National priorities of oriented research, experimental development and innovations

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1. Introduction

Research, experimental development and innovation (hereinafter only as "R&D") is one of the inseparable parts of development of every competitive society. However, for R&D activities to lead to the desired competitiveness, it is necessary that R&D activities and expenses are directed to areas, which could lead to competitiveness, i.e. priority areas.

The preparation of National Priorities of Oriented[1] Research, Experimental Development and Innovations (hereinafter only as "R&D Priorities") continues the goals and activities of the National Policy of Research, Development and Innovations of the Czech Republic 2009-2015 (hereinafter only as "NP R&D"), which had been approved by a Government Resolution of 8th June 2009 No. 729. One of the goals is to review the current priorities of the applied R&D.

Responsible for the preparation of the R&D Priorities, according to Provision § 35, par. 2 letter f) of the Act No. 130/2002 Coll. on the Support of R&D as amended by Act No. 110/2009 Coll., and according to the Reform of the R&D System in the Czech Republic, approved by the Government Resolution of 26th March 2008 No. 287, is the Council for Research, Development and Innovations (hereinafter only as the "Council"). The Council prepared the basic principles for the preparation of the R&D Priorities, which were approved by the Government Resolution of 6th April 2011 No. 244.

The reason for the review of current priorities of the applied R&D, which are part of the NP R&D is the fact that these priorities were formulated in a general and complex manner and lacked proper focus on areas, which would react to the society's needs, especially regarding the social and economic development of the Czech Republic. The low level of concentration of public resources into selected areas lead to the underfunding of some significant research branches, which are able to achieve breakthrough discoveries in basic oriented research and in applied research are able to find solutions, which could significantly contribute to the competitiveness of the Czech Republic and the fulfillment of important needs of the society's development. The R&D support programs, which are used to allocate a significant part of the support, often refer to the current priorities; however the real connection of these programs to the priorities is often just formal.

The R&D Priorities are newly established as a certain concrete object of public and private interest, which is a combination of long-term goals and multidisciplinary focus, is society-wide applicable and desirable, attainable with the Czech Republic's material and personal resources, solvable in the long-term and attainable via the R&D activities. The application of the new R&D Priorities will lead to a more effective use of public resources for the support of R&D, which would better reflect the key needs of the development of the Czech society. The main benefit and meaning of the R&D Priorities is the strategic orientation of the part (especially of the applied, but also of the basic) of the national R&D into areas, which will help solving fundamental current and expected future problems and challenges of the Czech Republic and will enable to use the potential opportunities for the balanced development of the Czech Republic.

[1] Oriented research focuses on solution of specific social and economic goals.

The R&D Priorities, which are planned until the year 2030 will newly become a part of the NP R&D and will then be used to prepare R&D programs for providing directed support. However, it will be necessary to project these R&D Priorities partially into the provision of institutional support for development of research organizations. Also these R&D Priorities will be used when preparing the proposed state budget R&D expenses, as stipulated by the Act No. 130/2002 Coll., on the Support of R&D as amended.

The R&D priorities are the result of the work of dozens of national experts from various sectors and fields based on outlook studies and analysis focused on the identification of the main issues and also the main valid strategic documents. Analyses of these materials and the preparation itself were made from May 2011 to January 2012. Part of the R&D Priorities are also the system measures, assessments of relations between individual fields and forms of their utilization during the implementation of R&D in the Czech Republic.

The R&D Priorities continue not only the objectives of NP R&D but also the Strategy of International Competitiveness[2], National Innovation Strategy[3] and reflect also the priority areas of the newly prepared European-level framework program Horizon 2020.

2. Bases for the preparation of R&D Priorities

2.1. Current situation in the Czech Republic

Current priorities of the applied R&D are part of the NP R&D, according to which they should be updated after 2011 (see provision "A 2-1: Review priorities of applied research, development and innovations in relation the needs of the Czech Republic's sustainable development, where the public support of applied R&D should further be provided particularly in relation to the needs of the application sphere set out in the priority areas").

Experience with the current applied R&D priorities, valid since 2009, shows that the originally defined priorities de facto include all areas of R&D which are performed in the Czech Republic. Also with regard to changes in European policies it is clear that the current priorities no longer correspond with the needs of the Czech society, current economic situation or new EU priority areas. The issues of population ageing, food safety, environment protection etc. are missing completely.

The current priorities of the applied R&D (Biologic and ecologic aspects of the sustainable development, Molecular biology and biotechnology, Energetic sources, Material research, Competitive mechanical engineering, Information society, Safety and protection, Priorities of the Czech society's development) aren't defined as goals, but areas of interest. The main shortcoming of these priorities is that they were assembled from all known areas and almost everything is a priority regardless of whether it is an issue both socially desirable and utilizable or whether the Czech Republic has the necessary personal or technical potential to solve such issues.

[2]Strategy of International Competitiveness of the Czech Republic for the years 2012-2020, approved by the Government Resolution of 27th September 2011 No. 713

[3]National Innovation Strategy of the Czech Republic, approved by the Government Resolution of 27th September 2011 No. 714

After evaluating the current situation[4] it is possible to state that during the preparation of the proposal for state budget R&D expenses these priorities are not taken into account or rather the current priorities do not even make it possible to be taken into account. When preparing the R&D programs for providing directed support mainly the departmental individual approach is being taken into account, favoring especially the potential of departmental R&D sites (state contribution-based organizations and public research institutions established by the appropriate Ministry – provider of the directed support) without ties to society's needs and cross-sectional issues. The priorities aren't being taken into account at all within the provision of institutional support. [5]

2.2. Comparison of international processes and approaches

There are several approaches to creating priorities. The first one is the focus not on specific priorities and goals, but on scientific fields in general. The Czech priorities were created in such way in the past. That's why now the second model has been chosen, which is to set specific goals, which should be solved within the R&D. The European countries practically don't use this model any more.

The second variant[6] of priority preparation is the orientation on concrete goals and issues. As is apparent from the approaches used by other states, the setting of priorities is based on defined social needs, or rather on specifically defined goals or questions, which should be solved via R&D. Other important factor is the potential of the given state (application, human resources, technical equipment) and the capacity of the state budget or the possibility to fund activities from other than public sources.

The process of preparation includes a wide array of important stakeholders of the innovation system (researchers, application sphere representatives, state administration etc.), which creates prerequisites for achieving a society-wide consensus about the long-term direction of R&D.

When creating priorities the European level is also taken into account, currently it is the synergy of national priorities with the framework program Horizon 2020 and other structural funds.

The second model is being used e.g. in Germany or Finland and had been used in the preparation of the R&D Priorities.

2.3. Process of preparation of R&D Priorities

The R&D Priorities preparation process was based on the Principles for Preparation of National R&D Priorities, created by the Council and approved by the Government Resolution of 6th April 2011 No. 244. R&D Priorities were created in several consequent phases.

In the first phase the outlook studies were prepared aimed at the identification of the main issues in the next 15-20 years. This also included references to the main strategic documents valid at the time.

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[4] Analyses and Studies of the R&D Council published at www.vyzkum.cz

[5] E.g. data in the R&D Information System; R&D programs approved by the government; summary evaluations of results of finished programs approved by the government, conclusions of evaluations of results of research organizations.

[6] E.g. PazourM.: Trendy přitvorběinovačnípolitikyvevybranýchevropskýchzemích. Ergo, year 04, No. 2, 2009 Klusáček, K. and others.:Knihazahraničníchdobrýchpraxípřirealizacipolitikvýzkumu, vývoje a inovací. Technologické centrum AV ČR, 2008 http://erawatch.jrc.ec.europa.eu/

In the second phase experts from both the public and private spheres were included. The Council established an Expert Coordination Council on 29th April 2011. This Council had 15 members.

The Coordination Council fulfilled the role of the main managing body of the preparation process. Based on the outlook studies prepared in the first phase the Coordination Council identified and defined six main areas, which were discussed and approved by the Council on 24th June 2011.

In the next phase the call to include experts in the work of expert panels has been published based on the defined priority areas. Based on the nomination and the proposal of the Expert Coordination Council the Council named individual expert panel members (in 6 panels there were a total of 105 experts from the public and private sectors, both persons active in R&D activities and those from the application sphere). The task of the expert panels was the identify priority goals for R&D, the fulfillment of which would significantly contribute to the removal of expected threats and the use of opportunities.

The expert panes identified priority targets in several steps. Firstly each priority area had been structured in detail and main and partial issue blocks were defined, i.e. areas, which further divided into narrowly defined blocks, the so-called subareas. In each subarea were defined social needs and based on those mid- and long-term national priority targets were identified. In the nest step the expert panels evaluated the identified targets according to their significance and attainability and based on these results primary targets were proposed.

The individual priority areas were then submitted to the Expert Coordination Council for completion. The translated reports of individual expert panels were compiled into the Summary Report, which includes the basic overview of areas, subareas and research targets, i.e. the draft R&D Priorities. The Expert Coordination Council then set draft allocation of funds for individual areas.

The proposal was then submitted to the providers' panel, which was composed of representatives of ministries and agencies, which provide support for R&D. The panel started participating in the preparations in February 2012 and its task was to propose the volume of funding which will enable fulfillment of the identified R&D Priorities.

The final proposal of R&D Priorities was presented to the Council and approved by a Government Resolution of 19th July, 2012 No. 522.

The list of Expert Coordination Council, expert panels and the providers' panel is included in Annex 1.

3. Priorities of oriented R&D

Within the R&D Priorities there are a total of six defined priority areas and each has several subareas with defined concrete targets.

Priority area	Subareas
Competitive knowledge-based economy	Application of new findings from the area of General Purpose Technologies (4 targets)
	Strengthening of sustainability of production and other economic activities (6 targets)
	Strengthening of safety and reliability (6 targets)
	Mapping and analysis of competitive advantages

	(1 target)
Sustainability of energetics and material resources	Sustainable energetics (25 targets)
	Lowering the energetic demands of the economy (6 targets)
	Material base (4 targets)
Environment for quality life	Natural resources (10 targets)
	Global changes (3 targets)
	Sustainable development of landscape and settlements (3 targets)
	Environmental technologies and eco-innovations (8 targets)
	Environment-friendly society (2 targets)
Social and cultural challenges	Demographic and social changes (8 targets)
	Government and administration (4 targets)
	Culture, values, identity and tradition (8 targets)
	Development and use of human potential (4 targets)
	Man, science and new technologies (2 targets)
Healthy population	Origin and development of diseases (14 targets)
	New diagnostic and therapeutic methods (15 targets)
	Epidemiology and prevention of the most serious diseases (12 targets)
Safe society	Safety of citizens (5 targets)
	Security of critical infrastructures and resources (7 targets)
	Crisis management and security policy (9 targets)
	Defense, defensibility and deployment of armed forces (4 targets

3.1. Competitive knowledge-based economy

Priority area 1, which deals with competitiveness, reacts to changes in the area of Czech Republic's competitiveness in global scale. *The Czech Republic's competitiveness decreases, competition on markets, where our products and services compete, is increasing*. In the future it is necessary to prevent the decrease of competitiveness; both the competitiveness itself and the social and economic impacts of this decrease.

Competitiveness of the economy is connected to the activities of the business and public sectors. The priority area therefore concentrates on both these spheres, with the aim to:

- Increase the productivity and efficiency of their activities and their functioning;
- Increase the quality, flexibility and attractiveness of their products (i.e. both commercial products and services and public services);
- Strengthen the sustainability of economy's development and growth.

The priority area is further divided into 4 areas - Application of new findings from the area of General Purpose Technologies, Strengthening of sustainability of production and other economic activities, Strengthening of safety and reliability and Mapping and analysis of competitive advantages.

Detailed structure of priority areas and subareas is included in Annex 2.

Table 1: Structure of the priority area Competitive knowledge-based economy

Priority area	Subarea	R&D Targets
1. Application of new findings from the area of General Purpose Technologies	1.1 GPTs for innovations of processes, products and services	1.1.1 To gain new utility values of the products by using new findings from area of GPTs
		1.1.2 To improve efficiency, safety, sustainability and reliability of processes (including lowering of energy intensity and costs of material) by using GPTs
		1.1.3 To streamline offered services and processes in direct services by using GPTs
		1.1.4 To streamline offered services and processes in the public sector by using GPTs
2. Strengthening of sustainability of production and other economic activities	2.1 Economy, efficiency and adaptability	2.1.1 To increase economy, efficiency and adaptability in transport - transport and handling systems and vehicles production to make these areas globally competitive
		2.1.2 To improve economy, efficiency and adaptability in industries to empower global competitiveness in this area
		2.1.3 To improve economy, efficiency and adaptability in electrical engineering, including IT industry and services to empower global competitiveness in this area
		2.1.4 To improve adaptability of products by cross departmental

		research
	2.2 Use values of products and services	2.2.1 To innovate products in the branches important for export by joint activities of manufacturing and research areas
		2.2.2 To improve competitiveness of products and services by improving their use values
3. Strengthening of safety and reliability	3.1 Safety and reliability of products and services	3.1.1 To establish complex policy to safety and reliability of products and services
		3.1.2 To improve reliability and safety of network systems by development and introduction of smart networks
	3.2 Safety and reliability of processes	3.2.1 To gain permanently high degree of the data protection and communication security in a dynamically changing environment
		3.2.2 To increase use and quality of autopilots and automation
		3.2.3 To increase quality of process monitoring and early warning systems
		3.2.4 To increase security and reliability of processes by using simulator and virtual reality means to gain significant reduction of both direct and indirect costs caused by their failures
4.Mapping and analysis of competitive advantages	4.1 Identification of the new opportunities of competitive advantage	4.1.1 Actual identification of the economic opportunity by the continuous global trends monitoring and scoring

3.1.1. Application of new finding from the General Purpose Technologies area

Focus of the "*Application of new finding from the General Purpose Technologies*[7]" area is on the transfer of new findings from the area of General Purpose Technologies. These technologies create space for the development of products with new or significantly improved abilities and push the limits of production capacities in a number of areas. The area includes one subarea, which monitors the use of new usable technologies when developing new products and improving efficiency of processes and services in the public sector.

3.1.2. Strengthening of sustainability of production and other economic activities

The area "*Strengthening of sustainability of production and other economic activities*" aims to improve the efficiency of production and processes within the existing capacities and structure of the Czech economy. The focus is on production flexibility connected to the development of non-technical competencies of businesses and also on the reduction of negative influences of economic activities on the environment. This area is further divided into two subareas, which aim to increase the economy, efficiency, and adaptability of production in decisive areas of the economic development of the Czech Republic and to increase the usability value of products and services in these areas. Partial targets in the subarea are oriented on the improvement of economy, efficiency, and adaptability in transport, machine engineering, ICT and electrical engineering and on the development of intradepartmental R&D. Partial targets in the second subarea aim to strengthen the oriented R&D concluded in cooperation of the public and private sectors and improvements of the utility of products and providing qualitatively new services.

3.1.3 Strengthening of safety and reliability

The main goal of the "Strengthening of safety and reliability" is to increase security and reliability of products and process by improving their technical parameters. The related goal is to reduce social costs arising due to the failure of products, services and processes. This area includes two subareas. The firs aims to limit the risk of failure of products both due to failure of the product itself and as a result of a human mistake, the other strives to increase the security and reliability of processes (production and others), which is reflected in the decrease of corporate and social costs related to their failure. Research targets of the subarea 3.1 are oriented on creating and implementing predictive systems for product safety and reliability management for the whole life cycle and to ensure security, stability and reliability of network systems. The research targets in the subarea 3.2 strive to increase the safety and reliability of processes by achieving a high degree of data protection, automation quality in the production process, quality of early warning systems with the aim to prevent accidents and malfunctions in processes and to create and utilize simulation of processes, which will enable to optimize their setting in order to minimize the risk of failure.

[7]General Purpose Technologies (GPTs) are universal technologies, which have potential to significantly alter the society via their impact on the already existing economic and social structures. The change is not brought by the technology itself, but only its specific use and application, which can be from different areas. A narrower term is the so-called Key Enabling Technologies (KETs), which represent specific identified technologies, which are currently crucial for changes in economy and society. Due to the long-term horizon of the priority area targets the broader term GPTs is used.

3.1.4 Mapping and analysis of competitive advantages

The area "Mapping and analysis of competitive advantages" focuses on creating conditions for early identification of new opportunities, which will contribute to the Czech Republic's competitive advantage. The goal is to continuously monitor these opportunities, find and assess them and then flexibly set up institutional environment, structures and mechanisms, which will enable to transform these opportunities into a competitive advantage. Area 4 includes one subarea, the goal of which is to systematically search for new opportunities to develop businesses in the Czech Republic and to transform the found opportunities into concrete measures for their use. The aim of RDI, formulated in one single goal in this area is to develop methods for identification of economic, social and technologic trends, which generate new business opportunities and threats regarding the structure of the Czech economy.

3.2. Sustainability of energetics and material resources

This priority area deals with energetics and material resources and reacts to current situation in the world as well as in Europe, where many primary resources are located in regions with unstable political environment or where Germany withdraws from the use of nuclear energy. The main challenge for the Czech Republic is ensuring long-term affordable energy for the population in the current and future unstable situation.

The priority area is divided into three areas - Sustainable energetics, Lowering the energetic demands of the economy and Material base.

Detailed structure of priority areas and subareas is included in Annex 3.

Table 2: Structure of the priority area Sustainability of energetics and material resources

Priority area	Subarea	R&D Targets
1. Sustainable energetics	1.1 Renewable resources of the energy	1.1.1 Development of the economically efficient solar energetics
		1.1.2 Development of the economically efficient geothermal energetics
		1.1.3 Development of the economically efficient use of the biomass
	1.2 Nuclear resources of the energy	1.2.1 Efficient long-term use of nowadays nuclear power plants
		1.2.2 Support of the security of the nuclear facilities
		1.2.3 Research ensuring support of the construction and running of the new economically efficient and secure blocks

		1.2.4 Research and development of the fuel cycle
		1.2.5 Deposition of the nuclear waste and used combustibles
		1.2.6 Research and development in the area of reactor of the IV generation, mostly effective and secure fast reactors
	1.3 Fossil resources of the energy	1.3.1 Economically efficient and ecological fossil energetics and heating industry
	1.4 Power lines including power accumulation	1.4.1 Capacity, reliability and safety of the spinal power lines
		1.4.2 Modification of the lines for the „demand-side management“
		1.4.3 Power accumulation including use of the hydro energy
		1.4.4 Safety and durability of the power lines
	1.5 Production and distribution of the heat / coldness including cogeneration and trigeneration	1.5.1 Heat withdrawal from power stations in the basic load
		1.5.2 Effective cogeneration (trigeneration) in SCZT sources in works with partial load (system services)
		1.5.3 Distributed combined production of the energy, heat and coldness from every kind of resources
		1.5.4 Transport and accumulation of the heat
		1.5.5 Efficient management of the modification of the indoor environs
		1.5.6 Alternative resources - exploitation of wastes
	1.6 Energy in the transport	1.6.1 To increase the quotient of the agro fuel as a compensation for the

		fossil sources
		1.6.2 To increase the quotient of the use of the electric energy in the transport as a compensation for fossil sources
		1.6.3 To establish in the perspective the use of hydrogen as a transport power source
	1.7 System development of the Czech energetics in the context of the development of the EU energetics	1.7.1 System analysis for the support of the balanced state energetics conception (SEC), another related strategic documents of the state and regional developing concepts considering the EU frame
		1.7.2 Integral conception of the development of the municipalities and regions with the verification with the demo projects (linked to the SET Plan – Smart Cities and Smart Regions)
2. Lowering the energetic demands of the economy	2.1 Lowering the energetic demands of the economy	2.1.1 Energy budget of the materials and fuels for the whole stroke
		2.1.2 Research and development of the new energy saving industrial technologies
		2.1.3 Increases in the use values and durability of the buildings
	2.2 New technologies and processes with a potential utilisation in the economy	2.2.1 Participation of the R&D in the international activities in the area of the utilisation of the nuclear fusion
		2.2.2 New methods and procedures in the area of the diagnostic to increase the reliability, security and durability of the energy devices
		2.2.3 Biotechnology, bioengineering and genetics
3. Material base	3.1 Advanced materials	3.1.1 Long-term perspective of the provision of the raw materials for the

		economy of the Czech Republic
		3.1.2 Advanced materials for the competitiveness
		3.1.3 Innovation and sustainability of the classical materials
		3.1.4 Use of the nanomaterials and nanotechnologies

3.2.1 Sustainable energetics

The main goal of the "Sustainable energetics" area is to achieve long-term sustainable energetic mix based on many sources, with priority use of all domestic energetic sources, increase of energetic independence and ensuring energetic security of the Czech Republic.

The area is further divided into seven subareas, which cover the issue of producing electricity and heating, their distribution and accumulation and the issue of energetics in transport. Attention is given to systemic development of Czech energetics in relation to the development of energetics in the EU.

- Renewable energy sources
- Nuclear energy sources
- Fossil energy sources
- Electric grids including energy accumulation
- Production and distribution of heating/cooling including cogeneration and trigeneration
- Energy in transport
- Systemic development of Czech energetics in the context of the development of energetics in the EU

The targets of individual subareas are directed towards the increase of the share of renewable sources in the final consumption, ensuring safe and reliable electricity and heating supply from various sources and efficient and safe use of nuclear energy. The goal is also to increase the efficiency of energy production, lowering of emissions of greenhouse gases and negative impacts of energy production. In the area of transportation the research is directed to improve the ecologization and electrification of transport. Another significant goal is to ensure strategic management of the energy sector.

3.2.2. Lowering the energetic demands of the economy

The target of the research made in the area of "*Lowering the energetic demands of the economy"* is to sustain the current pace of decreasing the energetic demands of the economy and improve the quality of the environment. The research is directed toward a less resource-demanding society with a low production of carbon, which will also reflect in the increase of competitiveness and higher energetic security of the Czech Republic. Another target is the development of activities (particularly of the basic oriented research nature) in areas, which have expected potential for use in energetics and enable to strengthen competitiveness and participation of the Czech Republic in international initiatives.

3.2.3. Material base

The target of the research made in the area of "*Material base*" is to achieve sustainable and competitive material economy and production with minimal impact of material flows on environment. A significant target is also the efficient use of all resources and technological changes leading to changes in the limitation of the use of materials with high energetic costs of production.

3.3 Environment for quality life

The priority area dealing with environment for quality life includes a wide array of activities particularly from the environment area. The priority axis has been divided into a total of five subareas - Natural resources, Global changes, Sustainable development of landscape and settlements, Environmental technologies and eco-innovations, Environment-friendly society.

Detailed structure of priority areas and subareas is included in Annex 4.

Table 3: Structure of the priority area Environment for quality life

Priority area	**Subarea**	**R&D Targets**
1. Natural resources	1.1 Biodiversity	1.1.1 Increase of the long-term efficiency of the particular territorial natural and landscape preservation leading to the support of the metapopulations of decreasing threatened species and species with the focal point of occurrence in the biotopes created or strongly influenced by humans
		1.1.2 Formation of the efficient kinds of measures to maintain natural associations and natural biotopes of species
		1.1.3 Valuation of the impact of the plant and animal invasions and development of the instruments for their limitation

		1.1.4 Valuation, survey and categorization of ecosystem services including creation of the instruments for valuation of their fact accuracy and practical utility
	1.2 Water	1.2.1 Reduction of the water pollution from point and non-point sources and the sustainable use of the water resources
	1.3 Soil	1.3.1 Increase of the content of the stable organic mass and the support of functional diversity of soil organisms with collateral maintenance of the productivity character of soil
		1.3.3 Increase of the retention ability of the wetland soil and implementing of the retention zones
	1.4 Air	1.4.1 Limitation of the emissions of polluting substances from anthropogenic sources
		1.4.2 Gadgetry of the spread and deposition of the polluting substances
	1.5 Mineral deposits and effects of mining on the environment	1.5.1 Enforcement of the sustainability of the procurement with mineral primary commodities
2. Global changes	2.1 Methods of mitigation and adaptation for global and local changes	2.1.1 Proposition of the adaptive measures in the particular sector of the economy of the Czech Republic and proposition of the instruments for GHG emissions lowering
	2.2 Biogeochemical cycles of nitrogen and phosphor	2.2.1 Optimisation of the streams of the reactive forms of nitrogen and phosphor (Nr a Pr)
	2.3 Dangerous substances in the natural environment	2.3.1 Natural environment and health

3. Sustainable development of landscape and settlements	3.1 Green infrastructure - stable structure of the landscape	3.1.1 Creation of the conceptual instruments of the landscape planning
	3.2 Agriculture and forestry	3.2.1 Acquirement of practically useful information for effective agricultural production in the ecologically and economically long-term sustainable systems of farming
	3.3 Urbanism and intelligent human settlements	3.3.1 Design of modern methods and systems of construction and keeping of the intelligent human settlements with minimum impacts on the environment
4.Environmental technologies and eco-innovations	4.1 Environment-friendly technologies, techniques and materials	4.1.1 Technologies and products increasing complex efficiency of the exploitation of primary sources
	4.2 Biotechnology, material, energetic and emissive efficient technologies, products and services	4.2.1 To gain qualitatively new primal product by using biotechnological methods
		4.2.2 To prepare biotechnological methods for the complex wasteless use of the biomass
	4.3 Minimisation of the waste production and their re-use	4.3.1 New recycling technologies - their output being substances with comparable quality to the input raw materials
		4.3.2 New effective methods of energetic use of wastes with a minimisation of the negative environmental influences
	4.4 Removing of the dangerous substances - old damages from the environment	4.4.1 Increase of the efficiency of the redevelopment technologies and introduce of the new methods of redevelopment
	4.5 Minimisation of the chemical substances risk	4.5.1 Technology for the minimisation of the risks of the POPs, toxic metals, hormonal disruptors, pharmaceutical residuals, pesticides and another pollutants for the human health and

		life organisms
		4.5.2 Technologies for replacement of the risk substances under the REACH legislation and replacement of the dangerous substances by less harmful
5. Environment-friendly society	5.1 Patterns of consumption of the population	5.1.1 To develop efficient methods for the change of patterns of consumption in the direction of minimisation of the effects of consumption on the stabile function of natural resources and eco-system services
	5.2 Measures of the environment-friendly growth	5.2.1 To design innovative instruments of the environmental preservation with the target of minimisation of the costs of their functioning

3.3.1. Natural resources

The main goal of the area "*Natural resources*" is to ensure the functioning and stability of the key parts of the environment – biodiversity, water, soil, air and mineral deposits. The area is divided into five subareas according to the environment parts. The targets of individual subareas of R&D focus on protection and limitation of the impact of human activity on the environment and increasing its quality and diversity, its efficient protection and creation of biotopes with minimal regulatory impact of human activity. The goal is to set principles and implement new ways of effective use of natural resources in the Czech Republic.

3.3.2. Global changes

The aim of "*Global changes*" is to prevent factors influencing changes in the environment's parts, which affect the cycle of matters and substances in nature and which alter the balance in biodiversity and create risks for human health. The goals of the research concluded in this area aim to implement measures to lessen the expected negative process of global change in environment, to optimize chemical composition of natural components and to lessen the impacts of global changes on human health.

3.3.3. Sustainable development of environment and human settlements

The aim of the research concluded in the area of "*Sustainable development of environment and human settlements*" is to decrease the fragmentation of landscape in the Czech Republic due to the changes of territorial structure of settlement and product ion activities of man. This can be achieved through the research of factors, which prevent sustainable use of environment components and contribute to the overall deterioration of their ecologic functions, implementation of modern methods and systems of construction of intelligent settlements with minimum energetic and resource demand and research of ways to achieve adequate food and resource self-sufficiency.

3.3.4. Environmental technology and eco-innovation

The main goal of the area "*Environmental technology and eco-innovation*" is the implementation of technologies and processes, the influence of which on environment is lesser than with technologies with similar function, output and technology and new processes, which are used to reduce the strain on environment in the area of protection of air, water, waste management, recycling and removal of old ecologic damages. Due to the scope and severity of this issue the area is divided into five subareas. The research goals of individual subareas aim for a higher rate of application of technologies and materials with minimal impact on environment, implementation of biotechnologies into production and the use of biotechnologies in production of renewable sources of resources and energy. The research targets of the subareas concentrate on ways to minimize waste and ways to reuse it.

3.3.5. Environment-friendly society

The aim of the research in the area "Environment-friendly society" is the way of setting up the development of economy, which will prevent deterioration of environment, loss of biodiversity and unsustainable use of natural resources. The research aims to find solutions, which will enable a transition of the society to sustainable patterns of consumption and to create an appropriate mix of tools of environment-friendly growth, which will be in accordance to the legislation of the Czech Republic, EU and will take into account international ratifications regarding environment.

3.4. Social and cultural challenges

Priority area 4 deals with cultural and social challenges characteristic for current modern society. These are issues of life-long learning, social inclusion and demographic changes in the society, especially ageing. The main goal isn't the prolonging of the absolute life span, but to push the limit of active life and maintaining its quality at an older age, which is complexly incorporated in the concept of active ageing. This concept of active ageing is a great challenge even at the European level, where this will be solved in several programs and is also included in the framework program Horizon 2020. Another great challenge will be the projection of the population's age structure into the labour market, satisfaction of social services and country's competitiveness.

The priority area is divided into five topical areas - Demographic and social changes, Government and administration, Culture, values, identity and tradition, Development and use of human potential and Man, science and new technologies.

Detailed structure of priority areas and subareas is included in Annex 5.

Table 4: Structure of the priority area Social and cultural challenges

Priority area	Subarea	R&D Targets
1. Demographic and social changes	1.1 Demographic ageing, family policy	1.1.1 Implementation of complex support of active ageing
		1.1.2 Improvement of reproduction potential of the population by improving the value of family in society and improving the efficiency of fertility

		support
		1.1.3 Prediction and evaluation of impacts of significant population fluctuations and territorial inequalities
	1.2 Marginalization and integration of socially disadvantaged groups	1.2.1 Prevention of deprivation, exclusion and segregation
		1.2.2. Lessening of the impact and depth of exclusion, marginalization and stigmatization
	1.3 Social inequalities, cohesion and social state	1.3.1 Improvement of the equality of conditions in access to education and labour market, housing, social security and services
	1.4 Migration, mobility and territorial cohesion	1.4.1 Efficient use of migration potential
		1.4.2 Improvement of territorial cohesion
2. Government and administration	2.1 Citizen, state and society	2.1.1 Legitimate political system
		2.1.2 Legitimate legal system
		2.1.3 Legitimate socio-economic system
	2.2 Public policies and administration	2.2.1 Functional and efficient public policies and environment
3. Culture, values, identity and tradition	3.1 Changes in value structures and ethics	3.1.1 Changes in basic ethical principles of life in society
		3.1.2 Philosophic and sociologic reflection of the media influence on the change of human life and forming of society
	3.2 National, regional and local identity and tradition	3.2.1 Knowledge of history as a prerequisite of keeping a national, regional and local identity, memory and tradition in a national context
		3.2.2 Research of language and literature as a tool for maintaining

		identity
		3.2.3 Creative historical and theoretic reflection of artistic work
	3.3 Material and immaterial cultural heritage	3.3.1 Active protection of the cultural heritage
		3.3.2 Reception of cultural heritage as a tool of national self-awareness and state representation
	3.4. Religion	3.4.1 Reflection of the role of religion in current Czech society in a global context
4.Development and use of human potential	4.1 Education, upbringing, lifelong education	4.1.1 Set new educational goals
		4.1.2 Establish a fully functional system of lifelong education
	4.2 Labour market and employment policy	4.2.1 Employment policy increasing the competences of the workforce and increasing the absorption capacity of the labour market
	4.3 Protection and support of human health	4.3.1 Efficient functioning of the cross-departmental system of protection and support of the health of the population
5. Man, science and new technologies	5.1 Possibilities and conditions for the development of research, development and innovations	5.1.1 Analysis of the effect of knowledge in the Czech social system
	5.2 Adaptability of man and society to new technologies	5.2.1 Adaptation to new technologies

3.4.1. Demographic and social changes

The goal of the "Demographic and social changes" area is to implement the support for active ageing, create more favourable conditions for the implementation of reproduction intents of young people and reduction of the impacts of population fluctuation. It also contains integration of socially disadvantaged groups, prevention of social inequalities and the issue of migration. The base for the improvement of social cohesion is the improvement of equality of conditions and access to

education, labour market and other services. Active approach and efficient use of migration potential presents an opportunity how to prevent some problems; however at the same time migration brings foreign elements into the domestic environment and puts higher demands on maintaining of the territorial cohesion.

3.4.2 Government and administration

The main goal of the area named "Government and administration" is the need of innovation in the current system and the adaptation of the political system and administration to current and future needs of the Czech society with the aim to create a legitimate political, legal and socio-economic system, which readily reacts and successfully eliminates internal and external threats. The prerequisite for the transition of new ways of government into the society's functioning are the effective public policies and administration, specifically the discovery of a dynamic balance between the needs of the public sector, private sector and the citizens.

3.4.3 Culture, values, identity and tradition

The third area "Culture, values, identity and tradition" deals with the thesis, that the common denominator of the society's cohesion is the common culture defined apart from language and historically changeable territory by a set of generally acceptable cultural characteristics. The attention, which the state gives to its own history and its care for the cultural heritage, is an evidence of its advancement and sovereignty. Therefore it is important to find factors affecting the changes in the perception of the so-called traditional values and culture, characteristic of the process of creation of regional and local identity, among others by discovering and making available the cultural heritage and reflection of the society's religious situation.

3.4.4 Development and use of human potential

The fourth part deals with "Development and use of human potential". The key prerequisite of further development is the creation of an effective education system, which will as much as possible react to the demands of the society, labour market and economy, will be interconnected with the labour market's demands and other tools completing the active employment policy. The effort to develop and apply a cross-departmental system of health protection is aimed at the improvement of life.

3.4.5 Man, science and new technologies

The last of the five areas focuses on the topic of "Man, science and new technologies". To form a knowledge-based society it is crucial to setup optimal parameters of the R&D system in the Czech Republic while also taking into account the international context. Within social innovations it is necessary to maximize adaptation to new technologies and achieve maximum possible rate of their adoption.

3.5. Healthy population

The priority area 5 considers the healthy population to be a cornerstone of an economically, socially and humanly successful society. This doesn't mean only medical research but also sociology population psychology, demography etc. It is also necessary to focus on prevention, society behaviour and its faulty nutrition, habitual, motoric and other negative patterns. Attention must be paid to external influences of the environment, which are undergoing major changes.

The priority area Healthy population had been divided into three areas - Origin and development of diseases, New diagnostic and therapeutic methods, Epidemiology and prevention of the most serious diseases.

Detailed structure of priority areas and subareas is included in Annex 6.

Table 5: Structure of the priority areaHealthy population

Priority area	**Subarea**	**R&D Targets**
1. Origin and development of diseases	1.1 Metabolic and endocrinal diseases	1.1.1 Aetiology and pathophysiology of insulin resistance
		1.1.2 Aetiology and pathogenesis of immunity-based endocrinal diseases
		1.1.3 Pathogenesis and treatment of diabetes complications
	1.2 Circulatory system diseases	1.2.1 Clarification of etiologic factors and pathophysiologic events affecting the origin and progress of cardiovascular and cerebrovascular diseases
		1.2.2. Development of early diagnostics of cardiovascular and cerebrovascular diseases and discovery of therapeutic modalities and processes in therapy of cardiovascular and cerebrovascular diseases with higher therapeutic efficiency and which is also more patient-friendly
	1.3 Cancer diseases	1.3.1 Cancer biology in relation to diagnostic and therapeutic goals
		1.3.2 Analysis of relations host-cancer as a tool to individualize diagnostics and treatment
	1.4 Neural and psychic diseases	1.4.1 Psychic and neurologic diseases
		1.4.2 Diagnostic of neural system[8]
		1.4.3 Improved efficiency of treatment

[8]Neural system comprises of the central (brain) and peripheral neural system

		methods of neural system diseases
		1.4.4 Ensuring the quality of life of patients with neural system diseases
	1.5 Motoric system and infectious immunologic diseases	1.5.1 Aetiology and pathogenesis of degenerative and metabolic diseases of the motoric system
		1.5.2 Definition of risk factors of the origin of allergic diseases and identification of new goals of targeted treatment of these diseases
	1.6 Infections	1.6.1 Aetiology and pathogenesis of significant infectious diseases
2. New diagnostic and therapeutic methods	2.1 In vitro diagnostics	2.1.1 Deepening of the knowledge in the area of –omic and high capacity methods
		2.1.2 New IVD technologies
	2.2 Low-cellular treatment	2.2.1 New low-cellular compound
		2.2.2 Identification of new therapeutic goals, new methods and procedures for biologic testing
	2.3 Biological medicaments including vaccines	2.3.1 New vaccines for prevention and treatment of diseases and addictions
	2.4 Drug delivery systems	2.4.1. Development of new carriers for directed administration and transportation of drugs
		2.4.2 Systems for overcoming biologic barriers and chemo-resistant diseases
	2.5 Genetic, cellular therapy and tissue replacements	2.5.1 Sources of cellular and tissue therapy
		2.5.2 Methods of differentiation and genetic modification of cells/tissues
		2.5.3 Biomaterials
	2.6 Development of new	2.6.1 Electric and magnetic mapping

	medical instruments	and stimulation
		2.6.2 Endovascular procedures
		2.6.3 Navigational and robotic system, neurostimulants. Improved accuracy and supervision of invasive techniques
	2.7 Innovative surgical procedures including transplantations	2.7.1 Surgical procedures and transplantations
		2.7.2 Non-invasive treatment
3. Epidemiology and prevention of the most serious diseases	3.1 Metabolic and endocrinal diseases	3.1.1 Evaluation of the impact of preventive measures on the origin of the most frequent metabolic disorders
	3.2 Circulatory system diseases	3.2.1 Population study: disease data
		3.2.2 Population intervention, assessment of the influence of preventive measures
	3.3 Cancer diseases	3.3.1 Screening and prevention of cancers
		3.3.2 Identification of risk factors and individuals in the population
	3.4 Neural and psychic diseases	3.4.1 Population study: disease data
		3.4.2 Population intervention, assessment of the influence of preventive measures
	3.5 Motoric system and infectious immunologic diseases	3.5.1 Epidemiology of degenerative and metabolic diseases of the motoric system
	3.6 Addictions	3.6.1 Ties
		3.6.2 Social impact
	3.7 Infections	3.7.1 Epidemiology of infectious diseases
		3.7.2 Domestic and imported food as a source of infections

3.5.1. Origin and development of diseases

The area "Origin and development of diseases" covers the most serious diseases (regarding their lethality, prevalence of negative social and economic consequences), such as civilization diseases, which are related to the unhealthy lifestyle of the population (the genetic predispositions play a significant part as well). The discovery of the mechanisms of the disease origin will significantly help early detection of the illness, development of new medical procedures and methods and as a result to improve and prolong people's lives and decrease the negative socio-economic impacts of the diseases. The area contains a total of 6 subareas divided according to the disease groups: metabolic and endocrine, circulatory system, cancer, neural and psychic, motoric system and infectious immunologic diseases with focus on the origin and development of allergic diseases, infections.

3.5.2. New diagnostic and therapeutic methods

Area 2 "New diagnostic and therapeutic methods" includes a wide array of methods and technologies for the treatment of the most serious diseases. The area was divided into 7 subareas reflecting newest and in the near future expected development in this area. Related to the rapid development of diagnostic methods in recent years it is possible to e.g. study with high accuracy the specific cellular populations or even specific proteins related to the given illness (subarea aimed at the application of new methods and technologies in In vitro diagnostics). At the forefront in modern therapeutic methods are various tissue replacements, which are quickly and effectively accepted by the patient's organism without causing negative influences or various limitations to the quality of his life (see subarea Genetic, cellular therapy and tissue replacements with focus on research of sources, methods and biomaterials). The effort to achieve the lowest possible negative influence on the patient's organism is also obvious in the development of methods for transplantation and regeneration and in application of mini-invasive surgical methods and procedures (subarea Innovative surgical procedures and Development of medical instruments and accessories). Very important is also the research and development of new or newly modified medicaments (see subareas Low-molecular medicaments, Biological medicaments including vaccines) and the method of their application and spread in organism (subarea Drug delivery systems regarding the research of carriers for release and transport of medicaments and systems for overcoming biologic barriers and chemo resistant diseases).

3.5.3. Epidemiology and prevention of the most serious diseases

Area 3 "Epidemiology and prevention of the most serious diseases" is divided according to disease in a similar manner as Area 1 dealing with their origin and development. In relation to the current development of society and the growing interconnection of the world there is an increasing need to monitor the origin of diseases and health problems in the population and the study of natural, social and economic factors, which determine or influence these occurrences. The epidemiologic research provides necessary information background not only for the successful therapy and prevention of diseases but also for the public administration when preparing and implementing health policies at the national and regional level.

3.6. Safe society

Priority area 6 deals with the necessity of adaptation of the Czech security system to new threats and risks. This includes natural and man-caused catastrophes. In the global context the focus must be on the threats of terrorist attacks and related protection of critical infrastructures, energetic security and suppression of organized crime.

In total there are four main areas - Safety of citizens, Security of critical infrastructures and resources, Crisis management and security policy, Defence, defensibility and deployment of armed forces.

Detailed structure of priority areas and subareas is included in Annex 7.

Table 6: Structure of the priority areaSafe society

Priority area	**Subarea**	**R&D Targets**
1. Safety of citizens	1.1 Protection of citizens	1.1.1 Support of measures and tasks of citizen protection
		1.1.2 Improvement of protection tools and services
		1.1.3 Security of towns and municipalities, informing, education and motivation of citizens
	1.2 Protection against crime, extremism and terrorism	1.2.1 Creation of useful methods of analysis of types and spread of crime and implementation of efficient tools of its suppression
		1.2.2. Minimizing cybernetic crime and data abuse
2. Security of critical infrastructures and resources	2.1 Protection, resistance and restoration of critical infrastructures	2.1.1 Development of alternative and emergency crisis processes
		2.1.2 Improvement of the CI resistance
		2.1.3 Ensuring and developing CI interoperability
		2.1.4 Efficient detection and identification of threats
		2.1.5 Development of ICT, telematics and cybernetic protection of CI
	2.2 Communication and ties between CI	2.2.1 Mutual dependences of CI systems
		2.2.2 Informational support of detection of possible unfavourable influences

3. Crisis management and security policy	3.1 Development of the state security policy and the Czech Republic's security system	3.1.1 Evaluation of the efficiency of strategic management and assessment documents in the security field
		3.1.2 Support of adaptability of the Czech security system to changes in the security environment and emerging new security threats
	3.2 Assessment of risks and threats, creation and development of scenarios, procedures and measures	3.2.1 Analysis of security threats and creation of scenarios of the development of the global, European and Czech security situation
		3.2.2 Support of specific security areas
	3.3 Systems of analysis, prevention, response and restoration	3.3.1 Improvement of systems of gathering and sorting information
		3.3.2 Analysis of security information
		3.3.3 Improvement of the efficiency of the security system and crisis management
		3.3.4 Improvement of systems of restoration support
	3.4. Legislative and legal problems	3.4.1 Legislative procedures and measures in case of a threat to the inner state security, extraordinary natural or anthropogenic events and crises
4.Defence, defensibility and deployment of armed forces	4.1 Development of the abilities of the armed forces	4.1.1 Development of new weapon and defence systems
		4.1.2 Preparation, mobility and sustainability of the armed forces
		4.1.3 Support of command and management
		4.1.4 Development of communication and information systems and cybernetic defence

3.6.1 Safety of citizens

The area “Safety of citizens” focuses on the elimination of possibilities of natural or anthropogenic catastrophes and minimization of the impacts of crises and extraordinary events on regions, towns, municipalities, health and lives of the people, their properties and living conditions. The second target in this group is to create such policy with appropriate tools, which will be able to support the creation and development of specific tools and procedures meant for combating all forms of serious crime activity.

3.6.2. Security of critical infrastructures and resources

In the area “Security of critical infrastructures and resources” were also identified two priority targets. The first one is to ensure the functionality of critical infrastructures with the aim to prevent the development of undesirable situations which arose as a result of external influences, including natural catastrophes and anthropogenic deeds, into critical situations. The second target in this area is to create information support for modelling of mutual dependencies of at least the crucial systems of the critical infrastructure, which will enable the early detection of threats arising from mutual dependencies and ties and a more accurate prediction of the development of behaviour and application of regulatory mechanisms, which minimize the likelihood of escalation of the critical situation and a possible overall collapse of the community with long-term consequences.

3.6.3. Crisis management and security policy

A total of four targets were identified in the area “Crisis management and security policy”. The first target is to improve the mechanism for creation and implementation of security policy based on a clearly defined structure, task and place of strategic directing and assessment documents in the area of security, which must be regularly updated depending on the development of the security environment and based on the strategic priorities of the security policy of NATO and EU. The second target is to create a mechanism of finding and identifying security threats and risks, which will be based on regular preparation of prognostic studies and scenarios of the development of the security situation and creation of a set of measures to eliminate detected threats. The third objective is to ensure for the operative and crisis activities interoperable technologies of gathering, sorting, saving, analysing, securing and accessibility of information and knowledge from open and intelligence sources and further ensure following information and applied technologies for effective use of information and knowledge for effective prevention of threats and an eventual response including emergency management and consequent restoration. The final goal is to develop legislative procedures and proposed legislative measures so that the legislative framework will create a complex environment for efficient activities of relevant bodies and will dynamically react to newly arising needs of the security system of the Czech Republic.

3.6.4. Defence, defensibility and deployment of armed forces

The focus of the area “Defence, defensibility and deployment of armed forces” is to ensure the development of Czech armed forces in key areas necessary to ensure the nation’s security, to achieve declared political-military ambitions of the Czech Republic and to fulfil the role and function of Czech armed forces.

4. Relations between priority areas

Although the R&D priorities or the individual priority areas set in relation to the basic social challenges were outlined mainly so that they won’t be overlapping, it is clear that there are stronger

or less significant ties between individual areas. That's why it is possible to find such relations between individual priority areas (hereinafter only as "PA"). These ties must be taken into account especially when creating R&D programmes directed at achieving priority targets so that the support will cover existing targets comprehensively.

In this part the most significant ties between individual areas are described, which were identified in the process of setting the priorities. A more detailed description of ties between individual targets is included in the identification lists of partial targets, which are a part of the Concluding Reports of the expert panels included in Annexes 2-7.

All priority areas are listed here for transparency, in the following text these are identified by their appropriate number:

PA 1 - Competitive knowledge-based economy

PA 2 - Sustainability of energetics and material resources

PA 3 - Environment for quality life

PA 4 - Social and cultural challenges

PA 5 - Healthy population

PA 6 - Safe society

4.1. Efficient use of energy and decreasing the energetic demands of economy

PA 1 follows these objectives especially in area 2 (Strengthening of sustainability of production and other economic activities) aimed at the increase of economy and efficiency of production regarding the use of energetic resources and in area 1 (Use of new findings from the field of GPTs), which strives to improve the efficiency of production processes by using the GPTs. Purposeful and economical use of energies is also included in the objectives of PA 2, especially in area 2 (Decreasing the energetic demands of economy), where the efficient use of energies is approached in a broader way regarding the use of new energetically effective technologies in energetics, industrial production as well as in final consumption. Another perspective is adopted in PA 3, which in area 4 (Environmental technologies and innovations) deals with the development of technologies, which increase the efficiency of use of primary resources.

4.2. Sustainable development of transport and transport systems

PA 1 sets in its goals in area 2 (Strengthening of sustainability of production and other economic activities) the increase of economy and efficiency of transport, where focus is on the use of new alternative fuels and more efficient use of transport vehicles. These goals are related to the topic of development of energetics in transport, which is discussed in PA 2 in area 1 (Sustainable energetics).

4.3. Strengthening of the security of production processes

This topic is in PA 1 mentioned in the whole area 3 aimed at the strengthening of safety and reliability. Ties to other priority areas can be seen especially in the area of network systems security,

which is included in the goals of PA 2 regarding the security of energy grids, specifically in area 1 (Sustainable energetics) and further in the area of protection and security of data (and their transfer), which is in a broader sense of a cybernetic security included in targets of PA 6, namely in area 2 (Security of critical infrastructures and sources).

4.4. Ensuring the safety of energy supply

One of the targets of PA 2 in area 1 (Sustainable energetics) and area 2 (Decreasing energetic demands of economy) is to ensure reliability and security of the energy supply. Apart from the above mentioned tie to PA 1 there is an obvious tie to PA 6 regarding the security of critical infrastructures and resources.

4.5. Biotechnologies and waste use

The area of biotechnology is included in PA 2 and PA 3. In PA 3 in area 1 (Sustainable energetics) are biotechnologies listed in connection to renewable energy sources and energetic use of biomass and in area 2 (Decreasing energetic demands of economy), where this issue is mentioned in relation to the production of biofuels of the 3rd generation, use of microorganisms and genetics. The research in these areas is related to the research proposed in PA 3 in area 4 (Environmental technologies and Eco innovations), which includes the issue of biotechnological processes and energetic use of waste and biomass. Energetic use of waste is also included in PA 2 in area 1 (Sustainable energetics).

4.6. Environment-friendly technologies

The issue of environment-friendly technologies is included in PA 3 in area 4 (Environmental technologies and innovations), where the attention is paid especially to environment-friendly technologies and materials and technologies increasing the overall efficiency of the use of primary resources. In PA 2 in area 1 (sustainable energetics) this topic is discussed in relation to efficient use of fossil resources and decrease of emission of polluting substances and greenhouse gases. The development of new technologies, which are characterized as economical and environment-friendly, is a part of PA 1 and its area 2 (Strengthening of sustainability of production and other economic activities)

4.7. Energetic aspects of development of towns and regions

The topic of development of towns and regions regarding energetics is included in area 1 (Sustainable energetics) in PA 2. This research is related to PA 3 and its area 3 (Sustainable development of landscape and human settlements), which deals with the issue of creating and maintaining intelligent human settlements with minimum impacts on environment.

4.8. Diagnostics and automatic process management

R&D aimed at new diagnostic methods to increase reliability, security and life of energetic facilities (e.g. sensor systems, data transfer and processing) is included in area 2 (Decreasing energetic demands of economy) in PA 2. This research is to a large degree related to the aim of PA 1 research in area 2 (Strengthening of sustainability of production and other economic activities), where the goal is the improvement of economy, efficiency and adaptability in electric engineering including IT.

4.9. Advanced materials and decreasing the material demands of the economy

The whole area 3 (Material base) of PA 2 is dedicated to the material research. It also includes the R&D of new advanced materials (including nanomaterials) as well as innovations of classic materials, which have the potential to contribute to the competitiveness of the Czech Republic. Material research in this priority area has a significant tie to PA 1, especially to area 1 (Use of new findings from the field of GPTs), where the goal is to use the utility of products and security and reliability of processes and also to area 2 (Strengthening of sustainability of production and other economic activities), which is aimed at the development of new technologies which use non-conventional materials and application of new materials. The Decreasing energetic demands of the economy is a part of area 3 (Material base) in PA 2.

4.10. Diagnostic and therapeutic methods

In PA 5 in the area 2 (New diagnostic and therapeutic methods) is included research aiming to develop new medical and diagnostic instruments, which is to a significant degree related to research in PA 1 in area 1 (Use of new findings from the field of GPTs) and in area 2 (Strengthening of sustainability of production and other economic activities).

4.11. Social aspects of R&D concluded in other priority areas – lifestyle of the population and environmental education

The PA 4 in area 4 (Development and application of human potential) contains the issue of protection and support of human health, which has a tie to the medical research included in PA 5, specifically the creation of cross-departmental system of health protection and support, which will be aimed at the improvement of the population's lifestyle and living and working conditions. The research in PA 4 has a certain tie to PA 3, especially in relation to the prevention of environmental damage.

5. System measures and continuous assessment

In relation to the R&D Priorities a number of system measures is being proposed, the implementation of which is a significant prerequisite of fulfilment of the set priority targets. Some of the proposed systemic measures have a general validity for all priority areas; others are specific for concrete priority areas. The following text lists all general system measures.

System measures, which are generally valid for most of the priority areas, can be divided into four groups:

- R&D environment;
- State interventions in R&D;
- Ensuring qualified human resources for R&D;
- Ensuring ties to international R&D activities in set priority areas.

5.1. R&D Environment

5.1.1. Ensure the stability of the R&D environment

The key condition for the development and building of top research teams and implementation of efficient tools of R&D support is the stability of the economic system and predictability of the R&D policy, because frequent changes (e.g. the tax deductible system, fluctuations in R&D funding) are the crucial hindrances to the sustainable development of these activities. The stability of the economic environment and especially the budgetary system of the state is also a key factor of sustainable development in this area. It is necessary to pay increased attention to the efficiency of the mechanisms of the creation and application of public policies, which present a significant aspect of stability of the relation of the state and the R&D environment.

5.1.2. Increase the efficiency and quality of public services, public administration and public policies

A number of domestic and foreign studies mention the undeveloped competences and ineffective processes within the public administration as one of the key problems of the Czech economy and society. In the end the measures improving efficiency and transparency of public administration and associated policies will strongly manifest also in the possibilities and abilities to implement the results of R&D in areas, which have a significant impact on the functioning and prosperity of the society. The key system area is decreasing of the administrative burden and costs of public administration and provision of public services, including the limitation of the risk of corruption behaviour. Attention must also be paid to the division of competences and authority among different levels of the public administration in relation to the changing social conditions, principle of subsidiarity and optimization of the income and expenses structure of the public administration institutions at various levels. An important part is also the creation and implementation of concepts for the measurement of productivity and quality in public administration and in the public sector in general. Therefore it is necessary to compile a comprehensive overview of what (and why) the public sector does, prepare a concept based on analyses, which defines the framework of its efficient functioning and in the final and most important step implement the recommendations of the concept. As important is how well and competently are these competences carried out. Bad, unprofessional work of the public sector brings similar social and economic costs as corruption does. Transparency, output measurements or clear manuals present the type of measures, which will help with the improvement of quality and efficiency of the public sector's activities. The improvement of quality of the public policies and administration will also require continuous assessment of their efficiency and impacts with the use of modern principles such as evidence-based policy, ex-post evaluation etc.

5.1.3. Ensure strategic management of R&D in the Czech Republic

Apart from the creation of a stable environment another important prerequisite is the efficient strategic management and coordinated funding of R&D. The strategic approach applied in the R&D policy requires continuous evaluation of the set of research priorities in relation to current and potential social challenges and implementation of gradual changes in funding in relation to set priorities. At the same time it must be ensured that the changes in funding don't cause destabilization of the R&D system. Regarding the existence of ties between individual research priorities it is also necessary to coordinate the preparation of programmes, which will support R&D

aiming to fulfil the priority partial and principal goals. A more efficient coordination of sector policies at the regional, national and international level will help to achieve synergy.

5.1.4. Ensure an open and flexible labour market

Open and sufficiently flexible labour market creates conditions for the implementation of project funded R&D and for international mobility of researchers. Therefore it is necessary to create such conditions for employing researchers, which will flexibly react to the conditions of research funding and will stimulate a two-way international movement of R&D workers (measure focusing on mobility is listed in system measures aimed at ensuring qualified human resources).

5.2. State interventions in R&D

5.2.1. Direct public support primarily to set priority areas

Due to this reason it is necessary to prepare not only new R&D programmes, whose aims and goals will correspond with the set priority targets as well as modify the focus of current R&D programmes so that their goals corresponded as much as possible with the newly set priority goals, which reflect current and expected needs of the development of the Czech society in the economic, social and environmental area. Priority areas and set targets must be additionally taken into account when preparing the Operational Programmes aimed at support of R&D in the next programming period of the EU Structural Funds.

5.2.2. Support and execute projects, which have the greatest potential to achieve principal goals

The key to the success in the process of a more efficient use of R&D results for the socio-economic development is not only the identification of priority areas and their targets, but also the selection and execution of projects, which lead to the set goals. The system of support should apart from stronger focus on quality and relevance of outputs enable the support of areas, where there may not be a clear and tangible success achievable with a fair likelihood; however the R&D provides prerequisites for making breakthrough discoveries or for significant progress in other R&D areas.

5.2.3. Support the innovation process as a whole

To improve the efficiency of use of new R&D findings in practice it is necessary to support in particular projects, which include the whole innovation cycle, i.e. from basic research to applied research, experimental development to the use of new knowledge in innovations. This way also the activities of research organizations will improve as well as their cooperation with the application sphere including a higher degree of participation of businesses in research.

5.2.4. Strengthen the cooperation between the academic research, universities, applied research and application sphere

In all tools of R&D support it is necessary to develop and support ties between universities and academic research organizations, where the applied research is concluded and the application sphere, which will contribute to a more efficient interconnection of basic research, applied research, experimental development and innovations. This should also be supported by a change in the rules for the Long-term Conceptual Development of Research Organizations based on their results. In relevant programmes it could be possible to use the share of private resources gained for their co-funding as an evaluation criterion.

5.2.5. Thoroughly ex ante and ex post evaluate programmes and supported projects

An important part of efficient state interventions in the R&D area is the ex-ante evaluation, continuous monitoring and ex-post evaluation of the results, benefits and impacts at various levels (project, programme and policy levels). For this evaluation it is necessary to create an adequate set of indicators, which will increase the pressure on goal achievement and will enable to evaluate benefits and especially the long-term impact of the supported R&D. Majority of these indicators must not be of formal nature but such that enable to evaluate the project's progress and the contribution of its results to the achievement of set targets. Also necessary is to improve the openness and transparency of the whole process of monitoring and assessment of all R&D activities.

5.2.6. In supported projects focus on dissemination of their results including their popularization

A plan of dissemination of its results, adequate educational activities and popularization of achieved results should be a part of the relevant projects, the aim of which corresponds with the priority areas (especially in larger projects). A system of knowledge management should also be created at the national level.

5.3. Ensuring qualified human resources for R&D;

5.3.1. Improve the quality of education at all school levels

To improve the competitiveness of the Czech Republic it is necessary to significantly improve the quality and relevance of education at all levels. Apart from the general increase in education quality focus should be on the broadening of knowledge in all areas of science and mathematics, broadening of managerial education as well as encouraging entrepreneurship. Due to the unfavourable situation in this area it is necessary to quickly find efficient processes, which will improve it. These should focus on education of key subjects (science) as well as finding ways to include new quality persons in the education process (e.g. by facilitating the participation of experts from the practical sphere into education).

5.3.2. Monitor and evaluate the quality of education at all levels

The quality of education must be monitored and evaluated with the use of appropriate, measurable and internationally comparable indicators. Results of this evaluation must be used for the improvement of education at all levels.

5.3.3. Develop the system of lifelong education according to the needs of knowledge-based society

The system of lifelong education must reflect current and expected labour market needs. The system must be interconnected with policies and stimuli, which will motivate to people to be active.

5.3.4. Create efficient mobility programmes

Mobility may to a significant degree contribute to the development of human resources in a number of areas. Because of this international mobility programmes should be used more widely, particularly by younger researchers, as they will help to develop their scientific careers. There should also be programmes, which will stimulate the mobility of researchers between the academic and business sectors, which will contribute to a better use of new findings in practice.

5.3.5. Efficiently use funding from the structural funds for improvement of the quality of human resources

Useful for the development of human resources is to use the funding from the structural funds, which present a suitable tool to support this type of activities. In this regard it is necessary to create and use relevant support mechanisms, which will aim to improve the quality of human resources at various levels.

5.4. Ensuring ties to international R&D activities in set priority areas.

5.4.1. Use large research infrastructures abroad

To develop R&D according to the needs of the Czech Republic it is necessary not only to support the establishment of large research infrastructures in the Czech Republic, but also to provide ties to key infrastructures and institutions abroad. Apart from the involvement of R&D conducted in these infrastructures it is also necessary to increase the participation of Czech companies in supplies and services for these infrastructures.

5.4.2. Support the participation of Czech research teams in international research

A better involvement of the Czech Republic in international research programmes and initiatives will contribute to the fulfilment of set goals. Public funding must be used to support the participation of Czech research teams (research organizations from the public and corporate sectors) in all international programmes and initiatives, the aim of which corresponds with the set priority areas.

6. Expenses for the implementation of R&D Priorities

Part of the preparation of R&D Priorities is also the setting of their ties to the R&D expenses from the state budget. The base for planning of expenses and their use is primarily the funding of R&D Priorities, whereas this concerns the use those state budget expenses, which were approved as expenses for R&D activities within the Act on the State Budget for the given calendar year.

Due to the fact that this concerns the continuously implemented R&D Priorities with the implementation period until 2030 and because it is not possible to predict the development in the amount of R&D expenses from the state budget, the expenses for individual areas of R&D Priorities can be set approximately as a share of expenses for the execution of all R&D Priorities.

The reason it isn't possible to define exact amounts of expenses for execution is the fact that to fulfil the R&D Priorities not only the directed support for grant or programme projects will be used, but the targets will be achieved also within the R&D activities supported by other forms (e.g. institutional support of long-term conceptual development of research organizations or international cooperation). It also cannot be excluded that some targets can be reached within specific university research.

The proposal of the approximate allocation of funding among individual priority areas is based on the evaluation of R&D Priorities according to four criteria:

- *Social desirability*, where the priority area is assessed according to its focus regarding the fulfilment of the needs of the society. Although all priority areas are crucial from the point of social desirability, there are certain differences in mutual conditionality and connection.

- *The current state of research and its potential for achieving the key targets*, which takes into account the quality and level of results, facilities and experience of the current R&D environment in the Czech Republic in areas, which are relevant to achieve the set goals.

- *Expensiveness and the scope of the priority area*, where the priority areas are assessed by their overall focus and the financial demands of the R&D activities necessary to achieve the set goals.

- *Participation of the private sector*, which takes into account the level of co-funding of R&D from private funds can be expected in the given priority area.

Apart from these criteria the EU priorities and proposed allocations in the draft Horizon 2020 programme were also taken into account. The purpose of the differentiation of the priority areas was to assess relative claims for R&D funding from public sources.

Preliminary allocation of funding to individual R&D Priority areas is based exclusively on the capacity of the state budget, not on the potential capacity of other public sources (e.g. EU funds etc.).

The percentage listed next to individual areas represents the approximate shares of funding, which will be allocated for the implementation of R&D priorities from the total R&D budget. Therefore this doesn't represent the total directed support funding. It is also expected that the share of private funding spent on the co-funding of projects aimed at the fulfilment of R&D Priorities will in some cases be higher and in some lower. The table may be considered as a recommendation, not as a directive for preparation of the state budget.

The listed allocation is approximate and includes the whole period of R&D Priorities implementation. Eventual changes will be made within the regular evaluation and update.

Priority area	Share of funding
Competitive knowledge-based economy	20 %
Sustainability of energetics and material resources	18 %
Environment for quality life	18 %
Social and cultural challenges	10 %
Healthy population	20 %
Safe society	14 %

7. Annexes

Annex 1	Composition of the Expert Coordination Council, expert panels and the providers' panel
Annex 2	Competitive knowledge-based economy
Annex 3	Sustainability of energetics and material resources
Annex 4	Environment for quality life