CESAER

The strong and united voice of universities of science and technology in Europe

Advancing research careers across Europe

Case studies of good practices and remaining challenges in advancing research careers in Europe

Report dated 30 March 2026

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Rooted in advanced engineering education and research, CESAER is an international association of leading specialised and comprehensive universities with a strong science and technology profile that advocate, learn from each other and inspire debates. Our Members champion excellence in higher education, training, research and innovation, contribute to knowledge societies for a sustainable future and deliver significant scientific, economic, social and societal impact.

Contributors and acknowledgements

This report elaborates on good practices in advancing research careers across our membership. Writers presented their case studies in May 2025 at a Task Force Human Resources meeting kindly hosted by Instituto Superior Técnico (IST) in Lisbon.

The work on this report was steered by Co-Chairs of Task Force Human Resources Tanya Bondarouk (University of Twente) and Manuel Heitor (Instituto Superior Técnico), and the drafting of this report was led by Vincent Klein Ikkink (CESAER Secretariat).

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Approval and editorial responsibility

This report has been approved for publication by the CESAER Presidency and editorial responsibility is assumed by the Secretary General.

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Introduction: Context and purpose of this annex

Since the publication of the CESAER 2024 report Research Careers: A Critical Choice for Europe, political momentum to attract and retain global research and innovation talent (both from within Europe and beyond) has intensified, exemplified by the launch of the Choose Europe for Science initiative—a measure that the Heitor report, CESAER, and other key stakeholders had already called for in 2024. This was further emphasised by European Commission President Ursula von der Leyen in May 2025, where she underlined that Europe stands at a pivotal moment in its ambition to remain a global leader in research, innovation, science, and technology.

These developments underline that addressing research career precarity and brain drain is more urgent than ever: research careers are not merely a workforce issue, but a strategic capability crucial to Europe's competitiveness, resilience, prosperity, and technological leadership. High-quality, stable, and attractive research and innovation careers are foundational to Europe's ability both to generate new knowledge and to translate it into societal and economic value.

Building on this momentum, the case studies in this report both showcase good practices from leading universities of science and technology across Europe and reaffirm the key recommendations of our 2024 report—recommendations that have only grown more urgent since their first publication in 2024.

As was highlighted in the 2024 report, reversing the trend of a net outflow of talented researchers requires a long-term, coordinated effort to improve stability, reduce precarity, and ensure that Europe offers research careers capable of attracting and empowering the next generation of scientific leaders. Developments in 2025, including the launch of the Choose Europe initiative, further confirm the continued relevance of these recommendations: enhancing stability in research careers; achieving a better balance between temporary and permanent contracts; strengthening institutional support for early-career researchers; establishing the European Research and Innovation Careers Observatory, and further strengthening its evidence-base with university-level data.

The good practices and case studies presented in this report (which can be seen as an annex or complement to the original 2024 report) demonstrate how universities of science and technology across Europe are already implementing innovative approaches aligned with these recommendations. Together, they show that taking decisive action to make Europe more attractive to researchers, particularly early-career researchers, is crucial for strengthening the continent's resilience, competitiveness, and technological leadership.

In this way, this document can be seen as a complementary addition and annex to CESAER's research careers report published in December 2024.

Overall key messages from the case studies

The case studies presented in this annex illustrate how universities across Europe are already taking concrete steps to strengthen stability, improve recruitment practices, and enhance support for early-career researchers. They also reaffirm a core principle: academic freedom, university autonomy, and protection from political interference are indispensable for world-class research environments capable of attracting and retaining top talent from within Europe and beyond. Any new initiative to improve research careers must therefore be developed in close consultation with the research and innovation community.

These cases demonstrate that Europe already knows what works. Long-term investment, stable and attractive research careers, open mobility pathways, and bottom-up excellence remain the foundations of a resilient and globally competitive research ecosystem. Key instruments such as the European Research Council (ERC) and Marie Skłodowska-Curie Actions (MSCA) exemplify the strength of fully bottom-up, researcher-led funding, allowing researchers to pursue frontier research free from thematic or political constraints. As geopolitical and technological pressures intensify, it is essential that these programmes maintain their exclusively bottom-up and researcher-led character. While top-down funding has an important role to play as well, it should be deployed through separate and well-designed instruments that complement, rather than constrain, existing bottom-up instruments that underpin the success of Europe's researcher-led ecosystem.

At the same time, Europe must significantly expand its capacity to attract and retain research talent. The Align, act, accelerate report highlighted a persistent structural challenge: Europe continues to evaluate more excellent proposals than it can fund. Proven programmes with a strong track record in attracting and retaining talent—particularly in fast-moving fields such as artificial intelligence and quantum computing—must be scaled up. Swiftly implementing the recommendation of the Align, Act, accelerate report to ensure all proposals rated as excellent are funded through a combination of EU, national, regional and structural instruments using tools such as the Seal of Excellence, would deliver immediate and transformative benefits for European research and innovation.

Initiatives such as MSCA Choose Europe for Science, the Union of Skills, and renewed efforts to remove visa, immigration, and mobility barriers—potentially through a future European Research Area Act—offer strategic opportunities to enhance Europe's global attractiveness, and fully establish the fifth freedom, as called for by Letta and others; the free circulation of researchers, scientific knowledge and technology. Crucially, the vision and implementation of these initiatives must not only aim at attracting global talent to Europe, but also at retaining and advancing talent already in Europe, ensuring continuity, excellence, and leadership across generations. Taken together, the evidence shows that Europe has the foundations of successful research ecosystems and already has identified the tools needed to act. Fully implementing the recommendations of our 2024 research careers report—strengthening long-term investment, creating stable and high-quality research jobs, safeguarding bottom-up funding, enhancing transparency and monitoring of career conditions, and enabling open and seamless mobility—is now more urgent than ever. Doing so will ensure that Europe attracts and retains the world's top research talent both from within and beyond Europe, while reinforcing its position as a leader in science and technology.

Summary of case studies

The case studies presented in this report illustrate how universities across Europe are addressing persistent challenges in research careers through institution-specific yet increasingly systemic approaches. While each case reflects a distinct national and institutional context, several common patterns emerge in how career development is structured, supported, and evolving—particularly for early-career researchers (R1–R2). Overall, the case studies demonstrate that universities of science and technology are actively developing and implementing effective practices to support research careers. The cases also showcase that positive research career impact depends not only on providing innovative career pathways, but also on coordinated action at national and European levels to further improve the stability, attractiveness, and sustainability of research careers.

Aalborg University: Structured career support through a PhD Career Hub

Aalborg University (AAU) has developed a structured, institution-wide approach to supporting early-stage researchers through its **PhD Career Hub**. The initiative responds to identified challenges among PhD candidates, including wellbeing considerations, uncertainty about career prospects, and lack of structured guidance. It consolidates mentoring, career courses, employer engagement, coaching and profiles into a coherent framework embedded across doctoral schools.

A defining feature is the mandatory integration of career planning into the PhD plan, ensuring structured dialogue between candidates and supervisors. This embeds career development within doctoral education rather than treating it as an optional activity. The model is supported by central coordination and strong institutional commitment, with career development integrated into governance and funding structures.

The approach also links career development with wellbeing, while explicitly preparing researchers for diverse career paths, including outside academia. Support for international collaboration and external engagement further strengthens researchers' professional development.

While broader structural factors—such as long academic career pathways and fluctuating PhD positions—remain, the AAU model demonstrates how institutions can proactively respond by improving guidance, skills development, and career awareness. Continued efforts focus on increasing visibility and uptake of services to ensure that all researchers benefit from the support available.

Brno University of Technology: Career development through innovation ecosystems

Brno University of Technology (BUT) integrates research career development within both a structured HR framework and a broader innovation ecosystem. Its policies, aligned with European standards such as the Charter and Code and HRS4R, provide transparent recruitment, defined career pathways (R1–R4), and structured progression mechanisms, alongside support for mobility, skills development, and work–life balance.

A central component of BUT's career development is the **ContriBUTe innovation ecosystem**, which connects research, education, and external stakeholders. It offers mentoring, prototyping infrastructure, networking opportunities, microgrants, and support for spin-offs and technology transfer, enabling researchers to apply research in practice and develop entrepreneurial competencies.

Participation leads to tangible outcomes, including improved confidence, communication skills, and professional networks, as well as engagement in collaborative and entrepreneurial activities. The initiative supports diverse career trajectories and contributes to a growing recognition of entrepreneurship as part of academic career development.

At the same time, the case highlights areas for further development, such as improving flexibility in combining academic and entrepreneurial activities and simplifying access to support mechanisms. These challenges reflect the evolving nature of integrating innovation into academic careers and point to opportunities for continued institutional refinement and alignment.

Delft University of Technology & QuTech: Research careers in mission-driven ecosystems

The Delft University of Technology case focuses on **QuTech**, a mission-driven quantum technology institute developed through long-term strategic investment and partnerships between academia, government, and industry. The model positions research careers within a large-scale, collaborative innovation ecosystem.

QuTech integrates fundamental research, engineering, and application-oriented development within a single framework, enabling interdisciplinary collaboration and engagement across the full innovation chain. Sustained funding and coordinated governance support long-term research capacity and the development of emerging fields such as quantum computing and communication.

Researchers benefit from close interaction with industry, participation in major national and European initiatives, and opportunities to contribute to both scientific and technological advances. This creates diverse career pathways that extend beyond traditional academic roles while maintaining a strong focus on research excellence.

The case also illustrates the complexity of such environments, including the need to balance exploratory research with mission-driven objectives. Addressing these dynamics requires ongoing coordination and sustained investment, highlighting the importance of long-term commitment not only at the institutional level but also from governments, funding bodies, and external partners to fully realise the potential of such ecosystems.

ETH Zürich: Strategic interventions for early-career support and diversity

The ETH Zürich case shows how targeted, data-driven strategies can strengthen early-career support and improve diversity in academic careers, particularly in STEM fields. The approach combines systematic monitoring of gender balance and career progression with coordinated interventions across different career stages, with a particular focus on the professorial pipeline and early-career transitions.

Key initiatives include the **H.I.T. Programme** (High Potential University Leaders Identity & Skills Training Programme – Inclusive Leadership in Academia), which supports women professors through leadership training, mentoring, coaching, and peer exchange, aiming to strengthen their progression into academic leadership roles. In parallel, the **CONNECT programme** (Connecting Women's Careers in Academia and Industry) supports early-stage researchers (R1–R2) by broadening career perspectives, strengthening professional networks, and facilitating connections with industry and non-academic sectors.

These initiatives are complemented by measures addressing recruitment and evaluation practices, helping to reduce bias and improve transparency. A central feature of the approach is the integration of

diversity and career development within institutional strategy, supported by continuous data collection and monitoring.

While progress remains gradual the case demonstrates how sustained institutional commitment, combined with targeted programmes, can drive meaningful and long-term improvements in research careers.

National Technical University of Ukraine – Kyiv Polytechnic Institute: Career structures and job quality

The case from Igor Sikorsky Kyiv Polytechnic Institute (KPI) focuses on the structure and quality of research careers, with particular attention to how career pathways are defined and implemented within the institution. It presents a framework aligned with the European R1–R4 model, describing a "career pyramid" that outlines progression from early-stage researchers to senior academic roles.

A key contribution is the emphasis on clear role definitions and structured progression, including how teaching and research responsibilities evolve across career stages. This clarity supports transparency and helps guide career development within the academic system.

KPI has introduced a range of programmes to support early-career researchers, including initiatives focused on professional development, research skills, and career advancement. These measures contribute to strengthening the pipeline of early-career researchers and improving their integration into institutional structures.

The case also highlights opportunities to further enhance the quality and attractiveness of research careers, particularly in relation to career stability and working conditions. It underlines that while institutional initiatives are important, broader structural factors also play a role.

Overall, the KPI example illustrates the importance of combining well-defined career frameworks with continuous improvements in job quality, supported by both institutional efforts and wider system-level developments.

The remainder of the report provides a full elaboration of each case study.

AALBORG UNIVERSITY

AAU PhD Hub and supporting Stage One (R1) researchers at Aalborg University

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Case study from Aalborg University

Introduction

The first case study presented in this report covers several initiatives created at Aalborg University (AAU) to support stage 1 researchers (PhD students, and to some extent postdocs). The unique career hub developed at AAU is described, followed by explanation on the recruitment of early-stage researchers (R1). Finally, suggestions for improvement of recruitment and career prospects of PhD students and postdocs are made to diminish precarity linked to temporary positions and to increase the employment stability of R1 researchers in Denmark and Europe.

Description of the AAU PhD Career Hub

The PhD Career Hub (Figure 1) has been developed as a key element in supporting primary stage 1 researchers at Aalborg University in addition to the effort made locally by the research group and the departments employing stage one researchers. The following part of this document describes the process of creating, implementing and running the hub. We also present the involved actors as well as the experienced challenges.

Figure 1. The career hub developed by the PhD administration supporting the Faculties of Medicine, Engineering and Technical and Natural Sciences at Aalborg University

Initial process

Based on international surveys made at universities across Europe, it has become clear that R1 researchers have severe challenges in relation to elements revolving around their wellbeing, career considerations, and academic challenges among other elements. A 2017 study showed that PhD student wellbeing deteriorated as the study progressed, making it evident that some critical elements affect most PhD candidates (Levecque et al., 2017).

Springer Nature completed an extensive survey amongst 6300 PhD students worldwide that showed additional concerns in relation to anxiety or depression caused by their studies and even challenges in relation to bullying and offensive behaviour (Springer Nature & Shift Learning, 2019).

These and other findings led the Doctoral School at the Technical Faculty of IT and Design at Aalborg University to conduct an internal survey combined with interviews of a group of PhD students. The group

was representative of all PhD students at AAU (in terms of gender and diversity, study progress, programme and financial aspects). The Aalborg survey and interviews revealed similar challenges to the aforementioned studies. It also showed warning signs related to feelings of insecurity, lack of a common goal for the PhD, doubt about their own performance, and future career after the PhD.

The findings of the study led to a test phase of the following initiatives aiming to create/provide/organise:

- Mentor programme at the department of Health Science and Technology;
- Personality profiles and feedback sessions with certified staff at the Doctoral School at the Faculty of Medicine and the Technical Faculty of IT and Design;
- 1:1 career sparring;
- Events with employers, trade unions and other third parties that had experience with employment of PhD students and their challenges after their PhD;
- Career courses for PhD students with an emphasis on creating inspiration and reflection about the future career paths.

All these initiatives were well received and especially the offer around personality profiles and feedback sessions received positive feedback from the PhD students.

The experience of these different initiatives was presented to the PhD Study Director by the administration, which is joint for all the Doctoral Schools at Aalborg University.[1] The offers and the model suggested by AAU PhD (AAU PhD career model, see updated version in Figure 1) was established and approved by the Strategic Council for Research and Innovation at Aalborg University in 2023 – making it a university wide initiative. The model contains both mandatory and voluntary elements that the PhD students can utilise while being enrolled.

The mandatory element is a section in the updated PhD plan about career considerations and discussions with the main supervisor. This forces both the PhD student and supervisor to have initial thoughts and considerations about the next steps after the PhD has been completed. The full overview of the permanent offers can be found on the website of the career hub.[2]

The Dominance, Influence, Steadiness, Conscientiousness (DISC) profiles are highly utilised across MED, TECH and ENG faculties. These profiles consist of a questionnaire where PhD students answer a variety of questions which gives them a profile in the everything DISC system created by Wiley. The R1 (and R2) researchers then get a feedback session from a certified professional from AAU PhD. These profiles create and provide insights into career elements such as motivation, stress factors, communication and other elements that are of utmost importance for both wellbeing and career decisions. This offer is unique when compared to other universities across Denmark and other European countries and serves a dual purpose in relation to both career development and wellbeing support. In addition to these elements, there are several add-ons throughout the year – all with a focus on career and wellbeing (including coaching).

One of the considerations underlying the career hub and the overall career efforts at AAU is that the vast majority of PhD students will have to find employment outside the academic world. The road to a permanent position in academia is becoming increasingly long and winding. In 2025, the average duration between PhD and the first permanent position at AAU is 9 years. Universities across Europe therefore have a considerable task at hand when it comes to preparing PhD graduates for a career outside of the academic world – which is one of the focus points of the career hub.

[1] Initially the Doctoral School of Social Sciences and Humanities did not take part in the project, but they have since been included and the offers are available for all PhD student at AAU.
[2] More information about the AAU PhD Career Hub.

Financial support is also given to PhD students who aim to collaborate internationally. This has proven to contribute to the professional and career development of PhD students and, enabling them to grow as individuals and independent researchers as well as to pursue academic or non-academic career in research and innovation after completion of the PhD degree (Rivas, 2024). External collaborations result also in the development of professional networks known to reduce loneliness, to help coping with the ups and downs related to doing a PhD (Pilbeam & Denyer, 2009) and to possibly reduce the well-known "imposter syndrome" (Pilbeam et al., 2013). A SciVal analysis of publications resulting from PhD studies completed between 2019 and 2023 at the MED faculty shows that papers co-authored with international collaborators have a 58% higher field-weighted citation impact, while those involving academic or non-academic partners have a 20% higher impact (Figure 2). This analysis underlines the benefit of external collaboration in terms of impact.

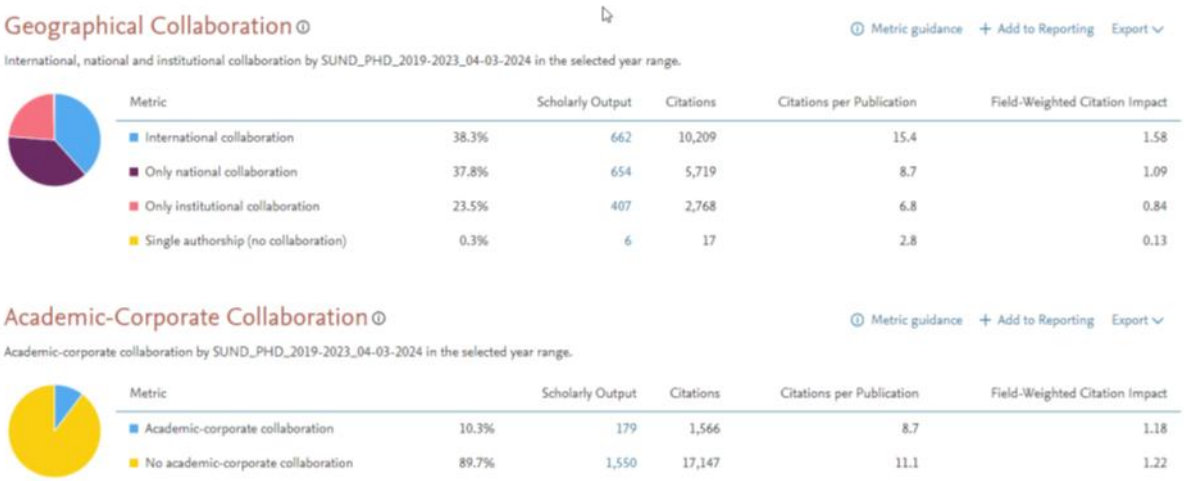

Figure 2. SciVal analysis of the publications issued from PhD studies completed between 2019 and 2023 at the Faculty of Medicine, Aalborg University.

In parallel to the career hub, it is worth mentioning that R1 researchers at Aalborg University can have a mentor and have one or several supervisors giving them supervision. Once every year, an appraisal interview is organised to discuss aspects related to teaching, research, funding and innovation as well as work-life balance using materials like e.g., the Vitae Researcher Development Framework and the accompanying lenses to support the professional development of researchers.[3] Moreover, all researchers are members of research groups to ensure information sharing and network development.

Funding

The initiative is supported by all the Doctoral Schools at Aalborg University with some joint initiatives and some solo initiatives as well. The funding therefore varies depending on the activities within the individual Doctoral Schools. Fixed initiatives such as the DISC profiling have become embedded in the budgets for the Doctoral Schools and are calculated on an annual basis, reflecting the number of DISC profiles made at each individual Doctoral School. Separate initiatives such as the career courses also receive separate funding from the individual Doctoral Schools.

The Doctoral Schools are funded by the individual faculties, and career development initiatives are now a fixed item in the budget of all Doctoral Schools. If the budget allows, additional funding may be added throughout the year to cover extra initiatives from external providers. Most of the services in the model are

[3] More information about the Vitae Researcher Development Framework can be found via https://vitae.ac.uk/

provided by AAU PhD (the administration for all the Doctoral Schools), where employees have been certified in DISC, coaching, and other elements to support this effort.

Of note, the Doctoral School of Medicine, Biomedical Science and Engineering (MEDICINE faculty) is active at both the national and international levels (ORPHEUS, NORDOC) to secure additional funding to promote scientific careers. Initiatives such as the Talent Ecosystems for Attractive Early Research Careers pilot (HORIZON WIDERA 2024 ERA 02) are particularly important, highlighting that future funding aimed at developing R&I skills is crucial to make Europe attractive for early career researchers.

Target group, scope and scale

The target group of the AAU PhD career hub includes all R1 researchers. The model and its contents have received extremely supportive feedback from international panels of researchers and academic managers that are all well-experienced with PhD education. This was noted during an international evaluation of the Doctoral Schools which takes place every 5 years (timeframe is displaced for the individual Doctoral Schools). The current frame of the model is aimed at PhD students only (R1). AAU PhD has, in collaboration with the Doctoral School of Engineering and Science & The Doctoral School in Medicine, Biomedical Science and Technology created a pilot project for selected postdocs. This pilot consisted of access to the DISC profiling offer and an online programme provided by external parties.[4] This programme was selected based on positive feedback from other Nordic universities in light of a network arrangement concerning career development for young researchers. Finally, a funding workshop was arranged in collaboration with our central funding office to educate the postdocs in relation to where and how to apply for funding as an early-stage researcher.

AAU PhD also sent a short survey to all postdocs at AAU to find out whether they had received any career development support and to assess their needs for such support. 70% of the 210 postdocs that received the survey responded within 20 minutes of the survey being sent. An overwhelming 100% of the respondents indicated that they found one or more of the efforts in the pilot project relevant. This initiative for postdoctoral fellows will be extended in 2026 to all postdocs at AAU, complementing the Excellence Programme, launched in 2025, which targets outstanding early-career researchers pursuing academic careers.

As of November 2025, 738 PhD students are enrolled at Aalborg University. We encourage all PhD students to take advantage of the opportunities we provide, emphasising the timing and context for career and well-being considerations. Nearly all participants in our career courses choose to complete a DISC profile afterwards. This approach aims to engage PhD students in career thinking, which noticeably increases their utilisation of available resources. Feedback from the career courses and DISC profiles has been extremely positive, indicating that students gain valuable insights into career planning, personal preferences, motivation, and potential stress factors.

Factors contributing to successful implementation

The successful development and implementation of the PhD career hub and model required several steps, considerations and iterations before its final form.

The pilot phase of the various initiatives across the Doctoral Schools provided valuable insights into what worked, what PhD students wanted, and how the model should be shaped. Initial feedback from PhD

[4] More information about the Postdoc Training can be found here.

boards, students, and supervisors fostered a shared sense of support for the initiative, ensuring that the services offered are relevant and meaningful.

In relation to a common approach to this project, two factors played a key role:

- Joint administration of Doctoral Schools at AAU. This structure allows AAU PhD to develop and support initiatives that span all Doctoral Schools, with backing from each School's management, including the PhD Study Director and PhD Board. The initiatives are also further evaluated and refined in regular meetings between the PhD Study Directors and PhD administration. This support has been essential for the development and implementation of the model.
- Strategic Council engagement. The model was presented to the Strategic Council for Research and Innovation—comprising Vice Deans for Research and Innovation, the Director of Innovation, the Vice Director for Research Services, and chaired by the Rector—on three occasions: during the idea phase, after the first iteration, and for final approval. The Council's endorsement has been essential for funding, institutional support, and project resources within AAU PhD administration.

As described earlier, the model has received positive feedback across all departments and units and the implementation was also supported by local administrative staff in relation to communication and visibility of the model and services.

Recruitment of R1 and R2 researchers at AAU

The recruitment of PhD students and postdoctoral researchers at AAU is governed by national legislation and local regulations. The parties involved include the department that secured project funding (typically the main supervisor), AAU PhD, and the central HR department.

Preparation, creation and publication of job posting

The HR department prepares the job posting and plans the recruitment process in detail by indicating the desired start date, application deadline, interview schedule, and assessment deadlines. The job advertisement follows a fixed form provided by the recruitment system. Roles and rights for the recruitment committee and expert assessors are assigned. These two groups are composed of senior scientific staff members (at least at an associate professor level) with expertise within the specific research area of the position. Typically, the potential main supervisor is part of either one or both committees. This ensures clarity, accountability, and readiness for a structured recruitment process.

Aalborg University has adopted an inclusive policy for job announcements to promote diversity and inclusion and thereby, fairness. Fixed sections such as salary and employment terms are maintained by the HR department. This ensures legal compliance and tailored communication for the position. The department reviews the posting using a checklist and publishes it on AAU's dedicated job site. According to Danish law, the announcement period must be no less than two weeks. Mandatory platforms also include Jobnet (all public institutions in Denmark must publish on this website) and Euraxess (for Marie Curie positions). The department may also advertise the position on other platforms of its choice.

Initiation of shortlisting and selection for assessment

AAU PhD initiates shortlisting after the application deadline. The recruitment committee advises the Head of Department on which applicant should be selected for assessment. The shortlisting is completed within three working days. The purpose of shortlisting applications is to ensure that assessment is provided solely to the most qualified applicants. This allows the assessment committee to spend their time on the most relevant applications.

Based on a recommendation from the recruitment committee, the Head of the Department nominates candidates for an assessment. Diversity is considered, and the Head of the Department shortlists the applicants based on who matches the needs of the department and the faculty in relation to the specific demands in the job listing. This seeks to promote fairness and transparency in candidate selection. AAU PhD informs applicants whether they proceed to assessment or not. Standard templates are used for communication, and handling potential objections, to ensure communication is aligned and similar for all applicants.

Assessment process

AAU PhD uploads assessment forms and notifies expert assessors. This is composed of two experts (minimum associate professor) within the scientific area. One of the members is the head of the local doctoral programme to ensure that the qualifications of the applicants match those required to complete a PhD study within the programme. A two-week deadline is set for completion of the assessments. This seeks to ensure structured and timely evaluations. AAU PhD reviews assessments for formal compliance, including completeness and qualification status. Following this, AAU PhD requests approval from the Head of the Department within a three-day period. AAU PhD communicates with applicants as needed, e.g., sharing assessments upon request. AAU PhD informs the recruitment committee that assessments are approved, and candidates are ready for interview selection. The recruitment committee, in collaboration with the Head of the Department, selects candidates for interviews to comply with a fair and documented interview selection.

Offer of employment

Once the interviews have been completed, the department informs AAU PhD when a candidate is selected. Candidates that have been invited to an interview but have been unsuccessful are notified by the recruitment committee, preferably by telephone. This ensures prompt and respectful communication. AAU PhD sends rejection letters to non-interviewed candidates and closes the position. It is important to note that PhD students can be enrolled at Danish universities without having an employment at the university at the same time. We provide information below regarding recruitment of PhD students from 2015 to 2024 based on announcements from the Faculties of Medicine (MED), Technical Faculty of IT and Design (TECH), and Engineering (ENG).

- MED: In 2015, 24 PhD positions were open based on announcements. This number decreased to 10 in 2024. Average annual change withing the last 10 years: −1.56 positions. The trend shows a gradual decline with some fluctuations. This is explained by the fact that approx. 2/3 of the PhD students are employed by the Aalborg University hospital.
- TECH: In 2015, 15 PhD positions were open based on announcements. This number rose to 51 in 2022 and then slightly declined. Average annual change withing the last 10 years: +2.56 positions. TECH faculty shows the most consistent growth over the period.
- ENG: The number of PhD positions with announcements peaked in 2017 and 2022 (50 and 53 positions, respectively) but dropped to 27 in 2024. Average annual change withing the last 10 years: −2.33 positions. The trend at ENG faculty is fluctuating with a significant recent decline.
- Total positions: The number of PhD positions with announcements peaked in 2022 with 119 positions but dropped to 77 in 2024. Average annual change withing the last 10 years: −1.33 positions. Overall, the total number of positions has declined in recent years after a period of growth.

From 2015 to 2024, TECH is the only category showing a positive average annual change, indicating growth. In contrast, MED and ENG have experienced declines, particularly in recent years. The total number of posted positions peaked in 2022 but has since decreased significantly, influenced by shifts in hiring trends, funding priorities from universities and research agencies, as well as changes in the socio-economic and geopolitical landscape.

The total number of enrolled PhD students each year is shown below, with 2,374 PhD students enrolled over the period 2015–2024. Enrolment fluctuated during this period, from 262 students in 2021 to 210 in 2024. Since 2021, there has been a downward trend in PhD enrolment (Figure 3). We expect the number of newly enrolled PhD students to stabilise at approximately 200 in the coming years.

Despite this trend, the AAU PhD career hub will continue to prioritise the quality of research career guidance, aiming to enhance the well-being of R1 researchers.

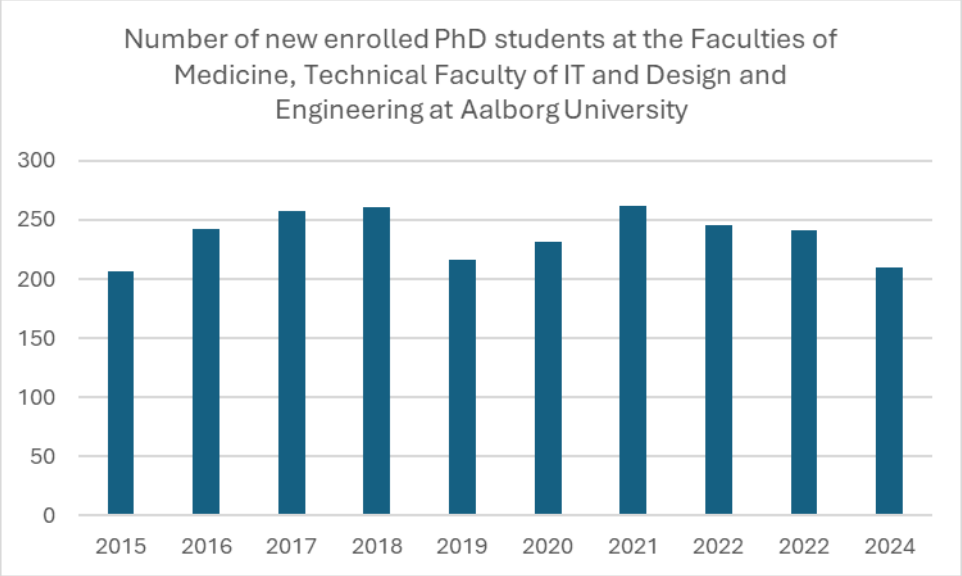

Figure 3. This chart shows the yearly number of newly enrolled PhD students at the Faculties of Medicine, Technical Faculty of IT and Design and Engineering at Aalborg University in the period 2015-2024

Improvement and development for sustainable career prospect

The recruitment process of R1 and R2 researchers functions well in general. AAU has initiated the process to receive the HRS4R award. Thus, AAU will soon follow the European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers (C&C).[5] The principles of the C&C form the foundation for the institution's continued development and implementation of its customised HRS4R action plan. Currently, AAU's development efforts focus on supporting professional growth for researchers and valuing and recognising mobility in research. In addition, there are areas for further improvement, including external advertising, structured screening tools, data-driven recruitment, and strengthening diversity and inclusion.

Long-term institutional commitment at the leadership level has made the development of the career hub possible. Moving forward, AAU PhD, the Doctoral Schools, and AAU will continue to refine the model, focusing on mapping individual career options and extending services to all postdocs. Additional components will be incorporated as needed. In the coming period, particular attention will be given to the visibility and uptake of the various services, as exemplified by efforts such as the Excellence Programme

[5] More information about the European Charter for Researchers can be found via https://euraxess.ec.europa.eu/hrexcellenceaward/european-charter-researchers

and AI:X laboratories at AAU. AAU is still not fully satisfied with the number of PhD students utilising these services. This challenge has been discussed with other Danish, Scandinavian, and European universities, and it appears to be a common issue. More targeted communication is expected to help address this issue.

AAU is also developing offerings that foster innovation and public-private collaboration among R1 researchers, serving as a lever for intersectoral mobility. We hope this case will inspire Danish, Nordic, and other European universities to establish or further enrich their own career hubs, complementing initiatives by research groups and departments. Specific national and European funding supporting the career development of R1 researchers will be essential to further enhance research and innovation competitiveness, and to ensure smoother transitions and collaboration between public and private sectors.

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BRNO UNIVERSITY OF TECHNOLOGY

How the university innovation and entrepreneurship ecosystem can support researcher career development

Authors: Vít Chlebovský, Kateřina Petrová, Jakub Ulč

Case study from Brno University of Technology

Executive summary

This case study explores how the innovation and entrepreneurship ecosystem ContriBUTe at Brno University of Technology (BUT) enhances career development pathways for young researchers by equipping them with entrepreneurial competencies, networks, and opportunities to translate research into practice. Positioned within a broader HR Excellence strategy aligned with European standards, BUT systematically supports early-career researchers (ECRs) not only through academic career structures but also through entrepreneurial infrastructure and mindset development.

ContriBUTe acts as an institutional platform that connects mentoring, prototyping infrastructure (MakerSpace), networking with industry, microgrants, pitch programmes and spin-off support, enabling researchers to gain market awareness, validation experience and professional confidence. The ecosystem operates across three persona profiles—from vision-driven innovators to business-oriented pragmatists and experienced technology transfer leaders—illustrating different pathways from lab to market and how entrepreneurial thinking supports career progression, both within and beyond academia.

Findings indicate that participation in ContriBUTe leads to tangible career-enhancing outcomes, such as enhanced self-efficacy, improved presentation and networking skills, creation of prototypes, involvement in industrial partnerships, and spin-off initiatives. On an institutional level, the programme contributes to cultural change, recognising entrepreneurship as a legitimate component of researcher performance and accelerating knowledge transfer processes.

Moreover, the case study demonstrates that innovation-driven entrepreneurship is connected to both academic and non-academic careers as an integrated competence pathway that increases professional adaptability, employability, and impact potential for young researchers.

About Brno University of Technology and its HR policy

The Human Resources (HR) policy at Brno University of Technology is strategically designed to ensure a stable, fair, and transparent environment for all employees, guided by the consistent application of equal opportunities. This framework is established through Guideline No.15/2024 – BUT Career Rules, which align with the University's Strategic Plan and Code of Conduct.

Alignment with European standards and OTM-R policy

BUT demonstrates a strong commitment to international standards through its adherence to the principles of the European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers. This commitment was officially recognised when BUT was awarded the HR Excellence in Research Award in 2019 and successfully renewed the certificate in 2023. As part of its commitment to HRS4R (The Human Resource Strategy for Researchers) HR Award, BUT implements an Open, Transparent and Merit-based Recruitment (OTM-R) policy, ensuring that recruitment and selection are governed by transparent rules. Recruitment for academic and research positions, including international selection procedures, is regulated by the Selection Procedure Rules at BUT and a Methodical directive, requiring job postings to be published in English on international platforms such as Euraxess, ResearchJobs, and ResearchGate.

Commitment to equal opportunities and gender equality

The underlying principle of the BUT Career Rules is the elimination of barriers to equal opportunities and the creation of conditions that promote work-life balance. The university is committed to eliminating discrimination on all grounds, including age, gender, race, and ethnic origin. To systematically advance gender equality, BUT established the position of Gender Equality Coordinator in 2022.

Key supporting measures include:

- The central policy document, the BUT Gender Equality Plan 2022–2024, which underwent a re-audit in 2024 and was succeeded by the BUT Gender Equality Plan 2025–2028 at the end of 2024.
- The publication of the Code of Gender-Sensitive Communication at BUT in 2024.
- Encouraging gender balance within selection/admission committees.
- Moderate but sustained improvement in gender representation, with the overall share of women employees in academic and research positions increasing from 19.3% in 2020 to 21.5% in 2024 (FTE).

Institutional ethics and social safety

BUT upholds ethical standards through the consistently applied BUT Code of Conduct, which is aligned with the European Charter for Researchers. Oversight is provided by the Ethics Committee, an advisory body to the Rector that reviews complaints regarding code compliance and offers guidance on ethical matters.

To address and eliminate negative workplace behaviour, BUT operates a zero-tolerance policy towards to all types of undesirable behaviour (mainly bullying, mobbing, abuse of authority and sexual harassment). Measures include:

- The establishment of the Coordinator for Social Safety (Ombudsperson role) in 2023.
- A network of trained contact persons and the installation of “trust boxes” at all faculties and institutes for accessible and confidential reporting.
- Formal definition of the responsibilities of focal points in the revised Guideline No. 12/2024 – Social Safety at BUT.

Academic and research career structure and development tools

BUT Career Rules establish a defined structure for career progression and provide extensive tools to support continuous staff development.

Career paths and merit-based progression

The BUT Career Rules classify positions into four basic career paths: academic, scientific-research, technical-economic, and blue-collar, allowing for both horizontal and vertical mobility. Academic staff and researchers are categorised using the European Framework for Research Careers (R1–R4), denoting progression from First Stage Researcher (R1) up to Leading Researcher (R4). BUT has also implemented a structured tenure-track system to foster merit-based advancement without requiring individuals to wait for vacant positions. Assistant Professors receive an initial three-year contract, renewable up to two times, allowing up to nine years to complete the postdoctoral qualification (habilitation) required for a full professorship. Regarding contract stability, BUT supports the concept of a single contract and follows the Labor Code, limiting fixed-term contracts to a maximum of three consecutive periods, ensuring that a vast majority of staff work on permanent contracts.

Tools for onboarding and ensuring diversity of academic backgrounds

The onboarding experience is formalised through an adaptation process regulated by Article 11 of the Career Rules. This process may involve a mentor who is responsible for integrating the new employee,

introducing the evaluation system, setting a career development plan, and for which they may receive exceptional remuneration. To enhance international openness and ensure diversity of academic backgrounds, BUT applies clear external-mobility requirements for postdoctoral (R2) recruitment. Applicants must have either completed their doctorate at a different institution or have a minimum of 12 months of professional experience elsewhere or have spent at least 12 months at another institution (preferably abroad).

Mobility and internationalisation support

Mobility is a strategic priority, coordinated by the Vice-Rector for Internationalisation and External Affairs.

Support mechanisms include:

- The BUT Scholarship and partnership programme for excellence, which provides targeted funding for the outgoing and incoming mobility of excellent researchers and students.
- Administrative support via the BUT Welcome Service, which assists international staff (both current and prospective) with residence formalities, communication with authorities, and accommodation.

Measures for work-life balance and reintegration

BUT is committed to helping employees, including researchers, balance their professional and personal lives. The university offers flexible working conditions—including part-time work, flexible working hours, and teleworking—in accordance with Article 12 of the BUT Career Rules.

Specific support measures include:

- The Edisonka Children's Group provides on-campus childcare, with plans for expansion to meet growing demand.
- Employees are included in the benefits programme during maternity, parental, or paternity leave, and parents of children under six are eligible for a child contribution (full name: contribution for the needs of a child under the age of six).
- The Guide to Work-Life Balance was published in 2024 to provide guidance for staff returning from long-term absences or career breaks.
- BUT promotes RESTART GRANTS from the Czech Science Foundation starting in 2025, specifically designed for scientists re-entering research after a career break due to caregiving responsibilities.

Tools and systems supporting career development of young researchers

BUT provides comprehensive support systems specifically targeted at doctoral students and early-career researchers (ECRs) to promote their transition into independent, successful scientists.

Financial and grant schemes

A robust system of internal funding schemes exists to support high-quality research and career advancement:

- Internal Grant Agency (IGA): This primary tool distributes approximately 80 million CZK (3.2 million EUR) annually through internal grant competitions to support the independent creative activity of master's and doctoral students.
- Research Excellence Fund: This unique institutional fund provides bridge funding to high-quality applicants (such as those holding the Seal of Excellence) who narrowly missed prestigious external

grants (like ERC, JUNIOR STAR), enabling them to continue their research for at least two additional years while preparing new proposals. The fund is also utilised to motivate and assist in preparing excellent grant proposals.

- Targeted support: BUT prioritises and supports applications for prestigious international and national grants relevant to ECRs, such as ERC, MSCA, EXPRO, and JUNIOR STAR (from the Czech Science Foundation).

Specialised doctoral education and supervision

Doctoral studies are based on an Individual Study Plan (ISP), developed in collaboration with a supervisor who provides regular consultations and guides professional development. The framework for supervisors' responsibilities and expected performance is standardised in Guideline No. 7/2024 Standard of PhD Supervisor.

Specific developmental models include:

- Industrial doctorates at BUT: BUT is the only university in the Czech Republic with a clearly regulated model for Industrial Doctorates (Directive No. 4/2024), enabling students to conduct applied research in partnership with industrial partners (e.g. Škoda Auto).
- Doctoral schools: The inter-university CEITEC BUT doctoral school offers the Advanced Materials and Nanosciences programme in an interdisciplinary setting. Furthermore, a new university-wide doctoral school was launched in September 2025 as a supportive educational platform, focusing on enhancing competencies in scientific publishing, project work, data handling, and career development.
- Cotutelle and international cooperation: BUT actively supports cotutelle (dual supervision) doctoral studies through formal agreements with international universities (e.g., RWTH Aachen and Lappeenranta-Lahti University of Technology).

Entrepreneurship and skills development

BUT fosters an entrepreneurial spirit through its ContriBUTe innovation and entrepreneurial ecosystem. This ecosystem offers targeted courses, mentoring, and events to promote entrepreneurship among both students and staff.

Professional and soft skills development is supported across the university:

- The Department of Project Support and Knowledge Transfer provides courses to ECRs and staff in areas such as intellectual property (IP) protection and technology transfer (TT). These courses cover IP fundamentals, patent types, prior art searches, and feature invited external experts.
- Training in academic writing, research promotion, and data management is provided by the Central Library.
- A pilot course focused on enhancing the teaching competences of PhD students and early career academics (covering learning management, digital skills, and communication) was launched in March 2025, planned to continue regularly after September 2025.

Institutional support for retention and wellbeing

The university maintains a comprehensive care system to support student retention (aiming to increase the PhD completion rate from 25% to 50%). Resources include:

- The Alfons BUT Centre, which provides professional and psychological counselling services covering motivation, stress management, and work-life balance issues.

- The system for reconciling work and family life, including flexible policies and the childcare allowance, is available to PhD students.

The future strategic development of human potential involves continuously strengthening the involvement of international researchers, improving gender balance in research, and enhancing measures to support work-life balance, aligned with the consistent implementation of HR Award policies.

Academic/ Professional Position	Total 2020	Female representation, %	International representation, % (excluding Slovak citizens)	Total 2024	Female representation, %	International representation, % (excluding Slovak citizens)
Professor	131.7	10.0 %	0.1 %	139.2	10.0 %	3.6 %
Associate Professor	290.6	11.5 %	0.3 %	307.3	13.7 %	0.7 %
Assistant Professor	543.2	25.6 %	1.3 %	560.4	25.7 %	2.3 %
Assistant	119.9	40.9 %	3.2 %	143.9	35.3 %	3.5 %
Other scientific, research, and development staff[6]	5.0	20.0 %	0 %	0	0 %	0 %
Scientific staff not included in other categories[7]	194.8	17.1 %	11.7 %	479	21.3 %	20.0 %
Technical and economic staff (participates in management and support of R&D&I at the institution)	1666.1	52.1 %	1.9 %	1257.5	64.4 %	1.5 %
Early career researcher (see definitions)	79.9	20.7 %	20.6 %	84.6	21.5 %	23.6 %
Scientific, research, and development staff involved in teaching	38.1	17.2 %	34.9 %	36.6	14.4 %	43.7 %
Total number of foreign nationals	250.0	31.6 %	57.6 %	261.4	31.4 %	38.9 %

Table 1. Overall statistics of the academic and professional positions

[6] Includes technical and professional staff essential for research but not directly involved, e.g., research facility operators.
[7] Includes all other staff not classified above, e.g., independent researchers.

Following the above description of BUT to set the context, the next section will address the role of entrepreneurial ecosystems for career development.

Introduction to entrepreneurship ecosystems

Why do some universities focus on entrepreneurship, what is their role in entrepreneurial ecosystems and how can it support career development?

It is believed that sharing experiences and creating supporting platforms for entrepreneurs helps all economic development. To explore this further, the concept of Entrepreneurial Ecosystems (EE) can be used. EE is composed of individuals, organisations, and institutions that can influence and foster successful entrepreneurial behaviour. An entrepreneurial ecosystem includes the following components: a conducive culture; enabling policies and leadership; availability of appropriate finance; quality human capital; venture-friendly markets for products; and a range of institutional and infrastructural supports (Diaconu & Du u, 2015). In most cases, EE is organised around the roles that government, philanthropists, anchor institutions, intermediaries, investors, and mentors play in collaboration in those ecosystems (Goldberg, 2018).

Entrepreneurship is a catalyst for innovation, transforming novel ideas into market-ready solutions and thereby stimulating economic growth. This dynamic is evident in the formation of clusters of innovation, where the synergy between educational institutions, research centres, and industries fosters an environment conducive to entrepreneurial ventures. For instance, prestigious universities such as Stanford have played a pivotal role in the development of Silicon Valley. They have contributed to the region's growth not only through their research outputs but also by fostering an entrepreneurial culture that rewards experimentation and risk-taking (Pacheco et al., 2023).

Previous studies also show that entrepreneurship is widely encouraged across university research labs, primarily those focusing on applied research (Roach, 2017). Research (Sá et al., 2025) shows that those university graduates who participated in entrepreneurship education are more likely to be self-employed and own their own business three years after graduating than the general population of university graduates.

As indicated by extant research, the provision of education in entrepreneurship can foster the development of students' skills and competencies related to entrepreneurship and cross-cultural understanding (Feola et al., 2024). This is a salient consideration in the contemporary era. The positive impact of university entrepreneurship support on entrepreneurial intention and fear of entrepreneurial failure among university students has been confirmed by additional research (Song & Lu, 2024). A substantial corpus of research, supported by case studies from leading universities such as MIT, has underscored the significance of cultivating an academic environment conducive to student entrepreneurship. This research suggests that universities can play a pivotal role in persuading students to pursue careers in entrepreneurship (Jansen et al., 2015).

Universities often foster entrepreneurship through a variety of structures and initiatives. In this context, University Entrepreneurial Centres (UECs) are a subset of University Entrepreneurial Ecosystems (UEEs). UECs focus on providing resources and support to entrepreneurs within the university, while UEEs are broader in scope, encompassing a range of stakeholders and factors that influence entrepreneurial activity (Deshpande & Guthrie, 2020).

Innovation and entrepreneurship (I&E) ecosystems, particularly those based at anchor institutions like universities, provide vital infrastructure and cultural support that significantly contributes to the professional career development of young researchers. These ecosystems operate by systematically

integrating entrepreneurial practices into their core functions, extending beyond traditional education and knowledge generation to actively fostering innovation and economic growth. For researchers, engaging with these ecosystems offers a pathway for developing entrepreneurship as a lifelong competence, helping them act upon ideas and opportunities and transform them into value for others, whether that value is financial, cultural, or social.

Crucially, institutional support systems—including dedicated entrepreneurship centres, incubators, and specialised courses—provide structured training in essential skills such as business planning, marketing, and finance. Furthermore, institutions focused on I&E aim to develop an "entrepreneurial mindset," resilience, and skills related to cross-cultural understanding, which are beneficial regardless of whether a researcher ultimately pursues a startup career or joins an established company.

I&E ecosystems provide young researchers with critical practical experience and resources necessary for transforming their innovative research into market-ready solutions. Universities, often acting as primary sources of knowledge and innovation, offer access to technology infrastructure, such as maker spaces, enabling students and nascent ventures to prototype and develop ideas, thereby promoting experiential learning. Researchers, including Ph.D. candidates, can leverage opportunities like pitch competitions, where they are required to present their research, anticipated outcomes, and plans for practical application, honing vital presentation and communication skills. Programmes like accelerators (e.g., MIT delta v or LAUNCH) also help transform early-stage startups based on scientific and technical discoveries into fundable companies, offering researchers a direct route to commercialisation. This systematic support enables university graduates who participate in entrepreneurship education to be more likely to pursue self-employment or launch their own businesses, fundamentally changing their career trajectory beyond traditional employment.

A critical component of the entrepreneurial ecosystem is the network of support, mentorship, and connections it provides, which constitutes a form of social capital essential for its durability and effectiveness. Mentorship is recognised internationally as a huge component of success for any entrepreneur. Young researchers gain access to experienced business leaders, professional advisors, and Entrepreneurs in Residence who provide personalised, professional advice and industry knowledge. For example, institutions establish networks of angel investors and experts who offer coaching, mentoring, and innovation training. Alumni often serve as essential role models and guides for future generations, contributing valuable networks and experience back to the university environment. This concerted effort to convene and connect ecosystem builders and entrepreneurs across local and global contexts allows researchers to expand their professional networks and gain practical consulting opportunities, with engaged students of one MOOC being 65% more likely to secure paid consulting work relating to entrepreneurial ecosystems.

Following this introduction to entrepreneurship ecosystems, the next section will explore the example of ContriBUTe at BUT.

Innovation and Entrepreneurship Ecosystem BUT ContriBUTe

ContriBUTe is a university innovation and entrepreneurial ecosystem that serves as an important foundation for fostering entrepreneurship across all disciplines at BUT. It connects education, opportunities, events, resources, and contacts in the field of innovation and entrepreneurship. It also supports talent development and helps both students and academics take the next step on their path to success, contributing to turning ideas into real business and supporting higher professional career satisfaction.

The ContriBUTe programme equips researchers with competencies and skills (research-specific and non-specific) that help lead to good career outcomes and fosters new 'collaborative ventures' between universities, industry, government and other sectors to enable the creation of new high-quality research & innovation jobs with well-defined careers, also beyond university careers.

ContriBUTe links education, opportunities and resources, helping researchers to develop the entrepreneurial and innovation skills that are key to a successful career both in and out of academia. At the same time, it fosters collaboration between universities, industry, and other sectors, contributing to the creation of new jobs in innovation and research. Evidence of the programme's positive impact includes student and staff involvement in entrepreneurial projects, the creation of start-ups and spin-offs collaboration with industry partners, leading to real job opportunities. The programme also provides mentoring and access to expert networks, facilitating the transition from academia to the world of innovation and entrepreneurship. A good portfolio of the success stories is already recorded.

The ContriBUTe programme is funded by a combination of internal university resources and possible external partnerships with industry and other organisations. Core funding is provided by the university as part of its strategy to support innovation and entrepreneurship. The programme's funding may be further complemented by regional and national grants aimed at promoting entrepreneurship and technology transfer. The duration of the programme is not fixed as it is a long-term initiative that is continuously developed and adapted to the needs of the university and its partners. In the case of external funding, specific projects or activities under the ContriBUTe programme may follow the timetable of individual grant schemes.

The key success factors of the ContriBUTe programme are:

1. Strong institutional support - University leadership sees innovation and entrepreneurship as a strategic priority and provides programmatic funding and administrative support. This enables the long-term sustainability and development of the ContriBUTe initiative.
2. Effective stakeholder engagement - The programme connects students, researchers, academics, industry partners and other organisations. Active engagement with companies and practitioners provides participants with valuable experience and contacts that enhance their employability.
3. Sustainable funding and flexibility - The combination of university resources with external funding (e.g. regional and national grants) allows the programme to adapt to current needs. This approach helps to develop new initiatives and ensures continuity of support.

Proactive strategic planning, the university's openness to collaboration with external partners and systematic evaluation of the impact of the programme have contributed to achieving these factors, helping to continuously improve the programme.

ContriBUTe and its influence on young researcher career development

A qualitative case study examines how the Innovation and Entrepreneurship Ecosystem ContriBUTe supports the career development of young researchers, and at the same time enables the commercialisation of research at Brno University of Technology across disciplines and career stages. The particular focus of this research is on three typified personas derived from data aggregation (Innovator-Idealist, Business Pragmatist, Experienced Technology Transfer Leader).

The case study design was chosen due to the need to understand the variability of paths "from lab to practice" in different contexts; the deliberate selection aims to maximise contrasts (faculties, career stages, experience with technology transfer/spin-offs, and connection to ContriBUTe) in order to compare patterns across individual cases. The empirical part is based on six semi-structured interviews lasting 60–90 minutes, supplemented by internal documentation and public project profiles; the data were recorded in the form of audio recordings and verbatim transcripts with contextual notes, after informed consent and with strict anonymisation. The analysis proceeded with open and axial coding into domains (motivation, competencies, barriers, support used, outputs/impact), followed by thematic analysis and cross-case synthesis; the resulting personas were induced from the data and verified on cases.

Quality and credibility were supported by triangulation of sources (interviews × documents × mini-case summaries), peer debriefing within the team, involvement of a second coder on part of the sample with unification of the coding book (monitoring and discussion of discrepancies), member verification of summaries with respondents, and maintenance of an audit trail (protocol versions, code versions, decision log).

Ethical and GDPR requirements were addressed by minimising personal data, pseudonymisation, and secure data storage. Expected outputs include short-term shifts (self-efficacy, entrepreneurial competencies, number of prototypes), medium-term effects (involvement in mentoring, BUT Idea/Start, MakerSpace, South Moravian Innovation Centre (JIC); generation of pilots and spin-off initiatives), and institutional changes (improvement of knowledge transfer processes, recognition of entrepreneurship in performance, clearer spin-off policy).

The study reflects the limitations of a small purposeful sample, the risk of self-representation, and the possible overlap of researcher-mentor roles; nevertheless, thanks to contrasting selection and cross-case synthesis, it provides transferable lessons for entrepreneurial ecosystem management.

Concerning the objective and analytical approach, the following research questions were formulated:

- RQ1: What barriers and support needs do actors perceive in the transition from research to practice (operationalised through time, financial, institutional, and knowledge barriers)?
- RQ2: What value does the ContriBUTe business ecosystem create for individuals at key points in their journey (competence, network, access to resources, market validation)?
- RQ3: Which support mechanisms (mentoring, infrastructure, spin-off rules) lead to measurable shifts, and how do these shifts manifest themselves at the individual and institutional levels (indicators include: competence, networks, tangible outputs, process changes).

Typology of academics in the process of research and its commercialisation at BUT

The following table summarises the results of the analysis of interviews conducted as part of the ContriBUTe research programme at Brno University of Technology. It presents three typical personas of academics who differ in their approach to linking research and business. It also includes a tabular and schematic representation of the relationships between the different types.

Type Persona	Characteristics	Motivation and goals	Key competences	Perceived barriers	Support needs (ContriBUTe)	Level of impact
Innovator – Idealist	Doctoral student or young researcher with a vision of social change, often from interdisciplinary fields.	Social impact, sustainability, and innovation that extend beyond the academic sphere.	Creativity, systems thinking, and the ability to formulate a vision.	Lack of experience with the business environment, difficulty navigating the support system, and lack of investment backing.	Mentoring, connecting with investors, business education, and recognition of social impact.	Micro – personal and value level of career development.
Business pragmatist	Technical student or doctoral candidate developing their own start-up alongside their studies.	Application of research, financial independence, and professional growth.	Technical proficiency, initiative, teamwork, and the ability to reflect practical knowledge in professional and research development.	Lack of flexibility in study schedule, poor coordination between faculties, and limited access to resources.	Shared infrastructure (MakerSpace, South Moravian Innovation Centre), fast microgrants, flexible study regime, networking.	Meso – linking education, research, and business.
Experienced leader in technology transfer	Senior academic with a history in technology transfer and experience with spin-offs.	Effective use of research results, strategic development of the university, and mentoring of younger colleagues.	Expertise, management skills, a network of contacts, and knowledge of the investment environment.	Rigid university structures, lengthy processes, and a lack of support in negotiations with investors.	Strategic professionalisation of support departments, legal and investment advice, and recognition of entrepreneurship as academic performance.	Macro – institutional development and ecosystem management.

Table 1. Typology of academics in the process of commercialising research at BUT

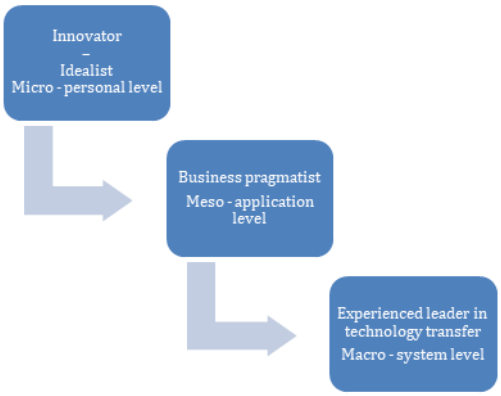

Diagram 1. Map of relationships between individuals and levels of support.

The personal level (micro) represents individuals with vision and motivation (Innovator–Idealist). The application level (meso) includes the interconnection of study, research, and entrepreneurship (Entrepreneurial Pragmatist). The system level (macro) represents experienced academics and the institutional framework (Experienced leader in technology transfer). The relationships between personas express the vertical flow of experience (mentoring) and the horizontal flow of cooperation and inspiration.

	Respondent 1 - From urban vision to sustainable Innovation	**Respondent 2 - A young innovator between the laboratory and the market**	**Respondent 3 - Mechatronics in entrepreneurial practice**
Context and target group	Respondent 1 is a doctoral student, who has long been involved in environmentally friendly urban planning and construction innovations. Their profile corresponds to that of a young academic – an innovator-idealist who combines scientific knowledge with broader social goals.	Respondent 2, a graduate and young researcher, focuses on sustainable energy and energy consumption management. The respondent belongs to a group of entrepreneurial pragmatists who apply research results in practice.	Respondent 3 is a doctoral student in mechatronics. During his studies, he founded his own company focused on the development of control systems for industrial applications. The respondent represents the type of entrepreneurial pragmatist who pragmatically combines an academic and entrepreneurial career, utilising both engineering knowledge and economic understanding.
Involvement of the ContriBUTe ecosystem	Through ContriBUTe and associated activities (especially BUT Idea and Networking), respondent 1 had the opportunity to consult their concept with mentors from the field	Respondent 2 joined the VUT Start programme and established contact with South Moravian Innovation Centre, where they received feedback on the business model of his energy start-up.	Through the ContriBUTe business ecosystem, respondent 3 leveraged consultations in technology transfer and utilised MakerSpace for prototyping. They also established cooperation

	Respondent 1 - From urban vision to sustainable Innovation	Respondent 2 - A young innovator between the laboratory and the market	Respondent 3 - Mechatronics in entrepreneurial practice
	and experts in sustainable innovation		with other doctoral students, industry experts, and mentors in the field of innovation.
Results and impact on professional development	Respondent 1 developed the ability to formulate his ideas not only as an architect but also as an innovator with an entrepreneurial mindset. Thanks to the respondent's mentors, they gained greater confidence in business negotiations with partners and investors.	Respondent 2 learned to work with the concept of market validation and created a functional prototype for energy flow management. Respondent 2 gained an overview of customer needs.	Respondent 3 acquired project management skills and developed the ability to present technical results in a business context. The respondent expanded their network of contacts, which enabled them to more effectively connect the academic environment with industrial practice and identify new opportunities for commercialising research.
Conclusion and lessons learned	The case of respondent 1 demonstrates that programmes like ContriBUTe can also support researchers from non-technical fields. Appropriately designed mentoring activities link socially responsible innovation with business practice.	Respondent 2 is proof that the innovative and entrepreneurial ecosystem of BUT (ContriBUTe) can act as a thought accelerator for technically oriented students and help overcome the barrier between the laboratory and the market.	This study demonstrates that there is no contradiction between research, entrepreneurship, and management education, and that the ContriBUTe programme supports the development of doctoral students' entrepreneurial skills and creates conditions for their natural transition between the academic and business spheres.

	Respondent 4 - From academic research to a technology start-up	Respondent 5 - Strategic innovator and mentor	Respondent 6 - Applied research as an accelerator of professional growth
Context and target group	Respondent 4 works at Brno University of Technology and is a co-founder of a company that was established as a spin-off. The respondent	Respondent 5 is the head of a research group at BUT and is the co-founder of several spin-off companies.	Respondent 6 works in the field of physical engineering and collaborates with industrial partners. The respondent represents an

	Respondent 4 - From academic research to a technology start-up	Respondent 5 - Strategic innovator and mentor	Respondent 6 - Applied research as an accelerator of professional growth
	is an academic leader in technology transfer.		experienced academic focused on applied research.
Involvement of the ContriBUTe ecosystem	As part of ContriBUTe, the respondent participated in mentoring and shared their experience with younger colleagues in the field of IT and cybernetics.	Respondent 5 is involved in the strategic development of the ContriBUTe programme, focusing on mentoring and the evaluation of spin-off policies.	The respondent uses ContriBUTe as a platform for connecting with industry and testing tools for evaluating the impact of research.
Results and impact on professional development	As part of ContriBUTe, the respondent participated in mentoring and shared their experience with younger colleagues in the field of IT and cybernetics.	The respondent has capitalised on their entrepreneurial experience in leading research teams and developing university policies in the field of technology transfer.	The respondent has developed the ability to transfer research results into practice and expanded their international contacts.
Conclusion and lessons learned	Respondent 4 is a prototype of a person who proves that experience with a technology start-up can be a natural part of an academic career.	This case confirms that systematic support for entrepreneurship improves the quality of research and the competitiveness of the university.	This case demonstrates that applied research and education within ContriBUTe promote cultural change towards entrepreneurial thinking.

Table 2. Summary of the interviews.

Results, implications and further steps

The implementation of the ContriBUTe innovation and entrepreneurship ecosystem demonstrates measurable benefits for young researchers at Brno University of Technology across micro, meso, and macro levels. At the micro level, participants report increased confidence in applying entrepreneurial tools, improved ability to articulate the societal and market value of their research and expanded professional networks. At the meso level, interdisciplinary collaboration and interaction with external stakeholders (industry, innovation centres, mentors) foster new research applications, pilot projects, and emerging spin-off activities. At the macro level, ContriBUTe contributes to a gradual cultural shift, where entrepreneurial engagement becomes increasingly recognised as a legitimate academic output and a pathway for career progression.

These findings imply that entrepreneurship-focused support mechanisms are not only about venture creation but act as accelerators of researcher skill development, identity formation, and career resilience. The programme strengthens the link between human capital development and knowledge transfer, positioning BUT as an institution where research careers evolve through both academic excellence and innovation capability.

To sustain and scale these effects, several strategic steps are recommended:

- Formal integration of entrepreneurial competencies into research career development frameworks, making them visible in evaluation, mentoring, and promotion criteria.
- Expansion of targeted mentoring and peer-to-peer learning models, particularly matching early-stage researchers with experienced technology transfer leaders.
- Strengthening flexible micro-support instruments (microgrants, prototyping vouchers, facilitated access to infrastructure) to lower the entry barrier for first experimentation.
- Systematic monitoring of career outcomes and spin-off trajectories to provide evidence of long-term impact and inform strategic decision-making.
- Deeper alignment with HR Excellence and gender equality frameworks, ensuring equitable access to entrepreneurial opportunities for all researcher profiles.

In the next phase, ContriBUTe can evolve from an enabling ecosystem into a strategic career accelerator, not only fostering start-ups but actively shaping a new profile of the entrepreneurial researcher—one who navigates academia, industry, and societal impact with agility. This positions BUT as a leading example of how universities can combine innovation ecosystems and HR development policy to create high-quality research careers with broader economic and societal relevance.

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BRNO
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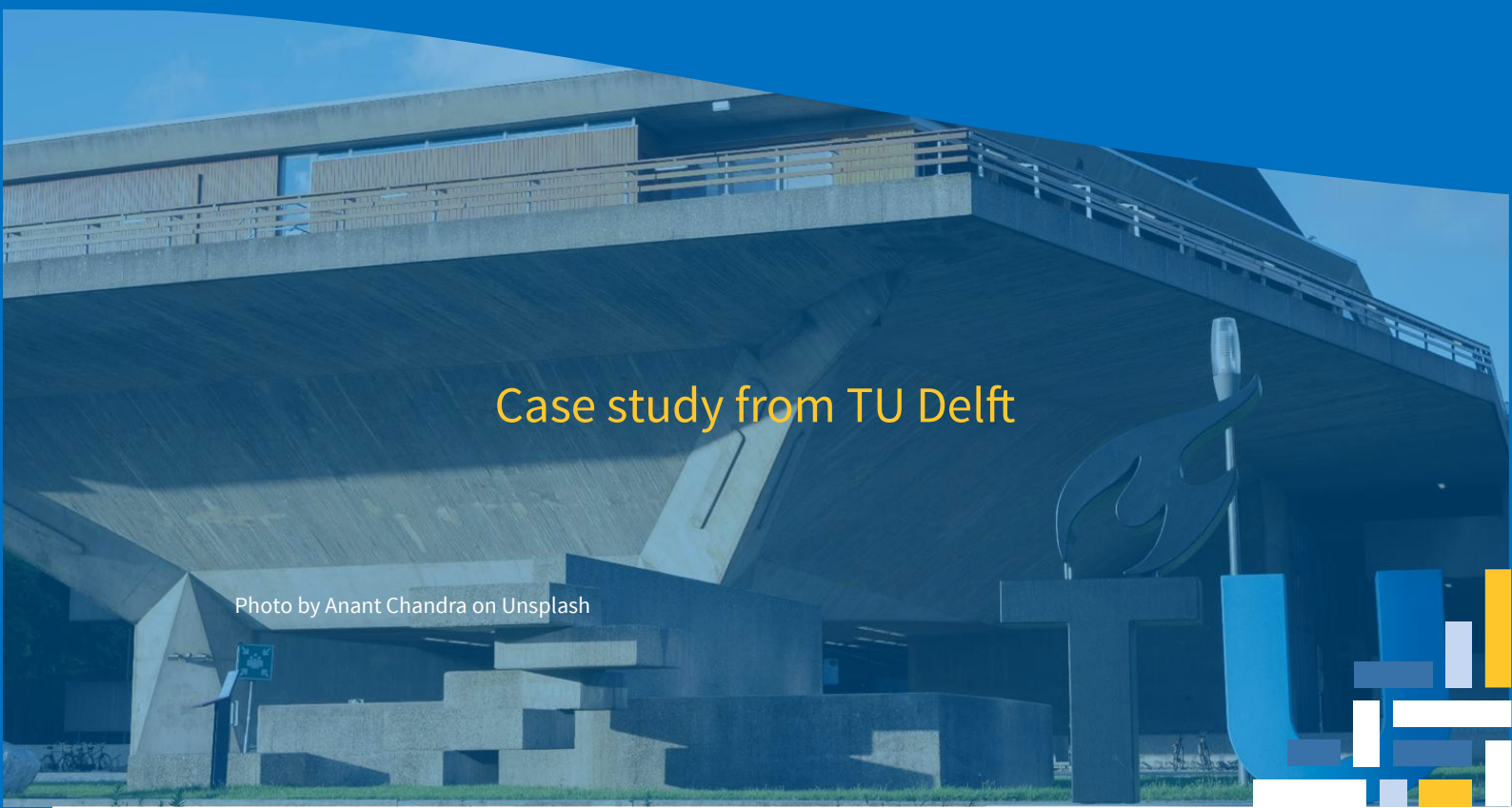
TU Delft Delft University of Technology

Development of the Quantum Ecosystem in Delft, the Netherlands

Authors: Anna Molleman (Senior Policy Advisor QuTech), Dr. Kees Eijkel (General Director QuTech), Prof. Ena Voûte (Pro Vice Rector International Affairs TU Delft)



Case study from TU Delft

Photo by Anant Chandra on Unsplash

Introduction

In 2013, Delft University of Technology (TU Delft) already had a very solid scientific competence in quantum science. This stemmed from a strong tradition in quantum and nanoscience.

A year earlier, a consortium of TU Delft and Leiden University was awarded an ERC Synergy Grant for a Quantum Computing Lab, providing an excellent basis for strongly synergetic research between the Delft scientific groups working on various solid-state qubit technologies. In addition, a Focus Group programme on Solid-State Quantum Information Processing was awarded by the Foundation for Fundamental Research on Matter (FOM) of the Dutch Research Council. To further strengthen this centre of excellence in quantum science and advance mission-driven technology development in quantum computing and the quantum internet, it was necessary to broaden the required expertise to include additional disciplines at TU Delft, such as computer science, quantum theory, and electrical engineering.

Furthermore, a different, complementary mindset - one of engineering focused on higher technological readiness levels (TRLs) - was considered essential. Discussions with the Netherlands Organisation for Applied Scientific Research (TNO) were held to this end.

These developments led to the establishment in 2014 of QuTech, the quantum technology institute of TU Delft and TNO. That same year, the Dutch government designated QuTech a 'National Icon' for its anticipated groundbreaking and innovative character and economic potential for the Netherlands.

Funding

The Dutch Ministers of Economic Affairs and of Education, Culture and Science, the Dutch Research Council, the Dutch Top Sector High Tech Systems and Materials ("Holland High Tech"), as well as TU Delft and TNO, subsequently joined forces to create a 10-year funding framework for QuTech (145 M€ in total).

QuTech has also had - and continues to have - successful large-scale research collaborations with several international technology companies. Within Horizon Europe, the Quantum Internet Alliance (QIA) runs a major research programme in the field of quantum communication. QuTech researchers are also successful in acquiring EU research projects.

In the Netherlands, QuTech played a crucial role in developing the National Agenda for Quantum Technology (NAQT), which is funded by the Dutch National Growth Fund for Quantum Technology. Quantum Delta NL (QDNL) is the governing body for the implementation of the NAQT. QuTech has several major projects funded by QDNL and has also successfully secured projects awarded by the Dutch Research Council.

QuTech mission

From its very beginning, QuTech has striven to unite the best of its parent organisations TU Delft and TNO and distinguish itself through a strong mission-driven approach (Figure 1), focusing on the combination of research excellence and relevance, creating academic as well as economic and societal impact.

Figure 1. QuTech's mission

Excellence and relevance are central to the missions of most public research organisations, but QuTech goes further, firmly believing that in emerging fields like quantum technology—where industry and markets are still in early stages—the vision of organisations like QuTech is crucial for driving the development of a local ecosystem. QuTech is committed to demonstrating leadership in this regard and taking a role in implementing its vision. Not only by conducting excellent research, but also by simultaneously developing and organising the ecosystem. These three elements - excellence, relevance, and leadership - defined QuTech in its current form.

Excellence relates to QuTech being an academic powerhouse, combining world-class scientific research with top-notch engineering on quantum computing and quantum communication. This has been, is, and will continue to be a core strength of QuTech, enabling it to remain a leading institute and a key destination in Delft, the Netherlands, and Europe—not just a location. Leadership, in this context, means that QuTech operates autonomously and defines its own position.

Relevance means that QuTech contributes to the impact of quantum technology by serving as the innovative powerhouse within the ecosystem, stimulating both local and European innovation. Leadership, in this context, involves fostering an entrepreneurial culture within and around QuTech—initiating and supporting the development of startups, collaborating closely with these companies, and forging strategic partnerships with leading industrial and other key players.

QuTech strategy

Research and engineering

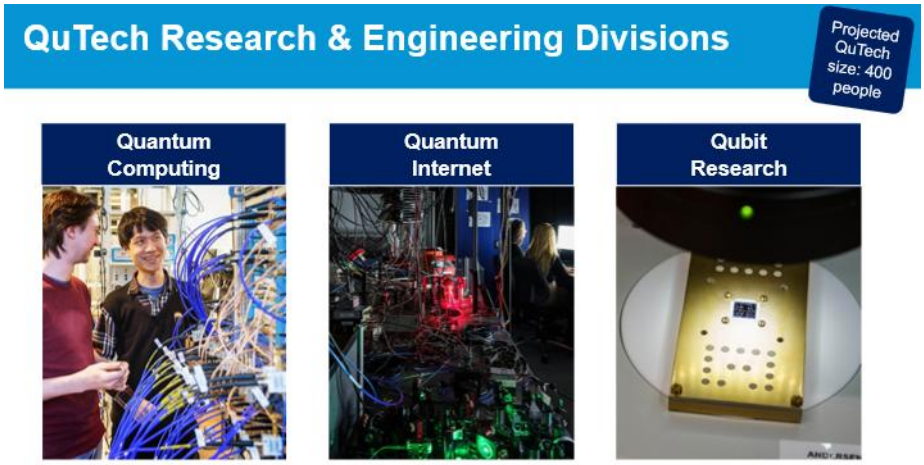


Figure 2. QuTech's research and engineering divisions

Research and engineering at QuTech are organised into three divisions, in which QuTech researchers and engineers collaborate with colleagues from the TU Delft Faculties of Applied Sciences (AS) and Electrical Engineering, Mathematics and Computer Science (EEMCS). QuTech's historic core expertise is in solid-state quantum information processing, specifically in computing and communication. In this domain the institute has a strong reputation on a global scale. This has been demonstrated over the past 10 years, not only by the international publication-based rankings in which QuTech consistently ranks among the best, but also by the interest from global technology giants seeking research collaborations with QuTech.

Making choices

QuTech has chosen not to broaden its scope too widely, but to continue focusing on quantum computing and quantum communication technologies. These quantum technologies are believed to offer attractive candidates for large-scale computers and internet systems. This does not, of course, change the fact that QuTech recognises the importance of other technologies, such as quantum sensors and quantum algorithms. Wherever relevant and possible, QuTech will actively interact on these with other parties in the ecosystem. This is already happening with QuTech's demonstrators and in the Catalyst programmes of QDNL. QuTech's engagement and relevance in ecosystem activities continuously sharpens the institute's priorities.

While always exploring new territories

While the research activities are heavily inspired by QuTech's quest in building full-stack systems, there is also a need to venture into new, unchartered territory in some cases. The state of development of the quantum field still requires breakthrough research and new alternatives. QuTech will pursue such risky new directions to examine alternative routes to its mission, and to create a deeper understanding of the technology. It is therefore important to keep a healthy breadth of approaches and continue to cover the full stack.

Quantum Computing Division: building the computer of the future	Quantum Internet Division: building a secure quantum internet	Qubit Research Division: next generation of qubits for quantum computing
Quantum computers have the potential to perform extremely complex calculations, by encoding information into quantum states. This opens the way for revolutionary applications, such as complex optimisation challenges or prediction, simulation, and modelling of the behaviour of molecules, catalysts, and new materials. Quantum computing requires the development of different layers of hardware and software. Together, these layers are referred to as the quantum computing stack. This stack is what is being explored at QuTech. The base of the stack – the 'quantum processor' – contains the qubits. QuTech is investigating different types of qubits, along with the system architecture that translates quantum algorithms into electronic signals that operate on the qubits.	A quantum internet is a radically new technology that connects (quantum) devices, such as quantum computers, over large distances. This will allow for novel innovations, including levels of privacy, security, and computation power that are impossible to achieve with today's internet. The QuTech mission is to provide the enabling technology for the future quantum internet and showcase the very first fully functional quantum networks. QuTech is unique in that it's working on every single aspect necessary for realising quantum networks: it is developing the software, the interface between software and hardware, and the hardware.	The number one quantum computing challenge is that qubits (the basic units in quantum computers) are extremely fragile. Qubits are easily influenced by many things, like light and temperature. Quantum decoherence is what happens as a quantum system gradually loses its special quantum behaviour over time. To overcome this challenge, QuTech studies new types of qubits that are by design protected from outside influences. These new qubits are referred to as 'protected qubits' and have the potential to outperform established technologies. QuTech aims to understand, develop, and demonstrate protected qubits. In this effort material science, quantum theory, and novel device design are combined.

Focused on the mission

QuTech's mission:

Creating the quantum future: from world-class research to world-changing innovation.

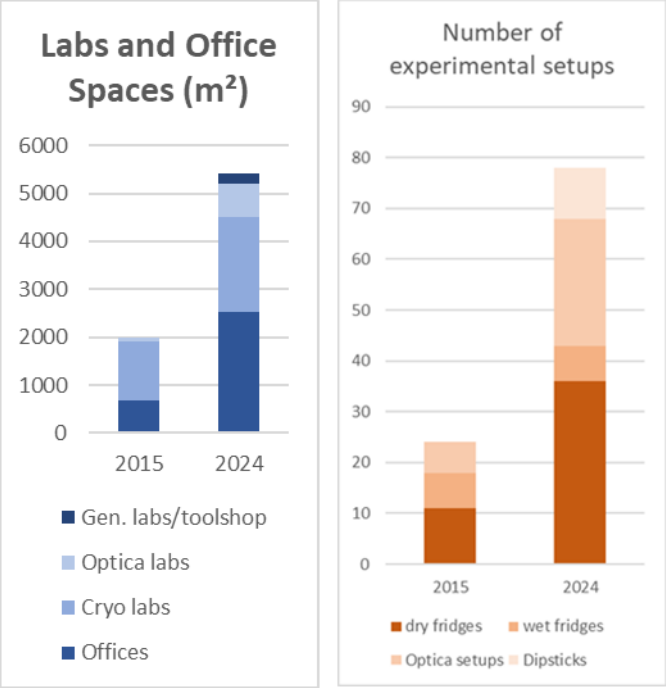
We perform world-class research and develop scalable prototypes of a quantum computer and a quantum internet, in close connection with a thriving quantum technology ecosystem for which we act as an enabler.

QuTech consistently strives to uphold the crucial principle that everyone should focus on activities that contribute to the institute's mission, while recognising that this can sometimes be challenging in the academic world. The management continues to drive this process.

However, this is not being done through a top-down effort geared towards one single quantum computer or network technology. For this, the development of the field of quantum technology is simply not advanced enough. The choice for several high-potential solid-state options in combination with a full-stack approach combines focus with a limited but relevant spread of options. It creates space for intermixing of ideas and cross-fertilisation in technology development.

It also creates multiple options for commercialisation, for different technological routes and at different levels of the full stack. QuTech believes that this approach has the best chance of providing the Netherlands and Europe with critical control points in a future supply chain.

The need for state-of-the-art research facilities



The availability of state-of-the-art research facilities has been essential for all QuTech activities. This includes cryostats, optical setups, cleanroom facilities, and measurement equipment. Government funding, as well as the success of QuTech researchers in securing research projects in Dutch and EU Horizon programmes, have provided the necessary flexibility and growth. But the continued maintenance, upgrades, and necessary expansion of these facilities require significant investments and therefore pose a challenging task for universities. However, the value of such facilities for the growing ecosystem is a factor that is believed to convince stakeholders: these facilities need a cooperative approach.

Figure 3. Increase of labs, office spaces and experimental setups

Creating and supporting a local quantum ecosystem

QuTech embraces the creation of an economic footprint in the Netherlands and the EU as a core part of its mission. QuTech management has always strongly believed that creating a local quantum ecosystem where scientists, entrepreneurs, and investors connect, will act as a magnet for new talent and funding. QuTech contributes by supporting the creation of startups and fostering strategic partnerships to strengthen the ecosystem. Where possible, QuTech organises ways to structure close collaboration with its external partners. Internally, QuTech's employees are empowered to combine research, innovation and entrepreneurial activities.

Specialised industrial teams with the necessary financial resources often work on a single technology. These are developments that advance the quantum field and from which the rest of the world, including QuTech, can benefit. As a public research institute, QuTech's role is different. As part of the development of the local ecosystem, the institute has succeeded in this competition by taking a Darwinian approach: developing multiple research options with high potential and helping to commercialise them.

In this way, QuTech contributes to creating pivotal control points in a future supply chain. This approach has proven to be successful. QuTech wants to be a source for knowledge, talent and organisational power to shape and nurture the ecosystem, to the benefit of the Netherlands and Europe.

Figure 4. Startups and scale-ups in the Delft quantum ecosystem.

QuTech Entrepreneurship Exploratory Programme

The emergence of early QuTech startups demonstrated the strong entrepreneurial potential of QuTech researchers but also highlighted the need for a more structured pathway to guide future ventures. QuTech launched its Entrepreneurship Exploratory Programme to provide researchers with dedicated support, resources, and a safe framework to explore entrepreneurship. The programme not only empowers internal teams to focus full-time on venture creation but also ensures that promising innovations are developed in close alignment with TU Delft, enabling both founders and the university to benefit from long-term value creations.

Three core components of the programme:

- Ideation and concept development.
- Venture enablement and team resourcing, supported by access to a Venture Readiness Ticket (€200k-500k).
- Pre-validation in collaboration with Delft Enterprises, TU Delft's body responsible for managing the university's spin-off portfolio.

Figure 5. Phases QuTech Entrepreneurship Exploratory Programme

(PoC: Proof of Concept. MVP: Minimal Viable Product. IP: Intellectual Property)

The programme allows researchers to validate business ideas without sacrificing their job security or incurring direct financial risk and is strongly focused on spinning out these activities. This has proven to be 100% successful to date.

It provides the time and resources necessary to advance deep tech innovations towards proof-of-concept (PoC) or minimum viable products (MVP). The teams involved benefit from access to TU Delft's extensive facilities, including specialised QuTech laboratories, cleanrooms, equipment, the university networks, and professional support services such as IP, project management and communications. This approach has proven successful: among the startups in the local ecosystem, 24 co-founders come from TU Delft (QuTech or the AS and EEMCS faculties), and 3 from TNO.

Interacting within the ecosystem

The relationship to the ecosystem is reciprocal. After a phase of research, successful technologies are commercialised by the QuTech local partners. The speed and focus created by these partners enable faster technological development. This, in turn, creates opportunities for QuTech to build more advanced systems together with its ecosystem partners, support its own research with better technologies, and to identify new research challenges. By collaborating in the ecosystem to jointly create full-stack solutions, QuTech's research efforts gain in relevance, and the commercialisation pathways become clearer. In other words, the sum is greater than its parts.

A good example includes the collaboration through our demonstrators. Within the Hectoqubit project, for example, QuTech and several of its startups are working on a 40-qubit system to demonstrate the technology and explore the challenges of integration. QuTech believes that building such systems is only possible in collaboration with its ecosystem partners. Future demonstrators could be relevant, for example, in demonstrating a new qubit type or a control stack at the scale of 100 qubits, or a 15-node network that clearly outperforms existing technology platforms. A demonstration at this scale would surpass the level of scientific proof of principle for a new technology and provide a strong indication of its industrial potential.

"For us it has always been clear: quantum computing should be seen as a value chain where each company or university picks one subproblem and focuses on being the best at that part."

Niels Bultink
CEO Qblox

Investments in Quantum startups

In recent years, both large corporations and ambitious startups (and their Venture Capitalists) have invested massively in quantum technology. So far, more than 100 million euros of private capital has been invested in Delft startups. In addition, the Delft quantum startups are increasingly benefiting from and being recognised by the European Innovation Council (EIC), which provides targeted funding support at different stages of their innovation journey. This includes the first steps towards venture creation, helping teams transform promising research results into validated business concepts. Many of the Delft startups have been selected by the EIC Accelerator programme to accelerate market entry and growth. Besides this, Delft-based startups also participate in major European Quantum Flagship projects such as QIA and QLSI2 (Quantum Large-Scale Integration with silicon).

The proximity of the NL's largest House of Quantum

The ultimate goal of the QuTech institute is to develop quantum technology featuring 'made in Delft' concepts and components. Close proximity serves as a powerful catalyst, enabling collaboration and amplifying impact.

In 2019, QuTech launched the Quantum Delft initiative designed to attract innovative quantum businesses to Delft while keeping the community connected and informed about the latest developments. This effort led – with support and funding of QDNL - to the creation of the House of Quantum, which today hosts more than 20 companies, including both university spin-offs and external partners from the Netherlands and abroad.

In 2022, Quantum Delft partnered with the municipalities of Delft, Leiden, the Hague, and Rotterdam, as well as with the Metropole Region Rotterdam and the Hague (MRDH), and the Province of South Holland. This partnership is aimed at bridging research, industry, and government to accelerate quantum innovation across the South Holland region. Quantum Delft's activities are co-funded by TU Delft/QuTech, the South Holland regional programme and QDNL.

Education

Training new talent is essential for building the future quantum research and industrial workforce. On-the-job training for talent, targeted MSc and possibly BSc programme, and lifelong learning are considered as essential components for creating a thriving ecosystem.

As a research institute, QuTech does not itself offer BSc and MSc programmes, but QuTech researchers (incl. PhD's) contribute significantly to the faculty curricula. Examples include the TU Delft minor in Quantum Science and Quantum Information and the MSc programme in Quantum Information Science & Technology at TU Delft and Leiden University.

QuTech and the TU Delft faculties (Applied Sciences & Electrical Engineering, Mathematics and Computer Science) are acutely aware that the demand for quantum education will only increase in the coming years to meet the growth of the quantum field. Collaborating on a shared vision for the development of quantum education with other parties in the local ecosystem and beyond is crucial. QuTech can play a key connecting role in this regard.

In its early years, QuTech established the QuTech Academy, which is a significant addition to the institute's international visibility and positioning. QuTech Academy offers massive open online courses and has already awarded tens of thousands of course certificates. For those interested, you can find additional knowledge about quantum computing on The School of Quantum platform. You can also delve deeper into the research being conducted at QuTech by checking out the recorded seminars series QuTech360.

The Delft quantum ecosystem, with partners in academia and industry, welcomes new students. To support a more diverse learning environment, QuTech offers scholarships for excellent, international students interested in a Master's track in quantum.

QuTech Academic also focuses on education aimed at employees in industrial companies. An example of a project in which QuTech participates is QTEdu (Quantum Technology Education), part of the EU Quantum Flagship research and innovation programme. QTEdu brings together quantum professionals from education, research, and industry backgrounds to help define the future of Europe's quantum workforce. Another example is Quantum for Business (QFB), a European initiative, developed by QuTech, Cronos Group, TNO, TU Delft and Quantum Delta NL, with the mission to increase the adoption of Quantum Technology in the market by transferring academic knowledge and expertise to businesses interested in leveraging the potential of quantum.

People

"I enjoy working together with a variety of people, from professors to students, from controllers to engineers. At QuTech you're really part of the team"

Maren Slieker
Project Officer

The position and strength that QuTech has built in its first ten years are due to its embedding within TU Delft as a research institute with its own governance, line management, and budget allocation, which it manages independently within the TU Delft framework. Even more importantly, this achievement is driven by the people at QuTech and TU Delft. QuTech has a large pool of talented individuals who set high standards and consistently succeed in advancing ambition, securing funding, fostering entrepreneurship, and strengthening the institute's organisation. To date, people of many nationalities work closely together at QuTech, creating a diverse and collaborative environment.

Researchers and engineers collaborate with QuTech's cryo-engineering team, electronics team, dedicated software engineers, project support staff, and management support staff. This approach - characterised by horizontal interaction between stakeholders - creates a diverse pool of resources, quite unique in a primarily academic work environment. Moreover, the in-depth collaboration between physicists and engineers within QuTech is a key asset and distinguishing feature. In the coming years, the institute will continuously develop the entire QuTech team to continue meeting the demands of its mission. This will influence the balance between physics, engineering, and application development.

"My favourite thing about working at QuTech is the ecosystem: a group of fun diverse people, international vibe, and an incredible amount of knowledge all in one place."

Giordano Scappucci
Group lead / Principal Investigator

Academic career development

QuTech invests in the development of its researchers and their team members. QuTech Principal Investigators (PIs) receive a start package upon joining, enabling them to fill a few PhD or postdoc positions or purchase equipment. Recently, two starting PIs have also received support from TU Delft, respectively from the Technology Fellowship for top female scientists and from the Delft Excellence Fund, which focuses on attracting top international scientists.

The Recognition and Rewards programme of TU Delft (since 2019) is a key component of TU Delft's Human Resources (HR) policy. The focus is not only on research results but also on broader involvement and contributions to the organisation, as well as on creating societal impact and leadership. Team spirit and team science are explicitly valued. The human side and strong teamwork are also given considerable attention.

Most PIs, both seconded from faculties and QuTech researchers, follow an Academic Career Track at TU Delft. This involves making a substantial contribution to the development of faculty curricula and teaching.

Social inclusion and cohesion

QuTech cherishes its people and will continue to strive to offer them a work environment that is both ambitious and healthy in the years to come. Diversity and inclusion are high on the agenda. QuTech strives to be an international working environment where staff and students from diverse backgrounds and cultures feel at home and supported. Diversity in its broadest sense is valued, including gender, culture, age, sexual orientation, ethnicity, physical and mental ability, socioeconomic background and opinion. These unique personal characteristics and experiences are valuable components for excellence and innovation. A key priority is that people at QuTech always feel safe. Social safety is actively discussed, and (mandatory) training sessions are organised. The QuTech EtiQuette, developed by the people of QuTech, includes the institute's guidelines for socially safe behaviour. Being part of TU Delft, QuTech explicitly subscribes the Integrity Statement in the TU Delft Code of Conduct and asks all its staff and students to do the same.

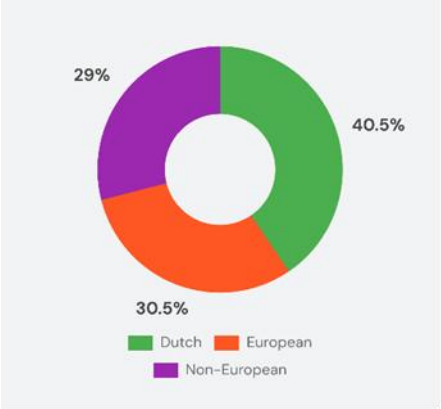


Figure 6. Nationalities at QuTech: Dutch, EU, non-EU (December 2024)

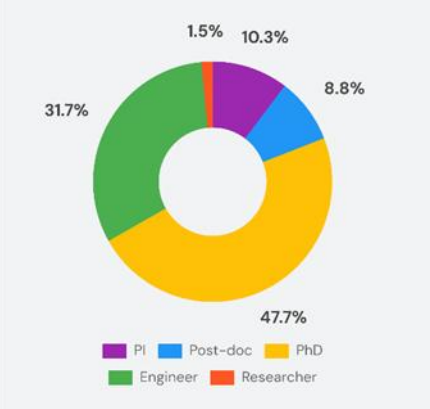


Figure 7. Research positions (December 2024)

QuTech places a strong emphasis on social activities, which are highly valued by its employees. Major successes are celebrated, and a multi-day outing is organised annually. There are also an annual Christmas event and a summer barbecue, each featuring a spectacular performance by the own QuTech band.

TU Delft, which QuTech is part of, gives extensive support for international colleagues with a (spouse) welcoming service, housing support and an on-campus international school. The Dutch government offers a special temporary tax advantage for highly skilled workers seeking employment in the Netherlands.

Staff numbers QuTech and Delft startups

QuTech's successful operations are reflected in its workforce. The institute grew from 110 employees (57 FTEs) at the end of 2015 to 316 employees (252 FTEs) in December 2024. The number of employees is expected to remain around this size in the coming years, mainly because almost all PI positions have been filled. The workforce of companies in the Delft quantum ecosystem is already higher: 450 employees around the third quarter of 2025 and is expected to grow to 2,000 employees around 2030.

Figure 8. Mid 2025 staff members at 'Delft grown' quantum companies.

In closing

The significant progress and impact of the first ten years - such as the National Agenda for Quantum Technology (NAQT), the National Growth Fund quantum programme, the creation of several spin-off companies, and the broad developments in the quantum field - now call for a new approach, which requires a different structure for collaboration between TU Delft and TNO on quantum.

In 2024, TNO and TU Delft decided to conclude the joint governance model for their collaboration on quantum technology and to continue in a regular programmatic cooperation model. TNO will increasingly focus on industry through Business-to-Business (B2B) projects, a core activity of the organisation. As of 2025, QuTech has continued as the interfaculty quantum research institute of TU Delft. QuTech's mission remains unchanged: QuTech continues to focus on excellent research and ecosystem development, including promoting and supporting startups.

Period 2025-2030

Within TU Delft, QuTech will further develop the collaboration on application development (with the faculties, e.g. with Electrical Engineering, Mathematics and Computer Science (EEMCS), Aerospace Engineering, and Mechanical Engineering) and investigate opportunities in the field of additional enabling technologies (if applicable also with other faculties), and for responsible innovation and innovation management (Technology, Policy and Management).

Within the Netherlands, Quantum Delta NL (QDNL) has made a significant impact on the quantum landscape, including its contribution to the realisation of the Delft House of Quantum, where quantum startups collaborate with QuTech and faculties, as well as with private parties and TNO. QuTech will use the consortium built by QDNL to further engage with national partners where possible. Connections are relevant at the level of technologies (TU Eindhoven, University of Twente), applications (Leiden University, University of Amsterdam), and broader topics such as knowledge security and the acquisition of companies for collaboration (Ministry of Economic Affairs, QDNL). A long-standing partnership exists with our local partner, TNO.

Within the EU, QuTech holds a strong position in Brussels for the quantum internet and is building one for quantum computing. The institute aims to collaborate with leading, complementary partners, with the goal of establishing several new strategic partnerships. The guiding principle is that a strong EU benefits all; national efforts, including those in the Netherlands, are focused on optimising QuTech's positioning to achieve this collectively, and to build the strongest possible consortia for the EU.

Looking ahead, QuTech's continued success in driving the quantum ecosystem depends on addressing three key needs that extend beyond its current achievements and core university activities.

Three needs going forward

- Thinking outside the university boundaries – generating targeted IP

TU Delft and QuTech are playing a strong role in initiating and supporting the quantum ecosystem. QuTech is strongly committed to valorising the knowledge generated within the institute. This involves identifying, initiating, and supporting startup initiatives through business development activities and Quantum Delft. Additional efforts—including associated costs—are also being made to generate targeted IP. These are essential efforts that underpin the success of ecosystem development. In doing so, QuTech may go beyond what normally falls under the university's core tasks. To continue this, administrative and financial support are essential. After all, within universities, there is constant pressure to prioritise research and education, and grants are scarce to finance these kinds of ecosystem-building activities. Ultimately, a better connection between the Dutch Ministry for Economic Affairs, the European Commission, and TU Delft is needed to move forward.

- Preparatory phase of start-ups – need for funding possibilities

QuTech previously allocated funds from the 10-year funding framework specifically to support and fund the preparatory phase of startup companies within the institute. This includes, for example, completing the final proof-of-concept, securing intellectual property, developing a business plan, attracting investors, and so on. These funds have now been used up. No suitable grants are available to continue this work. The institute is currently making this possible with stopgap measures, but a good financing base would be very valuable to continue.

- Lab facilities for Scale-ups jointly with the university

Finally, there is the scaling up of quantum companies that are moving towards their own cleanrooms. Collaboration with TU Delft in these types of labs remains crucial to ensure continued collaboration within the ecosystem.

TU Delft
Delft University of Technology

ETH zürich

Advancing Research Careers at ETH Zürich: Strategic Interventions for Early-Career Support and Academic Leadership in STEM

Authors: Daniela Hansen and Raphaela Hettlage

Case study from ETH Zürich

Executive summary

ETH Zürich is strongly committed to fostering inclusive and sustainable research careers, particularly in the STEM disciplines where gender imbalances are more pronounced. ETH Zürich has a number of Vice Presidents that make up its leadership structure. The establishment of the Vice Presidency for Personnel Development and Leadership (VPPL) in late 2020 has strengthened the emphasis on diversity and inclusion.

The Gender Strategy at the Professional Level and two distinct programmes have been central to these efforts: the gender strategy defines measures at the level of faculty recruitment, while the H.I.T. Programme targets appointed women professors (R3/R4 profiles), and the CONNECT Programme focuses on early- to mid-career researchers (R1/R2 profiles). These initiatives address different stages of the academic pipeline and have complementary impacts on fostering diversity and inclusion at ETH.

The gender strategy set a target of 40% newly appointed women professors for the 2021–2024 period, a goal that was reached and surpassed. For the subsequent four-year period (2025–2028), this target has been raised to 45%. While the H.I.T. Programme aims to break the "glass ceiling" by preparing women professors for top academic leadership positions, CONNECT seeks to strengthen foundational career support for women scientists at earlier stages, particularly critical in STEM fields where early attrition is a known issue. Evidence of success is mainly qualitative, based on career trajectories, participant satisfaction, and increased visibility; systematic longitudinal quantitative studies are currently not available.

In the past two decades, the proportion of women professors at ETH increased significantly from 8.9% in 2000 to 20.8% in 2023. Women now constitute 35% of all scientific staff and 32% of doctoral students, underscoring the importance of targeted interventions and the success of the initiatives introduced in this case study. The chart on the next page shows the proportions of women and men at different academic career levels at ETH in 2024. While we have seen progress, women remain under-represented in all cases. For instance, women hold only 19% of full professorship (R4).

Advancing research careers at ETH

In one sentence

ETH Zürich strengthens research careers in STEM by promoting women in the recruitment process and providing targeted support both for early-career women and leadership development for women professors, driving systemic change at ETH toward greater inclusivity.

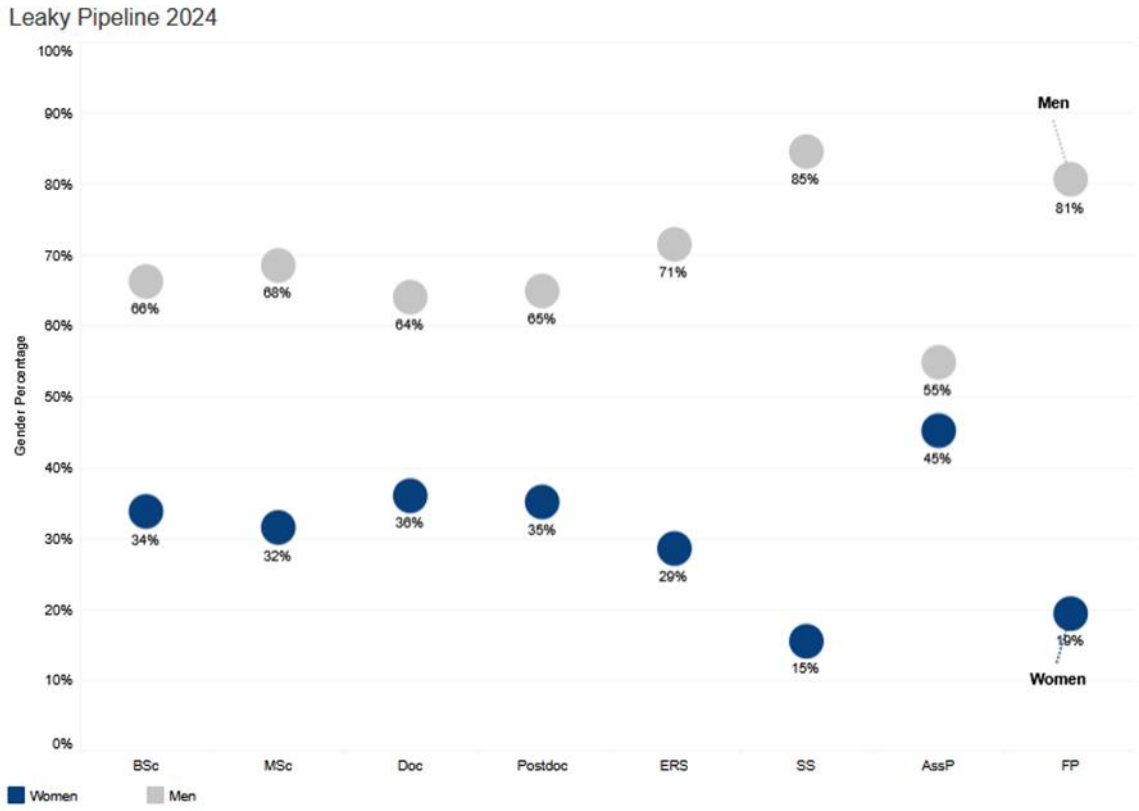


Figure 1. Proportion of women and men on different academic levels 2024.[8]

About ETH Zürich

Founded in 1855, ETH Zürich is one of the world's leading science and technology universities. With a focus on excellence in teaching, research, and innovation, ETH has produced 22 Nobel Prize laureates, including Albert Einstein. Today, the university hosts about 24,500 students and 4,500 doctoral candidates, supported by over 11,000 staff members. ETH consists of 16 different research departments. Internationality is key to ETH's identity, with 40% of students and more than half of its professors having international backgrounds.

ETH's main activities include teaching, pioneering research, knowledge and technology transfer, and proactive societal engagement. The institution focuses on sustainability, responsible resource management, and fostering innovation through spin-offs and industry collaborations. Approximately 30 spin-off companies based on research conducted at ETH are founded every year.

Financially, ETH is predominantly funded through the Swiss federal government, with additional support from competitive research grants and private partnerships.

To monitor diversity and equality within its workforce, ETH systematically collects and publishes detailed data through its Equality Monitoring reports. Further information on diversity monitoring and statistics can be found on the ETH Equality Monitoring page.

[8] BSc = Bachelor's students, MSc = Master's students, Doc = doctoral candidates, Postdoc = postdoctoral candidates and research associates II, ERS = Established Researchers and Scientific Collaborators (fixed term contracts), SS = senior scientists and leading scientists (permanent contracts), AssP = assistant professors, FP = full and associate professors (permanent contracts).

Data overview: Gender balance and diversity at ETH Zürich

In 2024, 37 people assumed a professorship at ETH Zürich, 46 percent of whom are women. This percentage has been increasing over the last ten years, since, for example in 2014, women professors made up 17 percent of new hires. Still, the overall 19 percent of women professors (Full/Associate, R4 and Assistant Professors, R3) is low. It is rising slowly but constantly, with a plus of 1.6% compared to the previous year. The proportion of women professors has steadily increased from 8.9% in 2000, indicating sustained progress over more than two decades. The Gender Strategy at the Professorial Level, introduced in 2021, has played an important role in heightening awareness of gender equality and introducing measures to increase the representation of women professors.

However, women remain underrepresented particularly at the full professorial level and within technical disciplines such as engineering, computer science, and physics.

On the level of doctoral students, a slow but steady increase of the number of women can be observed. With a share of 36 percent in 2024, the proportion of women has increased by 0.6 percent compared to last year. The gender ratio among Bachelor's and Master's students has not changed significantly across ETH in the last years. The proportion of women remains at a low level in 2024 (women Bachelor's students: 34%, women Master's students: 32%, see chart above).

In addition to gender monitoring, ETH Zürich tracks broader diversity indicators, including nationality, discipline, and career stage. Data from the ETH Equality Monitoring reports show that while improvements have been achieved across most categories, the transition from early-career researcher to permanent academic positions remains a key challenge, particularly for women in STEM fields.

Efforts to advance gender equality have been driven by ETH's gender strategy at the professorial level and two complementary programmes. The gender strategy guides faculty recruitment practices, whereas the H.I.T. Programme supports women professors in R3/R4 profiles, and the CONNECT Programme is designed for researchers at the R1/R2 levels. By addressing distinct phases of the academic career trajectory, these initiatives work in synergy to promote greater diversity and inclusion at ETH.

ETH Zürich's gender strategy at the professorial level

The proportion of women professors (Full/Associate R4 and Assistant R3) has been low at ETH, but steadily grew, as illustrated by the following charts showing data from the past ten years (2015–2024).

In 2015, only 45 of the 391 full and associate professors (R4) were women, representing 11.5% of the total. This number has increased over the last ten years: in 2024, 82 (19%) women held a professorship.

In 2015, women represented 22% (18 of 83) of the assistant professors (R3). By 2024, this number had risen to 47, corresponding to 45%, indicating a substantial increase in female representation over the period of 2015-2024. This slow but steady increase in the number of women professors is due to a growing awareness of gender equality and related initiatives at ETH.

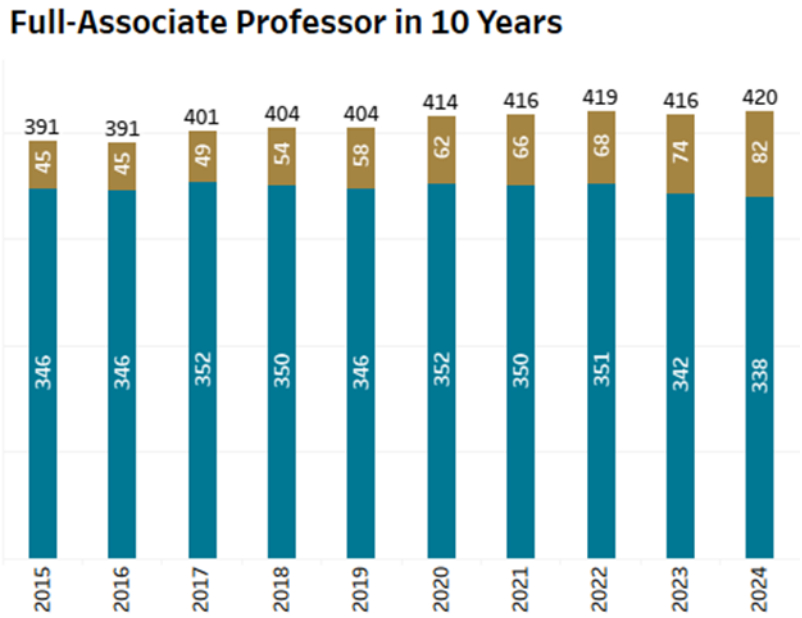


Figure 2: Proportion of women and men on level Full and Associate Professors 2015-2024.

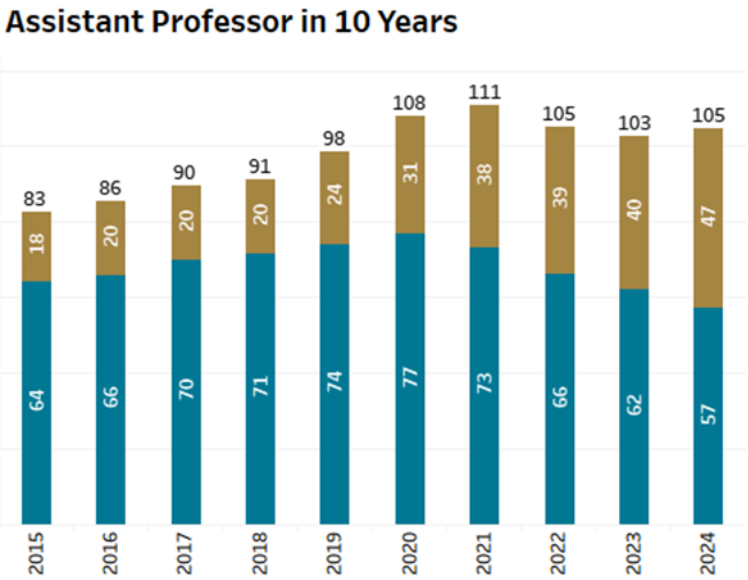


Figure 3: Proportion of women and men on level Assistant Professors 2015-2024.

Swissuniversities, the umbrella organisation of higher education institutions in Switzerland, published a paper with recommendations and good practice for professorial recruitment in 2020. With its own strategy – the Gender Strategy at the Professorial Level, introduced in 2021- ETH is committed to creating a more balanced and inclusive academic environment at the professorial level. With this strategy, ETH has taken decisive steps to boost the number of women professors. The target of reaching at least 40% women among the newly recruited professors has been reached and surpassed: during the four-year period from 2021 to 2024, 49% of all newly recruited professors were women. For the four-year period from 2025 to 2028, the target has been set to 45%.

ETH's Gender Strategy at the Professorial Level is founded on the belief that diversity in perspectives, research approaches, and experiences enhances and strengthens ETH's knowledge-driven mission.

The strategy defines a variety of measures at the level of faculty recruitments:

- Faculty position advertisements are drafted in gender-neutral language and explicitly encourage applications from women. In addition, they emphasise ETH's commitment to equal opportunities, support for dual-career couples, and the promotion of work–family balance.
- Search committees play a pivotal role in the recruitment process for professorships. As a rule, they should include at least three women professors as committee members. Within each search committee, one voting member – typically a male professor from the department – assumes the role of a Gender and Diversity Advocate. This role entails supporting the committee in ensuring fair, unprejudiced and transparent procedures throughout the selection and evaluation of applicants.
- The chair of a search committee is responsible for ensuring that the selection process adheres to the principles of the Declaration on Research Assessment (DORA)[9] and that the committee actively seeks out potential female candidates.
- As a rule, at least two female candidates should be invited to participate in the interview process and the final recommendation of the committee – usually a short list of up to three candidates – should include at least one female candidate.
- For the appointment of assistant professors (R3), which targets early-career scientists, a net academic age limit is in place: candidates should have at most eight years of academic experience since their doctoral examination. Parental leave, industry experience, or the acquisition of relevant competencies outside academia are taken into account when calculating the net academic age. In the evaluation process, the candidates' achievements are assessed in relation to their net academic age, and the full range of criteria relevant to each individual candidate is considered carefully.

Fostering inclusive research careers across career stages

To showcase ETH's efforts in promoting inclusive and sustainable research careers, two programmes have been selected for this case study: the H.I.T. Programme and the CONNECT Programme. These programmes were chosen because they address different, yet complementary, phases of academic career development.

The H.I.T. Programme is designed specifically to support women professors aiming for top academic leadership positions within universities. It targets full and associate professors (R4) as well as assistant professors (R3) and focuses exclusively on academic careers, offering training and networking tailored to the needs of individuals pursuing leadership roles within higher education institutions.

In contrast, the CONNECT Programme is aimed at early- to mid-career researchers (R1 and R2) and takes a broader approach by linking young women scientists with role models from industry and the public sector. Its activities are intended to strengthen professional networks, enhance career prospects, and provide insight into a wide range of career opportunities beyond academic research.

Together, these programmes illustrate ETH's strategic and layered approach to fostering diversity and inclusion in research careers, combining top-down leadership development and bottom-up talent retention strategies.

[9] The Declaration on Research Assessment (DORA) is an international initiative that promotes the improvement of research evaluation practices. It advocates for assessing research based on its quality and impact rather than relying solely on journal-based metrics such as the Journal Impact Factor. DORA encourages institutions, funders, and researchers to use a broader range of criteria to recognise diverse contributions to science.

H.I.T. Programme

The High Potential University Leaders Identity & Skills Training Programme – Inclusive Leadership in Academia (H.I.T.) Programme is a national leadership programme supported by all Swiss universities, including ETH Zürich. Its primary aim is to strengthen the representation of women professors in academic leadership roles at faculty levels by providing tailored skills development and networking opportunities for women professors.

The programme offers structured training in academic leadership and strategic career planning. Participants benefit from networking opportunities across research disciplines, institutions, academic cultures, and leadership levels, mentoring arrangements with senior academic leaders, personalised coaching, and peer support groups. In addition, the programme aims at exchanging best practices for good leadership across Swiss universities, and leadership shadowing opportunities. The programme has been particularly important for supporting women in STEM fields, where leadership positions remain predominantly filled by men.

From 2019 to 2024, 100 women full and associate professors from all research disciplines of Swiss universities, including ETH, participated in the programme. Among ETH participants, notable alumnae include Professor Vanessa Wood, Vice President for Knowledge Transfer and Corporate Relations at ETH, Professor Tanja Stadler, President of the Swiss National COVID-19 Science Task Force, and Professor Annette Oxenius who has recently been appointed ETH Vice President for Research. More than 75% of the participants have taken up new leadership responsibilities in their institutions and/or were promoted to new roles (e.g., chairs) in their faculties.[10] Overall, the programme has seen a steady growing interest over the four rounds (2019 to 2024) with more than 170 applications submitted to date.

The H.I.T. Programme is financed through a combination of national and institutional funding sources. It was initially supported by Swissuniversities through the federal P7 programme (2019–2024), and participating institutions, including ETH, contribute additional funding and in-kind support. Some participant fees are also subsidised by their home institutions. Since the new round in 2025, the H.I.T. Programme is no longer a pilot programme and is now a permanent offer, fully funded by all Swiss universities.

The H.I.T. Programme

The H.I.T. Programme – High Potential University Leaders Identity & Skills Training Programme – is a leadership development programme in Switzerland, aiming to increase the number of female professors in leadership roles at university.

The programme typically enrols approximately 25 participants per annual round, and it is anticipated that around 125 alumnae will have completed the programme by the end of 2025. Evaluation data, though mainly qualitative, suggests that participation in H.I.T. correlates with an increased number of women moving into senior leadership roles at their institutions.

[10] Other notable alumnae include Prof. Virginia Richter, new Rector of the University of Berne (2024, first female rector at University of Berne) and Prof. Annalisa Berzigotti: Clinic Director for Hepatology, Dept. Of Visceral Surgery and Medicine, University of Berne (2021).

Key factors contributing to the programme's success include consistent support from university leadership, the creation of interdisciplinary and cross-institutional peer networks, and the strategic focus on equipping participants with both technical leadership skills and tools for navigating institutional power structures. Alumnae serve as programme ambassadors, and also as role models and agents of change in their institutions.[11]

CONNECT Programme

The CONNECT programme - Connecting Women's Careers in Academia and Industry - is a programme of all ETH institutions - ETH Zürich, École Polytechnique Fédérale de Lausanne (EPFL) PSI, Empa, EAWAG, WSL and the University of Lausanne (UNIL). It encourages young women STEM scientists to plan and develop their career and allows companies to interact with highly qualified women scientists. The CONNECT programme aims to inspire participants to bridge the gap between academia and industry or the public sector. It supports early- to mid-career researchers (R1 and R2) by offering structured opportunities to explore non-academic careers, develop application skills, gain job market knowledge, engage in career reflection, and expand professional networks. A key goal is to connect young women researchers with role models in industry and the public sector, broadening career perspectives beyond academia.

The programme offers approximately seven workshops covering career development, CV preparation, and company site visits, including meetings with role models and HR representatives. These activities facilitate professional exchange, foster interdisciplinary collaborations, and improve visibility for women researchers within the institution.

Since its launch, participation in CONNECT has grown steadily, with 210 participants to date. Feedback has been consistently positive, with over 85% of participants stating they would recommend the programme. Participants particularly value the opportunity to expand networks and receive practical guidance for career advancement.

CONNECT is funded through a combination of national and institutional sources. All participating institutions, including ETH, contribute funding and in-kind support. Since 2023, the programme is funded by all participating institutions and sponsored by industry and public sector partners. Participants pay a fee of CHF 450. Industry and public sector partners cover a variety of sectors, including pharmaceuticals, medical technology, mechanical engineering, reinsurance, optics and optoelectronics, software, and federal departments such as DETEC.

The programme's success is closely tied to its responsiveness to participant feedback, its integration into ETH's broader diversity and inclusion strategy, and its ability to adapt activities to the needs of researchers across disciplines. A current challenge is establishing meaningful connections between participants and industry partners that translate into sufficient employment opportunities.

The CONNECT Programme

CONNECT offers young women researchers (R1, R2) the opportunity to gain insight into non-academic career paths. Participating companies and institutions from the public sector benefit from the direct exchange with highly qualified and highly motivated potential future employees.

[11] As model for the H.I.T. Programme served the AKKA Programme at Lund University, Sweden.

Conclusion ETH case study

The combination of the Gender Strategy at the Professorial Level, the H.I.T. Programme, and the CONNECT Programme illustrates ETH Zürich's strategic approach to fostering inclusive research careers. The gender strategy has contributed to a steady increase in the recruitment of women professors. The H.I.T. Programme focuses on leadership development for senior academics, supporting women professors in advancing to top university management and decision-making positions, directly addressing the need for greater female representation at the highest levels of academia. The inter-institutional aspect of both H.I.T. and CONNECT is crucial for networking and a key factor in their success.

The CONNECT Programme strengthens the early stages of the academic pipeline by providing structured networking, mentoring, and connections with role models from industry and the public sector. This broader focus enhances retention and career development opportunities for early-career women researchers, which is essential for long-term systemic change in STEM fields.

Although quantitative evidence on career outcomes remains limited, qualitative feedback and observed career progressions among participants suggest that these programmes are having a meaningful impact. Key success factors include strong institutional support, integration into ETH's Strategic Framework for Diversity, Equality and Inclusion, and responsiveness to participant needs.

To consolidate the successes achieved so far, continued and sustained investment in longitudinal impact tracking and the further integration of intersectional perspectives will be crucial. ETH's example provides valuable insights for institutions across Europe seeking to strengthen diversity and stability in research careers. At both the national and European levels, dedicated and coordinated funding schemes, policy incentives, and long-term support frameworks will be key to ensure that such programmes can be scaled, sustained, and embedded structurally across the research ecosystem.

Key messages:

- The Gender Strategy at the Professorial Level takes measures to create a more balanced and inclusive academic environment at the professorial level.
- The H.I.T. Programme targets women professors aiming for senior academic leadership roles within universities.
- The CONNECT Programme supports early-career women researchers and links them with role models from industry and the public sector.
- Evidence of success is primarily qualitative but supported by career progression trends and high participant satisfaction rates.
- Continued efforts at institutional, European and national levels are needed to further embed intersectional strategies and to improve quantitative tracking of long-term career outcomes.

Acknowledgements

The authors would like to thank Munjong Kolss (ETH Office for Faculty Affairs), Yiqing Ling (ETH Institutional Research) and Sydney Luca-Lion (ETH Diversity) for their contribution.

ETH zürich

Research careers and the quality of research jobs

Authors: Mykhailo Bezuhlyi, Maryna Kravchenko and Kateryna Boiarynova

Case study from National Technical University of Ukraine Igor Sikorsky Kyiv Polytechnic Institute

Executive summary

National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute" (Igor Sikorsky KPI) is Ukraine's leading technical university, founded in 1898.[12] It comprises 10 educational and research institutes, 14 faculties, more than 10 research institutes; laboratories and centres. As of 2024, there are nearly 23,000 students and over 2,800 academic and teaching staff in the university.

Igor Sikorsky Kyiv Polytechnic Institute places strong emphasis on supporting the development of academic and research staff throughout their career stages. Key programs and practices include:

- Step-by-step system for research skills development: scientific clubs – research groups – scientific schools. [13] [14] [15] [16]
- The All-Ukrainian Innovation Ecosystem Sikorsky Challenge Ukraine: an open platform uniting university, research institutions, public authorities, businesses, investment funds, and NGOs.[17] [18]
- Science Parks: Kyivska Polytechnika Corporation,[19] Fincord-Polytech,[20] Sikorsky Challenge Science Park of Additive Technologies.[21]
- Young Professor Award: Annual recognition of the KPI's academic staff under 35 for their scientific achievements.[22]
- Publication Award: An annual event, during which winners are awarded for the best textbooks, manuals, and monographs.[23]
- Centre for Career Development: supports students and graduates through informational assistance, contributing to successful careers.[24]

Igor Sikorsky KPI actively participates in international research programmes and grant projects such as Horizon Europe, Erasmus+, NAWA, NATO Science for Peace and Security, and others.

The university hosts a wide array of programmes and research centres: The Space Programme, (nanosatellite, PolyITAN), the World Data Centre for Geoinformatics and Sustainable Development,[25] the Educational-Scientific-Innovative Cluster, Sikorsky Energy Innovation Hub, Progrestech-Ukraine, the Ukrainian-Japanese Centre, the Industry 4.0 Centre.

Educational and Research Laboratories[26]: Siemens, Ajax Systems Lab for Electronic Wireless Security Systems, Digital Power, Wiessmann Educational-Technology, KPI—GlobalLogic Ukraine High-Tech, the Virtual Lab for Energy Modelling, Lab of Signals and Processes in Radio Engineering, Renewable Energy,

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[12] Igor Sikorsky Kyiv Polytechnic Institute. *University*. Available at: https://kpi.ua/university

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[22] *Igor Sikorsky Kyiv Polytechnic Institute. Contest "Teacher-researcher".* Available at: https://kpi.ua/en/teacher-researcher

[23] Igor Sikorsky Kyiv Polytechnic Institute. The competition for the best textbooks. *Available at:* https://kpi.ua/en/best-textbooks-competition

[24] *Igor Sikorsky Kyiv Polytechnic Institute. Career Development Centre of Igor Sikorsky Kyiv Polytechnic Institute. Available at: ЦРК – Центр розвитку кар'єри*

[25] World Data Centre for Geoinformatics and Sustainable Development. About us. Available at: http://wdc.org.ua/en/about-us

[26] Igor Sikorsky Kyiv Polytechnic Institute. *Laboratories.* Available at: https://kpi.ua/laboratory?page=3

Cybersecurity Industrial Control System, Student Innovation Tech, Embedded Systems, the Datacom, Lab for Innovative Technologies in Energy and Transport, VLSI etc.

Key findings on research career development at Igor Sikorsky KPI

Over the past decade, the university has faced a concerning trend of declining numbers of highly qualified full-time academic and research staff. Unfortunately, a decrease has been observed across all career stages defined by the European Framework for Research Careers: R1 (First Stage Researcher), R2 (Recognised Researcher), R3 (Established Researcher), and R4 (Leading Researcher):

- 2015: R1 : R2 : R3 : R4 = 1,00 : 0,64 : 2,06 : 0,86
- 2024: R1 : R2 : R3 : R4 = 1,00 : 0,30 : 0,93 : 0,73

This trend indicates the presence of systemic challenges related to the outflow of young talent into other sectors of the economy. This situation is driven by several factors: low salary levels, high academic expectations, and heavy teaching loads for R2-level researchers (550–600 contact hours per year). In addition, many researchers move rapidly to the R3 level because academic ranks are often attained within one to two years after completing a PhD. Career progression is further hindered by the limited availability of positions, many of which are held by employees of retirement age.

Some observations on the definition of academic positions at Igor Sikorsky KPI

There are notable differences between academic and research positions in Ukraine and the profiles defined by the European Framework for Research Careers (EFRC). The EFRC does not define specific job titles or ranks; instead, it outlines four universal researcher profiles: R1 – First Stage Researcher, R2 – Recognised Researcher, R3 – Established Researcher, and R4 – Leading Researcher.

In Ukraine, academic positions are regulated by the Law of Ukraine "On Higher Education".[27] The official list of academic and teaching positions at higher education institutions is established by the Cabinet of Ministers of Ukraine.[28] The structure of academic and research positions in Ukraine does not directly align with the EFRC profiles. Based on comparative analysis, the following correlations are proposed (Table 1).

EFRC profiles	Researcher categories	Academic and Research staff categories at Igor Sikorsky KPI
R1: First Stage Researcher	Researchers conducting research under supervision, typically before earning a PhD	PhD Students (Aspirants), Aspirants employed as Assistants, with a Master's degree
R2: Recognised Researcher	PhD holders who have not yet achieved full research independence, including project leadership or independent grant acquisition	Academic staff: Senior Lecturers with a PhD Research staff: Doctoral Researchers and Junior Researchers

[27] Verkhovna Rada of Ukraine. *On Higher Education: Law of Ukraine No. 1556-VII of July 1, 2014 (as amended on April 9, 2025).* Available at: https://zakon.rada.gov.ua/laws/show/1556-18#Text

[28] Cabinet of Ministers of Ukraine. *On Approval of the List of Positions of Pedagogical and Academic Staff: Resolution No. 963 of August 14, 2019 (as amended on February 18, 2025).* Available at: https://zakon.rada.gov.ua/laws/show/963-2019-п#Text

EFRC profiles	Researcher categories	Academic and Research staff categories at Igor Sikorsky KPI
R3: Established Researcher	PhD holders capable of independently leading research, securing funding, and supervising research teams	Academic staff: Associate Professors Research staff: Senior Researchers
R4: Leading Researcher	Highly experienced researchers, recognised as leaders in their field, and actively managing research projects and participating in national and international expert networks	Academic staff: Professors Research staff: Leading Researchers. Administrative staff: Heads of Department, Deans of the Faculty, Directors of the Institute, Rector

Table 1. Mapping of EFRC Researcher Categories and Academic and Research Staff Categories at Igor Sikorsky Kyiv Polytechnic Institute

Appendixes 1 and 2 present a breakdown of university administrative positions, support staff, and positions related to teaching and research. Between 2015 and 2024, the total number of academic staff and administrators at Igor Sikorsky KPI decreased (reduction of 11.7%).

The number of administrative personnel and department directors at the university increased. The most significant reductions occurred among technical specialists, particularly laboratory assistants (–38.9%) — primarily due to the decline in student enrolment — and librarians (–24.0%) as a result of digitalisation processes.

The reduction in academic staff at Igor Sikorsky KPI between 2015 and 2024 amounted to 12.2 percent. One of the main reasons for this negative trend lies in the specifics of the higher education funding system in Ukraine.

According to the Law of Ukraine on Higher Education, state funding, including the allocation of the state order, is determined by the number of students. Their decline, driven by the reduced birth rate during the economic crisis of the 1990s and large-scale migration processes caused by military aggression, has resulted in fewer contact teaching hours, the consolidation of departments, and, consequently, staff reductions. In addition, a natural attrition of faculty due to retirement continues. The distribution of academic personnel by faculties from 2014 to 2024 is presented in Appendix 3.

It should be noted that Ukrainian universities do not offer non-temporary or permanent contracts for academic and research staff in the full sense. There are two types of contracts used in universities:

1. Temporary contract—in Ukrainian regulations, it is a fixed-term employment agreement for a term of up to 1 year, which can be signed without any competitive selection if the requirements are met.
2. Non-temporary contract—in Ukrainian regulations, it is a contract for a term of up to 5 years, which is signed based on the results of a competitive selection. It can be for 1, 3, or 5 years and it is abbreviated FTE.

Between 2015 and 2024, the number of employees on non-temporary contracts increased only marginally, by 2.3 percent. In contrast, the number of staff on temporary contracts grew by 41.3 percent, which can be attributed in part to the sharp increase in the number of PhD candidates.

A detailed analysis by category shows that after completing third-cycle (educational and research) doctoral studies, the increase in positions at the R2 level remains relatively modest. This is largely due to insufficient salary levels, which motivate young professionals to pursue careers in private companies and organisations that offer higher pay and faster advancement. In contrast, the R4 level shows growth in academic staff. This trend reflects the effectiveness of institutional strategies implemented by Igor Sikorsky KPI to support and incentivise academic progression.

Nonetheless, a structural imbalance between academic and research personnel persists. Until the reform, including the adoption of the Law of Ukraine "On Amendments to Certain Laws of Ukraine on Supporting Research Activities in Higher Education Institutions",[29] academic and teaching staff had been regarded as a single category in higher education institutions.

A closer examination of staff categories provides the following insights (Figure 1 on next page):

- R2: Most contract-based staff are assistant professors, indicating a continuing inflow of early-career scholars into the university sector. Postdoctoral fellows make up 40.8 percent of this category—a relatively high figure, explained in part by the financial support provided to doctoral candidates.
- R3: The proportion of Associate professors within the overall staff structure has remained nearly stable for the past decade.
- R4: Most administrative personnel in this category hold non-temporary contracts. A growing proportion of staff are classified as academic personnel (Professor, Research Professor). The relatively small share of Research Professors (8.1%) is partly due to the common practice of individuals holding multiple positions simultaneously.

[29] Parliament of Ukraine. *Law of Ukraine "On Amendments to Certain Laws of Ukraine on Support of Scientific Work in Higher Education Institutions"*. Available at: Новини комітетів - Президент України підписав Закон України "Про внесення змін до деяких законів України щодо підтримки наукової роботи в закладах вищої освіти" - Офіційний портал Верховної Ради України

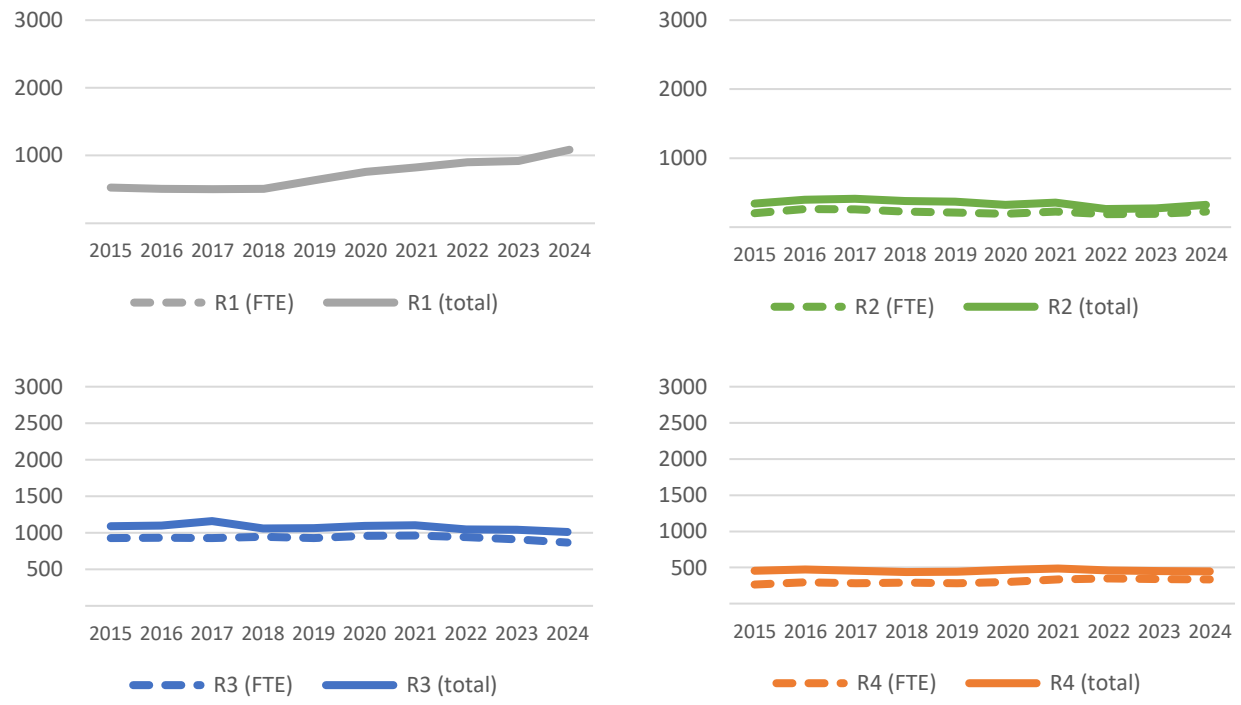

Figure 1 (four graphs above). FTE in Levels of Academic Positions at Igor Sikorsky Kyiv Polytechnic Institute, 2015-2024

Brief description of the "career pyramid" in terms of the evolution of the various profiles of researchers and teachers (R1, R2, R3, R4)

Figure 2 illustrates changes in the ratio of permanent and temporary positions across the four levels of academic careers defined by the European Framework for Research Careers (EFRC), from R1 to R4. Both in 2015 and in 2024, the composition of staff at the R3 level remained stable. At the R1 level, nearly all positions at the university are temporary, which is typical for PhD candidates employed under one-year temporary contracts. At the R2 level, both the number and structure of positions have remained relatively constant, with permanent contracts continuing to dominate.

At the R3 level, the number of permanent positions has remained largely unchanged since 2015. However, the relative proportion of permanent positions within this category has increased due to growth in administrative personnel occupying roles at the R3 level.

At the R4 level, a slight decline was recorded. More notably, the number of personnel classified under R3 has decreased. The percentage of full-time equivalent (FTE) staff in the R2 and R4 categories remained relatively stable, in contrast to the decline observed in the R3 category (Figures 3-4 on the next page). Key contributing factors include the brain drain of academic staff and the depletion of the internal human resource pool.

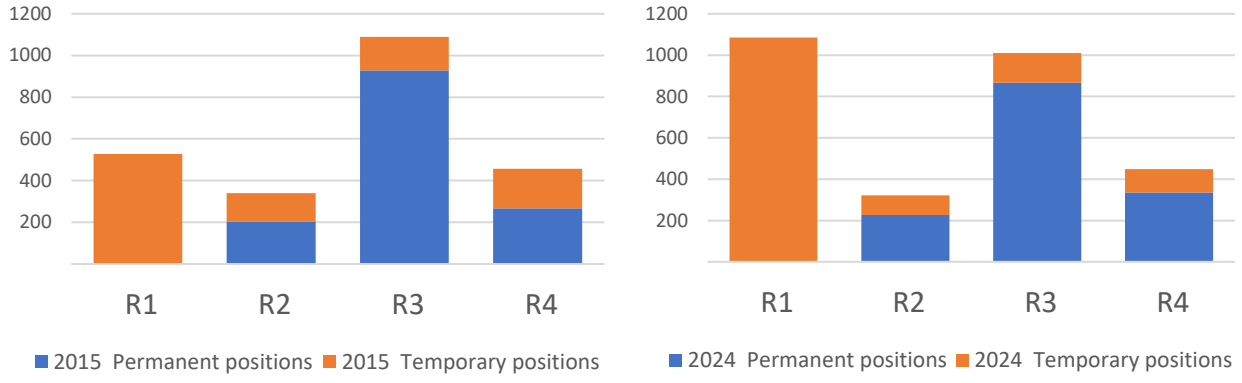

Figure 2: Igor Sikorsky Kyiv Polytechnic Institute academic staff by researcher categories and employment, 2015, 2024

Overall, Igor Sikorsky KPI is experiencing a restructuring of its academic career pyramid. As observed in figures 3 and 4 below, this is characterised by an expansion of its lower tier (R2), weakening of the middle tier (R3), and stabilisation of the upper tier (R4). Such a structure is indicative of a transitional phase in which the system is adapting to external challenges but has not yet achieved a sustainable equilibrium.

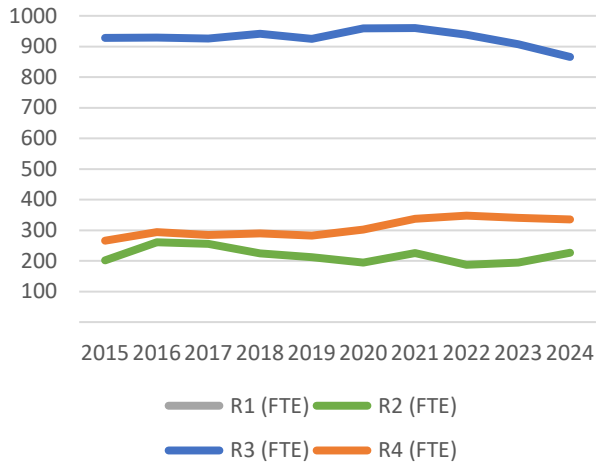

Figure 3. Academic Staff Number of FTE, 2015-2024

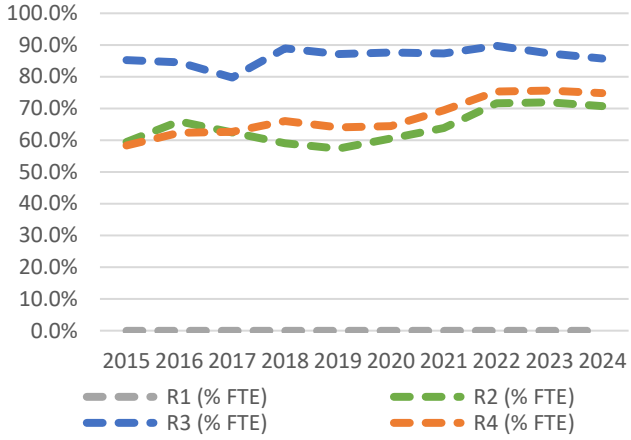

Figure 4. Academic Staff Percentage of FTE, 2015-2024

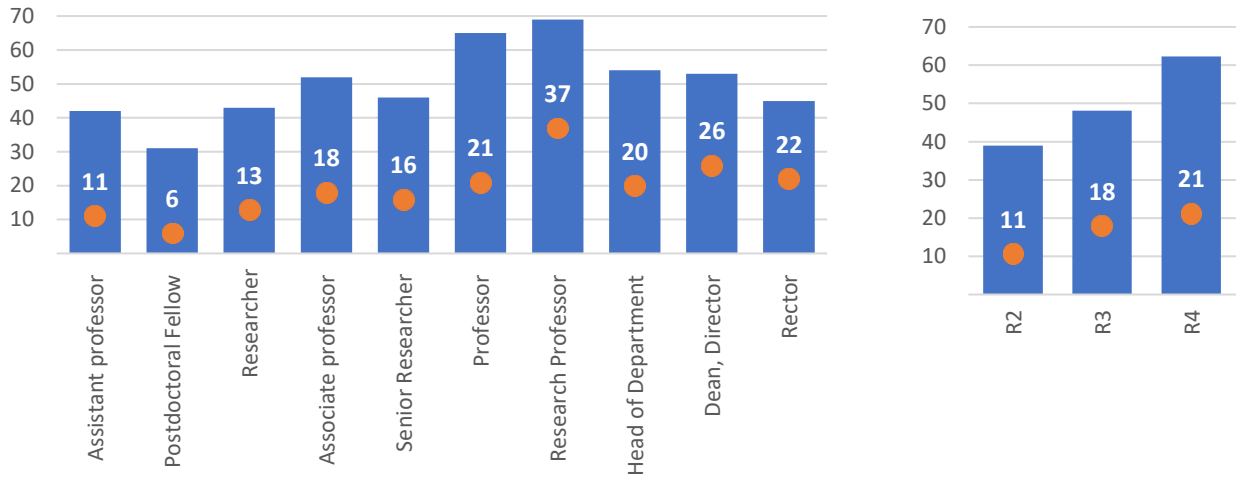

Figure 5. Igor Sikorsky Kyiv Polytechnic Institute academic staff by age (vertical axis) and work experience (figures in white) in the university, 2024

An analysis of the age structure in figure 5 reveals a classic "experience pyramid" typical of Ukrainian higher education institutions. Higher academic positions correspond to older age and longer professional experience, which aligns with the increasing qualification demands across the levels defined by the European Framework for Research Careers (Figure 5, Appendix 4). A closer examination of age and work experience in the left graph of figure 5 provides the following insights:

- R2. The youngest group comprises postdoctoral fellows, with an average age of 30 and approximately six years of work experience. This indicates active participation in postdoctoral programmes and doctoral training by early-career researchers.
- R3. Associate professors and senior researchers represent the mid-career group, suggesting an inclination toward research among younger academic personnel.
- R4. The average age of Heads of Department, Deans, and Institute Directors is 55–56 years, indicating some success in rejuvenating administrative staff. Nevertheless, considering the retirement age in Ukraine (60 for women and 65 for men), the age profile of academic staff remains relatively high.

Lastly, the structural composition of Igor Sikorsky KPI includes 14 faculties, which can be found in Appendix 3. Appendix 3.1 provides a detailed breakdown of academic staff by Researcher Category and employment status for 2024. In units with a large number of employees, the share of temporary contracts is higher, suggesting that these structural units lack a stable model for human resource development and experience moderate staff turnover.

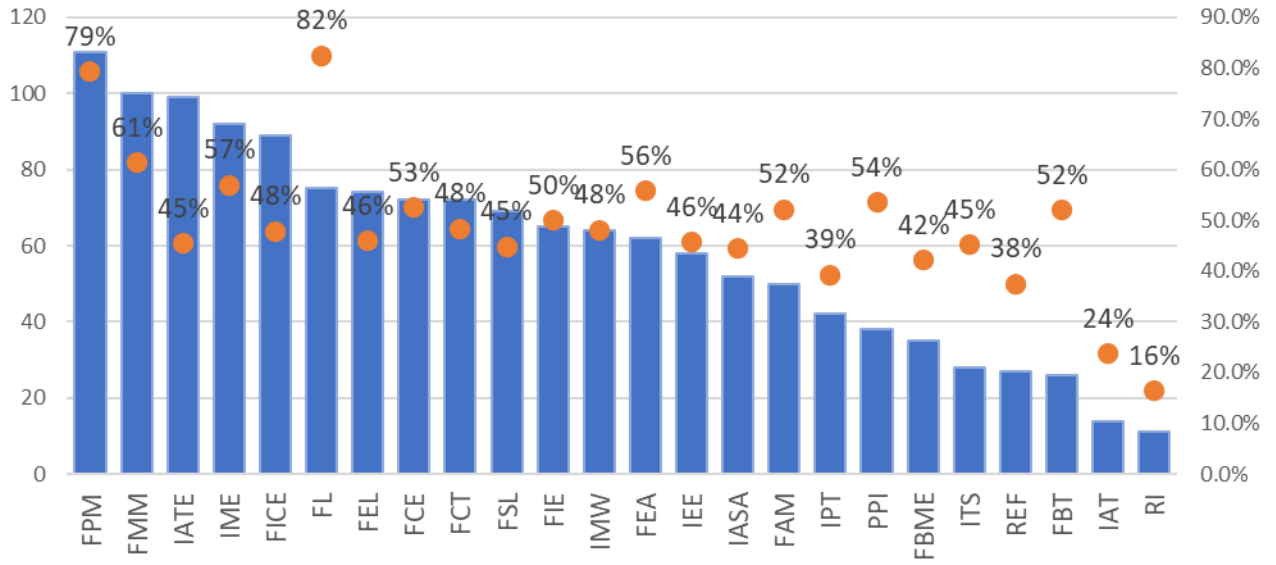

Figure 6. Faculties and Institutes of Igor Sikorsky Kyiv Polytechnic Institute academic staff: number of FTE and percentage of FTE, 2024

Current programmes to support the career of young researchers

Supporting the career advancement of early-career staff is essential for ensuring their professional development and retention within the academic community. Igor Sikorsky KPI participates in various national and European programmes and also implements its own institutional initiatives.

National initiatives supporting research careers

A number of programmatic and institutional mechanisms are in place in Ukraine to support researchers at various stages of their scientific career trajectories:

- Competition for research and development project proposals by the National Research Foundation of Ukraine. In 2024, the Foundation is funding 14 projects at Igor Sikorsky KPI (amounting to €0.47 million), all of which involve the participation of early-career researchers.[30]
- Research project competitions of the Council of Young Scientists at the Ministry of Education and Science of Ukraine.[31] In 2024, young researchers at Igor Sikorsky KPI are implementing 10 projects supported through this mechanism.
- Competitive selection of research and development projects for higher education institutions and national universities.[32]
- Competition for research and scientific-technical (experimental) development projects by young scientists.[33]
- State Scholarships, Awards, and Grants for Ukrainian Scientists. [34] [35] [36] [37] [38]

Initiatives by university supporting research careers

To motivate young leading lecturers at the university Igor Sikorsky KPI holds an annual competition for the Young Teacher-Researcher nomination for Academic staff aged up to 35 inclusive with a higher education degree at least of the Master's level, or scholars aged up to 40 inclusive with a Doctor of Sciences degree.[39]

Academic staff members in full-time positions or with internal part-time employment, working at least 0.25 of a full-time equivalent and with an annual teaching workload of no less than 100 classroom hours, are eligible to participate in the competition. Indicators considered in the evaluation of participants' applications are as follows:

1. Defence of a PhD, Candidate of Sciences, or Doctor of Sciences theses by the nominee or under the nominee's supervision;
2. Teaching disciplines in English, amounting to at least 50 hours per year;
3. Preparation of educational and methodological materials in English;
4. Nominee's share (in thousand UAH) in research projects;
5. Publications;
6. Number of publications, citations, and Hirsch Index (Scopus, WoS, Google Scholar databases);
7. Intellectual property documents received;

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[30] National Research Foundation of Ukraine. *Current calls.* Available at: https://nrfu.org.ua/contests/current-calls
[31] Young Scientists Council. *Projects.* Available at: https://ysc.in.ua/proiekty
[32] Ministry of Education and Science of Ukraine. *Competitive selection of research and development projects by higher education institutions and scientific institutions.* Available at: https://mon.gov.ua/nauka/nauka-2/konkursni-vidbori-naukovikh-naukovo-tekhnichnikh-robit-ta-proektiv/konkursniy-vidbir-proektiv-naukovikh-doslidzhen-i-rozrobok-zvo-ta-nu
[33] Ministry of Education and Science of Ukraine. *On approval of the Regulations on the holding by the MES of Ukraine of a Competition for projects of fundamental scientific research, applied scientific research and scientific and technical developments of young scientists: Regulation* No. 1287 of December 14, 2015. https://zakon.rada.gov.ua/laws/show/z0015-16#Text
[34] NIM Media. *State scholarships and awards for scientists in Ukraine.* Available at: https://nim.media/articles/derzhavni-stipendiyi-ta-premiyi-dlya-naukovtsiv-v-ukrayini
[35] Verkhovna Rada of Ukraine. About the Prize of the Verkhovna Rada of Ukraine for Young Scientists*: Law of Ukraine No. 2675-VIII of* January 16, 2019. Available at: https://zakon.rada.gov.ua/laws/show/2675-19#Text
[36] National Academy of Sciences of Ukraine. *Awards and grants for young scientists.* Available at: http://www.nas.gov.ua/young
[37] President of Ukraine. *About the State scholarships for outstanding young scientists of the National Academy of Sciences of Ukraine*: *Decree No. 945/2000 of* August 11, 2000. Available at: https://www.president.gov.ua/documents/9452000-39
[38] National Academy of Sciences of Ukraine. *Competition for grants of the President of Ukraine to support research of young scientists.* Available at: https://old.nas.gov.ua/UA/Competition/Pages/About.aspx?CompetitionID=002
[39] Igor Sikorsky Kyiv Polytechnic Institute. *Contest "Teacher-researcher".* Available at: https://kpi.ua/en/teacher-researcher

8. Participation in national and international festivals and competitions: Sikorsky Challenge and others;
9. Exhibits and innovative projects presented at scientific and technical exhibitions and events;
10. Textbooks and educational manuals approved by the Academic Council of Igor Sikorsky KPI;
11. Monographs: approved by the Academic Council of Igor Sikorsky KPI; foreign publications; collective works; published in OECD languages; published by leading international publishing houses (e.g., Springer);
12. Supervision of scientific papers, diploma theses, and projects of higher education applicants awarded at national or international competitions;
13. Supervision of higher education applicants awarded at national or international Olympiads;
14. Recognition of the nominee's scientific achievements: awards and grants from the President of Ukraine, distinctions from the Verkhovna Rada and the Cabinet of Ministers of Ukraine.

The evaluation of nominees is conducted by Committees of the Academic Council of Igor Sikorsky KPI. Winners of the Young Teacher-Researcher nomination are approved annually by an open vote of the Academic Council of Igor Sikorsky KPI.

Based on the decision of the Academic Council of Igor Sikorsky KPI, winners of the competition receive a Diploma of the established standard and a salary supplement equal to 20% of their official salary for a period of one year (funded from both general and special university budgets). Young researchers and lecturers of Igor Sikorsky KPI actively participate in the competition, as can be observed in table 5.

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Applicants	27	49	47	42	44	48	46	45	42	64
Winners	25	25	26	35	35	35	35	35	35	32

Table 5. Young Lecturer-Researcher Competition Statistics, 2015-2024

A second example of a university initiative to support research careers is the Competition for the Best Textbook, Educational Manual, or Monograph. This competition aims to encourage faculty and researchers to create high-quality academic works.[40]

A third example is the Sikorsky Challenge Innovation Startup Competition. The goal of the Competition is to identify the most promising innovative developments created by youth, members of the academic community, and representatives of the entrepreneurial sector from both Ukraine and other countries. Students, postgraduates, higher education applicants, researchers, staff of higher education institutions and research organisations are invited to participate.

University support for academic and teaching staff during martial law and military aggression

Since the onset of military aggression, Igor Sikorsky Kyiv Polytechnic Institute has developed and implemented an action plan to support its academic personnel.

Preservation of academic and teaching positions and contracts

The university has ensured the continuity of employment contracts for academic and research staff, including those who have relocated abroad, through a system of flexible workloads. This mechanism has

[40] Igor Sikorsky Kyiv Polytechnic Institute. *The competition for the best textbooks.* Available at: https://kpi.ua/en/best-textbooks-competition

allowed staff to allocate their working hours, either partially or fully, to teaching and/or research activities, depending on individual circumstances.

Strict return requirements were imposed solely on administrative positions, while no rigid deadlines were set for academic staff. This approach helped to minimise the risk of losing key specialists.

Remote work format

Faculty members who are currently outside Ukraine are assigned workloads that do not require in-person presence and are compatible with remote work formats.

In accordance with Igor Sikorsky KPI Order 'On the Procedure for the Work of Employees of Igor Sikorsky Kyiv Polytechnic Institute During the Period of Martial Law',[41] the remote work format, initially introduced during the COVID-19 pandemic, has been officially extended for all academic and teaching staff for the full duration of martial law – until further notice from the university administration. This approach has ensured the continuity of essential processes: educational, through stable online teaching, and research, through support for remote scientific activity. These measures have minimised risks related to staff safety and local travel, while enabling flexible personnel policies during a period of instability.

To maintain the educational process, two remote learning modes were implemented:

- Synchronous mode — real-time online teaching supported by Zoom, which provided free and expanded access to Zoom Meetings for Education for all Ukrainian educational institutions, and by the free Google Meet service.
- Asynchronous learning mode — introduced in response to challenges caused by energy instability, such as blackouts. This mode is supported by the Sikorsky Distance Learning Platform, the open virtual learning environment of Igor Sikorsky KPI.[42] The platform hosts remote courses for all disciplines in accordance with academic curricula. This has ensured 24/7 access to educational content for students and enabled continuous teaching by professors, even under force-majeure conditions (e.g., blackouts, evacuations, or unstable internet connection). When necessary, students and professors can access university facilities equipped with autonomous power supplies and stable internet connection, such as the Scientific and Technical Library named after H.I. Denysenko.

Academic staff and students are provided with access to teaching materials and research publications through the Electronic Archive of Scientific and Educational Materials of Igor Sikorsky KPI, which serves as a comprehensive knowledge base.[43]

Currently, the university operates under a hybrid learning model. In-person teaching is used only for selected educational components and is carried out in university buildings that include access to protective shelters.

Safety conditions

The university has created safe conditions for faculty members and students, including the establishment of air raid shelters in academic buildings. These shelters have enabled the transition to blended learning and provide secure working conditions for academic and teaching staff. A clear distribution system has been implemented, with escort maps guiding students to their designated shelters. Additionally, "Points

[41] Igor Sikorsky Kyiv Polytechnic Institute. Order "On the Procedure for the Work of Employees of Igor Sikorsky Kyiv Polytechnic Institute During the Period of Martial Law" No. NU/78/2022 dated May 26, 2022. Available at: https://document.kpi.ua/2022_HY-78
[42] Sikorsky distance learning platform. Available at: https://www.sikorsky-distance.org
[43] ELAKPI. Available at: https://ela.kpi.ua/home

of Invincibility" equipped with Starlink internet access, computers, and generators allow academic staff to continue their work and students to pursue studies during power disruptions and air attacks.

According to a survey conducted at the beginning of the military aggression, 10% of academic and teaching staff had relocated abroad. Today, this number has decreased to only 1.5%.

Igor Sikorsky Kyiv Polytechnic Institute expresses sincere gratitude to partner universities in the United Kingdom, Poland, and Japan for their financial support in setting up shelters. The total shelter area continues to expand annually, enabling the gradual restoration of in-person learning and the growth of courses delivered offline.

Social and psychological support

In response to the challenges posed by the war, Igor Sikorsky KPI has implemented a range of socially oriented measures.

- Temporary accommodation. This includes the provision of temporary housing for staff members who found themselves in critical life circumstances or were forced to relocate internally from high-risk areas. This enabled researchers from remote or affected regions to continue working in laboratories while residing on campus.
- Material assistance. Staff members facing challenging life situations have the opportunity to receive financial support from the university. The Trade Union Committee of Igor Sikorsky Kyiv Polytechnic Institute has established a dedicated fund to provide financial assistance to university employees whose residential property has been destroyed or damaged as a consequence of military hostilities. This support is strictly allocated to staff members for whom the affected property constituted their sole place of residence.
- Psychological support. The academic staff regularly receive support through psychological counselling services and resilience training sessions.

Research Support

The Scientific and Technical Library named after H.I. Denysenko has ensured remote access to electronic databases, academic journals, repositories, and bibliometric systems such as Scopus, Web of Science, IEEE, Springer, and others.

The practice of holding remote consultations and conducting academic meetings via digital platforms has evolved into a stable model of international research collaboration. What started as a temporary solution has become a sustainable format for scientific exchange in times of limited mobility during the period of martial law.

Early-career researchers of Igor Sikorsky KPI have been able to present their work at international scientific events remotely, which has lowered participation barriers. This has expanded the global scientific presence of KPI researchers, regardless of physical location. Moreover, cloud-based research environments have enabled efficient communication and collaboration in joint projects.

Lastly, video conferencing platforms are also used for thesis defence, allowing participation from academic community members across Ukraine and abroad.

European initiatives supporting research careers at KPI

Horizon Europe Programme. The programme framework includes general support measures to improve access for researchers and institutions affected by armed aggression. Currently, Ukraine's participation in these programme does not require the payment of financial contributions. Additional initiatives have also been established to enhance the engagement of Ukrainian participants and facilitate their active involvement in the programme.[44] Igor Sikorsky KPI hosts two National Contact Points for Horizon Europe and actively participates in projects.[45]

Erasmus+.[46] Igor Sikorsky KPI participates in Erasmus+ through a number of projects, including EUSDIP, ESC4ERG, SSCEU, NEXT, IFU, MATHS-DISC, Eco Minds, UNICITIES, COIL-SERENADE, and Open4UA DIGISKILLS. The university is also actively involved in credit mobility projects (KA1, ICM),[47] which engage students, PhD candidates, and early-career teaching staff.

The German Academic Exchange Service (DAAD). Igor Sikorsky KPI actively participates in DAAD programme, which offer opportunities for study and scholarships to early-career professionals.[48]

Programme of the Polish National Agency for Academic Exchange (Narodowa Agencja Wymiany Akademickie, NAWA). Participation in NAWA initiatives creates favourable conditions for the academic mobility of students, PhD candidates, and academic staff.

Research Fellowships. Academic staff at Igor Sikorsky KPI may benefit from a range of fellowships offered by international universities and organisations.

[44] Horizon Europe Office in Ukraine. On the Exceptional Support for Ukraine in the Field of Research and Innovation. Available at: https://horizon-europe.org.ua/uk/about-he/support-for-ukraine
[45] Igor Sikorsky Kyiv Polytechnic Institute. Vice-Rector Andriy Shysholin on the results of the University's international activities in 2024. *Available at:* https://kpi.ua/2024-pzmz
[46] National Erasmus+ Office in Ukraine. *About the Programme.* Available at: https://erasmusplus.org.ua/programa-yes-erazmus/pro-programu
[47] Department of Academic Mobility of Igor Sikorsky Kyiv Polytechnic Institute. *Credit Mobility Projects (KA1, ICM).* Available at: https://mobilnist.kpi.ua/creditna-mobilnist
[48] German Academic Exchange Service. Available at: https://www.daad-ukraine.org

Conclusion KPI case study

Over the past decade, the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute" has made consistent efforts to develop a support system for research careers, particularly for young researchers. At the same time, a comprehensive analysis of the university's staffing structure reveals both positive trends and persistent challenges that require systemic solutions within the framework of institutional human capital management.

A key strength lies in the multi-level system for developing research skills, from student scientific societies to research groups and schools. Moreover, during martial law and military aggression, KPI has demonstrated crucial resilience in supporting academics to continue their work, both in Ukraine and abroad.

Nevertheless, a long-term analysis of staff composition dynamics according to the European Framework for Research Careers (EFRC) highlights certain risks. In particular, the declining proportion of researchers at the R1–R2 stages points to insufficient mechanisms for attracting and retaining young professionals in academic research and teaching. Widespread use of temporary contracts further contributes to instability, limiting secure working conditions, social protection, and opportunities for professional development.

Internationalisation through programmes such as Horizon Europe, Erasmus+, DAAD, NAWA, and various international fellowships plays a vital role in supporting young researchers. However, these measures cannot fully offset systemic gaps in the national context.

Igor Sikorsky KPI is currently transforming its staffing model in alignment with the EFRC. Establishing a sustainable support model for young researchers requires not only competitions and infrastructure, but also transparent and attractive career trajectories, fair remuneration, academic freedom, balanced teaching and research workloads, and institutional support aimed at the long-term development of the university's research and academic potential.

To fully address these systemic gaps, coordinated action at both the national and European levels is essential. This includes sustained funding for researcher career development, policies that promote stable and attractive academic positions, support for international mobility and collaboration, and initiatives that ensure long-term alignment with frameworks like the EFRC. Such measures would complement institutional efforts and help create resilient, transparent, and sustainable career pathways for young researchers.

Appendixes of this case study

Further details on the KPI case study, together with a full bibliography and an in-depth analysis of R1–R4 researchers by faculty and contract type (permanent versus temporary), are available in the supplementary annex B which can be found here.

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