MINISTERSTVO ŠKOLSTVÍ, MLÁDEŽE A TĚLOVÝCHOVY

SELF-EVALUATION REPORT IN MODULES 4 AND 5

UNIVERSITY: Czech Technical University in Prague

COMPANY REGISTRATION NUMBER (CRN): 68407700

MINISTERSTVO ŠKOLSTVÍ, MLÁDEŽE A TĚLOVÝCHOVY

MODULE 4 VIABILITY

ORGANISATION, MANAGEMENT AND SUPPORT FOR R&D&I

4.1 Organisation and management of R&D&I

The university gives a concise account of its management system and organisational structure for R&D&I, highlighting the following aspects:

- the role of the rector's office, dean's office and the management of the university's institutes in the organisation and management of R&D&I,
- the involvement of international scientific councils or other independent advisory bodies (if any),
- the university's organisational structure in relation to R&D&I (e.g. the internal structuring of institutes and departments into research or project teams, if there is any such structuring; interdisciplinary research centres, etc.),
- the relevant internal regulation is included as an appendix to the general information on remuneration at the university.

It also briefly comments on data from the appendix (tables 4.1.1 and 4.1.2) on the number and structure of the university's employees contributing to R&D&I.

Self-evaluation:

CTU consists of 8 Faculties, 6 University Institutes (referred to here as "Institutes"), and the rector's office. One of the Institutes – the Institute of Physical Education and Sports – does not have research in its mission, and therefore does not appear in this document and is not evaluated. The Faculty of Architecture stands somewhere in between technology and the arts, is included in this evaluation although most of the Faculty's architectonic results are not scientific per se.

The management of the university is governed by the law and by the Statute of CTU, approved by the Ministry of Education, Youth and Sports.

The Rector's Office is responsible for contacts and contracts with the "outside world ". It also provides information, guidance and best practices to the Faculties and Institutes, and carries out internal auditing and control activities. Some big projects, typically advancing the university as a whole, are managed within the Rector's Office.

The Faculties are – by law and by the Statute – responsible for the scientific research conducted within their labs, institutes and departments. The Faculty statutes specify the internal structures and the rules of operation within the Faculties, under which Dean's Offices support and control the research within their Faculty. This system allows the structures to reflect the broad scope of CTU and also the fact that the scientific output of each of the four oldest Faculties of the CTU is sufficient to exceed the scientific output of most universities in this country. The high degree of independence of the faculties is justified by the significance of their work.

The CTU culture is based on a high degree of freedom together with responsibility – the Faculties as well as the Institutes have always had a high degree of autonomy, and they have given a high degree of autonomy to their departments and to their professors. In turn, the professors have worked hard to guide young colleagues towards excellence, to serve the community and to obtain external funding to carry out their research. 300+ years of history prove that this recipe has worked well within the Czech boundary conditions.

HTML links to additional documentation: Statute of the CTU

4.2 Support system of R&D&I and measures to stimulate high-quality science

The university gives a concise account of systemic stimulation measures / tools (if any) to promote quality of R&D&I. This can be done in a bulleted list for the university as a whole.

Self-evaluation:

CTU is dedicated to the quality of its services to the community, the most important of which are research and education. The university stimulates high quality R&D&I through:

- Rector's prizes: for the Best Scientific Result, the Best Publication, the Best Technology Transfer to Industry, the Best PhD Thesis, and the Best PhD Supervisor.
- Renumeration for Authors of Publication(s) in journals with IF and for authors of cited articles (RAPC).
- The governmental R&D&I funding is distributed to the CTU units according to their R&D performance, and their Innovation performance, based on publication quality, citations, licensed and international patents and research cooperation with industry.

The CTU information system provides various data enabling direct comparisons to be made between its units and scientists. This data and ranking is used by the university management and also by individual scientists. This open competition has a positive effect on the quality of the outputs, and offers a clear indication of the high standards that are to be maintained ("name and shame" – poor performance does not go unnoticed).

Stimulation measures are also applied at Faculty level and at Institute level.

HTML links to additional documentation:

4.3 Institutional regulations for the use of institutional support for the LCDRO

The university describes its strategy for using institutional support for the LCDRO in managing institutionally supported research work (e.g. prioritising the university's research topics in line with individual needs; internal grant agencies; motivational tools) and how institutional support was split among individual workplaces / research teams in the 2014–2018 reporting period.

Self-evaluation:

CTU is gradually moving from allocating money to the Faculties and Institutes on the basis of "how it comes from the government". New CTU money allocation rules are gradually being implemented.

At the beginning of the period under review, all money was allocated to the Faculties and Institutes on the basis of the Evaluation of the Research and Development Council of the Government of the Czech Republic, with the exception of the money awarded for Rector's prizes for research (approx. CZK 1M).

In 2018, LCDRO money was used at the level of the university to stimulate RAPC (see 4.2). A part of this money was distributed to the Faculties on the basis of the new CTU rules, which emphasized and therefore implied quality.

In 2020, the amount of money distributed using the CTU rules was increased, and the *Rector's future fund* was established.

HTML links to additional documentation:

4.4 Strategy for the establishing, financing and long-term development and sustainability of research centres and large research infrastructures[1] (if any)

The university gives a concise account of its strategy for the sustainability and development of its large research infrastructure, if it is the host organisation for such a project. It also describes its strategy for the sustainability and development of its research centre(s) developed in 2007–2015 under the European Structural Funds (Operational Programmes: Research and Development for Innovations, Prague – Competitiveness) and supported during the sustainability period under the National Sustainability Programme, if such a research centre is part of the university.

Self-evaluation:

CTU hosts or participates in a significant number of Large Research Infrastructures. These can be divided into in situ facilities (the VR-1 Training reactor, the Van de Graaff particle accelerator) and the participation of Czech teams in major international research facilities (CERN, Brookhaven National Laboratory, FAIR Darmstadt, Laboratoire Souterrain de Modane, Fermilab). A systematic approach to key operational factors, which determines their sustainability, covers: 1) a long-term human resources development strategy; 2) long-term multisource financial support; and 3) systematic building of a portfolio of users (both national and international). In the case of in situ facilities, these factors are complemented by regular upgrades of the technology, which are crucial for the long-term safe, secure and effective operation of these nuclear research installations.

The two CTU research centres developed from European Structural Funds (*University centre for energy efficient buildings* and *Centre of vehicles for sustainable mobility*) are sustainable by design. The main points of the strategy are that CTU 1) set up realistic projects, 2) appointed excellent

[1] *Under Section 2(2)(d) of Act No 130/2002, as amended, a large research infrastructure is a research infrastructure that is an essential research facility for comprehensive research and development work with high financial and technological demands, which is approved by the government and established to also be used by other research organisations.*

scientific managers as directors, and 3) reached consensus on financing among all stakeholders before launching the project.

HTML links to additional documentation:

4.5 Training system in the area of intellectual property protection and technology transfer

The university gives a concise account of its internal system for training undergraduate and postgraduate students and employees in the area of intellectual property protection and technology transfer (if there is such a training system).

Self-evaluation:

The Rector's Office's Department of Technology Transfer, which includes the Patent Centre, is a dedicated department responsible for supporting the agenda of intellectual property protection and technology transfer. The CTU Patent Centre provides help with writing and submitting patent applications for the whole university, and also carries out training in this area.

Training in the area of intellectual property protection and technology transfer is also developed and performed as a part of the HR Award process, in cooperation between the Department of Technology Transfer and the CTU library.

Guidelines and information materials are prepared with the help of working group D of the OP VVV project "Development of capacity for strategic management of research at CTU in Prague - CZ.02.2.69/0.0/0.0/16_028/0006215.

Training and professional workshops in the field of intellectual property and technology transfer are carried out within the OP VVV project "Supporting expert capacity for effective technology transfer at CTU" - CZ.02.2.69 / 0.0 / 0.0 / 16_014 / 0000650.

There is a compulsory elective course XP32ODV under the title "Intellectual property protection" at the Faculty of Electrical Engineering, which is especially aimed at doctoral students in e-learning form.

Training is also provided by our CTU InQbay incubator.

There is a section on Intellectual Property Protection - FAQ Copyright, FAQ Patents", on the CTU Library website. There is also a face-to-face course and an e-learning course entitled "Information for Science and Research" for PhD students, in which part of the course is devoted to intellectual property protection, types of legal protection and patent databases.

HTML links to additional documentation:

DOCTORAL STUDIES

4.6 Organisation of doctoral studies

The university gives a concise account of the organisation and management of doctoral studies: structure, key statistics, information on promotion and recruitment schemes, external communications concerning doctoral studies (e.g. cooperation with the Czech Academy of Sciences, cooperation with the application sphere, recruitment abroad, etc.), eventually any other relevant information such as the existence of a doctoral school, basic courses in soft skills, etc.

Self-evaluation:
All eight Faculties and also the Klokner Institute host doctoral programs. One common doctoral program – the History of Technology – is temporarily hosted by the Rector's Office. The vast majority of doctoral programs are accredited for four years of study; a few three-year programs are hosted by the Faculty of Transportation Sciences.

There are currently 1942 PhD students enrolled in a total of 205 PhD programs at CTU. The number of PhD study programs is abundant at the moment. This is temporarily inevitable, due to a transition period forced by a change in the Act on Higher Education, effective since September 2016. This change required all programs to be re-accredited. Temporarily, what is in fact the same study program mostly counts as four accredited programs: the old program running in Czech, the old program running in English, the new Czech program and the new English program. The transition will be completed by the end of 2024, when the old programs will come to an end.

Most of the doctoral programs are accredited both in Czech and in English. A small number of exceptions fall into the category of old programs accredited before 2016. These programs can no longer admit new students and are being replaced by newly-accredited programs as quickly as the National Accreditation Office is able to process them.

Most of the Institutes of the Czech Academy of Sciences (CAS) are located within Prague. CTU makes use of this advantage and has an umbrella agreement on joint PhD Education with CAS. Institutes of the Academy working in areas relevant to CTU study programs take part in our PhD programmes on the basis of agreements between Faculties and CAS Institutes. Access to CAS staff and facilities, and to the whole cluster of top-class facilities and institutions in Prague, adds greatly to the experience of studying in a PhD program at CTU.

Many dissertation topics are in response to the direct needs of industry, while others are more focused on basic research. In particular, several PhD study programmes at the Faculty of Nuclear Sciences and Physical Engineering are based on pure science, focusing on high energy physics, theoretical informatics and mathematical physics.

PhD students are considered as First Stage Researchers (R1 according to the European Framework for Research Careers), and their rights and duties have been guaranteed since 2017 by The European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers, which are endorsed by CTU.
The right and duties of PhD students are also considered in Action Plan HRS4R converging to HRS4R - The Human Resources Strategy for Researchers as a part of the HR Award process. PhD students will also be included in the CTU Career Code, which is under discussion.

Soft skills courses are offered to PhD students by their faculties. Since 2015, the Rector's Office in cooperation with National Technical Library has run a course in Scientific Writing, in the winter semester and also in the summer semester. Since 2017, this course has also been made available to PhD students from neighboring universities and Institutes of the Academy of Sciences, who have made use of this opportunity.

HTML links to additional documentation:

4.7 Internationalisation of doctoral studies

The university gives an account, with specific examples, of international cooperation in doctoral studies, e.g. building open doctoral study programmes for foreign nationals and creating international networks for doctoral studies; care for foreign students coming within the framework of mobility; support and the existence of joint individual doctoral studies as part of international cooperation (e.g. joint degrees), individual contracts (e.g. cotutelle degrees), study visits and research internships abroad, etc.

Self-evaluation:

Internationalization of doctoral studies is an important part of the CTU Strategy for international cooperation in R&D. CTU doctoral programs are generally available both in Czech and in English. The preferred language of a PhD thesis is English.

The CTU Study and Examination Rules stipulate that PhD students must gain experience abroad as a part of their education (except for students coming from abroad). At the same time CTU actively supports efforts to attract prospective PhD students from abroad.

The CTU international office (part of the Rector's office) supports international students. We are part of Comenius, Erasmus+, Erasmus Mundus, Leonardo da Vinci, Athens, France Mobility, to name at least the main programs. Any international student has a right to obtain affordable accommodation within CTU student dormitories. We provide assistance during the visa process (we make use of *régime student,* introduced by the Ministry of Foreign Affairs). In 2019, a good connection was established between universities in Prague and the city hall. We are happy that the City of Prague has established an office that helps young researchers from abroad to settle in Prague.

CTU strongly prefers individual contracts (en co-tutelle) to joint degrees at PhD level. Individual contracts are simpler to administer and easier to adapt to the needs and the personalities of specific students and supervisors. 21 dissertations were defended as double degrees (en co-tutelle) between 2014 and 2018.

Our programs are open to any nationality, except when an embargo prevents us from accepting citizens of certain rogue states. Supervisors as well as the PhD support administration have sufficient command of English. We switch to English whenever English-speaking colleagues appear.

CTU was active in setting up the *Study in Prague* platform, and has been a very active member since its very beginning. It enables us to join forces in collaborative brand building of Prague as a recognized worldclass educational and research centre. Since 2014, PhD programs have been advertised to foreign students and universities through this channel.

CTU has been a spiritus movens in the establishment of **Prg.ai**, which promotes research in Artificial Intelligence (AI). Prg.ai was set up by CTU, Charles University and the City of Prague. It supports research, development and education in the area of AI, and aims at attracting excellent PhD students, scientists and developers from around the world to Prague. Prg.ai is now a strong ecosystem with broad industry participation.

CTU has signed a number of MOUs and agreements on cooperation with foreign universities and research institutions, of which 238 are currently valid. Of these agreements, 110 are with universities ranked in the top 500 by QS. Of these agreements, 69 are focused on research cooperation, while the others cover a broader range of cooperation. We keep the rule that Faculties and Institutes are

autonomous in signing agreements on their own. Once more than one CTU unit is involved in cooperation with the same partner institution, an agreement can be signed at university level. The number of active cooperation agreements, including Faculty agreements, exceeds 500.

HTML links to additional documentation:

4.8 Subsequent careers for doctoral graduates (support conditions)

The university lists specific measures to support doctoral graduates (e.g. internal subsidy schemes for the further development of new scientists, postdoctoral fellows, active search for opportunities abroad, etc.) and provides representative data in the appendix (table 4.8.1) to illustrate subsequent careers for doctoral graduates, with a maximum of ten examples of how graduates proved themselves in the 2014–2018 reporting period.

Self-evaluation:

New young researchers are important.

CTU has no systematic approach to help fresh PhD alumni to get a job, simply because that is not an issue (nor is it or has it ever been for our master or bachelor level alumni). Rather, we provide a high standard, which ensures that our graduates are competitive on the employment market. Our PhD students are involved in international scientific or R&D cooperation, and are very attractive for employers. This leads a more serious issue - that PhD students are lured away, and may leave for an industrial career instead of submitting their dissertation.

Our approach goes beyond just subsidizing PhD students. We create fair conditions for them. We provide incentives based on results, not on age. A high degree of autonomy is offered to anyone in academia, but results count. In addition, some faculties have internal funding schemes to support postdocs in establishing their own research groups, submitting competitive research projects and establishing international cooperation.

Subsequent professional paths for doctoral graduates are defined in the CTU Career Code, which is currently under discussion.

HTML links to additional documentation:

4.9 Rules for funding doctoral students, including foreign students (stimulation and motivation tools)

The university provides information on methods for funding doctoral students (Ph.D. students), including foreign students, covering personal expenses (grants) and other expenses. The university also lists specific stimulation and motivation tools of the financial support for doctoral students in addition to their regular grants.

Self-evaluation:

Students are funded according to the Rules for Granting Scholarships of CTU. To the best of our knowledge, CTU is the only Czech university that has implemented an obligation to pay a minimum of CZK 12 000 (approx. EUR 480) /month/(doctoral student) directly into the Scholarship rules.

An important part of PhD student funding is provided via the CTU Student Grant Competition. Any PhD student is eligible for a grant. The money can be used for travelling to conferences, equipment and materials; a student can be awarded up to EUR 5500 per year in the form of a scholarship. These small grants not only provide money for students, but also help them to learn how to apply for grants later in their professional career.

Students are fully eligible for Rector's Prizes and for renumeration for excellent publication(s) and / or for citations. PhD students are evaluated annually. Based on the results, they receive additional scholarship money.

The vast majority of PhD students work as members of research teams that are supported by external grants, under the supervision of a professor. This work is a further source of income for the student, and helps to cover the student's research costs.

HTML links to additional documentation:

https://www.cvut.cz/en/internal-ctu-regulations

https://sgs.cvut.cz/

NATIONAL AND INTERNATIONAL COOPERATION AND MOBILITY IN R&D&I

4.10 Significant cooperation in R&D&I at national level

The university gives a maximum of five specific examples of cooperation in R&D&I at national level.

Self-evaluation:

GE Aviation Czech - has decided to establish an R&D and production center for its new segment of turboprop engines in CR. This was enabled by a collaborative agreement with CTU-FME which gave GE Aviation Czech access to the testing infrastructure of the ground testbed (dynamometric, core, propeller) and the flying test bed at FME for the new generation of turboprop engines. The test cells were built using EU structural funds in a program in which FEE, FNPE of CTU and FME TU Brno also participate.

CESTI is a research project focused on technical innovations aimed at eliminating deficiencies in the present-day transport infrastructure. It deals with the road and railway transport network, including bridges and tunnels. Environmental issues, aspects of safety and reliability of structures and effective management systems are addressed comprehensively. The project

responds to the requirements for a cost-efficient, material and energy sustainable, resilient, reliable, smart and accessible transport infrastructure. A project worth EUR 13,793 Million.

Skoda Auto – Long-term cooperation with the leading car producer in Czechia, working on topics across all CTU Faculties:

The core of the virtual reality system for pre-production phases (called VRUT - Virtual Reality Universal Toolkit) was developed by a group headed by prof. Jiří Bittner. His team develops new components/functions of VRUT every year based on requirements communicated by Skoda Auto experts. In 2018, VRUT replaced some of the other commercial VR systems previously used in Škoda Auto.

Other R&D topics include thermodynamic engine simulations, modeling of cycles of vehicles of all drives, gearboxes, internal and external aerodynamics, development of production technologies, innovations in mobility such as car sharing, robotics for production (including robots for product line operator rehabilitation), etc.

Czech Aerospace Research Centre, together with other companies (VZLU, 5M, Rigaku, TTS, IST, HVM Plasma) - preparation and implementation of experiments for the Czech VZLUSAT-1 satellite for miniCube missions QB50 (launched on June 23, 2017).

C-ROADS Czech Republic - together with 8 other participants - implementation of cooperative systems on specific highway sections in the Czech Republic, cities, public transport and railway crossings and test operation of services for drivers. The project is a part of the European platform for implementing harmonized cooperative systems and service operation for end users in all EU states.

HTML links to additional documentation:

4.11 Significant cooperation in R&D&I at international level

The university gives a maximum of ten specific examples of cooperation in R&D&I at international level. The university briefly describes the forms of international cooperation (at their own discretion). It also presents in brief the specific results and impacts on R&D&I for the university resulting from the international cooperation described above, presenting a maximum of ten examples.

Self-evaluation:
Representative examples of cooperation:

CERN –
Scientists from CTU play an active role in cutting-edge experiments in particle physics at CERN, addressing basic questions of matter and the universe. In the ALICE and ATLAS experimental collaboration projects on the Large Hadron Collider (LHC), scientists from CTU are key members of the team and contribute significantly to the collection and evaluation of the experimental data and to the planning of future experiments.

Brookhaven National Laboratory
Our participation in this multinational research center operated by the US Department of Energy resulted in the fact that the DoE is listed as the number one institution in terms of international co-authors of CTU publications.

C.E.L.S.A. alliance
CTU is a founding member of this alliance aimed at selecting and incubating promising new international teams (and providing seed money for their initial collaboration in research, before they are mature enough to apply for money from EU funds).

Joint Research Centre (JRC)
Collaboration with several JRC sites (Karlsruhe, Petten, Ispra) allows our scientists to contribute to the quest to address important issues of today, e.g. safe use of nuclear energy, nuclear non-proliferation, sustainable energy systems, and others.

ESA
Many contracts focused on developing and characterizing components for terrestrial and space use, e.g., the thermal hyperspectral imaging system (THETIS), which integrates a calomel-based acousto-optic tunable filter, the calibration standard for the ESA I-SOC space optical clock project, etc.

Toyota
The Toyota Research Lab was established at the Faculty of Electrical Eng. in 2017 as a result of long-term collaboration, since 2003, on a project basis. The Toyota Research Lab integrates researchers from three departments of FEE, covering a broad range of expertise (computer vision, artificial intelligence, simulation, graphics) relevant to autonomous driving. The Lab has been successfully reviewed, and the funding will be long-term. Toyota Motor Europe funds this unit at approximately EUR 1 Million per year. The unit is headed by Prof. Jiri Matas.

NANOCEM
This is a consortium of academic partners (24) and industrial partners (9, including Heidelbergcement, LafargeHolcim, and Sika), all interested in fundamental research in the nanoscale science of cement and concrete. CTU has been a representative since the beginning in 2004. Close collaboration resulted

in Core project 10 – Micromechanical analysis of blended cement-based composites (2012-2015, 226 kEUR) and the development of ConTemp software (which is now used in 20+ countries in the world).

Adobe (USA) – a gift (USD 189k) in support of research activities in the field of automatic stylization of images and videos based on hand-drawn exemplars, 9 journal articles and 6 U.S. patents were created between 2014 and 2018).

Managing Automated Vehicles Enhances Network (MAVEN)
Collaboration among 7 partners (CTU FTS; IMTECH TRAFFIC & INFRA BV; Deutsches Zentrum für Luft- und Raumfahrt; Hyundai Motor Europe Technical Center; TomTom; POLIS; City of Helmond).
Solutions for managing connected and automated vehicles in an urban environment (with signalized intersections and mixed traffic). A unique local-level routing algorithm for optimal infrastructure-assisted routing of automated vehicles. A solution for impact assessment combining user assessment, field tests and microscopic simulation has been adopted.

RICAIP (Research and Innovation Center for Advanced Industrial Production)
This center is being developed at CIIRC CTU with 3 partners: DFKI and ZEMA (Germany) and CEITEC BUT. It is aimed at building highly distributed testbed facilities which can be interlinked using virtual and augmented reality to be fully integrated in functionalities that are distributed physically. The European-wide network of RICAIP-compliant testbeds is expected to form the backbone of the R&D activities in AI and robotics for industrial applications.

HTML links to additional documentation:

4.12 Mobility of academic staff and researchers (including segmental and intersegmental mobility)

The university gives a concise and structured account of the mobility of its academic staff and researchers, covering the following areas:

- the mobility of doctoral students and academic staff in connection with R&D&I (strategy, system, policies), with a maximum of ten specific examples that it considers especially fruitful,
- any barriers to the mobility of academic staff and researchers.

Self-evaluation:

The Study and Examination Rules for Students at CTU require PhD students to spend at least one month at a research institution outside the Czech Republic for the purposes of their research. Some faculties have internal rules that require longer research stays.

Mobility is one of the criteria for the evaluation of researchers, for selection processes and for the system for promoting academic staff, according to the CTU Career Code, which is currently under discussion.

The rules for Habilitation Proceedings and for Proceedings to Appoint Professors at CTU have since 2017 included mobility experience among the criteria for promotion.

CTU takes advantage of national programs supporting mobility. Within a project under the title Development of Intersectoral Mobility, EUR 8 Million has been spent on hiring post-docs from other universities. Since then, multiple projects supporting CTU staff travel to gain experience abroad have

been obtained. While CTU offers help, the primary responsibility rests on the shoulders of department heads and individual employees.

Examples:

M. Čapek - Lund University, Sweden: A novel topic of fundamental bounds in electromagnetism has been developed from its theoretical foundations to practical implementation in state-of-the-art EM solvers. The development has been based on strong international cooperation in which CTU in Prague is now a participant. There is ongoing fruitful collaboration, including workshops organized twice a year, short courses at conferences, invited talks, and joint publications.

D. Sýkora – Walt Disney Studios, USA: A novel Ink-and-Ray algorithm enabling automated conversion of 2D cartoons into 3D versions. This work was materialized in the Lion King, released in July 2019. The Lion King is the highest-grossing animated film of all-time.

V. Klika - University of Oxford's Mathematical Institute, UK. He applied his expertise in nonequilibrium thermodynamics to mathematical modelling of biological processes. The visit has so far resulted in three joint journal publications and a monograph on multiscale thermodynamics, and has led to continuing collaboration.

M. Svítek - The University of Texas at El Paso, USA: Visiting professor; Lectures on Sustainable Transportation and Smart Cities. Development of a new Dual Master's Degree Program in Transportation and Logistics Systems under the Atlantis project. Establishment of a new Joint-degree master program in Smart Cities.

J. Holub – Pennsylvania State Univ.: Fulbright Visiting Scholar Program. Benefits: extending the researcher's specialization to a new topic, starting new cooperation, new insights into research, teaching and university organization

D. Vrba - Thomas Jefferson University Hospital, Philadelphia, USA. He studied the use of metamaterials for microwave surface hyperthermia, and cooperation with Prof. Paul Staufer has been established. This cooperation has led to several publications in Q1 journals and to progress in cancer medicine.

L. Šnobl - Centre de recherches mathématiques, Montréal, Canada. Joint publications including a monograph on Lie algebras. In 2018, he became an External Associate Member of the Mathematical Physics Laboratory of the Centre de recherches mathématiques.

Young scientists:

M. Fencl - Eawag - Swiss Federal Institute of Aquatic Science and Technology, PhD-intership, and Technical University of Denmark - Environment, **postdoctoral researcher.** This promising young researcher works on rainfall-runoff phenomena in urban river basins, the use of data from the network of microwave links operated by telecommunication operators to estimate rainfall intensities, and on integrating this data into the urban drainage system. Both mobilities helped him to establish valuable international cooperation for himself and for CTU.

Vasilija Abramović – UCL Bartlett School of Architecture, UK., In the framework of her PhD research under the supervision of Prof.dr.ir. Henri Achten, Vasilija Abramović was from 2017-2019 a member of the Interactive Architecture Lab of the Bartlett School of Architecture, University College, London.

From 2018 she obtained the position of Visiting Lecturer at the University of Westminster, School of Architecture and Cities.

The high teaching load, which used to be a major barrier to academic staff mobility, has gradually been alleviated as the ratio between students and researchers has decreased.

HTML links to additional documentation:

https://www.cvut.cz/en/habilitation-procedures-and-procedures-for-appointing-professors

4.13 Internationalisation of the internal environment

The university describes the basic framework for the internationalisation of its internal environment in relation to R&D&I and lists the tools to meet the objectives of internationalisation and how they are implemented. Any barriers to internationalisation can also be mentioned.

Self-evaluation:

The university has taken measures to create an international environment within all CTU units. While English is the *lingua franca* for researchers as well as managers, part of the support staff has still poor command of English, despite the availability of courses and attempts to motivate participation in them. The present situation may last some more time, as older people had to learn Russian at school and at the unversity, not English.

An important step forward was completed in 2014 as a side-effect of the Development of Intersectoral Mobility project, e.g. bilingual documents such as work agreements, translation of internal documents into English and making English truly the second language of the CTU webpages..

Internationalization of the internal environment in relation to R&D&I also forms a part of the HR award process. Most internal documents and forms are available in English, and administrative staff are required to speak English.

The CTU Guidelines for Recruitment document is under preparation. Article 2 of the Hiring Process Code for Academic Staff at CTU will be accordingly revised to provide standards for the recruitment procedure in terms of openness, efficiency, and transparency, including the obligation to announce each position in English language on the university web and also on the university EURAXESS profile.

HTML links to additional documentation:

HUMAN RESOURCES AND CAREERS IN R&D&I

4.14 System for career growth for academic staff and researchers

The university describes the system for career growth for academic staff and researchers. It presents information on long-term placements for own academic staff abroad, and for foreign academics at the evaluated university (i.e. sabbaticals, whether there are particular regulations or a support system); international selection procedures; regulations for career growth; mentoring (if any); the transparent distribution of institutional Full Time Equivalents (FTE´s); its position on successive contracts and senior academic posts; arrangements for staff to return after placements at external workplaces, including abroad; any other information the university considers relevant. It provides a link to any career regulations or similar document (if any).

Self-evaluation:

The system for career growth for academic staff and researchers is described in the CTU Career Code, which is currently under discussion, and also in the CTU Guidelines for Recruitment working document.

Faculties and Institutes already have an annual evaluation system for teaching and scientific achievements and other activities of academic and research staff.

The university has a transparent scheme for distributing money. There is no direct regulation on the number of FTEs – e.g who has money, who can pay / hire people.

HTML links to additional documentation:

4.15 Evaluation system of academic staff and researchers and filling key positions in R&D&I

The university gives a concise account of its evaluation system of academic staff and researchers (the basic rules and principles for internal evaluation) and the rules for filling senior positions in relation to R&D&I.

Self-evaluation:

The evaluation system for academic staff and researchers is described in the CTU Career Code, which is currently under discussion.

Rules for filling positions in relation to R&D&I are described in the CTU Career Code, and also in the CTU Guidelines for Recruitment working document.

At the same time, there are separate rules for obtaining the grade of Professor and Associate professor. Associate professor grade is a de facto condition for senior positions (head of department, dean, rector).

HTML links to additional documentation: Habilitation procedures

4.16 Recruitment system for academic staff and researchers from the external environment

The university gives a concise account of its recruitment system for academic workers from the external environment, especially from other countries (if there is any such system at faculty or university level).

Self-evaluation:

The competitive hiring procedures for academic staff and researchers are described in the CTU Guidelines for Recruitment working document, and is bound by the Recruitment Rules for an Academic Staff Position at CTU.

Since 2014, EURAXESS has been used to advertise free positions.

According to law, hiring is performed by the Faculties and University Institutes.

HTML links to additional documentation: Rules of selection procedure to appoint academic workers

4.17 Human resources structure

In the appendix the university describes the current situation, age structure and development trend for staff contributing to R&D&I, and their structure by job classification and gender in the 2014–2018 reporting period (tables 4.17.1 and 4.17.2), including workers who are foreign nationals (apart from Slovak nationals) contributing to the university's R&D&I (table 4.17.3).
The university states whether it holds an HR Award, or whether the university aims to receive one and how it is done.

Self-evaluation:

The human resources structure is still affected by the transition period after the Velvet Revolution (1989). Low income levels for university employees and for PhD students, and the opening up of opportunities in business, displaced most young people from academia after 1989. The result was clearly visible in the age structure of CTU professors in 2014: the ratio of professors over 60 to those under 60 was 2.26, and the ratio for associate professors was 0.94). Attempts were made by the rector and deans, and by the end of 2018 there was a slight improvement in the ratio for professors, to 2.11. There was much greater progress as far as associate professors were concerned, where the ratio dropped to 0.68. The reservoir of younger associate professors is already beginning to make it possible to rejuvenate the corpus of professors.

There was a strong gender imbalance in 2014, and only a small improvement in 2018.

There has been a small percentage of foreign nationals – 3%. However, there is a promising trend, as the number of foreign nationals has been rising steadily at a rate of 6% per year.

On September 10, 2019, CTU in Prague received the HR Excellence in Research Award from the European Commission.

HTML links to additional documentation:

4.18 Gender equality measures

The university gives a concise account of measures concerning the implementation of gender equality in the areas required for evaluation criteria 4.14, 4.15 and 4.16, highlighting the career path, the recruitment process, the filling of senior positions (including gender equality in senior positions; tables 4.18.1 and 4.18.2), nominations to professional bodies, the evaluation system and remuneration. It also gives a concise account of measures to harmonise family life and work for researchers (flexible working hours, flexible forms of work, management of maternity / parental leave, facilitating child care and care for family members, age management in relation to gender) and measures to eliminate negative behaviour in the workplace such as mobbing or sexual harassment.

Self-evaluation:

CTU operates on-campus short-time and full-time daycare and an elementary school that is used extensively by early-career researchers (and their children). Part-time positions and remote work are offered to employees. Parents on maternal and parental leave are considered to be taking career breaks, as specified, e.g., in Article 19 of the Study and Examination Rules for Students at CTU.

Flexible working hours and flexible forms of work are enforced directly by Higher Education Act 111/1998 Col.

Equal opportunity principles are included in the Hiring Process Code, as an obligatory part of any announcement of a position. Article 3 of the Hiring Process Code will be extended to specify that the ratio of women in the selection committee must exceed the FTE ratio for the academic staff of the relevant Faculty or Institute.

Parental leave is substracted from the performance evaluation periods relevant to habilitation and the appointment procedures for a professor.

There is a great deal of inertia, and despite measures that have been taken there remains a considerable imbalance between the number of women and men working in R&D&I. We have achieved an increase in the number of female students at CTU. However improving the gender structure of the university staff participation in R&D&I is a long-term undertaking, and balance will not be achieved within the forseeable future.

As an important starting point, we have now balanced the top management: Out of the 8 appointed members of the top management of the university (e.g. Vice-rectors, Chancellor and Bursar), there are currently 4 women.

HTML links to additional documentation:

FUNDING FOR R&D&I

4.19 Structure of funding for R&D&I

The university comments on the proportions of total costs/expenditure paid from public and non-public sources by the type of R&D&I in the 2014–2018 reporting period according to table 4.19.1 in the appendix.
As complementary data to the tables 4.19.2, 4.19.3 and 4.19.4 in the appendix, the university presents an overview of research projects obtained in the 2014–2018 reporting period, with information on the level of funding raised and whether these were solo or collaborative projects. It briefly comments on the data in the tables.
The university also lists the five most significant projects from the aforementioned list of prestigious international individual projects (ERC[2] , MSCA[3], HHMI[4], HFSP[5], NSF[6], etc.) with basic information (at the university's discretion and regardless of who the provider is: title, specialisation, agency, level of funding, other project participants and any other relevant information).

Self-evaluation:
Most of the science carried out at CTU is funded from public sources – e.g. by the Ministry of Education, by other ministries, and by Czech and foreign grant agencies.
However, some parts of CTU are quite successful in attracting private money on contracts, close to the 20% limit imposed by GBER. This may soon become a limitation to further development and cooperation with industry.
More than one half of the income for science came from project funding. The ratio of project funding to institutional funding has increased over time. CTU is happy to be able to attract grant money. However, dependency on this source of funding involves potential instability and uncertainty for young researchers who rely on being hired on projects.

Five projects from the list:
AI4REASON - ERC-COG (Josef Urban, EUR 1 200 k):
The goal of the AI4REASON project is to achieve a breakthrough in what is considered a very hard problem in AI and automation of reasoning, namely the problem of automatically proving theorems in large and complex theories.
These complex formal theories arise in projects aimed at verifying present-day advanced mathematics, such as the Formal Proof of the Kepler Conjecture (Flyspeck), verifying software and hardware designs such as the kernel of the seL4 operating system, and verifying other advanced systems and technologies of the present-day information society.

ELE – ERC Evolving Language Ecosystems (Pavel Tvrdík, 3234 kEUR):
The ELE project studies the fundamental principles of programming language evolution with the goal of developing practical tools and technologies in support of the evolution of complete ecosystems of programming languages.

[2] *The European Research Council (ERC) is part of the "Excellent Science" pillar of the Horizon 2020 programme. The ERC supports high-quality research by funding individual lead researchers and their research teams.*
[3] *Marie Skłodowska-Curie actions (MSCA) are part of the "Excellent Science" pillar of the Horizon 2020 programme, and are also aimed at supporting young researchers, including doctoral candidates.*
[4] *The Howard Hughes Medical Institute is a non-profit organisation in the United States that provides significant funding for international biomedical research.*
[5] *The Human Frontier Science Program is an international programme for funding research, especially in the natural sciences and information science.*
[6] *National Science Foundation (USA)*

The project is organized along four parallel research directions, each covering a different aspect of the evolution of programming language: evolving semantics, evolving implementations, evolving programming disciplines, and evolving legacy code. The aim of the project is to develop the theoretical foundation of revolutionary new approaches to handling PL ecosystems that will significantly reduce the cost of maintaining PL ecosystems under continuous development in hardware platforms and programming methodologies.

SOLUTION – MSCA - Solid lubrication for emerging engineering applications (Antonio Cammarata, EUR 465 k) :
This project combines theoretical approaches represented by advanced nanoscale ab initio simulations, laboratory design and fabrication of novel solid lubricants, supported by simulations, and also the up-scaling of promising solutions and their application in selected emerging engineering applications. Through intensive training and knowledge sharing, SOLUTION will link industries from various areas dealing with similar issues. Highly individualized multidisciplinary training, reflecting actual market needs, together with scientific excellence, will generate an open-mind generation able to harvest multidisciplinary knowledge and to successfully face challenges represented by the design of competitive solid lubricants.

CELTA – MSCA - Convergence of Electronics and Photonics Technologies for Enabling Terahertz Applications (Karel Hoffmann, EUR 232 k):
CELTA ESRs will develop beam steering technology for communication applications, a photonic vector analyser for spectroscopy and materials characterization, and a THz imager for sensing applications. Within the process, the project aims to prepare the next generation of researchers, who will enable Europe to take a leading role in the multidisciplinary area of utilizing Terahertz technology for applications involving components and complete systems for sensing, instrumentation, imaging, spectroscopy, and communications.

VISLON - MSCA-ITN - European Training Network on Visible light based Interoperability and Networking (Stanislav Zvánovec, EUR 465 k):
Visible light communication (VLC) is one of the most promising current areas of research, with significant potential for high-impact results. Successful outcomes might revolutionize the utilization of LEDs for modern infrastructures to add novel functionalities in addition to illumination. VLC has been proposed for smart homes and streets, manufacturing and medical environments for increased data security and reduced interference, or two-way vehicle-to-vehicle and vehicle-to-roadside infrastructure communications as part of the emerging intelligent transportation systems for increasing road safety.

HTML links to additional documentation:

4.20 Support for obtaining foreign research projects (including the strategy for obtaining prestigious foreign funding for R&D&I)

The university gives a concise account of its strategy, tools and support system for obtaining foreign research projects, e.g. arrangements for administrative support, project counselling, management of information on R&D&I, organising project management, the existence of auxiliary funding (internal subsidies) to help produce quality applications, etc.

Self-evaluation:

Developing international partnerships is an important part of the CTU Strategy for International cooperation in R&D. We are part of the C.E.L.S.A. network, which aims at future international projects.

The support can be divided into three stages.

Prior to submission, the ANLUPA system pushes information on calls to prospective applicants. Some parts of the application are prepared by the Rector‘s Office. ANLUPA was jointly created by CTU and the University of Chemistry and Technology Prague, and has been licensed to over 30 research organizations in the Czech Republic.

During the execution of the project, we provide advice (accounting, reporting) as well as tools to keep track of finances, reports, etc.

After the project, help with audits is provided.

HTML links to additional documentation:

FORMATIVE EVALUATION OF R&D&I AND THE START-UP STRATEGY (WITH POTENTIAL FOR APPLICATION)

4.21 Internal and external system for evaluating research units (groups, teams, departments, institutes)

The university gives a concise account of the system for the internal and external evaluation of research units, and the internal and external system for monitoring / evaluating research teams / groups / departments / institutes (if there is such a system).

Self-evaluation:

CTU has a transparent information system, in which achievements, recognitions and other results of the university's impact on society can easily be seen by all members of the academic body (e.g. students and employees). This system allows benchmarking between units (faculties, departments, individuals). At the same time, it helps to prevent scientific misconduct.

The system also provides outputs relevant to PhD Studies, anonymized with respect to students but containing full information on the performance of PhD supervisors. Another important view provided by the system is on promotions to an associate professorship or to a full professorship, where the (measurable part of) the performance is compared with the requirements.

In 2017, an Internal Evaluation Board (IEB) was set up. The duties and the responsibilities of the IEB cover evaluations of all processes within CTU. In particular, IEB
a) approves the proposal of regulations concerning the quality-ensuring system of the educational, creative, and related activities and of the internal quality evaluation of the educational, creative, and related activities prior to submission to the Academic Senate;
b) is in charge of the course of the internal evaluation of the educational, creative, and related activities;
c) processes the reports from the internal evaluation of the quality of the educational, creative, and related activities, and in addition to these reports also continuously maintains records regarding the internal evaluation of the quality of the educational, creative, and other related activities of the University.

Recently, the system has been enriched by an International Advisory Board.

HTML links to additional documentation:

4.22 Conditions for setting up new teams and introducing new research topics (start-up strategy)

The university describes its strategy / options for setting up new research teams (including international teams), support for their work at the university (sharing instruments, laboratories and information equipment for R&D&I) and the policy for ensuring conditions in place for the creation of new high-quality research focuses / topics, above all with potential for application.

Self-evaluation:

Teachers and researchers are free to set their own research topics and to publish the results. However, they have to find money for the research.

All members of the staff are free (and are encouraged) to apply for grants. The PI of grants are responsible for grant money, including hiring researchers. Departments provide support (technology, rooms, computers, administrative support, instrument sharing).

Assistants prove their ability to obtain external funding within the habilitation process. Candidates for a full professorship have to prove this ability again, on a higher level, and they have to present evidence that they have created new high-quality research topic(s), established research teams and have acquired an international reputation.

Professors who have great ideas and good teams behind them compete for big external projects. Projects of this kind may also be instigated at management level, especially in cases where critical momentum requires a large number of researchers from a range of fields of specialization.

HTML links to additional documentation:

4.23 External advisory bodies for R&D&I, independent feedback for R&D&I

The university gives a concise account of its external advisory body for R&D&I (if any), e.g. an international scientific council.

Self-evaluation:

CTU has an International Advisory Board (not limited to R&D&I only).

There are other external advisory bodies working at Faculty level.

The scientific boards of the University, Faculties and Institutes have external members, usually from industry, from national and/or foreign universities and from national regulatory bodies.

HTML links to additional documentation:

RESEARCH INFRASTRUCTURE

4.24 System for acquiring and renewing instruments and equipment for R&D&I

The university describes its system for acquiring / optimising the acquisition of expensive instruments and equipment and the renewal of older expensive instruments. It briefly comments on the data from the appendix (table 4.24.1).

Self-evaluation:

Most of this equipment is acquired using money from grants, including European Operational Programs. Any acquisition must be in accordance with all requirements of the respective grant agency.

CTU operates several unique research facilities, e.g. the VR-1 educational nuclear reactor, the Van de Graaff particle accelerator, and the tokamak. These facilities require regular maintance, checks and upgrades in conformity with the regulations governing their operation. Several of them are included in the Roadmap of Large Research Infrastructures of the Czech Republic, which opens more funding opportunities and also obliges CTU to provide open and fair access to these facilities for researchers from inside and outside the university.

Capital investment results in writeoffs, which are accumulated in CTU funds. This money is used to renew equipment, and we keep a reserve for future needs.

HTML links to additional documentation:

4.25 System for sharing instruments and equipment for R&D&I

The university outlines the internal organisation of its research infrastructure (technologies, expensive instruments and instrument sets). It describes its system for sharing (including sharing with external research organisations and researchers) expensive instruments and instrument sets, i.e. its core facilities (if there is such a system) and the sharing of instruments and instrument sets.

Self-evaluation:

Expensive equipment is generally shared. We insist that any expensive equipment has its “owner”, who is responsible for its maintenance and operational costs.
In some cases, when a piece of equipment was bought with grant money, sharing may be prohibited by the rules of the grant agency for the whole duration of the project. In these cases, we fully respect the policy of the donor.
We note that Czech grant agencies generally do not allow services to be eligible for budgeting within the same organization.

HTML links to additional documentation:

4.26 Internal regulations and measures for maintaining good practice in R&D&I (e.g. Code of Conduct for Research Integrity, ethical issues)

The university gives a concise account of how it oversees compliance with the ethical aspects of R&D&I. It presents a brief description of the system (which may include links to the statute and rules of procedure for the ethics committee(s), if there are any), e.g. in connection with the European Code of Conduct for Research Integrity.

Self-evaluation:
The Ethics committee of CTU, in compliance with the CTU code of Ethics and the Rules of Procedure of the Ethics Committee, oversees compliance with the ethical standards at CTU.

A separate body, the Commission for Scientific Work Ethics at CTU, is responsible for assessing all ethical questions of carrying out experiments, personal data processing and protection. Prior consent of this commission is required where the research/experiments include personal data, the human body, experiments on animals, or personal data collection and/or processing, or, on request, for any other reason.

All Academic Senates are very sensitive to any breach of ethical rules.

These three pillars – together with CTU tradition – keep the CTU community ethically healthy.

HTML links to additional documentation: **Committee for Ethics in Research** , **Rules of Procedure of the Ethics Commission**, CTU internal regulations

4.27 Open Access strategy for information from R&D&I

The university gives a concise account of its institutional strategy for Open Science 2.0/Open Access (if any), including e.g. the operation of an institutional repository or other tools.

Self-evaluation:
CTU gives preference to Open Science 2.0/Open Access, unless restricted by the rights of collaborating institutions or by law.

Authors of papers that, for some reason, are not published in Open Access journals or in ARXIVE, should upload their papers to CTU institutional repository (DSpace).

We do not support “open access” predator journals.

HTML links to additional documentation:

4.28 Data Management strategy for research data

The university describes its policy for managing research data, e.g. comments on how data is collected, made accessible and shared; intellectual property protection; personal data ethics and protection; archiving; backup; risk management; responsibility for datasets; quality assurance, etc.

Self-evaluation:

Nowadays there are only basic rules of behaviour within the rules for computer use and the computer network. These written guidelines are complemented by a set of best practices in employee information to guide behaviour in the digital world, sharing and transmitting data.

In connection with recent legal requirements for cyber security, a set of internal guidelines and directives was prepared in 2019 to address all issues of security in a comprehensive manner. Currently, nine texts are under development:
Safe user behaviour, Safe use of cryptographic protection, Safe use of mobile devices, Secure transmission of information, Communications network safety, Privacy of data, Protection against malware, Access control, and a Methodology for risk analysis.

This will facilitate the establishment of a functional but comprehensive system for handling data by the end of 2020.

HTML links to additional documentation:

APPENDICES (TABLES)

4.1 Organisation and management of R&D&I

4.1.1 Structure of staff contributing to the university's R&D&I (numbers of physical employees and workers)

Academic/professional position/year	Total						Of whom women					
	2014	2015	2016	2017	2018	average	2014	2015	2016	2017	2018	average
Professors	245	242	247	255	253	248,4	15	16	19	20	21	18,2
Associate professors	437	440	423	425	431	431,2	54	51	53	60	61	55,8
Assistant professors	1189	1195	1182	1180	1205	1190,2	315	321	309	307	313	313
Assistants	141	132	112	107	106	119,6	45	41	40	37	39	40,4
Scientific, research and development staff contributing to teaching	740	700	711	850	1090	818,2	122	123	132	162	207	149,2
Postdoctoral fellows	232	228	185	159	152	191,2	43	48	33	29	26	35,8
Ph.D. students	2030	1973	1915	1779	1755	1890,4	450	442	455	448	478	454,6
Other scientific, research and development staff	0	0	0	0	0	0	0	0	0	0	0	0
Scientific staff outside the above categories	0	0	0	0	0	0	0	0	0	0	0	0
Total	5014	4910	4775	4755	4992	4889	1044	1042	1041	1063	1145	1067

Note: This is the total number of employees/workers as at 31 December of the calendar year in question (in full-time or part-time employment, excluding persons with contracts for services or contracts for work). They do not include other contractual arrangements under the Civil Code concerning the purchasing of services.

Note: "Postdoctoral fellows" are staff at the research institution or university up to five years after defending their Ph.D. qualifications or equivalent. They work as part of the institution's research team, usually under the guidance of experienced scientific staff on specific tasks, and they publish their results both individually and as part of their teams. They have fixed-term employment contracts with the research institution (for 1–3 years) for between one and a maximum of three successive terms of employment. Their salaries are subject to the rules for the institution's salary system, and they may additionally receive remuneration as part of their research grant projects.
"Ph.D. students" is the number of doctoral students regardless of whether they are employed or not.
"Other scientific, research and development staff" covers technical and professional staff who are not directly involved in R&D&I, but are indispensable for research work (e.g. servicing the research facility).
"Scientific staff outside the above categories" covers all other staff who cannot be classified under any of the categories listed (e.g. independent scientific/research workers).

4.1.2 Structure of staff contributing to the university's R&D&I (average converted numbers)

Academic/professional position/year	Total						Of whom women					
	2014	2015	2016	2017	2018	Average	2014	2015	2016	2017	2018	Average
Professors	187,65	189,97	193,77	199,56	199,61	194,11	12,62	12,24	13,43	15,01	15,57	13,77
Associate professors	325,58	338,76	335,78	335,09	342,92	335,63	41,15	42,03	42,59	46,70	48,96	44,29
Assistant professors	918,52	908,05	904,69	906,16	921,39	911,76	238,23	232,27	221,31	220,55	225,22	227,52
Assistants	97,73	88,78	77,45	74,54	75,09	82,72	26,53	29,07	28,25	27,13	25,50	27,30
Scientific, research and development staff contributing to teaching	437,96	451,61	411,38	464,87	610,18	475,20	62,40	72,16	66,56	71,56	105,14	75,56
Postdoctoral fellows	32,81	50,52	48,77	47,22	25,07	40,88	6,04	9,22	8,60	7,85	3,33	7,01
Ph.D. students	402,35	376,50	356,27	359,62	427,70	384,49	70,69	66,88	66,06	62,74	85,76	70,43
Other scientific, research and development staff	0	0	0	0	0	0	0	0	0	0	0	0
Scientific staff outside the above categories	0	0	0	0	0	0	0	0	0	0	0	0
Total	2402,60	2404,19	2328,11	2387,06	2601,96	2525	457,66	463,87	446,80	451,54	509,48	466

Note: The average converted number is the proportion of the total number of hours worked over the monitoring period from 1 January to 31 December by all workers (excluding persons with contracts for services or contracts for work) and the total annual working hours of a full-time employee.

4.8 Subsequent careers for doctoral graduates

4.8.1 Information on subsequent careers for doctoral graduates

Graduate's name, surname (initials) and degrees	Discipline in which the graduate obtained a Ph.D. in the Czech Republic	Year in which Ph.D. was obtained	Subsequent career Employer, position, employment period
Luboš Pirkl, Ing. PhD.	MATHEMATICAL AND PHYSICAL ENGINEERING	2011	CFD Support, s.r.o., co-owner and executive director, since 2009
Dan Pilbauer, Ing. Ph.D.	Technical Cybernetics	2017	GIPSA-lab, Grenoble - joint research unit of CNRS, Grenoble-Inp and University of Grenoble-Alpes, 2017 - 2018
Lukáš Závorka Ing., Ph.D.	**Nuclear Engineering**	**2015**	**Los Alamos National Laboratory, Physics Division, Los Alamos, NM, USA, Researcher, 2017- present** **Physikalisch-Technische Bundesanstalt, Department of Ion and Neutron Radiation, Braunschweig, Germany, Researcher, 2015 - 2016** **Joint Institute for Nuclear Research, Department of Nuclear Spectroscopy and**

			Radiochemistry, Dubna, Russian Federation, Researcher, 2011 - 2015
Petr Siegl, Ing. Ph.D.	**Mathematical Engineering**	**2011**	**School of Mathematics and Physics, Queen's University Belfast, lecturer, 2018 - present** **SNSF Ambizione Fellow at the Mathematical Institute, University of Bern, 2015 - 2017** **Mathematical Institute, University of Bern, postdoc, 2014** **Mathematical Institute, University of Bern SCIEX Fellow, 2013** **Group of Mathematical Physics, University of Lisbon, postdoc 2012**
Tomáš Duša, Ing., Ph.D.	**Air Traffic Control and Management**	**2017**	**Director of GNSS Center of Excellence**
Antonín Blažek, Ing., Ph.D.	**Transportation System and Technology**	**2013**	**Chairman of the Board of Directors and General Director of the Railway Research Institute** **Deputy CEO of Czech Railways for passenger transport, World Research Steering Committee of UIC**
Martin Bujňák, Ing. Ph.D.	Artificial Intelligence and Biocybernetics	2013	**Capturing Reality**, co-founder and CEO, 2014 - present. A top-notch, arguably #1 company in the world in 3D reconstruction, based on the topic of his PhD thesis (Algebraic solutions to absolute pose problems). Co-founder – **Michal Jančošek**, Ing. PhD. – from the same year and discipline, supplemented the knowledge by a thesis (Large Scale Surface Reconstruction based on Point Visibility),
Michal Perdoch, Ing. Ph.D.	Artificial Intelligence and Biocybernetics	2011	**Oculus VR**, USA, research scientist, 2016 -present, **ETH Zurich**, Switzerland, post-doc researcher, 2014-2015, **National Robotics Engineering Center**, USA, senior engineer, 2013-2014
Vladimíra Petráková, Ing. Ph.D.	Biomedical and clinical technology	2013	Humboldt fellow at Free University Berlin, postdoctoral researcher

			2016-2019
Ilya Ivlev, M.D., Ph.D.	Biomedical and clinical technology	2014	1. Oregon Health and Science University; NIH-NLM Fellow – 2016-2019; Senior Research Associate – 2017-2019 2. Kaiser Permanente Center for Health Research; Affiliate Investigator – 2019 - Present

Note: List a maximum of ten examples of doctoral graduates who achieved significant professional success in the 2014–2018 reporting period. This may include graduates who graduated in the reporting period or within the five years prior to the reporting period (i.e. from 2009 onwards). If the graduates' names are not publicly accessible, please give their initials.

4.17 Human resources structure

4.17.1 Age structure of university staff contributing to R&D&I and their structure by job classification and gender in 2014 (numbers of physical employees and workers)

Academic/ professional position	29 or under		30 – 39 years		40 – 49 years		50 – 59 years		60 – 69 years		70 or over	
	Total	Women	Total	Women	Total	Women	Total	Women	Total	Women	Total	Women
Professors	0	0	3	0	18	0	54	2	80	9	90	4
Associate professors	0	0	52	6	86	9	85	18	104	15	110	6
Assistant professors	42	6	537	104	259	69	188	76	126	50	37	10
Assistants	46	14	74	18	12	8	6	4	2	1	1	0
Scientific, research and development staff contributing to teaching	294	61	296	45	64	9	34	4	26	2	26	1
Postdoctoral fellows	25	7	176	25	23	4	8	7	0	0	0	0
Ph.D. students	1198	268	664	144	105	24	53	13	10	1	0	0
Other scientific, research and development staff	0	0	0	0	0	0	0	0	0	0	0	0
Scientific staff outside the above categories	0	0	0	0	0	0	0	0	0	0	0	0

Note: This is the total number of employees/workers as at 31 December of the calendar year in question (in full-time or part-time employment, excluding persons with contracts for services or contracts for work). They do not include other contractual arrangements under the Civil Code concerning the purchasing of services.

4.17.2 Age structure of university staff contributing to R&D&I and their structure by job classification and gender in 2018 (numbers of physical employees and workers)

Academic/ professional position	29 or under		30 – 39 years		40 – 49 years		50 – 59 years		60 – 69 years		70 or over	
	Total	Women	Total	Women	Total	Women	Total	Women	Total	Women	Total	Women
Professors	0	0	1	0	28	3	53	4	77	7	94	7
Associate professors	0	0	38	4	140	13	78	17	92	23	83	4
Assistant professors	34	7	450	84	382	100	169	62	134	52	36	8
Assistants	21	5	58	16	16	12	6	4	5	2	0	0
Scientific, research and development staff contributing to teaching	377	84	489	100	120	16	40	4	33	2	31	1

Postdoctoral fellows	16	5	111	15	19	4	6	2	0	0	0	0
Ph.D. students	935	242	681	197	93	31	34	8	9	0	3	0
Other scientific, research and development staff	0	0	0	0	0	0	0	0	0	0	0	0
Scientific staff outside the above categories	0	0	0	0	0	0	0	0	0	0	0	0

Note: This is the total number of employees/workers as at 31 December of the calendar year in question (in full-time or part-time employment, excluding persons with contracts for services or contracts for work). They do not include other contractual arrangements under the Civil Code concerning the purchasing of services.

4.17.3 Staff contributing to the university's R&D&I who were foreign nationals in 2014 and 2018, other than Slovak nationals (average converted numbers)

Academic/professional position	Total 2014	Of whom women	Total 2018	Of whom women
Professors	1,15	0	1,80	0
Associate professors	2,00	0	3,86	0,50
Assistant professors	18,01	4,14	21,83	5,90
Assistants	3,92	1,50	1,93	0,93
Scientific, research and development staff contributing to teaching	57,10	9,89	92,24	16,18
Postdoctoral fellows	3,68	0	4,05	1,38
Ph.D. students	18,58	4,25	34,04	11,52
Other scientific, research and development staff	0	0	0	0
Scientific staff outside the above categories	0	0	0	0
Total foreign nationals	104,44	19,78	159,75	36,41

Note: The average converted number is the proportion of the total number of hours worked over the monitoring period from 1 January to 31 December by all workers (including contracts for work but excluding contracts for services) and the total annual working hours of a full-time employee

4.18 Gender equality measures

4.18.1 Gender equality in senior positions in 2014

Senior staff	Men	Women	Total
Rector	1	0	1
Vice-Rector	4	0	4
Academic senate	35	9	44
Academic board	35	4	39
Bursar	1	0	1
Board of governors	14	2	16

Note: If one person holds several positions at the university, each position is included.

4.18.2 Gender equality in senior positions in 2018

Senior staff	Men	Women	Total
Rector	1	0	1
Vice-Rector	3	2	5
Academic senate	44	8	52
Academic board	32	3	35
Bursar	1	0	1
Board of governors	12	3	15

Note: If one person holds several positions at the university, each position is included.

4.19 Structure of funding for R&D&I

4.19.1 Proportion (%) of total costs/expenditure by type of R&D&I funded from public and non-public sources

	2014	2015	2016	2017	2018	Total
Basic research	11,30%	14,75%	12,24%	11,01%	11,40%	12,01%
Applied research	23,37%	27,14%	25,92%	27,77%	30,21%	27,03%
Experimental development and innovation	65,33%	58,11%	61,84%	61,22%	58,39%	60,96%
Total	100%	100%	100%	100%	100%	100%

Note: Under Section 2 of Act No 130/2002, basic research refers to theoretical or experimental work performed largely for the purpose of gaining new knowledge of the basic principles of phenomena or observable reality, and is not primarily aimed at any practical application or use.

Innovation refers to the introduction of new or substantially improved products, processes or services.

For other definitions see OECD Fields of Research and Development (Frascati Manual 2015).

4.19.2 Projects supported by a provider from another country

As the beneficiary							
Provider/ Investor	Programme/ Subsidy scheme	Project title	Support (EUR thousand)				
			2014	2015	2016	2017	2018
EC	Horizon 2020	Multiscale Modelling Platform: Smart design of nano-enabled products in green technologies	187	-	102	37	
IVFund	IAEA Vienna	Assessment of Recharge Dynamics in Sedimentary and Fractured Granitic Structures of Catchments in the Northern Czech Republic Using the Tritium-Helium-3 Dating Technique	8				
CEDR	Energy Efficiency programme	FunDBitS - Functional Durability-based Bitumen Specifications		43	131		
ERA-NET	CoRePaSol	Characterization of Advanced Cold-Recycled Bitumen Stabilized Pavement Solutions	58	100	100		
NANOCEM	-	Micromechanical Analysis of Blended Cement-Based Composites	90	45			
European Comission	Seventh Framework Programme	Application of distributed control on smart structures	1	23	101	29	44

FM EHP and Norway	Bilateral Scholarship Programme – EEA and Norway grants	Enhanced navigation algorithms in joint research and education	-	1	40	-	-
International Atomic Energy Agency, Vienna, Austria	-	Characterization of High Energy Deuteron Pulses Produced by Dense Magnetized Plasmas	4	1	0	0	0
ESA	-	MOFINT - Propagation Models for Interference and Frequency Coordination Analyses	32	-	-	-	-
ESMO AIM	-	European Student Moon Orbiter - AOCS Integration Module	1	-	-	-	-
USA,European Office of Aerospace Research and Development	-	STENOGRAPHY- Universal Batch Steganalysis	25	7	83	-	-
Nadace Stichting NInet	-	Stratosphere IPS - Intrusion Prevention System	-	20	8	-	-
The Michael J. Fox Foundation	-	Automatic acoustic speech analysis and REM sleep behaviour disorder for detecting subjects at high risk for Parkinson's disease and other alpha-synucleinopathies	-	-	-	87	102
US Army	-	Development and Validation of the Enhanced AGENTFLY Simulation Platform with ATC Agent	74	-	2	14	8
Air Force Office of Scientific Research (AFOSR)	-	Flexible and Resilient Autonomous Systems	-	-	-	-	12
USA,European Office of Aerospace Research and Development	-	Domain-Independent Multiagent Planning: models, Stability and Complexity (Towards Robust Multiagent Plans)	67	76	-	-	-
US NAVY, OFFICE OF NAVAL RESEARCH GLOBAL	-	Optimizing Heterogeneous Intrusion Detection System Against a Rational Adversary	52	33	6	-	-
USA,European Office of Aerospace Research and Development	-	Support for the "The 13th International Conference on Autonomous Agents and Multi-Agent Systems (AAMAS 2014)"	7	-	-	-	-
US NAVY, OFFICE OF NAVAL RESEARCH GLOBAL	-	12th European Conference on Multi-Agent Systems (EUMAS 2014)	-	0	-	-	-

US NAVY, UK, NICOP	-	Extension of the Traffic Flow Modeling Project	-	-	2	-	-
US NAVY, OFFICE OF NAVAL RESEARCH GLOBAL	-	Using deep reinforcement learning to simulate a security analyst	-	-	-	-	2
US NAVY, OFFICE OF NAVAL RESEARCH GLOBAL	-	Defeating the Dark Triad in Cyber Security Using Game Theory	-	-	-	55	38
EC	Seventh Framework Programme	Cooperation in education and training In Nuclear CHemistry	63	70	32		
EC	Horizon 2020	A Modular European Education and Training Concept In Nuclear and RadioCHemistry				38	66
EC	Horizon 2020	GEN IV Integrated Oxide fuels recycling strategies				12	21
EC	Horizon 2020	Strengthening of Cooperation and Exchange for Nuclear Education and Training between the European Union and the Russian Federation	7	15	15	7	
IAEA Vienna International Atomic Energy Agency	-	Development and Testing of Coated Fuel Cladding for VVER Reactors with Enhanced Accident Tolerance			4	4	
European Space Agency	-	Network for Exploration and Space Science				14	14
European Space Agency	-	Comparison of optical time-transfer links					
European Space Agency	-	Space Situational Awareness Programme P2-SST-VII Expert Coordination Centres (phase 1)			6	6	6
European Space Agency	-	ISS - Space Optical Clock Mission, phase-A study			4	4	4
EC	-	Cooperation in education and training In Nuclear Chemistry	63	63	26		
EC	CEF	Programme Support Action (PSA) for the maintenance, adaptation and further development of a European ITS Framework Architecture for Intelligent Transport Services (ITS).	7	12			
EC	Horizon 2020	Evolving Language Ecosystems			1 132		739
EC	Horizon 2020	RICAIP: Research and Innovation Centre on Advanced Industrial Production				227	100
Other foreign provider	-	SyRoTek - System for robotic e-learning		10			

Total			**745**	**521**	**1 795**	**534**	**1 157**
As another participant							
Provider/ Investor	Programme/ Subsidy scheme	Project title	Support (EUR thousand)				
			2014	2015	2016	2017	2018
EC	Horizon 2020	Soil Hydrology research platform underpinning innovation to manage water scarcity in European and Chinese cropping systems					236 806
EC	Horizon 2020	Setting up a national qualification and training scheme for craftsmen in the Czech Republic and developing the further offer of training courses in Slovakia, Austria and Bulgaria					58 449
EC	Horizon 2020	Innovative training schemes for retrofitting to nZEB-levels				4 663	34 974
EC	Horizon 2020	Bentonite Mechanical Evolution				68 400	22 800
EC	Horizon 2020	Multi-scale Composite Material Selection Platform with Seamless Integration of Material Models and a Multidisciplinary Design Framework				192 858	83 627
EC	Horizon 2020	PROFessional multi-disciplinary TRAining and Continuing development in skills for NZEB principles		54 216	40 322		
EC	Horizon 2020	Quality management for building performance - improving energy performance by life cycle quality management			80 921	40 575	58 093
EC	Horizon 2020	Advanced Networking for Nuclear Education and Training and Transfer of Expertise			15 119		4 442
EC	Horizon 2020	Cement-based materials, properties, evolution, barrier functions		60 567		39 171	
EC	Horizon 2020	PROFessional multi-disciplinary TRAining and Continuing development in skills for NZEB principles		54 216	40 322		
EC	Seventh Framework Programme	Full Scale Demonstration of Plugs and Seals	307 700		132 854	92 394	
SNCZ	-	Development of Landuse Scenarios for the Sustainable Improvement of Water Quality and Erosion Protection in the Transboundary Neisse Catchment	73 556	47 904			
EC	Horizon 2020	TURBOmachinery REtrofits enabling FLEXible back-up capacity for the transition of the European energy system				88	
EC	Horizon 2020	ADvancing user acceptance of general purpose hybridized Vehicles by Improved Cost and Efficiency				111	
EC	Horizon 2020	Future Research, Advanced Development and Implementation Activities for Road Transport				13	
EC	Horizon 2020	IMplementation of Powertrain Control for Economic and Clean Real driving emIssion and fuel ConsUMption			16		14

EC	Horizon 2020	Flexible Fossil Power Plants for the Future Energy Market through new and advanced Turbine Technologies			107	43	
EC	Horizon 2020	Real World Advanced Technologies for Diesel Engines			29	26	
EC	Horizon 2020	Gas-Only internal combustion engines		42		64	60
EC	Research Programme of the Research Fund for Coal and Steel (RFCS)	The innovative system for coke oven wastewater treatment and water recovery with the use of clean technologies			50		
EC	Seventh Framework Programme	INTElligent FIXture for the manufacturing of low rigidity components	49	30	4		
EC	Seventh Framework Programme	Integration and Management of Performance and Road Efficiency of Electric Vehicle Electronics	33	56	7		
EC	Seventh Framework Programme	Clothes Perception and Manipulation	61				
EC	Seventh Framework Programme	New materials and control for a next generation of compact combined solar and heat pump systems with boosted energetic and exergetic performance	22	5			
EC	Seventh Framework Programme	Dynamic manufacturing of thin-walled work pieces by a milling process	82	8			
EC	Seventh Framework Programme	Sustainable Hydrothermal Manufacturing of Nanomaterials	31	6	3		
EC	Seventh Framework Programme	Damage risk assessment, economic impact and mitigation strategies for sustainable preservation of cultural heritage in the times of climate change.	10				
EC	Seventh Framework Programme	Centre for civil nuclear cooperation	40	40			
EC	Seventh Framework Programme	Aircraft External Noise Research Network and Co-operation	6	12	-	-	3
EC	Seventh Framework Programme	Dextrous Assembler Robot Working with embodied Intelligence	154	19	-	-	-
EC	Seventh Framework Programme	Designing Dynamic Distributed Cooperative Human-Machine Systems	7	-	-	-	-
EC	Seventh Framework Programme	Multiscale Modelling and Materials by Design of interface-controlled Radiation Damage in Crystalline Materials	119	-	-	-	-
EC	Seventh Framework Programme	SUstainable and PERsuasive Human Users moBility in future cities	246	-	-	-	-

EC	Seventh Framework Programme	GLObal Robotic telescopes Intelligent Array for e-Science	21	-	-	-	-
EC	Seventh Framework Programme	Mobile Assistance for Social Inclusion and Empowerment of Immigrants with Persuasive Learning Technologies and Social Network Services	108	79	-	-	-
EC	Seventh Framework Programme	Clothes Perception and Manipulation	154	22	-	-	-
EC	Seventh Framework Programme	Deformation Monitoring by High Resolution Terrestrial Long Range Sensing	13	-	-	-	-
EC	Seventh Framework Programme	Wireless Friendly Energy Efficient Buildings	139	94	-	-	-
EC	Seventh Framework Programme	SEcurity and SAfety MOdelling	9	5	-	2	-
EC	Seventh Framework Programme	Design, Monitoring and Operation of Adaptive Networked Embedded Systems	17	8	-	4	-
EC	Seventh Framework Programme	Adaptive Production Management	74	11	-	-	-
EC	Seventh Framework Programme	SUstainable PREdictive Maintenance for manufacturing Equipment	56	73	-	-	-
EC	Seventh Framework Programme	Distributed computing, storage and radio resource allocation over cooperative femtocells	188	-	-	-	-
EC	Seventh Framework Programme	Dense Cooperative Wireless Cloud Network	148	154	2	-	-
EC	Seventh Framework Programme	Planetary Robotics Vision Data Exploitation	62	82	-	-	-
EC	Seventh Framework Programme	ARTEMIS Innovation Pilot Programme	-	-	-	2	-
EC	Seventh Framework Programme	European Smart Mobility Resource Manager	43	235	50	-	-
EC	EMRP RESEARCH GRANT	EMRP RESEARCH EXCELLENCE GRANT	31	31	31	0	-
EC	Seventh Framework Programme	Silicon Carbide Power Electronics Technology for Energy Efficient Devices	54	78	73	98	-
EC	H2020-MCA ITN	Convergence of Electronics and Photonics Technologies for Enabling Terahertz Applications	-	-	1	57	49
EC	Horizon 2020	Integrated Activities for the High Energy Astrophysics Domain	-	-	32	40	35
EC	Horizon 2020	High-Performance Real-time Architectures for Low-Power Embedded Systems	-	-	968	66	-

EC	Horizon 2020	European initiative to enable validation for highly automated safe and secure systems	-	-	32	42	8
EC	Horizon 2020	Energy for Smart Objects	-	-	9	9	85
EC	Horizon 2020	Enabling seamless electromobility through smart vehicle-grid integration	-	-	37	94	81
EC	Horizon 2020	Live Action Data Input and Output	-	-	4	54	-
EC	H2020-MSCA-ITN	Solid lubrication for emerging engineering applications	-	-	-	17	134
EC	Horizon 2020	Controller Tools and Team Organisation for the Provision of Separation in Air Traffic Management	-	-	-	66	78
EC	Horizon 2020	Unlocking Large-Scale Access to Combined Mobility through a European MaaS Network	-	-	-	9	79
EC	H2020-MSCA-ITN-2017	European Training Network on Visible light based Interoperability and Networking	-	-	-	12	96
EC	Horizon 2020	Wide band gap Innovative SiC for Advanced Power	-	-	-	1	37
ESA	-	DEMON - Quality Evaluation Methods for Calomel Optical Elements	40	-	-	-	-
COST Action T	-	Development of a European-based Collaborative Network to Accelerate Technological and Clinical Progress in the Area of Medical Microwave Imaging	4	4	-	-	-
Czech-German Cooperation	-	UMTRIS: Umweltverträglichkeit von Transformatorenölen - alternative Isolierflüssigkeiten	-	-	-	8	12
Deutsche GIZ	-	Climate investment capacity: climate finance dynamics&structure for financing the 2030 targets	-	-	-	-	7
EC	Seventh Framework Programme	Safety of ACtinide Separation proceSSes	34	34	17		
EC	Seventh Framework Programme	Advanced fuelS for Generation IV reActors: Reprocessing and Dissolution	49	49	40		
EC	Horizon 2020	Advanced Networking for Nuclear Education and Training and Transfer of Expertise			12	12	12
EC	Seventh Framework Programme	Cooperation in education and training In Nuclear Chemistry	63	63	26		
EC	CEF	C-ROADS Czech Republic			1	6	6
EC	-	Mobile Assistance interagency teams to detect and prevent the esclation of violent radicalism			14	15	
EC	Horizon 2020	Managing Automated Vehicles Enhances Network			35	104	104
EC	Horizon 2020	Range of Electric SOlutions for L-category Vehicles		62			
EC	JUST	Strategic AssessmenT for LAW and Police Cooperation					10
EC	JUST	Judicial Strategy Against all Forms of Violent Extremism in Prison					42

EC	Seventh Framework Programme	The emerging threat of transversal terrorist alliances and the radicalization of the EU social climate	12	6			
EC	Seventh Framework Programme	ISDEP (IMPROVING SECURITY BY DEMOCRATIC PARTICIPATION)	41				
EC	Seventh Framework Programme	Easy-OBU (Enhanced (EGNOS/EDAS) Accuracy System with GNSS Outage Bridging Unit)	18				
EC	Seventh Framework Programme	CITI-SENSE Development of sensor-based Citizens' Observatory Community for improving quality of life in cities	42	63	36		
EC	Seventh Framework Programme	Network of European Asian Railway Research Capacities	18				
EC	-	The Experimental Development for Production in The Company SPEL, a.s.		-	-	-	228
(other foreign provider)	-	Use of modern visualization and simulation technology in the field of transport systems			43	58	76
(other foreign provider)		Specialized center for applied simulation and visualization	56				
EC	Seventh Framework Programme	Diagnostic Imaging Strategies for Patients with Stable Chest Pain and Intermediate Risk of Coronary Artery Disease: Comparative Effectiveness Research of Existing Technologies	19		5		
EC	Horizon 2020	European Joint Programme for the Integration of Radiation Protection Research			6		
EC		EAC – 2012-0600 European Real Life Learning Lab Alliance - EURL3A	82	-	-	-	-
EC	Horizon 2020	H20-633447 - MORE-CONNECT Development and advanced prefabrication of innovative, multifunctional building envelope elements for MOdular REtrofitting and CONNECTions		54	100	96	77
EC	Horizon 2020	Automated Urban Parking and Driving			135	158	174
EC	Horizon 2020	Decentralised Agile Coordination Across Supply Chains			18	127	150
EC	Horizon 2020	Safe human-robot interaction in logistic applications for highly flexible warehouses			161	123	122
EC	-	A robotic cell for the inspection of surface of painted uneven parts in industrial manufacturing.				15	115
EC	Horizon 2020	High-Performance Real-time Architectures for Low-Power Embedded Systems			115	115	115
EC	-	Factory of the future				26	72
EC	Horizon 2020	Live Action Data Input and Output			5	100	45
EC	Seventh Framework Programme	ECHORD Plus Plus / RadioRoSo: Radioactive Waste Robotic Sorter			3	38	13

EC	Seventh Framework Programme	Long-Term Human-Robot Teaming for Robot-Assisted Disaster Response	143	169	190	203	8
EC	Seventh Framework Programme	Adaptive Production Management	96	99			
FFG	Produktion der Zukunft	KnowDrift: Knowledge-Driven Industrial Robotics for Flexible Production				4	7
US Missile Defense Agency	-	FUMA: Fusion and Modeling Algorithms			40	78	108
Total			**3 078**	**1 847**	**2 763**	**2 641**	**2 760**

Note: List individual consortium projects financed from EU framework programmes (FP 7,[7] Horizon 2020[8] – excluding the ERC and MSCA, FP 9,[9] etc.) and the level of funding in euro (for collaborative projects, list the funding for the university), prestigious individual projects (ERC, MSCA, HHMI, HFSP, etc.) and the level of funding in euro (for this category of projects, additional information can be included at the university's discretion, e.g. specialisation, other project participants, any other relevant information), other foreign consortium projects and the level of funding in euro (HHMI, NIH,[10] Wellcome Trust,[11] etc.).
For collaborative projects, only list the funding for the university.

4.19.3 Projects supported by a provider from the Czech Republic

As the beneficiary							
Provider/ Investor	Programme/ Subsidy scheme	Project title	Support (EUR thousand)				
			2014	2015	2016	2017	2018
GA CR			5980	5600	6124	7160	8382
MEYS CR			5566	4103	5253	4453	3679
Min Agr CR			161	272	344	198	72
Min Cult CR			1787	1655	1252	1312	2097
Min Def CR			0	0	0	0	18
Min Health CR			313	259	258	358	368
Min Ind Trade CR			478	204	0	0	0
Min Int CR			3000	2073	723	1550	1593
TA CR			13012	12027	11605	11027	10768
Prague		The relationship of urban development and preparation of development plan documents	302	135			
EC	OP RDE	University Center for Energy Efficient Buildings (UCEEB)	12780	340			

[7] The Seventh Framework Programme for Research and Technological Development (FP 7) was the European Union's main instrument for financing European research in 2007–2013.
[8] Horizon 2020, the eighth framework programme for research and innovation (H2020), is the largest programme under EU structures for financing science, research and innovation in 2014–2020.
[9] The planned ninth EU framework programme for research and innovation (Horizon Europe) will replace Horizon 2020 and should operate in 2021–2027.
[10] National Institutes of Health (NIH) – an agency that is part of the United States Department of Health and Human Services. NIH is also an important actor in project support for biomedical research.
[11] An major British charity that chiefly supports biomedical research.

EC	OP RDE	Reduction of emissions in transport		886			
EC	OP RDE	Intelligent buildings	365	104			
EC	OP RDE	Materials Research for InovaSEED	833	316			
EC	OP RDE	Security and Defence for InovaSEED	954	234			
EC	OP RDE	Competitive engineering for InovaSEED	1227	275			
EC	OP RDE	InovaNET	284	0			
EC	OP EC	BIO-XUV Research Team Advancement at FBME CTU	218				
EC	OP EC	Integration of the team for research and development of new principles of nanotechnology in biomedicine for education and medical practice	299	121			
EC	OP EC	Support of inter-sectoral mobility and quality enhancement of research teams at the Czech Technical University in Prague	1221	3414			
EC	OP EC	CTU in Prague Popularization of Science and Research	465				
EC	OP EC	InovaCOM	388				
EC	OP EC	Civil protection and crisis and emergency management	300				
EC	OP RDE	Centre of Advanced Photovoltaics			876	314	1782
EC	OP RDE	Artificial Intelligence and Reasoning				549	1006
EC	OP RDE	Intelligent Machine Perception				484	456
EC	OP RDE	Robotics 4 Industry 4.0				703	1726
EC	OP RDE	Brookhaven National Laboratory - participation of the Czech Republic				179	253
EC	OP RDE	LSM underground laboratory - Czech participation in European-level research				190	327
EC	OP RDE	Van de Graaff Accelerator - a Tunable Source of Monoenergetic Neutrons and Light Ions				184	237
EC	OP RDE	Strengthening and development of research at the Czech Technical University in Prague with the use of the VR-1 Training Reactor research infrastructure for research activities				177	176
EC	OP RDE	Supporting expert capacity for effective technology transfer at CTU				490	336
EC	OP RDE	Modernization of Laboratories for Biomedical Engineering				3	8
EC	OP RDE	High Temperature Plasma and Fusion Technology Laboratory PlasmaLab@CTU				126	225
EC	OP RDE	Computer and technical infrastructure platform for the realization of a novel doctoral program in Quantum technologies				94	594
EC	OP RDE	Research Infrastructure for Doctoral Programmes at CTU FEE				118	2867
EC	OP RDE	Laboratories for a doctoral programme in Nuclear Safety, Security and Forensics				84	502
EC	OP RDE	Smart equipment for Postgraduate Students Incubato				26	48
EC	OP RDE	Infrastructure for the newly accredited doctoral programme in Geodesy and Cartography				106	312
EC	OP RDE	Ensuring infrastructure for the newly accredited doctoral programme in Building and Structural Engineering				218	669
EC	OP RDE	Modernization and adaptation of laboratories in the field of assistive technologies				55	60
EC	OP RDE	Establishment and development of the experimental facilities of FTS CTU in Prague				48	379

EC	OP RDE	Creating infrastructure for the innovated study programme in Physical and Material Engineering				168	634
EC	OP RDE	Innovated laboratory and testing infrastructure for the doctoral study programme in Building Engineering				303	656
EC	OP RDE	Modernisation of the infrastructure of the dostoral study programmes in water management and environmental engineering				360	1492
EC	OP RDE	Development and Transformation of the Doctoral Degree Study at FEE CTU				64	159
EC	OP RDE	Biomedical engineering for knowledge based economy				35	86
EC	OP RDE	International doctoral programme in high-temperature plasma and nuclear fusion				41	66
EC	OP RDE	Supporting accreditation of a modified doctoral study programme in Building and Structural Engineering				56	208
EC	OP RDE	Supporting the accreditation of a research oriented study programme in Building Engineering				54	124
EC	OP RDE	Development of doctoral programmes in water management and environmental engineering				68	239
EC	OP RDE	Development of the Physical and material engineering doctoral programme				52	193
EC	OP RDE	Novel research-oriented doctoral program in Quantum Technologies				44	79
EC	OP RDE	Assistive Technology for Sustainable Development and Active Life of Seniors and Handicapped Persons				23	53
EC	OP RDE	Instrumentation and computer-aided processes in medicine				75	104
EC	OP RDE	Nuclear Safety, Security and Forensics				75	153
EC	OP RDE	Innovation of the current doctoral study programme in Architecture and Construction and creation of new architectural programmes				65	152
EC	OP RDE	The establishment of a doctoral study program in Smart Cities and development of a research-focused study program at CTU FTS				32	100
EC	OP RDE	Risk management and safety of complex technological facilities				67	160
EC	OP RDE	Introduction of modernised accredited doctoral study programme in Geodesy and Cartography				42	127
EC	OP RDE	Research centre for low-carbon energy technologies					1837
EC	OP RDE	Research Center for Informatics					7907
EC	OP RDE	Engineering applications of microworld physics					1509
EC	OP RDE	Center of Advanced Aerospace Technology					26700
EC	OP RDE	Advanced Testing of Automotive Radars					268
EC	OP RDE	Novel nanostructures for engineering applications enabled by emerging techniques supported by advanced simulations					640
EC	OP RDE	Cluster 4.0 - Methodology of System Integration					923
EC	OP RDE	International Mobility of Researchers at CTU					1126
EC	OP RDE	Development of capacity for strategic research management at CTU in Prague				346	195
EC	OP RDE	International Mobility of Researchers ? MSCA-IF in CTU				132	79
EC	OP EIC	Development of an advanced engine brake for diesel truck engines		0	0	78	0
EC	OP EIC	Advanced Concrete Elements with Woven Reinforcement		0	0	86	331
EC	OP Prague	Concept Prague				399	405

EC	OP Prague	Large-volume transport and temporary storage of mixed municipal waste					143
EC	OP Prague	Smart Prague Technology Transfer					414
EC	OP Prague	Concept Prague - Personal health systems					564
EC	OP Prague	ČVUT FEL - ICT for Prague					480
EC	OP Prague	GLOMODO - Global traffic model of the City of Prague					52
EC	OP Prague	CTU FEL - Knowledge for Prague					349
EC	OP Prague	Preparation of commercialization of new education methods for the needs of the economy digitalization and industry 4.0					167
EC	OP Prague	Concepts of the Civl Engineering faculty of CTU for Prague 2017					491
Total			49930	32017	26436	32869	88304
As another participant							
Provider/ Investor	Programme/ Subsidy scheme	Project title	Support (EUR thousand)				
			2014	2015	2016	2017	2018
GA CR	Total projects and the level of funding in euro.		2277	2273	2059	1639	1228
MEYS CR			1734	1355	938	969	1112
Min Agr CR			20	65	47	92	125
Min Cult CR			534	431	187	227	543
Min Health CR			195	439	461	559	653
Min Ind Trade CR			1994	598	888	2980	5136
Min Int CR			637	364	136	334	358
TA CR			8800	8896	7860	9663	6535
EC	OP RDE	RINGEN - Research Infrastructure Upgrade				19	48
EC	OP RDE	3D Printing in civil engineering and architecture					192
EC	OP RDE	Smart City - Smart Region - Smart Community					193
EC	OP EIC						2
EC	OP EIC	Research and development of diesel aircraft engines		0	0	38	175
EC	OP EIC	Research of methods for high-precision measurements, and the development of instrumentation for the evaluation of nuclear-physical quantities and safe control of critical processes.		0	0	51	96
EC	OP EIC	Experimental Development for Production in SPEL, a.s.		0	0	0	228
EC	OP EIC	Modular air-conditioning units		0	0	18	83
EC	OP EIC	An early condensation detection system for heat-exchanging surfaces		0	0	47	142
EC	OP EIC	Protection against electric arcing and prevention of fire ignition		0	0	26	173
EC	OP EIC	Factory of the future		0	0	26	72
EC	OP EIC	Autonomous power stations		0	0	25	101
EC	OP EIC	System for efficient energy management		0	0	0	161
EC	OP EIC	A robotic cell for inspecting the surface of uneven painted parts in industrial manufacturing.		0	0	15	115
EC	OP EIC	Utilization of waste heat by transforming it into electric energy		0	0	6	78
EC	OP EIC	Tools for active energy management				0	65
EC	OP EIC	A complex software and hardware system for heartbeat monitoring				0	326

EC	OP EIC	Development of new technologies for firing lightweight ceramic aggregate				0	24
EC	OP EIC	Development of a continual brazing furnace with combined displacements of products and an integrated energy center				0	0
EC	OP EIC	Development an ophthalmo endoscope				0	6
EC	OP EIC	Research and development of a mobile condensing mini-power plant based on CHP and RES sources with built-in heat and electricity accumulation supplemented by an intelligent control system				0	59
Total			16190	14420	12576	16735	18029

Note: List total Czech Science Foundation projects and the level of funding in euro, total Technology Agency of the Czech Republic projects and the level of funding in euro, and total other state-funded projects and the level of funding in euro. For collaborative projects, list the funding for the university.
Please also list individual projects financed from EU structural funds and targeted exclusively at R&D&I (e.g. OP RDE,[12] OP EIC[13]) and the level of funding in euro, and individual projects financed from regional funds targeted exclusively at R&D&I and the level of funding in euro. For collaborative projects, only list the funding for the university.

4.19.4 Projects supported from non-public sources

As the beneficiary						
Provider/Investor	Project title	Support (EUR thousand)				
		2014	2015	2016	2017	2018
SURAO	**Expert services to SURAO – CTU in consortium with** Satra **and Mott MacDonald**			**140**	**1356**	**749**
	This is in addition to the amounts reported by Faculties and Institutes within Module 3.					
Total						
As another participant						
Provider/Investor	Project title	Support (EUR thousand)				
		2014	2015	2016	2017	2018
Total						

4.24 System for acquiring and renewing instruments and equipment for R&D&I

[12] *Operational Programme Research, Development and Education – a multiyear programme coordinated by the Ministry of Education, Youth and Sports. Under OP RDE, funding can be drawn in the 2014–2020 period from the European Structural and Investment Funds (ESIF).*
[13] *Operational Programme Enterprise and Innovation for Competitiveness – a multiyear programme coordinated by the Ministry of Industry and Trade for drawing funding from the European Regional Development Fund (in the 2014–2020 period).*

4.24.1 Overview of expenditure/costs for the research infrastructure and equipment in the 2014–2018 reporting period (including related non-investment and personnel costs).

Costs/expenditure (EUR thousand p.a.)	2014	2015	2016	2017	2018	Total assets value
Total costs/expenditure related to purchasing low-value fixed assets for R&D&I	89	160	14	47	139	450
Costs for equipment repair and maintenance	117	102	134	197	192	743
Purchasing tangible and intangible fixed assets for R&D&I (investments)						
Of which: software	29	110	0	220	487	846
Of which: other intangible fixed assets	0	46	0	0	0	46
Of which: land, buildings and structures	4475	12745	22210	545	34	40009
Other tangible fixed assets (machinery, instruments, equipment, etc.)	5922	4070	88	3512	6818	20410
Total expenditure on infrastructure for the year	10632	17232	22445	4522	7672	62503

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SUMMARY LIST OF ADDITIONAL DOCUMENTATION IN MODULE M4

Document Title	Criterion	Location (HTML link)
Annual reports		Click Document Title (active link)
Technology transfer at CTU	3.8 and 3.9	
Statute of the CTU	4.1	
CTU internal regulations	4.9	
SGS (Student grant competition)	4.9	
Habilitation procedures	4.12, 4.15	
Rules of selection procedure to appoint academic workers	4.16	
Statute of the Committee for Ethics in Research	4.26	
Rules of Procedure of the Ethics Commission	4.26	

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MODULE 5 STRATEGY AND POLICIES

R&D&I MISSION AND VISION

5.1 The evaluated institution's R&D&I mission and vision

The university gives a concise account of its vision and general mission for R&D&I (in the context of its education function and the strategy for university education under state policy or the relevant ministry, and comparing the mission as defined with the true situation). It supplements this account with active links to its strategic plan for teaching, scientific, research, development, innovation, artistic or other creative activity, and any update of this plan.

Self-evaluation:

Mission
We want to continue to be a research university that will educate the next generation of technically and universally equipped graduates and scientists for the ever-changing demands and needs of the coming decades.

Vision
Czech Technical University in Prague will strengthen its leading position among technical universities in the Czech Republic and its position as an internationally recognized research university, developing the talents and abilities of students, academics and other staff. It will direct its efforts to perform the function of a respected authority in educational, scientific, research, artistic and engineering creative activities, using the experience of past generations of engineers and architects and the capabilities of current and future academics and students.

HTML links for additional documentation: Strategy of CTU

R&D&I OBJECTIVES AND STRATEGIES

5.2 Research objectives and strategies before the next evaluation

The university gives a concise account of its research strategy and objectives (e.g. specificity, feasibility, the international context of its strategic plan for teaching, scientific, research, development, innovation, artistic or other creative activity, and any update of this plan). Also relevant is an account of how society and the market's needs have been identified.

Self-evaluation:

Through our mutual cooperation, we recognize the needs of all of our partners, the challenges and expectations of society and the labour market, and we constantly compare ourselves with the cutting edge in our sphere of activity. We reflect the current social development and estimate future developments.

We work with the best: we want to develop cooperation with the best universities and techniques in each country, especially with EUROTECH and CELSA. We the reflect EU's The Quantum Technologies Flagship initiative, being active participants in QuantERA consortium.

In 2020 a new CTU Strategic Plan for 2021-2025 will be prepared and approved. During its preparation, an analysis and revision of the priority fields of development will be carried out to reflect future opportunities, to take advantage of the university's strengths and to reduce future risks (Cost-Benefit, SWOT).

CTU will endeavor to acquire other major transnational prestigious projects, such as the European Center for Artificial Intelligence and the European University. In the European University project, we will form part of a consortium made up of the EuroTech universities and TalTech, which are groupings of excellent technical universities.

Particular attention will be paid to programs prepared within major projects funded by the Structural Funds: LIGHTEN Aerospace Technology in the Czech Republic AIML Industrial Technology Center: Artificial Intelligence and Machine Learning Research Center UCEEB 20+ Innovative Transport Technology Center

HTML links for additional documentation:

5.3 Relation to higher national and supranational strategic goals and measures for R&D&I

The university gives a concise account of how its R&D&I policies relate to meeting higher national and supranational strategic goals and measures for R&D&I in the context of the currently applicable documents, e.g. the European Commission's Europe 2020 strategy for smart, sustainable and inclusive growth, the National Research, Development and Innovations Policy for 2016–2020, the National Priorities for Research, Experimental Development and Innovations, the National Research and Innovation Strategy for Smart Specialisation (National RIS3 Strategy), etc.

Self-evaluation:

The number of national and supranational strategic documents is quite impressive. CTU is well related to all of them, or at least to points where they intersect. As to RIS3 strategies (national or regional), we not only conform to them, but have been active in the process of creating them (for example current CTU rector Vojtech Petracek presided over the Prague Innovation Council at the time when the current regional RIS3 was adopted).

As most of the documents mentioned aboveconsider a "future" only up to 2020, the latest national document will be treated first:

The focus of our research and its institutional support correspond fully to the **National Innovation Strategy of the Czech Republic 2019 - 2030** "*Country for Future*" in all of its points:

- ***A Country for R&D***: Research and Development Financing and Evaluation. We are introducing a system for distributing funds that is based on excellent publication and applied results and other results with an impact on the community in relation to Methodology 2017+.
- ***A Country for Technology***: Polytechnic Education. The results of creative activities are reflected in our lectures. Our doctoral students are directly involved in research. Our graduates are fully competitive on the global labor market.
- ***A Country for Startups***: National startup and spin-off infrastructure. We run an incubator, and we support the creation of innovations and fair knowledge transfer.
- ***A Country for Digitization***: Digital State, Production and Services. Our research in informatics is an important part of the Czech and European activities in Industry 4.0, which has its national centre at CTU. We are a founding member of the Prague AI initiative.
- ***A Country for Excellence***: Innovation and Research Centres. We have been creating and developing a number of research centres that advance basic research and also applied research.
- ***A Country for Investment***: Smart investment. We support our inventors in commercializing CTU's intellectual property. The Commercialization Council monitors and evaluates the strategy and selected sub-projects.
- ***A Country for Patents***: Intellectual Property Protection. We identify intellectual property with significant commercial potential and motivate our researchers to transfer knowledge. We are building a system of "Scouts of Technology" in every part of CTU. Patenting abroad is supported by the CTU Licensing Fund.
- ***A Country for Smart Infrastructure***: Mobility and the Building Environment. We explore intelligent solutions, intelligent buildings, and cities to help creativity.
- ***A Country for Smart People***: Smart Marketing. We communicate the results of our research on development and innovation at global and national level.

European Commission's Europe 2020 strategy for smart, sustainable and inclusive growth:

As an educational institution, we contribute strongly to the goal in target 4 **Education**: at least 40% of 30 to 34 years old to have completed tertiary or equivalent education. This also may contribute to headline target 1 **Employment**, but the current labour market is so hungry that education does not make much difference to employability.

Our research and development is strongly coupled to target 3 – Climate and Energy. Our inventions and new technical solutions help to save energy and material, and to limit emissions.

HTML links for additional documentation: National Innovation Strategy of the Czech Republic 2019 - 2030

5.4 Strategy and strategic management tools to improve the international or sectoral competitiveness of the university's research work and quality

The university gives a concise account of its strategy and strategic management tools to increase the international or sectoral competitiveness of the university's research activity and quality. In an appendix it lists the most significant international evaluations for R&D&I it has taken part in. It also sets out its vision and strategy for the next five-year period.

Self-evaluation:

Our strategy is to work hard and honestly, to give the initiative to our researchers, and to create a friendly and competitive environment. Our corporate culture, proven by three hundred years of successful history, helps us to do this.

We identify our weaknesses and we work to eliminate them. We apply internationally recognized standards and procedures.

We try to cooperate primarily with the best European and world research institutions and workplaces in order to see the way ahead sharply and be able to follow it.

HTML links for additional documentation:

TOOLS FOR IMPLEMENTING THE RESEARCH STRATEGY

5.5 Institutional tools for implementing the research strategy, emphasising support of quality R&D&I and the innovation environment

The university describes its institutional and strategic tools (e.g. strategic management tools, tools created to support the achievement of research objectives, legal and organisational regulations related to support of R&D&I, etc.) aimed at implementing its research strategy, with the emphasis on supporting quality of R&D&I and the innovation environment.

Self-evaluation:

According to Section 24 of the Act on Higher Education and the Statute of CTU, Faculty Rights include among others the right

- **a)** to exercise full control over the use of the financial resources that have been committed to the faculty.
- **b)** To decide or act on behalf of CTU to the full extent in the following matters that concern the faculty: the strategic focus of creative activity, International relationships and activities, supplementary activities, and the use of resources generated by these activities.

Therefore, the institutional tools are: money is distributed according to the quality of research, and common quality measures and ethical standards are facilitated.

HTML links for additional documentation: CTU internal regulations

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SUMMARY LIST OF ADDITIONAL DOCUMENTATION IN MODULE M5

Document Title	Criterion	Location (HTML link)
Annual reports		Click Document Title (active link)
Strategy of CTU		
Strategic plan	5.2	
National Innovation Strategy of the Czech Republic 2019 - 2030	5.3	
CTU internal regulations	5.5	

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REQUIRED APPENDICES M3-M5

1. **SWOT ANALYSIS**
2. **OUTCOMES OF RESULTS AVAILABLE FROM THE EVALUATION AT THE NATIONAL LEVEL**