



Where innovation starts

TU/e 2020 Strategic Plan



Technische Universiteit
Eindhoven
University of Technology

Where innovation starts

TU/e 2020
Strategic Plan





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Preface

The world is facing major challenges in fields like energy, climate, health, safety, sustainability, mobility and communication. New technological concepts are needed to deal with these challenges. Industry, knowledge institutions and government are working together via regional and thematic networks to enable these concepts to be realized.

Knowledge and innovation are increasingly becoming more and more important success factors in international economic relationships. Brainport, in Southeast Netherlands, has become one of Europe's most innovative regions. However, global competition is intensifying, with new hubs of knowledge and business in countries like China and India. In these countries large numbers of young people are choosing programs and careers in technology while the interest of young people in technology in the Netherlands is lagging behind. The Netherlands may want to be one of the five best performing countries in the world in terms of knowledge and innovation but funding in education, research and innovation is still modest.

In the context of these developments, Eindhoven University of Technology has been considering its future direction by studying domestic and foreign policy documents, holding brainstorm sessions with students and staff as well as roundtable meetings with external stakeholders. In addition, in a broad discussion on the possible spearhead of a new university strategy, we also took account of recent publications like the advice of the Commissie Toekomstbestendig Hoger Onderwijstelsel (the committee investigating how future-proof the higher education system is), the Knowledge and Innovation Agenda 2011-2020 of the KIA Coalition and the draft strategy document Brainport 2020. This last aims to strengthen the economic structure of Southeast Netherlands. The result of all this is the present, broadly supported TU/e 2020 Strategic Plan that responds to relevant internal and external developments.

We will be setting out a multi-year project program to implement this Strategic Plan, the consequences of which are contained in successive organizational plans, executive agendas and budgets. The annual reports will keep you updated.

We would like to thank all of those who cooperated to get this ambitious Strategic Plan off the ground, particularly the members of the TU/e 2020 Strategy Steering Committee who helped to guide things in the right direction. We invite students, staff and stakeholders to help us realize the plan.

Executive Board,

Dr.ir. Arno Peels, chairman
Prof.dr.ir. Hans van Duijn, rector
Mr. Jo van Ham, member
Ir. Harry Roumen, secretary

Eindhoven, January 2011

A group of five students are sitting on a green lawn in front of a large, modern building with a glass facade. The students are engaged in conversation. The building has a distinctive design with a large overhang. The sky is overcast. A red diagonal line runs across the image from the top right corner towards the bottom left.

Strategy in a nutshell

In 2020 TU/e will have a leading position in the world as an international research university in engineering science & technology. It will be known for its considerable scientific and societal impact and for the major impact it has on the competitiveness of Brainport (Southeast Netherlands) and the Dutch knowledge economy.

The following goals have been set to achieve this:

Education

- Realize University College Eindhoven with broad Bachelor programs
- Introduce differentiation in specialist Bachelor programs
- Cluster graduate programs in Graduate School
- Realize high success rates and an ambitious study climate
- Internationalize student population and educational programs
- Boost student intake via adequate marketing of renewed range of programs
- Reflect on life-long learning

Research

- Specific strengthening of excellence in the disciplines
- Realize TU/e Strategic Areas around key societal issues (Energy, Health, Smart Mobility)
- Stimulate innovative multidisciplinary research initiatives
- Develop highly promising R&D institutes in key niches
- Strengthen international research position

Knowledge valorization

- Realize more structured R&D cooperation with high-tech industry
- Boost effectiveness of knowledge and technology transfer to SMEs
- Boost participation in business-oriented education
- Boost number of successful start-up companies

Campus

- Transform campus into TU/e Science Park of national importance and international allure

Conditions

- Secure the required investments (600-700 million euros)
- Give plenty of scope to top talent, more women and foreigners in scientific positions
- Ensure that organization is in tune with strategy, clustering departments if necessary
- Benchmark central administrative services
- Take steps towards 'digital university'
- Develop international university culture
- Promote clustering of strengths in Dutch technology sector

Mission and profile

Eindhoven University of Technology (TU/e) is a research-driven and design-oriented technology university of international allure. Its focus is coherent education, research and knowledge valorization in the field of engineering science & technology.



In the education area TU/e educates engineers (Master of Science) that have a solid scientific basis and depth as well as the competences required to succeed in a wide range of societal sectors and jobs. In addition, TU/e educates designers (Professional Doctorate in Engineering) and researchers (Doctor of Philosophy) as well as academically trained science teachers (Master of Science).

In the research area TU/e prefers to focus on those fields of engineering science & technology in which it can play a significant role in the international scientific world (science for science) and where it can provide meaningful impulses to solving the major societal issues (science for society) and strengthen knowledge-intensive industry (science for industry).

Fundamental research spurred on by fascination provides the requisite basis for more applied research.

In the field of knowledge valorization TU/e is committed to ensuring that its research results are translated into successful innovations and new companies. TU/e encourages students and staff to be entrepreneurial.

The quality of the education and research complies with high international standards.

TU/e offers both students and staff an international and academic, intellectually stimulating, climate of study and work. This inspires broad personal development, societal and cultural engagement as well as an entrepreneurial outlook.

On its campus TU/e encourages the location and cooperation of higher education institutions, research institutes and (new) high-tech enterprises. The campus is developing into a TU/e Science Park of national significance and international allure.

The TU/e is part of the 3TU.Federation together with Delft University of Technology and University of Twente. The mutual collaboration and cooperation are intended to strengthen the competitive position and reputation of Dutch engineering science & technology universities in the world. Just as Delft and Twente, TU/e has its own identity and profile within the federation.

TU/e profiles itself as a leading international university specializing in engineering science & technology whose top-level education and research contribute to:

- progress in the engineering sciences,
- the development of technological innovations and, thereby,
- the solution of major societal issues and the growth of welfare and prosperity. It is, therefore, the engine of the regional knowledge economy.

In brief, TU/e is the university where innovation starts.





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Christel de Bakker, Bachelor's student
Architecture, Building and Planning

“I dream of having my own architecture firm and want to get as much knowledge as I can, also from other fields. Which makes the University College Eindhoven with its broad-based Bachelor program the perfect fit for me. I’m hard-working and I love a challenge. And an international environment where everyone is really committed to doing their best is simply irresistible.”

1 External developments and TU/e position

External developments provide good reasons for TU/e to consider its future position and direction. First and foremost is the world facing major challenges like energy, climate, health, security, sustainability, mobility and communication. New technological concepts are needed to rise to these challenges.





Governments promote industry and knowledge institutions to develop these concepts. Since the capacity for fundamental research in industry is declining, an option is cooperation between industry and knowledge institutions. Governments and enterprises are trying to influence the research agendas of universities. The financing of academic research is increasingly based on thematic research programs developed by consortia of enterprises, knowledge institutions and universities, and supported by governments and research sponsors. In general, the societal and economic challenges mentioned above are key issues. Their complexity demands multidisciplinary research throughout the knowledge chain, from fundamental research to proof of principle and proof of concept. By making proposals to these programs, academic research groups are expected to be competitive in acquiring the funding for their research projects and equipment. Shaping such consortia, programs and projects generally goes beyond the possibilities of individual departments and groups, with specific expertise and coordination needed at institutional level. In addition to the increasing program funding of university research, there is also a shift occurring from basic to personalized funding. This latter is fiercely competitive and only the most talented and excellent researchers are able to obtain personalized

research grants to spend as they see fit. European funding is accounting for a growing share of the total program and personalized research funding.

Global knowledge economy

Knowledge and innovation are becoming more and more important for international economic relationships. A global knowledge economy is developing quickly, with national borders and geographical distances fading. Knowledge-intensive companies prefer to settle in highly dynamic economic regions where high-tech universities and laboratories, knowledge institutions and suppliers are concentrated, where there is a sufficient flow of knowledge workers, and where the authorities are keen on facilitating and supporting them. New centers of knowledge and business are emerging in countries like China and India. In time only those top universities that enjoy a strong international position and reputation will be a location and binding factor of any importance. There is a real reputation race among universities worldwide and competition for students, scientists and funds is getting fiercer. Students and scientists are, like companies, less and less bound to a location. International science funds are becoming more and more important while international networks of partner universities and companies are growing. Networks, mergers and,

in some countries, concentrated sizeable government investments are prompting growth in the number of large powerful universities. With their state-of-the-art facilities, considerable funding possibilities and an attractive relational network, they have a considerable pull for the best students, top scientists, leading partners, research funds and international knowledge-intensive enterprises. These developments are crucial to the competitiveness of Southeast Netherlands.

Young people and technology

That also applies to the gradual decline in the numbers of young people in our country with an inherent interest in technology. Demographic change is the reason for an expected fall in the numbers of high-school leavers in the south of the Netherlands. However, there is a positive national trend in the growing share of high-school pupils opting for a science-related profile (Nature and Technology or Nature and Health). Those opting for Nature and Health tend to be led by career and societal motives and when they choose a technology program, this is predominantly geared to broader, multidisciplinary programs with a focus on career and society-based subjects. As differences in terms of talent, interest and motivation among incoming students widen, universities are expected to respond with a more differentiated range of educational programs. The technology sector demands more differentiation in the programs due to the growing need for the variety of engineers required in the labor market. These are no longer just highly knowledgeable, single-discipline specialists but increasingly engineers able to operate between different disciplines. Furthermore, design-oriented engineers are needed to supplement research-oriented engineers. Moreover, engineers are expected to be entrepreneurial

and have management skills. Throughout the whole spectrum, our country has a structural shortage of technological knowledge workers, which has a negative impact on the international competitiveness of the Netherlands in general and of Southeast Netherlands high-tech region in particular.

Making scientific knowledge practicable

Finally, the importance increasingly being attached to knowledge valorization and innovation can be considered a key development. While the Netherlands may be among the best in a scientific sense, that is not true of innovation where a growing number of countries are pulling ahead. Due in part to this the Dutch government has legally established knowledge valorization as the third core task of the universities in addition to education and research. This third core task aims to make scientific knowledge practicable from a societal and an economic perspective. Knowledge valorization gains shape via more systematic R&D cooperation between universities and industry, proactive knowledge and technology transfer between universities and small and medium sized enterprises, and systematic encouragement and support to new business based on the revenues of academic research. An increasing number of knowledge-intensive (start-up) companies and research institutes are locating on university campuses, working very closely with each other and with the respective university in a climate of open innovation.

Retention of position not self-evident

TU/e has built an excellent global reputation as a leading research university in engineering science & technology. The departments provide a high level of academic education in a context of excellent



fundamental and application-oriented research in fields relevant to the wider environment. The region of Southeast Netherlands is distinctive in its strong concentration of international high-tech companies and knowledge institutions. It is one of the most innovative regions in the world and profiles itself as an internationally attractive Brainport. In this ecosystem of cooperating companies and knowledge institutions, TU/e has an indispensable role to create relevant knowledge and educate high-tech knowledge workers. Very close cooperation with technology-intensive companies in the whole knowledge chain is a high priority for the university. This knowledge chain runs from fundamental research driven by fascination to delivery of proof of principle and proof of concept by innovative technological designs. Researchers with excellent positions within individual disciplines work closely together within TU/e in multidisciplinary research programs, developing these programs with industry and relevant knowledge institutions. At no other

Ir. Rokus van Iperen, chairman of the Supervisory Board of TU/e and chairman of the Executive Board of Océ

“TU/e is known far and wide for the good quality of its education, research and valorization. But the world is changing fast, with so many complex societal and economic issues at play. This Strategic Plan makes crystal clear the role that TU/e wants to fulfill.”



university in the world is the share of co-publications with researchers from industry within the entire scientific output as high as at TU/e. Knowledge valorization is powerfully embedded at TU/e as the third core task in addition to, or rather entwined with, the education and research core tasks. The university encourages students and staff to be entrepreneurial and offers them adequate support in establishing new companies. The excellent performances of TU/e in the fields of education, research and knowledge valorization are confirmed by its good position in the key international university rankings. All in all, TU/e is in good shape but there is cause to consider the future direction. As a consequence of the external developments outlined here, it is not self-evident that the current strong position can be retained in the longer term.

Implementing strategy

This Strategic Plan is staked on TU/e having a leading position in the world in 2020 as an international research university in engineering science & technology. It is also founded on being known for its significant scientific and societal impact as well as being a key factor in the competitiveness of the Brainport region and the Dutch knowledge economy.

Core values

TU/e will keep to its core values in which the academic character of the university and the scientific independence and integrity of the scientific staff are held in high esteem. Researchers have scope to do fundamental research on the basis of fascination and academic freedom. This is an essential condition for a research university to remain a key factor. International excellence in the individual disciplines is a prerequisite in rising successfully to interdisciplinary and multidisciplinary challenges. The relatively small scale of the university will be cultivated to facilitate a personal atmosphere, short lines of communication and interdisciplinary and interdepartmental cooperation. It goes without saying that the education, research and knowledge valorization core tasks should be strongly interrelated. Furthermore, the university is explicitly open to its societal environment. Close ties with the high-tech industry in its environment and an excellent relationship with local, provincial and national governments make the university distinctive.





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Wisse Trooster,
Bachelor's student Industrial Design

“How can someone feel more at ease in an airplane, and what effect can light have on this? My focus is mobility. I am testing this, trying to find out myself how people react. There is just so much to mobility – it’s endless. But what chiefly concerns me is how we can use technology to enable people’s lives to be more pleasant.”

2 Education

In 2020 TU/e will respond to the need of society and the knowledge industry for different kinds of academically trained engineers, technological designers and researchers, with the intake, progress and graduation of students adjusted accordingly.





A differentiated range of course programs will respond effectively to the different reasons why different groups of (potential) students choose to study particular subjects and to the need for different types of technological knowledge workers in the labor market. The study climate will be challenging and motivating. Education and the student population in 2020 will be very international. To achieve all of this the following initiatives will be taken.

University College Eindhoven

As an alternative to the existing discipline-based Bachelor programs, TU/e has begun a broad, intensive and accessible Bachelor program in Liberal Engineering Sciences for selected students. The venue is an ambitious, international and residential University College Eindhoven, located on the university campus. This University College Eindhoven offers the basis for educating young people to become a new kind of engineer (so-called thumbtack model) able to work in a multidisciplinary, international, multicultural setting and with strong teamwork and communication skills. He or she is focused on societal and economic challenges and is entrepreneurial. This type of engineer is a supplementary requirement by society to the traditionally educated engineer who is characterized by

specialization in a single discipline (so-called hatpin model). The University College Eindhoven intends to attract a new target group of students. For instance, those who prefer to delay their ultimate study choice, science students with a broad range of interests and societal orientation, foreign students and the science talents among the numerous expats in the Netherlands. Female students will also be a target group for the University College Eindhoven. The students of the University College Eindhoven will pursue subjects in a variety of engineering disciplines, gradually refining their studies in the direction of Master-level specializations. They also follow subjects that help them to see technology in its societal context, subjects from the perspective of human and social sciences. Demands made of students will be high in terms of their motivation and effort. They will have to work hard and put many hours into their studies but they do have the benefit of working in small groups, excellent facilities, an inspiring environment and motivated and approachable lecturers and mentors. In view of experiences elsewhere a success rate of at least 85% for the University College Eindhoven can be considered a feasible target.

The University College Eindhoven will deliver around 150 excellent graduates each year and thus account for a substantial intake in a number of Master programs.

Dr.ir. Caroline Hummels, study program manager of the Department of Industrial Design

“In order to develop technological innovations that bring about change in society, our students need to be motivated, socially committed, responsible, skilful, imaginative and passionate.”



Differentiation in specialist Bachelor programs

Apart from the new broad Bachelor program of the University College, TU/e will invest over the coming years in strengthening the market position of its discipline-based specialist Bachelor programs. Students within these programs will have more freedom of choice and this will appeal to a wider range of students. Students with an inherent interest in technology will remain the target group, and new target groups will be attracted. These include science students that see an engineering program largely as a step towards a glittering career and social status. It will also appeal to science students motivated to use technology to solve major societal issues, and to boost welfare and prosperity in the world. The share of female and ethnic minority students will increase considerably. This will be partly due to study routes geared to recognizable societal themes like energy, health, mobility, sustainability, welfare and communication via new media as well as study routes focusing on specific vocational categories like managers and entrepreneurs. Furthermore, the university will continue to offer honors programs for students seeking extra challenge along with deepening and broadening minor programs that offer students a real choice.

In addition to purely technological areas, these minors may include human and social sciences that are geared to the context of technology, like psychology and engineering, business for engineers, and technology and law. Students will be encouraged to do a minor at a (foreign) partner university. The principle is that in time only Bachelor programs that can continue to attract more than a hundred first-year students per academic year will remain as an independent program. Programs that do not meet this standard will be merged into broader programs or be terminated.

Graduate programs

The Master, designer and doctorate programs will be clustered in the coming years into discipline-based graduate programs revamped in English. That is in line with the contemporary international situation and will boost the student intake from outside TU/e. It will offer highly talented Bachelors a fast track to a Professional Doctorate in Engineering (PDEng) or regular doctorate (PhD). The graduate programs will be clustered in a Graduate School, with varied graduate programs. The Master programs will have a different composition, such as focus on regular engineering practice, starting a business, a designer program or a doctoral project and a variety of content-based graduation routes. Thematic graduate programs will attract students with a broad or societal interest in technology. The position of the two-year designer programs will be consolidated by expanding the range of courses, enhanced quality assurance, stronger marketing in the direction of potential participants and industry, integration of design projects in public-private R&D programs and boosting intake and graduation.

Success rate and climate of study

More than ever before, there will be a greater drive to realizing a challenging and motivating climate of study, with high study commitment and performance in a small-scale, intensive education setting the norm. An ambitious plan and supervision by educational specialists will enable improvements to be made in boosting the success rates in the Bachelor and Master programs. The opportunities for (self-)selection prior to and during selection at the start of Bachelor and Master programs will be optimized also with a view to this. This means that less apt students can be quickly channeled to alternative programs and top talent fast-tracked to challenging learning routes.

Internationalization

To become a truly international university and university community, the number of foreign students in both the Bachelor and Master programs must be significantly increased along with the international mobility of students with partner universities abroad. Joint programs will be established with selected partner universities on the premise of all Dutch students doing an internship or part of their program abroad. Bachelor programs that have the potential to attract considerable numbers of foreign students will be transformed into internationally geared programs in English. The broad Bachelor program of the University College Eindhoven will be international and in English at the outset. University-wide minors in the Bachelor programs will, in principle, be international and in English while MSc and PDEng programs and PhD programs will be integrated in internationally acknowledged, appealing graduate programs. Curricula and student facilities will be adjusted to an international and multicultural student population, with

sufficient affordable housing and residential facilities for foreign (exchange) students both on campus and in the city.

Student recruitment and study information

To substantially boost intake in the Bachelor, Master and designer programs it is not enough to just make the range of courses more attractive for a broader, more varied target group. The renewed range of programs must be explicitly profiled among potential students throughout the Netherlands and in the international higher education market. This will be a real spearhead of effort. Adequate information and supervision are more likely to result in interested prospects making a responsible study choice. The range of recruitment activities will be extended and contacts with prospects will be personalized as much as possible. At institutional level the recruitment process will be systematized along the lines of a professional marketing framework. The cooperation and collaboration between the individual programs will be strengthened while advice and support for the programs will be intensified in respect of communication. To facilitate the recruitment of foreign students, partner relations will be maintained with leading technology universities in many countries.

Quality control

TU/e is and remains committed to education of the best international level. Compliance with the basic criteria of the Dutch-Flemish Accreditation Organization is not enough. TU/e wants to demonstrably comply with international excellence standards whereby the intrinsic profile and level of the programs can be attuned to the required final qualifications of the students. Use will be made, in principle, of the Academic Competences and

Quality Assurance (ACQA) system designed by TU/e. The manageability of this system will be improved in cooperation with partner universities in the Netherlands and abroad. Furthermore, lessons learned from using this system will be applied in assessing the actual academic competences of students. As for the more procedural aspects of the quality of the education, quality assurance will take place through independent internal audits, partly with a view to the legal introduction of so-called institutional audits. In its quality control policy TU/e has opted for the combination of institutional audits and corresponding program visitations. All programs will be accredited once every six years and visited beforehand by independent external assessors. Where the results give cause, improvement measures will be taken.

Life-long learning

TU/e will consider the question of how to best position and manifest itself in the longer term in the life-long learning market in the technological sector. High-tech companies increasingly want to offer their best engineers the opportunity to gain a broader horizon through second Master programs and advanced, demand-driven programs for jobs like systems engineer or (chief) technology/innovation officer. Moreover, Bachelor graduates are tending to opt for work experience before deciding on whether to follow a Master program. This creates a need for part-time and dual Master programs customized for working students. In addition, interest is growing in shorter workshops and programs for technology knowledge workers. To ascertain TU/e's position in this market, collaboration is necessary with the technology universities of Delft and Twente and with University Maastricht and the University of Tilburg.

Education targets for 2020

Number of Bachelor and Master students	+ 50%
Share of female Bachelor and Master students	> 35%
Share of foreign Bachelor students	> 20%
Share of foreign Master students	> 35%
Share of Dutch students doing a foreign internship	> 90%
Share of graduates following an honors program/track	> 10%
Number of MSc graduates	+ 50%
Success rate of BSc programs*	> 70%
Success rate of MSc programs**	> 90%
Number of graduates following designer programs (PDEng)	+ 50%

* Percentage of those re-enrolling in the second year and successfully graduating after four years of commencing.

** Percentage of Master students successfully graduating after 30 months of commencing.





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Martijn van Zanten,
Master's student Chemical Engineering

“More people in the world are consuming more energy, so we need to come up with smart solutions. The nice thing about engineers is that they always try to find different and better solutions. For a more sustainable world, too. Myself, I want to help make production processes more energy-efficient.”

3 Research

In 2020 TU/e will be distinctive in the field of research. This will be achieved through excellence in the basic disciplines and systematic R&D cooperation with companies and other knowledge institutions on the basis of multidisciplinary Strategic Areas that concern several major societal research themes.





The research areas will give the university a more recognizable societal profile and therefore offer a greater attraction to socially-oriented students. The strategic areas will also substantially contribute to attracting secondary and tertiary funding (including European funds). TU/e will also distinguish itself in 2020 through the innovative multidisciplinary research programs of young talented researchers and a number of successfully positioned multidisciplinary R&D institutes in carefully selected niches. Fundamental research will be given considerable scope through fascination, a key quality if research is to remain relevant for the external environment for a sustained period. The quality of the research can compete with the very best in the international arena. In 2020 TU/e will have a strong international research position and reputation. To ensure success, the following initiatives will be taken or continued.

Promotion of excellence

The research within TU/e must be at the forefront internationally, and the university among the very best of the top performing engineering universities in Europe. Excellence will be strongly encouraged in the coming years. A key factor in this will be to attract and bind (potential) top researchers and to offer state-of-the-art research facilities. Revenues via secondary and tertiary funding

will be used for the benefit of the research groups or individual researchers that have acquired these funds in scientific competition. Departments can obtain funding from internal excellence funds to appoint top researchers to compensate for a temporary lack of educational scope. This fund can also offer financial encouragement to researchers who may well comply with the criteria for selection for external research grants but cannot be recipients due to oversubscription. This is part of the aim to encourage and support researchers to apply for personal research grants.

TU/e Strategic Areas

To ensure that research responds flexibly to dynamic external developments and to strengthen the societal and economic impact of the research, TU/e is concentrating its distinctive disciplinary research strengths in strategic areas around a limited number of major societal issues. These Strategic Areas provide the framework for the development of roadmaps and consortia with other universities, knowledge institutions and companies. TU/e will establish public-private research programs with these partners and acquire financial backing from government and research funds. The result will be focus, mass and quality within relevant research domains as well as a stronger social profile for

the university, more revenue capacity in secondary and tertiary funding plus greater attractiveness to potential students. The research lines of the strategic areas will be recognizably integrated in the programs on offer. The research cooperation between TU/e and industry and other knowledge institutions will be considerably strengthened by the Strategic Areas. Furthermore, TU/e hopes to encourage specific research institutes and research-driven, high-tech companies to locate at the university campus.

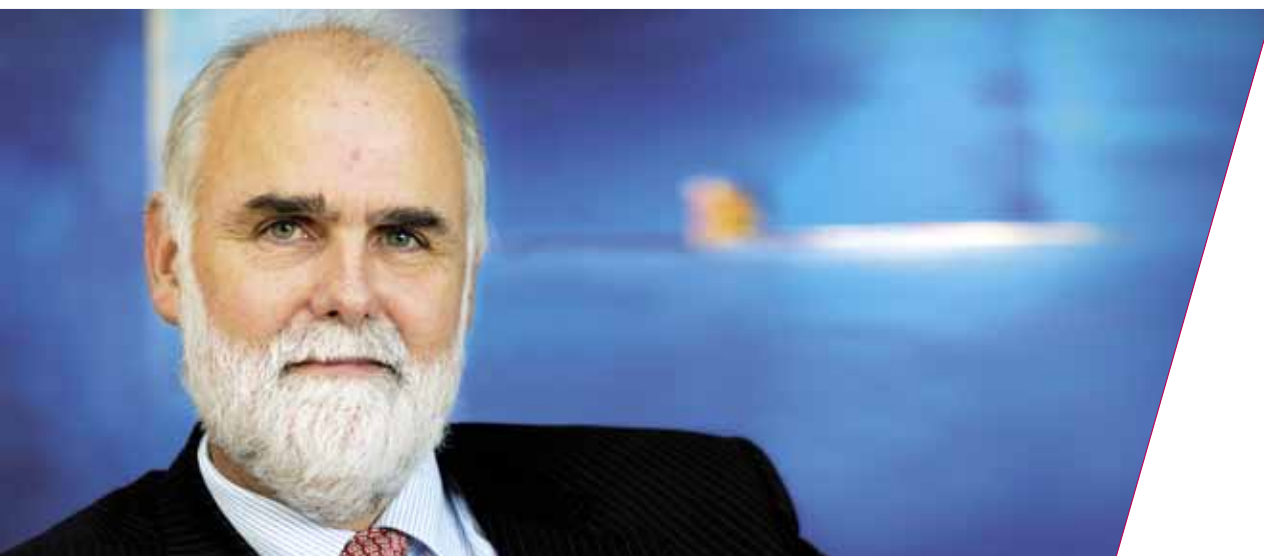
The first two TU/e Strategic Areas relate to the themes of Energy and Health while a third Strategic Area around the theme of Smart Mobility is being considered in respect of desirability and feasibility. The Strategic Areas will serve as an interface between chairs and sub-departments within the university, on the one hand, and with non-governmental bodies, companies and other knowledge institutions on the other. In the case of the latter, external parties, TU/e develops and shares knowledge for application within society. Each Strategic Area will be led by a director able to fully oversee the knowledge domain, bring relevant parties together and acquire the requisite funding. The directors have a key role in forming consortia and co-defining research roadmaps and programs with all the participating scientists. The respective chairs and sub-departments within the departments will be responsible for performing the actual research, with the requisite funding for research, equipment and infrastructure acquired from secondary and tertiary funds. Responsibility for scientific appointments will be borne by the departments. The directors will be appointed by the Executive Board and will report to the Board. A suitable administrative structure will be organized per Strategic Area.

High Potential Research Programs

In the next few years TU/e will continue to give selective temporary financial injections to high-risk innovative multidisciplinary research initiatives by talented young professors/university senior lecturers. Such a High Potential Research Program must offer good prospects for scientific innovation and, in the longer term, for the acquisition of external funds and for participation in external research and innovation programs. Following an initial period of several years, this must be able to be continued mostly on the basis of external funding. Accepted initiatives receive a stimulus amount of up to one million euros spread over four years. In exceptional cases programs may receive a contribution for a second period of four years. A maximum of 2.5 million euros is available each year for High Potential Research Programs.

Institutes

Over the coming years TU/e will support the establishment and development of several multidisciplinary R&D institutes in carefully selected niches and thus create a distinctive profile. In this respect support is given to the continued development of the TU/e Institute for Complex Molecular Systems (ICMS) into an internationally acknowledged center of excellence. The institute will excel not only in fundamental but also applied research and will be able to give a powerful boost to knowledge valorization in its area. Furthermore, the development of the TU/e Intelligent Lighting Institute (ILI), established in 2010, will be supported so that it can become an internationally leading center for light technology. The institute works on research and development lines co-established with industry. And finally, investment has already been guaranteed for the development of a TU/e



Institute for Research on ICT (EIRICT) that will cluster research strengths within TU/e in the field of ICT. This institute will produce a strong, distinctive position for TU/e within the Netherlands Institute for Research on ICT under the flag of the Dutch 3TU.Federation and in the Knowledge and Innovation Community 'EIT ICT Labs' within the European Institute of Innovation and Technology. Moreover, the institute must lead to an internationally distinctive ICT profile for TU/e.

Internationalization

To strengthen its international research position over the coming years TU/e will expand its participation in and revenues from European research programs. In addition to the strong positions already gained in the Knowledge and Innovation Communities (KIC's) 'InnoEnergy' and 'EIT ICT Labs', TU/e will be participating in future KIC's under the flag of the European Institute of Innovation and Technology. It will also strengthen its relationship with European Technology

Dr. Rick Harwig, until recently CTO of Philips and now asked by TU/e to shape the Energy Strategic Area

“The world is undergoing a tremendous energy transformation. Over the next forty years we will have to improve our consumption efficiency fivefold. Science has to respond to this real challenge if this is to happen. It will require researchers to cooperate even more closely than ever.”

Prof.dr. Bert Meijer, university professor at TU/e

“The considerable demands made on science and technology by a sustainable society will push the creativity of the current TU/e researcher and future TU/e engineer to their limits.”



Platforms and Joint Technology Initiatives. Where it fits the strategy, TU/e will enter into partnerships with leading foreign universities and take part in the network organizations of technological top universities. Research cooperation with leading research groups at foreign partner institutions will be strongly encouraged. Finally, TU/e aims for a more international permanent scientific staff. Vacancies will, by definition, be filled internationally.

Quality control

Quality control will remain a key focal issue over the coming years. In self-evaluations (every three years) and research visitations (every six years) TU/e will be moving in the same direction as Delft University of Technology and the University of Twente, partners in the 3TU.Federation. The intention is to allow the research in the context of research visitations to be internationally benchmarked against leading groups elsewhere in the same domains. The quality control system of TU/e in research will

essentially continue to target:

- improved quality of research;
- improved management of the research;
- accountability to the board, funds, government and society in a broad sense.

As a supplement to the visitations, TU/e also participates every three years in an independent citation impact study under the auspices of the 3TU.Federation so that a good view is retained of the quality of the departments, research groups and institutes as well as of the three engineering science & technology universities as a whole in the context of each other and relevant benchmark universities. In assessing the quality of departments, a consideration is the extent of success in the NWO innovation drive and in obtaining secondary and tertiary funding as well as the scores of the

members of the scientific staff in relevant performance indicators. Finally, TU/e will regularly have its position within its strategic key research domains compared with those of comparable leading benchmark universities.

Research targets 2020

Average visitation score for research groups*	> 4.2
Science citation impact score (cf. kroonindicator CWTS)**	> 1.55
Number of articles per annum in Web of Science	> 1.800
Share of international co-publications	> 50%
Share of co-publications with researchers from industry	> 15%
Share of indirect funding in total revenues	> 8%
Share of tertiary funding in total revenues	> 25%
Share of European research funding in total revenues	> 8%
Share of foreigners in permanent scientific staff	> 30%
Number of PhDs per annum	+ 50%
Number of PhDs per annum per professor (fte)	> 1.5

* Maximum score is 5.

** A score of 1.55 means 55% above world average.





**Where
innovation
starts**





Chantal van den Broek,
PhD student Biomedical Engineering

“I want to connect the engineering and medical worlds. Doctors tell us what they need and we respond with high-tech solutions. I have made a computer model that in the future will give doctors more insight into the condition of blood vessels. I meet many critical, inquisitive people in my work. That’s something I enjoy.”

4 Knowledge valorization

In 2020 TU/e will still have a leading position in knowledge valorization compared with the other Dutch universities. It will cooperate with industry and other relevant parties in R&D both within Strategic Areas sketched in section 3 and outside throughout the entire knowledge chain.





High-tech, medium-sized and small enterprises will make optimum use of the university via proactive knowledge and technology transfer. Among students and staff there is great interest in starting up their own companies. TU/e distinguishes itself by the production of successful high-tech start-ups. To achieve these aims, the following initiatives will be taken or continued.

R&D cooperation

By entering into, consolidating and expanding specific cooperative relationships in R&D with high-tech companies and related market parties, TU/e will continue to invest in reinforcing the basis for knowledge valorization in the coming years. There will be very close cooperation with technology-intensive companies and institutions within the whole knowledge chain, from fundamental research to the development of new and improved concepts mainly for complex high-tech products, systems, processes and services. The TU/e focus is therefore primarily on the development of joint research roadmaps and R&D programs within the research areas referred to in section 3. Forming sustainable public-private R&D consortia with companies and other knowledge institutions fits in with this approach whose ultimate aim is to create concrete innovations and new business. TU/e will also participate in the Knowledge

and Innovation Communities under the flag of the European Institute of Innovation and Technology that is geared to encouraging concrete innovations.

Knowledge and technology transfer

As for achieving concrete technological innovations, the high-tech SME sector may have a key role to play in the years ahead. TU/e is keen to rise to the challenge of finding suitable forms of cooperation with small and medium-sized high-tech enterprises, especially the emerging networks of SMEs with related R&D needs that offer interesting points of contact. United Brains - the joint knowledge and technology transfer organization of TU/e, Fontys Hogescholen, TNO, ROC Eindhoven and ROC Ter Aa (Helmond) - continues to play an intermediary role.

Entrepreneurship

The active promotion of entrepreneurship among students and staff will remain a key objective in the coming years. A minor in the Bachelor programs and a special graduation program in the Master programs enable TU/e students the possibility to prepare specifically for starting up a business. This is supplemented by information and PhD activities, programs and workshops about entrepreneurship. TU/e also undertakes research into

Dr.ir. Michael Boot, who gained his PhD from the Department of Mechanical Engineering and is one of the founders of Progression Industry BV that develops products for the automotive industry

“Early on I wanted to be an entrepreneur and come up with solutions to major problems like car emissions. A crucial part of getting from idea to product is to build a good prototype. At TU/e we can get hold of all the necessary assistance and knowledge.”



entrepreneurship in the technology sector via collaboration with the University of Tilburg in the joint Brabant Center of Entrepreneurship. This center will secure ties in the coming years with MBO and HBO institutes in the province. At that level, too, entrepreneurship will be promoted.

Start-ups

TU/e will continue its cooperation with the NV BOM, Brainport Development, the Design Academy Eindhoven, Fontys Hogescholen, Philips Technology Incubator, Rabobank Eindhoven-Veldhoven, Syntens and TNO Science and Industry in the Incubator3+. This valorization consortium is geared to the ongoing professionalization and streamlining of new business development in the region. In this context TU/e prioritizes the themes central to its Strategic Areas. In these areas specifically but also in other areas Incubator3+ encourages and supports spin-offs and start-ups from companies and knowledge institutions. The R&D roadmaps, drawn up

with external partners, will focus as much as possible on the development of new or innovative products and business. In encouraging and supporting new business, extra focus is shone on improving the quality of start-up initiatives and their growth. Specific investment will be made in improving the scouting of possible commercial inventions and in the screening of inventions for their commercialization. Work will also continue on expanding the TU/e Patent Fund and creating a Proof of Concept Fund. The existing regional pre-seed funds for techno and design start-ups will be incorporated in a pre-seed fund with more funding capacity. Linking the seed funds of the three technology universities into one powerful National Seed Fund will be an aim. In addition, a Venture Capital Fund will be established in Incubator3+ to fund successful start-ups in the growth phase as well as facilitating young companies in the broader sense in the growth phase. By enabling the funding arrangements in the successive phases to be better linked, the growth

of successful start-ups can be accelerated. Finally, TU/e and its regional partners will establish a building for start-ups, Catalyst, on the university campus. This will contain specific laboratory and workplace facilities for twenty to thirty university affiliated start-up companies in the technology sector. The eastern zone of the campus will offer location possibilities for research-driven companies affiliated to TU/e.

Knowledge valorization targets 2020

Share of tertiary funding in total revenues	> 25%
Number of TU/e related spin-offs and startups per annum	> 20
Number of patent applications TU/e per annum	> 20
Number of new licenses granted by TU/e per annum	> 20
Number of BSc minor entrepreneurship participants per academic year	> 100
Number of successful MSc entrepreneurship track participants per academic year	> 100

5 Campus

In 2020 the university campus will have, as TU/e Science Park, the stature of an innovation campus of national importance and international allure. TU/e Science Park will accommodate several hundreds of (mainly foreign) students and host a constant stream of conference participants and visiting scientists from all over the world. Top laboratories will be shared with partners from industry and other knowledge institutions.





The university campus houses tens of new and blossoming young high-tech companies and will be home to many leading R&D institutes, knowledge institutions and research-oriented companies/subsidiaries interacting with each other and the university in a climate of open innovation.

TU/e Science Park offers:

- adequate education, conference, residential and housing accommodation for (foreign) students, conference participants and guests;
- good catering, culture and sports facilities;
- excellent study and student facilities;
- state-of-the-art research laboratories;
- top facilities for high-tech starters;
- attractive location options for R&D institutes, knowledge institutions and research-driven companies.

TU/e Science Park will be a living environment, in the evenings and at weekends, too. It will complement the High Tech Campus Eindhoven and the two campuses will profile themselves under the Brainport flag. To achieve this the university campus will undergo a significant transformation in the coming years.

Development vision

A guideline for this transformation is the recently published 'Development Vision for TU/e Science Park' and the new zoning plan for the campus that is based on this. In the development vision the campus is divided into five zones:

- one for the compact accommodation of the university itself;
- one for the residence and conference functions;
- one for applied higher vocational education;
- one to house research-driven companies and R&D institutes;
- a green zone that runs through the campus and in which the sports facilities of the university are concentrated to a large degree.

The intention is to develop very different but cohesive zones on the basis of a single park concept so that the sharing of knowledge and facilities add value to the different users. With a view to this the zonal development accounts for the creation of common facilities. A strong landscape plan and firmly orchestrated quality control by TU/e will help to develop TU/e Science Park into a high-tech environment where companies and knowledge institutions want to locate, knowledge workers want to work and students want to study and live.

Ir. Veronique Marks, director of TU/e
Real Estate Management

“Those who wander around TU/e Science Park in the future will imagine themselves in a green city. The residential quality will be tremendously improved with a meandering Dommel river as well as more restaurants and housing. In short, a place to be.”



All university buildings will be concentrated in a compact university zone. This is coupled to the reallocation and renovation or demolition of a large number of existing buildings and with new building development. This will all be achieved via four major projects according to a Master Plan established under the title Campus 2020. The Master Plan will be modified where necessary according to the development vision and this strategic plan. The TU/e Institute for Complex Molecular Systems and the future University College Eindhoven will also have to be housed. Finally, a drastic revitalization of the university zone is on the agenda and university buildings that become vacant elsewhere on the campus will be reallocated or demolished.

In terms of the residential function, TU/e aims to create attractive and affordable accommodation on and in the vicinity of the campus, especially for foreign students, designers-in-training and PhD students as well as for students of the future University College Eindhoven.

In total 700 residential units will be built on campus and operated by third parties. Adequate accommodation will also be needed on campus for conference participants and visiting scientists.

TU/e offers accommodation options to all the applied engineering programs of Fontys Hogescholen in the zone for applied higher vocational education, thereby strengthening the cooperation within higher applied engineering education in the region.

TU/e offers accommodation options to research-driven companies, high-tech starters and R&D institutes in the eastern zone of the campus. Together with regional partners a new building for start-ups, Catalyst, will be realized in the vicinity of existing accommodation for new entrepreneurs. Catalyst will house specific laboratory and workplace facilities for twenty to thirty university affiliated start-ups in the technology sector. It will also house FOM Rijnhuizen, which will develop into a broad research institute in the field of energy, working very closely with the scientific staff of the university. TU/e is committed to attracting many more relevant companies and institutes to its Science Park on the basis of sharing laboratories and other research facilities with other campus residents.

Investments

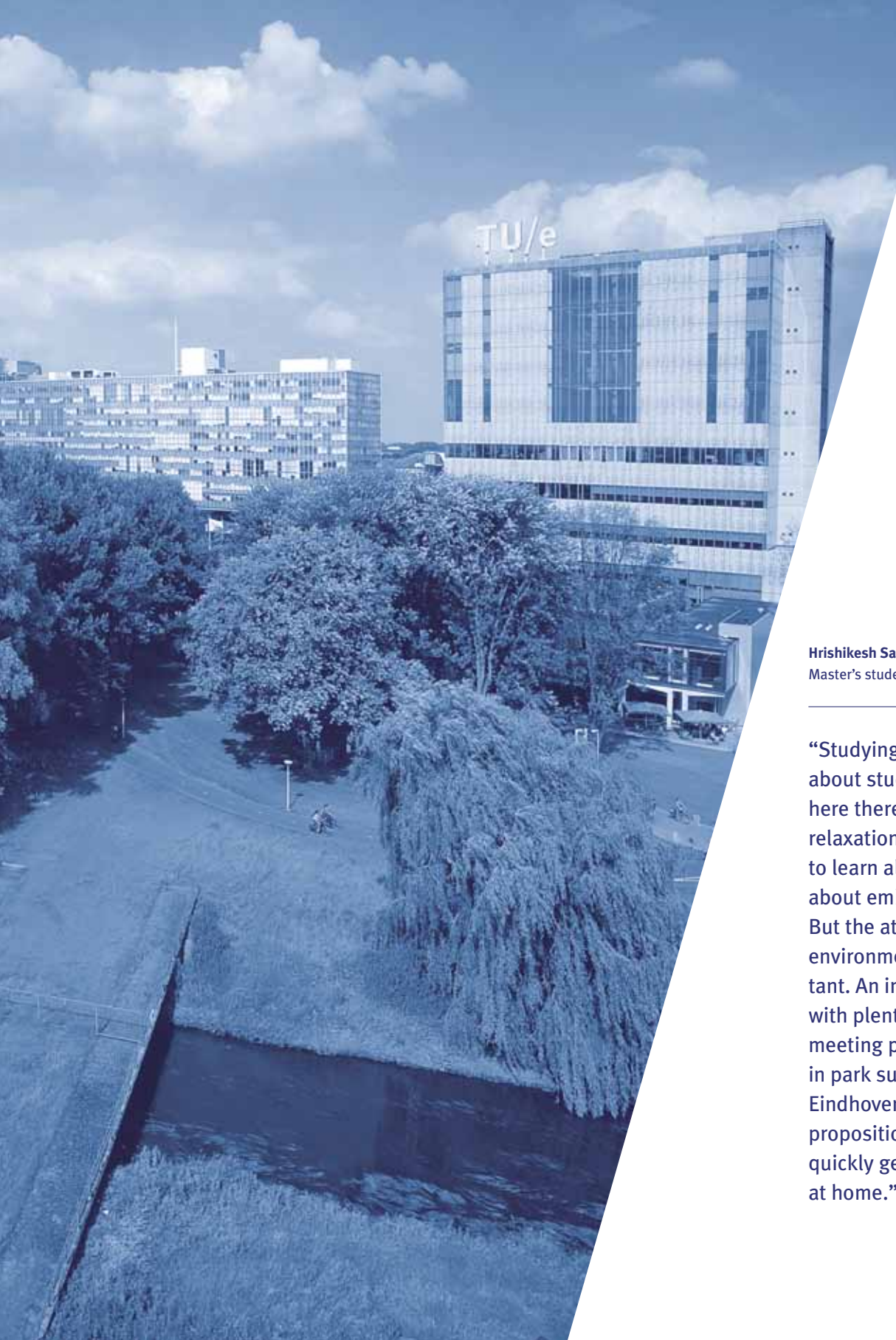
TU/e will be investing 250 million euros itself in the coming years on buildings, laboratories and facilities on its campus. It is also intended to attract 200 million euros in investments and subsidies from other parties.





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Hrishikesh Salunkhe,
Master's student Embedded Systems

“Studying in India is just about studying. Fortunately, here there is also time for relaxation. I came to TU/e to learn all there is to learn about embedded systems. But the atmosphere and environment are also important. An international campus with plenty of opportunity for meeting people and to live in park surroundings make Eindhoven a more attractive proposition. You will more quickly get a sense of being at home.”

6 Conditions

To be able to adequately implement the Strategic Plan a corresponding strategic program has been established under the direct orchestration of the Executive Board.

A project is defined and a project leader appointed for each initiative. Clear performance targets are set and agreements made per project about the authorization and responsibility of the project leader, method, personnel deployment, planning and budget.





The strategic program and its projects are embedded in the regular management cycle (organizational plan, executive annual agenda, quarterly reports and annual report). Progress will be discussed systematically and coherently with internal and external stakeholders and thus promote support for and involvement in the program. Measures will also be taken to encourage connection, intervention and cooperation processes across all organizational entities.

Financing

Implementation of the strategy requires substantial long-term financial impulses and investments, a total of some 600-700 million euros comprising:

- a planned investment of 250 million euros in the accommodation of the university itself;
- 200 million euros for the transformation of the campus into TU/e Science Park (especially to realize residential units for students and the housing of companies, R&D institutes and R&D facilities shared with third parties);
- 150-250 million euros for the other strategic initiatives.

TU/e is able to cover a maximum of half the required 600-700 million euros itself (including the 250 million euro already planned investment in the accommodation of the university). The other half will have to come from investments, participations, contributions and subsidies from third parties.

Personnel

The strategy makes new accents in personnel policy desirable, such as boosting the share of foreigners in the permanent scientific staff and attracting top international scientists. This means scouting top talent at both departmental and institutional level along with a more open recruitment policy. In that recruitment policy quality outweighs the extent to which the expertise domain of a candidate fits the highly defined intrinsic profile of a vacancy. To attract and bind top talent TU/e will make wider use of the tenure track system (temporary appointment as university lecturer or senior lecturer with - upon good performance - the prospect of a permanent appointment as senior lecturer or professor) and or the personal professorship. The number of women in (management) scientific positions will be considerably increased, with the aim of a 20% share of female professors and senior lecturers. To reach that target TU/e will actively scout female talent at institutional level.

Organization

The TU/e maxim for its organizational structure is that ‘organization follows strategy’. Currently there is no direct need to change the existing nine-department structure but change will arrive in the coming years as a department’s self-reliance comes under pressure when student intake successively dips below a particular level and the basis for top quality research becomes too narrow. Apart from any organizational adjustments TU/e promotes small, allied departments that collaborate and cooperate for their management and administrative functions and tasks. The clustering of allied departments may become necessary in time.

For the implementation of the strategy TU/e is setting new and tougher requirements for professionalism, efficiency and mutual coherence for the central administration, promoting coherent and systematic support to strategic initiatives across the administrative columns. The coherence and professionalism of support from the Executive Board in areas like policy development, management of issues, external appointments, public affairs and lobbying will be specifically strengthened. Over the coming years TU/e intends to benchmark the central services per type of service against other universities in terms of professionalism, effectiveness and efficiency. Where necessary, improvement measures will follow. In general, TU/e aims to limit as much as possible the size of administrative and support staff in relation to the scientific personnel yet at the same time prevent members of the scientific staff having to undertake tasks that can be better (and more cheaply) fulfilled by administrative and support staff.

Digital university

As for the ICT infrastructure and use of ICT resources, TU/e will take steps over the coming years towards the concept of the digital university so that the ICT infrastructure is accessible and available ‘anytime, anywhere and with any device’. Moreover, TU/e wants to stay at the forefront of internal ICT services compared with the other universities in our country. The goal is more individualization and personalization across the services board.

ICT facilities must remain state-of-the-art for research which implies an extension of the space for the central accommodation and management of powerful computer systems and safeguarding superfast connections with systems and institutions, anywhere in the world. There will be a switch to a better research registration system and open access of research publications.

In the field of education and management TU/e opts for an ICT infrastructure at the level of proven technology, whereby experiments with new technologies will occur when the opportunity arises. The Digital Learning and Working Environment will be systematically improved and expanded. Links will be made to social media networks, making optimal use of the fact that all students have a laptop computer with standard software. Where desirable, operating systems that are still separated will be incorporated within common architecture. TU/e will respond optimally to new needs in the field of e-learning.



International culture

In line with the internationalization initiatives in recent years, TU/e will develop into a truly international university with an international culture en route to 2020, with English being systematically introduced as a second language. To bind foreign students and staff to our country and, in particular, our region, they will be made familiar with Dutch language, society and culture. All internal facilities for students and staff will be geared to an international and multicultural university community, with essential central facilities open 24/7. The involvement among foreign students in the life of the associations will be promoted jointly with the boards of the study and student associations while a strong communication approach will strengthen the international name and reputation of TU/e.

Prof.dr. Ruth Oldenziel, professor at the Department of Industrial Engineering & Innovation Sciences

“TU/e aims to have more women in scientific positions. Studies regularly show that mixed teams perform better and are more innovative. The diversity is evident not only in gender but also in age and ethnic origin.”



3TU.Federation

The competitiveness of TU/e in the world is enhanced by collaboration and cooperation with the two other technology universities in our country (Delft University of Technology and the University of Twente). The 3TU.Federation is committed to further clustering the strengths of the Dutch technology sector. In addition to the three engineering science & technology universities, the Large Technology Institutes and TNO will certainly be involved. The three engineering science & technology universities will work to create a Dutch Technology Council that can act as a governing body and representative of the technology sector in our country. The council can orchestrate the process of collaboration, cooperation and clustering among all the respective institutions and can play a decisive role in distributing government funding within the sector. Clustering within the technology domain around major societal themes can contribute substantially to the necessary strengthening of the international competitiveness of the Dutch knowledge economy, a goal to which TU/e is committed.





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