERING (3mE)	
Department	Chair
Process and Energy	Prof. dr. ir. B.J. (Bendiks Jan) Boersma
Biomechanical Engineering	Prof. dr. H.E.J. (Dirk Jan) Veeger
Maritime and Transport Technology	Prof. ir. J.J. (Hans) Hopman
Materials Science and Engineering	Prof. dr. I.M. (Ian) Richardson
Precision and Microsystems Engineering	Prof. dr. Ir. J.L. (Just) Herder
Delft Center for Systems and Control	Prof. dr.ir. J. (Hans) Hellendoorn
Cognitive Robotics	Prof. dr. Ir. M. (Max) Mulder (a.i.)

Appendix 2

PERSONAL GRANTS AND SUBSIDIES

Overview of personal grants and subsidies from NWO and ERC.

EU	
ERC ADVANCED GRANT	
Prof.dr.ir. C.P.A. Wapenaar (CEG)	Virtual Seismology: monitoring the Earth's subsurface with underground virtual earthquakes and virtual seismometers
ERC CONSOLIDATOR GRANT	
Prof.dr.ir. R. Hanson (AS)	QNETWORK
ERC STARTING GRANT	
Dr. M. Mazo Espinosa (3mE)	Scheduling of Event-triggered Control Tasks
Dr.ir. L. Laan (AS)	A combined in vitro and in vivo approach to dissect biochemical network evolution
Dr.ir. M.A. van der Veen (AS)	Constructing polar rotors in n metal-organic frameworks for memories and energy harvesting
Dr. W.A. Smith (AS)	Selective Conversion of Water and CO ₂ Using Interfacial Electrochemical Engineering
NWO	
VICI	
Prof.dr.ir. P.M.A. Desmet (ID)	From gloomy to cheerful
VIDI	
Dr. M.E. Aubin-Tam (AS)	Getting a hold on protein transport machines
Dr.ir. L. Laan (AS)	Dissecting biochemical network structures, which facilitate evolution
Prof.dr. E. Eisemann (EEMCS)	NextView: Many Views of Virtual Worlds
Dr.ir. C.Hauff (EEMCS)	SearchX: Integrating search and sensemaking into large-scale open online learning
Dr.ir. J.C.F. de Winter (3mE)	How should automated vehicles communicate with other road users?
Dr. T.H. Taminiau (AS)	Facult-tolerant protection of quantum states with spins in diamond
Dr.ir. G.A. Bohlin (AE)	Multidimensional mapping of spatio-thermochemical states
Dr.ir. F.H.W. Körmann (3mE)	How to mix the perfect high entropy alloy cocktail?
VENI	
Dr.ir. A. Sciacchitano (AE)	Deploying Uncertainty Quantification in Particle Image Velocimetry
Dr.ir. A.M.H. Pluymakers (CEG)	Are rocks made out of sugar: how does a realistic pore fluid chemistry influence rock mechanics?
Dr.ir. M.M.M. Bisschops Msc. (AS)	Aging yeast to understand dementia
Dr.ir. J. Alonso-Mora (3mE)	Robots among humans: safe and socially intuitive navigation

Dr.ir. F. Luzia de Nóbrega Msc. (AS)	Understanding inter-species gene exchange and compatibility
RUBICON	
Dr.ir. B.J. Hensen (AS)	Long Range Entanglement in a Silicon Quantum-processor
Dr. J.O. Island Msc. (AS)	Engineering parafermion bound states in graphene heterostructures
Dr. F. Wu Msc. (AS)	Energy budgeting of microbial players in global carbon and nitrogen cycles
Ir. B. Berghuis (AS)	Unmasking microbial genomes with microfluidics
Ir. P.L. Wang (CEG)	Energy-efficient autonomous driving trains
AWARDS FOR PHASE 1 TAKE-OFF FEASIBILITY STUDY	
Prof. dr. ir. M. Zeman (EEMCS)	Fourier Optical Measurement System with bias light
Dr. ir. W Mugge (3mE)	STIL: Suppressing Tremor through Inertial Loading
Dr. ir. J.F.M. Molenbroek (IDE)	Manometric: Automated workflow from 3D scan to customized 3D printed orthotics
Prof. dr. ir. J.L. Herder (3mE)	Spring Sense Solutions: converting passive mechanisms into sensing systems
Dr. ir. A. Tsouvalas (CEG)	Commercial feasibility of the next generation noise mitigation system: 'Woodpecker'
Dr. ir. W.A. Serdijn (EEMCS)	Improving pressure ulcer prevention with smart mobility monitoring in healthcare institutions
Prof. dr. ir. R. Dekker (EEMCS)	Design, Fabrication and Testing of an User-Friendly Interface for Organ on Chips
Prof. dr. ir. K. Bertels (EEMCS)	Big Data Accelerated Solutions: Domain-Level Synthesis for Reconfigurable Data Centers
Dr. ir. Z. Rusak (EEMCS)	Anything Connected: An intuitive platform for broad product interoperability
Prof.dr. A. Schmidt-Ott (AS)	Advanced nanofluid cooling system for high power electronics
Dr. ir. J. Alonso-Mora (3mE)	Automated aircraft inspections by drone
Dr. ir. J. van Gemert (EEMCS)	Automated Jet Engine Inspection
K.G. van Hecke MSc (AE)	Autonomous microdrones for targeted insect control
Prof. dr. ir. Q. Chu (AE)	Drones for Work
Dr. ir. J.F.M. Molenbroek (IDE)	Inflatable safety bed for adults
Dr. ir. Z. Al-Ars (EEMCS)	Deep Learning based Predictive Maintenance for Industrial Process Control
Prof. dr. ir. E.E.E. Charbon (EEMCS)	LiDAR System for Advanced Driver Assistance System (ADAS) and Fully Autonomous Vehicles
Dr. ir. T. Horeman (3mE)	OptiClips for Delayed Sterilization
Prof. dr. ir. P. Colonna (AE)	SPRHOUT (Solar PoweRed Horticultural Off-grid UniT)

AWARDS FOR PHASE 2
TAKE-OFF FEASIBILITY STUDY

Prof. dr. ir. M. Wisse	Deep Learning for industrial robots (Delft Robotics BV)
Ir. J.G. van Dijk	Designing the next generation toothbrush (Dental Robotics BV)
M. Kamphuis MSc	ProGauntlet (CrossGuard BV)
Dr. ir. R.A. Verzijlbergh	Weather Finecasting (Wiffle BV)
S.J. Bosman MSc.	Cryogenic circuit technology for the quantum industry and –physics labs 2.0
B.J.M. Arntz	GBM Works - Vibro-drill
Dr. ir. L. Galatro	High gamma vector network analyser (HG -VNA)
Ir. I.S. Swager	Smart pressure ulcer prevention
C. van de Kamp	SpringScan; Scaling up our in-store “Matras Advies Tool”
Dr. ir. M.E. Aguirre	Force-Responsive Manipulators
Drs. T.M. Werts	Healthy and vital working environment

Appendix 3

FULL PROFESSOR APPOINTMENTS

NAME	M/F	CHAIR / WORK AREA	FACULTy	DATE OF DECISION	FTE	DURATION
Prof.dr. J. Reich	m	Higher Education	3mE	24 January	1.0	indefinite period
Prof.dr.ir. J. Harlaar	m	Clinical Biomechanics	3mE	24 January	0.8	indefinite period
Prof.dr. R. Ross	m	Performance of High Voltage Energy Systems	EEMCS	24 January	0.2	5 years
Prof.dr. B. Rieger	m	Antoni van Leeuwenhoek Professor	AS	24 January	1.0	indefinite period
Prof..dr.ir. A.P. van 't Veer	m	Ship Hydromechanics	3mE	24 January	1.0	indefinite period
Prof.ir. P.T.M. Vaessen	m	Hybrid Transmission Systems	EEMCS	14 February	0.2	5 years
Prof.dr. P.M.J. Herman	m	Ecological Hydraulic Engineering	CEG	28 February	0.4	until retirement age
Prof.dr.ir. C. Poelma	m	Multiphase Systems	3mE	7 March	1.0	indefinite period
Prof.dr. S.J. Watson	m	Wind Energy Systems	AE	7 March	1.0	indefinite period
Prof.dr. M.A. Larson	f	Speech and Language Processing	EEMCS	21 March	0.2	5 years
Prof.dr. E.W. McCune	m	Sustainable Wireless Systems	EEMCS	5 April	0.2	5 years
Prof.dr. J. Groeneweg	m	Safety in Healthcare	TPM	23 May	0.2	5 years
Prof.dr.ir. R.H.J. Fastenau	m	Full professor at Faculty EEMCS, Dean Open and Online Education	EEMCS	30 May	0.6	until retirement age
Prof.dr.mr.ir. N. Doorn	f	Antoni van Leeuwenhoek Professor	TPM	27 June	1.0	indefinite period
Prof.dr.ir. B.J.H. van de Wiel	m	Antoni van Leeuwenhoek Professor	CEG	27 June	1.0	indefinite period
Prof.dr.ir. M.K. de Kreuk	f	Environmental Technology	CEG	27 June	1.0	indefinite period
Prof.dr. Z. Li	m	Rail Systems and Monitoring	CEG	27 June	1.0	indefinite period
Prof.dr. ir. Z. Lukszo	f	Smart Energy Systems	TPM	27 June	1.0	indefinite period
Prof.dr. W.D. van Driel	m	Micro/Nanoelectronics Reliability	EEMCS	4 July	0.2	5 years
Prof.dr. R.M.P. Goverde	m	Railway Traffic Operations and Management	CEG	27 August	1.0	indefinite period
Prof.dr. W. Tittel	m	Quantum Secured Communications	EEMCS	26 September	1.0	indefinite period
Prof.dr. A.A. Zadpoor	m	Biomaterials and Tissue Mechanics	3mE	10 October	1.0	indefinite period
Prof.dr. R.R. Negenborn	m	Multimachine Operations & Logistics	3mE	24 October	1.0	indefinite period
Prof.dr.ir. J.M.C. Mol	m	Corrosion Technology and Electrochemistry	3mE	24 October	1.0	indefinite period
Prof.dr. S.C. Steele-Dunne	f	Mircrowave remote sensing for water resources	CEG	31 October	1.0	indefinite period

Prof.dr.ir. H. Vallery	f	Human motor augmentation	3mE	31 October	1.0	indefinite period
Prof.dr. M.J. Santofimia Navarro	f	Physical Metallurgy	3mE	14 November	1.0	indefinite period
Prof.dr. S. Sinzinger	m	Micro-Optics and Opto-Mechatronics	3mE	5 December	1.0	indefinite period
Prof.dr.ir. R.L. Lagendijk	m	Distinguished Professor	EEMCS	5 December		
Prof.dr.ir. J.W. van Wingerden	m	Data Driven Control	3mE	12 December	1.0	indefinite period
Prof.dr.ir. C.A. Bakker	f	Design Metodology for Sustainability and Circular Economy	IDE	19 December	1.0	indefinite period
Prof. C. Dransfeld	m	Aircraft Manufacturing Technologies	AE	19 December	1.0	indefinite period

Appendix 4

OVERVIEW OF ANCILLARY ACTIVITIES OF MEMBERS OF THE EXECUTIVE BOARD AND SUPERVISORY BOARD (overview on 31 December 2017)

ANCILLARY ACTIVITIES OF MEMBERS OF THE EXECUTIVE BOARD

Tim van der Hagen

President of the Executive Board

- Member of the Advisory Council for Science, Technology and Innovation (AWTI)
- Member of the central board of The Royal Netherlands Society of Engineers (KIVI)
- Member of the Board of the Netherlands Energy Research Alliance (NERA)
- Member of the Board of GROW: Growth through Research, Development and Demonstration in Offshore Wind
- Member of the Supervisory Board of the Central Organisation for Radioactive Waste (COVRA)
- Member of the TNO Strategic Advisory Board on Energy

Karel Luyben

Rector Magnificus

- Chairman of the Supervisory Board of Applikon Biotechnology
- Member of the Supervisory Board of Theater de Veste
- Member of Research Development & Innovation Advisory Board Akzo Nobel
- President Toekomstbeeld der Techniek Foundation

Anka Mulder

Vice-President for Education & Operations

- Member of the Hochschulrat Technische Universität Hamburg
- Member of the Supervisory Board of Hotelschool The Hague
- Member of the Supervisory Board of IHE Foundation
- Member of the University Advisory Board of edX
- Member of the Comité d'orientation stratégique, Sorbonne Université
- Member of the Advisory Board for student housing provider DUWO
- Member of the Advisory Council of Stichting FutureNL

The ancillary positions of the members of the Executive Board are with permission of the Supervisory Board. This permission is not automatically granted. Further information on the TU Delft policy concerning ancillary positions can be found on the TU Delft website.

Jeroen van der Veer

- President of the Supervisory Board of the Delft University of Technology
- President of the Supervisory Board of ING
- Chairman of the Supervisory Board of Philips
- Member of the Supervisory Board of BosKalis
- Member of the Supervisory Board of Statoil, Norway
- President of the Platform Bèta Techniek
- Member of the Supervisory Board of the Netherlands Open Air Museum
- President of the Concertgebouw Fund
- Co-chairman Global Forum Council The Future of Energy (WEF)
- Chairman of the Community of Chairmen (WEF)
- Chairman of the Advisory Council of the Rotterdam Climate Initiative

Carolien Gehrels

- Member of the Supervisory Board of the Delft University of Technology
- Member of the Supervisory Board of Bouwinvest REIM
- Member of the Board of World Waternet
- Member of the Dutch Creative Council, Ministry of Economic Affairs
- Member of the Board of the Urban Renewal Platform
- Chairwoman of Ambassadors of Music Education Platform
- Member of the Supervisory Board of the Royal Concertgebouw Orchestra Amsterdam
- Chairwoman of the Board of Women Inc.
- Member of the Board of Friends of the Amsterdam Police
- Member of the Supervisory Board of The Blue Fund
- Member of the Board of Johan Cruyff Foundation
- Member of the Advisory Council of ASN Bank

Laetitia Smits van Oyen

- Member of the Supervisory Board of the Delft University of Technology
- President of the Supervisory Board of Sociaal Werkbedrijf Werkse! BV
- Member of the Board of the 'Zorg en Bijstand' Foundation in The Hague
- Member of the Board of the African Parks Conservation
- Supervisor of the Curaçao Dolphin Academy NV
- Secretary of the Friends of the Mauritshuis Foundation

Gijsbert de Zoeten

- Member of the Supervisory Board of the Delft University of Technology
- Member of the governing board of the Registered Controller programme at VU University Amsterdam
- President of the HDM Youth Academy Foundation

Luc Soete

- Member of the Supervisory Board of the Delft University of Technology
- Member of the KNAW committee 'Impact in kaart' (Impact mapped) and President of the KNAW committee 'relatie Publieke Private Onderzoeksfinanciering' (relation Public-Private Research funding)
- Member of the committee 'Doelmatigheid Hoger Onderwijs' (Expendiency Higher Education)
- Commissioner of Media Group Limburg Netherlands and independent governor of the Zeven Eycken foundation
- Chairman of the "Economic and Social Impact of Research" expert group of the European Commission
- President of the 'compass group' of the Limburg Regional Economic Cooperation (LIREs) in Belgian Limburg
- Member of the Brainport Network, as driving force of the EU-domain
- Member of the Advisory Board of the School of Business, Management and Economics and President of the Advisory Group of the Science Policy Research Unit of the Sussex University
- President of the Advisory Board of UNU-CRIS in Bruges, Belgium

Appendix 5

CLARITY NOTES

These notes provide further clarification of several accountability items in the annual report, including the outsourcing of teaching duties, the investment of public funds in private activities, exchange agreements with foreign institutions and the development of customised tracks.

TU Delft personnel and initial degree programmes

Data on the enrolment of personnel in initial degree programmes are not aggregated. If this occurs at all, it only involves a very small number.

Outsourcing to private organisations

The degree programmes registered in the CROHO are provided by the institution itself, where a number of programmes are entirely or partly provided in collaboration with partner universities. There is no outsourcing to private organisations. TU Delft does not use public funds for private educational activities.

Expenditure of public funds on private activities

TU Delft spends public funds on such private activities as providing facilities for students (housing or other facilities). The scope of these activities, permitted by the relevant laws and regulations, is extremely limited and makes a positive contribution to improving the quality of the education and/or research.

Tailored tracks

There are no paid tailored tracks for external organisations and/or companies within the existing degree programmes.

Modules

Students occasionally take programme modules without actually intending to obtain the degree certificate. These students belong to the HBO bridging student group and are enrolled in Bachelor's degree programmes in order to follow bridging programmes in accordance with an agreement with the ministry.

Emergency fund

An emergency fund exists for students with financial problems. The emergency fund is only used in exceptional cases, always involves a loan and always involves costs other than tuition fees, such as hospital costs. Tuition fees are never reimbursed.

Following a different degree programme than the one in which the student is enrolled

This is not applicable at TU Delft.

Exchange agreements

TU Delft has exchange agreements with a broad range of foreign knowledge institutions. In the 2016-2017 academic year, 600 foreign students participated in exchange programmes at TU Delft, and there was an equivalent number of outgoing exchange students. There were no applications for funding for any of these students. More than 3,000 Dutch students gained international experience following a degree programme this year. An overview of the knowledge institutions with which TU Delft has an exchange agreement can be found at www.tudelft.nl/en/education/programmes/exchange.

Appendix 6

DEFINITIONS

Term	Definition / Description
Bachelor's degree	A Bachelor's degree is a degree certificate awarded as a result of the successful completion of the Bachelor's degree programme.
Binding recommendation on the continuation of studies (BSA)	If a student does not meet the BSA requirements of a minimum of 45 ECTS (European Credits) in the first year of enrolment, he/she may not re-enrol in this TU Delft programme for three years. The following recommendations are given in the course of the academic year (in March and August): Positive, Doubtful, Negative or Postponed (= special circumstances preventing the student from meeting the requirements). In addition, the number and percentage of students who discontinue their studies before 1 February of the current academic year is shown. The definitive binding recommendation (in September) does not contain the Doubtful category.
Foreign student	A student who does not possess Dutch citizenship.
First-year student at the institution	A person who is enrolled at TU Delft as a student for the first time in the academic year in question.
Re-enrolment students	Students who enrol for the second academic year of the same programme/faculty/institution as the one in which they started.
Master's degree	A Master's (or doctoraal) degree is a degree certificate awarded as a result of the successful completion of the final examination of a Master's or doctoraal degree programme.
Degree programme	A degree programme is a Bachelor's or Master's degree programme accredited by the Ministry of Education, Culture and Science. All programmes are registered in the Central Register of Higher Education Degree Programmes (CROHO). This register also indicates whether the programme is funded by the government.
Reference date	The date on which the selection is made during a count. The reference date for intake and population is 1 December of the academic year in question. That means that only the students who are enrolled on 1 December will be included in the count. The reference date for degree certificates, drop-out and pass rates is 31 August of the academic year in question. All degree certificates awarded up to and including that date will be counted.
Profiling Fund	The purpose of the Profiling Fund is to provide financial assistance to students who have fallen behind in their studies due to exceptional circumstances, as specified in Art. 7.51, paragraph 2 of the WHW. The following are regarded as exceptional circumstances: situations beyond the student's control, recognised administrative or participation activities, or top-level participation in sports or culture.
Propedeeuse	This consists of the stipulated 60 ECTS of the first year of the Bachelor's degree programme. The name 'propedeeuse' was abolished as from the 2014-2015 academic year.
Pass rates	The percentage of students who have completed the programme (or institution, faculty) successfully (obtained a degree certificate). This can be broken down into different groups (such as foreign citizens, women and joiners from pre-university education).

Bridging class / Bridging programme	<p>A bridging class student does not have sufficient qualifications to directly enter a Master's programme. The bridging programme yields approximately 30 ECTS (depending on the Master's programme and the prior education) and ensures that the student is admitted to the selected Master's programme. Bridging-programme students are often HBO students lacking a sufficient background in mathematics, but in the past few years they have also included several Bachelor's students.</p> <p>Note: these are not Bachelor's or Master's students (even though they were enrolled in the Bachelor's degree programme up to and including 2005 and in the Master's programme from 2006 to 2010). As of 2011, bridging-programme students are no longer allowed to enrol in a Master's programme.</p>
Student (degree student)	<p>A student is a person who is enrolled 'as a student' at TU Delft in accordance with the Higher Education and Research Act. The following students are included in the education statistics of TU Delft (on the reference date of 1 December):</p> <ul style="list-style-type: none"> • those who are enrolled as full-time or external students • those who intend to complete a TU Delft programme and obtain a degree certificate • those who paid tuition or examination fees to TU Delft <p>The condition 'Has paid the tuition fee to TU Delft' means that some of the students active in the so-called joint programmes are not included in these indicators. Only their main study programme counts: a student can be enrolled in multiple study programmes, but will in this way only be counted once.</p> <p>The counts do not include the following students, unless specified otherwise:</p> <ul style="list-style-type: none"> • exchange students • free mover students • minor students • guest students • contract students <p>These exceptions concern students who do study at TU Delft, but who do not intend to take a degree audit here.</p>
Duration of study	<p>The time that elapses (in years) between the first-time enrolment and the time at which the relevant diploma has been achieved. The first-time enrolment is taken to be 1 September of the academic year in question. The time of graduation occurs when the student has met the final requirement for obtaining the diploma in question.</p>
Study switcher	<p>A student who chooses to enrol in a programme that is different from the programme in which he/she was originally enrolled (at TU Delft).</p>
Drop-out	<p>Students who leave the programme, either to discontinue their studies or to study somewhere else. There are three different types of drop-out: at programme level, at faculty level and at institutional level (TU Delft-wide).</p>
Joiner from pre-university education	<p>A student who earned the VWO diploma in the same academic year as the one in which he or she enrolled at TU Delft as a first-year student.</p>



