

SELF-EVALUATION REPORT MODULE 3

EVALUATED UNIT: Czech Institute of Informatics, Robotics, and Cybernetics

FORD: Engineering and Technology

MODUL 3 SOCIAL RELEVANCE

SOCIAL RELEVANCE / SOCIAL BENEFIT OF THE EVALUATED UNIT¹

3.1 General self-assessment of the social benefit of R&D&I in the fields of research at the evaluated unit, and of the evaluated unit as a whole

The evaluated unit gives a concise, general but informative account of the benefit of R&D&I in the fields in the 2014–2018 reporting period.

Self-evaluation:

The Czech Institute of Informatics, Robotics and Cybernetics (**CIIRC CTU**) is a young, recently established university institute (founded in 2013). Its fields of interest are automatic control and optimization, robotics, artificial intelligence, computer vision and machine learning, designing decision and diagnostic systems, applications in medicine, energy and transport, including smart homes and smart cities.

CIIRC links excellence in research with applicability of results in industrial/clinical practice. There are 2 ERC Grant holders working at CIIRC and 3 Teams of Excellence established under the OP VVV (ESFRI) funding program, and 12 Horizon 2020 projects.

CIIRC has been deeply involved in activities connected with Industry 4.0 since the very beginning, and became the country leader in this field. CIIRC is systematically building an AI R&D ecosystem aimed at this topic, consisting of the experimental testbed, the National Center for Industry 4.0, etc. The methodologies used in Industry 4.0 have been re-used in the areas of smart cities and smart grids. CIIRC's strength is in interdisciplinary research focused on topics from health and social care.

HTML links to additional documentation:

Official web pages of institution - <https://www.ciirc.cvut.cz>

APPLIED RESEARCH PROJECTS

3.2 Applied research projects²

The evaluated unit presents a maximum of the five most significant (from the perspective of evaluated unit) applied research projects in the 2014–2018 reporting period from the complete list in the appendix (tables 3.2.1 and 3.2.2), particularly with regard to the results achieved or a project's potential for application.

¹ In accordance with Section 22(1) of Act No 111/1998 on universities, amending certain acts (the Universities Act), as amended.

² Under Section 2(1)(b) of Act No 130/2002, applied research is theoretical and experimental work aimed at gaining new knowledge and skills for the developing of new or substantially improved products, processes or services; applied research includes industrial research or experimental development, or a combination of both. Under Article 2 of Commission Regulation (EU) No 651/2014 of 17 June 2014 declaring certain categories of aid compatible with the internal market in application of Articles 107 and 108 of the Treaty, industrial research means planned research or critical investigation aimed at the acquisition of new knowledge and skills for developing new products, processes or services, or for bringing about a significant improvement in existing products, processes or services. It comprises the creation of component parts of complex systems, and may include the construction of prototypes in a laboratory environment or in an environment with simulated interfaces to existing systems as well as of pilot lines, when necessary for the industrial research and notably for generic technology validation; experimental development means acquiring, combining, shaping and using existing scientific, technological, business and other relevant knowledge and skills with the aim of developing new or improved products, processes or services. This may also include, for example, activities aiming at the conceptual definition, planning and documentation of new products, processes or services.

Self-evaluation:

- **Centre for Applied Cybernetics, TE 01020197, 2012-2019, 359 M CZK (=14.4 M EUR). Principal investigator: Vladimír Kučera**
- **HERCULES - High-Performance Embedded Real-time Architectures for Low-Power Many-Core Systems - Horizon2020, European Commission 688860, Z. Hanzalek**
- **AI4REASON - Artificial Intelligence for Large-Scale Computer-Assisted Reasoning. ERC Consolidator project No. 649043, 2015-2020, CTU-CIIRC. Principal investigator: Josef Urban.**
- **R4I: Robotics for Industry 4.0, co-funded by EU, the call for Excellent Research Teams within the Operational Programme OP VVV. Principal investigator: Robert Babuška. The project runs from June 2017 to October 2022.**
- **IMPACT: Intelligent Machine Perception, co-funded by EU, the call for Excellent Research Teams within the Operational Programme OP VVV. Principal investigator: Josef Šivic. The project runs from June 2017 to October 2022.**

HTML links to additional documentation:

3.3 Contract research³

The evaluated unit briefly comments on revenues from contract research for the 2014–2018 reporting period from the complete list in the appendix (tables 3.3.1 and 3.3.2).

Self-evaluation:

CIIRC received EUR 1.38 million from foreign clients and EUR 2.09 million from clients from the Czech Republic during the period 2014-2018, e.g.:

Škoda Auto - EUR 657.000

North Carolina State University - EUR 440.000

Volkswagen AG - EUR 190.000

CEPS - EUR 50.000.

Rockwell Automation - EUR 210.000.

HTML links to additional documentation:

3.4 Revenues from non-public sources (besides grants or contract research) from research work

The evaluated unit briefly comments on revenues for the 2014–2018 reporting period for R&D&I from non-public sources, besides grants or contract research (e.g. licences sold, spin-off revenues, gifts, etc.). It presents a complete list in the appendix (table 3.4.1).

³ For a definition of contract research for the purposes of evaluation in the universities sector, see Article 2.2.1 of the Community framework for State aid for research and development and innovation (2014/C 198/01).

Self-evaluation:

Alexa competition (290.000 EUR). The team won second place in this prestigious world-wide public competition.

Donations, for example Google EUR 33.000, and from Siemens.

The Magma simulation tool licence agreement was received from CEPS (EUR 85.000).

HTML links to additional documentation:

APPLIED RESEARCH RESULTS

3.5 Applied research results with an existing or prospective economic impact on society

The evaluated unit briefly comments on a maximum of the five most significant (from the perspective of the evaluated unit) applied research results that have already been applied in practice, or that will realistically be applied, in the 2014–2018 reporting period from the overview in the appendix (table 3.5.1).

Self-evaluation:

- DIGICOR project (H2020): **a digital market place for efficient supply chain creation and management** has been developed. The platform is being operated by HANSE-AEROSPACE.
- The ARUM project (H2020) resulted in novel production planning and scheduling multi-agent technology. Used in **production scheduling systems for assembling the fuselages of A350 and A320 aircraft** in the Airbus Hamburg and Bremen facilities.
- For **Asseco solutions**, we developed an automatic tool to perform What-if Analysis of a given production company. It computes and estimates **how the production process will be influenced by different decisions made or events occurred in terms of time**.
- Kerberos/Kyklop: A system for automatic 3D reconstruction of vehicle undercarriage shape and images. Application in **security inspection**. Available on the security market.
- **Energetics projects group** - projects (MAFRI project + MAGMA model) are used to mitigate the risk of an increase in energy prices . Application explored by ČEPS.

HTML links to additional documentation:

3.6 Significant applied research results with an impact other than an economic one on society

The evaluated unit gives a concise account of a maximum of the five most significant (from the perspective of the evaluated unit) applied research results with an impact other than an economic one on society in the 2014–2018 reporting period (typically results from disciplines in the humanities and social sciences) from the overview in the appendix (table 3.6.1).

Self-evaluation:

Part of our research is focused on applications in medicine and social care. In these projects the social impact and the impact on the quality of life is greater than the direct economic impact.

- The **Electronic Delivery Book** software system helps doctors monitor fetal well-being during delivery.
- **Epilepsy management system.**

An important set of projects is aimed at improving the efficiency and the quality of University education:

- **StudentAnalyse** – this application of learning analytics has reduced the number of students who had to leave CTU because they failed to pass their exams.

HTML links to additional documentation:

Electronic Delivery Book - <https://www.researchgate.net/publication/325452741>

Epilepsy management system - <https://www.ncbi.nlm.nih.gov/pubmed/30310759>

COOPERATION WITH THE NON-ACADEMIC ENVIRONMENT AND TECHNOLOGY TRANSFER

3.7 The evaluated unit's most significant interactions with the non-academic application/corporate sphere

The evaluated unit gives a concise account of the most typical users of its outputs. It explains whether and how it identifies them and how it works with them. It provides examples of a maximum of ten of the most significant interactions with the non-academic environment in the 2014–2018 reporting period.

Self-evaluation:

CIIRC cooperates with many industrial partners worldwide. CIIRC is aiming to build joint research labs with these companies, as it already has done, e.g. with Škoda Auto, Rockwell Automation and Eaton. With many other companies, CIIRC has signed contracts for research (e.g. with Porsche Engineering, Ford Motor Comp. etc.) or for collaborative research (e.g. CertiCon, MediWare etc.).

- **Škoda Auto**
- **Rockwell Automation**
- **EATON**
- **Porsche Engineering Services s.r.o.**
- **Ford Motor Company**
- South African utility company **ESKOM**, via its research arm **Wits Enterprise**.
- Collaboration with the Netherlands Forensic Institute (NFI), Netherlands Police.
- **Plzenska Teplarenska**
- **Mediware a.s.**

HTML links to additional documentation:

3.8 System and support of technology transfer and intellectual property protection (can be extended to the whole university, emphasising the specific features of the evaluated unit)

The evaluated unit gives a concise account of its system of technology transfer. It conducts an evaluation of the quality of its applied research and the effectiveness of technology transfer using the data presented in the appendix (table 3.5.1). This commentary will highlight the number of filed and granted patents (Czech and international) and licences sold.

Self-evaluation:

CIIRC uses a combined approach to technology transfer that takes into account the specific features of the R&D field. One US patent and 2 Czech patents were awarded, and two packages of licenced software were sold. Specific approaches to technology transfer at CIIRC:

A) **joint labs with well-established industrial bodies** (Rockwell Automation, Eaton, Siemens, Skoda Auto, Lego, Česká zbrojovka) – this approach supports efficient collaborative research and contracted research – the extent is approx. CZK 6-7 mil per year.

B) **CIIRC's own eClub start-up accelerator and research incubator**, which runs with support from the CTU Media Lab Foundation . **eClub** organizes summer programs for 20-30 students each year, helping them to establish their own teams and companies.

C) **support for start-up companies** (e.g. Concerto.ai, and Factorio Solutions) which became implementation partners of CIIRC helping to accomplish pilot implementations in industry. These start-ups are organized as lean companies that are focused on particular problems defined by industry.

HTML links to additional documentation:

3.9 Strategy for setting up and support of spin-off firms or other forms of commercialization of R&D&I results (can be extended to the whole university, emphasising the specific features of the evaluated unit)

The evaluated unit gives a concise account of the practical use of its intellectual property in the form of setting up spin-off firms or other forms of commercialising R&D&I results (both with or without the participation of the university) established by the evaluated unit (university), another entity controlled by the evaluated unit (university), or an employee of the evaluated unit, presenting the model for their functioning and coordination, and control of intellectual property management of the evaluated unit (university).

Self-evaluation:

CIIRC employees and teams are trying to develop spin-off and start-up companies exploring the e-club accelerator. The strategy is to support start-ups in their development towards building efficient SMEs providing services and products inside the country and even elsewhere in Europe. In their more mature stage, the start-ups pay for the development services provided by CIIRC. The start-ups themselves are used by CIIRC to enhance the CIIRC solutions and infrastructure.

HTML links to additional documentation:

E-Club web page - <https://eclubprague.com/>

RECOGNITION BY THE SCIENTIFIC COMMUNITY

3.10 The most significant individual awards for R&D&I

The evaluated unit presents a maximum of ten examples of the most significant R&D&I awards received (in the Czech Republic and in other countries) in the 2014–2018 reporting period.

Self-evaluation:

- **Prof. Vladimír Mařík: Medal of Merit 1st level**, awarded by the President of the Czech Republic (2017)
- **Prof. Vladimír Mařík: ABB Lifetime Contribution to Factory Automation Award** (2016) from the IEEE Industrial electronics Society
- **2017 Longuet-Higgins Prize** for fundamental contributions to computer vision. Awarded for (Philbin, Chum, Isard, Sivic, Zisserman, CVPR 2007).
- **2x 2017 Helmholtz Prize** for fundamental contributions to computer vision. Awarded for (Sivic&Zisserman, ICCV 2003) and for (Sivic, Russell, Efros, Freeman, Zisserman, ICCV 2005)
- **Candidacy of the Year 2016 Award** (Libor Přeučil): Prague Convention Ambassador Program for the International Conference on Intelligent Robots and Systems (IROS 2021, Prague)
- **Google Faculty Research Award**, 2016 – Josef Urban
- **ACM Multimedia Grand Challenge 1st Prize** (2014) – Jan Zahálka
- **AMAZON Alexa Competition 2018, 2nd position** – Jan Šedivý

HTML links to additional documentation:**3.11 Recognition by the international R&D&I community**

The evaluated unit provides the following information / examples demonstrating recognition by the international scientific community in the 2014–2018 reporting period, with a commentary:

It presents a maximum of ten examples of its academic staff's participation on the editorial boards of international scientific journals (e.g. editor, member of the editorial board) in the appendix (table 3.11.1),

It presents a maximum of ten examples of the most significant invited lectures by the evaluated unit's academic staff abroad in the appendix (table 3.11.2),

It presents a maximum of ten examples of the most significant lectures by foreign scientists and other guests relevant to the R&D&I field in the appendix (table 3.11.3),

It presents a maximum of ten examples of the most significant elected memberships of professional societies (table 3.11.4).

Self-evaluation:

CIIRC CTU has gained a high level of international recognition ever since it was set up in 2013, in many scientific fields (Industry 4.0, Computer Vision, Control Theory, Optimization and Energetics). Let us mention such names as Vladimír Kučera and Michal Šebek (Control Theory), Josef Šivic, Jan Urban, Robert Babuška (AI and Machine Learning), Václav Hlaváč and Tomáš Pajdla (Robotics), Vladimír Mařík and Michael Valášek (Industry 4.0). CIIRC is well-recognized and respected in the worldwide AI and Industry 4.0 communities.

HTML links to additional documentation:

POPULARISATION OF R&D&I

3.12 The most significant activities in the popularisation of R&D&I and communication with the public

The evaluated unit gives a concise account of its main activities in the area of popularisation of R&D&I and communication with the public in the 2014–2018 reporting period, and presents a maximum of ten examples that it considers the most significant.

Self-evaluation:

August 25, 2016 – Visit of the German Chancellor Mrs. Angela Merkel

May 2, 2017 – Festive Opening of CIIRC CTU building, attended by the President of the Czech Republic Mr. Milos Zeman and by Prime Minister Mr. Bohuslav Sobotka

Sept 2017, 2018 Night of the Scientists. Yearly attendance at 800 – 1000 guests.

September 4, 2017 - Industry 4.0 Conference: the official start of the RICAIP project, the official launch of the national Centre for Industry 4.0, and the opening of the Testbed for Industry 4.0.

January 29, 2018, May 30, 2018, October 31, 2018 – Open house Day in the National Centre for Industry 4.0

May 30, 2018 Digital Touchpoints of Industry 4.0 in Austria, Czech Republic and Germany

May 25, 2018, Opening of Centre for the City of the Future

September 15, 2018 Experience the City in a Different Way - for the general public, attended by 600 guests

HTML links to additional documentation:

Official web pages of the institution - <https://www.ciirc.cvut.cz>

CIIRC CTU History web page - <https://www.ciirc.cvut.cz/about/historie-ciirc/>

APPENDICES (TABLES)

3.2 Applied research projects

3.2.1 Projects supported by a provider from the Czech Republic

As the beneficiary						
Provider	Project title	Support (EUR thousand)				
		2014	2015	2016	2017	2018
Min Edu Youth Sports CR	Adaptive Production Management	40.5	31.3			
TA CR	Definition of methodologies for the implementation of a digital infrastructure in primary and secondary schools			16.5		
TA CR	Developing a methodology for the creation of legislative provisions and for assessing the impact of legislation and regulation in terms of digital economy and business, electronic communication and e-government			14.4		
TA CR	Linkages between the Industry 4.0 Initiative and the agenda for Digitizing European Industry.			9.2		

TA CR	Validation and refined research on target segments of digital communications topics in education and innovation in education			9.3		
TA CR	Centre for Applied Cybernetics 3	1 057.4	1 041.2	1 130.8	1 159.4	1 226.7
Min Int CR	Kassandra - multi-camera vehicle undercarriage security scanner				72.1	85.1
TA CR	Imitation learning supported by language for industrial robotics				14.7	46.0
TA CR	Transposition of MAF-type reliability indicators into the national reliability standards applicable in corrective measures planning and evaluation, in case of indications of generation inadequacy within the CZ grid					41.0
TA CR	National Competence Center - Cybernetics and Artificial Intelligence					0.00
Total		1 097.8	1 072.6	1 180.2	1 246.3	1 399.0
As another participant						
Provider	Project title	Support (EUR thousand)				
		2014	2015	2016	2017	2018
Min Health CR	Features of Electromechanical Dyssynchrony that Predict the Effect of Cardiac Resynchronization Therapy		27.05	41.25	42.04	41.61
Min Health CR	Identifying the individual dynamics of glycaemia excursions in diabetic patients to improve self-managing procedures influencing insulin dosage		17.67	28.30	29.09	30.50
Min Ind Trade CR	Technology for integrating industrial robots into production systems based on Industry 4.0			20.79	61.60	64.50
Min Ind Trade CR	Research and project concept of a multifunctional robotic effector of an underground multirobot for storage of disposal casks in a deep geological repository, and realization of a prototype of a dual robotic effector module and its master control system				22.64	48.94
Min Ind Trade CR	Research and realization of a testing robotic multi-wheel platform, with a focus on its centration and symmetrical passage through circular profiles of disposal boreholes for the storage of disposal casks with SNF using multifunctional robotic technology					41.80
Min Ind Trade CR	GenomKit - Progressive technology for the rationalization of personalized pharmacogenomics, nutrigenomics and sports medicine					39.00
Min Ind Trade CR	Personal Health Assistance Systems				12.15	31.20

Min Int CR	Smart Camera - New Generation Monitoring Centre				51.99	51.79
TA CR	Advanced laser technology	13.44	29.69	29.22	30.00	
TA CR	DAMiAS - Data-driven Asset Management in the Automobile Industry Based on Semantic Modelling					108.14
TA CR	Research and realization of a prototype of a breakthrough solution of the Creobot Modular multifunctional autonomous modular for transport and manipulation in sophisticated manufacturing and assembly operations					78.97
TA CR	Secure power flexibility for grid control and market purposes (SecureFlex)					48.32
TA CR	Making a modern modular system for teaching mechatronics in line with the Industry 4.0 challenge					25.19
TA CR	MWPharmASIA - database extension of drug substances and their MWPharm models for the East Asian population and development of the NGS diagnostic panel and an algorithm for predicting statin pharmacokinetics/dynamics					0.00
Total		13.44	74.41	119.56	249.53	609.95

3.2.2 Projects supported by a provider from another country

As the beneficiary						
Provider	Project title	Support (EUR thousand)				
		2014	2015	2016	2017	2018
EC	Cluster 4.0 - Methodology of System Integration					922.82
EC	RICAIP: Research and Innovation Centre on Advanced Industrial Production				227.35	100.19
Other foreign provider	SyRoTek - System for robotic e-learning		10			
Total			10		227.35	1022.01
As another participant						
Provider	Project title	Support (EUR thousand)				
		2014	2015	2016	2017	2018
EC	Automated Urban Parking and Driving			134.84	158.28	173.82
EC	Decentralised Agile Coordination Across Supply Chains			18.04	127.37	150.21
EC	Safe human-robot interaction in logistic applications for highly flexible warehouses			160.97	122.62	121.61

EC	A robotic cell for inspecting the surface of painted uneven parts in industrial manufacturing.				14.74	115.47
EC	High-Performance Real-time Architectures for Low-Power Embedded Systems			114.96	114.96	114.96
EC	Factory of the future				26.43	71.64
EC	Live Action Data Input and Output			5.00	100.00	44.75
EC	ECHORD Plus Plus / RadioRoSo: Radioactive Waste Robotic Sorter			2.55	37.70	13.38
EC	Long-Term Human-Robot Teaming for Robot-Assisted Disaster Response	142.86	169.07	189.63	202.72	8.47
EC	Adaptive Production Management	95.59	98.78			
(other foreign provider)	KnowDrift: Knowledge-Driven Industrial Robotics for Flexible Production				4.43	6.50
(other foreign provider)	FUMA: Fusion and Modeling Algorithms			39.67	77.63	107.89
Total		238.45	267.85	665.65	986.88	928.70

3.3 Contract research

3.3.1 Research work contracted by a client from the Czech Republic

Client	Research title	Revenues (EUR thousand)				
		2014	2015	2016	2017	2018
ROCKWELL AUTOMATION Praha	Research in the field of Big Data	37.04	37.04	44.44	44.44	44.44
FCC PRUMYSLOVE SYST_	Computer Vision systems	11.11				
FITNESS REVOLUTION S	Prototype of software, functions and interfaces	7.22				
BLUE RAY A.S.	Design of the machine skeleton	22.67	29.33			
AZOS CZ, S.R.O.	Failure analysis in dynamic photogrammetry		2.85			
CEPS, A.S.	Modeling of energy distribution		0.37	17.41		32.00
CR-ENERGETICKY REGUL	Review of a feasibility study		3.70			
CYJNI SPOL.S.R.O. sídlo	Calculations for energy distribution		6.30			
EATON ELEKTROTECHNIK	Student Research Service Agreement		14.02	17.55	74.07	74.07
EKOLA GROUP, SPO	Data analysis, implementation of a mathematical model		10.37			
GASNET, S.R.O.	Project GAMMA		37.04	37.40	37.04	37.04
TMT SPOL. S R.O.	Development of a controller and SW for continuous power control		3.53			
WITTE NEJDEK, SPOL.	Method for automatic sharpening of camera images		1.94		2.52	
ZENTITY A.S.	A software module for pattern recognition		13.94			

ASSECO SOLUTIONS	IT technology			31.33		31.33
AUREL CZ s.r.o.	SW for 3D measurements			1.56		
AV ČR Termomechaniky	Feasibility study			6.67		
GOODBABY CZECH REPUBLIC	Research Services Agreement			1.95	35.00	
HIWIN S.R.O.	A software module for NC code drawing			20.67		
PORSCHE ENGINEERING1	Various projects for the automotive industry			36.67	92.70	89.11
SKODA AUTO,A.S.	Various projects for the automotive industry			33.23	382.91	241.30
TOOL AXIS S.R.O.	Construction of machine components using optimization methods			2.18		
ZAPADOČESKA UNIVER.	Modeling of objects			1.74		
APPLIED SUNRISE TECH	Integrated telemedicine program				4.44	
ATOS IT SOLUTIONS AN	An evaluation of external production capacity				5.56	13.70
FACTORIO SOLUTIONS,	Joint Laboratory Funding and Cooperation Services Agreement				17.28	29.63
KOVOSVIT MAS, A.S.	Structural calculations for the KL 285 machine				11.52	
MAGIK EYE S.R.O.	Joint Laboratory Funding and Student Research Services Agreement				11.11	11.11
POCKET VIRTUALITY A.	Laboratory Funding and Student Research Services Agreement				4.81	18.52
TOS KURIM - OS,A.S.	Calculations for the 365 110 801 machine				17.78	
TRATEC - CS, S.R.O.	Design, models, visualisation, presentation				6.17	
ČEZ	A study for teams A19 and P4					5.20
CS-BETON S.R.O.	Feasibility study					27.78
E.ON. DISTRIBUCE, A.	A Study for teams A19 and P4					5.20
FYZIKALNI USTAV AV C	Control SW for image storage					2.71
LEGO PRODUCTION S.R.	Digital Prepack					92.29
LINET SPOL. S R.O.	Tensometric Data processing					2.19
MIN SPRAVEDLNOSTI Odbor informatiky	Domain analysis for CTD					1.78
PANATTONI CZECH REPU	Panattoni Digital Park Study					3.70
PRE Distribuce	A Study for teams A19 and P4					5.20
PULS INVESTICNI S.R.	An evaluation of automatic production processes					5.11
Total		78.04	160.42	252.80	747.36	773.41

Note: List and describe contract research work with the revenue for the calendar year in question.

3.3.2 Research work contracted by a foreign client

Client	Research title	Revenues (EUR thousand)				
		2014	2015	2016	2017	2018
NC STATE UNIVERSITY Office of Contracts & Grants	Project Fusion and Modeling Algorithms (FUMA)	145.93		39.69	129.86	127.98
VOLKSWAGEN AG	Research work according to specific orders	5.00	30.00	34.00	14.90	105.00
MAGIK EYE INC.	Development of Calibration software for the Magik Eye 3D sensor system		10.84	36.32		9.58
FORD MOTOR COMPANY	Ontology Descriptions of Advanced Knowledge			45.09	47.58	37.96
CONCERTO AI	Joint Laboratory Agreement				94.43	166.54
FACULTY OF COMPUTING JEDDAH	Multiple UAV Experimental Test- Bed Design			12.01	34.46	
ADC AUTOMOTIVE DISTA	Development Agreement					58.87
DOOSAN MACHINE TOOLE Advanced Technology Team	Project proposal for developing a thermal error compensation model					35.95
WITS COMMERCIAL ENTE	Study of salts and available metals, experimental testing of nitrate salts					160.89
Total		150.93	40.84	167.10	321.23	702.76

Note: List and describe contract research work with the revenue for the calendar year in question.

3.4 Revenues from non-public sources (besides grants or contract research)

3.4.1 Overview of revenues from non-public sources raised for the 2014–2018 reporting period

Revenue type	Revenues (EUR thousand)				
	2014	2015	2016	2017	2018
License CEPS					84.92
Donation AGILE EUROPE (for an international conference)	-	1.852	-	-	-
Donation AMAZON - ALEXA PRIZE		-	48.148	43.619	199.054
Donation GOOGLE		-	-	32.931	-
Donation Česká spořitelna		-	-	7.407	-
Donation FCC		-	-	6.667	14.444
Donation CONSILIA FUTURA for CMB		-	-	-	0.926
Donation SIEMENS for NCP		-	-	18.519	-
Total	-	1.852	48.148	109.142	299.345

Note: List funds for R&D&I from non-public sources, besides grants or contract research (e.g. licences sold, spin-off revenues, gifts, etc.) in each calendar year.

3.5 Applied research results with an economic impact on society

3.5.1 Overview of applied research results in the 2014–2018 reporting period

List and describe the results that have already been applied in practice, or that will realistically be applied, with an existing or prospective economic impact on society. Under “patents” and “licences sold”, list all the results; under other results list a *maximum* of five items. Unless otherwise specified below, the definition of a result must correspond to the definitions under the Methodology for Evaluating Research Organisations and Research, Development and Innovation Purpose-Tied Aid Programmes, Appendix No 4: Definitions of Types of Results.

Results	Year	Title
European patent		
American patent	2017	Method for an Accurate Automated Non-invasive Measurement of Blood Pressure Waveform and Apparatus to Carry Out the Same - US20170196468A1
Czech licenced patent	2016	A method of precise automatic non-invasive sensing of a blood pulse wave and a device for performing this method - CZ20160006A3
	2018	Combined burnable absorber for nuclear reactor - Patent Application CZ PV 2018-742
Other foreign patents		
Licences sold	2018	Electronic delivery book system - University Hospital Brno entered into a licence contract
	2018	MAGMA modelling tool
Significant analyses / surveys / studies	2016	National concept of the Industry 4.0 initiative
Spin-off with a stake held by the evaluated unit		
Spin-off with no stake held by the evaluated unit	2014 - 2018	Rossume.ai, SlidesLive, CitiAdventuaires, X.GLU, Concerto.ai, Factorio Solutions, etc.
Prototypes	2018	Burnable absorber for nuclear reactor - Utility Model Application CZ PUV 2018-35787
Varieties and breeds		
Other: Verified technology	2017	Laser cutting of electrode from pyrolytic carbon
Other: Verified technology	2017	Lasered chip-breaker in a cutting tool combined with structuring

Note: “Licence” refers to a licence for a result of R&D&I in the broadest sense of the word (licences for patents, utility models, industrial designs; copyright licences for software and other works, and any other licences).

For the purposes of this methodology, a “spin-off” is a juridical person established to commercialise knowledge, usually with the inclusion/transfer of the rights to this knowledge to such juridical person. List all instances of legal persons.

3.6 Significant applied research results with an impact other than an economic one on society

3.6.1 Overview of applied research results for the 2014–2018 reporting period with an impact other than an economic one on society

Result type	Name	Anticipated impact
Software	Electronic Delivery Book	CIIRC CTU team
CLA	Abry, P.; Spilka, J.; Leonarduzzi, R.; Chudáček, V.; Pustelnik, N.; Doret, M.: Sparse learning for Intrapartum fetal heart rate analysis, <i>Biomedical Physics & Engineering Express</i> . 2018, 4(3), 11 pages, ISSN 2057-1976	CIIRC CTU participants (45%): Impact on higher capabilities of medical doctors to detect heart anomalies on the fly
CLA	Křemen, V.; Brinkmann, Benjamin H.; Kim, I.; Guragain, H. et al. Integrating Brain Implants With Local and Distributed Computing Devices: A Next Generation Epilepsy Management System <i>IEEE Journal of Translational Engineering in Health and Medicine</i> . 2018, 6 ISSN 2168-2372.	Křemen (3.7%) A very important contribution to the development of technology in the area of the Brain-Machine interfaces
CLA	Kucewicz, M.T.; Berry, B.M.; Miller, L.R.; Khadjevand, F.; Ezzyat, Y.; Stein, J.M.; Křemen, V.; Brinkmann, B.H. et al. Evidence for verbal memory enhancement with electrical brain stimulation in the lateral temporal cortex <i>Brain</i> . 2018, 141(1), 971-978. ISSN 0006-8950.	Křemen (5%): Contribution to the focused stimulation of the brain

Note: List and describe a maximum of five results (in line with the Definitions of Types of Results) that have already been applied in practice, or that will realistically be applied. These are typically results from disciplines in the humanities and social sciences, for which you should briefly describe their anticipated impact.

3.11 Recognition in the international R&D&I community

3.11.1 Participation of the evaluated unit's academic staff on the editorial boards of international scientific journals in the 2014–2018 reporting period

Name, surname and title(s) of the evaluated unit's member of staff	Title, publisher, city(-ies) and country(-ies) of origin of the scientific journal
Robert Babuška, Prof.	International Journal of General Systems, Taylor & Francis Ltd, 2-4 Park square, Milton Park, Abingdon, England
Zdeněk Hanzálek, Prof.	International Journal of Distributed Sensor Networks, Hindawi Publishing Corp, New York
Vladimír Kučera, Prof.	International Journal of Robust and Nonlinear Control, Wiley, Hoboken, New Jersey, USA
Lenka Lhotská, Assoc. Prof. and Vladimír Mařík Prof.	Transactions on Large-Scale Data- and Knowledge-Centered Systems, Springer Nature, Switzerland
Tomáš Pajdla, Assoc. Prof.	Foundations and Trends in Computer Graphics and Vision, Now Publishers, Hanover, USA
Tomáš Pajdla, Assoc. Prof.	IPSI Transactions on Computer Vision and Applications, Assoc Computing Machinery, New York, USA
Josef Šivic, Dr.	International Journal of Computer Vision, Springer
Josef Šivic, Dr.	IEEE Transactions on Pattern Analysis and Machine Intelligence, IEEE Computer soc, Los Alamitos, USA
Tomáš Vyhliďal, Prof. and Jaromír Fišer, Dr.	Kybernetika, Institute of Information Theory and Automation, Czech Academy of Science

Note: List a maximum of ten examples of academic staff's participation on the editorial boards of international scientific journals (e.g. editor, member of the editorial board, etc.).

3.11.2 The most significant invited lectures by the evaluated unit's academic staff at institutions in other countries during the 2014–2018 reporting period

Name, surname and title(s) of the evaluated unit's member of staff	Invited lecture title	Name of the host institution, conference or other event
Zdeněk Hanzálek, Prof.	An Energy Efficient Schedule for IEEE 802.15.4/ZigBee Cluster Tree WSN with Multiple Collision Domains and Period Crossing Constraint	University of North Carolina at Chapel Hill (2015)
Vladimír Kučera, Prof.	Control theory and its impact on society	International Federation of Automatic Control (IFAC), 8th Symposium on Robust Control, Bratislava, 2015
Vladimír Mařík, Prof.	Agents in Industry	Univ. of Arizona, Phoenix, 2015
Tomáš Pajdla, Assoc. Prof.	3D Reconstruction from Photographs Principles & Applications	IEEE 14th IAPR International Conference on Machine Vision Applications (MVA), 2015, Tokyo.
Tomáš Pajdla, Assoc. Prof.	Computational Algebraic Geometry in 3D Computer Vision	ICMS 2016 Berlin (icms2016.zib.de)
Josef Šivic, Dr.	Computer vision and visual recognition: current state-of-the-art and open problems	Classification of images, from watermark to web trends, Paris Sciences & Data, PSL, 2018
Radek Škoda, Dr.	Gen II reactors	INI2018 Umass Lowell, USA
Josef Urban Dr.	"Machine Learning for Proof Automation and Formalization"	24th International Conference on Types for Proofs and Programs, TYPES 2018, Braga, Portugal, 18 – 21 June 2018.
Josef Urban, Dr.	"Artificial Intelligence for Large-Scale Computer-Assisted Reasoning"	ERC Conference on FRONTIER RESEARCH AND ARTIFICIAL INTELLIGENCE, 25-26 October, 2018, Brussels.
Tomáš Vyhlídal, Prof.	Energy and ventilation in historic buildings	L'Institut National du Patrimoine (INP), Paris

Note: List a maximum of ten examples.

3.11.3 The most significant lectures by foreign scientists and other guests relevant to the R&D&I field at the evaluated unit during the 2014–2018 reporting period

Name, surname and title(s) of the lecturer	Lecturer's employer at the time of the lecture	Invited lecture title
Stephan Schulz, Dr.	DHBW Stuttgart	Amazing Stories - Towards E 2.0, 2016
Bill Magwood, Dr.	NEA OECD	Nuclear Energy Agency role for the Czech nuclear sector, September 2018
Ben Goertzl, Dr.	SingularityNet	From Here to Human-Level AGI in 4 Simple Steps, 2018

Christian Szegedi, Dr.	Google Research	Deep Neural Networks
Dimitar Filev, Dr.	Ford Motor Comp.	Evolution Systems in AI
Petr Skobelev, Prof.	Univ. of Samara	Applications of Multi-Agent Systems
Tomas Mikolov, Dr. 2017-08-25	Facebook AI Research, USA	Neural Networks for Natural Language Processing
Akihiro Sugimoto, 2017-09-25	National Institute of Informatics (NII), Japan	Deeply Supervised 3D Recurrent FCN for Salient Object Detection in Videos
Alexei Efros, 2018-05-25	UC Berkeley, CA, USA	Self-supervision, Meta-supervision, Curiosity: Making Computers Study Harder
David Fouhey, 2018-10-25	University of Michigan, MI, USA	Understanding how to get to places and do things

Note: Relevant solely for the R&D&I field. List a maximum of ten examples.

3.11.4 The most significant elected membership in foreign of professional societies relevant to the R&D&I field at the evaluated unit during the 2014–2018 reporting period

Name, surname and title(s) of the evaluated unit's member of staff	Name of professional society	Type of membership
Robert Babuška, Prof.	Advisory committee for drones at the Dutch Ministry of Justice and Security in 2017-18.	member
Vladimír Kučera, Prof.	Institute of Electrical and Electronics Engineers (IEEE)	Life Fellow, 2017
Lenka Lhotská, assoc. prof.	European Federation of Medical Informatics	Council member
Vladimír Mařík, Prof.	Board of Governors and Executive Committee IEEE SMC – since 2014, USA	Vice-president
Vladimír Mařík, Prof.	International Advisory Board of Software Competence Center Hagenberg, Austria since 2017	Chairman
Josef Šivic, Dr.	Computer Vision Foundation	advisory board member
Tomáš Vyhřídál, Prof.	IFAC (International Federation of Automatic Control)	vice-chair of Technical Committee 2.2. Linear Control Systems

Note: List a maximum of ten examples.



MINISTERSTVO ŠKOLSTVÍ,
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SUMMARY LIST OF ADDITIONAL DOCUMENTATION IN MODULE M3

Document Title	Criterion	Location (HTML link)