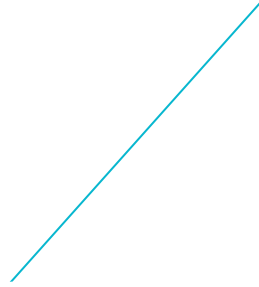


ANNUAL REPORT



ANNUAL REPORT 2021



TUHH
Hamburg
University of
Technology

Facts and figures

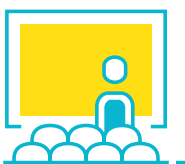
7,430
STUDENTS



972
NEW STUDENTS
in the bachelor's programme

1,290
DEGREES

105
DOCTORATES



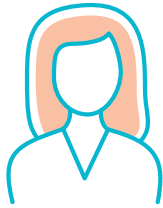
100
PROFESSORS (FTE)

Incl. junior professors

775
ACADEMIC STAFF

(FTE, incl. third-party funded employees)

584
NON-ACADEMIC PERSONNEL (FTE)



27.5 %
FEMALE STUDENTS

20.8 %
FRAUENANTEIL
WISSENSCHAFTLICHES PERSONAL
(Vollzeitäquivalente, inkl. Drittmittel)

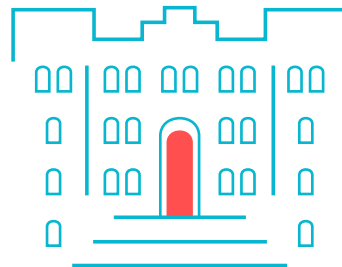
26.2 %
INTERNATIONAL STUDENTS

11.8 %
INTERNATIONALER ANTEIL
WISSENSCHAFTLICHES PERSONAL



153.5
TOTAL EXPENSES
(€ million)

44
THIRD-PARTY INCOME
(€ million)





Foreword

DEAR READERS,

I am delighted that TU Hamburg can present you with this Annual Report 2021. 2021 was a very eventful year for the University of Technology with many successes in challenging conditions. This report covers the many developments and innovations that occurred.

The COVID-19 pandemic significantly influenced teaching. At TU Hamburg, we facilitated as much in-person teaching as we could justify. Small groups in the first semesters and laboratory experiments could largely be held on campus. Many courses were conducted digitally with considerable effort. Much of this will certainly also enrich and improve teaching in the future. Always missing, however, were personal encounters, direct and creative interactions in class, as well as between researchers and all employees at TU Hamburg.

In 2021, the financial situation of the City of Hamburg and the universities remained strained due to

the covid measures. We had to forego filling some professorships and realign others. In administration and academics, job vacancies were utilised and positions were cut. Major investments in research were postponed. Nevertheless, through joint efforts, we were able to provide and further develop challenging, well-taught classes during these times, achieve excellent research results and acquire many new projects. I am pleased that the measures have resulted in the TU ending the year 2021 with a balanced budget.

In response to the challenges of the future, we conducted an intensive strategy process in 2021. This resulted in the development and introduction of a new research structure with five research fields.

With great pleasure, we welcomed eleven newly appointed colleagues who strengthen TU Hamburg and pursue research and teaching tasks with



great drive and enthusiasm. This report includes their brief introductions.

In November, TU Hamburg's growth process was evaluated by a high-calibre expert commission appointed by the Ministry of Science (BWFGB). The experts reviewed TU Hamburg's development and profile building since the beginning of the 2018 growth phase and gave it an extremely positive assessment. Their report praised TU's efforts and urged policymakers to "maintain momentum" and seamlessly follow up with a second development phase. We were delighted with the positive decision as well as the recommendation to proceed, both of which are of great importance for our further development.

In 2021, we were able to position ourselves well for the challenges of the future. In times of upheaval, as a technical university, we must use technological innovations to find solutions to the challenges

facing society: **Technology for humanity**, be it against climate change and its consequences, for health, the mobility revolution or the energy transition. With our partners in industry and science, we will continue to tackle this task in the future, together.

Sincerely,

Andreas Timm-Giel
President

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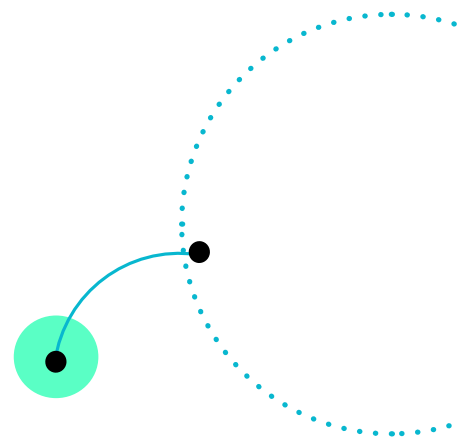
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JANUARY

- Andreas Timm-Giel elected President of TU Hamburg
- Commitment and good grades: 91 students receive a "Deutschland-stipendium" scholarship

FEBRUARY

- Key Technology Mathematics – New international master's programme Inter-Maths at TU Hamburg and at four other European partner universities in Vienna, Nice, L'Aquila and Barcelona approved to start as of the winter semester

MARCH

- Young Talent Campus launches new STEM career orientation series – a dive into university experience for interested pupils in years 9-13
- Start-ups made easy – TU Hamburg among the TOP 20 in "Gründungsradar" (Start-up Radar) 2020

APRIL

- Online agency ranking – social media performance and mobile visibility of TU Hamburg among the TOP 10 Northern German Universities
- Digital Girls' Day at TU Hamburg
- Grant renewal of WIPANO: "WIPANO – Knowledge and Technology Transfer through Patents and Standards" supports, among other things, commercially exploiting innovative ideas and inventions from public research.

MAY

- President Andreas Timm-Giel becomes spokesman for the Hamburg State University Conference (LHK)
- "TUHH Guidelines for Ensuring Good Academic Practice" unanimously adopted by the Academic Senate
- Open T-Shape for Sustainable Development – Collaborative project receives funding from the Foundation for Innovation in University Teaching
- From Hamburg to Canada – DAAD supports student exchange between TU Hamburg and the University of Waterloo

JUNE

- Business magazine "Wirtschaftswoche" ranking – Industrial Engineering and Computer Science of TU Hamburg among the Top 10
- From Hamburg to Australia – TU Hamburg and the University of Newcastle renew dual degree agreement

JULY

- MLE-Days on machine-learning application fields
- 10,000 euros prize money – Christopher Krause, Nils Albrecht and Dr.-Ing. Jan Lewandowsky receive science awards from the Gisela and Erwin Sick Foundation
- Innovative work and social commitment – Sebastian Paarmann, Fernand Kantati (Initiative S-Plus), Annika Holzschuh, Eric Wagemann (Tutorial Mechanics I), Dr Niklas Kühn receive Karl H. Ditze Prizes

SEPTEMBER

- STEM future: International HackSTEM hackathon takes place at TU Hamburg
- University ranking U-Multirank – TU Hamburg leads German universities in technology transfer



OKTOBER

- Mobility of the future – TU Hamburg at the ITS World Congress

NOVEMBER

- Joint DFG research training group with HafenCity University "Urban Future Making" approved
- SFB draft proposal "Smart Reactors" submitted to the German Research Foundation (DFG)
- New building opening: Centre for Studies and Doctoral Studies (ZSP) – 2,000 sqm for new professorships, the Graduate Academy, the TU College of Excellence and student working groups
- TU Hamburg's new brand identity – Newly designed brand elements support the brand essence "Technology for People"
- 30th anniversary of the exchange programme with the University of Waterloo, Canada

University Development



COMMISSION ASSESSES TU HAMBURG

Everyone at TU Hamburg who was involved in the project has put a great deal of work, energy and creativity into the university's development process, which started back in 2018. Was it worth it? Do the results meet the expectations? To answer these questions, the TU Executive Board presented the strategic course set out in recent years to a high-level commission.

For three days in November 2021, a five-member panel were guests of Hamburg University of Technology. The Chairman of the Evaluation Commission, Prof. Eckhard Weidner, Director of the Fraunhofer-UMSICHT-Institute, Prof. Ellen Ivers-Tiffée, Distinguished Senior Fellow at the Karlsruhe Institute of Technology (KIT), Prof. Julia Gillen, Vice President for Teaching and Studies, Leibniz University Hanover, Prof. Aad van der Horst, Senior Consultant, BAM Infraconsult,



01

and Prof. Thorsten Strufe from KIT, evaluated the growth process' progress. The commission's visit was the highlight of the year for the TU Executive Board as well as the TU's many stakeholders. Numerous employees played a role in making sure it could take place while adhering to covid measures – making lively discussions possible between the commission members, scientists and the administration.

STRENGTHENING RESEARCH

The first day focused on research. Those responsible for projects gave presentations on establishing new research structures as well as strengthening basic research, for example in the report on the Collaborative Research Centre "Tailored Multiscale Material Systems – M3 and on the I3 programme. The committee was given demonstrations on the further development of research fields through specific projects in TU Hamburg's "Technikum", using "Advanced Materials & (Bio) Processes" as an example.

TU President Andreas Timm-Giel then introduced the strategy for appointing professors. A total of 15 new professorships are expected to be filled by the end of the growth phase; 10 were already filled in 2021. "This significantly strengthens and raises the profile not only of TU Hamburg but also of Hamburg as a centre of science," the president explained. Key professorships are structured topically in a way that supports both Hamburg as a centre of science and research and the business clusters. They also aim to enable university and non-university partners to network even more effectively on-site. The new bridge professorships make up a key element of this, the president emphasised, giving the reviewers a deep insight into efforts that are already underway: Across Hamburg, interdisciplinary projects such as DASHH and ahoi.digital are consistently advancing the networking of information technology. Concurrently, interdisciplinary and innovative research is being developed and implemented as planned under the I3 funding programme at TU Hamburg. 13.2 million euros have already been invested. The newly appointed professors presented their research topics to the

commission during a large poster session held in the new HIP building in Harburg's upriver port.

MORE ATTRACTIVE RANGE OF STUDIES

The next day's focal point was on teaching at TU Hamburg. Staff members gave insights into teaching developments: new study programmes, increasing the appeal of existing study programmes, the internationalisation strategy and the international orientation of teaching within the EICIU University's framework. A presentation on the Graduate Academy's work provided an overview of the continuing education offering. Finally, talks on technology transfer, the Startup Dock business incubator and IP management rounded off the programme. A presentation by the Chancellor, Arne Burda, on how administration modernisation will be implemented as part of the growth process concluded the presentation of the growth programme. The team of experts then withdrew for an internal discussion.

At the end of the evaluation, the external experts were very impressed and enthusiastic about the efforts and results of the first phase of TU's growth process. The evaluation commission's recommendations now form the foundation of strategy development for the upcoming, second development phase. The corresponding process will start in 2022.

RESTRUCTURING TU HAMBURG'S RESEARCH ORGANISATION

RESEARCH FIELDS AND AREAS

TU Hamburg's research organisation was revised as part of the growth process. A new research structure was derived from intensive discussions with all schools of study, the main research areas, and within the committee for strategic research planning (AsPF): Five research fields and two research areas "Methods of Research in Science & Engineering" and "Societal & Economic Impact" were created.

Professors may align themselves with one or more research fields and may join a new research field at any time. In addition to application-oriented research, developing scientific methods is a priority in many institutes and working groups at TU Hamburg. Professors who see the core of their research in developing methods can also participate and organise in the area "Methods of Research in Science and Engineering @ TUHH".

Results and processes of university research are increasingly measured by their impact on business and society. Research topics, fields of activity, events and projects of TU Hamburg that are of particular social relevance are represented in the area "Societal and Economic Impact". Furthermore, this area generally serves to showcase cooperation with partners from industry and society.

The research field coordinators are the first point of contact for relevant inquiries from industry and society and actively contribute to the visibility of

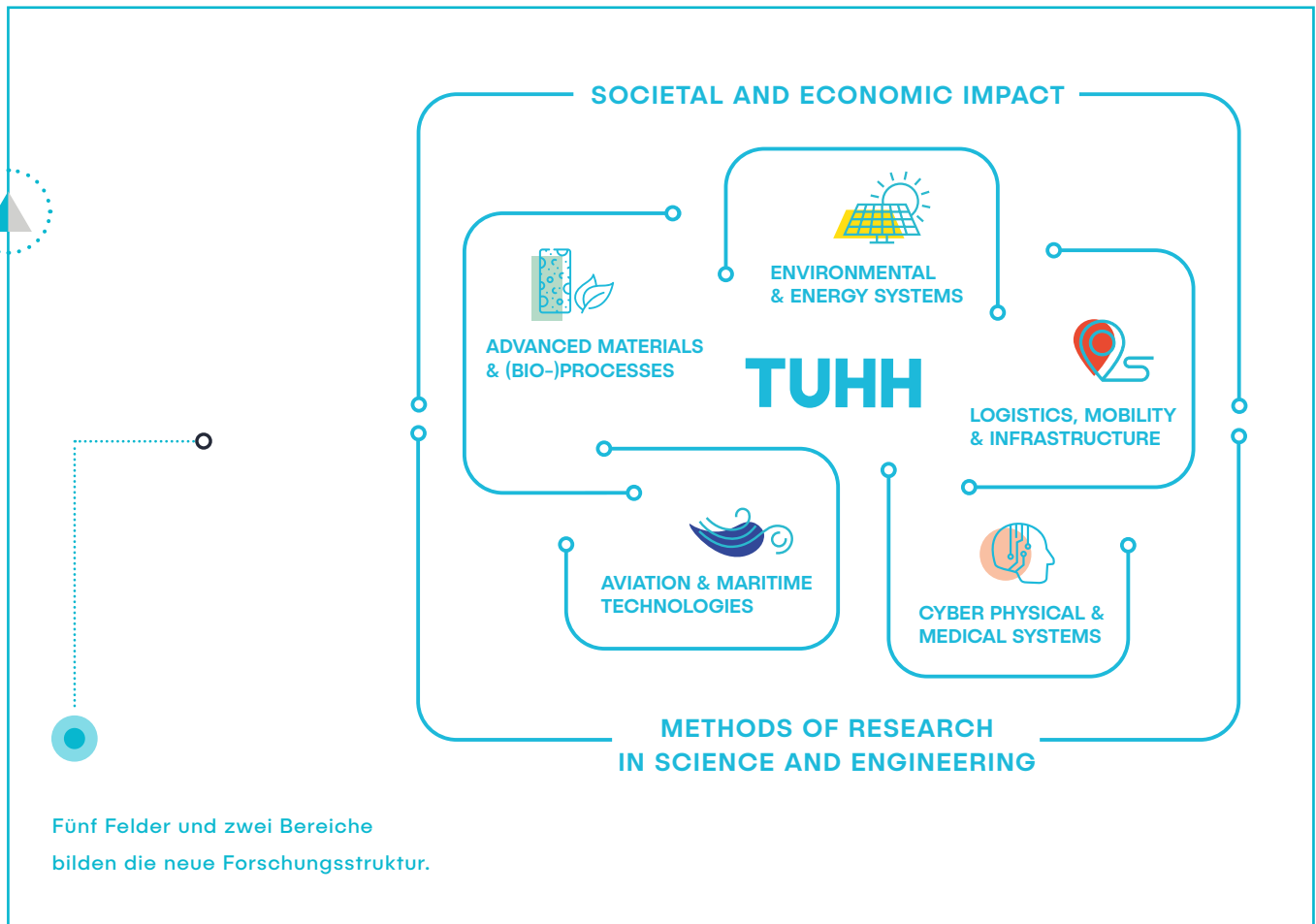
State Councillor Dr Eva Gumbel,
TU Vice President Research Prof. Irina
Smirnova, TU Chancellor Arne Burda,
TU President Prof. Andreas Timm-
Giel, Prof. Thorsten Strufe, Prof. Ellen
Ivers-Tiffée, Prof. Eckhard Weidner,
Prof. Aad van der Horst.
Photo: TU Hamburg

EVALUIERUNGSKOMMISSION
ZU GAST AN DER TU HAMBURG



Prof. Eckhard Weidner
im Gespräch mit
Prof. Irina Smirnova.





research at TU Hamburg. The research areas are reviewed by the AsPF every three years and adjusted as needed.

As a special highlight, in future, the research fields will organise the "Future Lecture" series on a rotating basis. High-ranking speakers will present important and forward-looking research topics to all members of TU Hamburg and the interested public. At the same time, they are expected to provide an impetus for the research fields' work and scientific orientation.

RESEARCH FOCUS

Underneath the five research fields, research at TU Hamburg is organised in research focuses (FSP). They bundle research in the schools of study in an interdisciplinary manner. Because many research questions can only be solved across disciplines, the FSPs are suitable platforms for cooperation and exchange. Some FSPs have already been working together successfully for years, while others have been realigned or newly established as part of the research organisation's restructuring.

Professors and other members of TU Hamburg who are academically active can be members of one or more research focuses. Every three years, the Academic Senate decides on whether the respective FSP should continue.

Since the restructuring, the following nine research focuses have been working at TU Hamburg:

- Advanced Materials
- Aviation Technologies
- Biobased Processes & Reactor Technologies
- Civil Infrastructure Systems
- Cyber-Physical Systems
- Environmental & Energy Systems
- Logistics Management & Technology
- Maritime Systems
- Medical Technology & Biomechanics

RESEARCH INITIATIVES

RESEARCH INITIATIVE BUILDING IN AND AROUND WATER

Research initiatives were newly introduced as part of the 2021 research restructuring. The instrument allows current research topics to be established at TU Hamburg within a short time and includes the participation of external partners from science or industry. Research initiatives arise directly from the community of scientists at TU Hamburg with an innovative, interdisciplinary concept.

In May 2021, the research initiative "Building in and Around Water" was established under the leadership of Prof. Jürgen Grabe. The research initiative addresses the consequences of human-made climate change, which pose major challenges to our society and coastal populations especially. In future, coastal regions will be greatly affected by changes. In this respect, it is imperative to analyse and evaluate the impact on essential infrastructures and derive recommendations for action.

In the medium term, the work of the research initiative "Building in and Around Water" may lead to a research focus being established at TU Hamburg.

Further information:

<https://www.tuhh.de/fibau/startseite.html>

RESEARCH INITIATIVE MACHINE LEARNING IN ENGINEERING (MLE)

Machine learning has become a key driver of economic innovation and development. The spectrum of applications is enormous and ranges from container control in maritime logistics to ensuring frequency stability in future electrical energy networks. However, its application potential in engineering is comparatively unknown and unexploited. This is where the newly founded research initiative "Machine Learning in Engineering (MLE)" wants to start. Under the direction of Prof. Christian Schuster and Prof. Volker Turau, MLE bundles competencies within Machine Learning at the Hamburg University of Technology, thus gaining visibility as an attractive contact for Hamburg's economy and industry. Scientists at all career levels and across all research areas at the TU are engaged in a joint effort with colleagues from the Helmholtz Centre Hereon. The research initiative works on different levels and is active within the TU through a lecture series and regular meetings where interested parties come together. To also serve the goal of knowledge transfer towards business and industry, the MLE Days were held for the first time in 2021. This two-day event for science and industry offered workshops on relevant topics.

Further information at <https://mle.hamburg/>

GOOD RESEARCH PRACTICE

Researchers and academics have been dealing with good research practice and how it should be designed precisely for quite some time. As early as 1998, the German Research Foundation (DFG) published the first memorandum on this topic area. The latest revision was presented to the public in July 2019 as the DFG Codex "Leitlinien zur Sicherung guter wissenschaftlicher Praxis" (Guidelines for Safeguarding Good Research Practice). These works reflect the respective state of national and international debate and can be understood as best practice standards.

Following the DFG Codex' publication, all German universities were requested to implement or integrate its content into their statutes on good research practice by mid-2021.

Against this background, Prof. Irina Smirnova, Vice President for Research, initiated a broad discourse on revising the previous TU guidelines for ensuring good research practice. The general university public and several external experts participated in the discussion, which was conducted with great intensity.

By February 2021, a working group consisting of representatives of all status groups had developed two central documents: the guideline for ensuring good research practice (based on the DFG Codex) and a supplementary internal document that addresses the application of the Codex's abstract contents in specific instructions for action as well as their implementation at TU Hamburg.

The policy has been submitted to the DFG for review and should subsequently be approved by the Academic Senate.

Further information: <https://www.tuhh.de/tuhh/forschung-und-transfer/gute-wissenschaftliche-praxis.html>


PROFESSOR SMARSLY

is developing walking robots that, among other things, can detect cracks in concrete.



»Implementing
visionary ideas«

Robot dogs on construction sites

Digital transformation is everywhere. It is not limited to voice-controlled televisions or self-driving cars. Digitisation can also optimise the construction of high-rise buildings. "Just a few years ago, it would have been considered impossible to print concrete. Now we can even build entire houses using 3D printing," says Prof. Kay Smarsly. The head of the new Institute for Digital and Autonomous Construction (IDAC) is working on buildings of the future. "All my research ideas are motivated by protecting humankind and nature and making life more enjoyable."

CONCRETE CHECKS BY A WALKING ROBOT

For example, Prof. Smarsly's research includes concrete printing, artificial intelligence (AI), and smart sensors used to monitor bridges, dams, and high-rise buildings. He and his team are currently working on intelligent walking robots that can monitor structures and communicate with each other. With the help of laser scanners and other sensors, they collect measurement data from buildings, which they then analyse independently using AI and forward to connected computer systems. "The robots can find their way around the structures on their own, somewhat similar to roaming dogs," the TU professor explains. As soon as they measure any abnormalities in the concrete during their inspection rounds – cracks, for example – the employees responsible on the construction site immediately receive a digital notification. Not only does this facilitate the construction work, but it also makes the buildings safer.



ENVIRONMENTAL PROTECTION THROUGH SENSORS

Environmental topics are also part of Kay Smarsly's research profile. The intelligent sensors he developed can not only measure damage to structures but also pollutants in the soil. Among other things, this allows the quality of drinking water to be tested anytime and anywhere in a cost-effective and easy-to-use manner. "We would like to use this technology in developing countries in the long term," Prof. Smarsly said.

The TU researcher is fascinated by the versatility his field of research entails: "Digital transformation allows me to implement visionary ideas and work across disciplines." However, he never actually had a scientific career in mind during his civil engineering studies. He just let things happen as they came, he said: "Ett kütt wie et kütt" – as they say in my homeland, the Rhineland." Before joining TU Hamburg, Kay Smarsly was a professor and chair at the Bauhaus University in Weimar.



Research



EVALUATION I³ PROGRAMME

The I³ programme was created in 2018 as a pillar of the growth programme. I³ stands for "Interdisciplinarity and Innovation in Engineering". Since then, interdisciplinary research projects by experienced scientists as well as for young scientists have been funded internally through three funding lines.

The I³ labs programme component aims to identify new interdisciplinary ideas and promote them through internal start-up funding to the point where the projects can subsequently attract external funding (e.g. from the DFG, the EU or as federal funding). Four experienced scientists were able to propose projects and apply for support for four years, each with one research position plus material resources – the funding volume thus amounts to approx. 1.4 million euros per I³ lab. After an interim evaluation, a decision will be made as to whether a fourth year of funding can be granted.

02

In April 2021, this interim evaluation of the first five I³ labs was conducted with the participation of 2 or 3 designated external expert reviewers from across Germany respectively.

A steering group formed by the members of the AsPF and external experts from the University of Bremen and the Helmholtz Centre Hereon prepared the results of an intensive day of peer review that included interviews, poster sessions and plenary presentations. On this basis, the Executive Board decided on subsequent funding for the following I³ labs:

- "Model-Based Machine Learning for Soft Tissue Modelling in Medicine."
- "Smart Reactors"
- "Business Analytics – Optimisation Potential and Strategic Risks for Maritime Logistics Systems."
- "HELIOS – Hamburg Electronics Lab for Integrated Optoelectronic Systems"
- We are now eagerly anticipating which I³ labs will develop into larger research networks at TU Hamburg in the coming years.

THIRD-PARTY RESEARCH

FUNDING BY THE GERMAN RESEARCH FOUNDATION (DFG)

In the area of DFG-funded basic research, TU Hamburg was able to raise around ten million euros in 2021. In addition to the successes in applying for research projects via the standard process, the approval of the DFG post-graduate training programme "Urban Future Making" is an important highlight. In cooperation with the HafenCity University Hamburg, which is in charge of the programme, establishing this research training group will make it possible to expand the training of young scientists in this scientific field. In addition, we succeeded in submitting a draft proposal for a collaborative research centre "Smart Reactor" to the DFG for review.



»Mediate
between users
and computers«

**JUNIOR PROFESSOR
CHRISTIAN DIETRICH**
*heads the Operating Systems
working group.*

Ensuring digital infrastructure

"If you notice your operating system, then I've done something wrong," says Prof. Christian Dietrich about his work. This is because the scientist deals with operating systems. They ensure that smartphones and computers can be booted up at all and that users can write texts, use apps or even play music. "With my research, I mediate between a computer's components, such as between the keyboard and mouse, and the software, i.e. primarily computer programs such as "Word" or "PowerPoint," explains the junior professor. Christian Dietrich's scientific career began with studies in computer science at the University of Erlangen-Nuremberg. After completing his doctorate at the University of Hanover, the native Franconian moved to the Elbe to set up and head the Operating Systems group at the TU. What he likes most about Hamburg are the Harburg Mountains and Franzbrötchen pastries. He likes to spend his free time on his bike or baking bread.

NATIONAL PROJECT FUNDING

Researchers were also active in and successful with national research funding. The main supporters are federal ministries and funding organisations such as the German Federation of Industrial Cooperative Research Associations (AIF). This can be illustrated in two examples: E.g., an AIF-funded collaborative project is developing offshore wind energy systems for hydrogen supply. The TU research team led by Prof. Sören Ehlers is investigating the effects of weather and water on wind turbines with the aim of making the turbines more resistant to waves, wind and temperature fluctuations to increase the service life of the metal structures and components. Prof. Christian Becker is working in the North German Energy Transition Field Test, which is funded by the German Federal Ministry for Economic Affairs and Climate, and together with his partners, is researching solutions for the holistic, climate-friendly further development of Hamburg's energy system. Prof. Kerstin Kuchta is active in the same project and is dedicated to the topic of new synergies in power-to-gas and biowaste utilisation. A research team from the Institute of Technical Thermodynamics, led by Prof. Arne Speerforck, is testing and optimising the design and operation of an aquifer heat storage system using measurement campaigns and model-based simulations.

EUROPEAN PROJECT FUNDING

Within the European project funding framework, a further seven Horizon 2020 projects and two Erasmus+ contracts totalling around €2,375,000 began at the TU in 2021. One example is a project in which Prof. Volker Gollnick is involved: It aims to reduce carbon emissions by optimally matching aircraft sizes and their ranges, taking air transport networks into account.

Further information on the successful EU applications of TU Hamburg: https://www.v.tuhh.de/forschung/projekte/european_commission.html

In 2021, the framework programmes also changed from Horizon 2020 to the new EU funding programme Horizon Europe.

All research projects are presented in TU Hamburg's Research Information System (FIS) as well as on the scientific institutes' respective pages. This instrument shows the range of TU's research activities:

<https://www.tuhh.de/tuhh/forschung-und-transfer/forschungsinformationssystem-und-forschungsbericht.html>

COOPERATION IN SCIENCE

The Hamburg metropolitan area boasts a surprisingly large number of public and private universities and non-university research institutions in a comparatively small area. The short distances within the city-state facilitate collaboration at all levels, be it individually between scientists, in collaborative projects, or at management and administrative levels. TU Hamburg has also been working closely with many Hamburg institutions for a long time, for example in the context of the Excellence Initiative or for the acquisition of Collaborative Research Centres at the DFG. The University of Hamburg, the German Electron Synchrotron (DESY), the Hereon in Geesthacht, the German Aerospace Centre (DLR) and the Fraunhofer-Gesellschaft (FhG) are important partners.

In 2018, TU Hamburg became a member of PIER ("Partnership for Innovation, Education and Transfer"), a network originally initiated by the University of Hamburg and DESY. Today, the network unites more than 15 partners from universities and non-university research institutions and represents important research areas relevant to Hamburg as a centre of science. TU Hamburg played a leading role in establishing the "Climate-Friendly Mobility" PIER pillar. Preparations are underway to establish the "Materials Sciences" pillar, which is of special importance for the TU. Expansion to other subjects is planned.

As part of the cooperation between TU Hamburg and DESY, the professorship "High-Resolution X-Ray Analysis of Materials" was filled as a bridge professorship between the two institutions. Preparations are underway to appoint another joint professorship for "3D Manufacturing of Hybrid, Multiscale Structures – from Nanoparticles to Components". Both bridge professorships further intensify the existing scientific networking between DESY and TU Hamburg.

Cooperation in the field of materials science was also further expanded with the Helmholtz Centre Hereon. The partners agreed on the joint appointment of two professorships on "Atomic Material Modelling" and "Machine Learning in Virtual Material Development" in this field.

In cooperation between TU Hamburg and the Fraunhofer-Gesellschaft, the joint professorship for "Industrialisation of Smart Materials" was announced. Prof. Ingomar Kelbassa accepted the resulting invitation. At the same time, Prof. Kelbassa takes over the management of the Fraunhofer Additive Production Technologies Facility IAPT in Bergedorf.



Mit diesem Bioreaktor im Technikum der TU Hamburg können neue Impfstoffe erforscht werden.

FÜR DIE DFG GEFÖRDERTE
GRUNDLAGENFORSCHUNG
KONNTE DIE TU HAMBURG
IN 2021 RUND
ZEHN MILLIONEN EURO
EINWERBEN.

In cooperation with DLR, Prof. Gerko Wende was appointed to the new joint professorship for "Digitisation of Efficient Repair and Maintenance Processes". This is associated with a management role for the DLR Institute for "Maintenance and Modification" based in Hamburg-Finkenwerder. Prof. Sören Ehlers, formerly a professor for the design and strength of ships at TU Hamburg, took over as head of the new DLR Institute for "Maritime Energy Systems" in Geesthacht. This further strengthens the "Aviation and Maritime Systems" research field.

OPEN ACCESS PUBLICATIONS

Publishing its scientific results is a central duty that a university has to society. In doing so, new knowledge can be made accessible to anyone interested. The majority of publications are published in scientific journals by a few publishers. The associated market concentration is increasingly tying up resources in library budgets, with

the result that dependencies are also increasing. Furthermore, being tied to a subscription means that the desired free distribution of knowledge is only possible to a limited extent. For this reason, publicly funded research institutions in particular have been striving for a system change for several years: from a subscription commitment including a transfer of all rights to genuine free access, "Open Access". In 2021, half of the articles by TU members were already published as Open Access.

access to scientists of TU Hamburg, their institutes, projects and publications. An online tool can be used, among other things, to transfer publication lists to the websites of institutes and scientists. Publications can now be maintained centrally in one place for all purposes.

Further information also at <https://tore.tuhh.de>

TU HAMBURG WINS DFG FUNDING "OPEN ACCESS PUBLICATION COSTS"

With funding support from the German Research Foundation (DFG) through the Open Access Publishing Costs programme, the University Library continues to expand open-access publishing opportunities for scientists.

For the years 2022-2024, the DFG has approved €152,600 in material funding for publication costs. Among other things, the Hamburg University of Technology's "excellent starting position" and "high level of commitment to the development of scientific publication infrastructures" were acknowledged. The funding will make it possible to strengthen the culture of publishing in Open Access in technical, scientific and engineering disciplines and to develop and shape it on an ongoing basis.

TRANSPARENT RESEARCH INFORMATION

TUHH Open Research (TORE) has been in regular operation as an open-source research information system (FIS) since 2021. The portal offers public

Teaching



NEW STUDY PROGRAMMES

Hamburg University of Technology has set itself the goal of educating young people to become committed engineers who employ technical expertise and are critical and constructive in how they seek solutions. Students at TU Hamburg learn to develop "technology for humanity" and to assume social responsibility to help shape the future of all.

Against this background, two new bachelor's degree programmes and a new European joint master's degree were created and offered for the first time at TU Hamburg in the winter semester 2021/22: "Green Technologies: Energy, Water, Climate," "Industrial Engineering – Logistics and Mobility Specialisation," and "InterMath – Interdisciplinary Mathematics."

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GREEN TECHNOLOGIES BACHELOR'S DEGREE PROGRAMME: ENERGY, WATER, CLIMATE

Climate change, high energy and resource consumption, ecosystem disruption, and a steadily growing world population are challenges that humanity is currently already facing. How the world of tomorrow will look crucially depends on which solutions are found to deal with these developments.

The Green Technologies programme: Energy, Water, Climate addresses precisely these issues. By combining specialist knowledge, and technical and communication skills, engineers are trained to think in a manner that is both interdisciplinary and solution-oriented. The focus is on "green" technologies for a sustainable, climate- and resource-friendly energy and water supply. To this end, the study programme combines the competencies of

energy technology, process technology, and sustainable supply and disposal engineering with natural science disciplines. From the fourth semester, students can select a specialised focus according to their personal interests. They can choose between the specialisations Energy Systems, Water, Bioresource Technology or Energy Technology. The programme commenced in the winter semester 2021/22 with 60 students.



BACHELOR'S DEGREE PROGRAMME IN INDUSTRIAL ENGINEERING AND MANAGEMENT – LOGISTICS AND MOBILITY SPECIALISATION

The bachelor's degree programme in Industrial Engineering and Management – Logistics and Mobility specialisation emerged from a comprehensive reform of the bachelor's degree programme in



»Decisively reduce
CO₂ footprint«

**JUNIOR PROFESSOR
SOHAN LAL**
*designs processing units
on computers.*

Fast computers that consume little energy

"I want to help significantly reduce people's CO₂ footprint," says Prof. Sohan Lal. Only his work results are not as obvious as the research on e-cars or solar cells. "I develop techniques to improve the performance and energy efficiency of parallel and many-core processors such as graphics processors. In other words: I'm excited when we can do more work with less energy using these devices," Professor Lal says. Meanwhile, such "massively parallel systems" are everywhere – in smartphones, cars and supercomputers. They help people do many things that would have been impossible some time ago. If, for example, the energy efficiency of each processor were to be increased by just five percent, this amount would be sufficient to supply around eleven million households in Germany with electricity for one hour! Before joining TU Hamburg, Sohan Lal worked at the Technical University of Berlin. He studied computer science and engineering at the Indian Institute of Technology Delhi (IIT Delhi) and in Jammu in northern India. The junior professor is looking forward to working with his new colleagues and living in Hamburg with his wife and two children. And in addition to cycling and reading, he has another hobby that is perfectly suited to windy Hamburg: Flying kites.

Logistics and Mobility and was established for the winter semester 2021/22. Students learn how to make logistics and mobility sustainable and fit for the future. They find new ways for sustainable supply chains in commercial or humanitarian logistics and research future-oriented digitisation strategies such as blockchain. To this end, students learn, for example, everything they need to know about the development and use of autonomous vehicles, electromobility or robot-assisted goods delivery. The programme commenced in the winter semester 2021/22 with nearly 130 students.



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INTERNATIONAL MASTER'S PROGRAMME INTERMATH - INTERDISCIPLINARY MATHEMATICS, JOINT MASTER'S

How can the spread of infectious diseases be simulated? Can intelligent systems support diagnoses by physicians? How are decisions in logistics optimised with the help of mathematical models? What methods can be used to simulate the development and treatment of tumours? Is bio-mobility the driver of the future?

The *Interdisciplinary Mathematics* programme is dedicated to these and other societal challenges. Innovative methods in mathematical modelling and scientific computing are developed and applied to solve such "real-world problems" in the fields of biomedicine and industrial engineering.

For this purpose, universities from five European cities (L'Aquila, Vienna, Hamburg, Nice, Barcelona) have joined forces and developed a unique,

Neue Bachelor-Studiengänge an der TU Hamburg: „Green Technologies: Energie, Wasser, Klima“ und „Wirtschaftsingenieurwesen – Fachrichtung Logistik und Mobilität“.



Fünf europäische Städte haben sich zum Joint Master-Studiengang Intermath – Interdisciplinary Mathematics zusammengeschlossen.

innovative and diverse offer in the field of interdisciplinary mathematics, which is supported by the EU under the Erasmus Mundus programme. The individual locations are responsible for modelling and simulation in the areas of infectious diseases and cancer research (University of L'Aquila), neuroscience (University of Côte d'Azur), computational biomedical imaging (TU Hamburg), fluid mechanics in industry (TU Vienna) and optimisation

in logistics (Autonomous University of Barcelona).

Approximately 20 students began the joint master's programme in the winter semester 2021/2022 at the University of L'Aquila in Italy, half of whom will be trained in numerical modelling at TU Hamburg in the summer semester 2022. Double the number of first-year students are expected for the subsequent cohort.

STUDY PROGRAMMES IN PLANNING

New study programmes have already been designed and prepared at TU Hamburg with a view to the winter semester 2022/23. Among others things, the new bachelor's degree programme in *Chemical and Bioengineering* will be offered this semester for the first time. It replaces the previous degree programmes in process engineering and bioprocess engineering. In chemical and bioengineering, properties of raw materials are used specifically and (bio)catalysts and processes are developed to create new products or to find more sustainable, energy-saving ways to make existing products. Efficient material conversion processes with extensive recycling options enable a circular economy with a minimal ecological footprint. Chemical and bioengineering thus make an important contribution to a resource-conserving and climate-friendly society.

In addition, the part-time master's programme in *Digital Journalism* will be offered in cooperation with the Hamburg Media School starting in the winter semester 2022/23. The programme offers journalists from Germany, Austria and Switzerland excellent continuing education. The focus will be on topics such as new types of media consumption, cross-media storytelling formats, digital sales markets and their audiences, and professional ethical requirements for digital media.



ACCREDITATION PROCEDURE

A study programme's accreditation is proof of its high quality. At TU Hamburg, therefore, all study



»Researching
in space«

**JUNIOR PROFESSOR
ULF KULAU**

*is an assistant professor
for smart sensors.*

Sensors that can decide for themselves

Prof. Ulf Kulau would actually have liked to become a pilot, but his eyes were too bad for that career path. Fortunately, he has fulfilled wish number two and makes "cool stuff with sensors" that are used in agriculture, aerospace and medicine. "Sensors and sensor networks have always fascinated me because they represent an interface between the real and digital worlds," explains the junior professor. Smart sensors can couple measured data with signal and data processing. They enable a fusion between sensor technology and computer science. After studying computer science and writing his dissertation at the Technical University of Braunschweig, Ulf Kulau joined DSI Aerospace Technologie in Bremen, working on research projects for space electronics. He developed the sensors for a smart shirt worn by German astronaut Matthias Maurer during his mission on the International Space Station (ISS). It measures minimal chest movements triggered by a heartbeat. The data obtained in space was then sent to Earth and analysed for further research.



programmes, for which it is possible, are accredited. The guarantee for successful accreditations is the joint commitment of professors and academic staff, the teaching-related administration and the students.

Therefore, almost all study programmes of TU Hamburg were in various stages of having their study quality externally evaluated in the year 2021. After the accreditation procedures were successfully completed, the study programmes of the Process Engineering and Civil Engineering Departments as well as the German-language study programmes of the Electrical Engineering, Computer Science and Mathematics Departments were awarded the quality seal of the German Accreditation Council for a further eight years. In the winter semester 2021/22, due to the pandemic, three virtual walk-throughs were also held for the programmes of the School of Study in Mechanical Engineering, the Department of Interdisciplinary Engineering and Technologies, and the two logistics programmes. The procedures for the bachelor's degree programmes "Green Technologies: Energy, Water, Climate" and "Industrial Engineering – Logistics and Mobility", which were established for the academic year 2021/22, were started for the first time in 2021.

I³PRO TEACHING

I³ProTeaching is a qualification programme for TU Hamburg's academic staff. By participating in the programme, they can enhance their teaching skills, overcome challenges in their teaching practice, develop their skills and network across disciplines in the university, and increase their career opportunities. The first priority is to offer participants a flexible programme geared to their interests and needs, from which they and their institutes benefit. I³ProTeaching is created and held by the Centre

for Teaching and Learning in cooperation with the Graduate Academy. In 2021, 54 academic staff members completed the programme. Another 63 participants began the programme in 2021. Hamburger Lehrpreis 2021

HAMBURG TEACHING AWARD 2021

The City of Hamburg awards the Hamburg Teaching Prize for outstanding teaching, innovative teaching methods and mediation concepts. The award is presented annually to teaching staff at Hamburg's six state universities and is endowed with 10,000 euros respectively. Students can submit nominations for the teaching award; the TU students selected Dr Johanna Peters in 2021. Her teaching concept in various in-lecture mechanics exercises as well as revision courses relies on highly personalised support that is optimally tailored to the individual skills of her students. During the covid pandemic, in particular, the scientist took advantage of digital tools to further illustrate her approaches. With the help of hands-on videos, a personal coaching offer and digital group work, the programme succeeded in instilling confidence in the students' abilities and optimally preparing them for their exams. The award ceremony by Science Senator Katharina Fegebank took place during a joint Senate reception.



»Important factors for a circular economy«

PROFESSOR STEFAN SCHULTE wants to use *Big Data* technologies to find solutions for less congestion and lower traffic volumes.

Managing Big Data and blockchain technologies

"When it comes to both mobility and production, in many cases, it comes down to processing large amounts of data." This is how Professor Stefan Schulte describes the core of his work. Big Data technologies help the computer scientist better control traffic flows and optimise transport capacities. This leads to less congestion and a lower volume of traffic. In addition to Big Data, blockchain and Internet-of-Things technologies can be used in manufacturing to track and recycle products throughout their lifecycle. "These are important factors in establishing a truly circular economy," the TU professor says. After ten years at the Vienna University of Technology, the native of northern Germany has now returned to his old home. At TU Hamburg, the computer scientist is dedicated to the task of building up the new Data Engineering Institute and, with his team, significantly shaping both research in the field of Big Data and the teaching that goes with it – especially in the bachelor's and master's degree programmes in Data Science.

SPECIAL OFFERINGS

ORIENTATION STUDIES

According to the principle: "study. try. decide.", TU Hamburg offers young people the chance to try out engineering studies over two semesters in various subjects as part of Orientation Studies (OS). 34 students took advantage of this opportunity in its second year and rounded off their orientation studies in the summer of 2021 with very special experiences: After a six-week in-person familiarisation phase, lockdown happened and, with it, orientation studies were also conducted digitally. For project work, this meant no more screwing and soldering to build a prototype. Instead, digital meetings were held on digital planning and calculation as well as to present results on "sustainable housing" via Zoom. Although the summer semester also commenced predominantly in a digital format, the OS students' drones and painting robots were once again able to be assembled, at least in part, in the student workshop, while maintaining hygiene measures. Starting their studies with a normal class size and close supervision during orientation studies proved particularly effective under these special pandemic conditions, as evidenced by the student opinion of Rebecca Gorny in an interview with the Hamburger Abendblatt: "I was surprised at what was possible at TU Hamburg. For me, the learning groups, also concerning social aspects during covid, were especially meaningful."



OPEN T-SHAPE FOR SUSTAINABLE DEVELOPMENT

DEVELOPING TECHNOLOGY-BASED IDEAS THAT CHANGE THE WORLD

The Institute for Technical Education and University Didactics (ITBH), headed by Prof. Knutzen, launched the Open T-Shape for Sustainable Development project in 2021 in association with HafenCity University Hamburg (HCU). Open learning opportunities are being developed in this collaborative project. The goal is to promote interdisciplinary skills to achieve the 17 Sustainable Development Goals (SDGs) of the United Nations (UN). The project addresses topics such as sustainable industrial production, the fight against hunger, and the provision of clean energy or sustainable urban development from a technological perspective. Students can earn a certificate in addition to their degree. They acquire basic and in-depth knowledge in open online courses. They then work with other students to develop solutions for current and societal challenges. Unlike many honours programmes, participation in the T-Shape offering is tied solely to learner interest and motivation. The project has been funded with over two million euros since August 2021 as part of the "Strengthening University Teaching Through Digitisation" funding line of the Foundation for Innovation in University Teaching.

Link to open learning opportunities:
<https://sdg-campus.de/>



»Passing on and discovering knowledge«

PROFESSOR NIHAT AY

heads the Institute for Data Science Foundations at TU Hamburg.

Understanding the world with the help of Data Science

We live in an age where data is generated both constantly and everywhere. With his research, Prof. Nihat Ay would like to contribute to the ability to make informed individual as well as global, socio-political decisions from this flood of data in the future. Nihat Ay sees us humans as the model for this process: "We are constantly being bombarded with raw data that we have to sort out and evaluate. We assign meaning to it and use it to understand our surrounding world. This process of understanding is the basis of all action." For this, the scientist researches in the field of embodied intelligence. "You can imagine, for example, a four-legged robot that learns to walk. Our approach is that this system uses sensory data to develop its very own view of the world and uses this as the basis for its targeted navigation," says the mathematician. This principle could then be applied to more general, complex systems. "Not just the robot should learn to run, but also traffic and social systems should, in a more abstract sense, run optimally. My goal is to provide an answer to this using the fundamentals of Data Science," explains Prof. Ay.

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STUDIENKAMAT-ELEKTROTECHNIK,
INFORMATIK-UND-MATHEMATIK





MINTFIT HAMBURG WORKPLACE

As a well-connected scientific partner, Hamburg University of Technology is involved in a large number of collaborative projects. One of these has been the *MINTFIT Hamburg Project* since 2014 – a cooperation between Hamburg's universities (HAW, HCU, TU Hamburg, UHH/UKE). It develops online services for pupils and first-year students and offers various services in the areas of e-assessment, e-learning, digitisation of teaching and learning, and study preparation. Since 2021, the project has been permanently located at TU Hamburg as the operating unit "Arbeitsstelle MINTFIT Hamburg (AMH)" (MINTFIT Hamburg Workplace).

AMH operates the online platform "MINTFIT" in the area of "tests/courses". It offers self-assessment tests and learning opportunities in mathematics, physics, chemistry and computer science for students. Its objectives are to reduce dropout rates through better preparation for university and to promote STEM fields. Thanks to a wide national reach and a strong partner network, it promotes Hamburg as a location for STEM studies – especially the profile of TU Hamburg – beyond the region's borders. With more than 300,000 visitors and 40,000 test participations annually, MINTFIT is one of the most-used platforms of this kind in Germany.

The e-assessment area focuses on promoting electronic testing. AMH is a full-service provider for consulting on and implementing electronic examinations at Hamburg's universities. For this pur-

pose, it operates the "mobile test centre" – with 100 notebooks as well as 200 iPads and the self-developed examination software "YAPS". Thus, testers who are interested in testing electronically do not have to have the technical expertise to do so. In the summer semester 2019, the first two electronic exams were successfully tested with around 180 participants in the mobile test centre. In the meantime, around 4,200 people have been electronically examined through regular operations at TU Hamburg in over 60 examination runs – and the trend continues upward.

Further information at <https://amh.tuhh.de>.



DUAL@TUHH

TU Hamburg also offers its bachelor's and master's degree programmes in a dual study variant in cooperation with companies from regional and national industry. The study concept combines full university studies with professional practice in engineering. The students are employed by a company TU Hamburg cooperates with and form cross-curricular cohorts from the entire spectrum of engineering sciences. Seminars on the development of personal competence round off the programme ensuring that graduates can face the challenges of the working world in a responsible manner.

In the study cohort starting in the winter semester 2021/22, 36 students in eleven study programmes took up dual studies in the bachelor's programme. A large share of bachelor's graduates is continu-

ing their dual studies in the consecutive master's programme.

New companies have also been brought into the programme again for students starting their studies in the 2021/22 year. They include companies from the logistics, construction, energy supply, process engineering and IT sectors, as well as the metal and electrical engineering industries.

Since January 2021, the dual study option has been undergoing structural development as part of the accreditation of the bachelor's and master's degree programmes. The aim is to offer the dual study programme as a practice-integrated intensive study programme from the winter semester 2022/23.



ROBOTIK@TUHH

To support pupils in MINT subjects (mathematics, computer science, natural science and technology), a comprehensive marketing and promotion concept for young people was established at TU Hamburg with robotik@TUHH in cooperation with the employers' association NORDMETALL. By organising robotics and technology courses in lower, middle and upper secondary schools as well as in district schools and the 4th year of primary school, pupils interested in science and technology are encouraged and inspired about engineering topics early on.

In autumn 2021, the new robotics lab opened on the TU Hamburg campus. Computer workstations, soldering stations and workbenches are availa-



»Secure and resilient in the face of attacks«

**PROFESSOR
SIBYLLE FRÖSCHLE**

*heads the Institute for Secure
Cyber-Physical Systems*

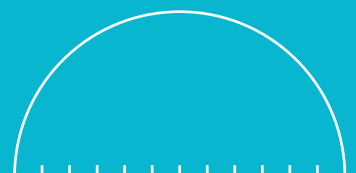
Network and automate systems

Professor Sibylle Fröschle has been researching model-based developments of embedded systems for 20 years. These are computers that perform a monitoring, control or filtering function in devices, for example for medical technology, in aircraft or motor vehicles, as well as in washing machines, refrigerators or mobile phones.

The increasing networking and automation of such embedded systems are accompanied by a close coupling of informational, mechanical and electronic components. The complex systems that emerge pose a major challenge for cyber security. "Cyberattacks can also have security implications. The Institute for Secure Cyber-Physical Systems takes an integrated approach with the goal of achieving demonstrable security and resilience in the face of such attacks," explains Prof. Fröschle. After holding positions at the University of Edinburgh and the University of Warsaw, the computer scientist worked at the OFFIS Institute for Computer Science at the University of Oldenburg, where she taught as a "Privatdozent".

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STUDIENKAMAT-ELEKTROTECHNIK,
INFORMATIK-UND-MATHEMATIK



ble for courses with up to 20 participants. New 3D printers make 3D-printing classes run smoothly, and a selection of heavier-duty tools allows participants to perform hands-on activities.

INTERNATIONALES



ECIU UNIVERSITY

ECIU University is an EU-funded European university that aims to create a completely new educational model at the European level. It brings learners, educators, and researchers together with cities and businesses to solve real-world challenges, known as "societal challenges."

As one of 13 partner universities of ECIU University, TU Hamburg is actively involved in developing and establishing innovative teaching formats and shaping a visionary European Higher Education Area. A particular focus is on the teaching concept of challenge-based learning (CBL). Here, learners work together with players from science, administration, companies or civil society associations on innovative solutions for socially relevant and real challenges. Learning always takes place in interdisciplinary and international teams. In terms of content, the challenges to be worked on in the pilot phase (2019–2022) are based on The United Nations' SDG 11: Sustainable cities and settlements. Courses within this framework have been offered at TU Hamburg since the winter semester 2020/21.

Developing corresponding concepts for ECIU University and the university-didactic support of teaching staff is carried out by the Centre for Teaching and Learning (ZLL) in the "Competence Centre CBL" (C3BL), which was established for this purpose. The members of the ECIU University send scientists and students to the joint teaching programme. For example, in the autumn of 2021, a joint workshop on "Basic Principles in CBL" was held by faculty from TU Hamburg with faculty from the ECIU Alliance.

Through the challenges offered, TU Hamburg will increase student mobility as well as TU Hamburg's attractiveness in the context of other student exchange programmes. At the same time, the challenges prepare students for increasingly project-based work in companies. However, due to the pandemic, planned in-person visits to partner universities in 2021 could only be held online.

The ECIU University's activities developed thus far are to be pursued and expanded at TU Hamburg. The partners are driven by the vision of jointly establishing European offerings by 2030, especially in the area of continuing education with a hybrid European campus.

[More information at **eciu.org**](https://www.eciu.org)

ERASMUS+ CHARTER FOR TU HAMBURG

Erasmus+ is the European Union's programme for education, youth and sport. It is a vital element in making German universities more international and is also a symbol of the European community and its values. The programme focuses on promoting mobility in particular.





»Using knowledge from fundamental research«



PROFESSOR JOHANNES GESCHER

heads the Institute of Technical Microbiology.

Making biotechnology more sustainable

Prof. Johannes Gescher is no longer exactly sure why he wanted to become a scientist. However, the biologist could never imagine doing anything other than researching and teaching at a university. Born in Fulda, he is a new professor at TU Hamburg and heads the Institute of Technical Microbiology. Previously, he worked at the Karlsruhe Institute of Technology (KIT) for ten years. Johannes Gescher's research deals with the still relatively young discipline of microbial bio-electrochemistry. It explores how to refine waste streams from biomass or improve wastewater treatment. Microorganisms play a crucial role in this process. The TU scientist's research focuses on their metabolic processes.

GENERATING ELECTRICITY FROM WASTE MATERIALS

"In addition to us humans – who use respiration to reduce oxygen to water to produce energy for our metabolism – a wide variety of anaerobic microorganisms use alternative energy sources," the scientist explains. The microorganisms use iron oxides, which they practically inhale. They have developed a strategy to transfer electrons through their respiratory chain to the cell surface and, ultimately, to iron. This insight is paying off for the researchers: One particularly exciting thing is that, for research purposes, iron can be exchanged for an anode as an electron acceptor. In this process, microorganisms transfer the electrons produced during metabolism to an electrode, thus generating electri-

city. "Microbial bio-electrochemistry is a wonderful example of how knowledge from basic research can lead to new biotechnological processes," explains Prof. Gescher. "For example, electricity can be generated from organic matter, such as wastewater or waste."

ESTABLISHING COOPERATIONS

"In my research, I would like to work as interdisciplinarily as possible with various other research groups and establish long-term collaborations with companies," says the scientist. "As the new head of the biochemical engineering programme, I'm passionate about developing the programme to train more outstanding bioengineers in the future." The newcomer to Hamburg is married and has two daughters. He likes to spend his free time doing sporting activities. However, he cannot practice his favourite hobby, ultra runs in the mountains, here in the north.

In 2021, 86 TU Hamburg students were able to benefit from a mobility grant under Erasmus+ and stayed abroad at one of the European partner universities. Popular destination countries included Sweden, Finland and Norway, followed by Spain and Italy. In turn, 115 international students, especially from France and Spain, came to TU Hamburg for a stay abroad through Erasmus+.

The participating universities' adoption of the Erasmus+ Charter is a prerequisite for applying for funding for all types of mobility and project tracks and also determines the quality framework for cooperation activities. TU Hamburg successfully applied for the quality certificate ECHE (Erasmus Charter for Higher Education 2021-2027) under the new programme generation Erasmus+ and, by achieving maximum points, demonstrated that it has created all conditions to successfully implement the programme at the TU.

TU Hamburg in society



COOPERATIONS WITH BUSINESS AND INDUSTRY

The cooperative relationships are traditionally strong between TU Hamburg and the business community in the Hamburg metropolitan region and far beyond, as demonstrated by its constant good positions in the international rankings Times Higher Education and U-Multirank. TU Hamburg regularly achieves top positions in the categories "third-party funding from business cooperations", "joint publications", "joint theses", "patents" and "spin-offs".

In 2021, TU Hamburg was able to strengthen its cooperation with the regional business community through its membership in the Hamburg Federation of Industry (IVH) and its intensive collaboration with the Chamber of Commerce. The aim is to accelerate the transfer of innovation to small and medium-sized enterprises and industry, thereby strengthening the business location's long-term future viability. To this end, TU Hamburg is in continuous dialogue with the



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two leading associations, contributes to their established exchange formats and develops ideas for new joint formats of cooperation between science and industry.

In addition to maintaining the existing network with partners Airbus, Lufthansa Technik, Jungheinrich, Mankiewicz and NXP, a framework cooperation agreement was concluded with ContiTech AG and TUTECH Innovation GmbH. ContiTech has set up an Innovation Hub at the tradition-steeped Harburg location, where it will systematically expand research and application in the fields of materials, digitalisation, software engineering and hydrogen technologies together with Hamburg University of Technology and TUTECH.

In the cooperation with industry, the endowed professorships financed by private industry at TU Hamburg occupy a particularly prominent position. In the area of "quantum computing" – which will become increasingly important in the future – during the reporting period, TU Hamburg and the company Fujitsu initiated the appointment procedure for

an endowed professorship with full institute furnishings in "Quantum Inspired Optimisation". Due to its application-oriented focus, this professorship is an important building block within Hamburg's quantum computing strategy. A professorship endowed by the Birkel family (Tempowerk) dedicated to "Organisational Design and Collaboration Engineering" will systematically research success factors in technology transfer and develop methods of how knowledge transfer can be designed to strengthen innovation in partnership between science and business. To this end, the Tempowerk Technology Park is integrated into research and teaching as a field-test laboratory, thus ensuring a close link between theory and practice.

For TU Hamburg, these, and other, cooperations are an important factor for the success of necessary transfer processes from research and teaching to business and society. In addition to opening up additional financial scope, the collaborations always provide an impetus for application-oriented research and the opportunity to make scientific findings available to society more quickly.

TRANSFER AND START-UP SUPPORT

An essential part of a technical university's mission is to transfer research results to applications in business and industry. At TU Hamburg, this has long been a tradition that has taken very different forms: Our graduates bring knowledge and innovation to their new employers, and our continuing education programmes also contribute to knowledge transfer. Research is conducted jointly with industry and business in collaborative projects. In cooperation with the TU subsidiary Tutech Innovation GmbH, TU scientists also carry out direct industrial collaborations. Registered inventions and patents are another important transfer instrument; the Patent Exploitation Agency (PVA) supports them in this. In addition, employees and students implement findings and knowledge in their own start-ups. Founders can find support and advice at the Start-up Port and beyourpilot. One example is shown at the end of this chapter – the start-up company traceless materials GmbH, which was particularly successful in 2021.

DIRECT INDUSTRY COOPERATION

Tutech Innovation GmbH (Tutech) is a subsidiary of TU Hamburg and the Free and Hanseatic City of Hamburg. For more than 25 years, it has been mediating and supporting TU Hamburg's direct cooperation with industry.

In 2021, Tutech supported TU scientists in around 170 projects with industry with a revenue of seven million euros. The focus was on projects in mechanical engineering, in particular aircraft construction and shipbuilding, and process engineering. The strategic partnership with Tempowerk was further expanded. Increased efforts in innovation manage-



SCHOOL OF MECHANICAL ENGINEERING



»Developing novel material systems.«

**JUNIOR PROFESSOR
KALINE P. FURLAN**

*heads the working group for
Integrated Ceramic-based
Materials Systems.*

Materials and how they are processed

Professor Kaline P. Furlan advises her students to observe closely: "What materials do you see and how were they processed?" the junior professor asks. After all, almost all the things we use daily are made of certain materials and with special materials technology. For example, ballpoint pens have a casing that is manufactured by extrusion or injection moulding. Coffee cups are usually formed from a powder suspension and then sintered. And sunscreens often contain ceramic titanium oxide nanoparticles that reflect the sun's rays like tiny mirrors. The scientist has always been fascinated by materials and engineering. Kaline P. Furlan completed her bachelor's degree in materials science at the Federal University of Santa Catarina in Brazil. With a stopover at the Fraunhofer Institute for Manufacturing Technology and Applied Materials Research in Bremen, she came to Hamburg after completing her doctorate and has been working at the TU for five years as part of the collaborative research centre "Tailored, multiscale materials systems".



ment and marketing aim to make the transfer-related successes more visible and thus contribute to the growth of the region and the technology cluster around TU Hamburg.

PATENT EXPLOITATION IS AGAIN SUCCESSFUL

In 2021, an important aspect in which TU Hamburg was also successful was protecting and exploiting inventions: The Patent Exploitation Agency (PVA) intensively supported 19 new invention disclosures of the TU and continued the patent management and exploitation of more than 40 IP families. As an example, the TU Hamburg spin-off LignoPure was successfully launched by transferring property rights to the company. In addition to exploitation activities, an IP-Day at TU Hamburg was organised in November 2021 and TU Hamburg's IP strategy and guidelines were adapted to even more transparently demonstrate the university's founder-friendly positioning.

Further information: tutech.com/ip-management

INITIATION OF TRANSFER PROJECTS: CALLS FOR TRANSFER

TU members continued to actively embrace the Calls for Transfer (C4T) funding format in 2021. The aim is to transfer promising ideas, inventions and smaller research projects, which are often not pursued further, to industry or society. Project applications in this regard can be supported with up to EUR 30,000 in start-up funding. Of 17 project applications from a wide range of research areas at TU Hamburg, twelve were funded. With the help of C4T, 28 projects from TU Hamburg out of 52 submissions were already approved during the entire funding period (2018–2021), resulting in new colla-

borative partnerships, numerous publications, start-ups, patent applications, and third-party funding in the six-figure range. The projects that started in the 2021 reporting year also promise innovations that can practically help shape our future: Application topics range from supply chain management in crises, to nanolaminate patches for bridges, to robotic autopsies. All successful project applications are united by the pursuit of progress and change, thinking "outside the box", and a clearly laid out plan for how to use the funding to move from theory to practice.

FOUNDATION SUPPORT

STARTUP PORT

Start-up ideas and start-ups have long been given extensive support at TU Hamburg through the Startup Dock. Close networking with academic institutions in the metropolitan region was initiated through the beyourpilot project and the EXIST-V-funding Startup Port. Then, in September 2021, the association's "Startup Port" brand was launched. Under TU Hamburg's leadership, the participating universities are now pooling their energy into supporting start-ups. In addition to opening up existing offers at all collaborative universities, several new programmes were developed for networking and continuing education for those interested. This enables them to offer the most comprehensive assistance possible to prospective start-ups as well as individual founders, interested students and researchers. The supported individuals and teams can participate in all offers free of charge thanks to funding from the Federal Ministry of Economics and Climate Protection.



Das Verpackungsmaterial
aus pflanzlichen Reststoffen
ist kompostierbar.



Traceless-Gründerin Anne Lamp
möchte der globalen Umwelt-
verschmutzung entgegenzuwirken,
indem sie eine Verpackungs-
alternative zu Plastik herstellt.



The Startup Port network includes TU Hamburg, the University of Hamburg, the University Medical Centre Hamburg-Eppendorf, HAW Hamburg, Leuphana University Lüneburg, Helmut Schmidt University and Wedel University of Applied Sciences.

Tutech operates the "Startup Port @TUHH" start-up centre at Harburger Schloßstraße.

Further information: startupdock.de and startupport.de

BEYOURLPILOT

The start-up platform beyourpilot was established to provide even better support for start-ups. Since 2019, in addition to the online platform, it has also been providing direct consulting services for female founders with its partners: University of Hamburg,

HAW Hamburg and TU Hamburg, as well as DESY. Hamburg Media School (HMS) joined the "beyourpilot" series as a further partner in August 2021. The Ministry of Economics and Innovation of the Free and Hanseatic City of Hamburg is financially supporting the project. The network will also be expanded in the future. The project builds on the existing start-up support provided by Tutech's start-up services and works closely with the EXIST-funded "Startup Port". Through this support system, people interested in founding a company, start-ups and young companies gain access to financing instruments, further experts outside the partner institutions and resources such as office space, laboratories, tools and a job wall. The alliances "beyourpilot" and "Startup Port" aim to merge all offerings under one brand.

Further information: beyourpilot.com

TRACELESS – A SUCCESSFUL SPIN-OFF

Two researchers at TU Hamburg who were particularly successful in setting up a company are Anne Lamp and Johanna Baare. The founders have made it their mission to counteract global pollution by producing a packaging alternative to plastic.

While working on her doctorate in the laboratory of the Institute for Environmental Technology and Energy Economics, Anne Lamp came across a process that can be used to obtain a material from plant residues that has similar properties to plastic. However, it consists of purely natural substances and is therefore completely degradable. Together with Johanna, she further developed this material into a market-ready product including a successful business model.

The company's foundation followed in 2020. Since then, the founding team from Hamburg University of Technology has made it to the top of the TOP 50 start-ups in Germany with their innovation. It was also the most awarded start-up in the country in 2021. Among other things, they have won the Hamburg Founders' Prize and the German Founders' Prize 2022.

From the beginning, "traceless materials" received energetic support from the Hamburg start-up ecosystem. Institutions such as TU Hamburg's Startup Dock, beyourpilot and Startup Port, funding programmes such as Calls4Transfer and IFB InnoRampUp, and also TU Hamburg itself were on hand with advice, support as well as funding to give the science spin-off the right boost.



»Save weight
and material«

**PROFESSOR
BENEDIKT KRIEGESMANN**

*is committed to making
aircraft lighter.*



SCHOOL OF MECHANICAL ENGINEERING

Lighter aircraft for lower emissions

Prof. Benedikt Kriegesmann is motivated by the idea of sustainability: "The more weight and material we save in aircraft structures, the less fuel an aircraft needs to move and the fewer carbon dioxide emissions are released." This is a goal that the TU professor already worked towards as a development engineer at Airbus. 3D printing or carbon fibre-reinforced plastic are often used to make a component, such as the fuselage of an aircraft, as light as possible. Structures manufactured in this way can be precisely tailored to their respective loads, but they can also be very sensitive to material variations or manufacturing defects. To counteract this, the civil engineer combines probability calculations with computer-based simulation and optimisation methods. In doing so, he finds optimally designed components that are not only lightweight but also robust. At TU Hamburg, Benedikt Kriegesmann plans to combine his six years of research work as part of his junior professorship with the new Institute for Structural Mechanics in Lightweight Construction. The Münster native finds a balance to his research work primarily through music – to the extent his three children let him.





»Cooling and heating rooms«

**PROFESSOR
ARNE SPEERFORCK**

*is the head of the Institute of
Technical Thermodynamics*

Air conditioning in line with the energy transition

Prof. Arne Speerforck has a mission. He wants people to feel comfortable in their homes and workplaces. The professor at the Institute of Technical Thermodynamics is, therefore, primarily concerned with air conditioning. The energy for this must come from the most efficient or climate-neutral sources possible, such as heat pumps. In addition to developing suitable "hardware", for Arne Speerforck, existing energy must be used efficiently: "We want to integrate more renewable energy into the existing grids. To achieve this, the electricity, gas and heating networks must be more closely interconnected," he says. Hamburg University of Technology is not unknown territory for him; he already studied mechanical engineering here. After a detour to the University of Maryland, USA, and several years of management work in R&D technology development for heat pumps at the heating manufacturer Vaillant Group, he has now returned to TU Hamburg, where water and wind – Speerforck's preferred elements – are always close by.

ALUMNI NETWORK TU & YOU

TU & YOU promotes personal and professional exchange between alumni, students, TU members, foundation members and representatives from business, industry and society. Within the last eight years, the number of association members has increased to over 2,200. The network has a total of 4,300 members worldwide. TU & YOU is a networking initiative of TU Hamburg, the Alumni Association, the Foundation for the Promotion of TU Hamburg and Tutech Innovation GmbH.

Events are an important part of the alumni's work to build up and perpetuate the network and bond to the alma mater. Since July 2020, TU & YOU has been live broadcasting via video conference with "Talk Around the World" every second Wednesday of the month: It offers news from the Executive Board and sometimes current research presented by the institute's laboratory. In the second part, alumni report on their work, their projects, as well as their time at TU Hamburg.

In 2021, TU & YOU founded the women's network EMPOWER.ING. It aims to bring together female graduates from different industries and age groups with the goal of sharing valuable experience and knowledge. Furthermore, it aims to promote networking among alumnae, female students as well as female academics and to increase the visibility of women in the STEM field. In the long term, the network's activities should lead to increased TU alumnae networking and the creation of a global female competence network.



／ GENDER AND FAMILY EQUALITY

One of the core tasks of equal opportunities work is monitoring all appointment procedures and job-filling procedures of the scientific staff. In addition, 2021 also saw the continuation of a large number of activities and projects that had already been established in previous years.

A new addition in 2021 is the BWFGB-funded collaborative project "Close the Gap." This is intended to mitigate the pandemic-related consequences, especially for female scientists. It also addresses male scientists concerning issues and challenges related to reconciling work and family. TU Hamburg has received €40,000 from the "Close the Gap" project for measures over three years, for example, for personnel support through student assistants, subsidies for childcare/care for relatives in need, proofreading, travel allowances or coaching. In addition, a cross-university network "Close the Gap" was founded as an exchange platform.

In 2021, the "Gender-Equitable Language Working Group" of TU Hamburg's Academic Senate developed a guideline on gender-equitable language. The recommendations show what to look for in everyday communication to make language gender-equitable. This explicitly involves university-relevant forms of communication such as teaching, e-mails, speeches or forms. The guide is available on the TU Hamburg website:

https://www.tuhh.de/t3resources/tuhh/download/universitaet/richtlinien/220405_TUHH_Leitfaden_Gendergerechte_Sprache.pdf

Equality work was given a new organisational structure in 2021. The topics of gender equality, family equality and, newly, the topic of diversity are united under the umbrella of the Equality Unit so that synergies between the topics can be even better utilised.

Administration



The importance of a modern and effective administration, especially at a university, cannot be overstated. The reorganisation and modernisation of TU Hamburg's administration were also pursued consistently in 2021. Some selected highlights are presented here.

ESTABLISHING A STAFF UNIT FOR DIGITISATION AND CHANGE MANAGEMENT

TU Hamburg's administration is undergoing a continuous and holistic modernisation process. Within this framework, organisational structures will be further developed, services further digitised, processes optimised and service quality further improved. These measures are flanked by various executive development measures. The foundation was laid for establishing a "Digitisation and Change Management" staff unit to provide professional support for the processes surrounding the admini-



05


station's modernisation and digitisation, which will start work at the beginning of 2022.

ADOPTING A REAL-ESTATE-MANAGEMENT CONCEPT

The previous structure of real estate management provided for the three organisational units "Building Management," "Technical Operations Service," and "Technical Service for Building Maintenance," as well as an officer for structural building development. This structure could no longer optimally reflect the diverse demands of running a modern technical university. Therefore, the subdivisions were merged into one department and the newly established management position was filled. The thus-developed departmental concept provides for the professionalisation of structures and services: The functions of technical, infrastructural, structural and now also commercial building management are clearly structured and aligned

with TU Hamburg's needs. In addition, a staff unit for area management will equally deal with the strategic and operational issues of providing adequate space and rooms for research, teaching and administration. An order centre will improve service quality, speed and transparency of processes. This is accompanied by the introduction of a new CAFM system (Computer Aided Facility Management). This means that all requirements for maintenance, asset accounting, fault service or area planning can be planned and documented centrally and digitally.

In the meantime, with the imminent completion of the first growth phase, a considerable demand for space has also manifested itself. This demand cannot foreseeably be met by existing space on the Schwarzenberg Campus. In a constant exchange with BWFGB, concrete plans were therefore made to expand TU Hamburg in Harburg's upstream port.



New management in the computer center and university library

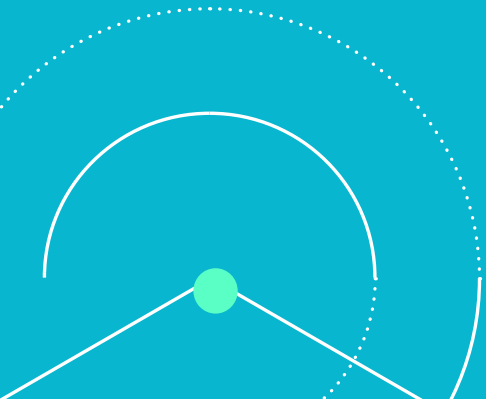
Feldsien-Sudhaus as head of TUB in August 2021, and Hans-Gerrit Möws became the new head of the Computer Center in July 2021, succeeding Dr. Manfred Schössler.

Graduate librarian **BEATE RAJSKI** has been working at TU Hamburg since 1989. After five years working with users, she moved to the library's IT department, and in 2013, took over as department head of the library's digital services as well as the research data unit. From 2018–2020, she was the project manager for research data management and TU Hamburg's representative in the Hamburg Open Science programme. In 2020, she then became Deputy Library Director and assumed strategic responsibility for User Services.



DIE BIBLIOTHEK
auf dem Campus der TU Hamburg.

After completing his studies at Helmut Schmidt University, **GERRIT MÖWS** worked for the German Armed Forces as head of operations and staff services and for civil-military cooperation in Bosnia-Herzegovina. In 2006, he took over the "Warning the Population" department at the Federal Office of Civil Protection and Disaster Assistance, and was responsible for hazard detection as well as developing and operating the federal and state governments' joint warning system as well as connected systems such as the NINA warning app. In 2017, he moved to the Federal Institute for Geosciences and Natural Resources and took over as Head of Central Information Technology for the Geocentre Hanover.



FURTHER DEVELOPMENT OF FINANCE AND ACCOUNTING

Strategic financial management was restructured in 2021. This has made it possible to even better provide the university management and all other internal and external stakeholders with the necessary information for the reliable and sustainable financial management of TU Hamburg. First, this relates to the core activities of consistent planning and fine-tuning, consisting of site assessments, deviation and cause analyses. Second, the demand for ensuring appropriate financial transparency in the university and strengthening financial awareness based on comprehensible, quantitatively ascertainable variables has also been successfully met.

For the first time, all sources of special financing are now integrated into a financial strategic plan following the same standards. This enables TU Hamburg to take a holistic approach to financial management and anticipate financial risks as early as possible. In addition, we continued to systematically work on introducing a web-based financial reporting system. At the beginning of 2022, institutes and other institutions without direct SAP access will thus also be able to view their financial resources daily using a web browser.

FURTHER DEVELOPMENT OF RISK MANAGEMENT

Risks are inseparable from any institutional action and can negatively affect the process of setting and achieving goals. Risks result from the natural uncertainty of future events – which is regularly accompanied by an incomplete level of information – and are reflected in the possibility of negative deviations from a defined target figure. If risks

are not promptly identified and managed, they can impair the institution's successful further development. In 2021, the risk management manual was revised and the risk categories for TU Hamburg were reviewed.

The Executive Board appointed Dr Volker Pekron, Head of Finance and Accounting and Deputy Chancellor, as the new Chief Risk Officer.

Statistics 2021

TEACHING

STUDENTS

STUDENTS IN WINTER SEMESTER 2021/2022 ¹	2019	2020	2021
TOTAL	7,703	7,564	7,430
Study programmes for the degrees B.Sc./M.Sc./MBA/M.A.	6,911	6,788	6,661
Teaching training programmes (<i>cross-university degrees: work study/technology, industrial-technical sciences</i>)	620	620	642
Orientation program	23	172	134
Doctoral and exchange students, academic further education, etc.	149	99	97
Share of women in %	26.9	26.9	27.3
Share of international students in % ²	25.9	25.9	25.7
Share of students with international university entrance qualification in % ³	20.2	20.2	19.6
Share of students in standard period of study in %	64.1	63.4	58.6 ⁴

Data basis: Official student statistics winter semester 2021/22 (December 2021).

¹ Data: Official student statistics winter semester 2021/22 (as of December 2021).

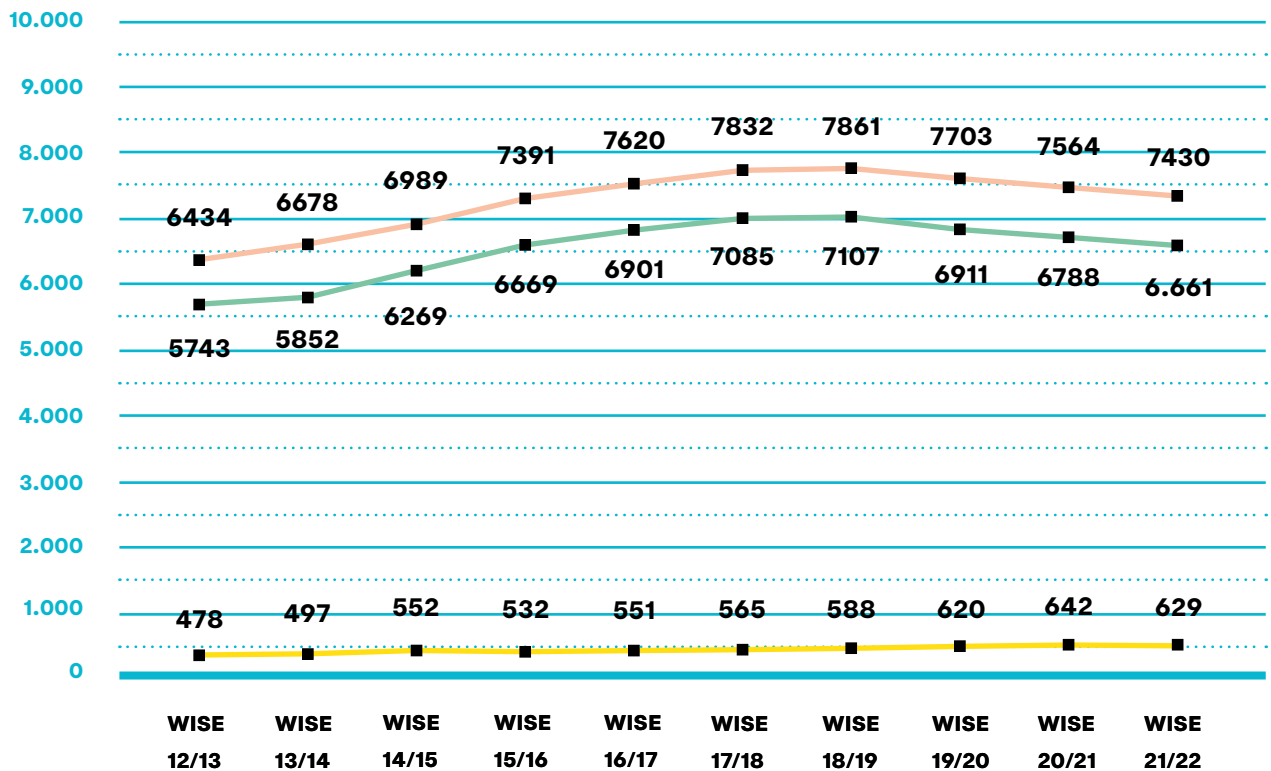
² Students with non-German citizenship.

³ Students with non-German university entrance qualification.

⁴ The drop in students in regular study time is due to the covid pandemic.

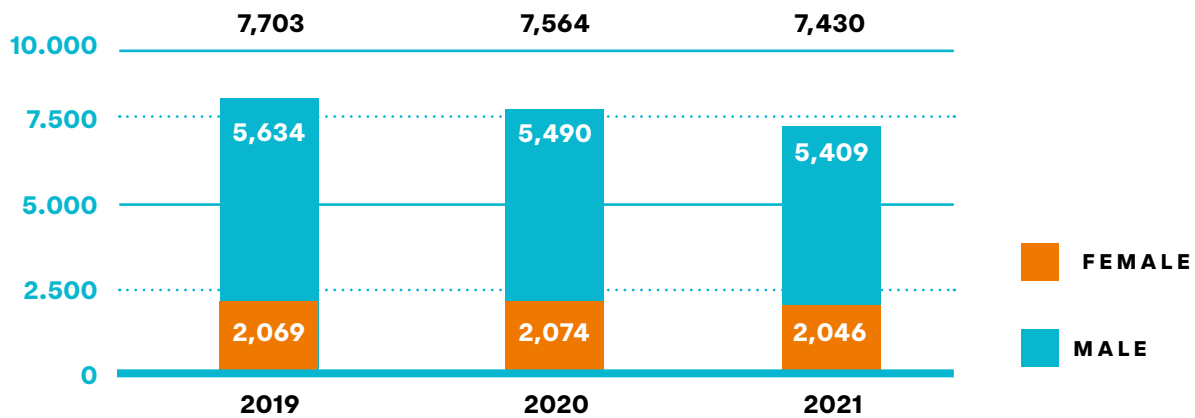
06

ENTWICKLUNG DER STUDIERENDENZAHLEN



- Total student number, including students on leave, orientation program, doctoral and exchange students
- B.Sc. and M.Sc. (German)
- Teaching Degree Programm

STUDENTS



BACHELOR

BACHELOR OF SCIENCE STUDENTS BY SCHOOL OF STUDIES	NUMBER ¹	STUDENT SHARE IN %					
		WOMEN	INT. UEQ ²	INT. ³	1. FS ⁴	SSP ⁵	SSP+2 ⁶
Civil Engineering	574	38	10	19	21	64	80
Electrical Engineering, Computer Science and Mathematics	1,061	16	11	19	23	65	80
Mechanical Engineering	923	14	6	14	16	53	71
Process Engineering	260	39	11	16	24	58	72
Management Sciences and Technology	380	31	2	13	28	55	70
Interdisciplinary Engineering Sciences and Technologies	806	27	13	19	23	73	84
TOTAL	4,004	24	9	17	22	62	77

¹ Data: Official student statistics winter semester 2021/22 (December 2021..; ² Students with non-German university entrance qualification.;

³ Students with non-German citizenship.; ⁴ Students in the 1st semester of study (FS); ⁵ Students in standard study period (SSP);

⁶ Students in standard study + 2 semesters (SSP+2).

STUDENTS BY STUDY PROGRAMME (BACHELOR OF SCIENCE)	NUMBER ¹	STUDENT SHARE IN %					
		WOMEN	INT. UEQ ²	INT. ³	1. FS ⁴	SSP ⁵	SSP+2 ⁶
General Engineering	411	27	5	11	23	73	86
Civil and Environmental Engineering	574	38	10	19	21	64	80
Bioprocess Engineering	110	53	11	15	27	63	75
Computational Informatics (<i>discontinuing</i>)	1	0	0	0	0	0	0
Computer Science	449	13	9	18	22	62	80
Data Science ***	55	25	7	16	69	100	100
Electrical Engineering	183	10	10	16	20	56	73
Energy and Environmental Engineering **	107	35	7	14	0	50	75
Engineering Science ***	30	33	43	43	43	100	100
General Engineering Science *	72	31	51	57	0	61	78
Green Technologies	65	38	3	3	92	100	100
Computer Science and Engineering	306	16	17	25	18	66	80
Logistics and Mobility **	248	37	3	17	0	31	54
Mechanical Engineering	850	14	6	14	15	52	70
Mechatronics	121	11	18	30	16	61	79
Naval Architecture	73	19	12	21	27	63	84
Technomathematics	67	36	1	4	19	73	91
Process Engineering	150	29	11	17	21	54	70
Engineering and Management – Major in Logistics and Mobility ****	132	20	1	5	80	100	100
TOTAL	4,004	24	9	17	22	62	77

* *Discontinuing: last enrolments WiSe 2019/20*

** *Discontinuing: last enrolments WiSe 2020/21*

*** *Start: WiSe 2020/21*

**** *Start: WiSe 2021/22*

MASTER STUDENTS	NUMBER ¹	STUDENTS SHARE IN %				
		WOMAN	INT. UEQ ²	INT. ³	SSP ⁵	SSP+2 ⁶
TOTAL <i>(Master German and English language)</i>	2,657	27	41	43	53	83
MASTER GERMAN LANGUAGE						
Civil Engineering	227	37	18	23	57	86
Electrical Engineering, Computer Science and Mathematics	213	13	9	14	61	81
Mechanical Engineering	614	20	10	14	56	80
Process Engineering	169	37	13	14	63	86
Management Sciences and Technology	286	34	7	10	63	89
Interdisciplinary Engineering Sciences and Technologies	33	30	0	3	42	82
TOTAL	1,542	26	11	14	58	83
MASTER ENGLISH LANGUAGE						
Civil Engineering	98	48	99	99	41	70
Electrical Engineering, Computer Science and Mathematics	333	33	83	83	44	77
Mechanical Engineering	409	10	75	76	46	74
Process Engineering	136	42	99	99	54	76
Management Sciences and Technology	54	46	72	72	63	96
Northern Institute of Technology	85	35	74	73	45	74
TOTAL	1,115	28	82	82	55	76

STUDENTS BY DEGREE LEVEL <i>(cross-university)</i>	NUMBER ¹	STUDENT SHARE IN %					
		WOMAN	INT. UEQ ²	INT. ³	1. FS ⁴	SSP ⁵	SSP+2 ⁶
Bachelor	355	49	1	6	7	59	81
Master	274	61	1	5	10	54	83
TOTAL	629	54	1	5	8	57	83
BACHELOR AND MASTER STUDENTS <i>(cross-university degrees)</i>							
Industrial-/technical sciences	278	21	0	1	59	81	81
Work study/technology	351	80	1	9	55	82	83
TOTAL	629	54	1	6	57	83	83

¹ Data: Official student statistics winter semester 2021/22 (December 2021)..; ² Students with non-German university entrance qualification.;

³ Students with non-German citizenship.; ⁴ Students in the 1st semester of study (FS).; ⁵ Students in standard study;

⁶ Students in standard study + 2 semesters (SSP+2)

NEW STUDENTS

NEW STUDENTS IN THE WINTER SEMESTER	2019	2020	2021
TOTAL	1,248	1,066	972
IN THE BACHELOR'S STUDY PROGRAMMES (B.SC.)			
Share women in %	24	23	24
Share of international students in % ¹	19	15	11
Share with international university entrance qualification in % ²	10	8	5
IN THE TEACHING TRAINING PROGRAMMES (cross-university degrees: work study/technology, industrial-technical sciences)	124	55	65
Share women in %	57	58	34
Share of international students in %	3	2	0
Share with international university entrance qualification in % ²	0	0	0

GRADUATES / DEGREES

ABSOLVENT*INNEN	2019	2020	2021
TOTAL	1,276	1,144	1,290
OF WHICH IN THE STUDY PROGRAMMES			
B.Sc.	536	519	500
M.Sc./MBA/M.A.	684	572	658
OF WHICH IN TEACHER TRAINING STUDY PROGRAMS (cross-university)			
Work study/technology	66	63	73
Industrial-technical sciences	56	53	59

¹ Students with non-German university entrance qualification.

² Students with non-German citizenship.

DEGREE TYPE <i>(without teaching profession)</i>	NUMBER ¹	STUDENT SHARE IN %			
		WOMAN	INT. ²	SSP ³	SSP+2 ⁴
TOTAL	1,158	23	26	8	42
Bachelor of Science	500	24	10	10	28
All masters	658	23	39	7	53
Of which					
Master of Arts	14	43	71	7	79
Master of Business Administration	14	29	79	7	36
Master of Science (English Language)	226	19	88	8	39
Master of Science (German language)	404	24	9	7	61

BACHELOR'S DEGREES <i>(without teaching training)</i>	NUMBER ¹	STUDENT SHARE IN %			
		WOMAN	INT. ²	SSP ³	SSP+2 ⁴
Civil Engineering	69	35	10	4	28
Electrical Engineering, Computer Science and Mathematics	87	13	13	20	34
Mechanical Engineering	145	14	8	8	16
Process Engineering	36	33	8	0	19
Management Sciences and Technology	67	49	13	10	25
Interdisciplinary Engineering Sciences and Technologies	96	21	10	10	45
TOTAL	500	24	10	10	28

¹ Data: Official student statistics winter semester 2021/22 (December 2021.); ² Students with non-German university entrance qualification.; ³ Students in standard study period (SSP); ⁴ Students in standard study + 2 semesters (SSP+2).

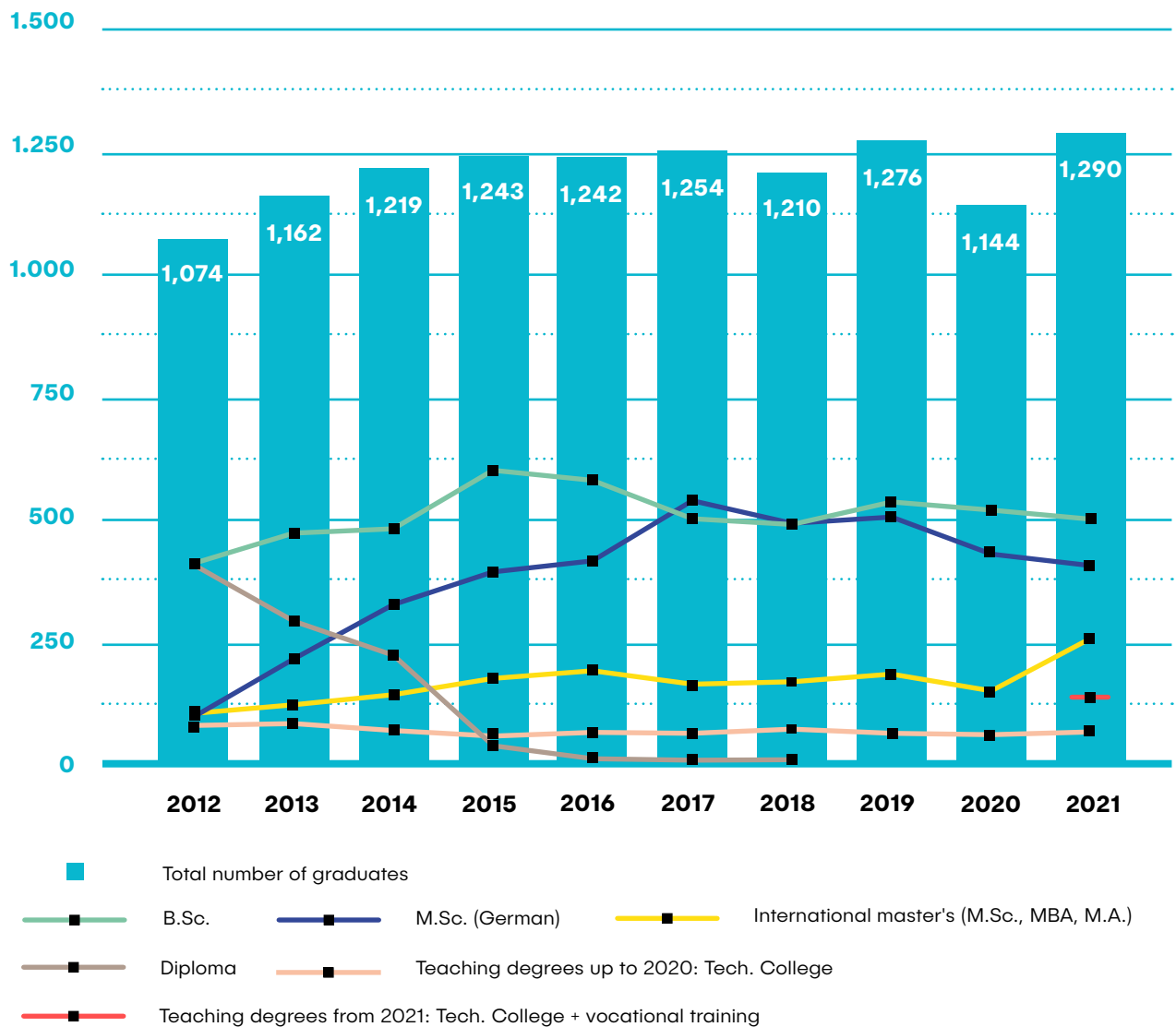
MASTER'S DEGREES <i>(without teaching training)</i>	NUMBER ¹	STUDENT SHARE IN %						
		WOMAN	INT. ²	SSP ³	SSP+2 ⁴			
Civil Engineering	57	39	11	7	70			
Electrical Engineering, Computer Science and Mathematics	66	8	15	11	61			
Mechanical Engineering	152	20	6	7	53			
Process Engineering	48	38	10	4	63			
Management Sciences and Technology	76	29	5	8	72			
Interdisciplinary Engineering Sciences and Technologies	5	20	20	0	0			
Northern Institute of Technology	-	-	-	-	-			
TOTAL	404	24	9	7	61			
OF WHICH IN ENGLISH MASTER NUMBER <i>(without teaching training)</i>								
Civil Engineering	19	47	95	5	26			
Electrical Engineering, Computer Science and Mathematics	42	33	100	0	33			
Mechanical Engineering	124	6	81	2	38			
Process Engineering	29	34	100	3	38			
Management Sciences and Technology	12	8	67	67	100			
Interdisciplinary Engineering Sciences and Technologies	-	-	-	-	-			
Northern Institute of Technology	28	36	75	7	57			
TOTAL	254	20	86	6	41			
MASTER'S DEGREES <i>(without teaching training)</i>	TOTAL	B	E	M	V	W	FIT	NIT
NUMBER	658	76	108	145	77	67	5	28

¹ Data: Official student statistics winter semester 2021/22 (December 2021..; ² Students with non-German university entrance qualification.;

³ Students in standard study period (SSP); ⁴ Students in standard study + 2 semesters (SSP+2).

TEACHING DEGREES	TOTAL	SHARE OF WOMEN IN TOTAL IN %	OF WHICH BACHELORS	SHARE OF WOMEN IN BACHELORS IN %	OF WHICH MASTERS	SHARE OF WOMEN IN MASTERS IN %
Work study/ technology	73	85	46	87	27	81
Industrial- Technical Sciences	59	25	35	29	24	21
TOTAL	132	58	81	62	51	53

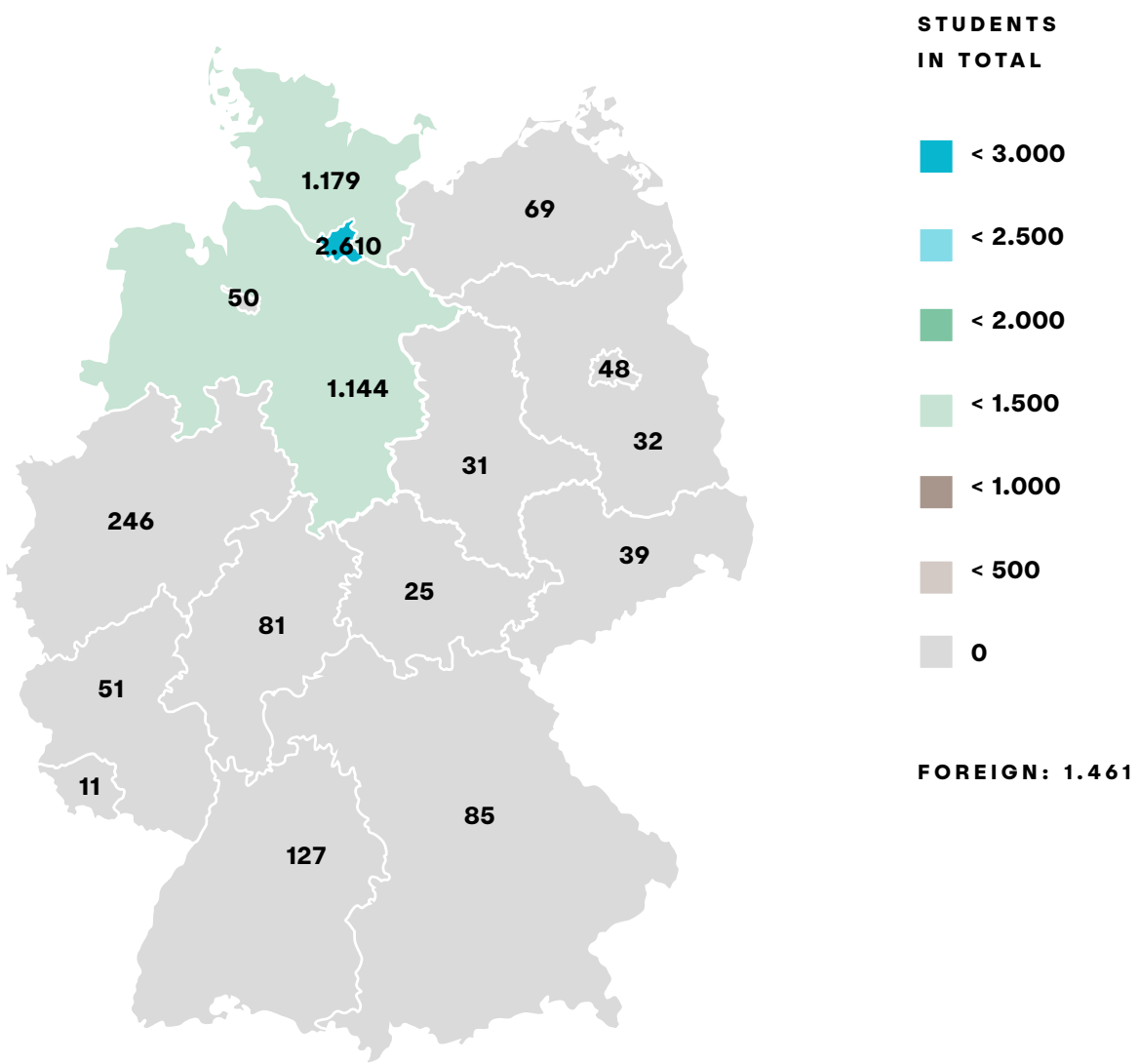
GRADUATES



ORIGIN OF STUDENTS BY PLACE OF UNIVERSITY ENTRANCE QUALIFICATION (UEQ)

STATE (ORIGIN UEQ)	STUDENTS (ALL BACHELOR & MASTER)	OF WHICH B.SC.	OF WHICH B.SC. 1. FS	SHARE B.SC. IN %	SHARE 1. FS B.SC. IN %
Baden-Württemberg	127	74	16	2	2
Bavaria	85	48	7	1	1
Berlin	48	33	9	1	1
Brandenburg	32	23	3	1	0
Bremen	50	31	11	1	1
Hamburg	2,610	1,717	373	47	45
Hesse	81	43	11	1	1
Mecklenburg-Western Pomerania	69	44	12	1	1
Lower Saxony	1,144	702	172	19	21
North Rhine-Westphalia	246	131	37	4	4
Rhineland-Palatinate	51	26	7	1	1
Saarland	11	7	3	0	0
Saxony	39	20	4	1	0
Saxony-Anhalt	31	24	4	1	0
Schleswig-Holstein	1,179	687	150	19	18
Thuringia	25	19	5	1	1
TOTAL GERMANY	5,828	3,629	824	100	100
Of which Hamburg metropolitan region	4,461	2,876	637	79	77
TOTAL	7,289	4,002	868	100	
Of which abroad	1,461	373	44	9	5

STUDENTS BY ORIGIN (UEQ)

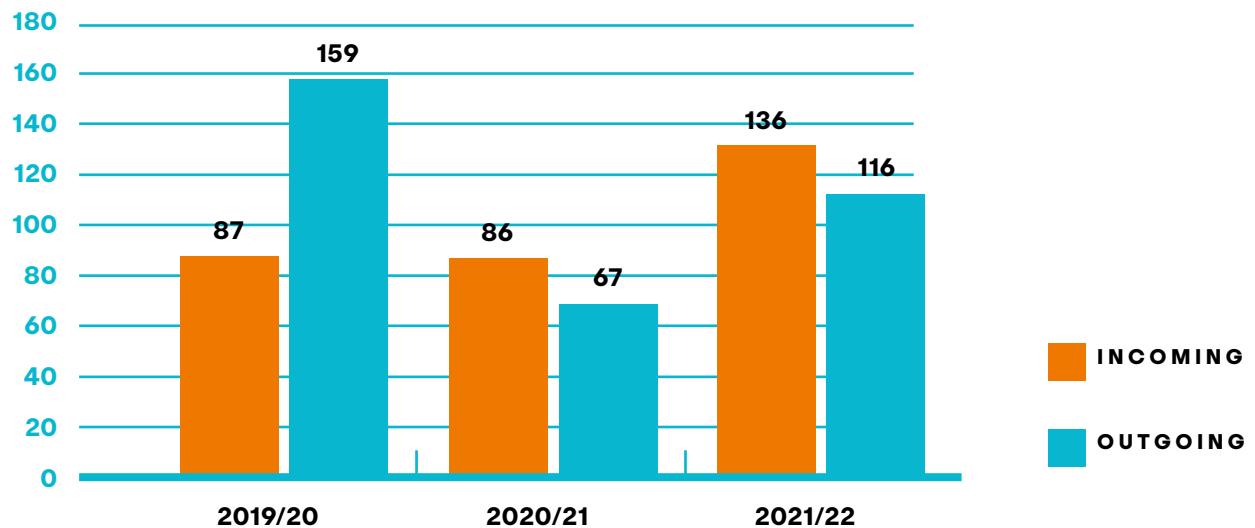


**HAMBURG METROPOLITAN REGION
(ORIGIN OF UNIVERSITY ENTRANCE QUALIFICATION/UEQ)**

STATE	COUNTIES/CITIES	CASES (ALL BACHELOR & MASTER)	OF WHICH B.SC.	OF WHICH B.SC. 1. FS	SHARE B.SC. IN %	SHARE B.SC. 1. FS IN %
Hamburg	Hamburg	2,610	1,717	373	60	59
Schleswig-Holstein	Dithmarschen (Heide)	45	19	3	1	0
	Herzogtum Lauenburg	102	65	14	2	2
	Lübeck	65	34	10	1	2
	Neumünster	48	25	5	1	1
	Ostholstein	38	24	4	1	1
	Pinneberg	253	164	27	6	4
	Segeberg	173	103	26	4	4
	Steinburg	65	41	10	1	2
	Stormarn	186	112	23	4	4
Lower Saxony	Cuxhaven	31	18	5	1	1
	Harburg	427	275	69	10	11
	Heidekreis	21	16	4	1	1
	Lüchow-Dannenberg	7	6	2	0	0
	Lüneburg	112	73	10	3	2
	Rotenburg (Wümme)	58	41	11	1	2
	Stade	160	105	30	4	5
	Uelzen	21	13	3	0	0
Mecklenburg- Western Pomerania	Ludwigslust-Parchim	12	7	2	0	0
	Nordwestmecklenburg	14	8	3	0	0
	Schwerin	13	10	3	0	0
TOTAL		4,461	2,876	637	100	100

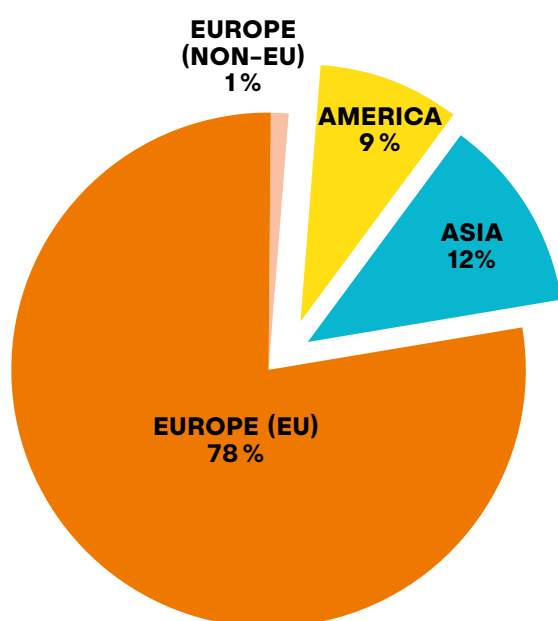
STUDENT MOBILITY

ACHIEVED MOBILITIES FROM TUHH (OUTGOING) AND TO TUHH (INCOMING)

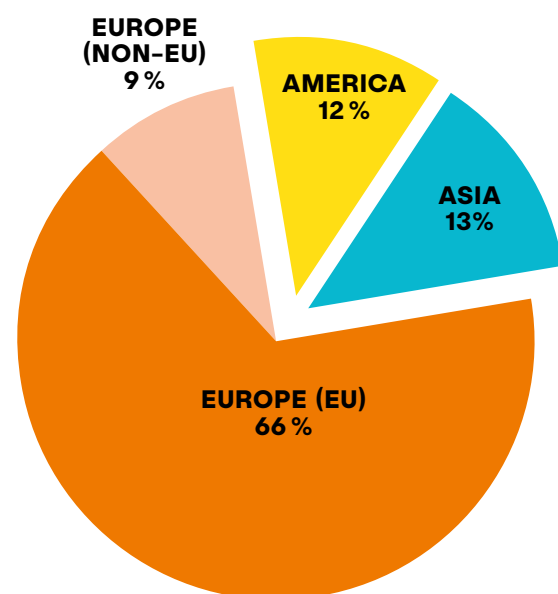


Data: International Office, As of: May 2022; figures include exchanges/mobilities to: Overseas, Erasmus study, ISAP, PROMOS free mover /or overseas internship or thesis, mobility fund free mover /or overseas internship or thesis, or similar, Erasmus internship. Not included: DAAD RISE global internship programme, IAESTE internship programme, AIESEC internship programme as well as other DAAD programmes if applicable.

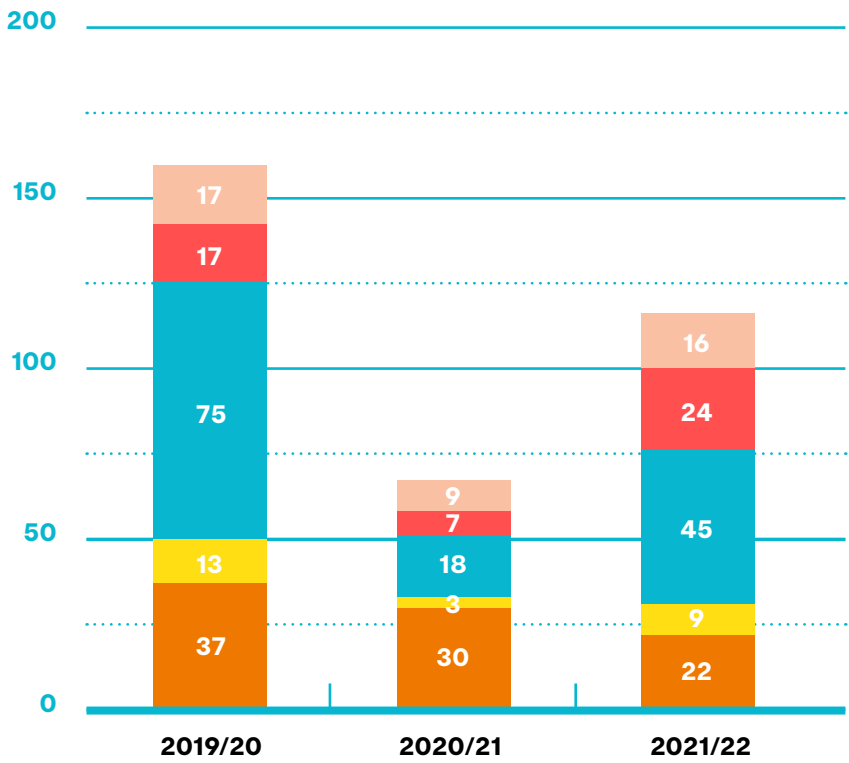
GASTSTUDIERENDE AN DER TU



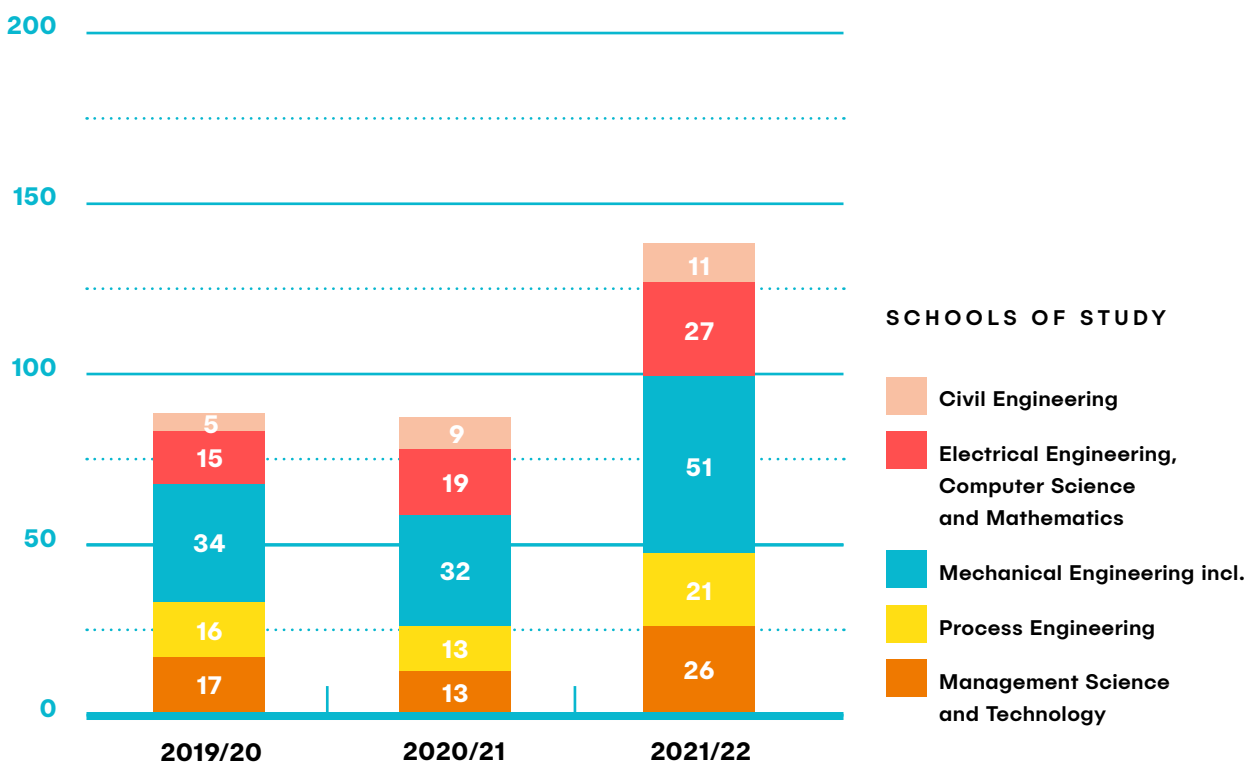
TU-STUDIERENDE IM AUSLAND



TU-STUDIERENDE IM AUSLAND



GASTSTUDIERENDE AN DER TU HAMBURG



ECIU – THE EUROPEAN CONSORTIUM
OF INNOVATIVE UNIVERSITIES

	NUMBER
NUMBER OF UNIVERSITIES IN THE NETWORK	14 (thereof 13 in Europe, 1 in Mexico)
NUMBER OF STUDENTS IN THE NETWORK	298,000
CHALLENGES (SINCE PROJECT START)	86 (of which 7 from TU Hamburg)
MICRO MODULES (SINCE PROJECT START)	138 (of which 4 from TU Hamburg)

General information about the ECIU at <https://www.eciu.org/> and on challenges and micro modules at <https://www.eciu.org/for-learners/about#cycle>.

DUAL STUDIERENDE

WISE 2021/22	NUMBER
BACHELOR NEW STUDENTS	36
MASTER NEW STUDENTS (CONSECUTIVE)	11

RESEARCH

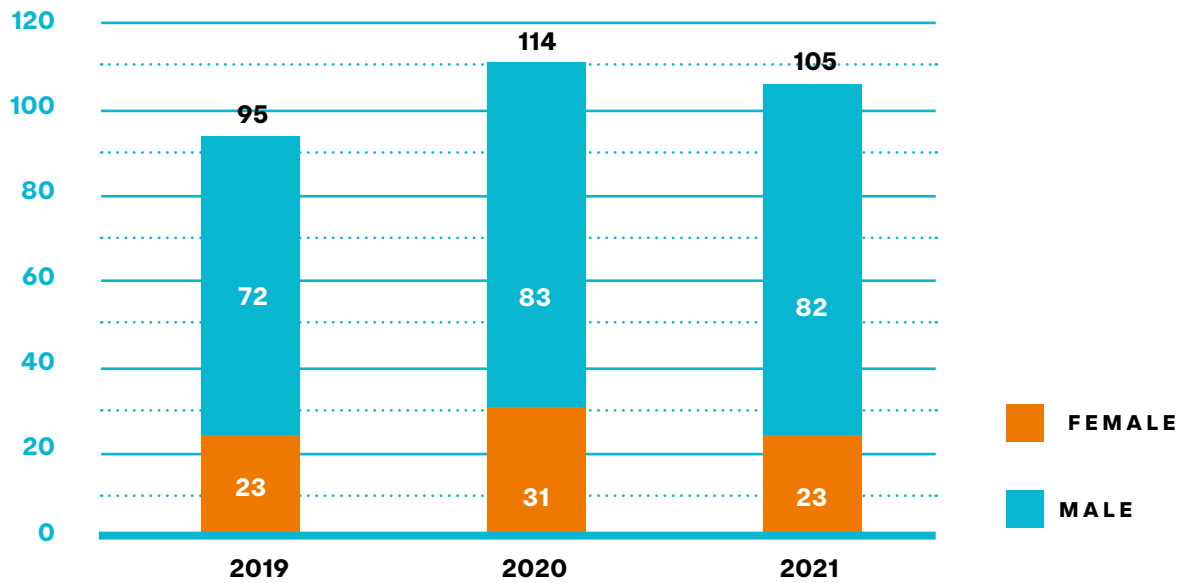
DOCTORAL STUDENTS, COMPLETED DOCTORATES AND HABILITATIONS

DOCTORAL CANDIDATES ¹	2019	2020	2021
Share women in %	24	23	23
Doctoral candidates per occupied professorship (W2/W3)	9.4	8,9	8,7
TOTAL	816	793	830
COMPLETED DOCTORATES ²			
Share women in %	24	27	22
Doctorates per occupied professorship (W2/W3)	1.1	1.2	1.1
TOTAL	95	114	105
COMPLETED HABILITATIONS			
Share women in %	50	0	0
TOTAL	2	1	2

¹ According to the Federal Statistical Office.

² According to data provided by the office of the doctoral committee.

COMPLETED DOCTORATES



DOCTORATES BY SCHOOL OF STUDY	2019		2020		2021	
	NUMBER	SHARE WOMEN IN %	NUMBER	SHARE WOMEN IN %	NUMBER	SHARE WOMEN IN %
Civil Engineering	7	43	10	30	11	27
Electrical Engineering, Computer Science and Mathematics	15	7	19	11	22	18
Industrial-Technical Sciences	3	33	5	20	4	0
Mechanical Engineering	45	16	43	26	37	16
Process Engineering	19	53	25	36	21	19
Management Sciences and Technology	6	17	12	42	10	60
TOTAL	95	24	114	27	105	22

RESEARCH PROJECTS AND RESEARCH RESOURCES

KEY FIGURES (BUSINESS DATA OF TU HAMBURG AND TUTECH INNOVATION GMBH)	2019	2020	2021
Number of third-party-funded research projects	757	784	606
Of which by origin			
DFG	145	132	146
Federal government (BMBF, BMWI and other ministries)	176	197	166
Federal State	67	38	58
EU, International	45	36	28
Other funding (e.g. Fraunhofer Society, German Federation of Industrial Cooperative Research Associations, Volkswagen Foundation)	87	66	44
Direct industrial research (Tutech Innovation GmbH)	237	315	164
Third-party funding in 2021 in EUR K	45,241	57,004	54,720
Current third-party expenses in 2021 in EUR K (incl. Tutech)	45,368	46,152	42,576
Of which DFG in EUR K	9,257	9,827	9,922
Third-party funded employees Total (full-time equivalents)	412	414.1	405.0
Of which scientific employees	386	393.2	383.4

TECHNOLOGY TRANSFER AND PUBLICATION SERVICES

TUTECH INNOVATION GMBH – KEY FIGURES	2019	2020	2021
Newly approved contract volume in cooperation with TU Hamburg in EUR K	8,020	4,562	7,637
Revenues in connection with TU Hamburg work areas in EUR K	8,934	6,670	6,998
Funding under the R&T Framework Programme and other EU programmes (approved applications TU Hamburg)	12	6	9
Events of the Tutech ACADEMY (number/participants*)	10 / 140	22 / 407	18 / 338

PUBLICATION IN 2021 BY SCHHOL OF STUDY ¹	B	E	G	M	V	W	TOTAL ²
PUBLICATIONS							
Article	64	136	45	248	139	46	676
inProceedings	22	106	22	96	4	30	300
In Book	2	19	3	5	10	15	55
Book	1	1	3	2	1	5	13
THESIS							
Dissertations	11	25	8	40	20	13	110
Habilitations	0	1	1	0	0	0	2
TOTAL PUBLICATIONS	100	288	82	392	174	112	1.160
NUMBER OPEN ACCESS							
All publication types	54	104	28	184	77	52	499
Of which all thesis	11	14	2	26	4	7	64

Source: TORE (Research Information System of TU Hamburg), As of: 21.03.2022.

PATENTE

PATENTS	2019	2020	2021
Invention disclosures	21	14	19
First-time patent applications	8	7	8
Patent re-filing	1	3	6
Patents granted	6	2	8
TOTAL	36	26	41

Data: Tutech Innovation GmbH, As of: April 2021.

¹ Deanships (B) Civil Engineering, (E) Electrical Engineering, Computer Science and Mathematics, G Industrial-Technical Sciences, (M) Mechanical Engineering, (V) Process Engineering, (W) Management Sciences and Technology.; ² In the case of publications with several authors, the publications are counted several times if the authors come from different schools of study. For TU Hamburg overall, , these publications are counted only once.

PERSONNEL AND FINANCES

PERSONNEL

BESETZTE STELLEN	FULL-TIME EQUIVALENTS (FTE)
Professorships	99.5
Of which junior professorships	7.0
Scientific staff (budget incl. chief engineer, third-party funds incl. Tutech)	758.0
Of which	
Budget (incl. chief engineer)	362.8
Third-party funds (incl. Tutech)	395.2
Technical, library and administrative staff (TVP)	583.6
Of which	
Executive Board, Presidential Office, Presidential Administration, interest groups, staff units and state funds	196.3
Library	29.1
Technical Service	52.0
Service area for Teaching and Studies	54.4
Computer Centre	67.9
Schools of Study	184.0

Positions filled at TU Hamburg (as of: 31.12.2021)

BESETZTE STELLEN IN DEN STUDIENDEKANATEN (HAUSHALT)

STAFFED POSITIONS IN FTES	2019	2020	2021
Professorships	89	95.1	92.5
Junior professorships	5.0	4.0	7.0
Senior engineers	60.5	66.3	61.6
Scientific employees	252.8	283.1	301.2
Technical and administrative staff	180.4	202.4	184.0

Staffed positions filled in schools of study (budget) (as of: 31.12.2021)

WISSENSCHAFTLICHES PERSONAL IN DEN STUDIENDEKANATEN

SCIENTIFIC STAFF IN FTE ¹	B	E	G	M	V	W	TOTAL
Professorships	11	26	4	27	10,5	14	92.5
Junior professorships	0	3	0	2	2	0	7
Senior engineers	9.6	17.7	2	17.4	9	6	61.7
Scientific employees	64.9	158.8	186.7	150.6	81.0	54.3	696.3
Of which financed by budgetary funds	29.1	100.9	13.1	76.4	44.3	37.5	301.2
Of which financed by third-party funds (TUHH)	29.5	57.4	159.5	73.3	22	10.5	352.2
Of which financed by third-party funds (Tutech)	6.28	0.55	14.15	0.98	14.72	6.28	42.95

Academic personnel in schools of study (as of: 31.12.2021)

¹ Deanships (B) Civil Engineering, (E) Electrical Engineering, Computer Science and Mathematics, (G) Industrial-Technical Sciences, (M) Mechanical Engineering, (V) Process Engineering, (W) Management Sciences and Technology.

THIRD-PARTY FUNDS

TOTAL THIRD-PARTY INCOME*	2020
Total third-party income*	44,4 Mio. €
of which Tutech Innovation GmbH in cooperation with Institutes	7,1 Mio. €
Third-party funding per professorship (full-time equivalent, W2 / W3)	495,677 €
of which Tutech Innovation GmbH in cooperation with Institutes	79,329 €

FINANCES

PROFIT PLAN (in EUR K)	YIELD 2021	APPROACH 2022
INCOME		
Income from operating activities	103,806	106,186
Of which operating subsidy for ongoing tasks	78,898	76,103
Of which income from special funds	24,908	30,083
Income from other grantors (third-party funds) ¹	35,711	42,110
Other income	13,973	14,245
Of which income from the reversal of the special item for investment grants	7,581	7,600
TOTAL INCOME	153,490	162,541
EXPENSES		
Expenses from operating activities (incl. third-party funds and tuition fees)	15,112	17,061
Personnel expenses (incl. third-party funds and tuition fees)	114,710	116,511
Depreciations	8,668	9,535
Other expenses incl. transfer payments	14,970	19,434
Other expenses	10,539	18,935
TOTAL EXPENSES	153,460	162,541

* As reported under the current target performance agreement to BWFGB. In the double-entry method, revenues represent the annual increase in funds. In doing so, funds for other fiscal years are accrued/posted to the respective years.

¹ Without Tutech Innovation GmbH

IMPRESSUM

HERAUSGEBER

Präsident der Technischen Universität Hamburg

REDAKTION

Dr. Monika Kaempfe; Dr. Johannes Harpenau,
Dr. Oliver Rayiet, Elke Schulze

GESTALTUNG

formlabor

BILDNACHWEIS

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Corporate Design

Gstrheinländer Worldwide GbR

Technische Universität Hamburg

Am Schwarzenberg-Campus 1

21073 Hamburg



**Technology
for humanity**