

Where innovation starts

Institutional Plan
2017 - 2020

April 2017



Technische Universiteit
Eindhoven
University of Technology

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Preface

The TU/e Strategic Plan 2020, presented in 2011, speaks to our ambition to have a large scientific and societal impact as an internationally renowned research university in engineering science & technology. This also delineates the role we want to play in the high-tech Brainport region and in the Dutch knowledge economy: to contribute to societal solutions and the competitiveness of the region by training talented engineers and doing excellent research.

The Strategic Plan 2020, presented by the university in 2011, is best characterized as a strategy of growth, with the core goal of increasing student numbers by 50%, up to about 11,000 students. Taking action on the large, global societal challenges and further developing the high-tech ecosystem of the Brainport region requires highly skilled technological knowledge workers. This year, we welcomed our 11,000th student, but this does not mean our growth is complete.

Still, this growth has so far been a great success: this ambitious target has been reached through the large-scale efforts of our staff. Our university community can be proud of what we achieved in such a short time. At the same time, this growth poses our main challenge for the near future: the number of students is rising faster than our means – to appoint scientists and lecturers and to invest in the required educational infrastructure. The most important priority is maintaining our educational quality: if our means are insufficient, we must limit the number of students.

However, it remains important to strive toward training more engineers – as an institution and a society. Not fully meeting the need for engineers will have a substantial impact: large talent shortages for our high-tech ecosystem, but also a step back in realizing new technology to support the energy transition, better healthcare and new,

more effective mobility. In short, it remains crucial to fully meet the growing need for engineers; for the Netherlands as a whole and the Eindhoven region in particular.

In addition to our growth, the university has also made strides in other areas: large-scale educational innovation, participation in excellent research projects, more intense collaboration with companies, renovations of buildings and facilities on campus and further development of our internal support processes. Many people have worked hard for these successes, which is why many ambitious goals for 2020 have already been achieved today. To allow both education and research to continue to shine in the near future, we do have to address new challenges. This is why this institutional plan provides an update to our Strategic Plan 2020, on themes such as excellence, international impact, partnerships, where people matter and a healthy financial basis.

In the coming years, TU/e needs to focus on these challenges. At the same time, important trends require us to look beyond 2020: digitization, global knowledge hubs, smart specialization of regions, increasing global competition for talent, and the strong need for innovation to maintain the competitive position of Dutch industry. To make timely decisions, together with our partners, we need to explore the world beyond the 2020 horizon.

For this reason, we are inviting students, employees and partners to work with us to make the updated Strategic Plan 2020 become reality and to start a conversation about what TU/e can look like in 2030.

The Executive Board,

Jan Mengelers, president
Prof. Frank Baaijens, rector magnificus
Jo van Ham, vice president
Eindhoven, April 2017

A night-time photograph of a park area with a large tree on the left and a circular path. In the background, a building is illuminated, and a large, curved, illuminated structure with the text 'THE WHERE INNOVATION STARTS' is visible. The text 'TU/e profile' is overlaid in large white letters on the left side of the image.

TU/e profile

Science for society, industry and science

Eindhoven University of Technology (TU/e) is a research university that specializes in engineering science and technology. Through our education, research and knowledge valorization, we contribute to:

- **Science for society:** solving the major societal challenges and increasing prosperity and well-being, with a focus on the strategic areas of Energy, Health and Smart Mobility.
- **Science for industry:** developing technological innovations in collaboration with industry, with a focus on High Tech Systems and Data Science.
- **Science for science:** promoting progress in engineering sciences through excellence, with a focus on Complex Molecular Systems and Integrated Photonics.

Excellence in education

We consider it our mission to educate engineers with a solid scientific foundation, who will contribute to society in important and innovative ways throughout their careers.

In the Bachelor College and Graduate School, the following elements are of crucial importance:

- Striving for excellence, most importantly through connecting research and education
- Electives and space for students to compose their own course profile
- 21st century skills
- Small scale and master-journeyman interactions as essential building blocks of academic education
- Internationalization of the student population, for a more diverse student body

Excellence in research

Through high-quality research, TU/e contributes to technological innovation and progress in engineering sciences. We focus on those areas where we can play an important role in the international arena. TU/e wants to boost the knowledge-intensive industry and other societal sectors characterized by a high or fast-growing degree of technological development.

Knowledge valorization

TU/e is an important player in the technological ecosystems of Brainport, the Netherlands and Europe, driven by the major industrial and societal challenges. We collaborate with companies and societal organizations to translate our research results into successful innovations, which help bring about new products, processes and companies. We stimulate entrepreneurship among our students and staff.

Partnerships

To fulfill our ambitions, TU/e collaborates with prominent national and international partners, including:

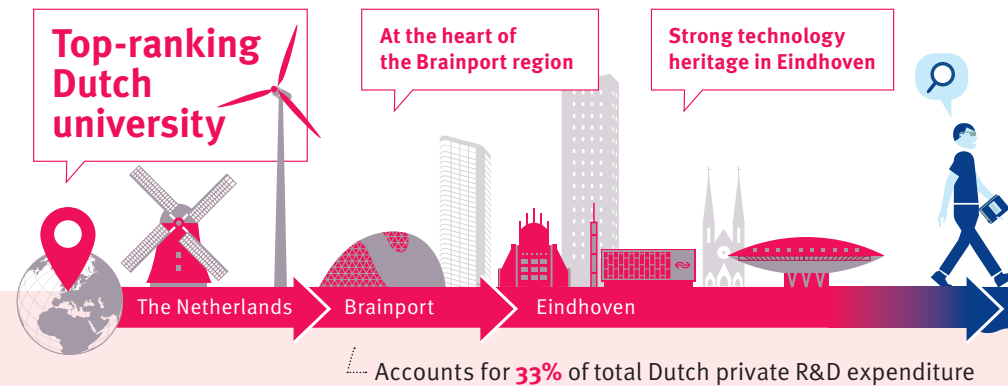
- The alliance with Utrecht University and UMC Utrecht.
- 4TU.Federation with TU Delft, University of Twente and Wageningen University.
- EuroTech Universities with Danmark Tekniske Universitet, Technische Universität München and Ecole Polytechnique Fédérale de Lausanne.

TU/e mission

We aim to establish ourselves as an internationally prominent university specialized in engineering science and technology. We offer high-quality education and research to contribute to progress in engineering sciences, innovative technology and growing prosperity in our region (technology and innovation hotspot Eindhoven) and beyond.

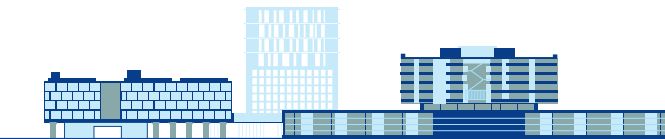
In short, TU/e presents itself as the university Where Innovation Starts.

All facts and figures
are based on the year 2016



3 Strategic areas

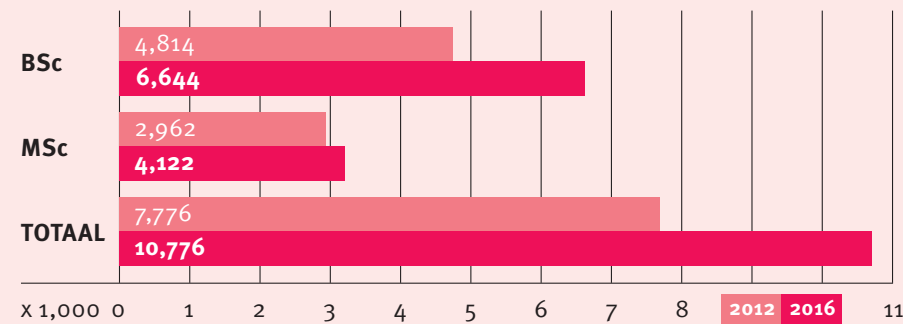
Energy **Health** **Smart Mobility**



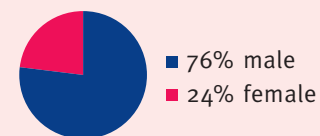
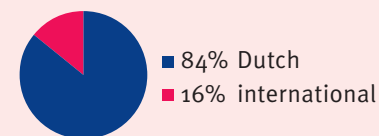
The TU/e campus covers an area of 75 hectares



Student growth



10,766 Total number of students More than **80** nationalities
(+38% growth compared to 2012)



Engineers for the future

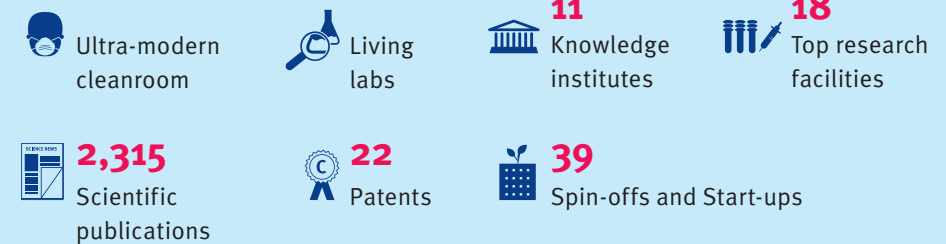
92%
Of the graduated
students find a job
within 6 months

2,426
Total degrees awarded
911 BSc / 1,144 MSc
137 PDEng / 234 PhD

41,715
Alumni
85% Male
15% Female

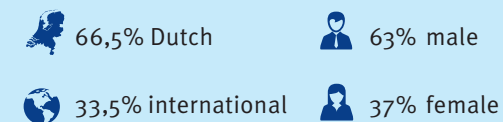


Ecosystem & characteristics



International working environment

2,946 Total staff (fte) **1,951** Research staff (fte)



141 Full professors
121 Parttime professors
125 Associate professors
310 Assistant professors
1,443 PhD fellows



Rankings





Midterm review of the Strategic Plan 2020

TU/e launched its Strategic Plan 2020 in 2011, after two years of conversations with TU/e staff and external experts and stakeholders. The Strategic Plan 2020 is, in essence, a growth strategy based on the societal need for highly educated engineers.

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Now, it is time for a midterm review of the TU/e Strategic Plan 2020 and, by extension, the Institutional Plan 2013-2016. In the past four years, external factors such as funding, high-tech ecosystem, research opportunities and student enrollment have changed. In this midterm review, we take stock of our performance in 2011-2015 and look ahead to the challenges for 2016-2020.

Education

The profile of our engineers has been broadened significantly with the major educational renewal in the Bachelor College (from 2012 onward) and the Graduate School (from 2015 onward). Quality assurance has improved as well. Our new educational vision focuses on a high level

of agency for students to compose their own competence and knowledge profile. With great effort from TU/e's scientific and support staff, these innovations have been very successful, and nearly all education goals for 2020 had already been reached in 2015.

Student numbers have grown more than expected. That means our goal for 2020 – an increase of 50% to 11,000 students – has already been achieved. The percentage of female students has also grown, from 18% in 2011 to 26% in 2016. We expect the total number of students to keep increasing until 2023.

In addition to this ambitious growth, we have also reached the desired levels when it comes to student performance. Undergraduate success rates have grown from around 40% to 70% within the allotted time. In addition, first-year student drop-out levels have been reduced from 23% to 17%.

In 2014, TU/e passed the NVAO institutional audit. The resulting recommendations are being implemented. As of 2016, educational support will be streamlined and organized interdepartmentally rather than in departmental programs. This will help optimize the growing number of programs that cross departmental boundaries and enable our students to fully utilize the space for electives.

In education, the great challenges for the next few years are accommodating growth, consolidating educational innovations and streamlining educational support.

Research and valorization

Research and valorization have made headway across the board. In the strategic areas, in innovative multi-disciplinary research initiatives and in developing promising R&D institutes in important niches, such as the Integrated Photonics Institute (IPI), the High Tech Systems Center (HTSC) and the Data Science Center Eindhoven (DSC/e). Important in achieving our ambitions is our Impuls program to create more PhD positions. With a 100-million-euro

In recent years, the following projects and achievements have helped shape the university's strategy:

Profile	Education	Research & Valorization	University
Science for society (2011) Strategic Areas: Energy, Health, Smart Mobility	Growth 2010: 7,300 students 2020: approx. 14,000 students	Excellence 4 x Gravitation (2013-2014) Strong participation in European FP7	Campus 2020 Construction & Renovation Groene Loper (2016)
Science for industry (2014) Data Science High Tech Systems	Bachelor College (2012) Engineer of the future Student performance	Focus & relevance Impuls program Industry partnerships	Digitization Information systems IT infrastructure
Science for science (2014) Complex Molecular Systems Integrated Photonics Institute	Graduate School (2014) Engineer of the future MSc, PDEng, PhD	Partnerships Utrecht 4TU EuroTech Universities	Diversity Female scientific staff (11% --> 17%) International scientific staff (15% --> 20%)
	Quality assurance Institutional audit (2013) University Teaching Qualification	Valorization Entrepreneurship Ecosystem development	Updated personnel policy Development tracks Broad evaluations
	New educational programs Automotive (2013) Data Science (2016)	Facilities Scaling up and renovating labs	Efficacy Low overhead

investment in collaboration with industry and government, the program has created around 270 PhD positions in the focal points of TU/e research. This has strengthened the collaboration with industry, increased investment in our research priorities and has helped compensate for reduced government funding, which had not been anticipated in 2011.

In addition to the Impuls program, we also achieved significant results in for instance the NWO Gravitation programs, the Seventh Framework Program and Horizon2020. At the same time, our international impact is under pressure due to the rise of science and technology in the BRIC-nations (Brazil, Russia, India and China) and the growing demand for education that causes TU/e scientists to spend more time on education and less time on research.

Our performance and excellent industry collaboration have gained international visibility. Thanks to the large number of TU/e professors who work both at the university and in industry, and the many collaborative publications that result from that, the European Commission has heralded TU/e as best practice for a ‘university as entrepreneurial ecosystem.’ For years now, TU/e holds a leading position in the international listing of publications with innovative companies.

The challenges for the next few years are solidifying our recruitment approach, to further stimulate excellence, and to create a stronger profile of the quality and relevance of TU/e research.

Cross-cutting themes

We have also made excellent progress in cross-cutting themes.

■ Campus 2020

The transformation of the TU/e Campus is the most obviously visible: the MetaForum, Flux, Ceres, FOM DIFFER, Catalyst, the Groene Loper and the two student apartment towers Aurora and Luna have been completed and campus infrastructure has been improved. Other buildings, such as our main building Atlas, are in progress. The concept of an Innovation Space is being developed: a hotspot for prototyping, hands-on education and research for student teams who can use the space to build and develop projects. With these new buildings and renovation, TU/e capacity has increased significantly, both in quantity and quality. Even so, many buildings are already being fully used.

■ HR

The TU/e scientific staff policy, ‘Excellent people attract excellent people: the next generation’ provides a recently updated and future-oriented foundation for recruiting. It will help TU/e attract driven and talented researchers, and offer them personalized career development plans that are based on their individual performance.

■ Internationalization

Progress has been made in recruiting international students. The TU/e ‘feel at home’ and ‘spouses initiative’ programs, part of HR policy developments for international scientific staff, have recently been named a best practice by the Forum for Expatriate Management (FEM). The development of an intercultural community on the TU/e Campus will soon start. In the coming years, we will invest more in internationalization, which is why this institutional plan contains an update of our strategy regarding international impact.

■ Digital University

Strides have been made in digitizing the many research, education and administration processes. A new Student Information System (OSIRIS) and Research Information System (PURE) have been introduced, and our policy regarding blended learning is being implemented. In the next few years, we will continue to stimulate departments to develop a ‘roadmap to blended learning.’ In addition, we have started to implement a new Learning Management System (CANVAS) and are looking into working with a digital examination system. These IT systems will support lecturers and make our education more student-focused.

■ Partnerships

An important element in the Strategic Plan 2020 is the university’s focus on developing and strengthening partnerships with industry, other universities and knowledge institutes: as a specialized university of technology, TU/e needs partners in industry and the wider international academic community to enhance the impact of our research and the quality of the engineers we educate. Substantial progress has been made through alliances with Utrecht University and the UMC Utrecht (2011), the start of EuroTech Universities (2012), the flagship projects from the TU/e Impuls program (2013-2016), the cooperation with Tilburg University in the Jheronimus Academy for Data Sciences (JADS) and an expansion of the 3TU.Federation into 4TU (2016).

Performance agreement

The Dutch universities have all made performance agreements with the minister of Education, Culture and Science (OCW), which are reviewed in their annual reports. At TU/e, the mandatory aspects for 2015 have been achieved, and so have almost all of the other goals. The positive judgment of the Review Committee Higher Education was accepted by the minister at the end of 2016.

Building on change

In conclusion, we are well underway with our 2020 strategy, and our results are significant. TU/e has achieved the majority of our goals for 2015, and even some for 2020. This success has required a tremendous effort. Major improvements have been achieved in our bachelor’s degree programs, master’s degree programs, the Digital University, Campus 2020, the personnel policy and many other projects.

The effects of these changes are clear: new curricula, new buildings and improved service processes. On the other hand, the workload for our scientific and supporting staff has increased significantly, especially in the fields where more students have signed up and where major changes have taken place.

In an outstanding achievement, our educational, scientific and valorization performance has remained high or has even increased throughout these changes. The consistently high student satisfaction levels are an important illustration of this. Thanks to these achievements, TU/e can consider itself one of the top European universities in the field of engineering.

While some projects will continue as planned, such as the Digital University and Campus 2020, others, such as the growing student numbers, bring new challenges. To face these challenges, TU/e can build on our excellent track record. These challenges will require substantial effort from scientific and supporting staff, so we need to manage our workloads and ensure maximum space for our primary processes: education and research.



Overview of projects of Strategic Plan 2020

	Bachelor College	Graduate School	Quality assurance education	Strategic Areas, Centers and Institutes	Educational excellence	Research infrastructure	Knowledge valorization
Goals 2020	<ul style="list-style-type: none"> ■ Differentiated and streamlined TU/e-wide education ■ Increase in numbers and diversity of student inflow ■ Securing quality and performance of undergraduate education 	<ul style="list-style-type: none"> ■ Coherent and internationally oriented graduate programs (MSc, PDEng, PhD) ■ Increase in numbers and diversity of graduates ■ Securing the quality of graduate programs and increasing performance 	<ul style="list-style-type: none"> ■ Securing and controlling the quality of programs (BSc, MSc, PDEng and PhD) 	<ul style="list-style-type: none"> ■ Increase connection between education and research with market and society, collaboration with governments, industry and societal organizations. 	<ul style="list-style-type: none"> ■ Targeted strengthening of educational excellence in certain disciplines and in innovative interdisciplinary fields 	<ul style="list-style-type: none"> ■ Profiling and professionalizing research facilities ■ Facility sharing with third parties ■ External funding for research facilities 	<ul style="list-style-type: none"> ■ Stimulating societal and economic use of TU/e knowledge, increasing external funding for research ■ Strengthening collaborations with industry, government and societal organizations ■ Stimulating entrepreneurial culture
Achieved in 2016	<ul style="list-style-type: none"> ■ Large-scale educational reform; new curricula completed; first class will graduate in 2015; performance increased significantly; evaluation by Ruth Graham in 2015 	<ul style="list-style-type: none"> ■ Reform and streamlining of MSc programs, start of new master's degree programs in 2015 ■ Increase in numbers and diversity of graduates 	<ul style="list-style-type: none"> ■ Quality assurance BSc programs improved. Institutional audit NVAO passed in 2013. Developed vision quality assurance graduate phase 	<ul style="list-style-type: none"> ■ Strategic Areas Energy, Health and Smart Mobility (2012), ■ High Tech Systems and Data Science Centers (2014) and ■ Institutes: Complex Molecular Systems (ICMS, 2010) and Integrated Photonics (IPI, 2016) 	<ul style="list-style-type: none"> ■ Realized large research programs with partners and companies (Gravitation, CBBC, etc.) ■ More focused research profile, based on science for society, industry and science 	<ul style="list-style-type: none"> ■ Overview of research facilities on website ■ Proposals for research facilities 	<ul style="list-style-type: none"> ■ TU/e Impuls PhD positions in progress ■ Developed vision and action plan for valorization ■ Initiatives and financial facilities entrepreneurship, developed with regional and national partners: STARTUP/eindhoven and Brightmove
Challenges 2017 - 2020	<ul style="list-style-type: none"> ■ Growing in a managed fashion, continuing educational reforms such as blended learning and educational differentiation; continuing to develop excellence in education 	<ul style="list-style-type: none"> ■ Increasing the excellence of graduate programs ■ Tailoring the graduate programs to our focus areas 	<ul style="list-style-type: none"> ■ Midterm review as preparation for second NVAO audit in 2019. Further development of quality assurance PDEng programs 	<ul style="list-style-type: none"> ■ Strengthening scientific profile of TU/e ■ Strengthening TU/e impact through roadmap-based partnerships with industry, governments and scientific institutes 	<ul style="list-style-type: none"> ■ Increased investment in recruiting excellent scientific talent and professional support of researchers' personal development ■ New approach for scouting and stimulating personal grants ■ Even more focused research profile around themes of excellence and impact 	<ul style="list-style-type: none"> ■ Realize TU/e roadmap for research facilities ■ Planning and obtaining external funding for large facilities 	<ul style="list-style-type: none"> ■ Achieving multiplier within TU/e Impuls program ■ Create living labs for relevant topics ■ Realize TU/e Research Support Network

	Future-oriented educational organization (TOO)	Partnerships	Internationalization	TU/e Campus	Human Resource Development	Digital university	
Goals 2020	<ul style="list-style-type: none"> ■ Reorganize educational organization and supporting processes to solve bottlenecks found in analysis in 2015. 	<ul style="list-style-type: none"> ■ Partnerships that contribute to the mission and strategy of TU/e, including flagship projects with companies and alliances with academic partners 	<ul style="list-style-type: none"> ■ More international student population, education and university culture 	<ul style="list-style-type: none"> ■ Developing TU/e Campus to sustainable campus of international standing ■ Increase sustainability, target of 50% climate neutral in 2030 	<ul style="list-style-type: none"> ■ Develop policy and tools for differentiated career development for scientific staff ■ Increase percentage of women in top scientific positions 	<ul style="list-style-type: none"> ■ IT infrastructure accessible anywhere, anytime, from any device ■ Ensure state-of-the-art IT facilities for research and education 	
Achieved in 2016	<ul style="list-style-type: none"> ■ Setting up new educational organization and support structure, optimizing educational processes and systems. 	<ul style="list-style-type: none"> ■ Alliance with Utrecht University and UMC Utrecht, participation in EuroTech and expanding 4TU by adding Wageningen University. ■ Flagship projects within TU/e Impuls program started 	<ul style="list-style-type: none"> ■ Action plan for international recruitment ■ Roadmap 'international experience' started ■ International partnerships (such as EuroTech) consolidated 	<ul style="list-style-type: none"> ■ MetaForum, Groene Loper, Ceres and Flux (all TU/e buildings) ■ Facilitated FOM DIFFER, Catalyst (incubator) and living spaces Aurora and Luna 	<ul style="list-style-type: none"> ■ Scientific personnel policy developed ■ Increased percentage of women in top scientific positions 	<ul style="list-style-type: none"> ■ Digital University program started ■ Learning management system CANVAS and research information system PURE implemented, personnel systems digitized 	
Challenges 2017 - 2020		<ul style="list-style-type: none"> ■ Consolidate and develop partnerships, focusing on long-term roadmaps ■ Explore role of partners in internationalization 	<ul style="list-style-type: none"> ■ Strengthening international TU/e community: more international students and staff, strengthening the international character of TU/e 	<ul style="list-style-type: none"> ■ Renovation Atlas (main building) and Gemini ■ Manage use of space with an eye to growing student numbers 	<ul style="list-style-type: none"> ■ Put in place a new approach for scouting and stimulating personal grants ■ Increased investment in interdepartmental talent management 	<ul style="list-style-type: none"> ■ Continue and update Digital University program: Blended Learning, Research Data Management and computational infrastructures 	



Update of Strategic Plan 2020

The results of this midterm review will be used to update the Strategic Plan 2020. Out of the 16 aspects of that plan, six will have a new or revised approach.

■ **Growth**
Moving from a strong investment in growth to a controlled approach to growth. Accommodating the growing student population while staying true to our educational vision: small scale, space for electives, and hands-on education.

■ **Excellence**
Our growing educational needs and the increasing ‘war for talent’ require more investment in attracting talented scientists to further increase our scientific quality and meet the growing demand for education.

■ **International impact**
Increasing the international impact of education, research and knowledge valorization, to strengthen our position in a range of scientific fields and increase the relevance of our university and graduates for industry and society.

■ **Partnerships**
Strengthening and creating partnerships with universities, research organizations, governments and industry. The goal is long-term collaboration with partners to create educational programs, attract scientific talent and work on knowledge valorization.

■ **People**
Attracting more talented scientists and enabling them to excel. Modernized service processes will enable a close connection between researchers and supporting staff.

■ **Finances**
We need to focus on funding the increased demand for education while maintaining our balance between education and research, becoming more effective at obtaining external research funding and further diversifying our income.

I. Managing growth

The TU/e student population is growing rapidly. In 2011, we set the goal to grow to around 11,000 students. This goal was reached in 2016. If we continue with our current approach, the student body will grow to around 14,000 students.

The university considers this growth a success: TU/e, societal parties such as the Platform Bèta en Techniek and the Dutch government have long worked toward increasing the number of graduates with a STEM degree. The companies in high-tech region Brainport and elsewhere in the Netherlands badly need these graduates. Recent studies also show that the demand for university-educated engineers is twice as big as the number of graduates.

TU/e is not the only university growing rapidly. Other universities of technology such as TU Delft and Wageningen University are also seeing an increase in STEM students. This growth in all STEM areas is very beneficial to Dutch society and industry.

Student-staff ratio		
2016	1:18	
2020	< 1:18	

However, this fast, consistent growth since 2012 also poses a challenge: accommodating a doubled student population requires doubled resources. Because government funding is not growing apace with the number of students, the ratio of staff to students will change from 1:14 in 2010 to 1:25 in 2020. In addition, the need for study facilities, lecture halls and laboratories will increase.

Basic principles for growth
TU/e aims to grow as much as possible, but in a managed way: growing in those areas where quality of education can be maintained, given the limited numbers of lecturers, labs and building space. TU/e formulated a number of leading principles for accommodating our growth:

- Excellence in education, science and research
- Intertwining research and education
- Small scale
- High intensity of student-teacher interaction
- On-campus
- T-shaped ‘engineers of the future’
- Close collaboration with industry
- ‘Where people matter’

Based on these leading principles, each program will be reviewed for available educational capacity and limits may be set on the number of incoming students. As a first elaboration on these principles, two generic conditions have been formulated:

- Extra financial means will be invested in extra scientific staff
- At least 1/3 of education will be ‘hands-on’

Percentage of incoming female students

2016 18%
2020 > 35%

In addition, increased diversity among students and staff is an important value. Our goals:

- Increasing the number of women to at least 1/3 of new students
- Increasing the number of international students to 20% undergraduates and 30% graduate students

Managing inflow

To manage the inflow of students in the undergraduate programs, TU/e will take the following steps:

- **Intensifying the program choice check-in:** TU/e advises all prospective students on program choice, based on self-report, a questionnaire, their high-school transcript, university experience such as a sample lecture, and a conversation with one of the bachelor’s degree program coaches. Intensifying this check-in means more interaction with prospective students, allowing these students to get a better idea of the nature of the program and the work involved.



- **Enforcing a May 1 enrollment cutoff:** the university may refuse students whose applications come in after May 1.
- **Introducing decentralized selection, the so-called *numerus fixus*.** When the number of applications exceeds the available capacity, the university will select which students to enroll. TU/e will adopt this measure if student inflow threatens to significantly exceed the available educational capacity. Even doing so, we will take on as many students as possible. Adopting a decentralized selection approach does not mean we aim to reduce the number of students. We aim to continue growing, in a managed way.

To manage the inflow of students in the graduate programs where needed, TU/e may decide to experiment with the following steps in 2017:

- **Introducing program choice advice:** similar to the undergraduate programs, we will give prospective students more opportunities to select a master’s degree program that suits them. We will aim our efforts mostly at second-year bachelor’s degree students, so they can prepare for the master’s degree program of their choice, for instance by taking specific third-year courses. We will also advise students about other opportunities than the matching graduate program.
- **Introducing assignment committees to relieve the pressure on certain research groups.** Where more students are interested in a research group than there is capacity to supervise them, TU/e will limit the number of students that can join those groups or specializations. Since some of our programs are interdepartmental, TU/e strives to use the same procedures with the various programs. This will help students understand potential limitations early and prevent bottlenecks where possible.
- **Selection of lateral entry students:** TU/e can apply different admission requirements for students who do not have a bachelor’s degree that matches the master’s degree program, for instance by holding entrance exams for subjects like math or English. Where international lateral entry students are concerned, we strive to maintain and increase our current high standards.
- **Excepting the Medical Engineering program,** TU/e is not considering to formally limit TU/e bachelor’s degree



graduates to only enrolling in the matching master’s degree program. However, this limitation is in place for the Medical Engineering program, and this experience will be used to test more formal selection criteria for students.

Percentage of incoming international students	
2016	BSc 7%; MSc 23%
2020	BSc 20%; MSc 30%

Increasing capacity

The abovementioned measures are necessary to maintain our quality in education. However, society needs universities to educate as many engineers as possible. We aim to increase our educational capacity. Recently, several steps have been made: instead of eight, there are now ten potential lecture hours per day, while the average number of lecture hours for undergraduate students have been reduced from 40 per week to 12-24.

- In the next few years, the university will investigate the following capacity-building measures:
- **Using ‘teaching assistants’:** senior students who will assist during classes, build relevant teaching experience and increase our educational capacity.
 - **New ways of graduating:** within a company, or using industry professionals to supervise graduation projects.
 - **Blended learning:** using online and blended learning materials to create more space for guidance and personal contact.

II. Excellence

TU/e is a global player and aims to consolidate and strengthen this position. We share this ambition with many of our partners in the Brainport region. TU/e strives to provide education, research and knowledge valorization on an internationally high level. This drive toward excellence is the basis for all we do at TU/e. In recent years, TU/e has reached an internationally renowned

position, especially where our top researchers have done pioneering work, supported by state-of-the-art facilities and talented fellow scientists.

At TU/e, all our researchers focus on both research and education, to guarantee the cohesion between the two. Taking part in both activities is an employment requirement at TU/e.

- Our goal is to strengthen our global position by enabling our scientists to research and teach at an internationally high level. To do this, several conditions must be met:
- Enough time and funding to do groundbreaking research.
 - Collaborations between talented researchers in a variety of disciplines.
 - Availability of state-of-the-art research facilities.

A Scientific Advisory Board will be established with scientists from within TU/e and outside. This committee will offer solicited and unsolicited advice on all matters regarding excellence, such as trends in education and research, priority-setting and research infrastructure.

Our ambition is to belong to Europe’s top 10 in Engineering, judged by our quality of education, research and knowledge valorization.

Percentage of publications in top 10 journals	
2013-2016	35.4%
2017-2020	> 40%

Attracting the most talented

Finding and recruiting promising young scientists
There is a fierce and growing competition to attract the most talented researchers – the ‘war for talent’. TU/e needs to attract many new researchers in the coming years. Serving the growing student population requires growing our scientific staff. From the perspective of excellence and intertwining research and education, TU/e aims high in its recruiting efforts: prospective scientific staff members

need to be able to perform on an internationally high level and focus on both research and education. Given the strong competition to attract scientific talent, TU/e will increase our efforts in scouting and recruiting top talents.

Scouting and recruitment should be a continuous process, identifying talented scientists early and involving them in academic collaboration with TU/e research groups. These scouting activities are primarily an investment in the future. When concrete job openings arise, we can then recruit candidates from these networks. Here, too, the university takes an interdepartmental approach, working together from a broad, interdisciplinary perspective.

In addition, we collaborate with local parties to facilitate housing and other necessities that help scientists ‘land’ successfully in the Brainport region.

Recruiting experienced scientists

For key positions in our research priorities, TU/e does not just look to our own high potentials, but also at experienced high-level scientists from elsewhere. Scientists who take on these roles will guide the direction of research in their fields and need to be part of the international scientific elite. Recruiting these elite scientists takes a special approach, which includes providing space for their research groups and providing state-of-the-art facilities. We have an interdepartmental approach to filling these key positions.

State-of-the-art research facilities

A stimulating, inspiring and well-equipped environment for research and education is one of the preconditions for pursuing excellence. Several ongoing projects are creating that attractive research and learning environment, such as renovating the TU/e Campus, improving the digital information systems and investing in research infrastructure. We aim to provide several large laboratories, open to TU/e scientific staff and R&D departments from outside TU/e, based on the example of labs such as the Microfablab and the NanoLab@TU/e.

Space for groundbreaking projects

Scientists are largely dependent on external research funding, such as the programs offered by NWO and EU, for the means to conduct research and hire PhD students and postdocs and to achieve critical mass. Among these are the personal grants from NWO (Talent Scheme, Rubicon) and EU’s Horizon 2020 (European Research Council and Marie Skłodowska-Curie Actions). These grants enable scientists to make steps in their career and work: gain work experience abroad, study a topic of their choosing, start their own research groups and set up groundbreaking research projects.

However, obtaining these grants is not easy. Competition is fierce, both within the Netherlands and abroad. In the near future, TU/e will increase the support available to acquire these grants. Candidates will be approached by their departments at least a year in advance, with the question whether and when they would like to submit a proposal. They will be given time to prepare the proposal, take courses and get support and feedback from coworkers.

Financing: projects funded by public organizations	
2012-2015	33 million per year
2020	37 million

Measuring and monitoring excellence

When striving for excellence, we need to make excellence visible and measure and monitor it. This can increase the quality of our education and research and help external parties evaluate our quality during assessment visits. In addition, TU/e will continue to make decisions about which fields of research and education to focus on. Each discipline may have its own ways to make excellence visible and measurable. There is no one-size-fits-all approach.

We need to provide a clear picture of our quality and contribution to society – toward prospective students, international peers, industry and society – to create new

collaborations and strengthen the reputation of our institution and its disciplines.

Reputation

Our ambition is to belong to Europe’s top 10 in engineering, judged by our quality in education, research and knowledge valorization. This position is not only important as recognition of our quality, but also to boost our attractiveness to students, researchers and partners.

Because students and researchers increasingly think globally in terms of their careers, a well-established international reputation is of significant importance. Prospective students and staff consider the distinguishing features of the university and our work in their field. Companies in the high-tech world do the same. TU/e can only generate sufficient regional impact if we belong to the international elite.

In short, reputation is not just a result of our quality, but it also contributes to further enhancing our quality. TU/e’s reputation is determined by how students, peers, companies and media view us. For this reason, we need to have a clear profile and strong distinguishing features that are communicated transparently. In this message, individual scientists and their groups take center stage: they are the face of TU/e and our education, research and knowledge valorization.

- In the coming years, TU/e will focus on strengthening our international position and reputation. We will do this by:
- Promoting excellence in research and education
 - Making decisions regarding our educational and research profile
 - Strengthening collaborations with industry and society, both nationally and internationally
 - Showing our research results, student achievements, scientific achievements and scientists
 - Better understanding our current international reputation among students, scientists, industry and society
 - Further defining the TU/e brand strategy
 - Improving our position in relevant rankings and other benchmarks, and placing these in context

III. Internationale impact

TU/e is an internationally leading university specialized in engineering science and technology. This position is characterized by a high quality of education and research and is supported by the international impact of the high-tech region Brainport. Our goal is to increase the international impact and character of education and research. This helps us to prepare our students for an international career, to stay a forerunner in science and to enhance our impact on the Brainport area’s high-tech ecosystem.

Education

One of the main goals of TU/e is to offer education at a high international level. Companies in the Brainport region’s high-tech ecosystem expect highly qualified TU/e graduates ready to apply their talents in competitive, international work environments. TU/e focuses on international star students, prepares all students for an international career and needs to establish itself as an international community. In recent years, much progress has been made to this end: nearly all programs are now offered in English, international student recruitment efforts have increased, and TU/e is participating in several international educational networks.

To recruit more talented students and increase the international character of the TU/e community, we aim to increase enrollment of international students in both our bachelor’s and master’s degree programs. TU/e uses a targeted approach: we aim for 20% international students among the new bachelor’s degree students and 35% among the new master’s degree students. In addition, TU/e is expanding the options for students to build experience abroad and we expect that nearly all students will use these options by 2020.

Research

Science is an international activity par excellence. Scientists around the world build on each other’s results. Each achievement is measured according to international standards. International work experience is essential for every scientific career and international collaboration is indispensable in every research program.

Increasing the international impact of our research means focusing on attracting the international elite and increasing our participation in international research programs. You can read more about how and why we want to attract prospective scientific staff in the chapter on Excellence.

Financing: European research projects	
2012-2015	25 million per year
2020	30 million

To establish international collaboration with other scientists and with companies and to obtain research funding, participation in international research programs such as the European Horizon 2020 program is key. This also stimulates the application of our research findings, while allowing technological developments to be shared immediately in international circles. The impact and importance of these programs have greatly increased in the past 20 years, and the European programs have become an important and indispensable foundation for TU/e's research activities.

TU/e ranks among the top in Europe when it comes to participating in European programs. This participation, however, is under pressure: due to an increase in the number of submitted proposals, the chances of winning a grant are reduced throughout Europe. Our university has noticed this: researchers spend more time writing proposals, but fewer are funded. For this reason, TU/e aims to increase our success rates in European programs by 2020. The Research Support Network, which shares expertise within departments and throughout the university, will be the most important instrument in supporting our scientists in creating grant proposals.

Percentage of joint international publications	
2016	53%
2020	> 60%

Networks and partnerships

Networks of universities or companies are important catalysts for international collaboration. In addition to international networks traditionally managed by researchers, other networks offer value through international recruitment and exchange of students, developing and profiling research expertise and supporting specific activities such as business creation.

In recent years, TU/e has chosen to participate in a variety of European networks. The EuroTech Universities network, with partners Danmark Tekniske Universitet, Technische Universität München and Ecole Polytechnique Fédérale de Lausanne, is chief among these. With these partners, TU/e aims to enhance our education and research on various themes, such as energy and mobility. In addition, EuroTech is an important instrument to make sure that relevant research topics remain on the European agenda. Our goal is, therefore, to increase our participation within EuroTech.

TU/e participates in three Knowledge and Innovation Communities (KICs) of the European Institute of Innovation and Technology: KIC Health, KIC InnoEnergy and EIT Digital. We also participate in a variety of public-private networks, such as the public-private partnerships within Horizon2020. TU/e will continue to stimulate participation in these networks, to support research valorization, entrepreneurship and collaboration with industry in Europe.

Percentage of students with experience studying abroad	
2016	46%
2020	90%

International reputation

A well-established reputation is important, especially internationally, to remain visible and attractive to scientific talent and prospective collaboration partners such as other universities, research institutes and companies. For this reason, the reputation-bolstering activities described in the Excellence chapter need to have a strong international perspective.



IV. Partnerships

To fulfill our mission, TU/e collaborates with other universities, research institutes, companies, societal organizations and governments. These collaboration programs will be consolidated. Being a small-scale, specialized university, TU/e needs partners to meet society’s challenges, attract international talent, do groundbreaking research and apply our research results in practice. These collaborations take the shape of bilateral partnerships and national and international research and education programs, such as Horizon2020 consortia, EIT-KICs, NWO’s Gravitational programs, Advanced Research Centers, our own TU/e Impuls program, the TU/e-UU Darcy center and the 4TU research centers.

Aandeel co-publicaties met industrie	
2016	14,5%
2020	15,0%

Strategic partners

Several of our many partnerships are considered strategic partnerships: universities, companies, societal organizations and governments with a similar mission regarding education and research, technology development and contributing to societal challenges. In other words: partners who share our goals within specific initiatives and who frequently collaborate with TU/e. These partnerships are important for the success of TU/e strategy.

Based on our experiences in the past few years, TU/e has developed a vision for strengthening our collaboration with our strategic partners. An important part of this vision is continuing and expanding our flagship projects, based on a long-term roadmap. TU/e and our partners use this roadmap to look ahead 5 to 10 years and to set goals for our scientific and technological development. From this roadmap, short-term, concrete collaborative projects are derived. Good examples are the Philips flagship projects in Data Science, Health Monitoring and Lighting.

TU/e created these flagship projects in our TU/e Impuls program, with TU/e and our partners each covering 50% of the costs. This has led to a promising start. In the near future, we will need to make new funding agreements, so TU/e, our partners, regional, national and international governments and societal organizations can continue this approach.

Four drivers characterize a strategic partnership:

- Stimulating scientific excellence, especially within our priority research fields such as Complex Molecular Sciences and Integrated Photonics.
- Developing technological innovations – new products, processes and businesses – in technology-intensive sectors: mobility, energy, health, high-tech systems, data sciences, sports, smart cities and photonics.
- Achieving impact: incorporating our technology into the knowledge-intensive industry and society and having an effect.
- Contributing to the innovation hotspot Brainport and beyond through focus on scientific excellence, technological innovations and impact.

Scientific excellence

Scientific excellence is essential to internationally acclaimed education and knowledge valorization. Our academic partners help us to gain a critical mass in these fields and others, to expand the frontiers of our knowledge and to offer high-quality education. Our aim is to establish long-term focused research and knowledge development programs with our partners and research funding organizations.

The alliance with Utrecht University and UMC Utrecht

In our alliance with Utrecht University (UU) and the University Medical Center Utrecht (UMCU), TU/e aims to meet societal challenges through collaboration and mutual alignment based on excellence in research and education. In recent years, projects were started on the topics of solar fuels, imaging, regenerative medicine and porous media, and the alliance partners collaborated in several Gravitational programs and valorization initiatives. In 2017, a 10 million euro fund will be created to support these initiatives and others.

Financing: projects funded by private organizations

2012-2015	59 million per year
2020	63 million

4TU.Federation

TU/e, Delft University of Technology, the University of Twente and, since 2016, Wageningen University constitute the 4TU.Federation. Its goal: to strengthen the technological disciplines in the Netherlands. The partners collaborate through many initiatives, such as the 4TU. Research Centers, joint master’s degree programs, several national research programs, facilities such as NanoLab and services such as the 4TU.Datacenter.

EuroTech Universities

Internationally, TU/e established the EuroTech Universities Alliance together with Danmark Tekniske Universitet (DTU), Technische Universität München (TUM) and Ecole Polytechnique Fédérale de Lausanne (EPFL). This alliance aims to generate technological solutions for societal challenges and to promote excellence in education, research and valorization. TU/e strives to further strengthen this alliance and to build bridges between the innovation ecosystems of Brainport, Copenhagen, Bavaria and Lausanne.

Zhejiang University

Outside of Europe, TU/e has an important partner in Zhejiang University. This collaboration is continuing in the Brainbridge program. In the near future, we will evaluate if we can use the same format to collaborate with other institutes outside of Europe.

Wageningen University and Research Center

The Netherlands is home to a strong agrofood sector, especially in the province of Noord-Brabant. In only a few decades, this sector has become very technology-intensive, so high-tech solutions offer tremendous added value. The collaboration of TU/e and Wageningen University, both bilaterally and through 4TU, focuses on developing and embedding high-tech solutions into the agro-food sector

and contributing to important challenges such as food supply and food safety.

Tilburg University

Tilburg University (TiU) is an important partner for TU/e in developing data science, for instance through the Jheronimus Academy for Data Sciences (JADS) in ‘s Hertogenbosch, focused on education and entrepreneurship. TiU’s expertise supports our developments in data science technologies, methods, applications and adoption in society. The future data scientists educated in the JADS can connect technology, practical application and socially responsible use.

Technological innovations

Corporate R&D and tier 1

TU/e, the corporate R&D organizations in the Brainport region and the innovative tier 1 ecosystem that supplies large companies together constitute the R&D basis of the region. Many companies in the region are active in R&D-intensive sectors such as technology, hardware and equipment, automotive, software and computer services, electronics and electrical equipment, industrial engineering and chemicals. TU/e holds a key position in this innovative ecosystem, and the R&D programs of our partners in the Brainport regions inspire our research priorities.

Start-ups with TU/e IP	
2016	8
2020	10

Innovation for new markets

Partners of TU/e are active on the entire technological spectrum, from emerging technologies to product improvement in mature technologies. Our added value is most clear in emerging technologies and innovations that unlock new markets. Although these technologies still have a long way to go before they become commercially viable, it is already clear that they will make an important contribution to solutions for societal challenges, such as



home healthcare, solar fuels and autonomous driving. To develop these technologies, TU/e collaborates with small and medium-sized enterprises, large enterprises and societal organizations such as Brainport Development. Living labs are an important practical application of this approach. The European Grand Societal Challenges, reflected by TU/e in our strategic areas, are an important inspiration.

Impact

TU/e is mostly active in technology readiness levels (TRL) 1-4: fundamental science, proof-of-principle, proof-of-concept and early prototyping. Since the turn of the century, it has become clear that most companies take up technological development from the product development stage onward, in TRL 7. This leaves a wide gap, which university, research institutes and companies need to cross.

TU/e will work on bridging these gaps by mapping the TRL lines for the TU/e research priorities, reinventing our role in these development lines and strategically searching for partners who can help build these bridges and create impact. Research organizations such as TNO and Fraunhofer, public-private partnerships such as PhotonDelta and Solliance, and public institutes such as the Maxima Medical Center and Catharina Hospital (CZ) are examples of important partners in bridging this gap and allowing innovations to become embedded in society.

Regional strategy: Brainport and beyond

TU/e is rooted in the Brainport region, a highly innovative region with a high private R&D capacity. The regional and international position of TU/e reinforce each other, since Brainport and our partner companies are also international players. On the one hand, TU/e can only contribute to the success of the region by being part of the international elite in education and research. On the other hand, our own strengths and those of the region allow us to participate in international networks such as EuroTech Universities.

We strive to be a central player in existing and upcoming technology ecosystems and to develop more

collaborations with our regional partners and create new business through start-ups and spin-offs. This role is expressed in clusters such as High Tech Systems, the Photon Delta photonic ecosystem and the living labs that have been established in recent years. In the coming years, TU/e and partners will collaborate to find more opportunities for creating knowledge and valorization programs with a long-term perspective.

V. Where people matter

In recent years, the scientific and supporting staff at TU/e has worked hard to shape our educational innovation, strengthen ties with industry and conduct high-level research. This has led to many excellent results: we have managed to implement major changes, and both our students and our partners value these projects and the ongoing high quality of education and research.

People are pivotal to these results. TU/e will focus on a solid basis for personal development and career paths, scientific and pedagogical competences for scientific staff, adequate support services and a manageable workload. In addition, TU/e focuses on an increased diversity of staff and students and in the TU/e international community. We have started to translate our successes into adjoining strategic themes and supporting processes, shaped by our scientific staff, supporting staff, students and partners. For instance, our supporting processes are now being shaped around the Bachelor College and Graduate School formats through our future-oriented educational organization program.

In these changes, it is crucial that everyone finds a fulfilling position that allows them to contribute to our quality and innovation. Our motto 'where innovation starts' is therefore reflected in the motto 'where people matter'.

The keys to a great performance together

In the next few years, TU/e will continue to elaborate on the changes we have started and deal with any challenge arising from them. Accommodating the leap in student numbers will focus our priorities and work processes. Our

staff must be able to enjoy their work and see their efforts pay off. To benefit from the strong drive our employees have to provide high-quality education and research, we need to make sure that our work environment allows everyone to optimally balance challenge and satisfaction, achievement and relaxation, and work and personal life. There needs to be space and support for talented professionals, but we also acknowledge that we need realistic expectations. Collaboration, a well-run and stimulating work environment, and space to define individual balance are the keys to the highest possible collective performance.

Percentage of female chairs	
2016	9.5%
2020	20%

The extra means brought to us by the growing student numbers will therefore be invested in the number and quality of our scientific staff. To do this, our support processes need to change to a future-oriented organization while keeping the budget for operations mostly the same. This requires a close connection between scientists and support staff, with collaborative decision-making about the best way to offer support, given our means and wishes. These changes can only be made from a basis of mutual and solid commitment.

Careers for talented people

As described in the Excellence chapter, TU/e needs to offer prospective employees an attractive career perspective, based on a broad, multidisciplinary approach. High performers need plenty of room for personal development and excellent performance in education, research and knowledge valorization. Our basic premise that ‘excellent people attract excellent people’ has led to the creation of development tracks for scientists, which offer a challenging growth perspective. Development tracks also offer a solid commitment from TU/e in an earlier stage than the usual Tenure Track systems. Current scientific staff will also have the opportunity to enter a development track and work on

their personal development and performance in a systematic way, through a long-term growth plan. Interdepartmental committees will advise on research careers and the creation of new chairs, based on the same broad, multidisciplinary approach.

Partnerships in operations

The growth in student numbers, lag in structural funding and the sweeping influence of digitization in education and research also affect the university’s business operations. Our operational vision, “TU/e in transition, supported by sustained management and operations” (2016), is our guide toward further professionalization and optimization. Here, too, quality is key: business operations and science are both essential to improve quality. In this partnership, operational management and support staff understand what is needed to achieve excellence and optimal research support. In turn, scientists appreciate and benefit from the professionalism of our support staff. Other leading principles, such as cost consciousness and standardizing work processes where possible, can only take root in this foundation of mutual understanding.

VI. A strong financial basis

University education has grown significantly in the past couple of years, while government funding and funding for public-private cooperation has decreased. Basic funding, too, has not kept pace and has even decreased slightly. In addition, educational funding will not grow as fast as our need to provide education. In our Institutional Plan 2013-2016, we already pointed out that it is a major challenge to make our research capacity grow at the same rate, even though this is necessary to guarantee the intertwining of education and research. This challenge has remained and even gained urgency for the upcoming years.



Indirect costs	
2016	14.9%
2020	< 15%

Solvency	
2016	35%
2020	> 32%

Balancing education and research

Basic government funding needs to remain adequate. TU/e and 4TU draw attention to the fact that the funding for education is lagging behind the demand. TU/e has already invested in recruiting additional scientific staff to prepare for this growing demand, and we will also invest future funding in our primary processes of education and research.

To ensure a proper balance between research and education expenditures, TU/e is considering adjusting our internal strategic allocation model. These adjustments will take shape in the 2019 budget.

Success in external funding competitions

The landscape of external research funding has changed significantly in recent years. The FES programs have stopped, top sectors have been assigned, the Seventh Framework Program has been succeeded by Horizon 2020 and both NWO and STW have an entirely new organization from 2017 onwards. In Europe, the success rates for funding have dropped dramatically in Horizon 2020. Even nationally, competition is fierce.

It is our ambition to be successful in this competition for funding, to provide our scientists the much-needed opportunity to take on interesting research challenges. TU/e research groups are lined-up well while they meet the two most important criteria for funding: excellence and impact.

Financing: projects funded by public and private organizations

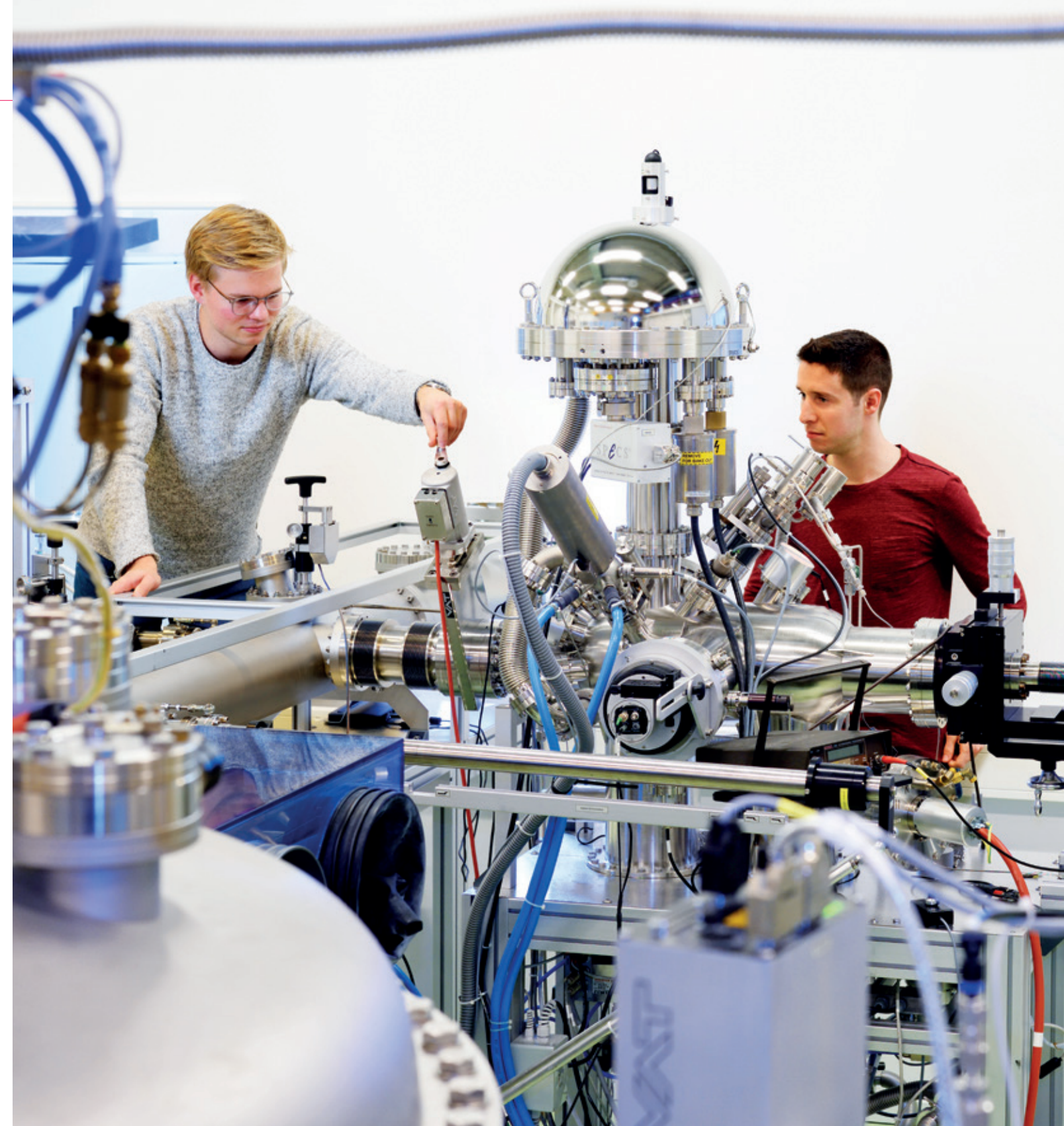
2012-2015	92 million per year
2020	100 million

Research excellence is a core value for TU/e. Our impact is boosted by our efforts in strategic areas and the various centers, through our partnerships with our private partners, by starting businesses and by entrepreneurial activities. In the upcoming years, TU/e will explore how to solidify these collaborations. The flagship projects in the Impuls program offer a valuable starting point: strategic partnerships based on medium- to long-term roadmaps and a diversified financing structure.

Because of our extensive participation in the European Framework programs and the growing demand for education, TU/e will not focus on increasing the number of proposals, but instead on increasing our success rates. We can do this by more effective internal communication and collaboration within the Research Support Network, for the best possible support when deploying new initiatives.

Diversification of funding

In addition to securing adequate basic funding and external research funding, TU/e will explore how we can build a broader financial base for education, research and knowledge valorization. TU/e is looking into private funding – 4th tier funding – and international research and valorization funds.



Toward a Strategy 2030

TU/e presented its Strategic Plan 2020 in 2010. Soon, the university will start working on its Strategic Plan 2030. In this plan, we will present how we wish to develop TU/e in an environment of stable growth, digitization and even fiercer international competition for talent. This long-term perspective is needed to start making timely and collaborative progress toward the desired results.

This institutional plan reports on the current state of affairs and where we want to be in 2020, but it is also the start of the discussion about our 2030 strategy. In this document, we identified the most important external developments that can help us look beyond the 2020 horizon and set course for 2030.

■ Digitization

Developments in and availability of digital technology poses a number of challenges to universities: students could get their educational materials and subject-matter knowledge from anywhere in the world and take courses at other universities without ever setting foot outside of Eindhoven. There is a potential for education to become much more varied, from cohesive curricula to unbundled curricula and stand-alone subjects.

The increasing digitization of our society in all aspects, which is especially true for technology, requires excellent digital skills of our technology students. Therefore, these skills must be integrated deeply within our education.

In addition, these new digital technologies mean that teaching methods themselves will change, see for example the rise of online Course Management Systems over the past 15 years. Virtual reality will make its debut. In research, big data will lead to new research methodologies and digital facilities will increase research possibilities.

■ Global innovations hubs

In the future, universities will be formative players in mostly regional ecosystems with a strong international position, such as the Brainport high-tech ecosystem. Think

global, act local. Our focus will continue to shift to entrepreneurship, resulting in many start-ups, spin-offs and scale-ups by students, scientists and graduates. It is clear that technological development in TRL levels 3 to 7 must increase, a challenge our university and partner companies will meet together. This will lead to more intense and different forms of public-private partnerships.

■ Global mobility

In higher education, like everywhere else, the world has become a smaller place. We can now speak of an international talent pool and global university brands. Earlier emerging economies such as China and India are investing heavily in science and engineering, challenging the leading position of universities in Europe. The 'war for talent' will increase in intensity, which means that our university needs to have an excellent range of offerings based on a well-defined profile.

■ Convergence of disciplines

Research is now more multidisciplinary than ever. In science and engineering, too, technology forces an approach where disciplines work together. Digital disciplines, physics, materials sciences, life sciences – all need to work together to achieve appealing research results. As a result, there will be strong cross-pollination and a boom in new subdisciplines.

■ 21st-century skills

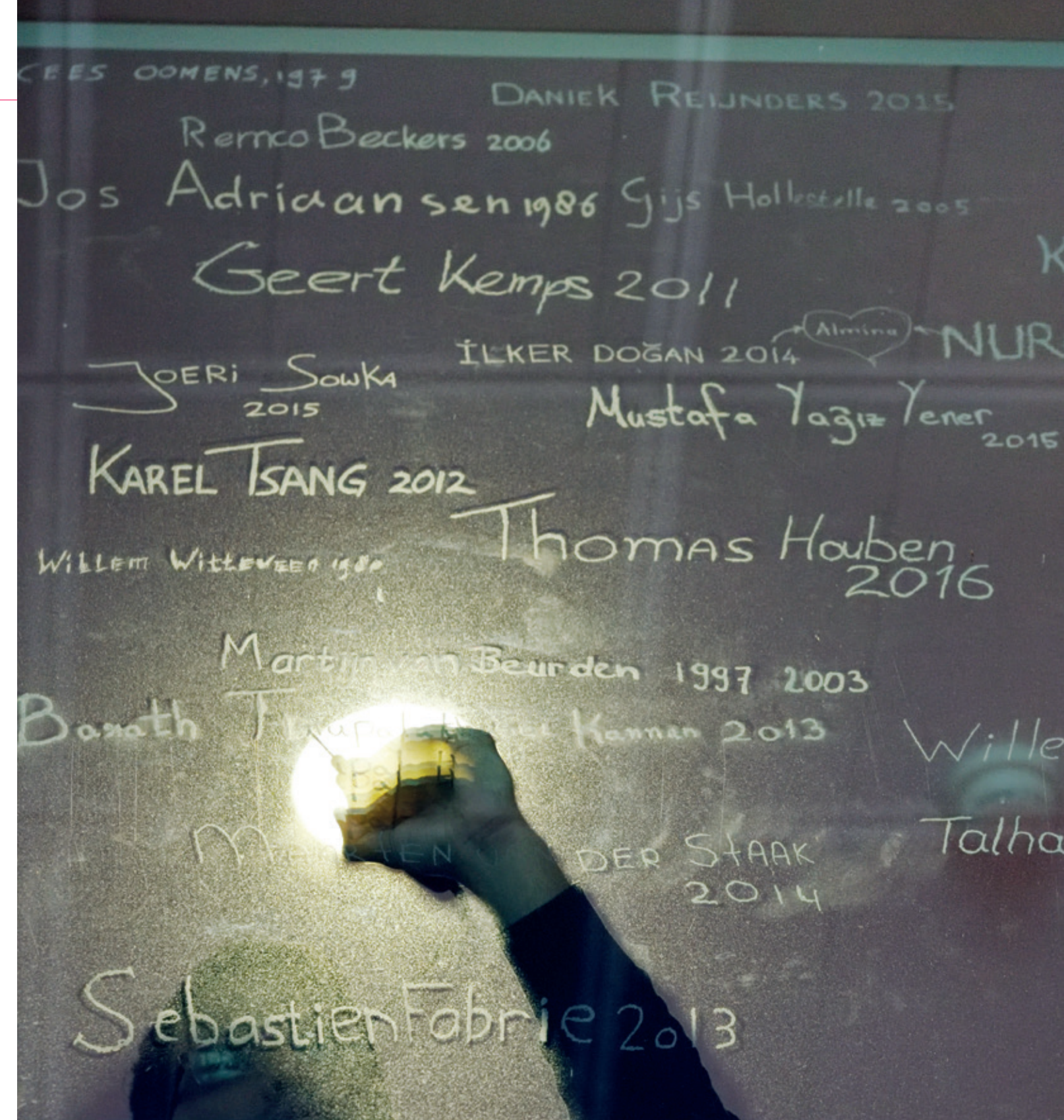
The profile of the engineer continues to change. Engineers need to know how technology is embedded in society (USE), have soft skills in addition to in-depth engineering knowledge and need to be at home in multidisciplinary teams. These are the 21st century skills that every student will need. In addition, the growing complexity of technology means that engineers need to be able to manage and improve complex operations on a systems level.

■ Impact

The influence of technology on society can be felt everywhere, and people are looking to new technologies to help solve the challenges society is facing. An important question is how TU/e can achieve our impact potential

regarding societal challenges, industrial developments, new business and societal policy.

These trends apply to the university, higher education and research, and will all be discussed intensively with TU/e staff and our colleagues at other universities. At the same time, we know that these trends will also influence industry, society and the way companies and the government view higher education and research. Knowing that knowledge economies such as Brainport or knowledge societies such as the Netherlands and Europe can only flourish if they are shaped collaboratively, TU/e will seek out conversations with our private partners and our regional, national and international governments.



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Where innovation starts