Feasibility study

for projects submitted as part of Operational Programme Research, Development and Education,

Priority Axis 1, Investment Priority 1, Specific Objective 2,

Call: **Long-term Intersectoral Cooperation and Long-term Intersectoral Cooperation for ITI**

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Abbreviations and explanatory notes

Abbreviation	Explanatory notes
IS KP14+	End applicant / beneficiary information system
MS2014+	2014+ Monitoring System
R&D	Research and development

1 GENERAL INFORMATION

Item	
Project title	SMART technologies to improve the quality of life in cities and regions
Name of applicant	University of Ostrava
Number of partners, research organizations	3
Number of partners, business corporations, State enterprises	5
Link to the published financial statements for business corporations and State enterprises (see Rules for Applicants and Beneficiaries – Specific Part, Relevant for all partners of this type)	Annual financial statements of the Mandatory partner AutoCont CZ Inc. for the accounting period 2016 is available in the public part of the Commercial Register: https://or.justice.cz/ias/ui/vypis-sl-firma?subjektId=60462 Annual financial statements of other partners - business corporations are also available in public part of the Commercial Register.
Name of the body / bodies of the applicant submitting the project application (name of the faculty, university)	University of Ostrava, Faculty of Science
Main field / field group of the project, as defined in Call Specific Rules.[1]	1AB1 – Social Studies
Secondary field / field group of the project, as defined in Call Specific Rules.	1AB2 – Mathematics and physics 1AB4 – Eart, atmosphere and environment sciences 1AB6 - Medicine 1AB8 – Informatics 1AB9.1-1AB9.4 – Industry: Electrical engineering and robotics 1AB9.5 – 1AB9.6 – Industry: Energy sector 1AB9.15 – Industry: Land transport systems and equipment

2 BRIEF PROJECT DESCRIPTION-ABSTRACT

In accordance with the Call - the main purpose of the project is to support intensification of long-term inter-sectoral cooperation between research and application spheres in the thematic area of SMART technologies applicable for improvement of life quality of citizens within urban and regional development. The project implies two-way transfer of knowledge and experience among the entities involved and further linking of research-application problems concerning SMART technologies with the latest research findings. Further the knowledge and experience with research problems and application options concerning use of SMART technologies for urban and regional development will be transferred especially to research staff, university students and public service staff.

The project will not focus on technical and technological aspects; there will be examined primarily organizational side and actually available SMART technologies, respectively possibilities of their use for improving of life quality at different levels of regional units. Actual problem of many SMART technologies is

[1] *Specity both the number and name as given in the Rules for Applicants and Beneficiaries – Specific Part.*

not the absence of suitable technology, but absence of suitable concept or solution that would meet all key factors for success of the entire SMART solution or concept.

The project consists of 12 key activities that are specified by the Call. The main activity of the project will be realization of KA 4 that consists of implementation of five joint research intents with clearly defined goals and outcomes. The aim of the research part is to jointly examine and propose methods and procedures for creation and implementation of socio-technical innovations enhancing the quality of life and that are based on SMART technologies.

The research part of the project consists in total of five single sub-research programs that systematically build on each other and focus on particular parts of the innovation cycle in relation to the specific world environment where SMART technologies are playing an increasing role. Within individual research programs there will be investigated methods and procedures for creation and implementation of social-technical innovations enhancing the quality of life that are based on SMART technologies.

The second cross-sectional research line of the project across the five research intents will on the basis of researches propose model SMART solutions and concepts at TRL3 (proof-of-concept), especially for areas of mobility and transport, energy and savings, health and social care, learning and education.

3 PROFILE OF THE APPLICANT AND PARTNERS

3.1 Brief Characteristics of the Project Applicant

University of Ostrava (Ostravská univerzita) – Project Applicant

The University of Ostrava (OU) was founded on 28th September 1991. It is an institution that is ready to bring progressive tendencies of European education to regional environment and therefore sees its role mainly in developing humanities, medicine, natural science and fine arts in a region traditionally associated particularly with industry. Nowadays the University of Ostrava consists of 6 faculties (Faculty of Fine Arts, Faculty of Social Studies (FSS), Faculty of Arts, Faculty of Medicine (FoM) and Faculty of Science) and two scientific institutes. The IT4Innovations Centre of Excellence, OU Division, Institute for Research and Application of Fuzzy Modelling focuses on the development of special mathematical methods and other areas of soft computing. The European Research Institute for Social Work sees as one of its main objectives the support of the professional growth of new scientists from both groups – students and academic staff.

The University of Ostrava has in total 1,156 employees, 727 of which are academics and researchers including 56 academic colleagues with foreign citizenship.

The University of Ostrava offers a wide range of bachelor, postgraduate master, master and doctoral study programs to prospective students. In 2015, there were opened 60 bachelor study programs, 48 follow-up master studies and 3 so-called long-term master programs and 23 doctoral degree programs in all levels and forms of study. As per 31st December 2015, studied at the University of Ostrava 9,620 students at all levels and forms of accredited study programs.

The mission of the university is to provide professional services in the area of education, development of science and research and support of new ideas and innovations. The University Library of the University of Ostrava significantly contributes to enhancing the service for science, research and education. This public

library provides specialised funds and information sources that thematically correspond to basic orientation of faculties. There is a unique Centre Pyramid within the university dealing with special needs of university students. The Information Technology Centre provides the operation and management of information and telecommunication means and systems at all university departments.

The University of Ostrava has a long-term experience with implementation and administration of research as well as development projects aimed at increasing the quality of teaching, supporting the further education of teachers and supporting the career development of academic personnel. In the previous programming period there were solved / co-ordinated 85 projects, of which were 76 COP projects and 4 OP R&DI with a total volume of used funds of more than 947,941 thousand CZK. OU was also a successful manager of projects in other operational programmes (OP E and OP HRE). A summary list of projects and details on their content can be found in website of OU. The following projects can be counted among the most important projects of University of Ostrava:

- OP R&DI: CZ.1.05/1.1.00/02.0070 – IT4Innovations Centre of Excellence,
- OP R&DI: CZ.1.05/2.1.00/03.0100 – IET Institute of Environmental Technology,
- OP R&DI: CZ.1.05/4.1.00/04.0151 – Infrastructure for the Implementation of Medical and Related Social and Natural Sciences and Research of the University of Ostrava,
- FP7: 31210 New BIO-technological Approaches for Biodegrading and Promoting the Environmental Biotransformation of Synthetic Polymeric Materials.

The University of Ostrava has also experience with handling of intellectual property protection items. Currently, it owns 6 utility models and 2 patents:

- *Utility models:*
  - 2009-20789 19691 Material for Removing Heavy Metal Ions from waste water
  - 2009-21307 19897 Ultrasound Assisted Extraction of Lutein and Zeaxanthin and Extraction by Means of Selective Solvents from Knotweed
  - 2010-22497 21067 Modular Filter Plant with Coal Filling
  - 2010-22497 21067 Three-component Two-phase System for Selective Extraction of Lutein from Plant Material
  - 2011-23772 22157 Equipment for Isomerization of Carotenoids
  - 2015-34933 29172 Ergonomic Device for Monitoring of Local Muscle Load
- *Patents*:
  - 2013-993 304972 Laparoscopic Radio-Frequency Operating Tool, Especially for Liver Resection
  - 2015-820 306627 Ergonomic Device for Monitoring of Local Muscle Load

Faculty of Science - research centre

The origin of Faculty of Science of the University of Ostrava is closely associated with the establishment of the university. The Academic Senate of The University of Ostrava established the Faculty of Science (FoS) with effect from 1st October 1991. The Faculty of Science consists of seven departments (Department of Biology and Ecology, Department of Physics, Department of Physical Geography and Geoecology, Department of Chemistry, Department of Computer Studies and Computers (DCSC), Department of Mathematics, Department of Human Geography and Regional Development). Education takes place in

dozens of disciplines at all levels of study, i.e. bachelor's, follow-up master's and doctor's Degrees. As per 31st October 2015 there were 1,295 students studying at the bachelor's degrees, 456 at the follow-up master's degrees and 157 at postgraduate doctoral study programme.

Out of the departments of Faculty of Science**, The Department of Human Geography and Regional Development and its Centre of Urban and Regional Management (CURM DHG FoS),** is most relevant from the point of view of the proposed project. One of the official general research direction (GRD) of the University of Ostrava is "Governance of territorial development" implemented by Centre of Urban and Regional Management CURM by The Department of Human Geography and Regional Development. CURM researches are based on cognition that competitiveness of municipalities and regions is determined by the initial structures and endogenous development potential on one hand and on the other hand by constellations of controlling systems of territorial development (participants and their reactions, external conditions, normative frameworks) that generates certain policy activities. The research of "Governance of territorial development" is focused on a number of partial aspects of governance, such as strategic planning (including territorial marketing), creating regional competitive advantages of regional agglomerations (CRA Constructing regional advantage) and thus primarily in old industrial regions (affected by economic restructuring and demographic changes etc.) and also in non-metropolitan regions.

CURM follows modern trends and innovative concepts in territorial development including concepts on learning cities / learning regions, smart cities/smart regions and e-government. CURM cooperates with Municipal Council of City of Ostrava (MCCO), Moravian-Silesian Region (MSR), Ministry of Regional Development (MRD) and a number of leading foreign research institutions such as Fraunhofer Institut Stuttgart, Leibniz Institute Leipzig, Helmholtz Institute Leipzig, John Moore University Liverpool, University La Sapienza Roma, Wirtschaftsuniversität Wien etc. Within the 3rd role of universities (social engagement of universities), CURM staff cooperates with partners from public as well as private sector to enhance life quality in cities and regions. CURM and its core team also conduct extensive research and publishing activities and are authors of 2 certified methodologies. CURM DHG provides education and research in doctoral study program Economic Geography and Regional Development and has capacities of students of doctoral and follow-up master studies. Additionally, academic colleagues from the Department of Human Geography will also be involved in DMS project.

In order to ensure successful project implementation in terms of meeting the indicators, the CURM DHG team applies a number of quantitative and qualitative research methods and techniques, including participatory techniques essential for the development and further consolidation of effective long-term inter-sectoral cooperation. The CURM team provides synthesis of knowledge within individual research plans of key activity KA 4.

Characteristics of CURM DHG

Structure of the scientific team:

- CURM Leader: doc. RNDr. Petr Rumpel, Ph.D. – expert project leader principal investigator

Senior researchers

- doc. RNDr. Petr Rumpel, PhD., h-index 6
- Mgr. Ondřej Slach, Ph.D., h-index 4

- RNDr. Jan Ženka, Ph.D., h-index 5

Junior researchers:

- RNDr. Petr Žufan, Ph.D.
- Mgr. Petr Dvořák, Ph.D.
- Mgr. Luděk Krtička
- Mgr. Alexandr Nováček
- Mgr. Adam Pavlík
- Mgr. Vojtěch Bosák
- Mgr. Vendula Reichová

Significant scientific research results of CURM

- ŽENKA, J., NOVOTNÝ, J., SLACH, O., KVĚTOŇ, V. (2015): Industrial specialization and economic performance: a case of Czech microregions. Norwegian Journal of Geography, vol. 69, no. 2, p. 67-79.
- BLAŽEK, J., RUMPEL, P., SKOKAN, K., ŽÍŽALOVÁ, P. (2013) Emerging regional innovation strategies in Central Europe: institutions and regional leadership in generating strategic outcomes. European Urban and Regional Studies. Volume 20, Issue 2, pages 275-294.
- TÖDTLING, F., RUMPEL, P., SKOKAN, K., HÖGLINGER, CH., GRILLITSCH, M. (2013) Innovation and knowledge sourcing of modern sectors in old industrial regions – A comparison of software firms in Moravia Silesia and Upper Austria. European Urban and Regional Studies, Volume 20, Issue 2, pages 188-205.
- BLAŽEK, J., RUMPEL, P., SKOKAN, K., ŽÍŽALOVÁ, P. (2011) Where Does the Knowledge for Knowledge intensive Industries Come From? The Case of Biotech in Prague and ICT in Ostrava. European Planning Studies. 2011, vol. 19, p. 1277-1303. RUMPEL, P., SLACH, O. (2012): Governance of shrinkage of the city of Ostrava. Prague: European Science and Art Publishing, pp. 258.
- GROSSMANN, K., HAASE, A., ARNDT, T., CORTESE, C., RINK, RUMPEL, P., SLACH, O., TICHÁ, I. VIOLANTE, A. (2014): Sozialräumliche Segregationsmuster in schrumpfenden Städten: Urbane8 / 162 Ungleichheiten Neue Entwicklungen zwischen Zentrum und Peripherie. Wiesbaden: Springer Fachmedien Wiesbaden, p. 89-115.
- RUMPEL, P., SLACH, O. (2014): Shrinking cities in central Europe. In: Herrschel, T., Dostál, P., Raška, P., Koutský, J. (eds.) Transitions in Regional Science – Regions in Transitions: Regional research in Central Europe. Prague: Wolters Kluwer, pp. 142-155.
- GROSSMANN, K., A. HAASE, T. ARNDT, C. CORTESE, RUMPEL, P., D. RINK, SLACH, O., TICHÁ, I., VIOLANTE, A. (2013): How Urban shrinkage impacts on patterns of socio-spatial segregation: The cases of Leipzig, Ostrava, and Genoa. In: YEAKEY, CC., SANDERS, V., WELLS, A., (eds.): Urban Ills: Post Recession Complexities to Urban Living in Global Contexts, New York, London: Lexington Books, pp. 241-268.

Significant grants (Czech central project database, international)

- 2011-2014: Rumpel, P.: Cluster life cycles – the role of actors, networks and institutions in emerging, growing, declining and renewing clusters. **EUROCORES/CSF** European Science Foundation CRP/11/E025, Coordinator: Doc. Dr. Jiří Blažek Ph.D. UK Prague, Project leader: Prof. Dr. Robert Hassink, University of Kiel, Germany.
- 2009-2011: Rumpel, P.: Governace of Shrinkage within a European Context – Shrink SMART. **EU 7th FP Framework Programme**. Coordinator: Helmholtz Institute for Environmental Research, Leipzig, Germany, Project leader Prof. Dr. Dieter Rink.
- 2007-2009: Rumpel, P.: CRA Constructing Regional Advantage, Towards State-of-the-Art Regional Innovation System Policies in Europe. **EUROCORES European Science Foundation CRP/07/E005-31 /CSF**. Czech Coordinator: Doc. Dr. Jiří Blažek Ph.D., UK Prague.

Further research projects:

- 2007-2011: The role of soft factors and amenities in the reduction of disparities of old industrial regions. MMR, Ministry of regional development. (Ministerstvo pro místní rozvoj MMR), WD-61-07-1.
- 2004-2006: Innovative concepts and approaches in socioeconomic development of localities and regions. (Inovativní koncepty a přístupy v socioekonomickém rozvoji územních jednotek). CSF, Grant agency of the Czech republic.
- 2005-2006: Marketing management of cities and regions. MMR, Ministry of regional development. WB-22-05.
- 2005-2006: The future of regional development agencies. MMR, Ministry of regional development. (Ministerstvo pro místní rozvoj MMR), WB-15-05.
- The most important results of collaboration with practice:

Other involved parts of the Applicants

The project will also involve a team of senior and junior researchers and doctoral candidates from the Department of Computer Science and Computers from the Faculty of Science implementing partial experimental projects within particular research plans (see CV Ing. Pavel Smolka Ph.D., RNDr. Jaroslav Žáček, Ph.D.; RNDr. Michal Janošek, Ph.D., Ing. Zdeňka Telnarová, Ph.D., Ing. Vladimír Bradáč, Ph.D.). Other OU teams are the team of the Faculty of Medicine (leader Prof. MUDr. Roman Hájek – telemedicine) and team of Faculty of Human Studies (expert leader of the research plan RP 1 Doc. Soňa Vávrová, expert leader of the experimental project FSS Doc. Alice Gojová), including doctoral students.

Leader of the individual key activities in terms of both professional and administrative sides will be preferably colleagues of 2 departments of Faculty of Science, mainly CURM DHG and Department of Computer science and Computers.

Individual departments of OU in cooperation with project partners will contribute through their research and publishing activities to meet the project indicators as follows:

- CURM DHG FoS of OU – 4 publishing outputs and an adequate share of other key activities within KA 4
- DCSC FoS of OU – 3 publishing outputs and an adequate share of other key activities within KA 4
- FSS OU – 3 publishing outputs and an adequate share of other key activities within KA 4
- FoM OU – 3 publishing outputs and an adequate share of other key activities within KA 4

3.2 Brief Characteristics of the Project Partners

Franhoufer IAO (eligible expenditure of CZK 17.4 million)

Fraunhofer IAO is a member of the Fraunhofer Society with the headquarters in Munich, Germany. The Fraunhofer Society was founded in 1949, employs over 24.000 researchers at 66 institutes and research units throughout Germany. The Fraunhofer Society has a global presence with another 60 institutes worldwide in the USA (Boston, Newark, San Jose, Maryland), South America (Sao Paulo, Santiago), Asia (Bangkok, Beijing, Bangalore, Jakarta, Tokyo, Singapore) and Africa (Dubai, Cairo, Pretoria). The annual research budget of the Fraunhofer Society is over 2 billion EUR, including over 1,7 billion EUR in contract research. Roughly 30% of the funding is provided by the German state and federal governments for advanced applied research.

Fraunhofer Institute for Industrial Engineering IAO, which is based in Stuttgart, helps companies and public institutions introduce new business models and efficient processes to make their businesses and operations more successful. Fraunhofer IAO regularly participates in international networks, investigating and shaping the frontline themes that are most relevant to the future of Germany and Europe as a business location. **The goal** of Fraunhofer IAO is to systematically optimize the ways in which people, organizations and technology interact. Fraunhofer IAO has its finger on the pulse when it comes to today's mega trends in technology and society.

Fraunhofer IAO research focuses on the following key areas:

- Digitalization and its effects on human-machine interaction, work design and business models
- Opportunities and challenges of urbanization and the "future market city"
- Impact of demographic changes on skills, employment and work
- Sustainable mobility concepts based on intelligent technologies
- Fraunhofer IAO clients

The clients range from major corporations and SMEs to public sector bodies and institutions.

Fraunhofer IAO teams. The interdisciplinary teams bring together colleagues from a range of specialist fields, including business management and economics, computer science, engineering, natural sciences, and social science. They take a wide-ranging, holistic approach to analysing key issues in order to pinpoint the most practical and feasible solutions.

Fraunhofer IAO network and cooperations

Fraunhofer IAO works closely together with our partner institute – the Institute of Human Factors and Technology Management (IAT) at the University of Stuttgart – as well as the Technical University of Berlin and a number of other institutes of higher education.

Fraunhofer IAO in numbers

Combined, Fraunhofer IAO and the IAT employ about 650 people and have a total of 15,000 m2 of office space, demonstration centers, and development and test laboratories. There are currently 634 running projects and 156 annual publications. The overall budget is some 38,5 mEUR. In 2016, 8 dissertations were completed, 61 studies finished, 6 diploma theses and 41 bachelor theses and 55 master theses awarded.

The leadership at the Fraunhofer IAO is made up of three executives and recognized scientists:

- Prof. Dr.-Ing. Prof. e. h. Wilhelm Bauer is since 2013 Executive Director of Fraunhofer Institute for Industrial Engineering IAO, Stuttgart.
- Univ.-Prof. Dr.-Ing. Dr.-Ing. E.h. Dr. h.c. Dieter Spath is again since 1.10.2016 Director of Fraunhofer IAO and IAT University of Stuttgart.
- apl. Prof. Dr.-Ing. habil. Anette Weisbecker is since 2013 Deputy Director Fraunhofer IAO and IAT University of Stuttgart.

Ongoing projects at the Fraunhofer IAO

There currently over 630 running projects at the Fraunhofer IAO. Many of these focus on issues around Smart Cities. The projects can be split in **two main groups**. First is the collaboration with cities and municipalities. Second is the applied collaboration with the private sector. Fraunhofer IAO is currently coordinating one of the largest EU H2020 SCC1 project called **Triangulum**. The purpose of this project is to showcase various applications of smart cities approaches to improving the quality of life of people in the following cities: Eindhoven, Manchester, Stavanger. The real projects in these cities span from smart district development to mobility solutions, energy management and data-driven urban management. Another project in the EU H2020 SCC1 category is called Smarter Together, where Fraunhofer IAO focuses on developing business models and financial models that bear relevance to Smart City solutions. The key focus of Smarter Together is co-creation and engagement with the user as a key element of increasing acceptance of Smart Cities and urban innovations. With regards to particular projects with the private sector, Fraunhofer IAO currently collaborates with a number of companies, namely: Bosch, Osram, Daimler, Porsche, e.on, TüV SüD, SAP and many others. Fraunhofer IAO has been extensively using the Morgenstadt platform that it developed to get companies and cities behind Smart City solutions. Some of the projects with the private sector cover issues such as autonomous driving, connected cars and IoT, urban farming, electric individual mobility as a service (MaaS), smart energy grids, data-driven urban management and many others.

Slesian university in Opava (Slezská univerzita v Opavě) (eligible expenditure of CZK 4.45 million)

Silesian University in Opava, is among the public universities in the Czech Republic the only one, which was founded after 1989 on „green-field site“, without possibility to continue in longer existence of any other previous faculty.

Silesian University in Opava passed a challenging evaluation at the beginning of the third millennium and is a member of European University Association. It has signed cooperation agreement with many foreign universities not only on European continent and tries to intensify contacts with the nearest universities in Polish Silesia. For this purpose, at its initiative was established Conference of Rectors of Silesian Universities. At the departments of Silesian University in Opava and Karviná scientific research is well developed, as demonstrated by the publications activities and scientific conferences that Silesian University in Opava organizes also at the international level. It is a university with a positive trend of development and wants to achieve high-quality awards also in the context of the universities of the European Union.

Silesian University consists of faculties and university institute, namely the Faculty of Philosophy and Science in Opava, the Faculty of Business Administration in Karvina, the Faculty of Public Policy in Opava, and from the Institute of Mathematics in Opava.

Faculty of Business Administration in Karviná operates in a city that has undergone extensive reconstruction in the last decades depending on the development of coal mining. Currently, the faculty offers study in bachelor's and follow-up Master's degree programs Economic Policy and Administration, Economocs and Management, System Engineering and Informatics. Accredited is also a Bachelor's degree program in Hotel management and Doctoral studies in the field of Economics and Management. The Faculty has engaged universally in cooperation with institutions of economic nature in the adjacent region and its graduates successfully apply in the business sphere.

Faculty of Business Administration in Karviná is very active in the field of science and research. It is plentifully involved in projects of the Grant Agency of the Czech Republic and others. Specifically, these solved projects can be mentioned:

CSF Projects

Project number according to the Czech central project database code list	Project title	Project researcher
GA16-17796S	Affiliation with financial conglomerate as a determinant of performance and risk of banks	prof. Ing. Daniel Stavárek, Ph.D.
GA14-02424S	Methods of Operations Research for Decision Support under Uncertainty Conditions	prof. RNDr. Jaroslav Ramík, CSc.
GA402/09/0405	Development of non-standard optimization methods and their applications in economy and management	prof. RNDr. Jaroslav Ramík, CSc.
GP402/09/P142	Institutional labour market framework in the context of economic	doc. Mgr. Ing. Michal Tvrdoň, Ph.D.

	convergence and adopting single currency	
402/06/0431 (2006-2008)	Research and development of multi-criteria decision methods and applications in public sector.	prof. RNDr. Jaroslav Ramík, CSc.
402/05/2758 (2005-2007)	Integration of the Financial Sector of New EU Member States into EMU	Prof. RNDr. PhDr. Stanislav Polouček, CSc.
GA402/03/P105 (2003-2005)	Multi-criteria analysis of the Czech Republic's macroeconomic position within the EU (POST-DOC grant)	doc. Ing. Marian Lebiedzik, Ph.D.
GA402/01/D126/B (POST_DOC grant)	Macroeconomic model of the Czech Republic	doc. Ing. Pavel Tuleja, Ph.D.

Internal grant projects of SU

2017

Researcher	Project title	Project number
Dr. Ing. Ingrid Majerová	Influence of selected macroeconomic and microeconomic determinants on the competitiveness of regions and firms in countries of the Visegrad group plus	SGS/13/2015
Ing. Radim Dolák, Ph.D.	Advanced methods of data acquisition and simulation techniques in business processes	SGS/19/2016
Ing. Pavlína Kirschnerová	Tax Reliefs of Individuals as a Part of Support to Public Policies of the Czech Republic	SGS/20/2016
Mgr. Stanislav Martinát, Ph.D.	Brownfields in urban and rural space: geographic, economic, historical, legal contexts and their importance for regional development (BURAN)	SGS/21/2016
prof. Ing. Daniel Stavárek, Ph.D.	The effect of fundamental factors and corporate governance on stock prices	SGS/23/2016

International programs

2007

IPREG	Mobility support within	Project registration number
Programme of Mobility Support Aimed at Students and Young Development and Research Workers in 2007 (Ing. Šebestová)	Project IPREG	VAVII2/06 /2007)

OP HRD ESF

Doc. Ing. Eva Wagnerová, CSc.	Increasing the competitiveness of women on the labour market in the Karvina region and in the MS Region	CZ4.1.03/2.2.15.1/0069 (2006-2007)

OP HRD ESF

Ing. Jiří Vaněk, CSc.	Improvement of managerial skills of small and medium-sized businesses managers	CZ4.1.03/2.2.15.1/0058 (2005-2007)

Specific impacts are listed below:

- MAZUREK, J., 2017. On Determinants of The Economic Growth of European Countries During 2005-2015. Comparative Economic Research, 20(2), 21-34. ISSN 2082-6737.
- MARTINÁT, S., TUREČKOVÁ, K., 2016. Local development in the post-mining countryside? Impacts of an agricultural ad plant on rural community. Geographia Technica, 11(1), 54-66. ISSN 1842-5135.
- JANOUŠKOVÁ, J., SOBOTOVIČOVÁ, Š., 2016. IMMOVABLE PROPERTY TAX IN THE CZECH REPUBLIC AS AN INSTRUMENT OF FISCAL DECENTRALIZATION IN SELECTED MUNICIPALITIES. Technological and Economic Development of Economy, VILNIUS GEDIMINAS TECH.UNIVERSITY, 22(6), 767-782. ISSN 2029-4913.
- TVRDOŇ, M., 2016. Decomposition of Unemployment: the Case of the Visegrad Group Countries. E& M EKONOMIE A MANAGEMENT, 19(1), 4-16. ISSN 1212-3609.
- TOŠENOVSKÝ, F., 2015. Multicriteria Decision-Making Weights and a Competitive Product Design. E+M Ekonomie a Management, 2015(1/2015), 84-93. ISSN 1212-3609.14 / 162
- NEVIMA, J., MAJEROVÁ, I., 2015. The Application of two Econometric Models in The ß-Convergence Approach in the Case of Visegrad Four Regions. Transformations in Business & Economics, 14(2A), 549-562. ISSN 1648-4460.
- MATOUŠEK, R., RUGHOO, A., SARANTIS, N., ASSAF, A., 2015. Bank performance and convergence during the financial crisis: Evidence from the 'old' European Union and Eurozone. JOURNAL OF BANKING & FINANCE, 2015(52), 28-2016. ISSN 0378-4266.
- MAZUREK, J., 2014. Are timss scores suitable proxies for nations human capital? Prague Economic Papers, 2(2), 181-197. ISSN 1210-0455.
- ROUBÍČKOVÁ, M., HERYÁN, T., 2014. Impacts of selected nace industries´ foreign ownership on the Czech economy. E+M Ekonomie a Management, 17(4), 58-69. ISSN 1212-3609.
- RAMÍK, J., 2014. Incomplete fuzzy preference matrix and its application to ranking of alternatives. International Journal of Intelligent Systems, 29(8), 20. ISSN 1098-111X.
- ŠEBESTOVÁ, J., NOWAKOVÁ, K., 2013. Dynamic Strategy for Sustainable Business Development: Mania or Hazard?. AMFITEATRU ECONOMIC, 15(34), 442-454. ISSN 1582-9146.
- Link to the web: http://www.slu.cz/slu/cz/.

ARRIVA MORAVA Inc. (partner without financial contribution)

Arriva Morava Inc. is engaged in consultancy in the field of transport, advertising, promotion and advertisements, and also in the operation of passenger road transport, operation of travel agency, provision of services and information to passengers in bus transport and other activities. Company

currently doesn‘t carry out its own research activities but is involved in training of its employees in an accredited training centre.

Arriva Morava Inc. may be proud of the pilot project of the introduction of 10 electric buses operating in public transport in Třinec. Electric buses were first presented to the public during the electromobility day, which took place on March 9, 2017. Třinec has thus become a pioneer in the field of electric transport in the Czech Republic. In the Moravian-Silesian Region Arriva Morava Inc. operates public transport in Bruntál, Český Těšín, Krnov, Přerov, Studénka, Šumperk, Třinec and Zábřeh. It can be said that the extent of its services is very wide in terms of location. Company also participates in suburban transport in Olomouc region and Moravian-Silesian region.

Among the services that company offers to its clients are operation of cyclobuses, skibuses and tourist buses. With the permission of Jeseníky Protected Landscape Area the company operates in selected dates accessible bus transport to the top of Jeseníky Mountains - Praděd. This transport is primarily intended for persons with reduced mobility. Arriva Morava Inc. is currently engaged in sustainable transport and in cooperation with representatives of municipalities and regions is looking for suitable solutions. Following the Strategy of the Smarter Moravian-Silesian Region, company joined the consortium dealing with this project, to engage in experimental verifications the field of transport.

Link to the web: http://www.arriva-morava.cz/

ČEZ ESCO, Inc. (partner without financial contribution)

CEZ ESCO company was established with the vision to provide customers everything they may demand within their energy needs. CEZ ESCO wants to be the first choice for those who are interested in installing or operating a local energy source or distribution network and want to consume energy efficiently and environment-friendly CEZ ESCO combines installation of energy-saving technologies and their financing with the supply of electricity and gas. CEZ ESCO's target customers are industrial companies, SMEs, state, municipal or private organizations and companies managing buildings and sites of all types from residential and administrative buildings, over hospitals and schools to sports premises. CEZ ESCO carries out supplies by its own capacity through other companies in the CEZ Group or in cooperation with reputable external partners. Current offer of CEZ ESCO includes:

- Installation and subsequent operation of small (local) energy sources, especially cogeneration units and gas boilers, in the near future also photovoltaics and other technologies.
- Heat supply.
- Solutions in the field of public lighting and lighting of industrial buildings and halls.
- Projects of energy buildings, including local distribution networks.
- Comprehensive energy savings projects, including EPC projects.
- Sale of electricity and gas.

Services provided by CEZ ESCO include the whole lifecycle of equipment from project preparation (study, project), installation (including financing, if necessary) to follow-up operation and maintenance of equipment. Company's goal is to be the first choice for customers who want to consume energy efficiently

and environment-friendly. In the field of science and research, ČEZ ESCO is actively involved. Company is involved, for example, in project QUANTUM. The task of the European QUANTUM project, which includes also ENESA from CEZ ESCO, is to develop and test by 2020 tools and service models to reduce energy consumption in buildings by optimizing their operations. Consortium of 14 partners is now intensively working, among other things, on testing tools and service models in 15 objects, but they also present the issue at different events.

Link to the web: https://www.cez.cz/cs/o-spolecnosti.html

Moravskoslezské inovační centrum, Inc. (partner without financial contribution)

Moravian-Silesian Innovation Centre Ostrava is a company for economic development of Ostrava and the Moravian-Silesian Region, whose mission is to develop and provide new services with a positive impact on:

- Development and attractiveness of local environment for business and innovation,
- Innovation and growth of local SMEs,
- Strengthening the local start-up community.

The aim of Moravian-Silesian Innovation Center is to cultivate the business environment in the region and actively help with the development of SMEs**.** It also actively participates in science and research.

The three main pillars of the centre (MSIC Scale Up, MSIC Expand, MSIC Collaboration) are unique programs designed to build their own innovative ecosystem. With the bold steps contributes to the change of overall perception of the region. Following the strategy of the Smarter Moravian-Silesian Region, MSIC wants to take part in partial experimental verifications in project and to participate in dissemination activities of the project.

Link to the web: https://www.ms-ic.cz/

BeePartner, Inc. (eligible expenditure of CZK 9 million)

Czech company BeePartner Inc. was established in November 2014, with the primary objective to provide comprehensive grant advice within the European Structural and Investment Funds. However, the scope of activities gradually developed and after three years of its existence, the company is now, in addition to providing grant advice, focusing on development consultancy, studies and analyses, marketing strategies, project design, creative marketing, portfolio management of shared projects and other related and interrelated activities.

In 2016, due to the growing amount of opportunities and potential in the field of SMART technologies, the company decided to designate all activities related to this topic to a separate internal unit entitled "Strategy and SMART" and concentrate on this issue. The company is also currently planning to set up a research institute that will include all science and development activities with the potential for developing SMART related technologies. Participation in this project is therefore one of the obvious actions which correlate with the company's activities.

Due to the company's focus and recent history, it is possible to quantify a number of applied results and activities, relevant to the project:

- implementation and research under the Jessica financial instrument,
- processing of the research and analytical part for a number of strategies:
    - FajnOVA - strategic plan of the city of Ostrava,
    - Smarter Region - a strategic document for the use and implementation of SMART solutions within the Moravian-Silesian region,
    - ReStart - strategies for the restructuring of the Moravian-Silesian, the Ústecký and Karlovarský regions,
    - Strategic plan of Bystřice nad Olší,
    - Better cities - a platform of the Union of Towns and Municipalities of the Czech Republic for the creation of sustainable improved cities, which are prepared for the challenges of the next decades,
    - Strategy of the Union of Towns and Municipalities of the district of Karviná.
    - Concept of Rural Development in the Moravian-Silesian Region,
- Synthesis of strategic documents of MAS CLLD,
- Marketing surveys for a number of private and public institutions,
- Cooperation on the SMART city Třinec concept.

The company has actually about 40 permanent employees and external associates, approximately ¼ of whom systematically work on SMART technology and follow-up activities. Research and development staff have a wealth of relevant experience from work at universities, as well as state and public institutions, city and municipal governments, and regions.

AutoCont CZ Inc. (eligible expenditure of CZK 4 million)

For many years AutoCont has been focusing on providing complete IT solutions and services for company customers and state administration. Gradually, it became one of the most important companies in the ICT market and AutoCont's offer covers the vast majority of ICT needs in companies and organizations. AutoCont adapts its internal organization to the needs and capacities of its customers. In a different way solves complex enterprise projects and in another way smaller projects for medium-sized commercial companies. But always with maximum emphasis on achieving required quality and in maximum cooperation with customer. In the five main areas of the solution and service portfolio is offered concentrated experience and know-how from a wide range of projects and contracts from various ICT areas. **Introduces and operates useful information technologies in organizations**. Systematic and long-term building of professional skills, careful monitoring of customer needs and, last but not least, well considered internal organization of the company - it all contributed to the fact, that AutoCont is currently the biggest and the most important Czech supplier of information and communication technologies in the Czech Republic and Slovak Republic. Since its establishment AutoCont CZ Inc. has been operating in a dynamically changing IT sector, where continuous innovation and development of new products and solutions are the basis for success. Innovations in the company are developed and managed on the basis of the "House of Innovation"

methodology applied across the company. Innovations are key component of the company's overall business strategy, which is defined in three-year cycles in the form of so-called VISION 201x.

The company implement research and development over a long period and considers it a critical factor of its commercial success. Selected research and development projects for clients:

- Project eGovernment I - Development and Implementation of Identity Management System and IDM
- Project eGovernment I ISZR - development of the communication interface to the basic registers
- Project eGovernment II e-Identity - design, implementation and operation of the system of electronic identity of citizens of the Czech Republic
- CIS STK - Central information system of Vehicle Examination Stations
- Region 4U -Information system supporting local retail networks.
- **OSnD** - development and implementation of a system for monitoring production's scrap rate
- **RFID Project in Automotive industry** - Development and implementation of a system for electronic registration and monitoring of the life cycle of materials and products.
- **Comprehensive data collection system for Mahler Behr Ostrava** - development of a system for recording and archiving of production data and its integration into the company's information system.
- **Wholesaler of Technical equipment for Buildings** - Development of a solution for biometric authentication for logistic department
- **IT4I** - design and implementation of the virtualization and backup infrastructure for the Salomon supercomputer, that is part of the IT4 Innovations National Supercomputing Center as part of VSB-Technical University of Ostrava
- eGOV II - Cloud Services for eGov
- **eGOV III – eHealth** - computerisation of the health sector
- eGOV III - Strategy eGovernment 2014+

Company has the following experience with successfully solved research and development projects funded by European funds:

- Receiving a grant in 2015 for the project Development of a specialized IS for logistics companies from the Operational Programme Enterprise and Innovation - ICT programme and strategic services.
- Obtaining a grant in 2016 for the project Development and Innovation of the IS PR amen - OP PIK Program (Operational Programme Entrepreneurship and Innovation for Competitiveness)

Vzdělávací a výzkumný institute Agel o.p.s (eligible expenditure of CZK 5.3 million)

Vzdělávací a výzkumný institut AGEL o.p.s. (Education and Research Institute AGEL) is a research organization whose primary objective is to carry out independently research and development and publicly

disseminate results of its activities in the form of educational events, publications and the transfer of knowledge. Company supports over a long period development of health care and introduction of modern trends in medicine in the Czech Republic.

Company's general objective remains support for the development of health care with the utmost utilization of acquired knowledge, prevention, and promotion of healthy lifestyles, aiming at the satisfaction of patients, employees and citizens.

In the past years Educational and Research Institute AGEL participated in several research projects in health care. We worked together on the preparation of a successful grant application for the MAGIC project under the HORIZONT 2020 and for several other projects under the program. Currently it is under way preparation for the patent process on the protection of intellectual property of the results of the Tissue Engineering project, cooperation between sister organizations – hospital Nemocnice Rudolfa a Stefanie, Benešov Inc. and Student Science s.r.o, headed by prof. RNDr. Evžen Amler, CSc. Company participated closely in the successful project in cooperation with company AGEL RESEARCH Inc. and experts from The General University Hospital in Prague. In 2017, the patent application was submitted and patent procedure is currently underway to apply the right to the technical solution of PERPHARMDIA project. The Institute also cooperates with the University Hospital Olomouc (National Telemedicine Centre) in the preparation of telemedicine research projects, and at the same time participates in the project Long-term cross-sectoral cooperation submitted by the University Hospital Olomouc within the call in ITI of Olomouc agglomerations focused on computerisation and digitization of healthcare.

4 COOPERATION UNDER PARTNERSHIPS BETWEEN RESEARCH ORGANIZATIONS AND THE APPLICATION SECTOR

These activities can not be funded to the partners supported under 25 GBER.

4.1 Establishing, implementing or enhancing cooperation under partnership between research organizations and the application sector, including international cooperation

The subject of this chapter is description of the content of KA 2 – Establishing, implementing or enhancing cooperation under partnerships of research organizations with subjects from application sector (b) and KA 5 - Activities leading to the establishment and intensification of international cooperation with foreign research entities and from application sector (e).

The main objective of KA 2 and KA 5 is to support establishment and strengthening of partnerships and cooperation between research organizations and application sector in the Czech Republic and abroad.

KA 2 will focus on activities consisting in establishment and enhancement of cooperation with application sector and intersectoral partnerships, analysing applicability of research results and transfer of practical experience and knowledge from application sector to the research one and vice versa. Establishment of cooperation will be declared by a Memorandum of Understanding or other appropriate document. The output of implementation and development of the cooperation will be joint activities, in particular obtaining practical data and feedback to verify applicability of R & D results and to obtain relevant data for possible use of research result through joint seminars, visits between subjects, participation in trade fairs,

twinning activities, publication activities, obtaining joint grant resources, treatment of creation of intellectual property and contracting cooperation.

KA 5 will be implemented in complementarity with KA 2 and also with KA 6 (see chapter 4.5), its purpose will be, in particular, to establish, intensify and enhance cooperation with foreign research and application subjects. In particular, it will be the organization of joint seminars with representatives of the application sector, visit to entities from the application sector, participation in the trade fair, twinning with subjects from application sector, publication of research results together with the application sector, obtaining joint grant projects, creation of intellectual property, preparation of contracts for further joint activities, as well as partial activities in obtaining data and documents for R & D , processing R & D materials, acquisition and two-way transfer of know-how, etc. From the point of view of subjects, they will be leading foreign institutions focusing on the research topic from key territories in the field of SMART technology.

The first purpose of these two activities is to support implementation of the joint activities of the partners, which will lead to enhancement and intensification of cooperation both within the project and beyond it. Correct and effective implementation of these KAs will be initial prerequisite for the successful development of cooperation also within the project's sustainability. A total of 8 institutions are involved in the project directly, another 5 institutions (self-governments) expressed their support for the implementation of this project. Research organizations (4 in total) will participate across various activities of the project, in addition to the realization of the research itself within KA 4 they will also contribute with their share to the implementation of other KAs linked to the defined research orientation. Within the KA 8 partners University of Ostrava and Silesian University in Opava will develop a total of two joint research centres within which research activities will take place. Each research organization has different culture, style of work and even language (a German partner), which will be interesting and mutually instructive for individual partners and their staff. Business corporations involved in the project will participate (financially 2) in accordance with OP RDE rules exclusively in carrying out research within KA 4 from the position of their expertise and competencies. They will bring their know-how into the project from the position of consulting companies, as well as providers of ICT solutions, energy companies and transport companies.

The second purpose of these activities is to extend the group of cooperating entities with other organizations from the Czech Republic and abroad. Therefore within these activities will be carried out many activities supporting establishment and development of this cooperation externally beyond the project consortium.

Structured overview of partial activities and their quantification:

- Establishment of the partnership within the project consortium - there are in total 8 partners in project consortium, and at the same time the minimum scope is fulfilled of the partnership including research organization (University of Ostrava) and one medium or large enterprise (Autocont, ČEZ Esco and Arriva Morava)
- Joint round table meetings (joint seminars) - at least quarterly will be held a joint round table meeting of the involved partners. Part of them will be only internal meetings, part of the meetings will have external character, where other relevant entities and experts from the application and R & D sector will also be invited. A total of at least 19 of these meetings are expected to be realized, of which at least 5 will be realized in the form of an external meeting.

- Visits, twinning activities and excursions to subjects from the application sector - it will be a continuous activity of the project, there are planned at least 5 Czech and 5 foreign excursions, which will be complemented by further meetings in order to establish and enhance cooperation (e.g. within hospitals, transport companies, IT companies, etc.)
- Participations at trade fairs, conferences and experts meetings and individual meetings to establish cooperation - at least 15 participations are planned, where the primary purpose will be to use the event to meet other entities and to negotiate with their representatives on the possibilities of cooperation. This will primarily involve foreign activities supplemented by activities within the Czech Republic. An indicative list of possible partners for establishing cooperation from abroad is given at the end of this chapter.
- Establishing cooperation with at least 3 other entities that will be declared, for example, on the basis of a Memorandum of Understanding or other appropriate contractual relationship.
- Joint preparation of grant applications - within the project, at least 2 other project applications will be prepared and submitted, which will serve as a tool for receiving grant funds
- Publications informing about the cooperation of entities (in synergy with KA 9) - ca 5 times for the project will be prepared a press release informing about cooperation within the project, which will be sent to regional and professional media.
- Addressing the issue of the creation and protection of common intellectual property - this will be a follow-up activity beyond the partnership agreements, where the issue of the creation and protection of intellectual property will be solved specifically for the needs of the project and beyond it (through a plan for the treatment of intellectual property).
- Other activities in accordance with the focus of this KA according to the current development and needs of the project.

Involvement of project team and partners in the implementation:

In this activity will be involved these workers, who will also be responsible for its implementation:

- Expert project leader,
- Expert leader KA 2,
- Expert leader KA 5 ,
- Researcher KA2,
- Researcher KA 5.

For the implementation of KA will be responsible project applicant OSU, which also has allocated funds for these activities in its budget. In the implementation of this KA will also be involved all other project partners from R & D organizations and businesses, they will participate especially in joint activities supporting enhancement of cooperation.

Outputs:
The main quantifiable outputs are listed in the summary table below. Other outputs will include partnership agreements, contractual documentation addressing the area of intellectual property creation

and protection, expert materials and attendance lists from meetings, minutes of the meetings, grant applications, press releases, etc.

Results and outputs of activity	Target Value of the Project Implementation
indicator 5 43 10 Number of supported cooperations	3
indicator CO 26 / 2 00 00 Number of enterprises cooperating with research institutions	4
Another result that is not reflected in indicators: for example, twinning, organization of joint events, internships in application sector entities. Joint round table meeting (joint seminar)	19
Other result, which is not reflect in indicators. (Submitted joint grant applications.)	2

Possible partners for establishing cooperation - foreign universities

This list of foreign universities serves as an indicative list of potential subjects with which it would be appropriate to establish co-operation within the project. These are universities that are specialized in the SMART area in their R & D activities or have a separate workplace for them.

UNIVERSITY TWENTE

https://www.utwente.nl/en/bms/SMARTcities/

Twente University is a modern, entrepreneurial university, leader in new technologies and catalyst for change, innovation and progress in society. Uiversity focuses on the technologies of the future, including ICT, biotechnology, nanotechnology, telemedicine, social and behavioral sciences are key for it. University has strong research institutes in these fields that combine excellence with great efforts to valorise business knowledge and social applications: they are successful in generating spin-off business. University has experience in cooperation with the business sphere. University Businness Development Team supports researchers who want to engage in research for the market.

This can be proved by Excellent centres of expertise oriented to the market Thermoplastic Composite Research Centers, Nanolab, **Experimental Center for Technical Medicine, Leo Center for Service Robotics, Virtual Reality Lab, Designlab**, European Membrane Institute.

UNIVERSITY OF LEEDS

http://www.leeds.ac.uk/

University, established in 1904, is one of the largest educational insitutes of university-type in the UK, a world-respected university with the quality of teaching and research. It is among the top 10 British universities. Academic strengths are combined with a wide range of disciplines that have a direct impact on the world culture, economy and the social sphere. Leeds builds on existing research and interdisciplinary work. Leeds strives to link branches to make it easier to cope with global changes **in cities, climate, culture, energy, food, health and water. Expertise in Sustainable Infrastructure, Sustainable Urban Development and society is applied for social and economic changes.**

SWINBURNE UNIVERSITY OF TECHNOLOGY

http://www.swinburne.edu.au/research/our-research/institutes/SMART-cities/

University opened a new **SMART Cities Research Institute** in June 2017. Its goal is to look for solutions to the new challenges of cities and the growing urban population and to support their ability to provide adequate services and create a good environment for life. The Institute focuses on connection of socio-technical disciplines, interdisciplinarity and collaborative approach.

LULEA UNIVERSITY OF TECHNOLOGY

https://www.ltu.se/edu/program/TCHEA/Arbeta-i-projekt?l=en

It is a Swedish Technical University, which provides a big scope to the students‘ activities in the SMART area. On this theme cooperates fields of mechanical engineering and sustainable energy. Working on the development of SMART products with in view of sustainability is the content of Sustainable Living branch of study. This is a three-year Master of Science (MSc) degree. Students acquire theoretical knowledge on a practical basis.

UNIVERSIDAD POLITÉCNICA OF MADRID

http://www.upm.es/internacional/UPM

The Technical University of Madrid was founded in 1971 through the integration of the Higher Technical Schools. At present, the University's objective is the creation, development, transmission and criticism of science, technology, and culture. On this assignment participate also University’s Institutes and Research Centres, that are able to take account of changes taking place in society and **excellence in their fields**. University is implementing a large SMART project within the call EIRBUS SMART City Development: Applying European and International Experience to the Mediterranean Region with the title ASCIMER (Assessing SMART Cities in the Mediterranean Region). This is a three-year research project aimed at developing a comprehensive framework to support public and private stakeholders so that they can make responsible decisions on the adoption of new SMART strategies and technologies.

Possible partners to establish co-operation - domestic companies and self governments

Below is mentioned a typical example of Czech companies and self-governments with which it would make sense to establish cooperation within the project.

- Self - governments: MS Region, Statutory City of Ostrava, Town of Třinec, Town of Jablunkov and Municipality of Palkovice - all of them supported preparation of the project and are interested in establishing cooperation.
- AGEL - Laboratory of Clinical Microbiology
- Railway Infrastructure Administration (Správa železniční dopravní cesty)- Information in the field of rail transport
- mmCité – producer of urban furniture,
- Toyota - Czech representation ot this brand,
- Siemens - in the Czech Republic operating subsidiaries,
- Cross Zlín – producer of intelligent technologies for transport,

- University Hospital Olomouc / Ostrava - health care providers and others.

Types of suitable foreign trade fairs, exhibitions and conferences

Below is mentioned type overview of foreign exhibitions, conferences and trade fairs, where it would make sense to establish co-operation, since a large number of relevant companies and institutions will be concentrated in one place. Foreign activities (participation in conferences, meetings, fairs, exhibitions, excursions, etc. within all relevant KAs) will take place both within the EU and in priority countries that have significantly developed area of using SMART technologies (especially USA, Canada, Japan, Israel, South Korea, Australia, UAE, China, Taiwan, Singapore, etc.).

SMART CITY EXPO WORLD CONGRESS

Barcelona

http://www.SMARTcityexpo.com/barcelona

Worldwide Fair trade with a wide range of activities with the SMART theme focused on cities: Sustainability, Society, Economy, Energy, Data, etc.

SMART CITIES EXPO WORLD FORUM

London

http://SMARTcitiesexpoworldforum.ae/

The trade fair combines the strength of the conference with state-of-the-art technologies, deals with SMART cities and urban planning technologies for the purpose of innovation, supports business, and brings together thousands of smart cities around the world. The conference program deals with the following topics: SMART Grid, SMART transport, lighting, large data analysis, human health, SMART management, business, etc.

SMART AUTOMATION AUSTRIA

Linz

The only professional fair trade in Austria for industrial automation and SMART technologies.

SMART CITIES INDIA EXPO

http://www.SMARTcitiesindia.com/

New Delhi

The exhibition is also associated with the conference. Key topics of the exhibition are SMART Water and Waste Management, SMART Environment, SMART Urban Planning, SMART Buildings, SMART IT, SMART Security, SMART Grid, SMART Energy and Government Initiatives.

SMART CITIES 2018

http://www.SMARTcityuk.com/

London

The conference will address secure platforms, data acquisition, its management, connectivity, and device communications with all systems and infrastructure. The following events will take place within the conference: Big Data World, Cloud Security Expo, Cloud Expo Europe & Data Center World.

SMART LONDON

https://www.SMARTiotlondon.com/

London

The conference will address secure platforms, data acquisition, its management, connectivity, and device communications with all systems and infrastructure. The following events will take place within the conference: Big Data World, Cloud Security Expo, Cloud Expo Europe & Data Center World.

SMART BUILDING CONFERENCE AMSTERDAM

Amsterdam

http://www.SMARTbuildingconference.com/

The SMART Building Conference (SBC) is a summit for professionals working in intelligent houses, intelligent offices, intelligent buildings and intelligent cities. SBC organizes a meeting that focuses on the latest technologies, business strategies, market research, and case studies of workflows through presentations from leading world experts in building. SBC is organized by Integrated Systems Events.

RESPONDING TO THE DIGITAL INFRASTRUCTRE ENERGY CHALLENGE

http://dcd.events/conferences/energySMART

Stockholm

The theme is digital and energy infrastructure. It includes all affected sectors (CT / IT services, Aviation and Defence, Automotive, Construction and Real Estate, Financial Services - Banking and Securities, Insurance, Investments, Energy, Chemical and Public Services, Administration - State and Local, Health Care, Medicine, pharmacy and biotechnology, hospitality, entertainment and leisure, production sector, media, advertising and PR, research and education, retail, transport and distribution, accounting, law).

SMART TO FUTURE CITIES

London

https://tmt.knect365.com/SMART-future-cities/

The themes of the event are digitalisation of urban life, for people, with people, big data, healthy cities, healthy people, safety, standards, administration and interoperability.

IEEE ANNUAL INTERNATIONAL SMART CITIES CONFERENCE

Wuxi

http://www.isc2-2017.com/

In 2017, took place the 3rd year of International Conference, co-funded by the IEEE SMART Cities Initiative, IEEE Power & Energy Society, and IEEE. The aim is to share experiences, support and prioritize the use of information, sensor technologies, engagement of the population, quality of life, effective production, economic development and sustainability of environment.

SMART 2017/SMART 2019

Berlin

http://www.smar2017.org/

It is a forum for international scientists, entrepreneurs and representatives of public infrastructure who will be presenting and debating on the functioning of public administration and progress in technologies of monitoring as well as methods for the evaluation and application of advanced materials. Platform for possible collaboration.

Eccomas Conference on SMART Structures and Materials

Madrid

http://congress.cimne.com/SMART2017/frontal/default.asp

It is a comparative forum for debating the current state of knowledge and the development of future ideas at an interdisciplinary level.

SMART Blue City

Heraklion-Crete

http://www.SMARTbluecity.com/

Intelligent, inclusive and resistant small and medium-sized towns and island communities in the Mediterranean:

Examining current paths and experiences. SMART topics by program in all possible areas.

WORLD SMART CITY FORUM BARCELONA

Barcelona

https://www.worldSMARTcity.org/

City representatives, together with representatives of industry, investors and other relevant organizations, will debate the rapidly changing world of smart cities, their transformation into creative, connected and sustainable urban environments. Everyone offers different view of the challenges for our cities and their solutions. Common search for IEC, ISO and ITU standards to help city representatives reach their ambitions.

NORDIC SMART CITIES

Stockholm

https://www.nordicSMARTcities.com/

Third Meeting of Nordic Smart Cities with the theme of perspectives and opportunities for smart and sustainable urban and community development. It is complemented by a large exhibition area.

SMART INFRASTRUCTURE ENABLES SMART CITIES

Washington D.C.

http://SMARTcitiesweek.com/2017-Washington/

The conference, held annually, attracts more than 1,300 people from around the world to discuss the possibilities of a smart infrastructure that enables smart cities. Representatives of leading American universities, a wide range of topics.

Types of suitable domestic trade fairs, exhibitions and conferences

CITYCIN

České Budějovice

http://citycon.cz/

The conference is addressed to representatives of state administration and self-government, technology suppliers, representatives of universities and other educational institutions and the professional public. Panel discussions, expert lectures, experience from practice, financial tools. The conference is organized by the Technology Center Písek.

SMART CITY BRNO

Brno

http://events.mafra.cz/konference/57-SMART-city-brno/

The topic of the conference is SMART City and SMART Region, SMART City as a smart public service to citizens, public administration and smart office, transport, infrastructure and intelligent traffic management, and energy and smart buildings.

SMART CITY V PRAXI

Brno, the accompanying program of AMPER 2017

http://www.SMARTcityvpraxi.cz/konference5.php

Expert conference focused on the theme what the smart city offers to the citizens and industry.

CZECH SMART A VELETRH URBIS

Brno

http://www.bvv.cz/urbis/

URBIS SMART CITY FAIR 2018 is the first full-fledged year of the international fair trade that follows the pilot year of the fair trade of smart solutions for cities and municipalities in 2017. On the platform of the most important trade fair administration in Central Europe and the city of Brno as the leader in innovation and the "follower city" of the program Horizont 2020 arise a unique space for sharing ideas and concrete solutions how to bring to life and develop the concept of SMART city in Central European cities and municipalities.

FOR INDUSTRY – FOR ENERGO SMART

Prague

http://forindustry.cz/

The main objective is to create a complex platform for solving the problems in individual branches of industry and engineering with a space for technological demonstrations and cooperation. The fair is a

unique opportunity to present modern production techniques, progressive technologies and innovative trends.

SCIENCE RESEARCH INNOVATION FAIR – We create an excellent future together

Brno

http://www.vvvi.cz/

Themes: among others - e-mobility and transport systems of the future, energy, SMART home, SMART city, etc.

SMART CITIES and regional development (SMART CITIES a regionální rozvoj)

Prague

www.stech.cz

The theme of the conference was the use of the digital revolution, which brings a huge amount of information resources generated by the life of the city. The penetration of information technology represents the release of the process of innovation and the implementation of technology in the city, where the phenomenon of big data and the movement of open data and its use on the basis of sharing becomes important. SMART City has to harmonise two approaches - environmental optimization and social interaction.

SMART CITIES FOR BETTER AND SAFETY LIFE - SMART CITY PLZEŇ

Plzeň

SMARTcity.plzen.eu

The aim is to deepen discussion and collaboration with representatives of cities and municipalities and universities and to educate professionals and general public about the benefits of integrated solutions according to the concept of Smart Cities that Siemens offers.

Seminar for representatives of towns and municipalities - smart public administration

Praha

www.mmr.cz

SMART YEAR 2017 – Smart cities for future

Brno

http://www.soutezchytramesta.cz/

Conference organized by company Czech top 100 and MC Triton. The event is linked to the national competition "Smart cities for the future".

Types of suitable foreign companies to establish co-operation

Below is mentioned general list of foreign companies that are world leaders in SMART technology. These companies collaborate with a number of research organizations on joint R & D projects. Within the project, it is desirable to establish and develop cooperation with one of the world's leading companies.

SIEMENS

http://www.siemens.cz/SMARTcities/

Siemens AG is a conglomerate company that is one of the largest producers of electronics in the world. Its international management is based in Berlin and Munich. At Siemens' research laboratories work worldwide 29,500 employees, working on new solutions for energy, industry and healthcare. Siemens offers cities a portfolio of solutions and expert knowledge to streamline their operations, develop sustainability and help cities become a better place to live.

An example of cooperation is the joint research company of Siemens and the urban energy companies of Vienna, called Aspern SMART City Research & Co. KG. Based on data about the life in a growing neighbourhood, they are tasked with inventing energy-saving innovations.

BOSCH

https://www.bosch-SMARThome.com/

Robert Bosch GmbH is a German company founded in 1886 by Robert Bosch. The headquarters of the global group with 374,778 employees is the city of Gerlingen, northwest of Stuttgart. The Bosch Group currently includes some 280 subsidiary companies, of which 230 are headquartered elsewhere than in Germany. They deliver parts and devices for the automotive industry, household appliances and power tools. They also deal with industrial packaging technology, manufacturing for construction and industry and security technology. The company is dedicated to households in its SMART concept. Bosch products can be automatically controlled by household processes. And it also deals with urban mobility and urban concepts.

SAMSUNG

http://www.samsung.com/cz/?cid=cz_ppc_google_Brand-10022017&gclid=Cj0KCQjw4eXPBRCtARIsADvOjY3Xs5GVE8f9j0Eltfr0aFbWOXr4sC9RgkbdutzIe4Nb5bn7rr8N5YaAvAzEALw_wcB

The Samsung Group is the largest company in South Korea and the 3rd largest worldwide conglomerate by revenue, which manages several companies in the world. It is comprised of a large number of international companies, all of which are linked under the Samsung brand, including Samsung Electronics, the world's largest electronics company, Samsung Heavy Industries, one of the world's largest shipbuilders, and Samsung Engineering & Construction, global construction company leader. These three multinational corporations form the basis of the Samsung group and reflect its name - the meaning of the Korean word Samsung is "three stars". It is also the leader in many domestic industries such as finance, chemical industry, retail and entertainment. In all these segments focuses on SMART solutions - in phones, bicycles, motorcycles, etc.

BMW

https://www.bmwgroup.com/en/innovation/technologies-and-mobility/connectivity.html

BMW is a German producer of cars, motorcycles and engines. Its headquarters are in Munich. BMW is the parent company of Mini and Rolls-Royce and, in recent times, the former Rover. In SMART specializes in electromobiles.

FUJITSU

http://www.fujitsu.com/global/solutions/business-technology/

Fujitsu is one of the largest Japanese companies in the field of Information and Communication Technology (ICT) and offers a complete portfolio of IT products, solutions and services. Approximately 159,000 employees of Fujitsu serve customers in more than 100 countries. Fujitsu, together with its customers, uses its many years of experience and the power of ICT to build the future of our society.

Company puts emphasis puts on SMART solutions in mobility. It regards mobility as a future theme, which will develop more dynamically and will be more person-cantered. It allows users to optimize its movements with applications and services that can process conditions in real-time and provide accurate instant information on various interesting places. Such abilities call by the term "smart mobility ". "SPATIOWL" provides infrastructure and services to achieve smart mobility through Fujitsu Cloud Computing, which uses big data for administration and analysis and Fujitsu's expertise in the field of mobility.

4.2 Preparation and development of long-term cooperation strategy

The subject of this chapter is a description of the content of KA 3 – Preparing and drawing up a strategy of long-term cooperation between research organizations and subjects from application sector (c).

The main objective of KA on the side of participating R & D institutions and subjects from application sector is to develop and implement key strategic and internal documents that will support a sustainable framework for long-term inter-sectoral R & D cooperation.

Within the activity will be elaborated strategy of cooperation between subjects in the form of a strategic framework, partial plans and subsequent adjustment of the internal directives and procedures supporting this cooperation. All new / updated documents will be approved and effective. Within the activity implementation of the strategy will be continually evaluated.

Together with KA 2, this is another activity designed to "kick-start" long-term, meaningful scientific-research collaboration. In essence, the proper implementation of this KA is one of the basic assumptions of long-term sustainability of project activities, respectively their further development.

The topic of project SMART technologies and their use for improving the quality of human life also provides a fundamental prerequisite for long-term sustainable cooperation as research in this area is at the very beginning and there is significant potential to develop the lessons learned and outputs towards further research or application of results in practice.

Structured overview of partial activities and their quantification:

- Implementation of joint meetings for the purpose of preparation and evaluation of a joint co-operation strategy - a total of 3 project partner meetings will be held within the project and they will be dedicated solely to the preparation and evaluation of the strategic framework of the cooperation. In addition, this activity will be linked to other project meetings, where cooperation strategy will be solved, for example, during partner round tables (see KA 2).
- Preparation of analytical and initial materials for the elaboration of a strategic framework for the cooperation of scientific research organizations and subjects from application sector.

- Creation of a strategic framework for cooperation that will be common for all involved institutions and partial strategic and internal documents of individual and involved subjects will be based on it.
- Creating / updating a Strategic Plan for Cooperation Development and relevant internal documentation of 4 participating R & D organizations, where long-term intersectoral cooperation will be established. The document will be implemented by each subject in accordance with its internal procedures and regulations.
- Creating / updating internal strategy for the long-term intersectoral cooperation with the scientific and research sector at the level of internal guidelines of 4 involved enterprises. This document will be implemented by each enterprise in accordance with its internal procedures and regulations and in harmony with its business and industry focus.
- Development of an action plan for strategic cooperation that will synthesize individual strategies and define further steps for their implementation. In particular, it will be an implementation plan of the strategy, which will be regularly updated for the next period (usually 1 year).
- Continuous evaluation of the fulfilment of the strategic framework for co-operation on the side of the individual subjects, as well as on the side of the overall cooperation framework.
- Other activities in accordance with the focus of this KA according to the current development and needs of the project.

Involvement of project team and partners in the implementation:

In this activity will be involved these workers, who will also be responsible for its implementation:

- Expert project leader,
- Expert leader KA 3,
- Researcher KA 3.

For the implementation of the KA will be responsible project applicant OSU, which has also allocated funds for this activity in its budget. In the implementation of this KA will be involved all other project partners of the R & D organizations and enterprises, in particular they will participate in all steps of the elaboration and implementation of the cooperation strategy.

Outputs:

The main quantifiable outputs are listed in the table below. Other outputs will include analytical and background materials for elaboration of strategic framework, internal documents of partners elaborated following the strategic documents, interim evaluation documents, action plan and background from joint strategic meetings.

Results and outputs of activity	Target Value of the Project Implementation
Indicator 2 15 02 Number of new products modernising strategic management systems in research organisations. (Specify the types of all products, brief characteristics and planned target value)	4

Other result, which is not reflect in indicators. (Common strategic framework for cooperation for all involved organizations and a follow-up action plan for its implementation	1

4.3 Activities leading to the dissemination of the results of joint research activity and its outputs

Subject of this chapter is a description of the content of KA 9 – Activities leading to the dissemination of the results of joint research activity and its outputs (i).

The main objective of the KA is to actively disseminate results of the joint research activities carried out within the project and their outputs to the defined target groups of the project and thus to support the utilization of the acquired knowledge and results of the R & D activities in the framework of the related research and development activities, as well as inform potentially collaborating subjects about factual content of the research and thus to support the acquisition of other potential partners for further scientific research cooperation.

Subject of this activity will be the implementation of logically connected set of dissemination activities focused on the research theme of the project and the partial results of the research. This will include, in particular, joint conferences, workshops, seminars, active participation in fair trades and presentations of the results to the application sector, the research sector, interest organizations, including public administration, in which the joint results of the research activity will be disseminated.

One of the main and innovative role in the dissemination activities will be played by the reconstructed building of the former coal tilting and coal grinding plant in Dolní Vítkovice area in Ostrava, which should be completely renovated and repaired by 2019/2020. In its open spaces should be created background for organizing interactive expositions on SMART technologies and their use for improving the quality of life. Reconstruction of the building will be implemented by the BeePartner partner, that would provide these spaces for presenting the results of the project and its outputs.

Another principle that will be included in this activity is the use of SMART technologies to disseminate the results and outputs of the project. Within the project, a number of printed materials will be eliminated, electronic media, digital content, audio-visual materials and the use of new technologies will play a key role.

The target groups of all dissemination activities are the same as the TG of the project, key target group will be Public Administration and Self Government, for which the outputs of the project are in part directly intended for further use.

Structured overview of partial activities and their quantification:

- Organization of 4 annual conferences held every year during the project implementation. This conference will be a key dissemination tool to inform target groups about the state of the project, its outputs and results. The conference will also be able to be thematic and dedicated to a particular topic in the context of using SMART technologies or specific areas of human life where technology is used. The conferences will take place directly in places (cities and towns) that have a positive relationship with SMART technology or where SMART technology are successfully

implemented. Overall, the innovation line of the entire conference will be supported and its maximum impact will be ensured.

- Total 35 x active participation in foreign and domestic conferences, trade fairs, exhibitions and expert meetings, the primary aim of which will be to disseminate the results and outputs of the project. An indicative list of possible actions is part of Chapter 4.1 Feasibility Study, but it will be updated within the project according to the current development and offer of the implemented actions. It will be both EU action and non-EU action with a highly developed environment for the implementation of SMART technologies.
- Arrangement of 5 external dissemination workshops.
- At least 12 x professional publications, including at least 6 publications in co-authorship of research organizations and businesses and 7 publications in co-authorship with foreign authors. Implementation of these publishing activities will be linked to KA 4 research.
- Regular publishing of press releases for the need of presentation of the project in regional or specialist media. These dissemination outputs will be created synergistically with the description in KA 2.
- Creation of 1 professional web presentation focused on results and outputs of the project. It will be an innovative presentation designed primarily for displaying through SMART technologies.
- Development of 1 professional dissemination strategy in the field of social media.
- Creation of an audio-visual set of demonstration, interactive and electronic materials as a basis for dissemination in social media, use within workshops, conferences, in professional web presentation, etc.
- Organize at least 1 interactive exposition of project results and outputs in the BeePartner building in the Dolni Vítkovice area in Ostrava dedicated to SMART technologies.
- Other activities in accordance with the focus of this KA according to the current development and needs of the project.

Involvement of project team and partners in the implementation:

In this activity will be involved these workers, who will also be responsible for its implementation:

- Expert project leader,
- Expert leader KA 9,
- Researcher KA 9.

For the implementation of the KA will be responsible project applicant OSU, that has also allocated funds for this activity in its budget. In the implementation of this KA will be involved all other project partners of the R & D organizations and enterprises, in particular they will participate in joint dissemination and promotional activities. A key role in the project will play BeePartner partner, who will provide space in the Dolní Vítkovice area for the need to organize an interactive exposition.

Outputs:

The main quantifiable outputs are listed in the table below. Other outputs will include active participation in conferences, trade fairs, exhibitions and expert meetings and associated materials, background materials for conferences and external dissemination workshops, expert publications, press releases, web presentation of the project, dissemination strategy for social media, set of audio-visual, demonstration, interactive and electronic materials, attendance lists and other process outputs and documents for the implementation of KA.

Results and outputs of activity	Target Value of the Project Implementation
Indicator 5 10 17 Number of organised one-off events (They are 4 conferences, 5 dissemination workshops and 1 interactive Exposition.)	10

4.4 Involvement of application sector representatives in teaching, incl. professional guidance of student papers/projects

Subject of this chapter is description of the content of KA 12 – Involvement of application sector representatives in teaching, incl. professional guidance of student papers/projects (l).

The main objective of KA is to provide students up-to-date knowledge and feedback from scientific research practice through the participation of experts from the application sector in teaching and guidance (consultations) of qualification papers.

The aim of this KA is to encourage participation of experts from the application sector (companies) in teaching and guidance on papers on the basis of remuneration. There will be selected potentially beneficial experts for teaching, and they will be enabled to take part in teaching / supervising of qualification papers.

Within the project it will be mainly involvement in teaching at the Faculty of Science and the Faculty of Social Studies at the University of Ostrava. Preliminary it will be the course Geography of Transport, Geography of the City, Information and Communication Technologies in Social Work (preliminary name of the subject) and others.

Apart from the representatives of the companies involved directly in the project, it seems to be potentially meaningful to involve relevant staff from other application companies and institutions, for example Association of Social Assistants in Ostrava, the Czech Charity, the Ministry of Transport, Geodetic firms etc. However, it must always be a relevant expert on the topic of the project, i.e. SMART technology.

Structured overview of partial activities and their quantification:

- Development of a plan for the involvement of experts from the application sector in teaching, guidance and consulting of qualification papers at the University of Ostrava.
- Regular semestral participation of representatives from the application sector in regular teaching and one-time lectures at least within 5 subjects.
- Regular semesteral attendance of representatives from the application sector in guidance and consultations of qualification papers in a minimum of 15 papers.

- Continuous evaluation of involvement of representatives from the application sector in teaching, guidance and consultations of qualification papers, continuous adjustment of the plan.
- Other activities in accordance with the focus of this KA according to the current development and needs of the project.

Involvement of project team and partners in the implementation:

In this activity will be involved these workers, who will also be responsible for its implementation •

- Expert project leader,
- Expert leader KA 12,
- Researcher KA 12 – practitioner.

For the implementation of the KA will be responsible project applicant OSU, that has also allocated funds for this activity in its budget and of which teaching representatives of application sector will be involved in. All other project partners will also be involved in the implementation of this KA primarily from the application companies, who will also participate in the teaching and guidance of qualification papers.

Outputs:

The main quantifiable outputs are listed in the table below. Other outputs will include developed plan, its ongoing evaluation and updating, as well as lists of involved students, supporting materials for teaching and qualification papers, elaborated qualification papers and other process outputs of the activity.

Results and outputs of activity	Target Value of the Project Implementation
Other results not reflected in indicators: Specify the planned involvement. (Number of supervised or consulted qualification papers by the application sphere experts.)	15
Number of courses with the participation of application sector experts.	5

4.5 Establishment and enhancement of intersectoral partnership

Subject of this chapter is description of the content of KA 6 – Activities leading to establishing and enhancing intersectoral partnerships (f).

The main objective of KA is, in synergy with KA 2 and KA 5, to significantly support the establishment and enhancement of intersectoral partnerships.

This activity will be implemented in complementarity with KA 2 and 5, it will be a similar type of activities as for KA 2 and 5 implemented with subjects across sectors according to the areas supported by the Call and simultaneously included in the project.

By Interdisciplinarity within the project are understood overlaps and synergies between the following disciplines:

- 1AB1 - Social sciences (the main discipline of the project)
- 1AB2 – Mathematics and physics
- 1AB4 – Earth, atmosphere and environment sciences
- 1AB6 - Medicine
- 1AB8 – Informatics
- 1AB9.1-1AB9.4 – Industry: Electrical engineering and robotics
- 1AB9.5 – 1AB9.6 – Industry: Energy sector
- 1AB9.15 – Industry: Land transport systems and equipment

Interdisciplinarity has fundamental importance in the implementation of this project. The very theme of SMART technology is basically interdisciplinary application across different areas of human life (see, for example, topics for experimental verification within the scope of research projects). Therefore, the intersection of the sectors (disciplines), respectively subjects and experts from various areas covered by the SMART technology theme will have a major positive impact on the project implementation. At the same time, it is scientifically proven that an increasing number of innovations are created right in the overlap and the edges of different disciplines. The aim of the project is therefore to maximally support this interdisciplinarity and give the space for further innovation.

Structured overview of partial activities and their quantification:

- Organization of ca 6 roundtables (external workshop - seminars) focused on support of establishment and enhancement of intersectoral partnerships and cooperation within the project. It will be a meeting of project team members with representatives of the above mentioned disciplines, respectively organizations active in them, all of them in the direct link to the focus and objectives of the project. Specifically to the project focus will always be defined for each round table interdisciplinary topics and areas of application of SMART technologies that will be the subject of the seminar.
- Other activities in accordance with the focus of this KA according to the current development and needs of the project.

Involvement of project team and partners in the implementation:

In this activity will be involved these workers, who will also be responsible for its implementation:

- Expert project leader,
- Expert leader KA 6,
- Researcher KA 6.

For the implementation of the KA will be responsible project applicant OSU, that has also allocated funds for this activity in its budget. In the implementation of this KA will be involved also all other project partners of the R & D organizations and enterprises, they will participate in joint round tables and develop topic of intersectoral cooperation.

Outputs:

The main quantifiable outputs are listed in the table below. Other outputs will include particularly supporting materials for each round table and attendance lists from them.

Results and outputs of activity	Target Value of the Project Implementation
Other results not reflected in indicators: These are round tables - external workshops aimed at establishing and enhancement of intersectoral partnerships.	6

4.6 Preparation of jointly developed international project applications

Subject of this chapter is description of the content of KA 7 – Preparation of jointly designed international project applications related to the activities and focus of the project on SMART technologies (g).

The main objective of the KA is to prepare and submit international project applications that will be linked to the realization of the research within the project.

The subject of this activity will be preparation of project applications into international grant programs and their submission. These will be mainly projects within the community, territorial, bilateral, cross-border and other programs supporting international R & D cooperation where the grant provider is outside the territory of the Czech Republic. Projects will be prepared and submitted together with the current partners of the project as well as with other subjects with whom the project co-operation will be established.

Of the possible programs and grant titles seem probable these one or their subsequent programs:

- Horizon 2020,
- Third Health Program 2020,
- Programs for international, Territorial and Cross-border cooperation Interreg,
- Urbact,
- Life +,
- and others according to current opportunities.

Topics of the prepared research grant applications will be directly related to the project's research plan or experimental and model verification within it.

In the preparation of international project applications will also be involved workers from partner organizations from the Czech Republic and abroad (per-diem) who will co-submit the project.

Structured overview of partial activities and their quantification:

- Continuous monitoring of international grant programs and opportunities where a grant application can be prepared and submitted.
- Addressing potential partners for submission of application, general agreement on the submission of application, research theme and other key aspects.

- Preparation of at least 2 x project proposals and follow up project (grant) applications including of all relevant annexes.
- Submission of 2 grant applications according to the rules of the relevant program.
- Backward evaluation of the submitted grant application and of the whole process of its preparation in order to learn from the possible success / failure of the grant application.
- Other activities in accordance with the focus of this KA according to the current development and needs of the project.

Involvement of project team and partners in the implementation:

In this activity will be involved these workers, who will also be responsible for its implementation:

- Expert project leader,
- Expert leader KA 7,
- Researcher KA 7.

For the implementation of the KA will be responsible project applicant OSU, that has also allocated funds for this activity in its budget. In the implementation of this KA will be involved also selected project partners from R & D organizations and enterprises, especially those that will also participate in submission of the project application as co-applicant (partner).

Outputs:

The main quantifiable outputs are listed in the table below. Other outputs will include all supporting materials and inputs to the submitted project applications, or other process outputs of the activity.

Results and outputs of activity	Target Value of the Project Implementation
indicator: 2 03 12 Number of participations of supported research teams carried out in international cooperation programmes	0
Other results not reflected in indicators, jointly filed project application during project implementation. Should you reflect this application in indicator 2 03 12, do not state it here. State only applications that you have not reflected in indicator 2 03 12, for which the submission of the application is only binding. (Number of submitted grant and project applications.)	2

5 RESEARCH PLANS

5.1 Common introduction to all research plans

5.1.1 Annotation of research part

The aim of the research part is to jointly examine and propose methods and procedures for creation and implementation of socio-technical innovations enhancing the quality of life and that are based on SMART technologies.

The factor that distinguishes this project from other ones also focusing on the popular and actual topic of SMART technologies is the particularly non-technical approach of this project. Neither any new technical solutions nor any new technologies will be designed, examined or developed within the project. On the contrary, there will be examined in particular the use of available SMART technologies within their involvement into creation of compact solutions and concepts in the cross-sectional view of the whole innovation cycle, actually possibilities and methods of their use within improving the life quality at different levels of territorial units. The topical problem of many SMART technologies is often not the absence of a suitable technology but the absence of an appropriate design, concept or solution that would meet all the key factors for success of the whole SMART solution or concept.

The project is based on international knowledge and available scientific research and implementation results, follows up with already realized researches in the branch and has the crucial potential to develop scientific research knowledge in the field of SMART technology utilization.

The research part of the project consists of in total five individual research sub-programs that systematically build on each other and focus on particular parts of innovative cycle in relation to a specific world environment, where SMART technologies are playing an increasing role. Within individual research programs, there will be examined methods and procedures for creation and implementation of socio-technical innovations enhancing the life quality of the society based on SMART technologies.

- RP no. 1 - Analysis of Needs, Opportunities and Readiness,
- RP no. 2 - Methods and Models of Conceptual Designs and Solutions,
- RP no. 3 - Metrics and Models of Social Efficiency,
- RP no. 4 - Methods for Verifying the Feasibility of Concepts and Solutions,
- RP no. 5 - Ex-post Analysis of Concepts and Solutions.

The second cross-sectional research line of the project across the five research plans (RPs) will on the basis of above mentioned researches propose model SMART solutions and concepts at TRL3 (proof-of-concept). These SMART concepts will be subordinated to the purpose of improving the life quality, whatever technological field will be the finally proposed concept or solution from the condition of improving the quality of life should always be met. However, all this will not be separated from the technological side – orientation towards the utilization of SMART technologies to design solutions. Experimental verification of applicability of the defined methods, procedures and tools at the level proof-of-concept on concrete cross-sectional examples from the area of human life such as:

- Mobility and Transportation,
- Energy and Resources,
- Health and Care,
- Education and Learning.

The concept of SMART technologies is understood in this project as technologies based on information and communication technology in its various forms and implementation areas, which are capable of real-time acquiring of different types of information, evaluate them and thus customize and modify processes and behaviour of individual elements of the defined environment. SMART city solution is created by connecting the concrete physical elements of a city-creating environment with the urban digital infrastructure. Thanks to the acquired data, it is possible to get to know better the needs and behaviour of the population and based on that to plan better further urban development.

The entire concept of the research and the logical cohesion of research plans and verification examples is schematically shown in the following chart of the modified innovation cycle:

Research plan:	Aim of the research plan:	Outcomes of the research plan:	Structure of sub-activities:	Cross-sectional experimental verification:
1 – Analyses of Needs, Opportunities and Readiness	The aim is to explore and design methods and procedures for implementation of analysis of needs, opportunities and readiness for utilization of SMART technologies in a defined area of human life.	Analytical tool, i.e. analysis – set of procedures and indicators or methodology for elaboration of an analyses or audit on mapping of problems / needs / opportunities / trends. Its characteristic feature will be that in different types of region, for different types of contracting authorities, in different areas of human life, identifies priorities for solution – for which it is possible to search a specific solution using SMART technologies.	The structure of partial activities to achieve the objectives is the same for each RP: 1 - Detailed analysis of available tools, methods and procedures. 2- Surveys between relevant subjects and experts. 3 - Processing and evaluation of acquired inputs. 4 - Design and creation of tools, methods and procedures.	Verification of the applicability of defined methods, procedures an tools on concrete cross-sectional examples from area of human life, in particular: - Mobility and Transportation - Energy and Resources - Health and Care - Education and Learning - The result will be: I. Specific and simulation-proven model designs of SMART concepts and solutions (at TRL 3) that will be further developed beyond the realisation of
2 - Methods and models of conceptual designs and solutions	The aim is to examine and propose methods and models of designs and concept preparations and solutions based on SMART technologies.	Set of creative tools, techniques and methodologies for designing of SMART solutions and concepts that build on proven needs and opportunities of a specific territorial unit.		
3 - Metrics and models of social efficiency	The aim is to research and design metrics and models for evaluation of innovations based on SMART technologies with the goal to maximize the size of social benefit.	Analytical toll for evaluation of social benefits and costs, mainly on the basis of CBA that will directly reflect the specifics of SMART technologies and the dynamically changing environment.	5A - Cross-sectional experimental verification of tools, methods and procedures: 14	

4 - Methods for verifying the feasibility of concepts and Solutions	The aim is to examine and design means and methods for verification of proposed SMART concepts and solutions in order to verify their feasibility prior to their application and implementation in practice.	Set of tools, methodologies and procedures for experimental verification of the designed SMART solution and evaluation of its feasibility.	defined verifications. 5B - Cross-sectional e experimental verification of tools, methods and procedures: another ca 5 verifications. (Note: Partial Activity 5 - see column on the right) 6 - Finalization of methods, tools and procedures and formulation of recommendations.	this project so that they can be subsequently put into practice. Or: II. Acquired inputs and information for the design of model conceptions and solutions based on SMART technologies. In total, 14 defined verifications will be implemented and another 5, which will be defined later during the project on the basis of the process of its elaboration, partial results and current needs.
Implementation and application of concepts and solutions	The aim of this phase is usually implementation of designed SMART solutions and concepts after proving their social benefit and feasibility at different levels of territorial units. HOWEVER, THIS PART IS NOT AN AIM OR SUBJECT OF THIS PROJECT, ITS MENTIONIG HERE HAS PRATICULARLY A CONTEXTUAL MEANING.			
5 - Ex-post analysis of concepts and solutions	The aim is to examine methods and procedures for realisation of ex-post analysis of the implementation of proposed SMART solution and concept in order to learn from the implementation and eventual adjustment of input premises for analytical, design and evaluation part of the preparation of these concepts and solutions.	Set of tools, methodologies and procedures for ex-post analysis of already implemented SMART solution and concept.		

From the table above, it is possible to elicit clear coherence of individual research plans. Outputs of each research plan will be further usable separately for the given phase of the modified innovation cycle or will be used as a cumulative complex within successive stages of preparation and implementation of SMART concepts and solutions.

Along with above mentioned, applies that the outputs of every research plan (defined tools, methodologies and procedures) will be experimentally verified on defined cross-sectional examples from human life. Therefore the second sphere of outputs will be a set of model designs and case studies on utilization of SMART technologies in specific cross-section examples from human life, especially mobility and transportation, energy and resources, health and care, education and learning.

An illustrative example of the procedure:

1. It applies that within the research plan No. 1 there will be created a tool to define opportunities of a city or region for implementing SMART concepts and solutions. This tool will be subsequently experimentally verified within defining of model opportunities in the area of mobility and transportation. Opportunities of a city, e.g. for the area of transport, will be modelled thanks to this tool.
2. An output of the research plan No. 2 will be concrete techniques for designing of SMART concepts and solutions. The given technique will be then experimentally verified for a model concept design that will utilize the defined opportunities of a city in the area of transportation. Thanks to use of this technique there will be defined a model concept e.g. for autonomous city transport system.
3. An output of the research plan No. 3 will be an analytical tool for evaluation of social benefits and costs in particular on the basis of social costs and benefits (CBA). This tool will be subsequently experimentally used for a model assessment of the model concept of the autonomous city transport system. Thanks to use of this tool the social benefit of the proposed concept for the autonomous city transport system will be modelled and verified. If the result is positive, the concept design will advance forward, if it is negative, the concept will need to be revised using the tools of techniques, methodologies and procedures defined within the research plan No. 2.
4. An output of the research plan No. 4 will be a methodology for experimental verification of designed SMART solution and evaluation of its feasibility (e.g. in the form of a computer simulation). This methodology will be experimentally verified on a defined model concept for the autonomous city transport system. By using this methodology there will be modelled the feasibility of the designed concept for city transport system. In case of a positive result, the model concept can be further developed so as it could be put into practice. In case that the concept is found to be unfeasible under present parameters and circumstances, it will need to be revised using the tools of techniques, methodologies and procedures defined within the research plan No. 2. Using of outputs of research No. 3 (efficiency evaluation) and No. 4 (feasibility evaluation) may also be done simultaneously.

5. Under ideal circumstances a social efficient and feasible model concept for the autonomous city transport system would be further elaborated and designed into the form of a concrete project that would be implemented by the city. However, this step is neither a part nor a subject of this project.

6. An output of the research plan No. 5 will be a methodology for elaboration of an ex-post analysis of this project. This methodology will be subsequently experimentally verified on a model example of implemented autonomous city transport system. The outcome of this experimental verification will be findings of two types. On one hand they will be used as a means of "learning" for further adjustment and optimization of tools, methodologies and procedures that are the outputs of research plans no. 1-4 (i.e., this is a matter of procedural assessment). On the other hand, the data itself will serve as information whether the given autonomous city transport system has met its defined goals and achieved any social benefits (i.e., this is a matter of factual assessment).

5.1.2 Current state of knowledge for all research plans

The whole topic of SMART city and SMART regions (SMART cities) is very complex. Even though the concept itself is not entirely new for public administration, the beginning of SMART cities dates back to the 1990s and is associated with the concept of SMART growth (Caldwell, 2002), there is not, in fact, a generally accepted definition of SMART cities that would correspond to the SMART cities concept on global level (Neirotti et al., 2014). The definition of the matter ranges from the interrelationship between the education of urban population, local amenities and attractiveness for educated citizens (e.g. Shapiro 2005, Glaeser, Berry, 2006, Winters, 2010) and emphasizing the importance of the creative class (Florida, 2002) up to theories describing cities that use information and communication technologies in order to improve the life quality of their inhabitants within the scope of sustainable development (Bakici et al., 2012).

Other authors combine both approaches (Nam, Pardo, 2011; Caragliu et al., 2011; Harrison, Donnelly, 2011). Elsewhere, the concept is considered to be a response to global climate change or a step in an effort to make city management more effective, or even to try to attract more Y and Z generations, who are often seen as promoters of new economic effectiveness (Harrison, Donnelly, 2011). The fact that the introduction of SMART cities may give rise to unpredictable consequences, such as widening existing inequalities rather than new technologies contributing to their solutions, must also be taken into consideration.

The social and ethical implications of the development of these technologies, as well as the growing influence of technology giants on city economics, the freedom and privacy of its inhabitants (Viitanen, Kingston, 2013) are a separate issue. SMART cities are also opening the way for the collection of so-called "big data", i.e. simply, cheaply and efficiently created databases, which collect information from various sources to test and create sophisticated simulations. From a philosophical point of view, SMART cities represent the "informational shift", i.e. a fourth revolution in the understanding of human existence, similar to the discoveries of Copernicus, Darwin and Freud, which changed the view on the mankind and the world through science (Floridi, 2009).

Based on analysis by company Deloitte, there is estimation that by 2020, 1.5 trillion US dollars will be invested in smart cities. Taking into account the responsible and efficient spending of public funds, it will become necessary to carefully consider the prospective concepts and choose sustainable, optimal and locally appropriate solutions. The range of measures and strategies available is very broad, as the starting point itself is not the same for individual cities or regions.

Link to the strategic documents

Focus and theme of the project is fully in harmony with the following strategic documents:

I. Regional RIS3 Strategy of the Moravian-Silesian Region and National RIS3 Strategy - see the mandatory annex.

II. The long-term plans of the University of Ostrava (LTP OU) and Silesian University in Opava (LTP SLU) and their strategic directions).

Within the LTP OU, the project is in harmony with Priority 2 focusing on the development of excellent science, particularly in the area of transfer of knowledge to the application sector, and Priority 3 SMART University, which widely supports the use of SMART concepts in university management and other related areas. Within the LTP SLU, the project is fully in harmony with the Priority Strategic Area 2 Science, Research and Creative Activities where the project develops strategic scientific and research direction of the university in economic and empirical research.

III. Strategic Framework of the Strategy of Economic Restructuralisation of the Ústí, Moravian-Silesian and Karlovy Vary Regions.

Within the Pillar A Business and Innovation, the project is in harmony with the support of innovative performance economy, within the Pillar C Research and Development, the project is in harmony with support for research and applicability of research findings, and within the Pillar E Social Stabilization, the project is generally in harmony with improving quality life in given territory.

IV. Program declaration of the Moravian-Silesian Region Coalition for the years 2016-2020.

In the area of Education, the project supports science and research and their connection with the practice so that business subjects of the region can base their perspective on regional own technical intelligence, in the area of Healthcare, the project is in harmony with the intention of introducing electronic systems and in the field of Transport is in harmony with the intention to improve the efficiency and availability of transport in the region.

V. ITI Strategy of Ostrava agglomeration.

Project is fully in harmony with the specific objective 2.3 Implement activities to support the strategy of Intelligence Specialization for the Moravian-Silesian Region. Thanks to the project, the innovative performance and competitiveness of local businesses and the University of Ostrava / Silesian University in Opava will be enhanced. Support will be given to the implementation of projects of long-term cooperation between research organizations and enterprises and intersectoral cooperation, capacity building and implementation of research projects in the pre-application phase, based on long-term market needs as well

as companies with great potential for achieving breakthrough results in the use of SMART technologies for improving quality of life. Additionally, the project is also in harmony with the specific objective 3.1 To support development of sustainable mobility, particularly in the field of support for intelligent transport systems.

5.1.3 Opportunities for further research development

From the point of view of defined tools, methodologies and procedures (that should represent outputs of individual research plans) it applies that the particular tools, methodologies and procedures mostly already exist and are generally used. Nevertheless, with regard to their further applicability for SMART concepts and solutions, tools, methodologies and procedures are showing a number of deficiencies and limitations that are subject of this very project. Therefore, there is a significant potential for further research and related development of defined outputs of research plans. Above all it concerns the following areas that are considered by this project:

- **Obsolescence** – many mentioned tools, methodologies and procedures originated before development of ICT and internet. And mainly ICT and internet have brought a lot of revolutionary changes into almost every sphere of human life. Previously applicable assumptions did not apply any more or had to be adjusted. All the more applies this fact for concepts and solutions based on SMART technologies, where ICT and internet play a significant role. One of the crucial assumptions is change in the speed of information distribution. Information systems now operate in real-time and the information can be transferred without delay to any place worldwide. SMART technologies have added the possibility to evaluate and respond in real-time. A model example evidencing this fact is treatment of patients with Blood Clotting Disorders. The obsolete model (which is still often used) is following: the patient regularly visits his doctor, who takes blood samples. These samples are sent to laboratory for evaluation, and subsequently they return to the doctor, who changes the patient's medication. The new SMART-based model suggests that the patient is equipped with a measuring device to carry out a blood analysis himself. The device sends the results immediately to the doctor and he (or artificial intelligence) decides how to change the medication. The patient has a real-time feed-back.
- **Generality** – a number of mentioned tools, methodologies and proposals are formulated generally for any concepts, solutions and projects. Considering the whole series of specifics of SMART technologies and solutions based on them, it is desirable that the given tools, methodologies and procedures are adapted directly for use within environment of SMART technologies. Methodologies for processing of CBAs could be a good example. These methodologies are general and they do not reflect SMART technology specifics that may affect for example different concept of shadow prices or discount rates, which are key inputs for processing of CBA. Therefore, one of the partial purposes of the project is to adapt tools, methods and procedures just for a specific use of SMART concepts and solutions.
- **The impossibility of practical use** – a number of tools, methodologies and procedures are made to be used in an "ideal world" where all predefined premises apply. However, many premises do not

apply in the real world and that is why limitation of inputs and simplified interpretation of outputs has to be performed. Very often is the instrument no longer usable for its original purpose. All this is further disrupted by SMART technologies. As an example can serve sensitivity analysis where, in order to simplify the calculation, only single-factor analysis is often performed, which is highly insufficient regarding the complex and turbulent conception of the world. Thus, one of the partial purposes of the project is to adapt tools, methods and procedures so that they reflect as much as possible the real state of the world where SMART technologies play a key role.

- **Sectoral focus** – the whole series of tools, methodologies and procedures are developed or adapted for use in a particular industry or area of human life where it works in a fully appropriate way. The possibility of utilizing them for other areas is then limited. A good example can be applied tools for evaluating of social costs and benefits of transport structures in USA and United Kingdom. These tools (on the basis of SW) are very good and serve well to their purpose. Nevertheless, they are not applicable for innovative transport models using SMART technologies. Thus, one of the partial purposes of the project is to adapt tools, methods and procedures so that they are applicable for new model solutions and projects where the innovative approach within using SMART technologies plays a key role.
- **Shortening of the innovative cycle and change of the environmental dynamics** – thanks to use of SMART technologies and their rush development the innovative cycle in many cases has been vitally shortened. E.g. means of transport equipped with an increasing number of detectors, sensors that makes the vehicle “smarter”. With regard to a rapid development of SMART innovations such cars are quickly outdated, although they are still used to their primary purpose. The present solution that would use these cars must be very quickly prepared and realised so as to avoid the case that due to innovations it will not be possible to implement the designed solution any more. Thus, one of the partial purposes of the project is to adjust and adapt tools, methods and procedures so that they are fully prepared for the shortening innovation cycle and are able to react dynamically to a changing environment.
- **Change of preferences** – together with the technological development and the world welfare increase, the preferences of inhabitants of cities and regions are also changing. Leisure time, own health and entertainment are getting more and more valuable in the advanced world. People start to be more willing to pay for things that bring them the required value, or demand this from cities of regions. That is why there is a growing demand on SMART concepts and solutions that help people to save time (e.g. transport systems), improve health (e.g. in form of air protection) or bring amusement (e.g. virtual reality). Therefore, one of the partial purposes of the project is to adjust and adapt tools, methods and procedures so that they maximally reflect the changing preferences of people and contribute to solution of their needs thanks to support of concepts and solutions based on SMART technologies.
- **Megatrends** – the world is changing and some prevailing megatrends can be watched. The mere use of new technologies is a megatrend itself. However, the main megatrend that has a real impact on many of the mentioned tools, methodologies and procedures, is the aging of the population. Especially in developed countries, an increasing number of people live to a ripe old age and make a

larger percentage of the population. This creates a dominant class of population with its specific needs. Therefore, one of the partial purposes of the project is to adjust and adapt tools, methods and procedures so that they maximally reflect the fact of newly emerging dominant group of elderly population.

5.1.4 Intellectual property treatment across research plans

This part is common to all research plans. Intellectual property treatment within the project will be subject of partnership framework agreements, where the shared ownership of relevant project outputs will be solved. Furthermore this will be solved within the project in particular in relation with KA 2 and 3.

Generally, the purpose of the project consortium is to publish the maximum results elaborated within the project and to pass them on to the professional and lay public, so that the acquired knowledge becomes the basis for further solutions and concepts based on SMART technologies.

Within the project there is planned submission of at least one international patent classification (IPC), where the rules require that the subject of this patent classification was not published yet. That is why part of the project outputs will be earmarked exactly for this purpose.

Combination of aid intensities in accordance with OP RDE rules and public aid rules enables the relevant part of the outputs to be subject of intellectual property protection. These cases, however, will always be handled individually and in accordance with rules of OP RDE and valid legislation.

5.1.5 Definition of the project research level

The OP RDE call and rules define the maximum research progress realized within this project at the highest progress level of research TRL 3. European Commission defines TRL 3 within the program Horizon 2020 as „experimental proof of concept". In the web of Ministry of Education, Youth and Sports (MEYS), in the FAQ section there is stated that it is possible to carry out laboratory testing as much as possible within the project. **The whole project follows this consensus and all research plans and their partial activities are planned and will be realized within the project at the maximum level of laboratory testing.**

For this reason it is crucial to define the term "laboratory" in relation to the project. Project focus on SMART innovations in cities and regions to support enhancement of life quality allows very limited laboratory testing in terms of "classical laboratory approach" as we know it e.g. from the fields of chemistry of physics (for example a closed room with a number of measuring and analytical instruments). For the area of urban innovations, we need to define the concept of "laboratory" in such a way so that the definition precisely matches the project specifics and its focus, however at the same time it should be conceptually a laboratory. The project applicant builds on consensus of the greatest research organization in Europe FRAUNHOFER, which for the needs of urban and regional research defines so called "City Lab" that exactly corresponds to the concept of classical laboratory, however it is adapted to the specifics of research.

Concept of City Lab - city laboratories for cities of future

The company Fraunhofer is Europe's largest application-oriented research organization and a key carrier of the concept and outputs of initiative Morgenstadt - city of future. The company's professional plans are oriented on people's needs: health, safety, communication, mobility, energy and the environment. Therefore, the work of scientists has a significant impact on people's lives. The scientists' approach is creative, they create new techniques, develop new products, improve procedures and open new ways and they invent the future.

Why City Lab?

Cities represent the key living spaces in the 21st century. A great challenge for sustainable cities where people would live well is a setting of strategic and long-term measures that must reflect current development and respond flexibly to changes. Cities of future must be regarded as a comprehensive system. With regard to the number of changes of the paradigm in various areas affecting cities and their surrounding areas, existing planning tools are no longer effective. Long-term strategies need to be synchronized between long-term and short-term innovation cycles and take into account, if possible, all the aspects that fundamentally influence formation of cities as well as city life.

The need of research in this area is nowadays extremely high. The Fraunhofer Research society is reacting to this with its activity Morgenstadt (city of future). The coherence of the explored subject "city" and asking questions of technical, process-oriented and systematic nature is one of the greatest challenges for finding paths within the development of sustainable society. Thanks to the thematic breadth of scientific expertise within Fraunhofer society and its development competences, it is possible to better approach the vision of the city of future - Morgenstadt.

Fraunhofer society has developed an extensive and multidisciplinary process that aims to create a global and scientifically validated scenario of the future as a model for a scientific approach oriented to the needs of cities and the practical use of developed tools.

Within the Morgenstadt Initiative, initiated by Fraunhofer scientists, cities are considered an experimental space, a laboratory, so called City Lab. In the framework of these laboratories it is possible to analyze urban systems by interdisciplinary teams and to create an integrated process for sustainable urban development for each city. Projects created in such an environment are then basis for further research and concurrently allow the use of existing tools and solutions.

The core of each City lab is the interdisciplinary collaboration of expert teams based on the comprehensive expertise of Morgenstadt. The local team provides data, information and organization of meetings, etc. The City Lab concept represents a concrete collaboration between cities and scientists from the Morgenstadt initiative.

This is an in-depth city analysis based on the procedures, tools and methods of the Morgenstadt system, developed by experts from the Fraunhofer research institute and proven in cities in Germany as well as abroad. While most urban studies are based on macroeconomic data such as population and economy

growth as well as property prices, the City Lab concept is based on different assumptions. In-depth urban analysis is based on regulation of the Morgenstadt method and implemented on the Morgenstadt model for sustainable urban development. This model can be divided into 3 analytical levels, which are developed together to understand the actual state of sustainable urban development into coherent strategies and also to develop an integrated development action plan.

Use for this project

This City Lab concept appears to be the ideal premise for implementing research within a project where cities will serve as laboratories. However, in order to meet the rules of advanced research within the OP RDE (maximum laboratory verification), the purpose of City Lab research will not be to design and develop concrete solutions for specific cities. On the contrary, the research team will use the city as an environment where it defines certain model situations, artificial conditions and generalized principles, on which it will subsequently perform its laboratory verification. It means that still we will have only a laboratory test. Thanks to this approach there will be acquired new insights and outcomes that will be further applicable within more advanced phases of research beyond the scope of this project. Support for the project expressed 5 local authorities in all (Moravian-Silesian Region, cities of Ostrava, Třinec and Jablunkov and municipality of Palkovice), which can well create the environment for City lab and can serve as municipal laboratories under fulfillment of the above mentioned conditions.

In addition, the partner of the project is FRAUNHOFER IAO (Institute for Industrial Engineering), which will provide the consortium with methodological support in order to treat the concept of urban lab within the project in the right way.

Note: If a description of the sub-activity beyond the TRL 3 of the laboratory verification appears somewhere in the text, this activity will no longer be implemented within this project.

5.1.6 Link to the current research of project partners - common to all planned researches

Guarantee for research plans

Within the project will be implemented 5 research plans in total, where selected partners will professionally guarantee their preparation/implementation. Distribution of professional guarantees of individual partners for research plans corresponds with their current scientific research and application orientation and has a logical link to existing activities. Thanks to the project, each of the partners will continue integrally on so far implemented activities and will develop them within the project. The project will thus support the extension of existing research plans as well as new intentions that are logically linked to the research strategy of the University of Ostrava and its partners.

Summary of current research activities affected by the project is mentioned in the description of each subject in the Chapter 3 FS. At the same time, partners will be involved across other research projects. This involvement is always described specifically for each research plan within the final part of subchapter 5.X.4 Research Objectives, Activities and Results, part Involvement of Partners and Cooperation Development.

RP 1 – Analyses of Needs, Opportunities and Readiness: University of Ostrava

RP 2 - Methods and Models of Conceptual Designs and Solutions: University of Ostrava

RP 3 - Metrics and Models of Social Efficiency: Silesian University in Opava

RP 4 - Methods for Verifying the Feasibility of Concepts and Solutions, Implementation and application of concepts and solutions: Fraunhofer IAO

RP 5 - Ex-post Analysis of Concepts and Solutions: BeePartner

Cross-sectional experimental model verification

Specific cross-sectional component of the research across the five research plans is always partial activity No 5. Cross-sectional Experimental Verification of Tools, Methods and Procedures: 14 defined verifications + further ca 5 verifications. See the description in the next part of FS. Even these verifications has always assigned guaranteeing project partners as follows:

Experimental Verification No. 1: Improving the quality of life of disadvantaged families with children and seniors through social work aimed at preventing e-exclusion

- University of Ostrava, Faculty of Social Studies

Experimental Verification No. 2: Progress in remote monitoring of patients and enhancing safety of treatment by patients with blood tumours

- University of Ostrava, Faculty of Medicine

Experimental Verification No. 3: Agglomeration monitoring system for air quality through a network of local stations with visualization support with the ambition to identify emission sources and achieve their reduction

- University of Ostrava, Faculty of Science

Experimental Verification No. 4: Complex diagnosis of the entry level of knowledge, skills, preferences and eventual learning disabilities of educated person

- University of Ostrava, Faculty of Science

Experimental Verification No. 5: Senior education in the context of IT inclusion

- University of Ostrava, Faculty of Science

Experimental Verification No. 6: Navigation and orientation options in medical facilities

- The Agel Educational and Research Institute

Experimental verification No. 7: Intelligent systems, traffic management and monitoring

- BeePartner

Experimental Verification No. 8: Electromobility

- BeePartner

Experimental Verification No. 9: Intelligent Building Management

- BeePartner

Experimental Verification No. 10: Use of smart technologies to improve communication of citizens with state administration with an emphasis on transport and energy

- Autocont

Experimental Verification No. 11: Metropolitan Governance of Integrated Transport Systems

- University of Ostrava, Faculty of Science

Experimental Verification No. 12: Spatial mismatch in metropolitan regions on the example of knowledge-intensive services

- University of Ostrava, Faculty of Science

Experimental Verification No. 13: Improving Transparency and City Mobility (Smart walking plan)

- University of Ostrava, Faculty of Science

Experimental Verification No. 14: Improving the quality of life in central parts of cities

- University of Ostrava, Faculty of Science

A specific role in the experimental verifications will be played by the partner Moravian-Silesian Innovation Center, which will be involved in each of them and will act as facilitator and leader of the innovation process in all experimental verifications.

5.1.7. Research team - common text for all research plans

Team composition, roles, research activities, and recruitment schedule

Following table illustrates the quality and involvement of the research team within the KA 4. Part of positions is occupied by specific experts, part create unoccupied positions. For unoccupied positions, their qualifying requirements are summarized further.

The whole team is set up to achieve given objectives and outputs of the project in a high quality and appropriate way, while respecting all rules of OP RDE and other restrictions.

Name and surname (for positions that have not yet been filled, give who "will be nominated")	Employer (applicant, project partner)	H-index (members by names)	Type - excellent - key - ordinary member	Position in the team (leader, researchers, technician, …)	Work load during project implementation term The years below are calendar years and correspond to budget years of the project.					
					2017	2018	2019	2020	2021	2022
Petr Rumpl	Applicant - OSU	13	Key member	Expert project leader and expert leader RP2		0,4	0,4	0,4	0,4	0,4
Jan Macháček	Applicant - OSU		Ordinary member	Leader KA2		0,1	0,1	0,1	0,1	0,1
Alexandr Nováček	Applicant - OSU		Ordinary member	Leader KA3		0,1	0,1	0,1	0,1	0,1
Tomás Drobík	Applicant - OSU		Ordinary member	Leader KA5		0,1	0,1	0,1	0,1	0,1
Martnik Žáček	Applicant - OSU		Ordinary member	Leader KA6		0,1	0,1	0,1	0,1	0,1
Jan Ženka/Ondřej Slach	Applicant - OSU		Ordinary member	Leader KA7		0,1	0,1	0,1	0,1	0,1
Luděk Krtička	Applicant - OSU		Ordinary member	Leader KA8		0,1	0,1	0,1	0,1	0,1
Beáta Kapošváry	Applicant - OSU		Ordinary member	Leader KA9		0,1	0,1	0,1	0,1	0,1
Petr Žufan	Applicant - OSU		Ordinary member	Leader KA10		0,1	0,1	0,1	0,1	0,1
Petr Dvořák	Applicant - OSU		Ordinary member	Leader KA11		0,1	0,1	0,1	0,1	0,1
Tomáš Hoch	Applicant - OSU		Ordinary member	Leader KA12		0,1	0,1	0,1	0,1	0,1
Roman Hájek	Applicant - OSU	27	Key member	Researcher KA4		0,2	0,2	0,2	0,2	0,2
Soňa Vávrová	Applicant - OSU	2	Key member	Researcher KA4		0,2	0,2	0,2	0,2	0,2
Pavel Smolka	Applicant - OSU	27	Key member	Researcher KA4		0,3	0,3	0,3	0,3	0,3
Jan Ženka	Applicant - OSU		Ordinary member	Researcher KA4	-	0,3	0,3	0,3	0,3	0,3
Ondřej Slach	Applicant - OSU		Ordinary	Researcher KA4	-	0,3	0,3	0,3	0,3	0,3

			member							
Jan Miklín	Applicant - OSU		Ordinary member	Researcher KA4	-	0,3	0,3	0,3	0,3	0,3
Luděk Krtička	Applicant - OSU		Ordinary member	Researcher KA4		0,3	0,3	0,3	0,3	0,3
will be nominated	Applicant - OSU		Ordinary member	Researcher KA4		0,3	0,3	0,3	0,3	0,3
Alice Gojová	Applicant - OSU		Ordinary member	Researcher KA4		0,2	0,2	0,2	0,2	0,2
Jaroslav Žáček	Applicant - OSU		Ordinary member	Researcher KA4		0,3	0,3	0,3	0,3	0,3
Michla Janošek	Applicant - OSU		Ordinary member	Researcher KA4		0,3	0,3	0,3	0,3	0,3
Zdeňka Telnarová	Applicant - OSU		Ordinary member	Researcher KA4		0,3	0,3	0,3	0,3	0,3
Vladimír Bradáč	Applicant - OSU		Ordinary member	Researcher KA4		0,3	0,3	0,3	0,3	0,3
Michaela Skořupová	Applicant - OSU		Ordinary member	Researcher KA4		0,3	0,3	0,3	0,3	0,3
Adéla Recmanová	Applicant - OSU		Ordinary member	Researcher KA4 - junior		0,3	0,3	0,3	0,3	0,3
Ivana Kowaliková	Applicant - OSU		Ordinary member	Researcher KA4 - junior		0,3	0,3	0,3	0,3	0,3
Naďa Machková Prajzová	Applicant - OSU		Ordinary member	Researcher KA4		0,5	0,5	0,5	0,5	0,5
Jan Nevima	Partner -SLU	4	Excellent researcher	Expert leader RP3, Researcher KA4	0	0,1	0,1	0,1	0,1	0,1
Marian Lebiedzik	Partner -SLU	1	Key member	Researcher KA4	0	0,1	0,1	0,1	0,1	0,1
Ingrid Majerová	Partner -SLU		Key member	Researcher KA4	0	0,1	0,1	0,1	0,1	0,1
Kamila Turečková	Partner -SLU		Key member	Researcher KA4	0	0,1	0,1	0,1	0,1	0,1
will be nominated	Partner- VAVIA		Ordinary member	Researcher KA4	0	0,3	0,9	0,9	0,9	0,9
will be nominated	Partner- VAVIA		Ordinary member	Researcher KA4	0	0,1	0,1	0,1	0,1	0,1
Nora Fanderl	Partner – Fraunhofer IAO		Key member	Researcher KA4	0	0,25	0,25	0,25	0	0
Petr Suska	Partner –		Key member	Researcher KA4	0	0,5	0,5	0,5	0,5	0,5

	Fraunhofer IAO									
Alanus von Radecki	Partner – Fraunhofer IAO		Key member	Researcher KA4	0	0,2	0,2	0,2	0	0
Damiam Wagner	Partner – Fraunhofer IAO		Key member	Researcher KA4	0	0,3	0,3	0,3	0	0
Jill Theobald	Partner – Fraunhofer IAO		Key member	Researcher KA4	0	0,75	0,75	0,75	0,75	0,75
David Sventek	Partner - BeePartner		Excellent researcher	Researcher KA4	0	0,2	0,2	0,2	0,2	0,2
Daniel Konczyna	Partner - BeePartner		Excellent researcher	Researcher KA4	0	0,2	0,2	0,2	0,2	0,2
David Kula	Partner - BeePartner	2	Key member	Researcher KA4	0	0,4	0,4	0,4	0,4	0,4
René Kohut	Partner - BeePartner		Ordinary member	Researcher KA4	0	0,5	0,5	0,5	0,5	0,5
will be nominated	Partner - BeePartner		Ordinary member	Researcher KA4 - junior	0	1	1	1	1	1
Vlastimil Pavlán	Partner - AutoCont		Excellent researcher	Researcher KA4	0	0,6	0,6	0,6	0,6	0,6
will be nominated	Applicant - OSU		Ordinary member	Researcher KA4 (CWS)	0	864	1152	1152	1152	1152
will be nominated	Applicant - OSU		Ordinary member	Researcher KA4 (CWS)	0	690	840	840	840	840
will be nominated	Applicant - OSU		Ordinary member	Researcher KA3 (CWS)	0	200	200	100	50	50
will be nominated	Applicant - OSU		Ordinary member	Researcher KA12 (CWS)	0	100	200	200	200	200
will be nominated	Applicant - OSU		Ordinary member	Researcher KA4 (CWS)	0	400	600	600	600	210
Jan Nevima	Partner -SLU		Excellent reserarcher	Researcher KA4 (CWS)	0	90	120	120	120	120
Marian Lebiedzik	Partner -SLU		Key member	Researcher KA4 (CWS)	0	90	120	120	120	120
Ingrid Majerová	Partner -SLU		Ordinary member	Researcher KA4 (CWS)	0	90	120	120	120	120
Kamila Turečková	Partner -SLU		Ordinary member	Researcher KA4 (CWS)	0	90	120	120	120	120
will be nominated	Partner -AutoCont		Ordinary member	Researcher KA4 (CWS)	0	80	80	80	80	80

Qualification prerequisites for unfilled positions. State for positions you plan to fill by excellent and key personnel and leaders.	
Staff member position	**Qualification prerequisites**
Researcher	Qualifying requirements will be university degree/higher education relevant to the position in the context of research programs (depending on the specific RP, experimental verification or KA), eventually proven practice in relation to the project. This will include workers with technical education in the field of IT, social science education, medical or, eventually, other in relation to the project. Knowledge of English will also be key. Qualifying requirements will be determined before the position is occupied. Some positions can also be occupied by students.

Results and outputs of activity	Target Value of the Project Implementation
Indicator: CO 24 / 2 04 00 Number of new researchers in supported entities	2

Results of key and excellent members of the expert team achieved over the last 5 years

5.2 Research plan – Analysis of needs, Opportunities and Preparations – RP 1

5.2.1 Abstract

The aim of Research plan 1 (RP1) is to explore and design methods and procedures for implementation an analysis of needs, opportunities and readiness to use SMART technology in a defined area of human life.Therefore, within RP 1, existing methods and procedures will be examined and adapted to identify and analyze needs, opportunities and readiness for different levels of self-governing territories so that they can be fully utilized for a specific environment using SMART technologies and introducing new concepts and solutions into urban environments and regions based on the use of SMART technologies. It concerns in particular the following areas:

- Needs - how different localities can identify problems and needs that can be solved using SMART technologies.
- Opportunities - what trends are noticeable, technological and social development, what opportunities exist and what should be taken into account when designing SMART solutions and concepts.
- Readiness - what are the key factors (limiting and accelerating) that determine the readiness of territorial units to implement SMART solutions and concepts?

Within the framework of the sub-activities, primarily a detailed analysis of available tools, methods and procedures will be carried out, which will be complemented by research among relevant entities

and experts. On the basis of the documents obtained by this method, the inputs will be processed and evaluated, leading to the design part, where different tools, methods and procedures for analysing needs, opportunities and readiness will be defined. Subsequently, a crucial role will be played by a cross-sectional experimental verification of these tools, methods and procedures on 10 already defined examples of energy and savings, transport and mobility, health and care, learning and education. On the basis of current knowledge and needs, other examples will be further added to the existing 10 model examples within the project. The final step will be completion and finalization of methods, tools and procedures, and formulation of recommendations.

The output will be an analytical tool, i.e. analysis - a set of procedures and indicators, or an analysis or audit methodology for mapping problems / needs / opportunities / trends. Its characteristic feature will be ability to identify priorities for solutions in different types of territory, for different types of contracting authorities, in different areas of human life, - for which it is possible to search a specific solution using SMART technologies.

5.2.2 Current state of knowledge

Current state of knowledge according to the scientific literature

Witkin and Altschuld (1995) in the publication entitled "Planning and Conducting Needs Assessments: A practical Guide" formulate the basic principles of practical realization of needs analysis, whereas they characterize the needs analysis itself as a "systematic set of procedures leading to the identification of priorities in relation to effective decision making in the allocation of resources " (s. 4). Concurrently, they draw attention to the need for a differentiated utilization of needs analysis in the sense of who processes needs analysis, why is needs analysis processed and how is it processed. By the latter they give a detailed analysis of specific methods that are described in detail, for example in chapters 2, 3 or 10.

Ibert (2003) summarizes in his publication knowledge of planning processes leading to innovations (here especially in cities and regions) and their individual phases. The first phase of the planning cycle is to identify the problem or a particular opportunity and to formulate its description. After formulating the problem follows: situational analysis, finding objectives in their alternatives, target selection, thinking about procedures it their alternatives, assessing alternatives, choosing one alternative and implementation of a solution.

One of the most widely used is a trend analysis in the form of scenario methods as planning methods for identifying current or future trends. For example, van Notten et al. (2003) distinguish in terms of content focus three scenarios: a) issue-based scenario in which social issues are a subject of interest; b) area-based scenarios that examine a specific geographic area (state, region or city), and c) Institution based scenarios focused on the area of interest of a particular organization(s) or sector. Very important is that the overlap between these scenarios is possible; however, it must not be self-serving. Apart from content focusing scenarios, they also differentiate scenarios according to their time span, namely to short-term scenarios where the time span usually ranges between 3 to 10 years and long-term scenarios with a lower limit 25 years. They also do not neglect the methodological aspect of the case by which they distinguish between intuitive and formal scenarios. The first is

based primarily on qualitative inputs which are eventually basis for creating scenarios. Typical features of this methodological approach lie in creation of stories or events. On the other hand, the formal approach prefers rational and analytical scenario processing.

No less problematic question is also the typology of scenarios, especially because the choice of a particular type of scenario is crucial for their creation. The almost exhaustive typology of the scripts by Börjeson et al. (2006), which differentiate the three basic categories of scenarios into (a) predictive, (b) exploratory, and (c) normative (for a more detailed description see Frič et al., 2010, where this typology is described in detail). The choice of a particular category and type of scenario depends on the objectives to be achieved. Another issue is the number of scenarios that can be highly variable, reflecting the fact that there is no "optimal number" of scenarios.

Docherty and McKiernan (2008) say that well-designed and specifically-oriented scenarios can be used for urban development in principle in three ways (p. 986). In the first place, they can be used to influence (regulate) the management of city development by reducing risk in decision-making (providing information), for which scenarios of future can serve, for example, for urban areas, public areas in central parts of cities, deprived urban areas or transport system. A variety of spatially or thematically segmented scenarios can test and validate the expectations associated with possible future developments of the territory or sector within a broad social debate. Secondly, scenarios can be used in strategic management, especially in simulating crisis situations, which can become a challenge or even an opportunity in case of early identification. And thirdly, the scenarios can serve as a valuable resource for learning the city, respectively to strengthen and develop the absorption and organizational capacity of the city and in relation to the future.

Market research, for example, can include image analysis. It investigates the inhabitants' image and perception of the city, or of its individual parts or products. A key factor in such research is a dual differentiation, namely a differentiation from the point of view of target groups and also a spatial differentiation, because attitudes and preferences of target groups in many cases are determined by spatial localization (for example, if we find that 30% of the city's population is not satisfied with the level of safety, the practical output for potential measures is approaching zero, as we will not be able to clearly define where the security is higher or lower, etc.). It can help to identify advantages and deficits in the perception of target groups, which can serve to better positioning of the monitored components (Fließ, Nonnenmacher, 2003).

Perhaps the best-known image acquisition method is a semantic differential (dichotomous profile) that was first used by Osgood, the American social psychologist (Osgood, 1952 In: Falk, 1997), by research of the meaning of words (semantics). In general, we can say about a semantic differential that it is a method whose principle is to capture subjective feelings and suppositions and to try interpreting them on an objective basis. Obtaining the necessary data is based on the spontaneous evaluation of the surveyed object by respondents.

Current state from the point of view of practice

Analysis and identification of needs, opportunities and readiness is a key part of the project under Research plan No. 1. An inadequate or non-existing analysis is always sooner or later reflected at all other stages, including the implementation of a given concept or solution. Needs analysis consists of

collecting information on the current state of the problem (Vodák-Kucharčíková, 2007). An effective tool for extensive data analysis is real-time modelling (e.g. GIS - spatial and statistical).

Various approaches are often applied to analyze the current state of affairs. Four interconnected activities can be realized - search of available literature and data, questionnaire survey, structured interviews and focus group, logical framework methods are used. Similar research has also been carried out to identify key areas for municipalities and also to identify areas that municipalities perceive to be insufficiently solved. Towns and smaller municipalities were addressed by means of a questionnaire survey through the presidency of the Union of Towns and Municipalities of the Czech Republic (hereinafter referred to as the "Union"). The questionnaire was intended for the city's top representatives. This approach was used in the project Needs / Priorities Analysis of Towns and Municipalities, the Role of Municipalities and Towns in Supporting Local Employment (International Advisory Centre for Municipalities -MEPCO, 2015).

The method for assessing urban readiness is the Morgenstadt Readiness Index - collaboration index. It is a method that can provide an exhaustive overview of the current need of any city in terms of development, political system and planning process. It is a method that is fully embedded in the successful Morgenstadt model and is based on the expertise and experience of a qualified team of professionals from Fraunhofer IAO. The tool works by combining a set of scientific indicators with qualitative action fields that evaluate political stability and the ability to work with innovations within the city and concurrently also the functional business points.

The Morgenstadt Analytical Framework (City Lab) is an action model focusing of speeding up and strengthening sustainable urban development. It is based on analyses of "six deep dive" and hundreds of case studies in an attempt to allow other cities to improve their sustainability reputation. Based on integrated framework indicators and the evaluation of more than 80 action fields, Morgenstadt experts have developed individual urban profiles serving to design and implement individual strategies for urban transformation. These City Labs enable the production of deep knowledge about the sustainability of cities. It shows where cities are lagging behind and proposes appropriate measures and also factors that prevent or enable urban development.

The "Morgenstadt: City Insights" innovation network supports cities in their development towards higher quality, resistance, environmentally friendly environment and innovation capability. There are a number of tools and solutions that can support cities in their effort to develop in smart cities. Gradually, they are tested and improved by Fraunhofer IAO researchers together with cities and industry partners. Thanks to the collaboration with the partner of Fraunhofer IAO project, the research team will have direct access to these materials.

In Germany, around € 100 million has been generated under the Morgenstadt initiative since 2014, which has been used for German or European research projects within pilot cities to define approaches for problem areas in the development of cities of the future. Based on urban life space analyses, these tools can serve to define urban sustainability. As a follow-up, Fraunhofer IAO, together with representatives of industry and local self-government, developed concepts and concrete measures to solve identified problems. The city thus became an experimental space, a

laboratory, the so-called urban lab of the future. There are available concepts for Prague, Chemnitz, Tiflis, Lisbon and Berlin Tegel.

The activity "centre of SMART cities", May 2014, describes the British approach using examples of cities London, Leeds and Birmingham, which have already identified their opportunities and created SMART plans for their development. The posting document notices two activities: top down and bottom up. The British approach is also described in the SMART City Framework Guide, which was issued by the British Standards Institute (2014), is approved by the Government and sets out the principles for implementing the strategy for individual cities.

American Standard ISO 37120/2014 Sustainable Development of Communities defines 17 key factors for evaluation of urban changes from a point of view of securing urban service and quality of life.

Entire foreign experiences and approaches will be used to identify and analyze needs, opportunities and readiness for different levels of territorial units for different concepts of SMART strategy implementation.

Potential for further development and production of applicable R & D results

The potential for further development and production of applicable R&D results is crucial, as evidenced by the above defined state of knowledge. It can be divided into several main areas:

- The factual adaptation of general approaches towards a specific topic of SMART technologies - this is a major potential development and potential for further application as the project will enable to adapt general existing models, approaches and tools directly to a specific area of concepts, projects and solutions that use SMART technologies. E.g. the basic principles of the practical implementation of the needs analysis will be incorporated and adapted for specific tools for identifying needs that can be met using SMART technology.
- Narrowing and selecting needs and opportunities that can be satisfied or exploited using SMART technology - the project has a great potential to define such tools, methods and procedures that help to define (precisely identify) such opportunities and needs that can be met or utilized by means of appropriate SMART technology, respectively concepts and methods based on them.
- Creating a basic set of inputs, parameters and indicators - the project has the potential to define a basic set of inputs, parameters and indicators that will be directly specific for use in identifying needs, opportunities and readiness for implementation of SMART solutions and concepts. It means that the inputs, parameters and indicators that will be used in adapted tools, methodologies and procedures will be defined.
- Development of tools for evaluation of readiness - most of the existing tools for assessing the readiness of cities and regions for certain changes are primarily based on descriptive procedures and their illustrative interpretation. Thanks to the project, the tools and methods for investigation of readiness will be further expanded and supplemented by the dimension of SMART technologies and, based on the realized research, it will be possible to directly define sets of concrete measures and recommendations that will help straigt determine how to develop weak spots and improve strong suits.

- The very use of SMART technologies to analyze needs, opportunities and readiness – regarding the focus of the project, it is desirable that SMART technologies will be used directly for the analytical process itself to make the process more efficient and simpler. Thanks to the project, there will be created recommendations and concepts that enable SMART technologies to be integrated into the analytical process.

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5.2.3 Link to the current research of the project partners

This part is elaborated jointly for all research plans at the beginning of chapter 5 of the Feasibility Study.

5.2.4 Research Objectives, Activities and Results

Research plan and its objectives

The main objective of RP 1 is **to study and design tools, methods and procedures for realizing analysis of needs, opportunities and readiness** for using SMART technologies in a defined area of human life. Therefore, existing methods and procedures will be examined and adapted within RP1 in order to identify and analyze needs, opportunities and readiness for different levels of territorial self-governing units so that they can be fully utilized for a specific environment of SMART technologies

and introducing new concepts and solutions into urban regional environment based on the use of SMART technologies.

Within the above-mentioned objective, the following areas are particularly concerned:

- Needs - how different territorial units can identify issues and needs that can be solved using SMART technologies.
- Opportunities - what trends are noticeable, technological and social development, what opportunities exist and what should be taken into account when designing SMART solutions and concepts.
- Readiness - what are the key factors (limiting and accelerating) that determine the readiness of territorial units to implement SMART solutions and concepts.

The main goal will be reached through the achievement of six sub-targets linked to individual sub-activities:

I. To perform a detailed analysis of available tools, methods and procedures for identifying needs, opportunities and readiness in general and specifically relied to the topic of the use of SMART technologies.
II. To conduct research into the relevant entities and experts regarding the current status and other needs in identifying needs, opportunities and readiness of cities and regions. There will be three groups of entities and experts:
    a. on the demand side - especially municipalities, cities, regions, public institutions, etc.,
    b. on the offer side - companies offering SMART solutions and products,
    c. research organizations, universities and support organizations standing between the two groups.
III. To process and evaluate acquired knowledge and information into a set of structured knowledge.
IV. Define individual tools, methods and procedures to analyze needs, opportunities and readiness of cities and regions to implement concepts and solutions based on SMART technology.
V. To verify Experimentally, at TRL 3 level, the defined tools, methods and procedures for energy, savings, transport and mobility, health and care, learning and education cases:
    a. There will be 10 specific model examples already defined.
    b. b. Further examples will be added based on the current process and needs of the project.
VI. Finally modify and complete methods, tools and procedures to analyze needs, opportunities and readiness of cities and regions to implement concepts and solutions based on SMART technologies and formulate final recommendations and suggestions for further research and applications.

The need to solve the research plan research

This subsection builds on the section above, which describes the potential for further development and production of applicable R&D results, and further defines concrete examples and areas of necessity.

Proper and purposeful analysis of needs, opportunities and readiness is very essential for the whole process of preparing, implementing and evaluating SMART concepts and solutions. The need to solve this research plan is based on the need to correctly set the basis not only for this project, but it is also binding for the entire research scope of the project.

In order to effectively and efficiently implement SMART technologies in projects and solutions that improve the quality of life of the population at different levels of the territorial units and in different areas of human life, it is essential to review and adapt existing methods and procedures in order to meaningfully define clear needs and opportunities (including threats) for given territories and subsequently assess the readiness to implement SMART-based solutions on this territory. These methods and procedures are often used in foreign examples, nevertheless, the development of this segment is not clearly defined yet, the solution can not be schematic and there is still a fundamental potential for their further modification and methodical completion based on new scientific knowledge and technological development.

The risks of the lack of clarity of SMART concepts also lie in the ignorance or ambiguity of trends in all areas affecting people's lives. These are primarily technical, technological and social trends along with environmental, political, legislative and economic trends. If there was not a sufficient analysis of needs, opportunities and readiness, SMART solutions could be improperly implemented in the context of these areas.

The "big brother" or "the reduction of human freedom" risk is also crucial, where misuse of these SMART technologies can lead to a solution without proper justification through real needs that will be rather of negative value to society.

Similarly, the same applies to the research of factors that speed up or hinder the readiness to implement SMART solutions and concepts. However, if the aim of this research plan is properly met, a set of procedures and indicators will be developed that will be applicable to individual solutions in different areas of human life and will take into account the diversity of individual environments, the level of the application area and the situation in which SMART solutions are a positive asset, primarily in connection with improving the quality of life of the population.

A well-elaborated analysis of the problems and the readiness of the territory as an important factor and the input is also appreciated by the Ministry for Regional Development that has announced a competition within support of applications of smart cities and one of the awarded titles is also the title "Smart idea of SMART city". This competition aims at projects that have not been implemented yet, but which are discussed in the SMART CITY community and can be part of longer-term development trends. They inspire stakeholders to discuss, meet, squeeze ideas, and engage in deeper thinking about preparing activities in the spirit of SMART CITY methodology.

A model example of the process of analysis (but imperfect) can be mentioned the approach of the City of Brno, which has proceeded conceptually since 2015 in the creation of a Sustainable Urban Mobility Plan by organizing expert workshops involving the professional public with the aim to propose several variants and visions. City of Brno it cooperates also with the City of Vienna and each month organizes a Smart City meeting, where there are discusses the different areas of the concept. It organizes urban events and accelerators (Ideacamps, Cityhacks), launches a web platform and plans to involve the general public in order to gradually publish the first data sets for preparation of innovative projects. However, this approach appreciated by many people has much room for further improvement, which is one of the priorities of this research plan and the project as a whole.

Partial activities leading to the achievement of the objectives of research plan

The implementation of research plan No. 1 is divided into 6 sub-activities in total, their structure and indicative schedule is shown in the following table:

Supposed timetable for partial activities:

Partial activity:	2018			2019				2020				2021				2022			
1 - Detailed analysis of available tools, methods and procedures																			
2- Surveys among relevant entities and experts																			
3 - Processing and evaluation of acquired inputs																			
4 - Design and creation of tools, methods and procedures																			
5 - Cross-sectional experimental verification of tools, methods and procedures: 14 defined validations																			
5 - Cross-sectional experimental verification of tools, methods and procedures: further approx. 5 validations																			

6 – Final modification and finalization of methods, tools and procedures and formulation of recommendations																		

Partial Activity 1: Detailed analysis of available tools, methods and procedures

The purpose of this sub-activity is to make a detailed set of relevant scientific and research findings on the tools, methods and procedures used to research the needs, opportunities and readiness of cities and regions in the following two levels:

- General level - what tools, methods and procedures exist in general and what are their strengths and weaknesses.
- Specific level in relation to SMART technologies - what are the specific tools, methods and procedures to analyse needs, opportunities and readiness to implement concepts and solutions based on SMART technologies.

In principle, this will be a secondary data analysis in the form of a "desk re-search". An analysis of the state of knowledge will be based on the following available sources of information:

- Professional publications in scientific journals (databases).
- Studies and reports by renowned national and international institutions.
- Specialized journals and publications.
- Practical tools, methods and procedures published on the Internet.

The output of this partial activity will be a structured, detailed summary of knowledge in a given field serving as an input for further partial activities.

Partial activity2: Survey among relevant entities and experts

The purpose of this partial activity is to get an actual overview of state of implementation of analysis of needs, opportunities and readiness made on defined sample of respondents, both within general projects and activities and specifically in relation to the SMART topic. Research will be conducted on the demand side (in particular municipalities, cities, regions, public institutions, etc.), on the offering side (SMART solutions and products) and among organisations staying between these two groups (research organizations, universities and support organizations). The point is to get an insight into the issue from all relevant groups. In particular, the following three data collection tools will be used in the research:

- Quantitative research through a structured questionnaire.
- Focus group with the participation of invited experts.
- Semi-structured interviews.

The output of this partial activity will be a structured summary of knowledge that will describe the current state of use of tools, procedures and methods for analysing needs, opportunities and readiness among defined entities and professionals.

Partial activity 3: Processing and evaluation of received inputs

The purpose of this third partial activity is to further process and evaluate the information and outputs received under partial activity No. 1 and No 2. Activity will be done in two steps:

- Synthesis of data and information - the acquired knowledge will be summed up and sorted into logical sets of knowledge.
- Abstraction of data and information - the acquired knowledge will be categorized and divided into several categories according to their significance.

The output of this third partial activity will be a compiled and categorized summary of knowledge that will then enter into another sub-activity.

Partial activity 4: Design and creation of tools, methods and procedures

The purpose of this partial activity is to define on an assorted and evaluated set of knowledge, the individual tools, methods and procedures for analysing the needs, opportunities and readiness of cities and regions to implement concepts based on SMRT technologies. The following procedures will be mainly used to design tools, methods and procedures:

- Induction and deduction - Based on the acquired knowledge, individual tools, methods and procedures will be defined.
- Analogy - Based on more generally defined tools, methods and procedures, there will be further modified and specified for use in SMART technology.

The output of this fourth part will be a preliminary set of proposed tools, methods and procedures that will serve to define the needs, opportunities and readiness of cities and municipalities to implement concepts and solutions based on the use of SMART technologies.

Partial activity 5: Cross-sectional experimental verification of tools, methods and procedures

The purpose of this sub-activity is experimental verification (at TRL 3 – proof of concept) of the applicability of the examined methods, procedures and tools on concrete cross-sectional examples from human life, this mainly concerns areas of **mobility and transportation, energy and sources, health and care, education and learning.** There will be carried out X larger verifications that are precisely defined below and Y smaller verifications that are mentioned only in general. The precise focus and the final listing of these examples of experimental verification of tools, methods and procedures will depend on the process of the project solution, achieved outputs and acquired knowledge.

The principle of this partial activity is to use these three scientific methods for the practical verification of defined tools, methods and procedures:

- Experiment - the given tool, method, or procedure will be tested in experimental controlled laboratory conditions (city lab).

- Modelling - A simplified image of reality will be created to serve as verification within predefined model examples and situations.
- Comparisons - experimental or model verification will be compared to the world without a given SMART intervention.

Note: In order to achieve clarity of the whole text, all cross-sectional experimental verification of tools, methods and procedures are described and specified only here within the description of sub-activities of research plan No. 1 and the information contained herein is valid across all five research plans. Thus, the sub-activity experimental verification is a part of other four research plans. Within the description of sub-activities it is always referred to the description in RP 1.

Experimental verification No. 1: Improvement of life quality of disadvantaged families with children and seniors by means of social work aimed at preventing e-exclusion

Leader of experimental verification: University of Ostrava, Faculty of Social Studies

The main purpose of this model verification is improving of life quality of inhabitants of Ostrava agglomeration using smart technologies by social work, namely target groups (1) disadvantaged families with children and (2) seniors. In the concrete, using SMART technologies for preventing e-exclusion of target group (1) disadvantaged families with children that are using social activation services for families with children or support of the institution for social and legal protection of children and (2) single-person households of seniors using the field-based social services. The partial goal of the verification is:

1) mapping of needs from the point of view of all participants (clients from the two target groups and social workers) in the area of SMART technologies as an effective tool of social work contributing to social inclusion in the present society based on information;
2) to set an efficient system of using SMART technologies in social work with the given target groups on the grounds of needs of social work participants;
3) evaluate the SMART-based system of social work with the given target groups with emphasis on preventing e-exclusion;

The aim of the verification is to identify and analyse needs of two target groups of social work: (1) disadvantaged families with children and seniors and (2) social workers in the area of e-inclusion. This means to focus on needs essential for integration of these families with children and seniors into participation on using ICT in everyday life and also in contact with social service providers. On the basis of need analysis we will develop an e-inclusion strategy, part of which will be utilization of SMART technologies to overcome e-exclusion. SMART technologies will serve both disadvantaged families with children and seniors, as well as social workers who participate in solving their life situation. The aim is to enhance life quality of disadvantaged families with children and seniors living in single-person households and thus to improve the quality of social work interventions.

Information and communication technologies (thereinafter “ICT”) play an increasing role in people’s lives. We meet them in all sorts of areas, such as e-Government, educational system or health service. They make life easier in many ways. Another side to this coin are plentiful pitfalls resulting from the computerisation of the society. One of them is so called digital exclusion (abbreviated e-exclusion), which means a gap between the people with access to ICT (whether it is a physical

accessibility or ability to use them) and those without any access to them. Especially the above mentioned target groups are very endangered by the e-exclusion because of a difficult social situation (often related to low socio-economic status or reduced mobility, which may lead to partial isolation).

The problem of using ICT in social work with **disadvantaged families and childr**en in the Czech environment was described by Vondrová (2014). Later, in the years 2016-2017, Recmanová and Vávrová (2017) carried out research focused on information and communication technologies in interventions of social work with children at risk and their families. There was carried out an interview with 25 social workers of social activation services for families with children and social workers from Department for Social and Legal Protection of Children. The topic of e-exclusion was by interviewees identified and perceived as highly problematic. There has been found out that the topic of e-exclusion actually and deeply affects disadvantaged families with children and therefore requires to be solved. Disadvantaged families with children face primarily problems with access to different types of information (e.g. in educational system –electronic pupil's record books; by doctors - information for patients), by using e-Government or within communication with different institutions. There is arising relatively new task for social workers and that is to respond to these problems and to help the service clients to manage them. Otherwise, there may come to a deepening of various forms of exclusion, which disadvantaged families with children have to face.

By the target group of **seniors** who live in a single-person household, the research activities of the presented project will focus on examining needs in the area of supporting seniors to maintain their independence and their ability to stay in their natural environment as long as possible namely using SMART technologies, information and assistive technologies.

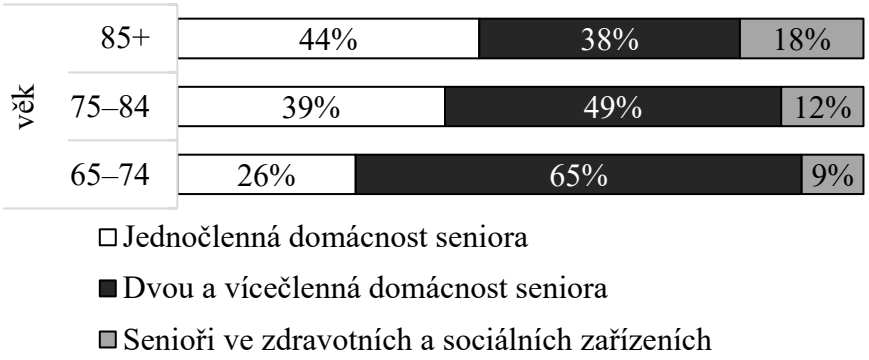
It is already known from foreign research that SMART technologies, information and assistive systems and technologies present for seniors a very important source of support in the social and health areas, thus enabling them to stay in their natural environment (see e.g. Hoenig, Taylor, Frank, 2003, Bradley, William, 2003, Louise, Rhoda, Bernadette, 2002, Morris, Ozanne, 2012, Morris, Adlar, 2013). There are no researches in the Czech Republic that would focus on investigation of needs in the sphere of SMART technologies for the elderly or preventing elderly e-exclusion. According to Chung, Lee and Kim (2016), there are no researches on seniors who live in single-person households because there are no special social services for them. At the same time, these authors call attention to the necessity to develop social services for these seniors, mainly because they thing that further research could contribute to findings that would improve their life quality.

A definition of CSOb (Czech Statistical Office) from 2014 describes the **Single-person household** as a household where a person over 65 years lives alone and manages an independent housekeeping. According to Social Service Act, **Field social services** are such services that are provided to seniors in their natural social environment.

According to CSOa data (2014), the age group of seniors (+65) recorded in the last decade the most significant absolute increase, which also influences the change in the structure of their households. The diagram No. 1 shows the dependence between the household type and the age of seniors. Seniors in the lower age group (65-74 years) live more often in a household with two or more

members (65%), which means that they live in a married or unmarried couple or as a common-law wife and husband. With increasing age, the pattern structure of senior households changes. The number of senior single-person households increases and on the contrary the proportion of seniors in households with two or more members falls (especially of people living in a couple). (CSOb, 2014)

Graph 1: Structure of households of citizens aged over 65 years in the Czech Republic



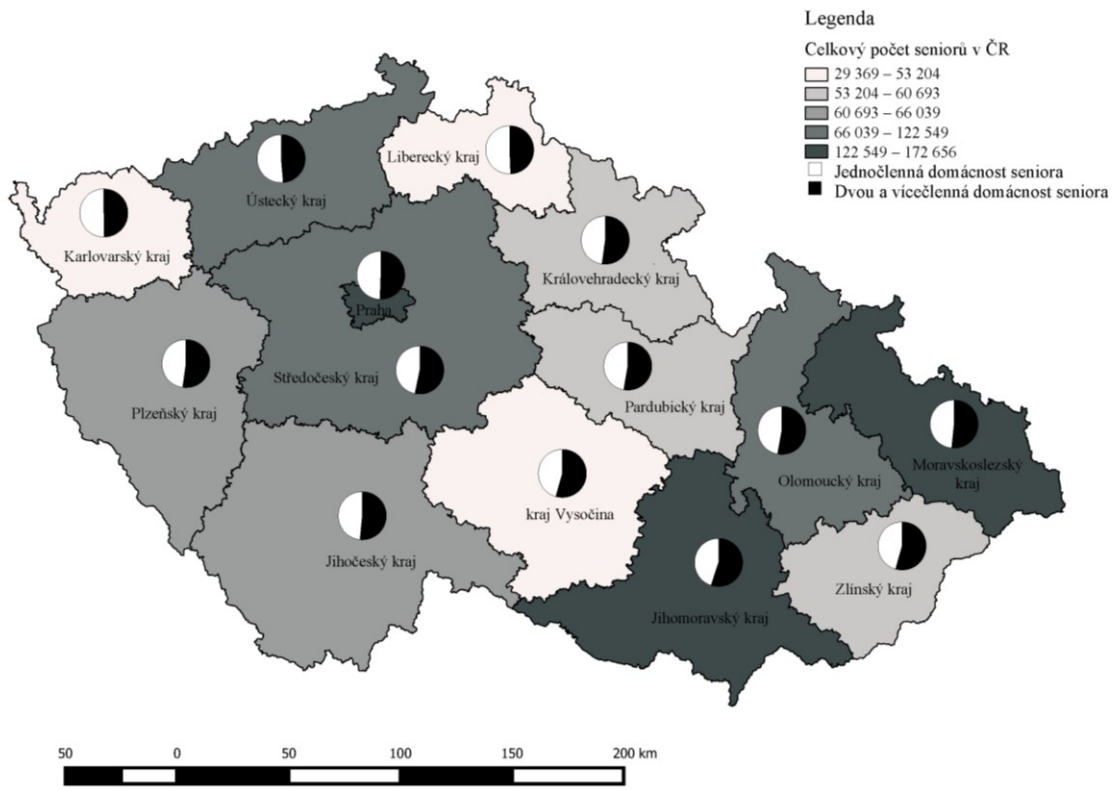
Key:

- Age
- One-person seniors household
- Two and more persons seniors household
- Seniors in medical and social facilities

Source: CSOb, Single-person households (2014), modified by authors

We know from data of CSOc (2015) that the number of seniors and structure of household types in Czech Republic are different within inter-regional comparison. The Figure 1 below shows the inter-regional comparison of the number of seniors and at the same time shows comparison according to the senior household type (single-person versus two- or multiple-member household of seniors).

Figure 1: Inter-regional comparison of number of people over 65 years and comparison according to the household type



Source: CSOd, Seniors in regions (2015), elaborated by author in SW QGIS2.12.3-Lyon, Equal Count

Key:

- Total number of seniors in the CR
- One-person seniors household
- Two and more persons seniors household

Source: CSOd, Seniors in regions (2015), elaborated by author in SW QGIS2.12.3-Lyon, Equal Count

According to CSO data, there were about 1.1 million households of seniors in the Czech Republic in 2011 with approximately 1.8 million people. Absolute majority of them were households of not working retirees, mainly widowed women. (CSOe, 2014) An inter-regional comparison of number of seniors (see figure 1) shows that the highest number of seniors was recorded in the capital city of Prague, South Moravian Region and the Moravian-Silesian Region. At the same time Figure 1 shows a comparison by senior household type (single-person household versus two- and multiple-member household). From the pie charts is obvious that in all regions is the distribution of single-person households and two- and multiple-member households of seniors almost balanced. Single-person households of seniors make up almost 500,000, which means that every third senior has an independent housekeeping. (CSOb, 2014) If we compare data relating to the number of single-person households of seniors from 2011 to 1970, it is apparent that since 1970 the number of senior single-

person households has increased by almost 50% (in absolute quantification it is more than 200 thousand).

Experimental Verification No. 2: Advance in remote monitoring of patients and increase of treatment safety by patients with blood tumours

Leader of experimental verification: University of Ostrava, Faculty of Medicine

The main purpose of this experimental verification is a remote monitoring and evaluation of facts about patients with blood tumours using telemedicine based on SMART technologies. For the pilot testing, there were selected three groups of patients and continuous measurement of body temperature and blood pressure, which are two key parameters that can serve as a so called “red flag” - alarming and warning features that can draw attention to a suspicion of incoming potential sepsis. Patients will be scanned via defined devices connected to a mobile hub that transfers data into a secured portal, to which medical staff and the operator have an online access. On the portal, there will be set parameters, when the doctor shell be informed. These parameters are the critical values of measured functions. Subsequently comes to the active communication with the patient.

Telemedicine and telemonitoring offer doctors the possibility of continual monitoring of body temperature and blood pressure in the course of home care. Ambulatory patients are at lower risk of infection with multi-resistant nosocomial strains, has a better life quality and, last but not least, there is a lower cost of the treatment. Telemonitoring enables immediate consultation of the actual patient’s health status with the physician and thus also the possibility of adequate assistance to the patient in case of detecting increased temperature and changes in blood pressure. Thanks to this measurement the development of sepsis with fatal consequences for the patient can be prevented.

Hemato-oncologic patients undergo a very demanding oncological treatment, consequence of which is always a decrease of single blood corpuscles in the blood count. These patients are endangered with a number of complications associated with the illness or with subsequent treatment. The course of illness and treatment is often complicated by various infections because these patients have reduced immunity. These are frequently infections that do not occur by healthy people; on the other hand, these could be also common diseases, however by these patients they have a serious course. As the treatment of hemato-oncologic patients by chemotherapy shifts to outpatient care, the speed at which the patient gets into the medical facility is a crucial factor for success.

In the population of the Czech Republic the proportion of patients with hemato-oncological disease is increasing. According to the National Cancer Registry, in 2014 there were some of the hemato-oncological diseases diagnosed by 1,929 men and 1,678 women, totally by 3,607 people. The prevalence of hemato-oncological diseases, as of the 31st¬ December 2014 was 27,100 people (Report No. R/1 (09/2016) of National Health Information System - abbr. NHIS). These patients are endangered with a number of complications associated with the disease or with the subsequent treatment. The annual increase in the incidence of hemato-oncological disease in the common population, together with an increase in the proportion of older age groups, cause pressure on the availability of health services. Here we can expect an increase in the number of outpatient visits and acute hospitalization.

The Clinic of Hemato-oncology at Teaching Hospital Ostrava is a top workplace and one of the eight hemato-oncological centres in the Czech Republic that care patients not only with hemato-oncological diagnostics but also patients with haemostatis disorders. At the Clinic of Hemato-oncology at Teaching Hospital Ostrava (which will participate in this experimental verification through the applicant) about 40 severe septic conditions per year are reported, which means an economic burden of about 35 million a year. By each case, it is necessary to be always prepared for the development of severe sepsis. In practice, this may be a typical case of deep hypotension (pressure decrease) with a dramatic start, shivers, tachycardia, disturbance of consciousness, or slower process lasting several hours to days when a patient with febrile neutropenia (fever with low count of white blood cells when the body cannot defend against infection) the pressure drops to limit values and decreased urine output and laboratory signs of decreased tissue perfusion develop. However, the severe sepsis can manifest atypically – only by lowering blood pressure (stated by 40mmHg) to limit values and by psychological changes. These conditions require immediate empirical aggressive antimicrobial and complex intensive care.

Experimental verification No. 3: Air quality monitoring system in the agglomeration by means of network of local stations with visualization support, with the ambition to identify emission sources and achieve their reduction

Leader of experimental verification: University of Ostrava, Faculty of Science

The main purpose of this experimental verification is to create an air quality monitoring system in the agglomeration by means of network of local stations with visualization support, with the ambition to identify emission sources and achieve their reduction. The idea of this model verification is based on scientific work by Donelly Meadows, which in 1997 defined twelve points of action for intervention into the system (Meadows 1999), in the concrete on point 6 – composition of information flows. This point of action says: just the fact that everyone has access to information about part of the system can highly affect how the system works. Thus, especially in the case of static emission sources, pollution should be reduced just because the information on emissions is publicly available and none of the entities want to be at the top of the biggest polluters. As an example we can mention US Emergency Planning and Community Right-to-Know Act of 1986 that registers all major air polluters. By 2004, thanks to this list of polluters and the consequent public pressure, the amount of waste and pollutions was reduced by 57 percent (USEPA 2004). No other regulations or repressive tools for reducing pollution were used.

The purpose of this experimental verification is to create a model of complex air quality system for cities based on use of SMART technologies. The substance of this model is to define spatial aspects of a city and to describe subsequent methods of measurement and data collection. This model will be followed by visualization in the form of an interactive map. For the application of point 6, it is necessary to make the highest possible personalization of the person with information. This can be achieved by using smaller IoT devices that will be placed in the framework of the whole system and will create a measuring grid. The particular devices will be able to measure concrete quantity (CO, SO, dust particles, eventually further quantities like, noise, light exposure, humidity) and send the values at required interval to the central device. After collecting data, it is possible to elaborate an interactive multi-layer map that will be used as a complex source of information on the actual state

of the city as a comprehensive system and for needs of future planning in the areas of transport regulation, industrial activities, of identification of unknown emission sources e.g. from local fireplaces. This information can also serve for improving traffic permeability in the city, with an emphasis on the emission factor, further can the visualization contribute to planning of bypasses or measuring of the effectiveness of already existing measures.

Experimental verification No. 4: Complex diagnosis of entry level of knowledge, skills, preferences and eventual learning disorders of educated person

Leader of experimental verification: University of Ostrava, Faculty of Science

The merit of this model experimental verification is a design of a model applicable in the environment of e-learning systems, which define in a complex way the diagnosis of the level of knowledge and skills of the educated person, diagnose indications of possible learning disorders and also diagnose preferences of the type of educational materials. In the second part, this model proposes implementation of education based on initial diagnostics emphasising support of individual and specific needs of the educated person and support of adaptability of e-learning environment using SMART technologies. At this stage, implementation of e-learning is built on an expert system. Part of this is also verification of the relevance of the model and modification of diagnostic methods of initial testing, and adjustment of the expert system managing the course of educational events.

Experimental verification No. 5: Education of seniors in the context of IT inclusion

Leader of experimental verification: University of Ostrava, Faculty of Science

The purpose of this experimental verification is creation and verification of a model approach focusing on senior educational events in the area of IT-technology, in the context of IT inclusion of seniors. Thus, the goal is to schematically design, create and verify the structure of educational events for seniors focusing on SMART and IT technologies that are establishing in our agglomeration. The educational events will respect the following points:

- Active use of SMART technologies in education and in the common life of seniors.
- Support of social inclusion, use of SMART technologies for effective social inclusion.
- Support of intergenerational dialogue by means of SMART technologies.
- Support of seniors' active access to education, seniors as organizers of educational activities using SMART technologies.

Experimental verification No. 6: Navigation and orientation possibilities in medical facilities

Leader of experimental verification: Educational and Research Institute AGEL

The main purpose of this experimental verification is to contribute to enhancement of comfort, efficiency and availability of medical care provided to patients through SMART technologies leading to improvement and simplification of navigation and orientation in medical facilities.

Due to their character, medical facilities are usually complex centres consisting of a number of multi-level, geometrically and interior-varying buildings. Orientation in these complexes is demanding for

patients as well as for medical staff and often leads to events that negatively affect patients' comfort, but also the operation and efficiency of the medical facilities. Present forms of fixed navigation do not meet the standards and requirements of a modern patient anymore and negatively affect the productivity of medical staff. According to study of Richard Wood Johnson foundation, the additional assistance in the orientation of patients represents for medical facilities of tertiary type an annual burden of around 4,500 man-hours.

The experimental verification No. 6 aims on improving of patients' orientation in medical facilities using modern navigation methods based of SMART technologies with emphasis on:

- Reducing workload of medical staff (information centres, assistance to patients by orientation to a target place, etc.)
- reduction of time delays by ordered patients due to disorientation in medical facilities,
- overall facilitation of movement and better access to all relevant parts of the medical facility,
- enhancement of quality and optimization of provided health service.

A key role within this verification will play the partner of the project – Educational and Research Institute Agel.

Experimental verification No. 7: Intelligent systems, traffic control and monitoring

Leader of experimental verification: BeePartner

The main purpose of this experimental verification is to experimentally verify the use of SMART technologies in model cases of intelligent control and monitoring of traffic within urban agglomerations. The verification will focus on traffic control and informing passengers about the traffic situation with the aim to increase traffic fluency and safety without the need to build complicated infrastructure constructions. The system includes in particular an adaptive system of traffic control, providing real-time traffic information, preference of vehicles of urban mass transportation (UMT) at light intersections, introducing electronic ticketing systems, development of parking information and navigation system, modification of traffic light signalisation and methodological support and cooperation by implementation of intelligent traffic control systems in towns and municipalities.

A key role within this verification will play the partner of the project Arriva Morava.

Experimental verification No. 8: Electromobility

Leader of experimental verification: BeePartner

The main purpose of this experimental verification is to experimentally verify the use of SMART technologies in model cases of sustainable electromobility. Electromobility becomes a main aspect of clean and sustainable mobility. Apart from accelerating the construction of essential infrastructure, such as recharging and fast-recharging stations, and support of all related measures and activities, sharing of electromobiles and bikes is on the increase. Interconnection of the network of recharging stations via the internet of things, sharing information about occupancy and additional services with

users, online information on the availability of shared vehicles are elements of smart solutions. In addition, the acquired data enables better planning of traffic infrastructure and flows.

A key role within this verification will play the partners of the project Arriva Morava and ČEZ-ESCO.

Experimental verification No. 9: Intelligent management of buildings

Leader of experimental verification: BeePartner

The main purpose of this experimental verification is to experimentally verify the use of SMART technologies in model cases of intelligent management of buildings with a focus on the overall energy performance and balance of buildings and building complexes. Reduction of energy performance of buildings positively affects both economy – lower costs and environment – reducing CO_2 production. Within modernization of public buildings, there is a great potential for use of SMART technologies for building and property management. Pilot examples show a possibility to design and implement smart sensors and automatic control that enable to evaluate and finally also reduce the total energy consumption and thus the operating costs along with a higher proportion of used alternative energy sources. A long-term objective is to apply standards such as (BIM – Building Information Modeling) on the buildings of the region. The objective is economic and ecological efficiency supported by use of SMART technologies.

A key role within this verification will play the partner of the project ČEZ-ESCO.

Experimental Verification No. 10: Use of SMART technologies in order to improve communication of citizens with state administration bodies with an emphasis on the areas of transport and energies

Leader of experimental verification: Autocont

The main aim of this experimental verification is to identify the needs of citizens for communication with the state administration, to analyse the data obtained and to design a model for using SMART technologies in this area.

The model can then be used to design model solutions, such as a system for reporting emergency situations and defects and subsequent automatic transfer of this information to relevant bodies that will ensure their processing and find appropriate solutions. This system could be used both by citizens and organizations responsible for specific areas (road repairs, water supply, electricity distribution, waste disposal, cleaning services, etc.).

Experimental verification further includes analysis of the use of personal communication tools and SMART technologies currently available to the general public, and the design of solutions for multimedia communication (photo, video, audio recording) in connection with automated localization (GPS) over the map details of the area.

The aim of the experimental verification is to design a model concept and structure of the system based on the information provided by the citizens, which will register their requirements and monitor the process of their solution. The data obtained in this way will enable organizations to target the resources necessary, for example, to eliminate defects more accurately, so that repairs are carried out at minimal cost and with minimal impact on the environment, life and health of citizens. A key role in this experimental verification will play the AUTOCONT partner.

Experimental Verification No. 11: Metropolitan governance of integrated transport systems

Leader of experimental verification: University of Ostrava, Faculty of Science

The purpose of this experimental verification is to design a model solution for more efficient governance of integrated transport systems. Integrated transport systems (ITS) represent one of the key elements of metropolitan governance (Bird Slack 2007). There are a number of researches that analyse and evaluate options from various perspectives (technical aspects, network optimization, interconnection of transport modes), whereas research in the context of governance focuses on the ways and forms of organization and the resulting measures at the institutional level (Kübler Koch, 2008, Koch 2013). Examples from abroad show that the importance of governance is crucial especially in polycentric regions.

Within the scope of the verification, there will be carried out: an ITS governance analysis in relation to the research conducted so far (e.g. Boruta 2008), the assessment of the main barriers in the functioning of model ITS governance, the collection, analysis and evaluation of governance of analogous model regions (Ruhr, Randstadt, etc.) and further model measures to remove existing ITS flaws will be designed.

This experimental verification is complementary and synergic with experimental verification No. 7.

Literature:

- Bird, R.M., Slack, E. (2007). An approach to metropolitan governance and finance. Environment and Planning C: Government and Policy, 25 (5), 729-755.
- Boruta, T. (2008): Integrated system of public transport in the Ostrava region. Geographic Information 12. 2008, vol. 12, vol. 1, pp. 62-68.
- Koch, P. (2013). Overestimating the shift from government to governance: Evidence from Swiss metropolitan areas. Governance, 26 (3), 397-423.
- Kübler, D., & Koch, P. (2008). Re-scaling network governance. The evolution of public transport management in two Swiss agglomerations. Flux, (2), 108-119.

Experimental Verification No. 12: Spatial mismatch in metropolitan regions on the example of knowledge-intensive services

Leader of experimental verification: University of Ostrava, Faculty of Science

The purpose of this experimental verification is to design new model solutions aimed at reducing the negative effects of spatial mismatch.

Study of spatial mismatch belongs to classical topics of geography (Holzer 1991). Negative space manifestations of spatial mismatch are, as a result of the suburbanization process, most evident in metropolitan regions. The structure of experimental research can, in principle, be twofold. First, using existing and new data to identify the location of knowledge-intensive business services (KIBS) within a model metropolitan region, with emphasis on selected cities as regional centres of these industries (cf. e.g. Zhao 2017). Secondly, identify by means of data from mobile phones the spatial mobility of labour in relation to the main employment centres and to identify the main problems that

result from this mismatch, such as concentrated transport sites, i.e. dynamic transport, as well as static transport problems.

Within the scope of the verification, the spatial organization of KIBS will be analysed and evaluated in the selected model metropolitan region and an analysis and evaluation of workers' mobility within KIBS will be conducted in combination with other methods (see Zhao et al., 2017). Examples of solutions to the problem of spatial mismatch in other regions and their solutions will be examined. Finally, illustrative measures will be proposed to overcome existing flaws in relation to spatial mismatch in the model region.

- Holzer, H.J. (1991). The spatial mismatch hypothesis: What has the evidence shown?. Urban Studies, 28 (1), 105-122.
- Zhao, J., Bentlage, M., Thierstein, A. (2017). Residence, workplace and commute: Interrelated spatial choices of knowledge workers in the metropolitan region of Munich. Journal of Transport Geography, 62, 197-212.

Experimental Verification No. 13: Improving permeability and mobility in cities (Smart walking plan)

Leader of experimental verification: University of Ostrava, Faculty of Science

The purpose of this experimental verification is to design model solutions to increase permeability in urban areas.

Cities in agglomeration, as well as others, are characterized by a high degree of fragmentation of physical structures, resulting in a number of barriers to population mobility (see Lynch 1960) and the factual exclusion of certain parts from the urban organism. In this case, it would be a research into the perception of sites and the identification of negative sites in cities (Krtička 2010, Liu et al., 2016). Based on the identification of these negative sites and on inspiration from abroad, model solutions would be designed to cultivate and functionally integrate these places into the urban organism with a view to achieve a higher quality of life and urban space.

Within the scope of the verification, the analysis, identification and evaluation of the spatial distribution of negative sites in the model cities at the micro level will be conducted; examples of solving the problem of spatial mismatch in other regions and their solution will be presented. In addition, model measures to remove existing flaws in the studied subject will be proposed.

- Krtička (2010): Questionnaire, map and survey. Geography for life in the 21st century: Collection of contributions from XXII. Congress of the Czech Geographical Society, organized by the University of Ostrava, Ostrava, August 31 - September 3, 2010. Ostrava: University of Ostrava, pp. 339-346.
- Liu, L., Zhou, B., Zhao, J., & Ryan, B.D. (2016). C-IMAGE: city cognitive mapping through geo-tagged photos. GeoJournal, 81 (6), 817-861.
- Lynch, K. (1960). The image of the city (Vol. 11). MIT press.

Experimental Verification No. 14: Enhancing the life quality in central parts of cities

Leader of experimental verification: University of Ostrava, Faculty of Science

The purpose of this verification is based on Jane Jacobs' motto: "Cities have the capability of providing something for everybody, only because, and only when, they are created by everybody" to design model solutions leading to a better quality of life in city centres.

The central parts of cities are, due to a number of factors, faced with a population decline, especially in the context of shrinking cities. However, it is still quite unclear, what is perceived by the residents of these parts as a positive or negative aspect, in terms of quality of life. Within the scope of verification, positive, insignificant and negative factors of quality of life in the central parts of cities will be first identified, using different methods (interviews, on-line questionnaires) (see e.g. Bereitschaft 2017) or new methods such as Visual Decision Support Tools (Kourtit Nijkamp, 2013). Further, the analysis and evaluations of approaches in the given topic area will be conducted in the context of analogous cities. The result will be a selection of model tools and projects that will help improve the quality of life in cities.

The verification process will analyse, identify and evaluate the life quality factors in selected model central parts of cities, and this will be compared with examples of solutions in other comparable cities and their solutions. Model measures will be proposed to eliminate existing flaws in the studied subject.

- Bereitschaft, B. (2017). Do "creative" and "non-creative" workers exhibit similar preferences for urban amenities? An exploratory case study of Omaha, Nebraska. Journal of Urbanism: International Research on Placemaking and Urban Sustainability, 10 (2), 198-216.
- Kourtit, K., Nijkamp, P. (2013). The use of visual decision support tools in an interactive stakeholder analysis - Old ports as new magnets for creative urban development. Sustainability, 5 (10), 4379-4405.

Additional experimental and model verifications:

Within the scope of the project implementation, further approx. 5 experimental and model verifications will be defined at TRL 3 level, which will depend on the following three inputs:

- Preparation and implementation of experimental verifications 1-14, their outputs and their results, which will allow the acquired knowledge to be used for defining other areas of experimental verification.
- Partial outputs from the implementation of individual research aims that will be used to identify areas of needs and opportunities where it is purposeful to prepare and conduct further verification.
- Current global developments and trends with an emphasis on SMART technologies to help identify situations where experimental verification is purposeful.

The output of partial activity No. 5 will be a set of experimental and model verifications that will be compared with the intervention/state of the world in the form of a comparative study without using the given solution or concept. There will be a total of 14 + approx. 5 case studies, the result and conclusion of which will be a list of recommendations and feedback on individual tools, methods and procedures.

Partial activity No. 6: Finalizing and completing of methods, tools and procedures, and formulating recommendations

The purpose of partial activity 6 is to adapt and complete proposed methods, procedures and tools based on outputs and recommendations from experimental and model verification.

The result and output of partial activity No.6 will be an experimentally proven and finalized set of tools, methods and procedures for analyzing needs, opportunities and readiness of cities and regions to implement SMART-based solutions and concepts. It will, in principle, be a major output of the entire research plan No. 1.

Partners involvement and collaboration development

The guarantying partner of research plan No. 1 will be the University of Ostrava, which will be responsible for the implementation of all partial activities. The research activity will also involve Fraunhofer IAO and BeePartner partners, who will also be involved in the implementation of partial research activities within RP 1.

A Specific component is partial activity No. 5 Cross-sectional experimental verification of tools, methods and procedures, where the above-mentioned institutions and other partners of the project will also be involved, whereas ever experimental verification will have its primary guaranteeing partners:

- Experimental Verification No. 1: improving the life quality of disadvantaged families with children and seniors through social work to prevent e-exclusion
    - University of Ostrava, Faculty of Social Studies
- Experimental Verification No. 2: progress in remote monitoring of patients and enhancing safety of treatment by patients with blood tumours
    - University of Ostrava, Faculty of Medicine
- Experimental Verification No. 3: agglomeration monitoring system for air quality through a network of local stations with visualization support with the ambition to identify emission sources and achieve their reduction
    - University of Ostrava, Faculty of Science
- Experimental Verification No. 4: complex diagnosis of the entry level of knowledge, skills, preferences and eventual learning disabilities of educated person
    - University of Ostrava, Faculty of Science
- Experimental Verification No. 5: senior education in the context of IT inclusion
    - University of Ostrava, Faculty of Science
- Experimental Verification No. 6: navigation and orientation options in medical facilities
    - The Agel Educational and Research Institute
- Experimental verification No. 7: Intelligent systems, traffic management and monitoring
    - Arriva Morava
    - BeePartner
- Experimental Verification No. 8: Electromobility
    - ČEZ ESCO
    - Arriva Morava

    - BeePartner
- Experimental Verification No. 9: Intelligent Building Management
    - ČEZ ESCO
    - BeePartner
- Experimental Verification No. 10: use of smart technologies to improve communication of citizens with state governments with an emphasis on transport and energy
    - Autocont
    - BeePartner
- Experimental Verification No. 11: Metropolitan Governance of Integrated Transport Systems
    - University of Ostrava, Faculty of Science
- Experimental Verification No. 12: Spatial mismatch in metropolitan regions on the example of knowledge-intensive services
    - University of Ostrava, Faculty of Science
- Experimental Verification No. 13: Improving Transparency and City Mobility (Smart walking plan)
    - University of Ostrava, Faculty of Science
- Experimental Verification No. 14: Improving the quality of life in central parts of cities
    - University of Ostrava, Faculty of Science

A specific role in the experimental verification will be played by the partner Moravian-Silesian Innovation Centre, which will be involved in each of them and will act as facilitator and leader of the innovation process in all experimental verifications.

Support for the project was also expressed by the following local authorities, who will participate (as supporters of the project) in particular on impulses and comments from the area of self-government (from the practice) and at the same time will provide input information experimental verification. Further, some of them will serve as a city lab for selected experimental verification and will then use project outputs as one of the inputs for their further development in the area of SMART technologies. Project support was officially declared by:

- Moravian-Silesian Region,
- The Statutory City of Ostrava,
- The town of Třinec,
- The town of Jablunkov,
- The municipality of Palkovice.

The self-government report shows that these are different levels of self-governing units, cities and municipalities, which is one of the great advantages of the project, because its outputs should be usable for all levels of self-governing municipalities, regardless of size and local importance.

Results and Outputs of the activity

The main quantifiable results and outputs are listed in the table below. In connection with RP 1, there is assumed the creation of at least 3 professional publications, of which at least 2 will be in co-operation with companies and at least 1 with foreign co-authorship.

Other outputs will include one proven and finalized set of tools, methods and procedures for analysing needs, opportunities and readiness of cities and regions to implement solutions and concepts based on SMART technologies. In principle, it will be an analytical tool, i.e. analysis - a set of procedures, indicators or methodologies for analyses or audit to map problems / needs / opportunities / trends. Its characteristic feature will be the ability to identify priorities for solutions in different types of territory, for different types of contracting authorities, in different areas of human life, - for which it is possible to search a specific solution using SMART technologies.

The final round of outputs will be 14 + 5 case studies demonstrating each experimental verification. This will be a cross-sectional result of all five research plans, however, it is mentioned only here by the RP 1 due to clarity.

Results and outputs of activity	Target Value of the Project Implementation
indicator: 2 02 11 Publications created by supported entities (selected types of documents)	3
indicator: 2 02 13 Publications in co-authorship of research organisations and enterprises (selected types of documents)	2
indicator: 2 02 16 Publications in co-authorship with researchers from abroad created by the supported entities (selected types of documents)	2
indicator: 2 20 11 International patent applications (PCT) created by supported entities Note: The international patent application will be a cross-sectional output of all research plans but, for the sake of clarity, it is only mentioned here by RP 1.	1
Other result that is not reflected in MIs: possible partial outcomes of implementing the activities are the results, which are defined according to the Definitions of types of research and experimental development results for the RIV database. (O - Other results - this concerns about 14 + approx. 5 case studies describing each experimental verification - it will be a cross-sectional result of all five research plans, but for the sake of clarity, it is only mentioned here by RP 1)	approx. 19
Other result, which is not reflect in indicators. (O - other results - This is a proven and finely modified set of tools, methods and procedures for analysing needs, opportunities and readiness of cities and regions to implement SMART-based solutions and concepts.)	1

5.2.5 Research Team

This part is elaborated jointly for all research plans at the beginning of chapter 5 of the Feasibility study.

5.2.6 Procured infrastructure and equipment and their necessity and utilisation

Core equipment /functional module (sort by price in descending order)	Number of item pieces	Total planned price excl. VAT (in thousands CZK)
Function module for creating a sensor network, collecting and analysing data	3 pcs	1,300 thousand of CZK

Characteristics:

Acquisition of 2000 pcs of sensors. Individual measuring points create sensor network that is necessary for coverage of the researched area. On the basis of measured data, a model of the pollutants in this area will be created. 600 pcs of measuring devices are necessary to cover an area of 1,5 km^2 in a square network with a distance of the elements 50 m.

Server for receiving measured data from measuring stations with multiple disk fields and possibility to make external backup copy, with the possibility to host the computational core of the air quality model. Laptop with computing power for scientific computations, that will be able to process in a short time large amount of data stored on the central element. This is the reason for really great computing power. This laptop will also be used to configure and manage measuring devices, thus purchase of another laptop solely for those purposes will be unnecessary.

Purpose of the purchased equipment:

The equipment will be purchased for the purposes of partial experimental verification No. 3: Agglomeration monitoring system for air quality through a network of local stations with visualization support with the ambition to identify emission sources and achieve their reduction.

Readiness of the infrastructure:

Sensor gauges will be located on selected objects in a selected location in accordance with laws and local regulations. Installing a server and laptop does not require special preparatory measures.

Equipment for creation of multi-types educational materials and software for processing of multimedia educational programs	2 pcs	1,100 thousand of CZK

Characteristics:

Mobile set that allows to record teacher's lecture with parallel integration of a projected presentation or demonstration on PC and with possibility of simultaneous integration of subtitles or translation into the sign language. All media are integrated into one data flow, mutually synchronized. This part includes both hardware and necessary software devices.

In many cases, it is necessary to modify and supplement learning materials made in multiple mode. For this purpose, this software is intended.

Purpose of the purchased equipment:

Acquired equipment will be used for Experimental Verification No. 4: Complex diagnosis of entry level of knowledge, skills, preferences and eventual learning disorders of educated person

Readiness of the infrastructure:

Acquired equipment does not impose special requirements for infrastructure readiness.

Equipment and software for remote monitoring of the vital functions of patients in the home environment	set	2,200 thousand of CZK

Characteristics:

Software license that allows remote monitoring of patients' physiological functions in the home environment in the mode 24/7 (36 months).
Continuous thermometer that the patient has fixed to the body, plus pressure gauges, plasters to stick thermometers, mobile HUB - smart phones with application for transmitting measured data for 100 patients.

Purpose of the purchased equipment:

Functional module will be acquired for the purpose of Experimental Verification No. 2: Progress in remote monitoring of patients and enhancing safety of treatment by patients with blood tumours

Readiness of the infrastructure:

Acquired equipment does not impose special requirements for infrastructure readiness except Wi-Fi connection of mobile phones

Set of computer and audio-visual technology	set	600 thousand of CZK

Characteristics:

This is a set of computer technology, including laptops, tablets, printer, data analysis software, camera and video camera.

Purpose of the purchased equipment:

Acquired equipment will be used to address research plans and partial experimental verifications.

Readiness of the infrastructure:

Acquired equipment does not impose special requirements for infrastructure readiness.

Equipment of research facility – software for processing multimedia learning programs	set	350 thousand of CZK

Characteristics:

Obtain maximum information from available data according to various defined input parameters related to SMART technology verification. Defined parameters depend on the verification technology.

Purpose of the purchased equipment:

To achieve this, it is' necessary to purchase display tools (laptop, Tablet, Mobil, projector, etc.), software equipment (here specially focused on so-called "big data" using business intelligence, with possible prediction) and HW equipment for high computing power.

Readiness of the infrastructure:

For data and technologies will be used local storages and cloud service. For access will be necessary only internet connection with appropriate speed.

Results and outputs of activity	Target Value of the Project Implementation
indicator: 2 41 01 Number of expanded or modernised research centres It Includes research centre at the University of Ostrava	1
indicator: CO25 / 2 05 00 Number of researchers working in modernised research infrastructures	16

5.3 Research plan - Methods and Models of Conceptual Designs and Solutions – RP 2

5.3.1 Abstract

The aim of Research plan 2 (RP 2) is to investigate and design methods, procedures and models for the design and preparation of concepts and solutions based on SMART technologies.

The given methods, procedures and models should serve to design and prepare SMART solutions and concepts that will be based on a properly and purposefully processed analysis of needs, opportunities and readiness. It means that solutions which will be designed using these methods, procedures and models should solve the real problems and needs of the population and contribute to enhancing the life quality in the given area.

In particular, the research program will examine creative tools, techniques and methodologies that can be adapted to design specific SMART concepts and solutions. Subsequently, these tools, techniques and methods will be processed into the recommended procedure for creating this type of innovation.

The course of the solution will be similar to that of other RPs. In the framework of the partial activities, a detailed analysis of available methods, procedures and models will be carried out first and subsequently complemented by research among relevant entities and experts. On the basis of the documents obtained, the inputs are processed and evaluated, leading to the design part, which will define the individual methods, tools and models used to design and prepare SMART concepts and solutions. Subsequently, as in the case of the next four RPs, the crucial cross-sectional experimental verification of these proposed methods, tools and models will be carried out on 14 already defined examples of energy and savings, transport and mobility, health and care, learning and education. Within the project, these 14 model examples will be further expanded by other examples on the basis of current knowledge and needs. This cross-sectional verification is common to all RPs, within each RP only a sub-part of the experimental verification will be implemented. The final step will be the final modification and finalization of methods, tools and models and the formulation of recommendations for their further use.

The output of RP 2 will be a set of creative methods, tools, techniques, methodologies and models for designing SMART solutions and concepts based on proven needs and opportunities of a particular territorial unit, which is also ready for their implementation. The current state of knowledge can be divided into several areas that are interconnected and illustrate the currently used tools, methods and procedures used to design and prepare projects.

5.3.2 Current state of knowledge

Current state of knowledge

The current state of knowledge can be divided into several areas that are interconnected and illustrate the currently used tools, methods and procedures used to design and prepare projects.

Either these are complex approaches to project and solution design, or tools for creative design of partial solutions.

SMART Marketplace (Bable) seems to be the first meaningful approach. It is an approach that helps cities and companies to design, obtain and implement solutions for smart cities. It provides knowledge and expertise for urban innovation. The purpose is to streamline projects for smart cities, to get the right partners, and to implement clever smart solutions. This will make investments in urban living laboratories more attractive and support the ecosystem of clever solutions.

Jann and Wegrich dealt with project designs and solutions in macro-conception. They study (2007) policy-making and the resulting strategies, measures and tools through the policy cycle theory, distinguish between the following cycles: problem definition, agenda development, policy formulation, policy implementation, policy evaluation and, partially, the termination of the policy. There is important that they clearly formulate the factors of success or failure of policy making and implementation. From other studies using the model of policy cycles lets name for example Crabbé and Leroy (2008) for environmental studies.

Recently, user-oriented service design, also known as "Design Thinking" (Ideo Company), is getting more and more frequent approach. The concept of design as a way of thinking was used in book by Gerbert A. Simon in 1969 "The Science of the Artificial", as part of design engineering in the book "Experiences in Visual Artificial" (1973) by Robert McKim and in 1980 in the book "How Designers Thing" by Bryan Lawson. Based on McKim's work, Rolf Faste extended this concept at Stanford University in the 1980s and 1990s. Then, this method was taken over by David M. Kelly, who founded the consulting company IDEO.

It is a method for practical and creative problem solving, based on reflection on future constructive results. Compared to other scientific methods that use the hypothesis and its verification, design thinking involves the emotional content of situations in and also feedback is built on these principles. Increasing interest in this process is especially in the field of software engineering and healthcare innovation. Design thinking tries to include all known aspects of the situation and seeks alternative solutions to deliver satisfactory results. This allows redefinition of the initial problem, the process of solutions and co-creating solutions.

Design thinking is the process of creative problem solving. Design thinking uses designer elements such as empathy and experimentation to get innovative solutions. While using design thinking, there are made decisions that build on real future customers' expectations rather than relying on historical experience or on instinct-based hazarding instead of evidence.

Design thinking is an innovation-oriented approach that integrates human needs, technology capabilities and business success requirements. It therefore emphasizes human beings, takes into account technological feasibility and economic sustainability.

Design thinking process usually consists of four phases.

- Getting inspiration: inspiring a new way of thinking by reflecting of what people really want,
- Creating ideas: suppressing past common solutions to get a breakthrough idea,
- Materialization of ideas: creating a prototype to show how can be ideas improved,

- Story sharing: developing a human story to inspire others to action.

For these reasons, this method seems to be optimal for using in SMART cities, because it takes into account both human and its needs as well as technology boundaries and emphasizes economic sustainability.

In addition to the design thinking method, other procedures and methods can be used to creatively design projects and solutions, for example:

- Forecasting method - it deals with anticipating the future development of society, economy, industry, environment, etc. The goal is to get an idea of the future state that is based on rational ways of anticipation. The forecasts obtained are of great importance for strategic management, risk management and planning.
- The Delphi method - this is a procedure for determining professional assessment of future development or status through a group of experts. It is a technique that uses subjective views of members of the expert group to gain an overall consensus of opinions. The Delphi method is used in practice to predict future developments based on consensus among experts. It is one of the methods of expert estimation. It is widely used in qualitative risk analysis, but also in project management and a wide range of other areas, where it is necessary to assess future developments or status by a group of experts.
- The method of writing scenarios of the future - This is a method that uses creative procedure as part of strategic planning. When planning the future, we must be able to evaluate all the known macro-risks, we must plan ahead and realize that today's thinking frameworks are changing and will be changing in the future. We must also prepare for possible discontinuities. For successful strategic planning, the most important shift in the thinking framework from the question, "Can anything happen?" to the question of "What do we do when something happens?". This makes it possible to make today a more successful decision about the future. As with classical strategic planning, it is first necessary to determine the planning framework (subject) and set the mission.
- Brainstorming - This is a group creative technique. The goal is to generate as many ideas as possible on the topic. For the first time introduced this idea an advertiser Alex Faickney Osborn in 1939 as a specific method, further he developed it in the book Applied Imagination (1953). The term brainstorming has become widely used in many languages for creative thinking. The term “brainstorming” has become widely used in many languages for creative thinking. The generation of ideas in the group is the basis of brainstorming based on the principle of postponed evaluation, with a high level of productivity for both individuals and the group, demonstrated by a number of research studies. It is used in a number of areas - from problem solving to generating highly creative ideas. It is used in management, marketing and scientific activities.

Potential for further development and production of applicable R & D results

Potential for further development and production of applicable R & D results in a similar spirit as for other research purposes. Space for up-to-date scientific and practical knowledge is crucial. Schematically can be divided into several main areas:

- Material adaptation of general approaches towards a specific SMART technology topic - this is the first option when defined tools that are commonly used to design solutions and projects can be modified effectively for use in designing specific SMART concepts and solutions. E.g. on the basis of Design Thinking methodology, a modified procedure will be designed to be used directly to prepare and design SMART concepts and solutions.
- Complementing and development of existing approaches to designing SMART concepts and solutions - there are several approaches to creating SMART concepts, solutions, projects or strategies in the world. Each of these concepts has its strengths, but it also has a number of weaknesses and potential for further development. Within the project, there will be linked to them and they will be developed in the form of creative methods, tools, techniques, methodologies and models.
- Micro X macro approach to the preparation and design of concepts and solutions - a part of the above-mentioned methodologies and approaches follows in particular the overall macro-view of the creation of a concrete solution, which is mostly the strategy and its derived implementation plan. In the contrary, other approaches explicitly solve proposals of individual concepts or solutions from a micro-point of view without linking to a wider context. One of the great potential of the project is to combine together these two levels within the proposed methods, tools, techniques, methodologies and models and to adapt them directly for use within designing SMART concepts and solutions.
- Creation of a basic set of inputs, parameters and indicators for proposed creative methods, tools, techniques, methodologies and models - the project has the potential to define a particular basic set of inputs, parameters and indicators that will be directly specific to the design part of SMART concepts and solutions.
- The use of SMART technologies within defined creative methods, tools, techniques, methodologies, and models – regarding the focus of the project, it is desirable that SMART technologies will be used directly for the design process to streamline and simplify the process. At the same time, it will enable to utilize other potential, for example, citizens who will be able to engage in the design of SMART concepts and solutions. Thanks to the project, there will be created recommendations and concepts that enable SMART technologies to be integrated into the design process.

Literature:

Crabbé, A., Leroy, P. (2012). The handbook of environmental policy evaluation. Earthscan.

Jann, W., & Wegrich, K. (2007). Theories of the policy cycle. Handbook of public policy analysis: Theory, politics and methods, 43-62.

5.3.3 Link to the current research of the project partners

This part is elaborated jointly for all research plans at the beginning of chapter 5 of the Feasibility study.

5.3.4 Research Objectives, Activities and Results

Research plan and its objectives

The main objective of research plan No. 2 (RP 2) is **to explore and design methods, procedures and models for designing and preparing concepts and solutions based on SMART technologies.** The given methods, procedures and models should serve to design and prepare SMART solutions and concepts that will be based on a properly and purposefully processed analysis of needs, opportunities and readiness. I.e., solutions that will be designed using these methods, procedures and models should solve the real problems and needs of the population and contribute to improving the life quality in the given area.

The research program will explore in particular creative tools, techniques and methodologies that can be adapted to design specific SMART concepts and solutions. Subsequently, these tools, techniques and methods will be processed into the recommended procedure for creating this type of innovations. This will include research preferably in the following resource areas:

- Macro-approaches to drafting and preparing concepts and solutions - in particular, the methodologies and strategic approaches that are used for designing concrete solutions, especially at strategic levels and that take the system as a whole.
- Micro-approaches to drafting and preparing concepts and solutions - these will be the specific tools, procedures and methods that are used to design partial and fragmental concepts and solutions.
- Creative tools, methods, techniques and approaches - there are myriads of these creative tools and approaches that will be subjected to further research within the project and integrated into the final proposals.
- Experienced practice approaches in areas other than SMART concepts and solutions - so-called good practice examples that have proved successful in drafting concepts and solutions will also be subject to research, and within the project, they will be adapted to the SMART technology area within the proposed concepts and solutions.

The main goal will be achieved through the achievement of six partial targets (similarly to other RPs) that are linked to the individual partial activities:

I. To carry out a detailed analysis of the available methods, tools, techniques, methodologies and models for preparing and drafting concepts and solutions in general and also specifically to the topic of the use of SMART technologies.
II. To perform research among relevant entities and experts on the current state of and other needs in designing concepts, projects and solutions based on SMART technologies.
    a. on the demand side - especially municipalities, cities, regions, public institutions, etc.,
    b. on the offering side of a company offering SMART solutions and products,
    c. research organizations, universities and support organizations standing between the two groups.
III. Process and evaluate acquired knowledge and information into a set of structured knowledge.

IV. Define individual methods, tools, techniques, methodologies and models that can be used to design and prepare concepts and solutions based on SMART technologies for cities and regions.

V. To verify experimentally defined creative methods, tools, techniques, methodologies and models for energy, saving, transport and mobility, health and care, learning and education cases, at TRL 3:
    a. There will be 14 specific model examples that were already defined.
    b. Further examples will be added based on the current process and needs of the project

VI. Finalize and complete methods, tools, techniques, methodologies and models for designing and preparing SMART-based concepts and solutions for cities and regions.

Need to solve the research plan

This subchapter builds on the section above describing the potential for further development and production of applicable R & D results, extends it and defines specific examples and areas of need for SMART technology methods, tools, techniques, methodologies and models for draft concepts and solutions.

The need to solve this research plan is based on purposeful and effective access and management of information and knowledge in the given field, as well as the effective use and application of models, tools and procedures for designing concepts and solutions. The target output of this research project is to create such set of tools, techniques and methodologies that will be applicable to a specific territory (municipality, city, region) with its specific problems, needs and opportunities. Therefore, the need for this research plan lies in the interconnection of the systematic steps in the design of the SMART solution, while taking into account the individual needs of the area or the problem that needs to be solved.

The need to address this research plan is also due to the complexity of the topic and its increased sensitivity in the preparation of SMART concepts and solutions. The need to address this research intent is also given by the complexity of the topic and its increased sensitivity in the preparation of SMART concepts and solutions. It is necessary to reflect the many aspects that are related to the SMART concept. Whether it concerns possible unforeseeable consequences associated with the implementation of SMART technologies, e.g. possible worsening inequalities, social and ethical impacts, growing influence of technology companies on urban economies, freedom and privacy of individuals. That is why this research plan should be given an increased level of attention and an extremely responsible approach. To make effective use of the presented methodologies and procedures, it is also important to get familiar with already existing methods and techniques that are already applied abroad, i.e. the outputs of research projects or initiatives of the European Commission.

Not very systematic and responsible approach to solving this issue is already reflected in examples of the approval of urban strategies in the Czech Republic and around the world. In these strategies, we can find a number of SMART-designed projects and activities that act more or less as random summary of what can be actually done in the SMART area what is currently available on the market.

Only few cities or regions are responsibly solving and thinking about their targeting and planned projects and activities for the future. Precisely the outputs of this project will help them to design concrete activities, concepts, solutions and projects that can subsequently get into the key strategic documents and concurrently will be based on real needs and opportunities and will clearly lead to an enhancement of the life quality of the population in a specific territory.

E.g. capital city Prague approved the Smart Prague Concept, which specifically aims at mobility, energy, information technology, the creative industry, or SMART governance. Prague intends to launch pilot projects in this area and to become a project coordinator in all the above-mentioned areas, which will be developed through cooperation between the academic sector, public institutions, business, as well as in collaboration with urban areas and citizens. However, at the same time there are principally and objectively missing tools, methods and procedures that could help Prague to globally design and prepare specific SMART projects in complex.

Similar procedures are applied, for example, by Brno, Písek, Pardubice and other cities in the Czech Republic and abroad. An exemplary approach that applies the basic principles for the preparation and design of concrete projects at the stage of designing concepts and solutions is the concept of strategic development of "Ostrava fajnOVA", awarded the Smart City Hall Award and the concept of the Moravian-Silesian region "Concept and Vision Smarter Region" that was awarded by Ministry of Regional Development within the contest Smart Region 2017. The partner of the project BeePartner participated in the fajnOVA concept and can take advantage of acquired experience when designing specific tools, methods, procedures, and models for designing SMART projects and activities within this project.

Partial activities leading to the project objectives

The realization of partial activities under research plan No. 2 is, in terms of its concept, similar to that of other RPs, it breaks down in total into 6 sub-activities, their structure and indicative timetable is shown in the following table:

Supposed timetable for partial activities:

Partial activity:	2018			2019				2020				2021				2022			
1 - Detailed analysis of available tools, methods and procedures																			
2- Surveys among relevant entities and experts																			
3 - Processing and evaluation of acquired inputs																			

4 - Design and creation of tools, methods and procedures																		
5 - Cross-sectional experimental verification of tools, methods and procedures: 14 defined validations																		
5 - Cross-sectional experimental verification of tools, methods and procedures: further approx. 5 validations																		
6 – Final modification and finalization of methods, tools and procedures and formulation of recommendations																		

Partial activity No. 1: Detailed analysis of available methods, tools, techniques, methodologies and models

The purpose of this partial activity is to make a detailed summary of the relevant scientific and research findings in respect of the available methods, tools, techniques, methodologies and models for designing and preparing SMART concepts and solutions in the following two levels:

- General level - what methods, tools, techniques, methodologies and models exist in general and what are their strengths and weaknesses.
- Specific level in relation to SMART technologies - what are the specific methods, tools, techniques, methodologies and models used to design and prepare concepts and solutions based on SMART technologies.

In principle, this will be a secondary data analysis in the form of a "desk research". An analysis of the state of findings will be based on the following available sources of information:

- Professional publications in scientific journals (databases).
- Studies and reports by renowned national and international institutions.
- Specialized professional journals and publications.
- Practical methods, tools, techniques, methodologies and models published on the Internet.

The output of this partial activity will be a structured, detailed summary of findings in a given field, serving as an input for further partial activities.

Partial activity No. 2: Surveys among relevant entities and experts

The purpose of this partial activity is to acquire a current overview of the actual state and methods of designing and preparing both general projects and activities, and specifically those related to the SMART topic, based on a defined sample of respondents. Research will be conducted on the demand side (in particular, municipalities, cities, regions, public institutions, etc.), on the supply side (companies offering SMART solutions and products), and organizations standing in between these two groups (research organizations, universities and support organizations). The aim is to get an insight into the issue from all relevant groups. In particular, the following three data collection tools will be used in the research:

- Quantitative research, using a structured questionnaire.
- Focus group with the participation of invited experts.
- Semi-structured interviews.

The output of this partial activity will be a structured summary of findings which will describe the current state of utilization of tools, techniques, methodologies and models for designing and preparation of SMART concepts and solutions among defined entities and experts.

Partial activity No. 3: Processing and evaluation of acquired inputs

The purpose of this third partial activity is to further process and evaluate the information and outputs acquired within the scope of partial activities No. 1 and No 2. The activity will be conducted in two steps:

- Synthesis of data and information - the acquired findings will be summarized and sorted into logical sets of findings.
- Abstraction of data and information - the acquired findings will be categorized and divided into several categories according to their significance.

The output of this third partial activity will be a compiled and categorized summary of findings which will further entered into another partial activity.

Partial activity No. 4: Design and creation of a set of creative methods, tools, techniques, methodologies and models

The purpose of this partial activity is to define individual methods, tools, techniques, methodologies and models for the design and preparation of SMART concepts and solutions of cities and regions on the basis of a sorted and evaluated set of findings. Following procedures will be used, in particular, to design methods, tools, techniques, methodologies and models:

- Induction and deduction - based on the acquired findings, individual methods, tools, techniques, methodologies and models will be defined.

- Analogy - based on more generally defined methods, tools, techniques, methodologies and models, these will be further adjusted and refined for use in the field of SMART technologies.

The output of this fourth part will be a preliminary set of proposed methods, tools, techniques, methodologies and models which will serve to design and prepare concepts and solutions based on SMART technologies for cities, regions and municipalities. This set will be further validated within the scope of partial activity No. 5.

Partial activity No. 5: Cross-sectional experimental verification of tools, methods and procedures

Cross-sectional experimental and model verification is common across all research plans. Each research plan will therefore always address only the part of its experimental and model verification which is relevant to the research plan. **The full description of the cross-sectional experimental verifications is provided in the description of Research plan No. 1 - see partial activity No.5 described in RP 1.**

Partial activity No. 6: Adjustment and finalizing of a set of creative methods, tools, techniques, methodologies and models, and formulating recommendations

The purpose of the partial activity No. 6 is to adjust and complete proposed methods, tools, techniques, methodologies and models based on outputs and recommendations from experimental and model verification.

The result and output of the partial activity No. 6 will be an experimentally proven and conclusively adjusted set of creative methods, tools, techniques, methodologies and models for designing SMART solutions and concepts based on the proven needs and opportunities of a particular territorial unit which is at the same time prepared for their implementation. In principal, it will be a major output of the entire research plan No. 2.

Involvement partner and development of cooperation

Guaranteeing partner of research plan No. 2 will be the University of Ostrava, which will be responsible for the implementation of all partial activities. In the research activity will also be involved workers of the partner Fraunhofer IAO and BeePartner, who will cross-sectionally participate also in partial research activities within RP 2.

Specific component is partial activity No. 5 Cross-sectional Experimental Verification of Tools, Methods and Procedure, the description of which is described uniformly for all research plans within the description of Research plan No. 1. **Also description of involvement and cooperation of the partners within this partial activity is common for all research plans and is described in this chapter of Research plan No. 1 - for description of partner involvement, see RP 1.**

Results and outputs of activity

The main quantifiable results and outputs are listed in the table below. It is assumed in connection with RP 2 the creation of at least 3 professional publications, of which at least 1 will be in co-authorship with enterprises and at least 1 with foreign co-authorship.

Other outputs will include 1 x verified and modified set of creative tools, techniques and methodologies for designing SMART solutions and concepts based on the verified needs and

opportunities of a particular territorial units. Logic of this output is the same as in Research plan No. 1. This set will serve municipalities, cities, regions and other actors as a comprehensive tool for designing and planning SMART projects, activities, concepts and solutions.

The final round of outputs will be 14 + 5 case studies demonstrating each experimental verification. This will be a cross-sectional result of all five research plans, **but with regard to the clarity it is reported only within the outputs of Research plan No. 1.**

Results and outputs of activity	Target Value of the Project Implementation
indicator: 2 02 11 Publications created by supported entities (selected types of documents)	3
indicator: 2 02 13 Publications in co-authorship of research organisations and enterprises (selected types of documents)	1
indicator: 2 02 16 Publications in co-authorship with researchers from abroad created by the supported entities (selected types of documents)	1
indicator: 2 20 11 International patent applications (PCT) created by supported entities Note: International patent application will be a cross-sectional output of all Research plans, but with regard to the clarity it is reported only here for RP 1	0
Other result that is not reflected in MIs: possible partial outcomes of implementing the activities are the results, which are defined according to the Definitions of types of research and experimental development results for the RPV database. (O - other results - these are about 14 + about 5 case studies describing each experimental verification. This will be the cross-sectional result of all five Research plans, with regard to the clarity it is reported only here for RP 1)	0
Other result, which is not reflect in indicators.	1

5.3.5 Research team

This part is elaborated jointly for all research plans at the beginning of chapter 5 of the Feasibility study.

5.3.6 Procured infrastructure and equipment and their necessity and utilisation

Procurement of equipment is mentioned only for RP 1 and RP3 but it will serve across all RPs, especially in the framework of experimental verification and implementation of research in defined RPs.

5.4 Research plan - Metrics and methods of social efficiency – RP 3Abstract

The objective of the Research plan No. 3 (RP 3) is to research and propose metrics and methods for evaluating innovative concepts and solutions based on SMART technologies in order to maximize the size of their social benefits and a consequent increase of the quality of life of a defined population group of the municipality, town, region or other territorial unit.

Within the research program, the purpose of the research will be to investigate the effectiveness of investments in SMART innovative concepts and solutions, i.e. social efficiency measured by improved quality of life. In particular, the following methods and procedures will be examined within the scope of the RP 3:

- Cost benefit analysis (CBA) - this is an essential theoretical basis for assessing the social benefits and costs of a given project or activity. Part of it will be partial aspects such as shadow prices, discount rates, or risk analysis.
- Other economic procedures, models and methods - in particular, other economic models for project and activity assessment, e.g. cost minimization, life cycle analysis, shared value creation, etc. will be examined.
- Non-economical (non-financial) aspects entering into the evaluation - various aspects of many features of human life, such as motivation, willingness to pay and bear the costs, human behaviour, social, cultural, geographic, ethical, psychological and other aspects entering the analysis, etc.
- Key success factors - the key success factors of the proposed concepts and solutions and the extent to which these factors will be met using so called "SMART test" will be examined.

The course of the solution will be similar to that of other RPs. In the framework of the partial activities, a detailed analysis of available metrics and methods for project and solution evaluation will be carried out first, which will be complemented by research among relevant entities and experts On the basis of the documents obtained, the inputs are processed and evaluated, leading to the design part, which will define the individual metrics and methods used to evaluate the effectiveness and benefits of SMART concepts and solutions. Subsequently, as in the case of the next four RPs, the crucial role will play cross-sectional experimental verification of these proposed metrics and methods on 14 already defined examples of energy and savings, transport and mobility, health and care, learning and education. Within the project, these 14 model examples will be further expanded by other examples on the basis of current knowledge and needs. This cross-sectional verification is common to all RPs, within each RP only a sub-part of the experimental verification will be implemented. The final step will be the final modification and finalization of metrics and methods based on SMART technologies and formulation of recommendations for their further use.

The output of RP 3 will be an analytical tool (including an appropriate set of metrics and indicators) for evaluation of social benefits and costs, especially on the basis of CBA, which will directly reflect the specifics of SMART technologies and dynamically changing environments.

5.4.2 Current state of knowledge

Current state of knowledge

Basic theoretical basis for assessing the effectiveness and benefits of the concepts and measures will be the Cost-Benefit Analysis. This has its name in English as "Cost Benefit Analysis", so the name "Cost Benefit Analysis", the CBA abbreviated or the name "Cost and Income Analysis", also appears in the Czech Republic. It is an instrument that is particularly useful in evaluating projects in the public sector, since it deals with both the financial costs and benefits of the project, and it also takes into account non-financial costs and revenues for the society or a defined group of project users.

A number of scientific works and partial methodologies have been developed on CBA (e.g. Brend, 2006 and Florio, 2008). In the Czech Republic, the CBA gained a wider awareness of the professional public and the public sector, especially in connection with the accession of the Czech Republic to the European Union. Thanks to this, the Czech Republic had the opportunity to draw funds from the European Structural and Investment Funds. To allocate these funds to individual projects, the EU has set a requirement for assessing each project through a feasibility study or its simplified form (for smaller projects) or through the CBA (in particular for larger projects).

Given that the CBA is analyzing the consequences of a project for society its purpose is to determine whether the project is beneficial for the society (i.e., that social benefits prevail) or, on the contrary, is not beneficial (i.e. that the social costs prevail). At the same time, CBA allows to set the preferential ranking of individual projects (Sieber 2004, p. 6).

The main categories of CBA include especially:

- Costs - these are the negative effects (losses) of the investment project.
- Benefits - these are the positive effects (benefits) of the implemented investment project.
- Cash flow - this is the financial statement of income and expenditure associated with the investment project.
- Beneficiary - subject, individual or member of a group to which the investment project has a positive or negative impact.
- Shadow Prices - this is a financial statement of the non-financial benefits and costs of a project, or a statement of financial income and costs in the absence of a perfectly competitive market.
- Social Discount Rate - expresses the best possible return on alternative investment relative to the investment assessed at the same level of risk of both investments. They differ from the financial discount rate in particular by missing market failures.
    - External Effects - positive or negative effects of an investment project affecting beneficiaries

In the context of practical CBA applications, the following application areas can be mentioned:

- European Commission Methodology - The European Union promotes implementation of CBA in the context of the assessment of part of the investment projects applying for

support from the European Structural and Investment Funds (Florio, 2008). The procedure for the implementation of CBA is specified in a number of documents, which also use the methodology applied in the Czech Republic for the Joint Regional Operational Program. Therefore, the basic procedure does not differ significantly here, but the methodological documents worked out by the European Commission are much more detailed and serve as the basis for the elaboration of national methodologies that take into account the particular institutional set-up in the given country.

- Methodology for the cost-benefit analysis of 8/2006 issued by DG Regio - it recommends and specifies some of the partial steps in the processing of CBA. First of all, it recommends to consider individual project variants so that not only one particular project is evaluated, but more variants have been taken into account. Another specification is to include the project's residual value in the analysis in case the project lifetime is longer than the calculated reference period. The document also recommends to include an overall risk analysis for the sensitivity analysis when individual project variables entering the sensitivity analysis should be supplemented by an estimate of the statistical distribution of the likelihood of their occurrence. If this statistical estimation can not be realized, for example due to missing historical data, the commission recommends that at least a qualitative assessment of individual Risk factors is made.
- Methodology of the Ministry of Transport for Waterway Projects - The Methodology for Assessing the Effectiveness of Investments on Waterways issued by the Ministry of Transport of the Czech Republic basically also takes over the implementation of the CBA, as is the case with the SROP methodology. Nevertheless, this methodology further completes the CBA process with some further steps or partial aspects. The CBA is complemented by marketing analysis and more detailed risk analysis.
- Methodology of the Ministry for Regional Development - Ministry for Regional Development in the current programming period is based on the European Commission's methodological materials and specifies the CBA processing within the current 2014-2020 programming period for projects funded by the European Structural and Investment Funds. For this purpose, it developed a Methodological Guideline for Call Management, Evaluation and Selection of Projects in the 2014-2020 programming period, where it merely specifies some aspects of the implementation of CBA for investment projects. To simplify the CBA, it recommends using a database of appraised socio-economic impacts of investment projects. This measure greatly simplifies part of the transfer of non-financial benefits and cash flow costs and ensures the comparability of the projects under consideration when the analysis is processed by other entities. On the other hand, it can lead to some simplifications, which may not reflect the true state. In any case, even this simplified project appraisal is, in terms of the efficiency of spending public funds, principally better than none. This methodology is presented here for illustrative reasons, as the trend towards simplification of CBA processing can be observed when comparing older and newer methodological materials of the European Commission and mediated by the Ministry for Regional Development. On the one hand, the range of publicly funded

projects (which includes EU funds) is increasing, on the other hand there is an effort to reduce the administrative difficulty of processing grant applications, which includes also CBA analysis. Therefore, the path of preconditioned values for assessing socio-economic impacts or establishing a recommended social discount rate should facilitate this process.

Alternatively to CBA is sometimes used Cost Minimization Analysis (CMA). CMA is a method that aims to economically compare some variants that lead to the same goal or output. In this case, are not primarily monitored the revenue or benefits of the selected project, but especially its costs. This analysis uses cost methods for evaluation of the project, which are presented in the earlier part of the study.

From the investor's point of view, is chosen the variant which has the lowest total costs. CMA can be processed in two principally different ways. The first one takes into account only the investment costs incurred in particular in the preparatory and implementation phases of the project, while the second way takes into account, in addition, the operational, remedial and eventually liquidation costs associated with the operational phase of the project (i.e., the costs of the whole life cycle of the project).

In the state administration, the first approach is used, which mainly takes into account the direct implementation costs in the preparatory and implementation phases of the project. The reason for this is to some extent Act No. 137/2006 Coll., On Public Procurement, which "motivates" to select a supplier on the basis of a single criterion, namely the price.

CMA has found its main application, especially in medicine, where it is used to choose between several treatments, procedures or medications, the use of which should lead to the same goal, i.e. cure the patient (Haycocks 2009, p. 2). This procedure is also often simplified and used as a support for the doctor’s decision about the choice of treatment, even when the results of the individual procedures are not entirely identical. This procedure is not, in principle, also bad, but in this case it should be just one of the inputs for the final decision of the doctor who makes the decision.

Diller et al. (2017) counts methods such as CBA among analytical and rational methods of expertly oriented spatial planning, adding that, under the influence of so-called communicative turn in planning come in also participative methods of efficiency assessment such as Ideal conferences, brainstorming, or Metaplantecnik (similar to those of Ježek et al., 2007).

In spatial planning, different types of methods of measuring social, environmental and economic impacts are used (for the first see e.g. Glasson, Wood, 2009). As a highly complex method, that can be applied also in other areas, can be considered for example the Retail Impact Assessment (RPA) study, which is used for the ex-ante evaluation of the impact of the construction of large-scale business units (Spilková, 2010). A key publication is the work of England (2012), who proposes a detailed methodology for measuring (positive / negative) economic, social and environmental impacts. Empirically oriented works include, for example, the work of Crosby et al. (2005).

Rehák and Štofko (2016) studied the impact of a big event on the example of Bratislava. In their work they distinguished between (positive / negative) influences in the areas of infrastructure and urban development, social, political and economic area. To calculate the economic impacts they applied the so-called Stynes model.

Similarly, Metzler and Huber (2007) analysed the regional impacts of the selected event (Bundesgartenschau 2005), where beside the tangible effects (tangible) included intangible effects such as impacts on competencies, networking, image effects, or impact on quality of life, regional image and identity.

Potential for further development and production of applicable R & D results

Potential for further development and production of applicable R & D results in a similar spirit as for other research purposes. Space for up-to-date scientific and practical knowledge is crucial.

Schematically can be divided into several main areas:

- Modification of methodical apparatus and input parameters - the CBA is increasingly perceived as a theoretical approach than the real-life tool. If this tool is used somewhere, it is often a simplified model that simplifies or deletes some of the input assumptions. Practical CBA applications often do not include a number of specific parts, simplified or historical indicators (such as a discount rate) are used or are prepared very schematically. Within the project, the CBA's theoretical approach will be subjected to research where proposed tools based on it will reflect as much as possible all the essential parts of the CBA directly for use in SMART concepts and solutions assessment.
- Adaptation of the models directly for the need of use of the assessment of SMART concepts and solutions - The CBA's general methodical apparatus will be adapted and directly adjusted to its use within evaluation of the SMART concepts and solutions for individual areas of human life (especially mobility and transport, health and care, energy and savings, education and learning, etc.). Similarly, some models based on CBA in the world are adapted especially for the need to assess investment projects of transport and specific infrastructure.
- Create a basic set of inputs, parameters, and indicators for an analytical tool serving to evaluate social benefits and costs - project has potential to define a basic specific set of inputs, parameters and indicators that will be directly specific to the analytical part in assessing the social effectiveness of SMART concepts and solutions.
- Using SMART technology itself to assess the social effectiveness of SMART concepts and solutions - as with other research plans, it also has a significant potential to use SMART technology itself throughout the process of assessing the social effectiveness of concepts and solutions. These technologies can greatly simplify, for example, the entire CBA course, for example by the fact that CBA results can be dynamically evaluated over time on the basis of a continuous supply of new data from sensors. This dynamic concept of CBA professional literature does not mention, and thanks to SMART technology it can be a breakthrough in evaluating the effectiveness of concepts and solutions.
- The "SMART test" development potential - the "SMART test" is a tool that is widely used in a number of industries and disciplines. Its purpose is to assess the profitability or feasibility of the chosen solution on the basis of selected indicators. The individual parameters of the solution are evaluated on a defined scale, the results are often interpreted using the so-called spider graph. This graph can be an appropriate addition to the whole project

assessment process, for example it can have a placement function whereby it will be possible to determine the utilization rate of "SMART technology" within the defined solution and to develop further steps and parameters used in the evaluation of innovative SMART concepts and solutions.

- Deeper understanding of non-financial aspects and their implementation in the evaluation process - a great potential for further development of knowledge also lies in a deeper understanding of the non-financial aspects that accompany the introduction of SMART concepts and solutions. Given that the SMART topic is generally new, it has not yet been fully explored and, in particular, its long-term effects on the ethical, legal, social, psychological and other areas of human life require further investigation and subsequently (or at the same time) their incorporation into the proper process of assessing SMART concepts and solutions to maximize their social benefits and costs of the given solution.

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5.4.3 Link to the current research of project partners

This part is elaborated jointly for all research plans at the beginning of chapter 5 of the Feasibility study.

5.4.4 Research Objectives, Activities and Results

Research plan and its objectives

The objective of the Research plan No. 3 (RP 3) is to research and propose metrics and methods for evaluating innovative concepts and solutions based on SMART technologies in order to maximize the size of their social benefits and a consequent increase of the quality of life of a defined population group of the municipality, town, region or other territorial unit.

RP aims towards creation of a set of composite indicators to measure social efficiency. RP wants to design and pilot the SMART solution based on the concept of sustainable development (economic, social and environmental pillar). It will also try to verify the link between the concept of sustainable development and the competitiveness of the territorial units. It can be assumed that the public administration, based on smart solutions of socio-economic problems, will achieve better development and at the same time will increase the competitiveness of the public administration, which will benefit other economic subjects of the given territorial unit. From the methodological point of view, economic modeling will be used with the application of selected mathematical-statistical methods, e.g. econometric modeling, correspondence analysis, factor analysis, etc. The aim of these methods will be to find the most important factors of SMART solution that will bring socially significant effects, or dentify barriers (costs) limiting the development of smart solutions.

The aim of this research plan is significantly associated with the elemental premise of the whole project that the use of SMART technologies, except for the obvious benefits, brings also significant costs to society, e.g. limitation of personal freedom, lesser anonymity, or constant supervision of everything. It is precisely the aim of this research plan to assess each other's overall social benefits, on the one hand, and all social costs (both financial and non-financial) on the other hand. The tool that will be the output of this intent should just allow to divide the solution into the following three groups and also specify their order:

I. SMART concepts and solutions that increase overall quality of life: social benefits > social costs, i.e. the project is socially effective and makes sense to implement it.
II. SMART concepts and solutions that reduce overall quality of life: social benefits < social costs, i.e. the project is not socially effective and does not make sense to implement it.
III. SMART concepts and solutions that have a neutral impact on quality of life: social benefits = social costs, i.g. the project is socially neutral and its implementation should be subject to further decision-making process, or the project should be reworked.

Within the research program, the purpose of the research will be to investigate the effectiveness of investments in SMART innovative concepts and solutions, i.e. social efficiency measured by improved quality of life. In particular, the following methods and procedures will be examined within the scope of the RP 3:

- Cost benefit analysis (CBA) - this is an essential theoretical basis for assessing the social benefits and costs of a given project or activity. Part of it will be partial aspects such as shadow prices, discount rates, or risk analysis.
- Other economic procedures, models and methods - in particular, other economic models for project and activity assessment will be examined, e.g. cost minimization, life cycle analysis, shared value creation (Creating Shared Value – ideological concept of Prof. Porter a M. Kramer) etc. For example, the method of creating shared value is a certain redefinition of the area of CSR, and some of its basic premises should also enter the whole process of evaluation of the SMART concepts and solutions.
- Non-economical (non-financial) aspects entering the evaluation - various aspects of many features of human life, such as motivation, willingness to pay and bear the costs, human behaviour, social, cultural, geographic, ethical, psychological and other aspects entering the analysis, etc. will be examined. This area of research-, resp. its focus on assessing SMART concepts and solutions is crucial, as SMART technologies can have a major and long-term impact on the non-economic aspects of people's lives.
- Key success factors - the key success factors of the proposed concepts and solutions and the extent to which these factors will be met using so called "SMART test" will be examined.

The main goal of RP 3 will be achieved through the achievement of six partial targets (similarly to other RPs) that are linked to the individual partial activities:

I. To carry out a detailed analysis of available methods and tools, used to evaluate the social effectiveness of projects, concepts and activities in general and specifically on the use of SMART technologies.
II. To perform research among relevant entities and experts on the current state of and other needs in evaluating the social effectiveness of concepts, projects a solutions based on SMART technologies.
    a. On the demand side – especially municipalities, cities, regions, public institutions, etc.,
    b. On the supply side – companies offering SMART solutions and products
    c. Research organizations, universities and support organizations standing between the two groups.
III. Process and evaluate acquired knowledge and information into a set of structured knowledge.
IV. Define individual methods and tools that can be used to evaluate social efficiency of concepts and solutions based on SMART technologies for cities and regions.
V. To verify experimentally at TRL3 level, defined methods and tools for evaluation of social efficiency on case studies from energy and savings, transport and mobility, health and care, learning and education sectors:
    a. There will be 14 specific model examples that were already defined.
    b. Further examples will be added based on the current process and needs of the project

VI. Finalize and complete methods and tools for evaluation designing and preparing SMART-based concepts and solutions for cities and regions.

The need to solve the research plan

This subchapter follows the part above that describes the potential for further development and production of applicable R & D results and further it extends and defines specific examples and areas of need for methods and tools for assessing the social efficiency of concepts and solutions based on SMART technologies.

The basic prerequisite for necessity is the application of SMART concepts and solutions with an effective and meaningful approach to the development of territory or individual areas of human life, not just the thoughtless take-over of the latest SMART trends and products available on the market. Therefore, it is necessary to have an overview of the tools for evaluating the benefits and costs of SMART concepts and solutions and also to use them for their purpose. In their use, it is necessary to take into account the specifics of the technologies and the implementation environment at the same time. In today's turbulent and connected world, which is in the process of permanent change, the proper and long-term assessment of the SMART concept or solution is crucial, the aim is to look for win-win strategies for all involved and thanks to it to participate in improvement of quality of life by using SMART technologies.

The need for this research plan lies also in enabling measurement of the meaningfulness and effectiveness of investments in these SMART technologies and technological concepts and solutions. It is also important to take into account the non-economic benefits and to evaluate them so that all aspects of the implementation of the SMART concept are included in the benefit calculation. The importance and benefits of addressing these issues should also be reflected in increased sensitivity in public decision making on public affairs, taking into account non-monetary aspects as well as in a more comprehensive view of the use of public space and public resources. All this is essential to implement, including understanding the context of smart cities, developing and creating strong and meaningful partnerships. If this research plan is not solved, the basic assumption of the project, i.e. a responsible approach in the application of SMART concepts and solutions and their direct link to the improvement of the quality of life of the population, would not be fulfilled.

A similar procedure, based on predefined methods and then application in a test environment, was applied, for example, in the planning of a new Vienna district. Aim of Smart Vienna set in the strategy is to reduce transport in the city by 20% between 1990 and 2025, with a 35% reduction in greenhouse gas emissions by 2020 and a 40% reduction in energy demand by 2050. The City of Vienna therefore created a live laboratory for concepts testing in its eastern district. Aspen Seestadt is an artificial city district where urban energy companies and the German company Siemens, run a joint research enterprise called Aspern SMART City Research & Co.KG. The aim of this research plan is to apply innovations focused on saving energy based on data about live in a growing district. Great emphasis is placed on the social and environmental dimensions of activities, that is, the quality of life of the population.

Partial activities leading to the objectives

In terms of its concept, the implementation of partial activities under Research plan No. 3 is similar to the other RPs, it breaks down in total to 6 partial activities, their structure and indicative timetable is shown in the following table:

Indicative timetable for partial activities:

Partial activity:	2018			2019				2020				2021				2022			
1 - Detailed analysis of available tools, methods and procedures																			
2- Surveys among relevant entities and experts																			
3 - Processing and evaluation of acquired inputs																			
4 - Design and creation of tools, methods and procedures																			
5 - Cross-sectional experimental verification of tools, methods and procedures: 14 defined validations																			
5 - Cross-sectional experimental verification of tools, methods and procedures: further approx. 5 validations																			
6 – Final modification and finalization of methods, tools and procedures and formulation of recommendations																			

Partial Activity 1: Detailed analysis of available tools and methods

The purpose of this partial activity is to make a detailed summary of relevant scientific-research and practical knowledge of available methods, tools, techniques, methodologies and models serving for evaluation of social efficiency and related relationships of SMART concepts and solutions in these two levels:

- General level: what methods, tools, techniques, methodologies and models exist in general and what are their strengths and weaknesses.
- Specific level in relation to SMART technology - what are the specific methods, tools, techniques, methodologies and models serving for evaluation of social efficiency of concepts and solutions based on SMART technologies.

Basically, this will be a secondary data analysis in the form of a "desk research". Analysis of the state of knowledge will be realized on the base of following available sources of information:

- Professional publications in scientific journals (databases).
- Studies and reports by renowned national and international institutions.
- Specialized journals and publications.
- Practical methods, tools, techniques, methodologies and models published on the Internet.

The output of this partial activity will be a structured, detailed summary of knowledge in a given field serving as an input for further partial activities.

Partial activity 2: Surveys between relevant subjects and experts

The purpose of this partial activity is to get a current overview of the actual state and ways of evaluation of social efficiency of both general projects and activities and specifically in relation to the SMART topic on a defined sample of respondents. Research will be conducted on the demand side (in particular, municipalities, cities, regions, public institutions, etc.), on the supply side (companies offering SMART solutions and products) and between the two groups standing organizations (research organizations, universities and support organizations). The point is to get an insight into the issue from all relevant groups. In particular, the following three data collection tools will be used in the research:

- Quantitative research through a structured questionnaire.
- Focus group with the participation of invited experts.
- Semi-structured interviews.

The output of this partial activity will be a structured summary of the findings that will describe the current state of use of methods, tools, techniques, methodologies and models for evaluation of social efficiency of (SMART) concepts and solutions among defined subjects and experts.

Partial activity 3: Processing and evaluation of received inputs

The purpose of this third partial activity is to further process and evaluate the information and outputs obtained within partial activities No. 1 and No 2. Activity will be divided into two partial steps:

- Synthesis of data and information - the acquired knowledge will be summarized and classified into logical sets of knowledge.
- Abstraction of data and information - the acquired knowledge will be categorized and divided into several categories according to their significance.

The output of this third partial activity will be a compiled and categorized summary of knowledge that will then enter into another partial activity.

Partial activity 4: Design and creation of set of methods and tools for evaluation of social efficiency

The purpose of this partial activity is to define on the basis of the ordered and evaluated set of knowledge individual methods and tools for evaluation of social efficiency of SMART concepts and solutions of cities and regions. The following methods will be used to design methods and tools:

- Induction and deduction - Based on the acquired knowledge, individual methods and tools will be defined.
- Analogy - based on more generally defined methods and tools, they will be further adapted and specified for use in the field of SMART technologies.

The output of this fourth part will be a preliminary set of proposed methods and tools that will serve to the evaluation of social efficiency of concepts and solutions based on SMART technologies for cities, regions and municipalities. This file will be further validated within the partial activity 5.

Partial activity 5: Cross-sectional experimental verification of methods and tools

Cross-sectional experimental and model verification is common across all research plans. Each research plan will therefore always address only part of its experimental and model verification that is relevant to the research plan. **A full description of the cross-sectional experimental verifications is given in the description of research plan No. 1 - see Partial activity 5 described in RP 1.**

Partial Activity 6: Final adjustments and completion of methods and tools and formulation of recommendations

Purpose of partial activity No. 6 is to adapt and complete proposed methods and tools on the basis of outputs and recommendations from experimental and model verification. The result and output of partial activity No. 6 will be mainly an analytical tool (including relevant set of metrics and indicators) for evaluation of social benefits and costs, especially on the basis of CBA, which will directly reflect the specifics of SMART technologies and dynamically changing environment. In its essence, it will be the main output of the entire research plan No. 3.

Partner Involvement and Collaboration Development

Guaranteeing partner of the research plan No. 3 will be Silesian university in Opava (Faculty of Business and Entrepreneurship in Karviná), that will be responsible for the implementation of all partial activities. In the research activities will be involved also workers of the project applicant from University of Ostrava and of the project partners from Fraunhofer IAO and BeePartner, who will also cross-sectionally participate in the implementation of partial research activities within RP 3.

Specific component is partial activity No. 5 Cross-sectional experimental verification of tools, methods and procedures, the description of which is consistently presented for all research plans

within the description of Research plan No. 1. Also, the description of the involvement and cooperation of the partners within this partial activity is common across all research plans and is given in the chapter of Research Intention No. 1 - for description of partner involvement, see RP 1.

Results and outputs of the activity

The main quantifiable results and outputs are listed in the table below. It is assumed in connection with RP 3 the creation of at least 3 professional publications, of which at least 1 will be in co-operation with enterprises and at least 1 with foreign co-authorship.

Other outputs will include 1 x proven and finely-tailored analytical tool (including relevant set of metrics and indicators) for evaluation of social benefits and costs, especially on the basis of CBA, which will directly reflect the specifics of SMART technologies and dynamically changing environment. The logic of this output is the same as in Research plan No. 1. This tool will serve municipalities, cities, regions and other actors as a comprehensive tool for the evaluation of the social efficiency of SMART projects, activities, concepts and solutions.

Results and outputs of activity	Target Value of the Project Implementation
indicator: 2 02 11 Publications created by supported entities (selected types of documents)	3
indicator: 2 02 13 Publications in co-authorship of research organisations and enterprises (selected types of documents)	1
indicator: 2 02 16 Publications in co-authorship with researchers from abroad created by the supported entities (selected types of documents)	1
indicator: 2 20 11 International patent applications (PCT) created by supported entities Note: International patent application will be a cross-sectional output of all Research plans, but with regard to the clarity it is reported only here for RP 1.	0
Other result that is not reflected in MIs: possible partial outcomes of implementing the activities are the results, which are defined according to the Definitions of types of research and experimental development results for the RIV database. (O - other results - these are 14 + ca 5 case studies describing each experimental verification. This will be the cross-sectional result of all five research plans, with regard to the clarity it is reported only here for IR1)	0
Other result, which is not reflect in indicators. (O - Other Results - This is a verified and finally modified set of tools, methods and procedures for analyzing the needs, opportunities and readiness of cities and regions for implementation of solutions and concepts based on SMART technologies.)	1

5.4.5 Research Team

This part is elaborated jointly for all research plans at the beginning of chapter 5 of the Feasibility study.

5.4.6 Procured infrastructure and equipment and their necessity and utilisation

Name of item / functional model: (List it in descending order of the price from the highest)	Number of pieces of the item	Total planned price excluding VAT (CZK thousand
Set of computer technology	4	139 thousand of CZK
Characteristics: 4 pcs of laptops for research team enabling works with demanding graphic programs Corel and SPSS (work with lots of data) **Purpose of the procured equipment:** For the purpose of implementation of partial activities within RP3 that are demanding for computing power. **Readiness of the infrastructure:** The device does not require any preparatory infrastructure.		

Results and outputs of activity	Target Value of the Project Implementation
indicator: 2 41 01 Number of expanded or modernised research centres This is a workplace of the Silesian University in Opava.	1
indicator: CO25 / 2 05 00 Number of researchers working in modernised research infrastructures	4

5.5 Research plan – Methods for verifying the feasibility of concepts and Solutions - RP 4

5.5.1 Abstract

The objective of the Research plan No. 4 is to research and propose ways and methods for verification of proposed SMART concepts and solutions to verify their feasibility before applying and implementing them in practice.

The purpose of this research program is to examine how to optimally validate proposed SMART solutions and concepts so that their feasibility can be verified. This sense is based on the assumption

of efficient spending of public funds. Practice has shown that many projects and activities have been designed to address the selected problem and have the potential to achieve a positive social impact, but the feasibility of the concept or project has not been verified. Therefore, the project had to be adjusted during its implementation, the costs and other parameters associated with it were changed or even was eventually ended with loss. It is precisely this failure that can be avoided by using methods that can test the feasibility of a given concept or solution even before the investment phase. A number of methods and tools to be explored can be used for this verification.

The course of the solution will be similar to that of other RPs. In the framework of the partial activities, a detailed analysis of available ways and methods will be carried out first, which will be complemented by research among relevant entities and experts. On the basis of the documents obtained, the inputs are processed and evaluated, leading to the design part, which will define the individual tools, methodologies and procedures used to verification of feasibility of SMART concepts and solutions. Subsequently, as in the case of the next four RPs, the crucial role will play cross-sectional experimental verification of these proposed ways and methods on 14 already defined examples of energy and savings, transport and mobility, health and care, learning and education. Within the project, these 14 model examples will be further expanded by other examples on the basis of current knowledge and needs. This cross-sectional verification is common to all RPs, within each RP only a sub-part of the experimental verification will be implemented. The final step will be the final modification and finalization of set of tools, methods and procedures for verification of feasibility of SMART projects and solutions and formulation of recommendations for their further use.

The output of RP 4 will be a set of tools, methods and procedures for experimental verification of proposed SMART concepts and solutions and evaluation of their feasibility.

5.5.2 Current state of knowledge

Current state of knowledge

The implementation of projects, concepts, solutions and activities is studied through several tools and methodologies. They are mainly the following:

- feasibility study (technical-economic study),
- standards and norms,
- simulation models,
- virtual and experimental models,
- a strategy as a supporting tool for assessing feasibility.

The key instrument is the feasibility study, which can have varied form and scope, and its main aim is to verify the feasibility of the selected project or solution from a number of perspectives (e.g. financial, technical, operational, legislative, etc.). It often has a standardized format and is presented in the form of an analytical text with recommendations to combine the use of other tools often with ICT support. From a global perspective, the use of the feasibility study is often enacted in the relevant legislation for a given range of projects and activities. Within the EU, the feasibility study has

become a standardized tool used in the preparation and implementation of projects funded by the European Funds.

In relation to the focus of the project, a highly valuable source is work from Weiß (2003) under the name Machbarkeitsstudien für regionalale Projekte. The author follows on from the basic principles of feasibility study known from classical business project management, from which he derives the principles and realization of a feasibility study for the needs of regional development projects. The author constructs his own, very detailed, guiding schemes for implementing a feasibility study on regional development projects. He distinguishes between the formalized and the simplified version of the feasibility study according to the investment amount of the project.

(pages 22 to 23).

Gugisch et al. (1998) evaluates in his work feasibility studies of regional projects in Bayerische Rhön and the Hochfranken region. On the basis of the gaps identified between the ideal model of the feasibility study on the one hand and the results of the implementation of concrete projects, on the other hand, they propose practical recommendations both for more effective implementation of feasibility studies and for the projects themselves.

Westland (2006) in his book *The Project Management Life Cycle* focuses on the feasibility study. In his case the purpose of the feasibility study is to evaluate the probability of success of the project and therefore the feasibility study also ascertains whether the project costs are adequate, whether the proposed solution is achievable and whether the risks are acceptable or that the identified problems can be avoided.

In the domestic context, dealt with the issue of feasibility study for example Sieber (2004), who developed a practical guide to the implementation of this method, or Němec (2002) in the context of company management.

Another range of tools for feasibility assessment are standards and norms. E.g. ISO Standard 37120/2014, entitled "Sustainable development of communities", defines 17 key indicators for assessing urban performance in terms of urban services and quality of life: economics, education, energy, environment, finance, fire and emergency situations, good governance, health, recreation, safety, protection, waste disposal, telecommunications and innovations, transport, urban planning, sewage, water and its quality. These indicators include a number of sub-indicators, and serve as reference points to city management, politicians, scientists, business leaders, planners, designers and other professionals who deal with the topic and create a policy for more comfortable, tolerant, sustainable, more economical, more attractive and prosperous cities.

An important range of tools are simulation and virtual models which make it possible to verify the feasibility of selected concepts and projects in the form of a simulation or model. Simulation is usually a numerical method, which involves experimenting with a special mathematical model of real systems primarily through SW. The essence of its utilization is to define all input parameters and variables that are then inserted into a complex or partial model. The analysis is able to simulate real processes and activities (such as the passage of visitors through the city), influenced by predefined variables and parameters (e.g. public transport capacity, day of the week, etc.). The outcome is an

assessment which indicates whether the concept or solution is feasible under the given conditions and parameters.

There exist a large number of such simulations and models in the world. A relatively well-known simulation is Monte Carlo, whereby the output of the method is, in particular, a distribution of density probability or a distribution function which requires further interpretation. Specific simulators are, for example, urban simulators (e.g. commercially available UrbanSim), which allow for better understanding of changes and conditions in cities when planning urban interventions or simulations for modeling natural disasters and attacks. In the Czech Republic the RODOS simulation model, developed at the Ostrava University of Mining and Technical Studies, has been relatively successful, allowing simulations to be made for transport measures and interventions.

As an example, a study by company Berger has been developed specifically for the purposes of global view on cities approach to SMART project feasibility analyses, which evaluates strategies of 85 SMART cities. It has been verified that there are growing number of cities that actually plan their progress and provide a thoughtful argument for their approach. Since 2012, the number of cities integrating SMART strategies into their approach has been growing. The average score within the scope of SMART City Strategy Index was 37 out of 100.

An appropriate tool which helps analyze the feasibility of a solution is a developed urban strategy. A SMART city strategy that covers six mutually related action fields, including a large number of subcategories and solutions has been defined as optimal for evaluating project feasibility. A complicated topic is digitization. Many cities start to digitize data. Research shows that if cities appoint a Chief Information Officer (CIO) or a Chief Digital Officer (CDO) such as Vienna, Amsterdam or Seoul, they gain a clear advantage. Centraliziation of data from all areas facilitates the coordination of SMART policy.

The comparison of the SMART index shows that the first place is occupied by the city of Vienna (73 out of 100) followed by Chicago and Singapore. Other cities follow: London, Santander and New York. Based on research, 10 key indicators which help develop a complex integrated urban SMART strategy have been identified. These indicators are primarily intended for city officials who design and implement the strategies. But they are also relevant to urban infrastructure operators and provide solutions for smart cities (whether it concerns big businesses or start-ups).

Experience has shown that for the successful implementation of a SMART project, concept or solution following 10 factors are the key preconditions:

1. Reassessing the role of the city and its administration to the model of the city as a service for its inhabitants and visitors.
2. Involving residents and other stakeholders into the planning and implementation process.
3. Avoiding isolated solutions requires a comprehensive concept of e-government and an active demand to use good practice approach.
4. Supporting citizens' initiatives, sustainable business models and other relevant private sector participants.
5. Creating a complete data strategy and data platform.

6. Supporting the creation and setting up of innovative hubs to facilitate and develop inspirational and innovative ecosystems.
7. Ensuring data security.
8. Involving infrastructure operators in the design, financing and implementation of initiatives.
9. Providing political support and integrated public feedback.
10. Creating a coordinating body and planning system.

Potential for further development and production of applicable R & D results

The current state of knowledge described above shows again that there exists significant potential for developing tools, methodologies and procedures for assessing the feasibility of SMART concepts, projects and solutions. The potential for further development and adaptation lies above all in the following levels:

- Practical adaptation and focus - general approaches to the feasibility study can be further modified and developed to be directly applicable to SMART concepts and solutions, based on currently available scientific knowledge and practice requirements. This means that the methodological process defining the assessment of individual feasibility areas (e.g. financial, technical, operational, implementation, social, legislative, environmental and other) can be modified to take into account the specificities and differences of SMART concepts and solutions. The final conclusions of the feasibility study will then be specifically related to the use of SMART technologies and concepts.
- The methodical approach to drafting feasibility study - particularly the Czech practice shows that feasibility studies for projects funded by European funds are often drafted pragmatically. This means that the parameters to be achieved are known in advance and the study is purposefully designed to achieve these parameters. This is a completely opposite approach to the purpose that the feasibility study should serve. The reason for this is often that the very methodology concept of a feasibility study is far from its purpose. Another common reason is "bureaucratization" of the entire process of drafting, whereby certain parts that are not relevant for the given project or concept assessment are included needlessly. This current project responds to the described shortcomings and will focus on creating such methodological support for the feasibility study that will be directly relevant and best usable for the project assessment process. The aim is to subsequently create a tool that will lead the project leader through individual steps to evaluate the feasibility of the project, and will actually help to identify weak and insufficiently solved points that may have a negative impact on the feasibility of the SMART concept or solution.
- Inputs to simulations and models - the ambition of this research plan is not to create entirely new simulation and model interfaces or tools, as there are countless for various purposes, as mentioned above. The aim is rather to choose, on the basis of the research, the models and simulations that are most useful for assessing the feasibility of SMART concepts and solutions. Furthermore, to adapt for these selected simulation tools and models certain input parameters and assumptions to best reflect the specifics of SMART projects and solutions.
- Adaptation of strategy development processes - there are a number of procedures for the development of strategies of various territorial units. Part of them, however, develops a

"strategy for the sake of a strategy" because the procedure chosen does not lead to the creation of a really useful strategy, but rather to the creation of a comprehensive meaningless document. This project will use the available up to date scientific and research findings and practical experience to bring recommendations for innovation in the process of city and regional strategy development and to identify projects and activities where SMART technology can be used. If the strategy incorporates all the key elements, it will become an important tool, serving as a basis for assessing the feasibility of SMART projects, concepts and solutions for cities and regions**.**

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5.5.3 Link to the current research of the project partners

This part is elaborated jointly for all research plans at the beginning of chapter 5 of the Feasibility study.

5.5.4 Research Objectives, Activities and Results

Research plan and its objectives

The objective of the Research plan No. 4 is to research and propose ways and methods for verification of proposed SMART concepts and solutions to verify their feasibility before applying and implementing them in practice.

The purpose of this research program is to explore how to optimally validate proposed SMART solutions and concepts so that they can be verified in a phase before they are implemented. This sense is based on the assumption of efficient spending of public funds. Practice has shown that many projects and activities have been designed to address the selected problem and have the potential to achieve a positive social impact, but the feasibility of the concept or project has not been verified. Therefore, project had to be adjusted during its implementation, the costs and other parameters associated with it were changed, or even eventually ended with loss. It is precisely this failure that can be avoided by using methods that can test feasibility of a given concept or solution even before the investment phase. A number of methods and tools to be explored can be used for this verification.

Verification of project's feasibility in its pre-implementation phase may have several types of conclusions, none of which are "incorrect":

- The proposed project, concept or solution is feasible in its proposed form.
- Proposed project, concept or solution is feasible in proposed form, but there is a potential for its further adjustments.
- Proposed project, concept or solution is not feasible in its proposed form, however there is a potential to further adjustments.
- Proposed project, concept or solution is not feasible in its proposed form.
- Feasibility of the proposed project, concept or solution can not be assessed.

Here, even the negative result of the feasibility assessment is positive for the company, because it helped to save project spending at the time before its implementation was started. It is the pre-implementation phase of the project that is typically characterized by the fact that the investment expenditures are relatively low and the possibility of influencing the form of the project is high. As soon as the implementation phase begins, this ratio begins to diminish, and after a certain time, it is reversed so that the possibility of influencing the form of the project is very low, while already invested expenditures are high.

The main goal of RP 4 will be achieved through the achievement of six partial targets (similarly to other RPs) that are linked to the individual partial activities:

I. To carry out a detailed analysis of available tools, methodologies and procedures to assess the feasibility of projects, concepts and activities in general and specifically on the use of SMART technologies.

II. To perform research among relevant entities and experts on the current state of and other needs in assessing feasibility of concepts, projects and solutions based on SMART technologies.
    a. on the demand side - especially municipalities, cities, regions, public institutions, etc.,
    b. on the supply side - companies offering SMART solutions and products,
    c. research organizations, universities and support organizations standing between the two groups.

III. Process and evaluate acquired knowledge and information into a set of structured knowledge.

IV. Define individual tools, methodologies and procedures that can be used to experimental verification of proposed SMART concepts and solutions and evaluation of its feasibility.

V. To verify experimentally at TRL 3 level defined tools, methodologies and procedures to experimental verification of proposed SMART concepts and solutions and evaluation of their feasibility on the examples from energy, saving, transport and mobility, health and care, learning and education:
    a. There will be 14 specific model examples that were already defined.

b. Further examples will be added based on the current process and needs of the project.

VI. Finalize and complete tools, methodologies and procedures for experimental verification of proposed SMART concepts and solutions and evaluation of their feasibility. Further formulate final recommendations and suggestions for further research and application.

The need to solve the research plan

This subchapter follows the part above that describes the potential for further development and production of applicable R & D results and further it extends and defines specific examples and areas of need for tools, methodologies and procedures for experimental verification of proposed SMART concepts and solutions and evaluation of their feasibility.

This research plan No. 4 aims to define specific tools, methodologies and procedures to help answer the question of how to optimally verify proposed SMART concepts and solutions and their feasibility. In practice, it should be ensured that if the local government or state administration is in the phase before applying some of the selected SMART technologies or their set (e.g. through an innovative SMART project), their need, meaningfulness and social effectiveness have already been analysed, it should necessarily have tools to verify the feasibility of proposed SMART solutions, concepts or projects.

Therefore, within this research plan, such tools will be defined on the basis of up-to-date scientific research knowledge and good practice of existing methods. It is expected that the own model of verification and evaluation of feasibility of the SMART concept or solution will be developed, which will be based on available knowledge from theory and practice. As mentioned above, without a proper assessment of the feasibility of the SMART project, there could be an unnecessary risk of a failed application of SMART concept or solution, recommended and proposed measures could fail in the implementation or operation phase.

The need to implement this research project demonstrates the demand for these tools from practice. A model example is represented e.g. by the city of Pardubice, which has signed up for the preparation of SMART City concept - an intelligent city. The concept has been aimed at ensuring the functioning of the urban ecosystem through modern technology, making it as simple, environmentally friendly and energy efficient as possible. The partner should be SMART City Point, Pardubice. The basic idea behind the established co-operation is the fact that technological progress should be used to solve the problems that local governments normally encounter: insufficient flow of the transport system, excess emissions, the energy demand of many objects and, as a consequence, the threat to the environment. It is therefore necessary to evaluate all aspects and direct activities towards comprehensive improvement in all areas. Discussion on the development of an intelligent parking system, bicycle sharing, bike charging stations etc. is underway This is all presented as a visualization of the so-called "SMART City Point Park", which will open to the public and serve as a demonstrator of these modern technologies. It is just this step that should be followed by the phase of feasibility assessment, because many solutions or concepts seem very interesting, even if they have clearly overwhelming social benefits, but when it comes to their realization, the reality may be

completely different, the measure can not be realized according to the original idea or its operational phase is not in harmony with expectations.

Partial activities leading to the achievement of the objectives

In terms of its concept, the implementation of partial activities under Research plan No. 4 is similar to the other RPs, it breaks down in total to 6 partial activities, their structure and indicative timetable is shown in the following table:

Indicative timetable for partial activities:

Partial activity:	2018			2019				2020				2021				2022			
1 - Detailed analysis of available tools, methods and procedures																			
2- Surveys among relevant entities and experts																			
3 - Processing and evaluation of acquired inputs																			
4 - Design and creation of tools, methods and procedures																			
5 - Cross-sectional experimental verification of tools, methods and procedures: 14 defined validations																			
5 - Cross-sectional experimental verification of tools, methods and procedures: further approx. 5 validations																			
6 – Final modification and finalization of methods, tools and procedures and formulation of recommendations																			

Partial Activity 1: Detailed analysis of available tools, methods and procedures

The purpose of this partial activity is to make a detailed summary of relevant scientific-research and practical knowledge of available methodologies, tools, techniques, methodologies and models to be used for verifying the feasibility of SMART concepts and solutions in these two points of view:

- General point of view: what methods, tools, techniques, methodologies and models exist in general and what are their strengths and weaknesses.
- Specific point of view in relation to SMART technology - what are the specific methods, tools, techniques, methodologies and models to evaluate the feasibility of concepts and solutions based on SMART technologies.

In essence, this will be a secondary data analysis in the form of a "desk research". An analysis of the state of knowledge will be based on the following available sources of information:

- Professional publications in scientific journals (databases).
- Studies and reports by renowned national and international institutions.
- Specialized journals and publications.
- Practical methods, tools, techniques, methodologies and models published on the Internet.

The output of this partial activity will be a structured, detailed summary of knowledge in a given field serving as an input for further partial activities.

Partial activity 2: Surveys between relevant subjects and experts

The purpose of this partial activity is to get a current overview of the actual status and ways of assessing and evaluating the feasibility of both general projects and activities and specifically in relation to the SMART topic on a defined sample of respondents. Research will be conducted on the demand side (in particular, municipalities, cities, regions, public institutions, etc.), on the supply side (companies offering SMART solutions and products) and between the two groups standing organizations (research organizations, universities and support organizations). The point is to get an insight into the issue from all relevant groups. In particular, the following three data collection tools will be used in the research:

- Quantitative research through a structured questionnaire.
- Focus group with the participation of invited experts.
- Semi-structured interviews.

The output of this partial activity will be a structured summary of the findings that will describe the current state of use of methods, tools, techniques, methodologies, and models for assessment of feasibility of (SMART) concepts and solutions among defined subjects and experts.

Partial activity 3: Processing and evaluation of received inputs

The purpose of this third partial activity is to further process and evaluate the information and outputs obtained within partial activities No. 1 and No 2. Activity will be divided into two partial steps:

- Synthesis of data and information - the acquired knowledge will be summarized and classified into logical sets of knowledge.
- Abstraction of data and information - the acquired knowledge will be categorized and divided into several categories according to their significance.

The output of this third partial activity will be a compiled and categorized summary of knowledge that will then enter into another partial activity.

Partial activity 4: Design and creation of tools, methodologies and procedures to evaluate feasibility

The purpose of this partial activity is to define individual tools, methodologies and procedures based on the organized and evaluated set of knowledge to evaluate the feasibility of SMART concepts and solutions of cities and regions. The following methods will be used to design methods and tools:

- Induction and deduction - Based on the acquired knowledge, individual methods and tools will be defined.
- Analogy - based on more generally defined methods and tools, they will be further adapted and specified for use in the field of SMART technologies.

The output of this fourth part will be a preliminary set of proposed tools, methodologies and procedures that will serve to evaluate and assess the feasibility of SMART-based concepts and solutions for cities, regions and municipalities. This file will be further validated within the partial activity 5.

Partial activity 5: Cross-sectional experimental verification of methods and tools

Cross-sectional experimental and model verification is common across all research plans. Each research plan will therefore always address only part of its experimental and model verification that is relevant to the research plan. **A full description of the cross-sectional experimental verification is given in the description of research plan No. 1 - see Partial activity 5 described in RP 1.**

Partial Activity 6: Final adjustments and completion of tools, methodologies and procedures to evaluate feasibility and formulation of recommendations

Purpose of partial activity No. 6 is to adapt and complete proposed tools, methodologies and procedures to evaluate feasibility on the basis of outputs and recommendations from experimental and model verification. The result and output of partial activity No. 6 will be a set of tools, methodologies and procedures for experimental verification of proposed SMART concepts and solutions and evaluation of its feasibility. In its essence, it will be the main output of the entire research plan No. 4.

Partner Involvement and Collaboration Development

Guaranteeing partner of the research plan No. 3 will be foreign research partner Fraunhofer IAO, who will be responsible for the implementation of all partial activities. In the research activities will also be involved workers of the University of Ostrava and BeePartner, who will also participate in the implementation of partial research activities within RP 3.

Specific component is partial activity No. 5 Cross-sectional experimental verification of tools, methods and procedures, the description of which is consistently presented for all research plans within the description of Research plan No. 1. **Also, the description of the involvement and cooperation of the partners within this partial activity is common across all research plans and is given in the chapter of Research Intention No. 1 - for description of partner involvement, see RP 1.**

Results and outputs of the activity

The main quantifiable results and outputs are listed in the table below. It is assumed in connection with RP 4 the creation of at least 2 professional publications, of which at least 1 will be in co-operation with enterprises and at least both of them with foreign co-authorship.

Other outputs will include 1 x proven and finely-tailored set of tools, methodologies, and procedures for experimental verification of proposed SMART concepts and solving and evaluation of their feasibility. The logic of this output is the same as in Research plan No. 1. This tool will serve municipalities, cities, regions and other actors as a comprehensive tool to evaluate the feasibility of SMART projects, activities, concepts and solutions.

The last type of outputs will be 14 + 5 case studies demonstrating each experimental verification.

It will be a cross-sectional result of all five research plans, but with regard to the clarity it is reported only within the outputs of Research plan No. 1.

Results and outputs of activity	**Target Value of the Project Implementation**
indicator: 2 02 11 Publications created by supported entities (selected types of documents)	2
indicator: 2 02 13 Publications in co-authorship of research organisations and enterprises (selected types of documents)	1
indicator: 2 02 16 Publications in co-authorship with researchers from abroad created by the supported entities (selected types of documents)	2
indicator: 2 20 11 International patent applications (PCT) created by supported entities Note: International patent application will be a cross-sectional output of all Research plans, but with regard to the clarity it is reported only here for RP 1	0
Other result that is not reflected in MIs: possible partial outcomes of implementing the activities are the results, which are defined according to the Definitions of types of research and experimental development results for the RIV database. (O - other results - these are 14 + ca 5 case studies describing each experimental verification. This will be the cross-sectional result of all five Research plans, with regard to the clarity it is reported only here for IR1)	0
Other result, which is not reflect in indicators. (O - Other Results - This is a verified and finally modified set of tools, methods and procedures for analyzing needs, opportunities and readiness of cities and regions to implement solutions and concepts based on SMART	1

technology	

5.5.5 Research Team

This part is elaborated jointly for all research plans at the beginning of chapter 5 of the Feasibility study.

5.5.6 Procured infrastructure and equipment and their necessity and utilisation

Procurement of equipment is mentioned only for RP 1 and RP3 but it will serve across all RPs, especially in the framework of experimental verification and implementation of research in defined RPs.

5.6 Research plan – Ex-post analysis of concepts and solution – RP 5

5.6.1 Abstract

The objective of research plan No. 5 (RP 5) is to examine the methods and procedures for the implementation of the ex-post analysis (post audit) of the proposed SMART solution and concept in order to learn from its implementation and for the need to adjust the input assumptions and parameters for the analytical, design and evaluation part of the preparation of these concepts and solutions

The purpose of this research program will be research of often neglected ex-post analysis and its use in backward assessments of already implemented projects based on SMART solutions and concepts. This analysis will focus in particular on the future and will help to learn from already implemented projects so that other projects based on SMART concepts and solutions will bring even more significant improvements in the quality of life.

The course of the solution will be similar to that of other RPs. In the framework of partial activities, a detailed analysis of available methods and procedures will be carried out first, complemented by research among relevant subjects and experts. On the basis of the documents obtained, the inputs are processed and evaluated, leading to the design part, which will define the individual methods and procedures for the implementation of the ex-post analysis of the implementation of the proposed SMART solution and the concept. Subsequently, as in the case of the next four RPs, the crucial role will play cross-sectional experimental verification of these proposed methods, tools and models on 14 already defined examples of energy and savings, transport and mobility, health and care, learning and education. Within the project, these 14 model examples will be further expanded by other examples on the basis of current knowledge and needs. This cross-sectional verification is common to all RPs, within each RP only a sub-part of the experimental verification will be

implemented. The last step will be the final modification and finalization of methods and procedures based on SMART solutions and concepts and formulation of recommendations for their further use.

The output of RP 5 will be a set of tools, methodologies and procedures for ex-post analysis of already implemented SMART solution and concept.

5.6.2 Current state knowledge

Current state knowledge

As part of the ex-post analysis (or project post-audits), which is not commonly used for applied solutions, the real impact and outcome of concepts and solutions are evaluated in order to acquire better knowledge and adjust the parameters for optimised concept assessment, and also to evaluate the benefits and costs actually achieved by the project.

As this is rather a marginal topic, it is quite difficult to find relevant applicable concepts in published materials.

According to available literature, post-audits of investment projects are an important tool for learning from mistakes and successes in the preparation and implementation of investment projects (Fotr, Špaček, Švecová 2009, p. 633). The objective of these audits is a factual and most accurate analysis of project implementation at all its stages, and the identification of all the possible factors that caused the project to deviate from the planned objectives (Scholleová 2009, p. 241). The aim is to find and identify deviations from the plan, to find their causes and to make recommendations for future project implementation. It is not, therefore, an instrument for finding and punishing the guilty party responsible for a possible failure. Post-audits should focus, in particular, on the assessment of these aspects (Fotr, Švecová, Špaček 2009, p. 639):

- concordance of the implemented investment project and the strategic focus of the company,
- compliance of the basic prerequisites with the reality for the realization of the project,
- correspondence of the expected economic outcomes and economic indicators with the actual results,
- identification of the causes of successes and failures,
- methods of solving possible emergency scenarios.

The key premise for the successful post-audit is an information base to be referred to. The most important part represents the project documentation of all phases of the project. In an ideal case, a post-audit is already an integral part of the organization's controlling processes. Consequently, the extent of the documentation and its requirements is already known in advance so that it can be carried out. As an example, the following key components have been identified for the successful post-audit of a project aimed at revitalizing Pverbed (Down, Kondolf 2002, 479):

- Assessment criteria for success of the project - setting clear criteria for the success of the project in the pre-investment phase.
- Initial survey - physical survey of the initial state of the project.
- Reasoning Proposals - linking post-audit to the achievement of the project goals.

- Project documentation - existing high quality technical and project documentation.
- Post-Project Survey - physical survey of already implemented project.
- Additional historical data –concerning the project surroundings.
- Secondary analysis - analysis of available documents.

Another possible problem in the implementation of post-audit can be soft factors, mainly based on the willingness and attitudes of employees of the organization, to cooperate in post-audit. When conducting a post-audit, it is also necessary to choose an approach that is not burdened by routine and customary habits. Ideally, an out-of-the-box way of thinking should be applied in order to seek the solution to the problem from viewpoint of the whole, rather than its parts.

Costs incurred to implement a properly conducted post-audit should be perceived as an investment in the realization of prospective projects, which should return over time, rather than as an additional cost to the audited project. As an example, British Petroleum gained the following four key benefits and improvements from the introduction of post-audits (Gulliver 1987, p. 130):

- more accurate cost appraisal and estimation for individual projects,
- better anticipation and mitigation of risks,
- more reliable selection and evaluation of suitable suppliers and partners,
- general improvement in project management.

Procedure for post-audit implementation

There is a logical pattern of post-audits that should be adhered to in their implementation. The first step should be the initial assessment of the success of the project as a whole. It is therefore an assessment of how the project helped to fulfil the organization's strategy or achieve the planned economic results.

The next step is to select and analyse risk factors in the pre-investment phase of the project. In particular, it is examined whether all the key risk factors have been identified, the assessment of the accuracy of the risk factors estimation and the identification of the causes of the deviations in relation to their possible suggestibility by the institution.

The third step is the assessment of crisis management plans for the implementation and operational part of the project. In particular, it is examined whether these plans were developed, whether the plans so created corresponded to the relevant plans, the degree of actual implementation of these crisis management plans and the effects they had on the project.

The last step focuses at the causes of the failures. As part of this step, the degree of difference from the expected status in relation to the project goal and its ongoing processes is examined. When using the causal analysis, it is necessary to find and identify the actual causes of the deviations. The end result of the entire post-audit should be a summary of the outcomes of the recommendations, which should prove useful for the preparation and implementation of future projects. Individual recommendations should address, in particular, the quality of preparation in the pre-investment phase, the assumptions about key variables, the selection of information resources and their processing, the choice of methodology used in accordance with the project objectives and the management of implementation and timely response processes (Scholleová, 2009, p.243).

Therefore, it concerns both the area of project management and the recommendations related to the individual phases of the project.

Post-Audit in State Administration and Local Government

There are no specific laws or ordinances required by state administration or local government (except of the general legal norms listed in Chapter 8) that would prescribe institutions to implement post-audits and define their process. It is therefore the role of each individual institution to implement their post-audit system into their structure. Ideally, an internal directive, standard, or methodical guideline is developed to define the importance of post-audit and its implementation process. However, the preferred option is that such a document relates to the preparation, implementation and retrospective assessment as a whole entity (e.g. a comprehensive investment standard) and post-audits are its integral components. These internal standards should comprise particular elements to facilitate their effective implementation (Kalouda, Mech, Voluntary 2007, p. 86). These include:

- proper logic structuring,
- definition of valid legislation the standard refers or relates to,
- definition of key concepts,
- establishing the methodology of the procedures and describing these procedures within the scope of the necessary measures,
- identifying competencies, obligations and responsible people who will be responsible for the commissioning, approval, implementation, checking and documentation of individual operations,
- schedules and procedures for updating the standard,
- appointment of a person responsible for supervision and compliance with the standard.

Examples of system post-audits of projects in state administration

In addition to the partial post-audit of investment projects, which ought to be implemented by individual institutions mainly for learning purposes, there are two important areas of post-audit in the Czech Republic, which, unlike the above-mentioned, show more systemic features. These include mandatory evaluations when implementing the operational programs, and the activities of the Supreme Audit Office.

I. Evaluation under Operational Programs

The evaluation of the operational programs is required by the European Commission, the body responsible for their implementation is the Ministry for Regional Development. These evaluations are performed either ex ante, concurrently, ex post or ad hoc, that is at all stages of implementation. These evaluations have a clear methodology and topic areas to be addressed (e.g. monitoring indicators, discrepancies, sustainability, calls, administrative capacity, etc.). However, these are not post-audits of investment projects in the true sense, as their purpose is to evaluate expenditure programs as a whole or as their sub-parts, but not individual projects themselves. The nearest to post-audits are impact evaluations that assess the impact and achievement of the objectives of a group of projects. The responsibility of the Ministry for Regional Development and other entities in

the implementation structure is to respect the results of these post-audits and follow relevant recommendations. Theoretically, the whole system ought to lead to the improvement in the allocation of funds through operational programs.

II. Supervisory activity of the Supreme Audit Office

The second specific area of post-audits is the activity of the Supreme Audit Office (SAO), which is defined by Act No. 166/1993 Coll., On the Supreme Audit Office. In the course of its activities, the SAO performs a number of inspections of investment projects and, in apart from formal and legislative errors, it also examines the effectiveness of the funds spent. Nevertheless, the level of enforcement of the liability for ineffective handling of funds is so low, that the Office's work is often reduced to only a formal level, though the SAO audit conclusions are very substantive and the recommendations given there are very meaningful. It is in fact the exact fulfilment of the role of post-audits by the SAO, which is only occasionally acted upon by the supervised institution, as evidenced by reoccurring mistakes in the annual reports (e.g. recurrent errors in ICT projects).

Evaluation as a further methodological approach for ex-post analysis

Kromrey (2001), in his text, deals with the concept of evaluation, or its definition, methodology of evaluation and, above all, formulates battery recommendations for its practical implementation.

He points out that evaluation is a highly complex method that must be used in accordance with clearly established principles and rules.

The book by Voogd (1982) has become one of the widely accepted sources of evaluation in the field of (spatial) planning, as evidenced by its high quote. The author focuses primarily on the following. Firstly, he focuses on the basic principles of multi-criteria evaluation, including the evaluation of its up to now use in urban and regional planning practice. Secondly, he discusses methods and techniques of multi-criteria evaluation in relation to their relevance to urban and regional planning. He also focuses on the rationale and explanation of the strengths of the multi-criteria evaluation for the needs of practice

The book titled Evaluation in Planning: evolution and prospects edited by Alexander (2006) analyses and evaluates evaluation in the context of planning. In a total of 14 chapters are discussed and studied different perspectives of the evaluation process on the example of concrete projects of an urban character or in relation to sustainable development

In a book edited by Stockmann (2007), the authors offer in particular practical recommendations for the implementation of the evaluation. Different evaluation tools and examples of their use can be used both by the contracting authority and, above all, by the evaluators in its design, planning and implementation.

To the concept of evaluation are even devoted separate journals. A valuable and inspiring source for evaluation of strategies, concepts, and specific policies or projects, is the journal Evaluation Theory and Practice, which is the only professional journal in the Czech Republic, that systematically deals with evaluation issues.

Similarly, Zeitschrift für Evaluation journal is fully devoted to evaluation issues from various branch perspectives. Another valuable resource is the Evaluation magazine, which was founded in 1995 and is published by the prestigious publishing house SAGE. The main objective of the magazine is to strengthen the theory, methodology and practice of evaluation, and it is an interdisciplinary oriented journal. Journal Evaluation and Program Planning (Elsevier), which is again of an interdisciplinary nature, can not be overlooked in this area, however, there is more emphasis on planning issues or the journal Research Evaluation (Oxford Academic).

Potential for further development and production of applicable R & D results

Given the above-mentioned information, ex-post analyses or post-audits are not a frequently used tool. If the post-audit is performed, it is usually for ad-hoc use that is not systemic. As more and more resources are spent on the implementation of projects, concepts and solutions, the implementation of post-audits becomes fundamentally justified. The potential for further knowledge enhancement can be seen mainly in the following areas:

- Systematization of the use of ex-post analyses - the project will contribute to post-audits becoming essential part of the system within the scope of state administration and local self-government projects. Relevant institutions will acquire tools, procedures and methods that will enable them to implement a systematic approach to ex-post analysis of SMART concepts and solutions, taking into account their specificities.
- Adaptation and design directly for SMART concepts and solutions - within the project there will be developed comprehensive methodologies, tools and procedures that will be directly tailored for the need to implement ex-post analyses of SMART projects, concepts and solutions. They will therefore involve all the specifics that concern the SMART area.
- Overlapping of tools, methodologies and procedures for other "non-SMART" projects and activities - since the area of post-auditing is not particularly prioritised by state administration bodies and local governments, the project can also expect a positive overlap with other projects and activities that are not SMART based. In other words, the implementation of the project will help relevant institutions to integrate and use post-audits for other projects and activities without a link to SMART.
- Utilization outside government and self-government - the acquired knowledge will be relevant to other non-governmental and local governmental entities that are involved in planning and implementing SMART concepts and solutions. These are, in particular, technology companies, research organizations, and non-governmental non-profit organizations that represent both the supply and demand side of SMART concepts and solutions.

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5.6.3 Link to current research of the project partners

This part is elaborated jointly for all research plans at the beginning of chapter 5 of the Feasibility study.

5.6.4 Research Objectives, Activities and Results

Research plan and its objectives

The main objective of the Research plan No. 5 (RP 5) is to research methods and procedures for the implementation of ex-post analysis (= post-audit) of implementation of the proposed SMART solution and concept in order to learn from its realization and for the necessary adjustments of the input assumptions and parameters for the analytical, the design and evaluation part of the preparation of these concepts and solutions.

Purpose of this research program will be research of often neglected ex-post analysis and its use in retrospective assessments of already implemented projects based on SMART solutions and concepts. This analysis will focus in particular on the future and will help to learn from already implemented projects so that other projects based on SMART concepts and solutions bring even more significant improvements in the quality of life.

Within the use of retrospective assessment of already implemented interventions, there will also be verified set of proposed composite indicators. In the end, it will be possible to identify (from macro and micro points of view) resources and barriers to territorial competitiveness just in connection with the use or non-use of SMART solutions. This will make it possible to determine which indicator is effective or inefficient. The output will be areas where with the help of SMART solutions can be suggested recommendations leading to improvement of the quality of life, not only in a comprehensive but also in a partial way. At the same time, it will be possible to declare additional public administration tasks in the area of smart solutions that will lead to cost optimization and thus reduce public administration spending to eliminate negative effects when not using SMART solutions. These measures can be used in a modified form also for other levels of territorial units.

As part of their use for the learning process, the possibilities of implementing the so-called differential analysis will be explored. It makes it possible to compare the whole process of identifying needs, opportunities and readiness, ways how to design solutions, how to assess social effectiveness, and a specific approach to assessing the feasibility of a particular implemented concept or solution. Historical data will be compared with the same procedure, but only after the implementation of the project. The result will be two sets of information where, based on the differential analysis, can be identified deviations, sources of these deviations and their reason. Based on this difference analysis, will be proposed modification of the whole process of preparation SMART concepts or solutions so

that their utilization corresponds as much as possible to the real situation within the implementation and operational phases.

The main goal will be achieved through the achievement of six partial targets (similarly to other RPs) that are linked to the individual partial activities:

I. To carry out detailed analysis of available methods, tools, techniques, methodologies and models to be used for ex-post analysis of already implemented solution and concept in general and specifically on the use of SMART technologies.

II. To perform research among relevant entities and experts on the current state of and other needs in using tools, methodologies and procedures used for ex-post analysis of already implemented SMART solutions and concepts. There will be three groups of subjects and experts:

    a. on the demand side - especially municipalities, cities, regions, public institutions, etc.,
    b. on the supply side - companies offering SMART solutions and products
    c. research organizations, universities and support organizations standing between the two groups.

III. Process and evaluate acquired knowledge and information into a set of structured knowledge.

IV. Define individual tools, methodologies and procedures that can be used to ex-post analysis of already implemented SMART solutions and concepts.

V. Experimentally, at TRL3 level verify defined creative methods, tools, techniques, methodologies and models for energy, saving, transport and mobility, health and care, learning and education cases:

    a. There will be 14 specific model examples that were already defined.
    b. Further examples will be added based on the current process and needs of the project.

VI. Finalize and complete set of tools, methodologies and procedures for ex-post analysis of already implemented SMART solutions and concepts. Further formulate final recommendations and suggestions for further research and application.

The need to solve the research plan

This subchapter follows the part above that describes the potential for further development and production of applicable R & D results and further it extends and defines specific examples and areas of need for tools, methodologies and procedures for ex-post analysis of already implemented SMART solutions and concept.

The necessity is evidenced by this assumption in practice. In case of successful application of all parts of the project intention, the project will be implemented and all objectives will be met (i.e., the project is implemented without deviations). If this unique phenomenon occurs, ex-post analysis usually no longer makes any sense. However, in real practice, this is rather the opposite and both positive and negative deviations from the original plans and assumptions are associated with almost

all projects. Therefore, at this moment, it makes a significant sense to do the postaudit of the project.

As part of the ex-post analysis, all the steps that will be taken will need to be evaluated and defined the level of the success of the measures, procedures and criteria applied. Use of ex-post analysis, resp. its results will serve as a methodical basis for other projects for the implementation of successful projects, concepts and solutions, or as a learning tool for avoiding bad examples.

The necessity of solving this research plan is also given by the responsible approach of self-governments and state administration for the future, which allows to learn and repeat only effective SMART solutions and thus to improve the quality of life in the implemented areas. If there was no tool kit for this phase, it would be difficult to evaluate the real impact of projects on the affected areas of human life. This phase is particularly necessary in a situation where practice shows that there is not a large amount of complex and successful (i.e. without significant negative deviations) of implemented projects and the data from these realizations can be key to finding good practice in the territory and concepts of further development so that it was possible to set parameters for more optimal use in future SMART concepts and solutions.

The need can also be demonstrated by a concrete example from practice. The new SMART city polygon centre in Plzeň, opened in 2017, is an application that saves money for public lighting, parking or buildings security. Currently are in polygon installed solutions for smart parking, various types of electric vehicle charging stations, VW eGolf, CNG filling stations, camera systems, smart public lighting, perimeter protection by drones and SMART City managing system. These examples also help to evaluate and prepare tools for assessing effects and impacts. In fact, there are too few comprehensive examples in the Czech environment that would allow effective evaluation in the complexity of the problem. With the gradual expansion of concepts, this tool will be more effective. It is now possible to work on this project within the Morgenstadt network, where real impacts can be evaluated and cities and representatives of other municipalities use them, or draw on foreign realizations and experiences. Within this project, an ex-post analysis of how much the implementation of the operational part of the project differs from the assumptions previously identified will play a crucial role.

Partial activities leading to the achievement of the objectives

In terms of its concept, the implementation of partial activities under Research plan No. 5 is similar to the other RPs, it breaks down in total to 6 partial activities, their structure and indicative timetable is shown in the following table:

Indicative timetable for partial activities:

Partial activity:	2018			2019				2020				2021				2022			
1 - Detailed analysis of available tools, methods and procedures																			

2- Surveys among relevant entities and experts																		
3 - Processing and evaluation of acquired inputs																		
4 - Design and creation of tools, methods and procedures																		
5 - Cross-sectional experimental verification of tools, methods and procedures: 14 defined validations																		
5 - Cross-sectional experimental verification of tools, methods and procedures: further approx. 5 validations																		
6 – Final modification and finalization of methods, tools and procedures and formulation of recommendations																		

Partial Activity 1: Detailed analysis of available tools, methods and procedures for ex-post analysis

The purpose of this partial activity is to make a detailed summary of relevant scientific-research and practical knowledge of available methods, tools, techniques, methodologies and models to be used for ex-post analysis (=postaudit) of the implementation of proposed SMART solution and concept in these two points of view:

- General point of view: what methods, tools, techniques, methodologies and models exist in general and what are their strengths and weaknesses.
- Specific point of view in relation to SMART technology - what are the specific methods, tools, techniques, methodologies and models for e-post analysis of concepts and solutions based on SMART technologies.

In essence, this will be a secondary data analysis in the form of a "desk research". An analysis of the state of knowledge will be based on the following available sources of information:

- Studies and reports by renowned national and international institutions.
- Specialized journals and publications.
- Practical methods, tools, technique, methodologies and models published on the Internet.

The output of this partial activity will be a structured, detailed summary of knowledge in a given field serving as an input for further partial activities.

Partial activity 2: Surveys between relevant subjects and experts

The purpose of this partial activity is to get a current overview of the actual status and implementation of ex-post analysis of both general projects and activities and specifically in relation to the SMART topic on a defined sample of respondents. Research will be conducted on the demand side (in particular, municipalities, cities, regions, public institutions, etc.), on the supply side (companies offering SMART solutions and products) and between the two groups standing organizations (research organizations, universities and support organizations). The point is to get an insight into the issue from all relevant groups. In particular, the following three data collection tools will be used in the research:

- Quantitative research through a structured questionnaire.
- Focus group with the participation of invited experts.
- Semi-structured interviews.

The output of this partial activity will be a structured summary of findings that will describe the current state of use of methods and procedures for realization of ex-post analysis of implemented SMART solutions and concept and solutions among defined subjects and experts.

Partial activity 3: Processing and evaluation of received inputs

The purpose of this third partial activity is to further process and evaluate the information and outputs obtained within partial activities No. 1 and No 2. Activity will be divided into two partial steps:

- Synthesis of data and information - the acquired knowledge will be summarized and classified into logical sets of knowledge.
- Abstraction of data and information - the acquired knowledge will be categorized and divided into several categories according to their significance.

The output of this third partial activity will be a compiled and categorized summary of knowledge that will then enter into another partial activity.

Partial activity 4: Design and creation of tools, methodologies and procedures to evaluate feasibility

The purpose of this partial activity is to define a set of tools, methodologies and procedures for the ex-post analysis of already implemented SMART solutions and the concept of cities and regions based on the organized and evaluated set of knowledge. The following procedures will be used to design tools, methodologies and procedures:

- Induction and deduction - Based on the acquired knowledge, individual methods, tools, techniques, methodologies and models will be defined.
- Analogy - based on more generally defined methods, tools, techniques, methodologies and models they will be further adapted and specified for use in the field of SMART technologies.

The output of this fourth part will be a preliminary set of proposed tools, methodologies and procedures to ex-post analysis of implemented SMART solutions and concepts for cities, regions and municipalities. This file will be further validated within the partial activity 5.

Partial activity 5: Cross-sectional experimental verification of tools, methods and procedures

Cross-sectional experimental and model verification is common across all research plans. Each research plan will therefore always address only part of its experimental and model verification that is relevant to the research plan. **A full description of the cross-sectional experimental verification is given in the description of research plan No. 1 - see Partial activity 5 described in RP 1.**

Partial Activity 6: Final adjustments and completion of tools, methodologies and procedures to ex-post analysis and models and formulation of recommendations

Purpose of partial activity No. 6 is to adapt and complete the proposed set of tools, methodologies and procedures for ex-post analysis of already implemented SMART solutions and concept based on outputs and recommendations from experimental and model verification.

The result and output of partial activity No. 6 will be an experimentally verified and finely-adjusted set of tools, methodologies and procedures for implementing an ex-post analysis of the implementation of the proposed SMART solution and concept in order to learn from its implementation and for the necessary adjustment of the input assumptions and parameters for the analytical, the design and evaluation part of the preparation of these concepts and solutions. In essence, this will be the main output of the entire research plan 2.

Partner Involvement and Collaboration Development

Guaranteeing partner of the research plan No. 5 will be project partner BeePartner, Inc., who will be responsible for the implementation of all partial activities. In the research activities will also be involved workers of the applicant University of Ostrava and the partners Fraunhofer IAO and the Silesian University in Opava, the Faculty of Business and Entrepreneurship in Karviná, who will also be involved in the implementation of partial research activities within RP 2.

Specific component is partial activity No. 5 Cross-sectional experimental verification of tools, methods and procedures, the description of which is consistently presented for all research plans within the description of Research Plan No. 1. **Also, the description of the involvement and cooperation of the partners within this partial activity is common across all research plans and is given in this chapter of Research plan No. 1 - for description of partner involvement, see RP 1.**

Results and outputs of activity

The main quantifiable results and outputs are listed in the table below. It is assumed in connection with RP 5 to create at least 1 professional publication, of which at least 1 will be in co-operation with enterprises and at least 1 with foreign co-authorship.

Other outputs will include 1 x proven and finely-tailored set of tools, methodologies, and procedures for ex-post analysis of the already implemented SMART solution and concept. The logic of this output is the same as in Research plan 1. This set will serve municipalities, cities, regions and other actors as a comprehensive tool for post-audit of SMART projects, activities, concepts and solutions.

The final type of outputs will be 14 + 5 case studies demonstrating each experimental verification.

This will be a cross-sectional result of all five research plans, **but with regard to the clarity it is only reported in the context of the outputs of Research plan No 1.**

Results and outputs of activity	Target Value of the Project Implementation
indicator: 2 02 11 Publications created by supported entities (selected types of documents)	1
indicator: 2 02 13 Publications in co-authorship of research organisations and enterprises (selected types of documents)	1
indicator: 2 02 16 Publications in co-authorship with researchers from abroad created by the supported entities (selected types of documents)	1
indicator: 2 20 11 International patent applications (PCT) created by supported entities Note: International patent application will be a cross-sectional output of all Research plans, but with regard to the clarity it is reported only here for RP 1.	0
Other result that is not reflected in MIs: possible partial outcomes of implementing the activities are the results, which are defined according to the Definitions of types of research and experimental development results for the RIV database. (O - other results - these are 14 + ca 5 case studies describing each experimental verification. This will be the cross-sectional result of all five Research plans, with regard to the clarity it is reported only here for IR1)	0
Other result, which is not reflect in indicators. (O - other results - set of tools, methodologies and procedures for ex-post analysis of already implemented SMART solution and concept)	1

5.6.5 Research Team

This part is elaborated jointly for all research plans at the beginning of chapter 5 of the Feasibility study.

5.6.6 Procured infrastructure and equipment and their necessity and utilisation

Procurement of equipment is mentioned only for RP 1 and RP3 but it will serve across all RPs, especially in the framework of experimental verification and implementation of research in defined RPs.

6 PROFESSIONAL TRAINING MEMBERSHIP OF ORGANIZATIONS

6.1 Professional training of researchers, relate to the activities and focus of the project

The subject of this chapter is a description of the content of KA 10 - Professional training of researchers, related to the activities and focus of the project on SMART technology (j)

The main objective of KA is to support professional training of project researchers in areas related to the activities and focus of the project in order to increase their qualifications, knowledge and skills, and to use it all further within the implementation of research and other professional activities of the project.

Content and purpose of this activity will be further training of researchers, which will be realized mainly through specialized courses, trainings and other educational activities related to research activities - the theme of SMART technology. The aim will be to develop a team to support its R & D activities.

Training will be divided into three sections. The first is the individual participation of a worker in a foreign or domestic educational event. These include, in particular, training courses (see the appropriate foreign training courses at the end of this subchapter) and specialized conferences, exhibitions and fairs, where participation serves primarily to the training of project researchers (see the appropriate foreign conferences, trade fairs and exhibitions listed in subchapter 4.1 of Feasibility study). The purpose of this participation is to give the employee opportunity to extend his/her education in a particular parts related to the project. Worker who will participate in such activity will then have possibility to disseminate gained knowledge further among the other members of the research team.

The second section are group training events, which aim is to organize a tailored training event for more members of the project's research team according to their real needs. A lecturer or other specialist will be invited to this event to lead it. Educational event will have the form of a seminar or workshop realized directly by the applicant or partner.

The third section serving to support the training of team members is self-study based on purchased literature, information materials and access to specialised databases. It is expected that these materials will be purchased within the project and then will be available to the members of the research team.

All three above mentioned sections of education will be selected very effectively in relation to the specific needs of the project. It will always be considered whether it is better for a given education to send a worker to an educational event, organize a group event, or support knowledge development by the acquisition of self-study documentation.

Priority topics of education include particularly news from the area of SMART technologies and their application, support for strategic planning, economic and econometric models, creative tools, interdisciplinary and social aspects of technologies, etc. The specific topic will always be defined and specified during the project implementation.

Structured overview of partial activities and their quantification:

- Participation in a total of 30 foreign professional courses and educational activities.
- Implementation of 6 internal educational seminars focused on a selected educational theme with the participation of a professional lecturer or expert from practice.
- Participation in a total of about 20 international conferences, excursions and expert meetings to educate researchers and experts of the project.
- Participation in about 20 national conferences, meetings and trade fairs for the training of project staff.
- Acquisition of professional literature and access to databases.
- Other activities in accordance with the focus of this KA according to the current development and needs of the project.

Involvement of project team and partners in the implementation:

In this activity will be involved these workers, who will also be responsible for its implementation:

- Expert project leader,
- Expert leader KA 10,
- Researcher KA10.

For the implementation of the KA will be responsible project applicant OSU, which also has allocated funds for these activities in its budget. In the implementation of this KA will also be involved all other project partners from R & D organizations. Businesses partners will participate in this KA without compensation from project budget.

Outputs:

The main quantifiable outputs are listed in the table below. Other outputs will include outputs, materials and documentation from educational activities, attendance lists and minutes of the events, purchased literature and other process outputs of the activity.

Results and outputs of activity	Target Value of the Project Implementation
Other result, which is not reflect in the indicators: professional courses, trainings and similar educational activities that have a direct link to the research activities of the project. It is not long-term and lifelong learning. (These are realized internal workshops - educational seminars.)	5
Other result, which is not reflect in the indicators: professional courses, trainings and similar educational activities that have a direct link to the research activities of the project. It is not long-term and lifelong learning. (These are about 20 domestic and 20 foreign conferences, meetings and fairs serving to educate project staff.)	40
Other result, which is not reflect in the indicators: professional courses, trainings and similar educational activities that have a direct link to the research activities of the project. It is not long-term and lifelong learning.	30

(These are approximately 30 participants in foreign professional courses and training activities.)	

Types of suitable foreign training courses

The following overview shows types of suitable foreign training courses that are thematically focused on the field of SMART technology and related aspects. This is a preliminary overview, which will be gradually refined within the project, based on the current offer and need for the project. This is a preliminary overview, which will be gradually refined and updated within the project based on the current offer and need for the project. These educational activities will take place both within the EU and in priority countries that have a significantly developed area of SMART technology use (especially USA, Canada, Japan, Israel, South Korea, Australia, the UAE, China, Taiwan, Singapore, etc.).

Online course SMART CITIES

https://www.futurelearn.com/courses/SMART-cities

Cities are an incubator of innovation and opportunity but also face great challenges - rapid urbanization, climate change and inequalities. What role do people play in this change? The course helps to understand how to find the own way in the area of smart cities.

Summer School of Twente University SMARTCITIES

https://www.utwente.nl/en/education/summer-school-curiousu/courses/SMART-cities/

The aim of the course is to come to know many aspects of SMART cities, from city management to infrastructure, learn how to apply knowledge from both sides - technical aspects and city management in the development of smart technologies. The purpose of the participation is to work in groups and multidisciplinary teams.

CityLAB IV: City Aesthetics and Citizenship

https://www.uantwerpen.be/en/summer-schools/citylab-v-the-smart-city/

Five-day Summer School with an Interdisciplinary Approach to Urban Aesthetics and Citizenship organized by the Antwerp Institute for Urban Studies.

SMART Cities and Communities

https://www.shortcoursesportal.com/studies/131300/SMART-cities-and-communities.html

This is a summer course organized by Standford University, USA. The course focuses on the role of information technology, the improvement of operations and the sustainability of cities and communities, the sum of what a "smarter" city can be for the community, the role of IT in making the city smarter, including studies - water, energy, transport, urban design and sustainability.

IEEE European Summer School

https://SMARTcities.ieee.org/education.html

The event is organized by the IEEE SMART Cities Initiative, IEEE Italy Section, in collaboration with Industrial Engineering, University of Trento, Italy.

SMART Cities – Technologies and Institutions

http://phdcourses.dk/Course/54635#.WftfF9DiY2w

The subject of this course for doctoral students is technological solutions and development, business models and ecosystems for realization of visions in various SMART applications, topics related to technology standardization, security and privacy, facilitation of institutional structures.

SMART Cities

https://www.edx.org/course/SMART-cities-ethx-ethx-fc-03x-1

An on-line course aimed at understanding how data and information affect the design, sustainability and resilience of cities. The course focuses on urban architecture, shows how basic information on cities and city research is provided. It tries to answer questions, how educated people are affecting cities. Presented cities - Zurich and Boston - use the flow of information for change.

6.2 Membership in organizational platforms of consortia

The subject of this chapter is a description of the content of KA 11 - Membership in professional organizations, platforms and consortia (k)

The main objective of KA is to involve in national and international professional organizations, platforms and consortia in order to obtain up-to-date information, knowledge and other inputs useful for the implementation of the project, especially its research part.

Content of this activity will be the implementation of a membership that relates to the professional activities and the topic of SMART technology. Within the project, the analysis and the benefits of involvement in individual organizations, platforms and consortia will be carried out. Subsequently, entries into potentially beneficial organizations and clusters will be made.

Membership in professional organizations / platforms / consortia is key to the implementation of the research plan and will be an integral part of the project. In order to meet the objectives of the project, the exchange of knowledge of the target group in the interaction with international professional organizations will form an integral part of the implementation of project activities. The target group will be mainly the staff of the involved research organizations, who will directly participate in the implementation of the project activities or benefit from the implementation of the individual activities (other target groups of the project).

As part of the engagement, the goal will be to gain access to the latest knowledge and information from the field of SMART technologies, to establish and develop cooperation within mentioned organizations and, last but not least, to get feedback from the professional public on the implemented research and its outputs. Organizations themselves will also serve as one of the means to disseminate outputs and project results in synergy with KA 9.

Structured overview of partial activities and their quantification:

- Detailed analysis of the relevant professional organizations, consortia and platforms, on the basis of which appropriate organizations will be selected in accordance with the objectives and focus of the project.

- Engagement in membership in about 5 (x 4 years) organizations throughout the project implementation through institutional membership of R & D partners of the consortium or individual membership of individual project researchers.
- Participation in about 20 expert meetings and annual conferences of the given organizations.
- Using available materials, information, and know-how thanks to the membership in the given organization for the need of self-study of individual team members, and in direct relation to use within defined research.
- Acquiring new impulses and feedback to conduct research from individual members of the organizations.
- Systematic evaluation of the benefits of membership in these organizations, implementation of possible changes.
- Other activities in accordance with the focus of this KA according to the current development and needs of the project. Involvement of project team and partners in the implementation:

In this activity will be involved these workers, who will also be responsible for its implementation:

- Expert project leader,
- Expert leader KA 12,
- Researcher KA12,

For the implementation of the KA will be responsible project applicant OSU, which also has allocated funds for these activities in its budget. In the implementation of this KA will also be involved all other project partners from R & D organizations and businesses, in particular, they will benefit directly from the involvement in the organizations and provided professional materials.

Outputs:

The main quantifiable outputs are listed in the table below. Other outputs will include, in particular, materials, backgrounds and know-how gained thanks to the membership, minutes of meeting within the meetings and other process outputs of this KA.

Results and outputs of activity	Target Value of the Project Implementation
Other result, which is not reflect in the indicators: Planned Memberships (Annual membership in a selected organization - number of memberships per year.)	5
Other result, which is not reflect in the indicators: Planned Memberships (Number of attendance at expert meetings and annual conferences of the organizations.)	20

Types of suitable professional organisations, platforms and consortia

This list presents suitable Czech and foreign types of professional organizations, platforms and consortia. Within the project, based on a carried out detailed analysis of usefulness, this list will be further updated and supplemented, followed by selecting the organizations to be involved in.

CZECH SMART CITY CLUSTER

http://czechSMARTcitycluster.cz/

The mission of the Czech SMART City Cluster (CSCC) is to develop a unique partnership between companies, government, self-government, knowledge institutions and city citizens. Czech SMART City Cluster, z.s. has its headquarters in the Technology Center of Písek, where this project originated and where two of the founding members of the cluster have the headquarters at the same time. The purpose of the cluster is to increase the competitiveness and economic growth of its members at the market of SMART City technologies. The main tools of support are the transformation of knowledge of development and research into the environment of cluster members, the strengthening of connections to scientific-research and educational institutions, the joint development of know-how on social, technical and economic solutions and the popularization of the SMART Cities concept. The CSCC tries to stimulate investment and innovation in participating cities and regions, to achieve the basic economic and environmental goals of SMART Cities' idea. Cluster members focus on the integration of smart technologies, for example in the areas of energy, intelligent buildings, transport and information and communication technologies. As part of their projects, they transform traditional Isolated Infrastructure into highly integrated systems reaching all levels, from buildings and technological units, through municipalities to regions level and subsequently the state level.

SMART CITIES AND COMMUNITIES. THE EUROPEAN INNOVATION PARTNERSHIP ON SMART CITIES AND COMMUNITIES

http://ec.europa.eu/eip/SMARTcities/index_en.htm

European Innovation Platform for Smart Cities and Communities. It brings together cities, industry and people to improve urban life through sustainable, integrated solutions. This includes applied innovation, better planning and a more participatory approach, more efficient use of energy, better transport solutions, intelligent use of information and communication technologies. At present, there are approximately 3,000 partners. It issued the first draft of the Operational Implementation Plan and the Strategic Implementation Plan, which provides detailed examples of smart city solutions.

CIVITAS

http://civitas.eu

It is a network of cities and for cities dealing with cleaner and better transport in Europe. It was founded by the European Commission in 2002 and since then has tested and implemented over 800 transport measures and solutions in over 80 cities in Europe - the Living Lab. Knowledge gained through practical experience were transformed into a number of research and innovation projects (e.g. ECCENTRPC, PORTIS and DESTINATIONS). CIVITAS offers the opportunity to take part in innovative transport solutions and learn from experienced professionals. CIVITAS seeks political consensus, new solutions for the market, and offers opportunities for funding and exchanging experiences in an effort to create a growing, better connected and more sustainable transport.

EUROCITIES

https://eu-SMARTcities.eu/user/register

It is a network of large cities in Europe. It was founded in 1986 by the mayors of the six major cities. Currently, it brings together more than 135 major European cities from 39 countries (from the Czech Republic - Brno, Plzeň, Prague). Through the thematic forums (culture, economy, environment, knowledge society, mobility, social work), are brought together working groups, projects and activities to share and exchange experiences. The aim is to strengthen the role of local authorities.

GREEN DIGITAL CHARTER

www.greendigitalcharter.eu

The Green Digital Charter responds to the European Commission recommendation from 2009 on the use of Information and Communication Technologies to facilitate the transition to a more energy-efficient, low-carbon economy. Currently, the Charter is signed by nearly 50 major European cities. From 2011 to 2014, the association implemented the NiCE project, funded under the 7th Framework Program. Currently, the GuiDanCe project, funded under Horizont 2020 Program, to support the coordination and further development of the Green Digital Charter initiatives. The project will run until February 2018. The initiative is recognized by public, private and European stakeholders and perceived as a professional, excellent and innovative platform for local ICT actions to save energy and coordinated and sustainable progress.

WORLD SMART CITY COMMUNITY

https://www.worldSMARTcity.org/about-us/

A community of professionals discovering the most important factors of SMART cities. A wide network of professionals from around the world. Key themes: mobility, water resources, energy, cybersecurity.

International Society for Telemedicine and eHealth (ISfTeH)

https://www.isfteh.org/

The International Society for Medicine and eHealth directs the international dissemination of knowledge and experience in telemedicine and eHealth and provides access to world-class eminent experts in this field. Its philosophy and vision is: to promote and support the activities of telemedicine and eHealth throughout the world; primary umbrella for national telemedicine and eHealth organizations; assistance in setting up new national organizations; Non-governmental and non-profit organization with close links to WHO and ITU (International Telecommunication Union); Support for countries with lower socio-economic status in telemedicine and eHealth.

husITa – human services information technology association

www.husita.org

Membership is free of charge and its benefits are professional networking, participation in husITa projects and events, discounts on conferences and publications, including the Technology in Human Services (operated by HusITA).

The Campaign to End Loneliness
https://www.campaigntoendloneliness.org/support-us/

It is a network of organizations founded in 2011 to promote the independence of seniors living in their natural environment. The organization aims to develop services that prevent social isolation and loneliness of seniors. More information about organization and possible support and engagement.

7 PROJECT MANAGEMENT

Organizational and management structure of the project

Project will be implemented by the project consortium headed by the applicant, University of Ostrava.
Project team will consist of two partial teams and one co-ordinating committee:

1) The administrative-organizational team,
2) Expert team,
3) Project Steering Committee.

1) The administrative-organizational team

For the successful administrative-organizational implementation of the project is established project team consisting of project manager, financial manager, assistant and administrator who will ensure the project management and the necessary administration in accordance with the approved project, legal act and valid documentation for the Call. Each partner will also nominate its project coordinator who will collaborate with the project team of the applicant and the partner‘s staff involved in the project.

Part of the project administration will also be staff involved in the implementation of tenders, accounting, HR and other supporting activities, who will perform these activities in the framework of their core activities in the relevant organization.

On the part of research organizations, the following positions will be represented:

- Project Manager (OSU) - This is the main project manager and overall coordinator of the project and partner collaboration. Project Manager is responsible for management, coordination and administration of the whole project, particularly from an organizational and administrative point of view, directly closely cooperates with the Expert leader of the project. He/she is also responsible for the coordination of partners involvement in the project, especially from the organizational and administrative side.
- Project coordinator on the beneficiary's Side (OSU) - this is a coordinating worker on the beneficiary's side. This position was created due to the great organizational difficulty and complexity of the whole project. While the project manager will manage the project as a whole across the partners, coordinator on beneficiary's side will be responsible solely for the

coordination on the side of OSU across the three involved faculties university departments. The worker will be responsible for coordination of the project on the side of partners, particularly on the organizational and administrative level. He/she will be a partner for the project manager on organizational and administrative issues of the project.

- Financial Manager (OSU) - is responsible for the financial management of the project and the preparation of financial documentation in relation to the beneficiary, partners and grant provider.
- Project Administrator (OSU) - is responsible for the administrative side of the whole project and documentation in relation to OSU and grant provider, cooperates with the relevant administrative workplaces of the partners.
- Project Assistant (OSU) - helps Project manager with project management and coordination, is in charge of partial and supportive tasks for the need of management, coordination and administration of the whole project. He/she is helpful to all members of the expert team and Project Steering Committee, helping them with some topical tasks.
- Project Coordinator on the Partner's side (SLU) - it is coordinating worker on the partner's side. The worker will be responsible for project coordination on the side of the partner, particularly on the organizational and administrative level. He/she will be a partner for applicant's employees on organizational and administrative issues of the project.
- Project Coordinator on the Partner's side (VAVIA) - it is coordinating worker on the partner's side. The worker will be responsible for project coordination on the side of the partner, particularly on the organizational and administrative level. He/she will be a partner for applicant's employees on organizational and administrative issues of the project.
- Project assistant on the Partner's side (VAVIA) and Project Assistant on the Partner‘s side - CWS (VAVIA) - helps with the management, coordination and administration of the project on the partner‘s side, is in charge of partial and supportive tasks for the need of management, coordination and administration of the project on the partner‘s side. He/she is helpful to all members of the project team on the partner's side, helps them with partial topical tasks.

2) Expert team

For the professional part of the project (especially the activity KA 4), will be responsible Expert leader of the project (the main researcher) who together with the expert leaders of the five research plans and individual teams of researchers will jointly implement the research activities of the project leading to the fulfillment of the stated goals and obligatory indicators of project. Project leader will also coordinate the link of KA 4 with other project activities. Other project activities KA 2, 3, and 5 to 12 will also have professional coordinator who will be responsible for their implementation. In selected further activities will also participate partial researchers (according to the scope and complexity of the KA).

3) Project Steering Committee

It will be a committee outside the basic management structure of the project. This committee will be composed of managers of all partners (a total of 9 subjects) regardless of whether they have a work load units within the project or not. This committee will decide on strategic and conceptual issues of

the project, to its decision will be subordinated the implementation of the whole project. This committee will meet regularly as needed (2-4 times per year). Between the meetings of this committee, the highest authority of the project will be its expert leader doc. RNDr. Petr Rumpel, Ph.D.

Procedures and tools of project management

For the purpose of project management will be used also project management tools, which make project management significantly more effective and secured. For the work with documents and files will be used a shared SharePoint disk storage with secure DMS. For effective implementation will also be used Doodle planning tools, Skype video-conferencing and Cisco system, creative FlipBoard, etc.

For the purpose of the management itself, will be used templates and tools, which enable to manage the project efficiently and at the same time serve as a preventive tool for risk management. These are in particular product sheets, a detailed dynamic timetable, financial tables for reporting and control purposes, minutes of meetings, evidence of outputs, activities and documents, etc.

From a methodological point of view, good practice tools for project management will be used. Due to the nature and focus of the project they are especially tools of classical and agile project management, which in mutual combination reflect very well the dynamically changing development of the planned project and its outputs. Individual parts of the project will be implemented in several weekly sprints, whose aim always will be to contribute to the fulfillment of the defined goal and outputs and maximally enable team's concentration on predetermined partial tasks. Fulfillment of project goals and outputs will be continuously monitored and the whole concept of project management will enable the team to take timely measures that will eliminate the emergence of negative risks. Due to the environment where the project is being implemented (public university), project management tools will also be used, especially for the purpose of keeping proper documentation and reporting in the project.

Project management will be provided by workers who have sufficient experience and at the same time participate in foreign and domestic educational activities focused on project management.

Name and surname (for positions that have not yet been filled, give who "will be nominated")	**Type - excellent - key - ordinary member**	**Position in the team (leader, researchers, technician, etc.)**	**Work load during project implementation term The years below are calendar years and correspond to budget years of the project.**					
			2017	**2018**	**2019**	**2020**	**2021**	**2022**
will be nominated	Ordinary member	Project manager (OSU)	-	0,45	0,45	0,45	0,45	0,45
Ing. Eliška Kulová, Ph.D.	Ordinary member	Project coordinator on the Beneficiary's Side (OSU)	-	0,5	0,5	0,5	0,5	0,5
Pavla Janíková	Ordinary member	Financial manager (OSU)	-	0,4	0,4	0,4	0,4	0,4
will be nominated	Ordinary member	Project administrator (OSU)	-	0,2	0,2	0,2	0,2	0,2

will be nominated	Ordinary member	Assistant (OSU)	-	0,3	0,3	0,3	0,3	0,3
will be nominated	Ordinary member	Project coordinator on the Partner's Side (SLU)	-	0,05	0,05	0,05	0,05	0,05
will be nominated	Ordinary member	Project coordinator on the Partner's Side (VAVIA)	-	0,1	0,1	0,1	0,1	0,1
will be nominated	Ordinary member	Assistant on the Partner's Side (VAVIA)	-	0,1	0,1	0,1	0,1	0,1
will be nominated	Ordinary member	Assistant Project coordinator on the Partner's Side CWS (VAVIA)	-	0,1	0,32	0,32	0,32	0,32

Qualification prerequisites for unfilled position. State for positions you plan to fill by excellent and key personnel and leaders.	
Staff member position	**Qualification prerequisites**
Project manager	This position requires a worker with a university degree at least at the level of Bc. or equivalent practices. Focus of education / practice on economic or managerial disciplines, eventually field related to the focus of the project. Also required are excellent organizational communication skills, knowledge of English both in word and in writing and at least basic orientation in project issues.
Project administrator	This position requires a worker with a university degree at least at the level of Bc. or equivalent practices. Focus of education / practice on administration, public administration, economic or managerial disciplines, eventually field related to the focus o the project. Also required are excellent organizational communication skills, basic knowledge of English, diligence and independence.
Assistant (OSU)	This position requires a worker with a university degree at least at the level of Bc. or equivalent practices. Focus of education / practice on administration, public administration, economic or managerial disciplines, eventually field related to the focus of the project. Also required are excellent organizational communication skills, basic knowledge of English, diligence and independence
Project coordinator on the Partner's Side (SLU)	This position requires a worker with a university degree at least at the level of Bc. or equivalent practices. Focus of education / practice on economic or managerial disciplines, eventually field related to the focus of the project. Also required are excellent organizational communication skills, knowledge of English both in word and in writing and at least basic orientation in project issues.
Assistant Project coordinator on the Partner's Side CWS (VAVIA)	This position requires a worker with a university degree at least at the level of Bc. or equivalent practices. Focus of education / practice on administration, public administration, economic or managerial disciplines, eventually field related to the focus of the project. Also required are excellent organizational communication skills, basic knowledge of English, diligence and independence.

7.1 Planned organisational structure during the project implementation term

The organizational and management structure of the project is described in the previous part. Beneficiary and the main implementer of the project is the University of Ostrava, which will join the project through three faculties.

The integration of the project into the applicant's structures will be as follows:

- Faculty of Science - the main research faculty, mainly through the Department of Social Geography and Regional Development, where the expert leader of the project doc. RNDr. Petr Rumpel, Ph.D. works,
- Faculty of Social Studies,
- Faculty of Medicine.

On the part of the beneficiary, the relevant university and faculty departments will be involved in the project, which will mainly be responsible for supporting activities related to the project (especially accounting, wages, personnel, travel orders, etc.).

7.2 Risk analysis

Within the preparation of the project, the research and implementation risks were identified, their gravity, the likelihood of their occurrence in relation to the objectives of the project. At the same time, measures have been proposed to prevent these risks and to eliminate their impact on the achievement of the objectives. Gravity is assessed on a scale from 1 to 5, where 1 represents low significance and 5 high significance. The likelihood of occurrence is judged on a scale from 0 to 1, where 0 represents an unlikely occurrence and a certain occurrence.

Part of the project management is also the risk management, a detailed risk plan will be prepared, these risks will be continually evaluated and measures will be taken to reduce their likelihood of occurrence. Part of the plan will also be a precise description of the corrective measures that will be used if accidentally any risk event happens. For the risk management will be used tools such as lead indicators, detailed control of the schedules and plans, etc.

Defining project risks and their prevention is / will be a high priority in the preparation / implementation of the project. The main preventive tools (or corrective measures) are mentioned specifically for each of the defined risks. Some of the above-mentioned project management tools will also be used for risk management, in particular dynamic project timetables with built-in control and advance mechanisms, product sheets and detailed financial management tables.

In the case of occurrence of several risks at the same time, a number of measures will be taken, which will consist of continuous internal control of the project, changes in management positions of the project, the possibility to ask for the substantial change of the project will be considered, and potential substantial risks will also be consulted with the grant provider and the founder in advance. All of the above mentioned Risks and risks mentioned in the following subchapter, are designed to allow to take a measure even when more types of risk occur at the same time (i.e. contingency measures). In particular, it is a measure of maximizing the control of fulfillment of detailed timetable elaborated within the project and to it related achievement of the set goals and outputs of the project. The contingency measures will be prepared for all risk events with a higher risk potential; in case of this situation, the respective time and financial reserve will be reserved. Due to the complexity of the project and the structure of its risks, it is not possible to accurately anticipate all possible combinations of the above mentioned risks. In any case, mentioned risks will be managed primarily individually within the project management, however, always in relation to the other risks, so that the individual preventive (or corrective) measures maximally support and affect positively more risks at the same time.

Research risks

Risk Identification	Gravity	Probability of occurrence	Link to KA	Prevention and action to eliminate the impacts
No new findings will come out of the research plan	5	0,01	KA4	The research team is sufficiently knowledgeable to provide for new and valuable knowledge in the area and to achieve the planned results of the project. The very topic of the project SMART technologies and their use for improving the quality of life is in itself predestined to the success, since it is still an uncharted research topic with great potential for discovering new knowledge.
Additional need to revise the proposed methods to achieving research objectives	3	0,1	KA4	The project was prepared by a team of experienced R&D experts and application practitioners who have thoroughly researched and know the current state of knowledge in the issue to be researched. Based on specific defined research objectives, implementation methods were chosen. During the project, the selected methods and procedures will be compared with the current state of knowledge and the research objectives so that the applied procedures and methods are consistent with the achievement of the objectives. The research team is composed of sufficiently knowledgeable experts, so we assume that the methods chosen will be appropriate to the research objectives and will lead to their achievement. Crisis measure: Adaptation of new methods and procedures obtained during the project implementation.
The research results will not be sufficient to file an International Patent Application	3	0,1	KA4	The research team has experience with research and has participated in a number of partial knowledge that was subsequently implemented in practice. Prevention: Linking 5 research plans with 19 experimental model verifications, which verify achieved results and project outputs.
Insufficient competence of the research team	3	0,01	All activities	The research team is made up of excellent, key and ordinary workers who have relevant competencies to address research tasks and achieve the objectives set. At the same time, ad-hoc positions are envisaged in the research team; these positions will flexibly complement the competencies of the core research team.

Risk Identification	Gravity	Probability of occurrence	Link to KA	Prevention and action to eliminate the impacts
Conflicts between the members of research teams, partners, loose of motivation of project team	3	0,1	KA1, KA4 and other KA	When implementing the project, it is necessary to use collectively all the individual knowledge and abilities of each team member, each member of the team accepts responsibility for the overall fulfilment of the project and, within the scope of its capabilities, passes the necessary knowledge to others. Part of the tasks created within the project will be addressed individually, but part in permanent or ad-hoc teams. In this case, the choice of the Right team leader, clear task definition, timetable assignment, resource assignment, and correct competence assignment will also play a big part. Crisis solution: Consistent application of contractual obligations between partners, replacement of non-cooperating team members, expert assistance of motivation coaches and practice experts.

Implementation risks

Risk Identification	Gravity	Probability of occurrence	Link to KA	Prevention and action to eliminate the impacts
Reduction of the amount of financial support – threat to the achievement of the project objectives	3	0,25	All activities	In case of temporary or permanent reduction of support, the project applicant would have the effort to complete the project even at the cost of certain own extra costs of the university and the partners, however the applicant is not currently able to fund the project in full. As part of the project preparation, careful preparation of the project budget is also taken into account in relation to the objectives of the project and the individual activities. All items are justified and assigned to specific activity. Corrective measures: Finding a different source of funding, especially from partner sources, possibly reducing the number of members of a team and reducing the number of project outputs.

Risk Identification	Gravity	Probability of occurrence	Link to KA	Prevention and action to eliminate the impacts
Inadequate utilisation of the project budget	3	0,1	All activities	The way and purpose of utilisation of project funds will be continuously controlled by the internal mechanisms of the university on more levels, administrative staff will be continuously send out to relevant trainings. When selecting suppliers, the OP RDE rules, valid legislation and university regulations will be respected. Within the financial management, an ongoing control mechanism will be set up, the financial state of the project will be evaluated in relation to its material fulfillment. At the partners' workplaces, tools for the effective elimination of this Risk are implemented
Poor project management and poor coordination across partnerships	4	0,01	All activities	Project management and organization of work is based on the long-term experience of team members with development and R & D projects, as well as on the experience of the expert leader of the project and leaders of key activities with the management of similar types of projects, the necessary coordination of the project and the team members ensures project manager. Applicant has a support department for the project management where experience and examples of god practice in project management are regularly shared.
Implementation of the project in contradiction with the approved application, the legal act and the OP RDE rules	5	0,05	All activities	The project consortium led by the applicant was already familiarized with the rules of OP RDE program and the relevant call and the project application was approved by the consortium. After the approval of the application, the whole consortium will be acquainted with the legal act and rules of the OP RDE, detailed timetable of the implementation, obligations resulting from the implementation of the project. There will be a created joint space for sharing project documentation and to ensure access to information within the consortium and a system of regular reporting to the project manager and the expert leader of the project will be set up so that we can continuously monitor the fulfillment of the set objectives in accordance with the rules of the OP RDE. Partners have experience with successful solutions of the projects, we consider the probability of this risk to be minimal. Crisis solution: Communication with provider of the support, active search for corrective actions
Unavailability of the required investment equipment due to time delay or funds reduction	4	0,05	KA8	Planned acquisition of equipment is available on the market, based on a market survey, there are no problems with its acquisition. A certain risk is the implementation of tenders according to the law and rules of OP RDE, where a procedural error may lead to a time lag. Prevention: Proper and consistent preparation of tender’s and specification of the subject, implementation of the procedure will be entrusted to experienced staff.

8 SECURING CO-FINANCING AT THE IMPLEMENTATION STAGE

Co-financing within the project totals 6.5 million CZK out of 87 million CZK of eligible expenditure of the project, which is 7.47%. Minimum co-financing rate 5% is thus complied for the whole project. Co-financing will be provided from the partners' own resources:

- BeePartner, Inc.: 4.5 million CZK, which corresponds to 50% of the partner's share. Partner turnover in 2016 was 16,557 million CZK.
- AutoCont CZ Inc.: 2 million CZK, which corresponds to 50% of the partner's share. Partner turnover in 2016 was 2,833.745 million CZK.

The turnover of both partners shows that both companies have sufficient capacity to co-finance the project.

9 SUSTAINABILITY

9.1 Financial sustainability

The following table fully respects the rules of the Call and rules of the OP RDE, including specific rules in relation to public support and project sustainability requirements. As part of a qualified estimate, it assumes and demonstrates financial sustainability for the years 2023-2027. Due to the timing of the project, when the main volume and scope is planned for the first part and the second part will be in volume and financially lower, and so the following table foresees the sustainability approximately in the scope of final state at the end of the project implementation period.

The table below shows the cumulative amounts for all project partners from the research and application sector.

Operating expenditure: These are personnel expenditure associated with the research team and Project Steering Committee, continuation of research activities and follow-up applied research, which will be based on project results and outputs.

Other operating expenditure: These are travel allowances, service, material and maintenance of acquired equipment of research centres in the same logical structure as during the project.

Institutional Funds: These are, in particular, funds allocated to the university to provide further research and other partners' own funds.

Grants: This is a follow-up grant financing of projects related to the subject of the research, mainly from foreign resources (community programs) and Czech resources (e.g. TAČR or MIT program).

Contractual research: These are resources for contractual research and subsequent commercialization / application of knowledge in the field of creation of smart solutions based on SMART technologies especially for customers from local authorities.

Project financial sustainability plan (in whole CZK)					
Item, including comment	Year 1	Year 2	Year 3	Year 4	Year 5
Operating expenditure - Personal Costs	CZK 5 million	CZK 5 million	CZK 5 million	CZK 5 million	CZK 5 million
Operating expenditure on material, energy, services and maintenance of the equipment purchased	CZK 1 million	CZK 1 million	CZK 1 million	CZK 1 million	CZK 1 million
Total operating costs	**CZK 6 million**	**CZK 6 million**	**CZK 6 million**	**CZK 6 million**	**CZK 6 million**
P Operating costs under Article 61[2] for projects not generating revenue (the revenue is not sufficient to fully cover the operating costs and are subject to other limitations)	CZK 0 million	CZK 0 million	CZK 0 million	CZK 0 million	CZK 0 million
Requirements for own financing (Total operating costs – Operating income), with the result being a positive value which is not zero	**CZK 6 million**	**CZK 6 million**	**CZK 6 million**	**CZK 6 million**	**CZK 6 million**
Sources of financing: institutional funds	CZK 1 million	CZK 1 million	CZK 1 million	CZK 1 million	CZK 1 million
Sources of financing: grants	CZK 3 million	CZK 3 million	CZK 3 million	CZK 3 million	CZK 3 million
Source of financing: contractual research	CZK 2 million	CZK 2 million	CZK 2 million	CZK 2 million	CZK 2 million
Sources of financing: give	CZK 0	CZK 0	CZK 0	CZK 0	CZK 0

[2] *Please also refer to Rules for Applicants and Beneficiaries, General Part.*

other relevant sources of financing	million	million	million	million	million
Sources of financing in total	**CZK 6 million**	**CZK 6 million**	**CZK 6 million**	**CZK 6 million**	**CZK 6 million**
Outstanding funding (enter 0 if the total sources of financing are equal to or higher than own financing requirements, otherwise enter the amount "Requirements for own financing – Total sources of financing"	CZK 0 million	CZK 0 million	CZK 0 million	CZK 0 million	CZK 0 million

9.2 Substantive sustainability

Both the applicant and the project partners respect sustainability rules and, in accordance with the OP RDE rules, plan to maintain activities and outputs of the project for the duration of sustainability even beyond its horizons. The fundamental sustainability of the project's effects is already its primary focus on the SMART technologies and their use in various areas of human life. The primary purpose of all project outputs is to provide a basis for follow-up activities, applied research, experimental development, and practical applications. The shared long-term purpose of use of SMART technologies is significant contribution of solutions based on them in all areas of human life. In other words, the purpose of the project is not to create "knowledge without application" but such outputs and results on which can be established other activities and development of the whole research in defined consortium of partners.

From the point of view of personal development, it is expected that the follow-up research activities will continue in the minimum extent of about 4-6 FTE / month. This is the extent that corresponds to the volume of involvement in the final phase of the project. However, this extent is at the same time considered to be minimal, on the contrary project consortium plans to use this project as an accelerator and to further develop the whole research of the use of SMART technologies to improve quality of life at all levels of research excellence. The research and management team of the project will therefore continue in solutions of the follow-up research topics, project outputs will also be developed towards possible applicability. The research will be carried out in connection with other research activities of the applicant and partners and synergistically with other activities that will ensure the sustainability of other research projects of the applicant and partners.

Also, the purpose of the project is to maintain the whole partner consortium and further expand it with other entities, mainly thanks to the activities under KA 2, 3, 5, 6, 9 and 10. Thanks to the planned conceptual approach to these activities and their mutual synergy with other project activities, it is assumed that the collaborating circle of subjects will grow with other institutions from both the application and the research and development sector across various disciplines.

The research team will gradually develop and complement on the basis of the assumed common rate of employee fluctuation and natural retirement or maternity leave. In this case, the team will always be complemented by an adequate professional whose knowledge and experience corresponds with the former worker. The relative advantage of the whole team across the partners is its average age, which is relatively low, and so creates significant potential for long-term sustainability of the team and the growth of its performance. The aim will also be to attract other young and start-up workers who will be gradually learning and gaining experience from older colleagues. The topic of SMART technology itself, which is very attractive for a number of start-up researchers, also helps to it. Under the HR policy the rules of equal treatment and non-discrimination will be respected.

The part of the project (especially of KA 10) and its sustainability will be further training of staff, which is very desirable at least at the level, that SMART technology requires to have permanently updated knowledge and information, especially from the technological field.

The planned results and outputs within the sustainability are also summarized in the following table. The plan is presented as a non-binding, qualified estimate based on currently available information for each

year cumulatively (this is a cumulative statement for each year of sustainability). Ambition of the entire project consortium is to continue continuously in the trend of producing results similarly to the project.

Code and name of the result	Target Value of the Project Implementation	Development plan in the sustainability period				
		1st year	2st year	3st year	4st year	5st year
2 03 12 Number of participations of aided research teams in international cooperation programmes	0	0	0	1	1	6
CO26 / 20000 Number of undertakings cooperating with research institutions	5	5	7	8	9	10
2 02 11 Specialised publications created by aided entities (selected types of documents)	12	14	16	18	20	22
20213 Publications in co-authorship of research organisations and enterprises (selected types of documents)	6	7	8	9	10	11
2 02 16 Scientific publications in co-authorship with researchers from abroad created by aided entities (selected types of documents)	6	7	8	9	10	11
2 20 11 International patent applications (PCT) created by included entities	0	0	0	1	1	1
Other result, which is not reflect in MI. Number of experimental model verifications of SMART technologies application.	19	21	23	25	27	29

10 ANNEXES