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INNOVATION STRATEGY

FOR SMART SPECIALISATION

OF THE REPUBLIC OF BULGARIA

2014-2020

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SUMMARY

Bulgaria as part of the EU is facing serious economic challenges that require the implementation of an ambitious economic policy. By the Innovation Strategy for Smart Specialization (IS3, ISSS, the Strategy) Bulgaria declares its vision for a policy change and overcoming of the existing socio-economic challenges:

- Low labor productivity;
- Low share of high-tech production;
- Demographic crisis – aging of population;
- Providing high quality and healthy life;

The development and implementation of the Strategy should be understood as a dynamic process of adopting the most appropriate areas to focus intervention on.

An effective partnership is needed to implement the Vision and objectives of the Strategy. The central and local government, industry and academia, NGOs and all stakeholders need to be involved in an on-going dialogue to reach a common understanding on the ways and means of achieving economic growth. This version of IS3 is part of a process that will continue during the years of the new budgetary period of the Operational Programs. The strategy includes conclusions, views, and proposals, experience – positive and not only positive – from the implementation of past measures and actions; It is based on analysis of Bulgarian strengths and weaknesses as well as on a good examples of successful policies of other countries.

Based on tradition, industrial and research capacity and potential, based on the competitive advantages it is necessary to plan and implement measures to address the major challenges facing the society. The Strategy should be implemented by means of a well-functioning monitoring and evaluation mechanism, and in partnership with all stakeholders, realizing effectively the "process of entrepreneurial discovery" and if necessary changing the interventions for implementing the Strategy. It is necessary to ensure a relationship between smart specialization and the objective of strengthening the orientation of public funds towards the results as a whole.

IS3 is based on the concept of a broader understanding of innovation[1] going beyond investment only in research or only in the manufacturing sector; it is also based on building competitiveness through design

[1] „**Innovation** is putting into use a new or significantly improved product (good or service) or a production process, a new marketing method or a new organizational method in business practice, workplace organization or external relations that create market advantages and increase the competitiveness of companies at that – according to Manuel from Oslo 3rd edition© OECD/EUROPEAN COMMUNITIES 2005).

Innovation is often defined as a new idea which proved successful in practice. The new idea may be a new product, practice, service, production process or a new method of organization. This new idea can be established as an innovation only if it becomes more or less basic application or proves its usefulness in practice. Transformation into basic application does not always depend only on the strength of the creative idea. It also depends on market opportunities, the willingness of the industry to accept it, economic efficiency, presentation and perception, random external factors, etc. Before the new idea can actually become a basic application, we cannot evaluate these factors and say whether the idea will find a market or whether it will be frequently applied/used. It is therefore not possible to be sure in advance whether the idea will become an innovation: one can only determine subsequently whether a new idea has led to true innovation.

Oftentimes it is not possible to define "innovation" in advance and identify certain activities as "innovative". The familiar innovation concepts include unidirectional ("linear") and interactive ("systems") innovations. Linear innovation is based on a research approach where the new ideas are the result of research and have been put into practice by unidirectional (linear) transfer of knowledge. Change and innovation are expected to be designed and organized, predictable and rationally planned.

and creative industries, innovation in the social sector and services, new business models and innovation based on practice.

Smart specialization is "smart" for two reasons:

• Identifying the priorities by policy makers close partnership with the industry (though not yet to the sufficient extent with the regions because of not addressing them at the regional level because of the strong centralization in the governance of the country);

• This process is taking global trends into consideration, stimulating the businesses to be ambitious but realistic in terms of what can be achieved if they will combine their capabilities in clusters and networks.

The first two parts of the Strategy cover the issues of the socio-economic analysis and capacity for research and innovation performance.

The challenges facing the industry are as follows:

- Bulgarian exports include mainly low-tech products;
- Internationalization of Bulgarian enterprises is low;
- Contribution of foreign direct investment in technology transfer is limited;
- Industrial production is extremely energy intensive, and energy inefficient;
- Labor productivity is low – as a result of the above factors.

Change can be made if in the identified thematic areas of the Strategy the following is stimulated:

- Attracting leading investors in high-tech industries and services, who can invest in the research and manufacturing and service units in the priority areas of the Strategy;
- Developing research and innovation infrastructure, including ICT infrastructure;
- Improving the quality of workforce – training of personnel necessary for the industry; increasing the number of students studying engineering, computer science; retaining and attracting talent; introducing the dual system of education;
- Implementing technological modernization in the manufacturing sector by using resource-efficient/waste-free technologies which are reducing pollution at the source, and reducing carbon emissions;

In interactive "systems" innovations, the base is also a result of research, but also of practice and intermediaries, consulting services, non-governmental organizations, researchers, etc. as participants in a "bottom-up" process. Interactive innovation includes existing (sometimes tacit) knowledge, which is not always purely scientific. Innovations created by an interactive approach often provide better targeted solutions that are easier to apply, as the process is favorable for accelerating the deployment and adoption of new ideas.

Both approaches to innovation are equally valid, but the consequences for programming are different. The linear approach is based on information activities, and linear methods for consulting and training. The interactive model relies mainly on collaboration, sharing of knowledge and mediation methods of consultation. This approach helps to develop the initial research results into practical applications and create new ideas through mutual enrichment of the participants

Innovation activities are carried out by entrepreneurs using existing knowledge and technology to develop and distribute new products and practices. An ecosystem that encourages entrepreneurship creates conditions for identifying business opportunities and facilitates access to 'raw materials', necessary for their development. State intervention in this process is intended to remove barriers to entrepreneurs' activities by providing appropriate incentives and legal and regulatory framework. However, even with existing stable institutional framework, innovation is often hampered by market failures. Given the uncertain outcome of innovation, companies are often reluctant to make sufficient investments in applied research. Especially in Europe, fear of failure is the main obstacle to innovation, although the knowledge generated in this way can be of great public value. In an environment where failure is stigmatized and has its business and social cost, government intervention to stimulate innovation and entrepreneurship is mandatory.

- Raising intra-firm productivity by improvements based on new techniques of management and introduction of new business models;
- Introducing high-tech components and knowledge-intensive business services in traditional industries and services;
- Promoting internationalization of enterprises so that they can enter the international markets;
- Reduce bureaucracy through more effective e-government.

The strategy consists of the following main parts:

- Analytical part which covers the socio-economic analysis, analysis of the capacity for innovation and research performance, and analysis of ICT and ICT potential. The SWOT analysis summarizes the conclusions of the analyses;
- Strategic part, which formulates the vision, strategic and operational objectives for realizing the vision; the proposed main activities associated with the achievement of the strategic objective, and an indicative financial plan;
- Proposal for effective and coordinated management of IS3 with an elaborated mechanism for monitoring and evaluation.

The analytical part summarizes data and conclusions set out in many materials prepared specifically for the Strategy and in connection with the new programming period for the Structural Funds.

Based on a quantitative analysis (1.8) and a qualitative analysis (2.6) an intersection point is sought in the cross analysis (2.7) where the quantitative and the qualitative evaluation of the potential of each economic activity is set out. Quantitative evaluation highlights the strengths of the economy. Qualitative analysis summarizes the state support to the economic activities through the National Innovation Fund, OPC, NSRF and other public instruments. Cross analysis gives a full evaluation of how quantitative advantages are complemented by qualitative ones, which determines the future potential for accelerated technological development. The logic of identification is to locate the intersection point between the group of economic activities and services and the research areas, where the expenditures of the business and the state for R&D are concentrated. Based on this analysis, the following technology areas have been defined:

- Mechatronics and clean technologies;
- Information and Communication Technology;
- Biotechnology;
- Nanotechnology;
- Creative industries, including cultural ones;
- Pharmacy;
- Food industry;

On the basis of proposals from businesses, and the established and declared interest of the academia to participate in international projects, including Horizon 2020[2], and on the basis of the assessment of international trends and market potential, four thematic areas have been identified and certain product and technology niches, services and productions have been specified:

- Information and communication technology;
- Mechatronics and clean technologies;
- Industries for healthy life and biotechnology (including food);
- New technologies in creative and recreation industries;

[2] Bulgarian research organizations and enterprises will be entitled to participate in EU programs, if the joint project is in accordance with the national thematic areas identified in the Strategy

<u>Vision:</u> By 2020 Bulgaria must make a qualitative leap in its innovation performance at EU level to tackle public challenges in the field of demography (reverse brain drain and youth entrepreneurship), sustainable development, intellectual capital and the nation's health.

<u>Strategic Goal: By 2020</u>, Bulgaria will move from the group of "modest innovators" into the group of "moderate innovators"[3].

In practice, this change in the indicators will be implemented through an effective policy for promoting:

- Innovation, research and development of human capital;
- Investment in high-tech areas in which Bulgaria has traditions, has created professionals and successfully competes on the international market;
- Export-oriented industries;

The Strategic objective 2020 will be realized by achieving two operational objectives:

Objective 1: Focus the investment for the development of innovation potential in the smart thematic areas (for creation and development of new technologies leading to competitive advantages and increase in the added value of domestic products and services).

Objective 2: Support for accelerated implementation of technologies, methods, etc. which improve resource efficiency and application of ICT in the enterprises in all industries.

Objective 1 will be implemented by two types of measures: vertical and horizontal.

Vertical measures are aimed at the development of the respective research and industrial areas; horizontal measures will stimulate the links between research and businesses, the attracting and retaining of quality human resources in the respective areas and the functioning of a favorable innovation environment.

For each of the four areas, the global trends, the situation in Bulgaria, and the challenges and upcoming activities have been summarized. This will allow under the OP to propose appropriate measures to address the identified challenges.

To improve the partnership between research institutes and businesses, it will be necessary to apply a combination of approaches for "active demand" and "high quality (research) supply". Good cooperation requires also a relevant infrastructure. Research infrastructure is part of the knowledge triangle. The Centers of Excellence will create necessary preconditions for the development of advanced technologies, where we have created scientific potential.

The Bulgarian research system is still isolated from the industry. A small part of the research results is aimed at improving the technological level of the industry and can hardly be implemented. It is encouraging that its structure is changing, due to focusing on new dynamic areas – quality of life, use of alternative energy sources, use of biodiversity as a source of resources, use of natural resources as a source of raw material for improving the nation's health. The development of sectors having a high level of knowledge will attract and retain young people in the country and will reduce the "brain drain".

To encourage the recruitment of highly qualified staff in the enterprises will be also a prerequisite for the development of their research and development units, which is the foundation for the creation of new knowledge. The quality of research in universities will play a significant role in the improved quality of education and diffusion of new ideas through close cooperation of universities with the business enterprises sector.

[3] IU Scoreboard

For this purpose, restructuring of teaching hours will be needed in order to provide more time for research that is particularly necessary for the career development of young scholars.

An important part of the research infrastructure is the electronic research infrastructure. E-infrastructure is an essential prerequisite for the successful participation of Bulgarian research laboratories in the EU research programs.

For the needs of the industry it is also necessary to reform vocational education and training. To keep the workforce moving in pace with the time it will be necessary to continue to apply the incentive measures for "lifelong learning".

Bulgaria's lagging behind in the field of "green markets" (energy efficiency technologies, waste treatment and recycling technologies, mobility and transport technologies, water supply and sewerage technologies, environmental and systems engineering, life sciences, nanotechnology, eco design, etc.) must be assessed as an opportunity for participation on a relatively "broad" market. Because of the huge gap in this field, a fast and efficient utilization of technology and knowledge is required in order to achieve a degree of integration in this market. A key role is played by the state, which should, especially through public procurement under OPRD and OPE 2014-2020, provide opportunities for the businesses to implement innovative solutions in the sectors of waste, water, energy efficiency and energy technologies.

Stimulation of resource efficiency would improve energy independence and independence from increasingly expensive raw materials for industrial production. Implementation of modern technologies will be essential to increasing productivity and competitiveness of production.

The extensive use of ICT in the industry includes activities related to the optimization of management and production processes, e-commerce and e-business, provision of affordable interactive on-line services (and digital inclusion for disadvantaged people and groups, the elderly and people with impaired mobility). In addition, ICT will create opportunities for flexible, distance and part-time work (including mothers), expanded use of ICT in the resource management activities, energy management, tracing of environmental characteristics and effects on climate change, environmental protection and monitoring in general. It will also enable participation in international platforms, distance and on-line trainings for companies and employees, environmentally-friendly and energy-efficient transport and improved mobility by implementing smart transport systems, etc. The areas for application of ICT are unlimited and lead directly to improved business performance. It is therefore necessary to encourage the use of ICT in all spheres of the industry.

IS3 will be implemented through the instruments of OPIC and OPSESG/Grants from the national budget within the three-year budget forecast, NSRF, NIF.

Measures for implementation of ISSS will be secured financially mainly by the Operational programs OPIC and OPSESG, and the part remaining for the account of state budget will be at the amount not exceeding the allocated resources for innovation within the frame of the laws for the state budget for every year of the planning period till 2020.

Achieving National Objective 2 of the National Program for Reforms – so that investment in R & D can reach 1.5 % of the GDP by 2020 – is not an end in itself. It is a guarantee that the state encourages the development of technology, new products and the development of the existing ones, promotes the improvement of education, and promotes the building of the necessary research and innovation infrastructure. The role of the Strategy is to identify the areas with the greatest potential for growth and direct the support thereto.

The process of defining product and technology niches will continue throughout the whole programming period on the basis of an on-going dialogue with representatives of industry, academia, and all stakeholders with an annual monitoring to track the implementation of the necessary actions to achieve the objectives formulated in the Strategy. The results of monitoring will impact the decisions of the Council for Smart Growth on changing the interventions, if necessary. Evaluation of the results will be

regularly made by an independent assessor, external to the system. Based on the knowledge gained from impact evaluation, the future interventions should be more effective in terms of the development of the country.

The Strategy proposes a mechanism for coordinating and implementing activities that should lead to its successful performance. Drawing from the experience of successful countries in terms of innovation, following the recommendations of the European Commission, taking into account the general understanding of high level management of the policy for growth, the Strategy proposes to establish a Council for Smart Growth with the Council of Ministers, chaired by the Prime Minister. Members of this Council from the central government are 4 ministers – those of MEE, MES, MTITC and MAF, 4 academics – renowned scholars, scientists and researchers, 4 business representatives – successful businessmen of high reputation in the community. The Council will have the task and responsibility to determine the trend of development of the thematic areas of the economy for which there is public consent that these areas are leading and promising for the country.

INTRODUCTION

The European Context

The Innovation strategy for smart specialization is based on "the process of entrepreneurial discovery" for identifying the economic priorities within the research and innovation to create a competitive advantage through the development and tuning of the country's strengths in research and development to industry needs. The aim is to respond to new opportunities and changes in the market by focusing investments in areas that provide increased value added of the economy and its competitiveness on international markets. ISSS is inherently a process that will continue throughout the program period.

Innovation strategy for smart specialization (ISSS) is being developed in accordance with the strategy of the Union 2020 for smart, sustainable and inclusive growth, and to achieve thematic goal 1 of Art. 9 Regulation (EU) 1300/2013 - "Strengthening research, technological development and innovation." ISSS is a thematically precondition from Annex XI of the regulation and its implementation depends on the allocation of funds under the "Innovation and Competitiveness" and "Education and science for smart growth "OP's.

The process of identification of smart specialization is dynamic, involving partners from the economic and scientific fields, as well as civil society to identify areas in which the country has a chance to excel and build its image in the international markets.

Measures undertaken to continue the process of entrepreneurial discovery will allow to support those areas that have the potential for growth and that will contribute most to solve the socio-economic challenges facing society.

Placing an emphasis on supporting national specialization will lead to greater concentration and more effective use of national and European public funding, but also to improved coordination and synergies between initiatives taken at EU, national and regional level. ISSS is being developed in accordance with the vision of Bulgaria as defined in the National Development Plan - Bulgaria 2020 Action Plan for the Danube Strategy „for unlocking the potential of the economy."

Based on the experience from the implementation of OPC 2007-2013 and in accordance with the recommendations of the EC, ISSS provides a system for the identification and support of smart specialization, such as:

- engaging leading entrepreneurs and partners in development and innovation activities in academia and business;
- focusing on supporting national areas of specialization;
- integrating and coordinating activities between public and private sector organizations and entrepreneurs' processes vertically;
- based on data and facts;
- concentrating spending on research and innovation by eliminating fragmentation or duplication of research funds;
- indicating the inter sectoral areas of specialization;
- creating conditions for increasing private investment in research and innovation.

National context

ISSS is based on the analyses and conclusions of the implementation of the Innovation Strategy of the Republic of Bulgaria (2004), lessons learned from the implementation of the Operational Program "Development of the Competitiveness of Bulgarian Economy" 2007-2013 (OPC) and is developed in coordination and to supplement goals and priorities of the National Reforms Program, National Development Program Bulgaria 2020. ISSS is being developed and will be implemented nationwide in

coordination and to supplement the National Strategy for Scientific Research 2020, National Roadmap for Research Infrastructure. ISSS is coordinated with the "National Strategy for the Promotion of Small and Medium Enterprises 2014-2020 ', taking into account the conclusions and recommendations in the annual reports on the development of SMEs; updated National Strategy for population demographic development in Bulgaria (2012-2030) and the National Concept for promotion of active life among old people (2012-2030). During this planning period innovative strategies for smart specialization on regional level (classification NUTS II) have not been developed, however the needs and challenges at regional level are the basis of this document and a key element in the strategy implementation.

1. SOCIO-ECONOMIC ANALYSIS

1.1 General macroeconomic overview

The Republic of Bulgaria became a Member State of the European Union in 2007 and ranked 12th in area, 16th in population and 22nd place in GDP in 2012 and 2013. The country is under a currency board regime (binding national currency to the euro) and is characterized by industrialized, free market economy, medium developed private sector and a relatively small domestic market.

In the latest 2016 edition of the Global Competitiveness Report of the **World Economic Forum**, Bulgaria is ranked 57th, 5 places up compared to the previous report. The country's improved competitiveness is the result of the combined effect of activities in the areas that are used to assess the Global Competitiveness Index. In terms of technology readiness Bulgaria has moved eight places up and occupies 44th position. The country has a remarkable result in access to high-speed internet, broadband internet access and the number of Internet users. However, Bulgaria has dropped down in the higher education and training index (69th position, 6 places down) and labor market (61st position, 12 places down). Performance is poor in the innovations index (2.97) and institutions index (3.38). (Rating Scale with a maximum 7). In order to improve its competitiveness, Bulgaria needs to focus its efforts on improving the quality of the labor force (increasing investment in education, with the introduction of mechanisms to accommodate the needs of industry) and on stimulating the vigor in the demand and introduction of new technologies, promoting the absorption of innovations by the market, building capacity to absorb and adapt foreign technologies and knowledge.

After the financial and economic crisis, Bulgarian economy is on a path of slow recovery due to relatively low demand. In 2010-2011 the engine of growth was the external demand, while in 2012-2013 the focus was on the domestic demand. GDP growth in Bulgaria in 2012 and 2013 amounted to 0.8% and 0.9%. The state of economic activity in the EU has a direct impact on the country's exports, and indirectly on consumption and FDI, therefore it can have a mixed impact on future GDP growth. In comparative terms, GDP per capita in 2012 was 47% of the average for EU 28, which is the lowest level among the Member States. In turn, this position is directly related to the level of productivity of the Bulgarian economy. Reaching the average level of income in the EU requires catching up in productivity, which in the medium term is not possible without technological modernization and changes to the business model of corporate governance. Bulgaria needs an active integration policy for FDI and innovation policy at the sectoral level, to build capacity in the labor force for the absorption and adaptation of modern technologies and knowledge.

The slow recovery of the Bulgarian economy has an impact on the **unemployment** rate, which, albeit slowly, has gradually increased from 9.47 % in 2010; reaching 11.3% in 2013. **Youth unemployment** is a major problem for the existence of a competitive economy and active social inclusion. Businesses still do not give priority to the quality of the workforce, which can be seen in the limited investment in continued vocational training. Linking education with the needs of the labor market, especially private business and high-tech industries, is a "bottleneck" in the sustainable economic development of Bulgaria. It is necessary to link admission in Bulgarian universities to the needs of professionals in these areas and increase the share of engineering graduates and science and education initiatives in the utilization of new knowledge. The current education structure is not conducive to transition to innovation-based growth.

Bad demographics (higher proportion of people over working age than those of working age) will intensify workforce problems. Therefore, Bulgaria should focus its efforts on reducing the dropout from the education system by encouraging work habits formation and educating staff (secondary and tertiary) in accordance with the needs of industry.

The **Currency Board** allows the maintenance of price stability by ensuring the stability of the national currency.

It is expected over the period to 2016 for the **budget deficit** to gradually decrease - from - 1.5% of GDP in 2014 to - 0.7% of GDP in 2016

There is progress in the provision of electronic services by the tax and customs administrations and the introduction of other facilities for citizens and businesses, and this has had a positive impact on **tax collection** - a key aspect of macroeconomic development.

Grey economy remains a major obstacle to the achievement of sustainable economic growth. Along with moonlighting work, it negatively affects the achievement of macroeconomic objectives, quality and productivity at work and social cohesion, reducing tax revenues and directly affecting the underfunding of social systems.

1.2. Business support policy

Government policy in support of enterprises is based on two complementary approaches:

- Creating a favorable overall environment for business and
- Improving access to finance, both for start-ups and emerging businesses.

The main objective of the first approach is the implementation of a policy to reduce the administrative and legal burden, reduce obstacles for trade, privatization and de-monopolization and improving taxation, establishing e-government, as well as creating a positive public attitude and entrepreneurial culture.

The second approach is realized through the implementation of diverse programs to support entrepreneurs in dealing with specific problems - preparation for starting a business, financing and investment, company growth, quality management, export activity, staff training and development etc., all implemented by national and European programs and funds.

Bulgaria is the Member State with the lowest income tax on individuals (10%) and with the lowest corporate income tax (10%) and is among the top countries with the lowest rates of VAT (20%). Such a business environment is oriented to actively attract FDI and entrepreneurial development. However, low corporate tax and low cost of labor are not sufficient to stimulate economic development. They are not sufficient conditions for an export-oriented enterprise, seeking FDI-based technology. The strength of the Bulgarian entrepreneurship is the result of relatively favorable business environment in terms of access to credit, investors' protection and starting a business. However, Bulgaria has serious weaknesses related to the performance of contracts, addressing issues in bankruptcy, cross-border trade, obtaining building and production permits, obtaining access to electricity[4], which hinders the effective development of entrepreneurship.

The role of the state is to create and develop a sustainable environment and favorable conditions for business. An independent and expeditious legal system must be in place. The business sector needs the administrative burden to be reduced and the development of e-government, which will not only accelerate the absorption of EU funds, but will also lead to better coordination and monitoring of national and local policies.

Simplifying and facilitating licensing and permits regimes is a priority for the Bulgarian government. Work on the implementation of the already adopted packages to reduce the regulatory burden on Bulgarian companies will continue and new packages will be included. Measures will be taken to reduce to a maximum of 3 months the time required to obtain licenses and permits to undertake and carry out a specific activity by an enterprise. By the end of 2015 the Bulgarian government (in the Strategy for administration development) will continue employing the rule that the introduction of a new license or

[4] http://www.doingbusiness.org/data/exploreeconomies/bulgaria

registration will be balanced by the removal of another such regime. Acceleration of bankruptcy procedures will be introduced providing a second chance for honest entrepreneurs.

Bulgaria's place in relation to the global technological frontier and leading economies points to the adoption of new technologies as a major area of innovation policy. This requires knowledge, skills and the workforce capacity to absorb new technologies and accelerate diffusion especially in the areas of their specialization. Bulgaria has the potential to develop the education of the younger population, but at the same time much is to be desired as the transition to a higher stage of technological development requires skills to adapt and develop in many new technology areas. Given the low levels of performance and technology, the national policy needs to address not only the expansion of education, but even more to focus on improving its quality; targeting the areas of current and future demand, i.e. coordination of policies in innovation, education, training and the labor market is needed.

Another important factor which will support the development of the innovative and high-tech potential of Bulgarian business is ensuring its access to new markets and sources of projects, grants and commercial financing through the national membership of Bulgaria in the European organizations and initiatives with activities in high technology. For example, by strategy and membership of Bulgaria in CERN (European Organization for Nuclear Research), ESA (European Space Agency), in European public-private partnerships for research and innovation the country could access demanding technology markets. European public-private partnerships aim at developing new technologies, products and services that provide the European industry with a leading role on world markets. They are financed by public funds from "Horizon 2020" research and innovation and private investment by leading industry companies for implementation and commercialization where SME's can also participate. Joint enterprises/Joint undertakings/are entities that are created for Joint Technology Initiatives (JTIs.). Bulgaria has taken steps to join the SP "Biotechnology" (BBI), SP "Fuel cells and hydrogen-2" (FCH-2) and SP "ECSEL" - Electronic components and systems for European leadership. Bulgaria also participates in other programs: "AAL" - to improve the quality of life of older people, "EMPIR" - metrology solutions to social challenges such as energy, environment and health, which are funded jointly by the "Horizon 2020" and the member country and the program Eurostars-2.

Each of these corresponds to the technology areas for smart specialization in Bulgaria identified below.

Bulgaria participates in the competition for European awards for promoting entrepreneurship. There is a preliminary selection of candidates at national level under the leadership of the Ministry of Economy and Energy and the selected candidates take part in the European competition. The aim is to identify and grant recognition to those who most successfully promote entrepreneurship in Bulgaria and serve as an example in the implementation of policies and practices in this area, by drawing attention to the importance of entrepreneurship, encouraging and inspiring future entrepreneurs. The following projects have been realized: Brandiko, Th13teen Arts and TECHNOSTART.

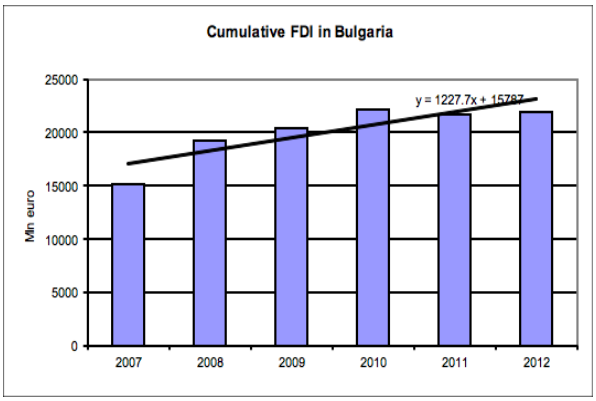
In the implementation of this strategy other participations of the country in joint European partnerships can be seen and supported according to the specific conditions.

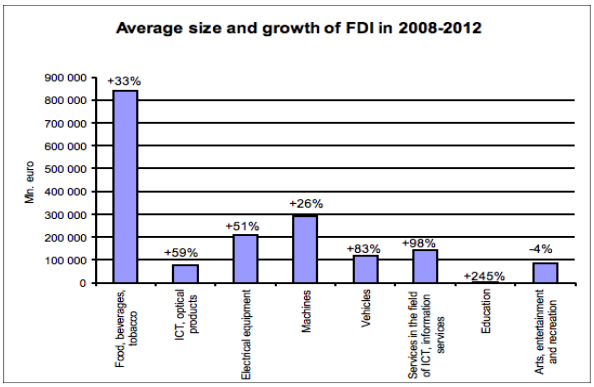
1.3. Foreign Direct Investments

The policy for promoting investments[5] is aimed at increasing economic activity and technological development in production and services with high added value as well as the creation of new productive jobs and decreasing regional disparities in socio-economic development.

[5] Primarily through the implementation of special legislation: Investment Promotion Act (IPA) and its Implementation Regulations

Investments are a key driver of growth and an important factor for improving the competitiveness of the economy by improving productivity as a result of technological innovation and process optimization in enterprises, improving resource efficiency, expanding opportunities for exports, particularly as a result of foreign direct investment (FDI).





Source NSI BG

Special legislation assists the policy of encouraging investment by implementing administrative and financial incentives, including shortened procedures and individual administrative services; acquisition of state and municipal property under facilitated conditions; financial support for construction of components of the necessary technical infrastructure; financial support for staff training and for partial reimbursement of compulsory employer contributions for newly hired employees; a package of government incentives for priority investment projects.

The government's goal is to promote investment in high-tech industries and services for opening highly productive jobs as well as jobs in the regions with the highest unemployment rate:

- **Machine building, electronics, automotive, medical equipment, optical products, medicines, etc.;**
- **Information and Communication Technologies (ICT) and scientific research;**
- **Technological and industrial parks for high-tech industries and innovation.**

Encouraged economic activities include:

- **Activities in the industrial sector:** processing, including high-tech industries.
- **Activities in the service sector:**
    - Activities defined by Eurostat as high and intensive knowledge-based services: creation and deployment of software products and services based on computer technology, accounting and auditing activities, tax consultancy, professional activities in central offices, architectural and engineering activities, technical testing and analysis, research and development, education and human health.
    - Logistic, incl. transport infrastructure – air-ports, ports etc.
    - Office administrative and support activities, activities of telephone service centers and other business support activities.

The total volume of input investments after the crisis year 2009 amounted to little more than 1 billion Euros.

In structural terms, after Bulgaria joining the EU, nearly one third of the accumulated investments are in manufacturing (mainly in "production and distribution of electricity and heat", "production of rubber and

plastics and non-metallic materials," "metallurgy ", textiles and clothing, footwear and leather"). They are followed by the "real estate transactions" (16%), "Trade, repair of motor vehicles and motorcycles" (15%) and "communication" (13%). In terms of dynamics, the biggest investments increase is in mining and quarrying (4 times), education (nearly three times), and in the field of information technology and services (approximately 2-fold). Within manufacturing investments in automobile production and distribution of electricity and heating have almost doubled. Investments in metallurgy have increased by 60%, while those in the production of computer, electronic and optical equipment by 59%. Foreign investments contribution to technology transfer is limited.

Foreign direct investments are oriented towards important components of the innovation system (education and ICT), as well as sectors with potential for development as automotive (83% growth), electrical equipment (51% growth), food products and beverages (30% growth), etc.

1.4. Sectoral specialization in manufacturing and services.

The analysis of the GDP ***structure*** after Bulgaria becoming an EU member shows relative stability and emphasizes the importance of the industry and services sector in the economic development of the country:

- Agricultural Sector - 5%;
- Industry - 25% (mining and quarrying, manufacturing, production and distribution of electricity, heat and gas, water supply, sewerage, waste management and remediation activities)
- Construction - 6.0%;
- Service sector - 64%.

In terms of the ***dynamics*** of the added value generated in the period 2007-2013, it is most increased in the services sector (38.0%), followed by the industrial sector (33.0%), agricultural sector (18.0%) with construction experiencing a negative change (9.0%).

Manufacturing is a leading sector, providing almost 80% of the production output. ***The share of added value in production*** is highest in high technology activities:

- High-tech activities - 35%
- Average high-tech activities - 23%
- Average low-tech activities - 11%
- Low-tech activities - 24%

Leading among medium and high-tech economic activities are medicinal products, computer and communication equipment, machinery and metal products, where the share of value added in manufactured products is between 30-35%.

Services sector creates 64% of total value added in the country, accounting for nearly 40% of the value of services provided. Share of value added in the provision of services is greatest in high-tech knowledge-intensive services:

- Knowledge-intensive market services - 34%
- Knowledge-intensive high-tech services - 51%
- Less knowledge-intensive services - 32%
- Other less knowledge-intensive market services - 40%

Within the high-tech services those that stand out are information technology (58% - added value of the value of services provided), telecommunications (52%- added value of the value of services provided), information services (51%- added value of the value of services provided). The share of value added in providing knowledge-intensive market services is greatest in legal and accounting services (61%) and in less knowledge-intensive market services, particularly in trade, the share fluctuating between 43-49%.

Employment in industry is estimated at 617 000, with 525 000 in manufacturing only. Services employ about 1 million, i.e. twice as many employees as in the manufacturing industry.

In terms of technological intensity of economic activities, employment is concentrated in medium-low and low-tech activities (82%), as well as providing less knowledge-intensive services (81%), i.e. high-technology sectors of production and services employ 18-19% of employees in the manufacturing and services sectors.

To establish the ***comparative competitive advantages and production and export specialization*** of Bulgarian products, the Balassa methodology[6] was used. Revealed comparative advantages (production and export specialization) were found for 85 product groups covering 79.5% of Bulgarian exports in 2012 and 76% in 2011.

The share of high-tech exports was 5.6% (2012). This is owed equally to the production of computer, electronic and optical products and manufacture of medicinal substances and products.

The exports of medium and low-tech products (71%) are predominant, with 65.3% being the result of production and export specialization, which provides competitive advantages of Bulgarian products in international markets. It is owed most to products as monofilament plastic fiber, metal salts, energy producing facilities, fertilizers, electrical cables and conductors, machinery for agriculture and forestry, household appliances, bearings (ball or roller), printed circuit boards, resistors, apparatus for the management and distribution of electricity, bicycles, perfumery, cosmetics and essential oils, forklift trucks, electric transformers and pumps in the group of medium-high technology activities; ores of precious metals, lead, copper, zinc, packaging, household glass, sanitary articles, vegetable fats and oils, ceramics, minerals and steel products from the group of medium-low technological activities, and wheat, barley, corn , tobacco, clothing, oil seeds and oleaginous fruits, preserves and more from the group of low-tech activities.

In seven product groups Bulgaria is a leader in terms of revealed comparative advantages among EU member states and the Balkans in (Monofilament plastic fiber, metal salts, ores of precious metals, lead, copper, oil seeds and extraction of "soft" oils, women's clothing).

In terms of technological intensity sectors (economic activities), the following conclusions could be made:

- Most businesses and most employees are concentrated in low-tech activities and they generate the majority of added value;
- In high-tech activities, labor productivity is above the national average;
- 82% of the employees are engaged in low-tech activities and they create 75% of value added in technological activities;
- Medicinal substances and products are characterized by a minimum number of employed and maximum labor productivity;
- Production of clothing is characterized by maximum number of employed, high export orientation and minimum labor productivity.

In terms of ***sustainable economic development,*** the solution is increased productivity and added value rather than the supply of goods and services at low prices.

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[6] Estimates made cover 258 product groups (third level of aggregation according to SITC rev.4), distributed according to the global technology intensity of each economic activity (KID2008). All member states of the EU28 are taken into account, as well as Balkan non-member states.

http://www.mi.government.bg/files/useruploads/files/innovations/compadvantagesbg2014part1.pdf
http://www.mi.government.bg/files/useruploads/files/innovations/compadvantagesbg2014part2.pdf .

Two emerging areas stand out, which were identified during the stakeholders' consultation. They cannot be captured through the international standard classifications.

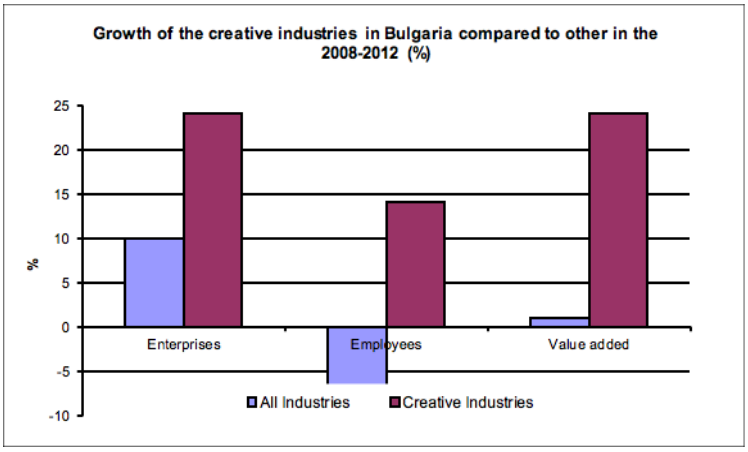
Creative Industries

Dynamics in the development of creative industries in Bulgaria stands out significantly amid slowed growth for the entire economy.

Growth in the number of enterprises, employment and added value is at times higher than other sectors. This is mostly due to the contribution of information technology, information services and the production of movies, TV shows and recordings. At the same time, there is a significant delay in architectural and advertising activities. But there is obvious overall progress in the creative industries.

For the period 2008-2012, the number of enterprises in Bulgarian creative industries increased by 23.5% against 10.6% for the whole economy. Value added also grew by 23.5%, while growth in enterprises from all sectors was only by 0.7%. Most significant is the difference in employment growth. As businesses in the creative industries employment for the period increased by 13.7%, there was an overall decrease by -9.6% in other sectors.

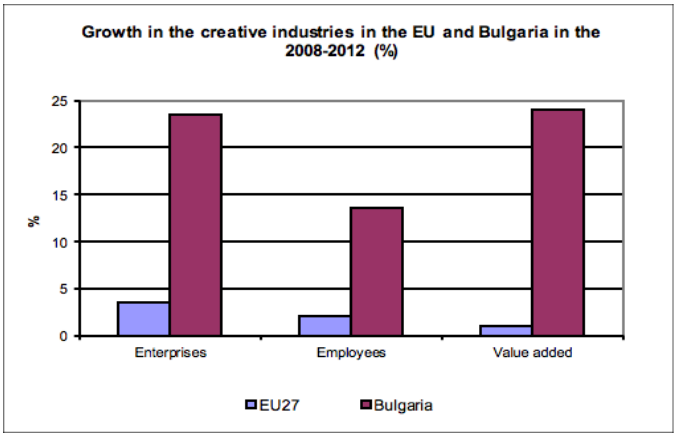
Creative industries in Bulgaria cover 21,812 enterprises (7.1% of all businesses in 2012, the share in 2008 was 6.3%). Creative industries employ 88,700 people, or 5 percent of the labor force, while in 2008 their share was 3.9%. Added value of businesses in the creative industries was equal to 1,340mn. Euro or 7.6% of the added value created by all enterprises. Its share in 2008 was 6.2%. It is obvious those creative industries are gaining a stronger position in Bulgarian economy and that their contribution is growing dynamically. These shares can grow further as they still lag behind by 1-2% compared to the EU average.



Source: SME Performance Review, NSI and own calculations

European trends in the field of creative industries stand in a similar way, albeit with a slightly less pronounced pace compared to European economy. The number of businesses in the creative industries in the EU for the period 2008-2012 increased by 3.8%, while for all sectors it was only 0.5%. Employment in creative industries increased by 1.6%, while overall employment fell by 1.5%. Added value of creative industries has a minimal growth of 0.9%, which seems optimistic amid a 3% decline in the value added in European companies in all sectors.

Compared to the EU sector of creative industries, in Bulgaria the sector is developing dynamically and as stated above, it has more potential for growth. While the number of businesses in the creative industries in the EU for the period 2008-2012 increased by 3.8%, in Bulgaria it increased by 23.5%. Employment growth in the EU was 1.6% and 13.7% in Bulgaria. The added value of creative enterprises in Bulgaria increased by 23.5% and that of the EU by 0.9%.



Source: SME Performance Review, NSI and own calculations

10 facts about creative industries in Bulgaria

1. In the period 2008-2012 only four sectors showed growth in both the number of enterprises, employment and value added. Three of them were from the creative industries: film industry, information technology and research and development, if classified as creative industries
2. IT is the second highest labor productivity sector in Bulgaria following companies from research and development.
3. Among the top 10 most productive sectors in Bulgaria there are 5 sectors of the creative industries: information technology; Film industry; Architectural activities; Advertising; Research and Development
4. Value added per employee in IT in Bulgaria was equal to two employed in the automotive industry and in the manufacture of metal products
5. In the film industry for the past four years the number of companies increased by 50%, the value added by 40% and employment by 25%.
6. The four highest grossing feature films produced in Bulgaria for the last three years have brought to it's producers worldwide revenues of 900 million dollars.
7. Information technologies employ half the number of employed in construction; however their productivity is three times higher.
8. The profit per employee in the film industry is equal the profit of three employees in the clothing industry, courier services and retail combined.
9. Creative industries in Bulgaria employ about 88,700 people. This is equivalent to the entire population of the district centers of Razgrad and Lovech together.
10. Companies from the creative industries in Bulgaria have a total annual turnover of 6.2 billion leva. This is equal to the budget expenditures of all municipalities in Bulgaria.

Organic Products (Bio Products)

In Bulgaria, the number of organic food producers is over 1 000 and according to preliminary data, the number of organic producers, processors and traders has increased significantly - from 2,016 in 2012 they have reached 3,157 in 2013. The upward trend was also observed in the area in the control system, which in 2013 were 79,709 ha, and in 2012 they were 40,378 ha. Driven by global trends, Bulgarian producers seek to increase their areas and products. The dynamic development of the market for organic products is creating a shortage of raw materials for the production of bio products. This is to the apparent benefit of Bulgarian organic producers who export more than 90% of their produce, mostly to Germany. Exports are mainly from farmers' organizations such as the cooperative "Bio Bulgaria - Oil" (production and export of organic essential oils and derivatives - lavender oil, rose oil, peppermint oil and others with a market; rose water and lavender water, dried organic herbs, some cultivated, like mint and lavender and some wild like lime, nettle and chamomile; organic plants – roses, lavender and mint). The produce of the Cooperative "Bio Oil Bulgaria" is certified by the Swiss organization IMO, which is represented in Bulgaria by "Balkan Bio-cert "LTD.

At present there are already manufacturers in the Bulgarian market that offer quality and wholesome children's foods (for children aged 1 to 3 years). One of them is the organic food company for children's meals KIC Group Co. Ltd.

Bulgaria has a long tradition in agriculture and many reserved areas rich in biodiversity, have important prerequisites for the development of organic farming. Therefore, it is a **major policy priority for the Ministry of Agriculture and Food in the new programming period 2014-2020**. The new CAP will introduce the component "Green payments" as part of the direct payments to Bulgarian farmers. The overall resource for the farmers amounts to 240 million. Euros per year. The Program for Rural Development provides for the establishment of a separate instrument "Organic Farming" with financial resources of 110 million. Euros. The ambition of the MAF is organic products to be included in the menu of all Bulgarians - an achievable goal due to the constantly growing number of manufacturers switching from conventional to organic farming.

Under OPIC 2007-2013 the project **"Cluster for development and promotion of organic foods and their consumption in Bulgaria"**, which is being implemented until April 2015, on the territory of Southwest and South Central Bulgaria, the establishment of an administrative body is planned as well as participation and organization of conferences, round tables, seminars on the problems of organic products and many others. Disbursements are currently 246 thousand lev (126 thousand Euros), which is about 50% of the total budget of the project.

1.5 Export / import and trade by sectors[7]

Bulgaria's membership in the EU has led to the orientation of trade towards Europe. Trade with member states now accounts for about 60% of the turnover of the country. Over the period 2008-2013, Bulgaria's trade increased from 40.3 to 48.1 billion. Euros (19.3% growth), including exports reaching 22.2 billion.

[7] NSI, MEE calculations

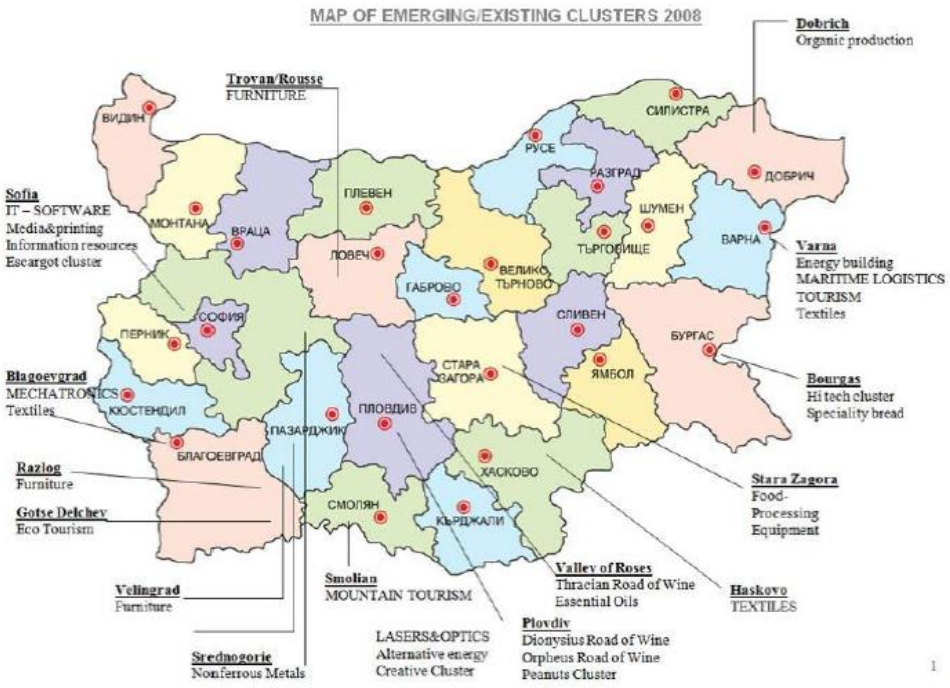
Euros (up by 46.2%), while imports reached 25.9 billion. Euros (up by 3.0%). Despite the rapid growth of exports, the trade balance continues to be negative.

The fastest growing export sector is agricultural products (almost 2-fold increase), food (almost 2-fold increase), machinery (up by 50%), etc. High-tech exports amounted to 6%, but there is significant growth in the exports of computer, electronic and optical products which have increased by 37%, while that of medicinal substances and products almost 3 times. Imports of food products mark the biggest increase (by 42%), followed by chemicals (30%), while import of machineries has shrunk by 14%.

High-tech products are increasingly dominating exports (computers and communication equipment, electronic and optical products, medicinal substances and products) resulting from the existing and increasing capacity, which is the basis for sectoral specialization of the country. Organic products (mainly in the sector of agriculture and food) have direct contributed to the significant increase in exports of these product groups. Traditions in manufacturing and export of various products in the field of machine building, cosmetics, textiles and clothing, etc. are the required field for nanotechnology development.

1.6 Established and emerging clusters

Development and implementation of cluster policy in the world is a proven way to increase productivity, competitiveness and internationalization. There are a number of good practices in this regard. Bulgaria has financially supported this process within OP Competitiveness 2007-2013 with a concrete procedure, "Support for cluster development in Bulgaria" for the total amount of 15.1 million Euros.



Project proposals submitted by new or existing clusters include over 1 000 members, including companies, NGOs, almost all accredited universities in Bulgaria, and a large number of municipalities. Beneficiaries' registered offices are in Sofia and major cities. Their business is carried out throughout the country and cannot be divided on a regional basis.

Existing industrial clusters concentrate on technological activities related to the adaptation and use of already known technologies in their field of business. In respect of the degree of development of Bulgarian industry, it is quite common for them to seek options for competitive advantages, based primarily on adaptation and application of already known technologies rather than investing in expensive projects for research and development. Potential and existing clusters at different stages of their life cycle will need assistance in various areas, including enhancing managerial and entrepreneurial skills and investment

support. If not, most of them will not be able to attain the level of development, efficiency and innovation of the EU-15 clusters.

The total number of existing clusters in Bulgaria at present is 190 (according to CIELA[8]). For the new programming period it is planned that the measures for support of clusters should be specific for start-ups and for existing ones.

Classification of clusters in Bulgaria will help improve coordination on macro-regional level. As inherently clusters do not respect regional boundaries, improving coordination and strategic planning are key to establishing conditions for generating innovative dynamics in Bulgarian clusters.

In the strategic analysis of AT Kearney were identified key industries and industrial clusters with growth potential based on the comparative local advantages, including agricultural-foods and health care, transport and logistics, transport equipment and machine building, IT and outsourcing, chemical industry, electronics and electrical engineering. This assessment corresponds to the analysis of exports noted above. Estimates of Development Program Bulgaria 2020 show that investments in priority areas could generate up to 33% growth .

The Operational Program "Innovation and Competitiveness" 2014-2020 provides support for sustainable clusters and specific activities to support clusters will be determined on the classification of existing clusters into different categories, depending on the stage of development (developed, developing and new). For each category concrete measures and an indicative allocation of the dedicated financial resource will be proposed. Successful clusters need to achieve further growth and scale to become the basis for attracting FDI, interregional cooperation, added value and competitive advantages.

The Association of clusters[9] have identified the following clusters as the most active members:

- Automotive Cluster Bulgaria, South-West Region - Sofia
- Bulgarian Cluster "Telecommunications" South-West Region - Sofia
- EVIC - Industrial Cluster "Electric" (awarded the Bronze label) South-West Region - Sofia
- ICT Cluster Plovdiv (won bronze label) Southern Central Region - Plovdiv
- Microelectronics and Embedded Systems Cluster South-West Region - Sofia
- "Mechatronics and Automation" Cluster (awarded the Bronze label) South-West Region - Sofia
- "Bulgarian Industrial Cluster" Association SER - Varna
- Srednogorie Med Industrial Cluster (won bronze label) SCR - Srednogorie
- Foundation ICT Cluster, SWR - Sofia
- Specialized Institute for Apparel and Textile Cluster (SCIAT) - Danube (won bronze label) SWR - Sofia
- Bulgarian Furniture Cluster (won bronze label) SWR - Sofia
- Marine Cluster Bulgaria, SER - Varna
- Association "Cluster for Health Tourism - Bulgaria" SWR - Sofia

Business clusters can be used as engines for regional smart specialization in Bulgaria because they include elements of innovation infrastructure existing in the various regions. Moreover, the development and creation of new clusters is a prerequisite for the development of links between education, training and business. Clusters can contribute to setting standards of competence required by the various professions. Location of vocational schools and relevant university programs can play an important role in the creation of clusters.

[8] CIELA is the main informational system used in Bulgaria

[9] The Association represents the interests of over 250 companies employing between 18-20,000 people.

Potential for future development and support can be found in clusters with a typical "Bulgarian characteristics" - cluster "Bulgarian yogurt" - export of technologies, equipment and services for the production of yogurt; cluster "Bulgarian rose oil" - the development of Cosmetic perfume industry based on efficient production of rose oil; cluster "electricity production from biomass" - the development of technology and production equipment for the generation of electricity from various biomasses.

Within the implementation of cluster policy Bulgaria has participated in the cluster platform SEENECO, whose main purpose is to promote professionalism of the managers of clusters in Southeast Europe through the application of tools developed by the European Cluster Excellence Initiative (ECEI), which will subsequently be employed at regional level. [10]

1.7. Regional specialization [11].

Bulgaria is traditionally a highly centralized country. After study of the state structure and governance of regions NUTS-2 it was adopted instead of the concept "Regional specialization" to be used the concept "Geographical specialization". During the past programming period all regions in Bulgaria have developed Regional Innovation Strategies (RIS) under the auspices of the European Commission initiative "Innovative Regions in Europe." A limited part of the measures provided for in these strategies have been implemented due to the high centralization of decision-making and management. All measures related to innovation and support programs are coordinated centrally.

The number of employed in Bulgaria is just less than 3 million. Around one third of them are engaged in various economic activities in the territory of the South-West Region, where the capital is located. Another third of all employed are concentrated in two other southern regions of the country - the south-central and southeast and the rest in the three northern regions. Therefore, one third of all employed are in the three northern regions and the other two thirds are in the territory of Southern Bulgaria.

From the analysis of **economic activities that generate maximum employment in the areas of planning** it can be concluded that with the exception of the North West and North Central regions in all other areas the potential for specialization is a fact. With the exception of architectural, engineering, and activities in the field of information technologies that are among the leading innovative activities, specialization in low-innovation activities prevails: **food industry and related activities, as well as the production of clothing and furniture.**

The analysis of the **leading innovative economic activities** shows that specialization is concentrated in the Southwest region, but there is potential for specialization in other regions too - production of medicines (NWR), production of medicinal products (NCR) and information services (SER). Regional potential for innovation specialization is observed in the production of pesticides (SCR), production of measuring equipment (NWR, NER SCR), aircraft and spacecraft (SCR, SER), chemicals, cosmetics and toiletries (NER, SCR), electronic components and printed circuits (NCR, SCR), production of general purpose machinery (NWR, NCR, SER) and others.

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[10] The project focuses on increasing the competitiveness and sustainability of clusters, primarily at the organizational level.

Partners are representatives of national and regional authorities and cluster initiatives, focusing on the following areas: • Transfer of knowledge, materials and methodologies developed by ECEI • The development of sustainable training structures. • Contributing to the development of European portfolio of "excellent" clusters. • Supporting cooperation between international clusters, including through direct interaction between cluster managers in SEE and experienced ones in other countries.

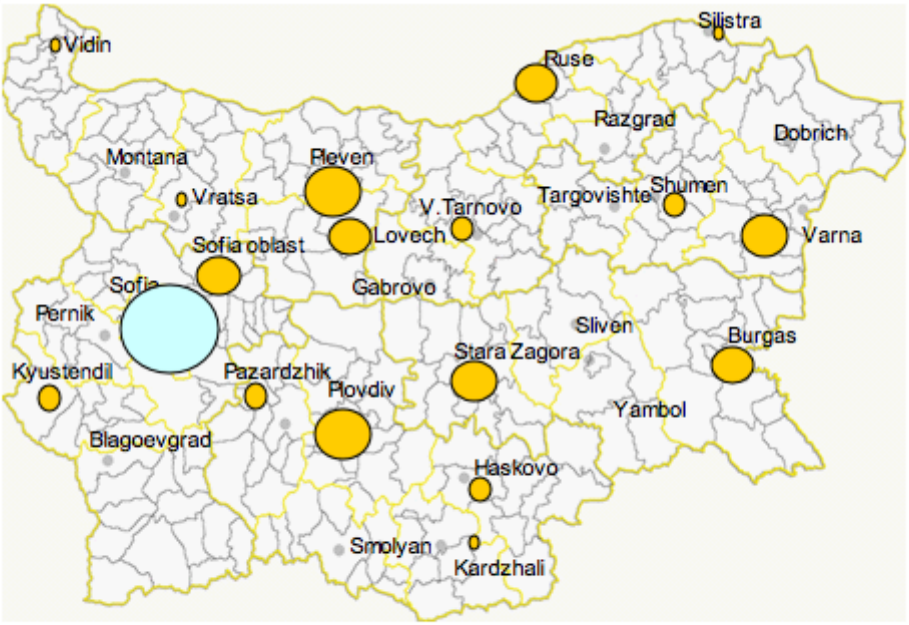
[11] Regional specialization of regions is calculated on the basis of data on employment in the economic activities of the area (third level of aggregation as per KID2008) using the formula

RS = , where *Empl* – number of employed, i- economic activity, *R*- Region, *BG* – Bulgaria. If the obtained result is bigger than one, we conclude there is specialization in the area of the respective business. Aggregating data to the second level of classification of economic activities provides an opportunity to see where and to what extent the specialization of each region is concentrated.

Employment in activities in the field of information technology and architectural and engineering activities stands out. Scientific research in technical sciences combined with production of software, production of computers and equipment for measurement, electronics, optical equipment, telecommunications, consultancy in the field of management and others are the basis of the development of information and communication technologies and mechatronics. Despite the concentration of these activities in The South West Region (mainly in Sofia), there is a potential for future regional specialization. Another innovative area that concentrates employment is the manufacturing of medicinal products. Along with research in medicinal science it forms the existing and future potential for regional specialization in the field of **pharmacy.** Last but not least we can reference engineering and in particular the potential for specialization in **electric car production**.

From geographical point of view, the existing potential for regional specialization in leading innovation is located diagonally from Southwest Bulgaria through central Bulgaria to Northeast Bulgaria

Here is how the regional specialization[12] of the **leading innovative activity, namely research in the natural, medical and technical sciences**, looks like. Estimates show that 73% of employment in this economic activity is concentrated in Sofia, but the map shows the potential for specialization in other areas and cities. Thus, the potential of Plovdiv and Stara Zagora is approximately equal to that in Pleven and Varna, followed by Bourgas and Ruse. Regional concentration of companies, meaning institutes and research centers, is similar.

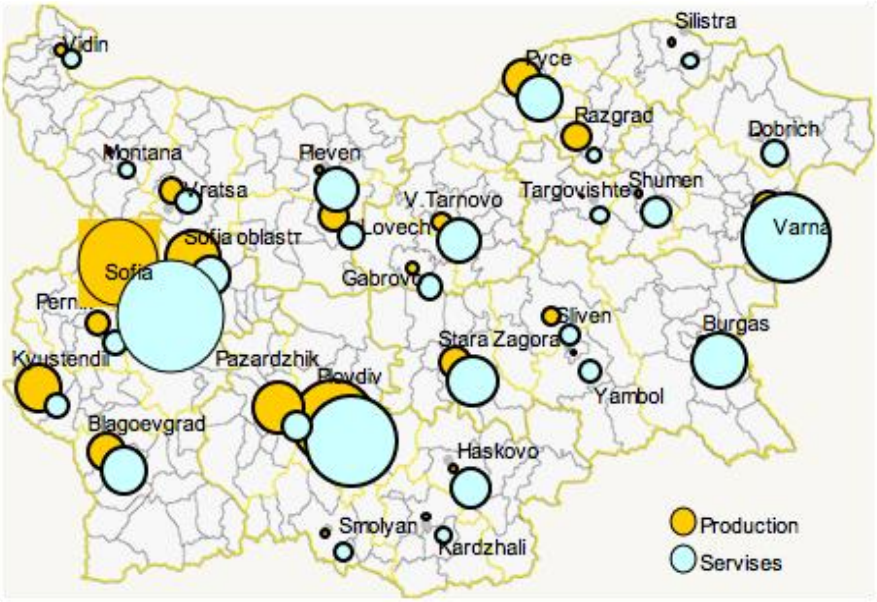


Source: DB Amadeus, own calculations

[12] Calculations are based on data on employment. On this chart Sofia has been deliberately reduced in scale and other areas have been enlarged for better representation of the regional potential.

- **High-tech industries and knowledge-intensive services.**

The group of high-tech industries and high-tech knowledge-intensive services includes production of medicinal substances and products, the production of computers, electronics and optics, services in the production of movies and TV shows, sound recording and music publishing, radio and television activities, telecommunications, information technology, information services and research and development.

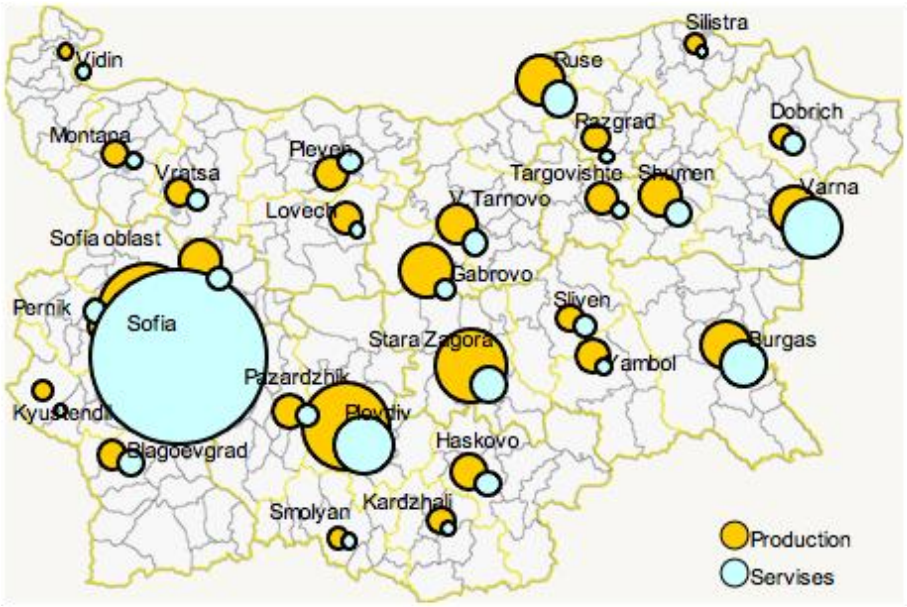


Source: DB Amadeus, own calculations

This group employs a total of more than 120 000. All activities of the group are characterized by a high degree of specialization in regional cities. Except for the production of medicinal substances and products, all other activities are characterized by medium and high share of SMEs. Activities are highly concentrated in Sofia with more than 80% of employees in industry and services operating in the capital. Specialization of the workforce combined with the density of enterprises is a prerequisite for the implementation of a cluster policy.

- **Medium-high and medium-low tech industries and market services (financial intermediation not included).**

The group of medium-high and medium-low technology industries[13] covers economic activities from C19 to C30 under the Classification of Economic Activities (KID-2008) - refined petroleum products, chemicals, machinery, vehicles, rubber and plastics, metals and others and knowledge-intensive market services - legal, accounting, managerial, technical testing and analysis, market research, providing manpower and others.



Source: DB Amadeus, own calculations

This group employs nearly 230 000, almost equally divided between manufacturing and services. With the exception of Sofia, the highest concentration of medium-tech production and market services is located in the central regions of the country - the regions of Plovdiv, Stara Zagora, Gabrovo and Veliko Tarnovo, as well as in the East of the country - Varna, Bourgas, Rouse and Shumen.

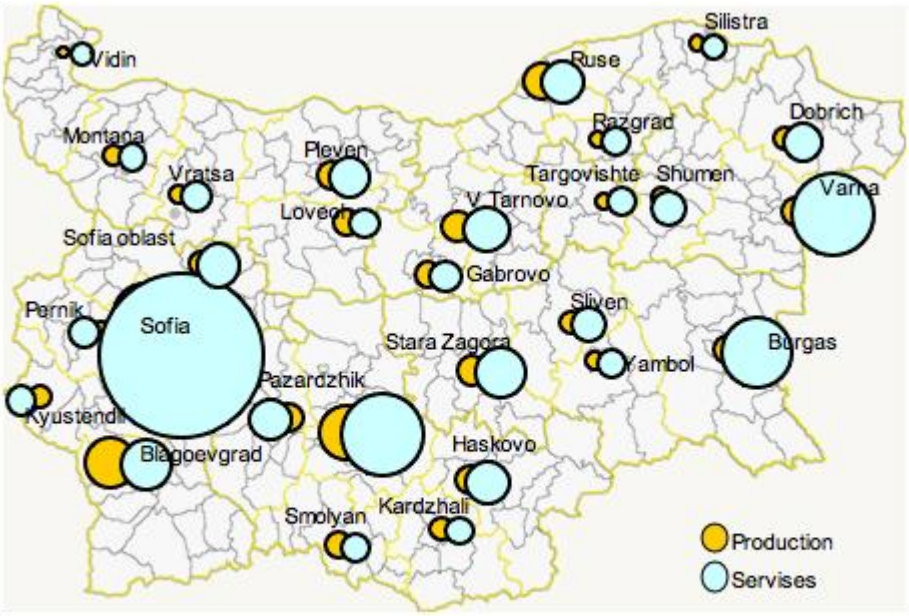
- **Low-Tech industries and less knowledge-intensive market services**

The Low-Tech group includes economic activities related to the production of food, beverages, tobacco, textiles, clothing, leather, wood, furniture, and services such as retail, transportation, hotels, restaurants, real estate, leasing, tour operators, reservations, computer repairs and others.

The group employs around 1.5 million, approximately 350 thousand in production and just over 1 million in services. This is the group of economic activities and services that generates maximum employment

[13] BSMEPA 2014-2020 and ISSS-related analyzes

and is characterized by a relatively good regional specialization in the food industry, wood processing, furniture, textiles and clothing.



Source: DB Amadeus, own calculations

In addition to the analytical material developed by the team of the Ministry of Economy, during the period from December 2014 to July 2015 were held series of meetings and discussions. In the period December 2014 and February 2015 there were meetings with stakeholders in the six regions. The purpose of these meetings has been to reveal regional capacity in identified thematic areas of ISSS. Furthermore, through the regional partnership network and the regional development councils the analytical materials were obtained from all six regions (including review of the 28 areas) in which thematic areas are sorted by relevance in terms of available regional capacity. This approach enabled the thematic areas to be focused on regions, where projects under the first two thematic areas will be underpinned by bonus points when applying under priority axis 1 of the operational program "Innovation and competiveness" and the priority axis 1 of the operational program "Science and education for smart growth", specific objective 2: Improve the territorial and thematic distribution of research infrastructures in order to develop regional smart specialization. The bonus system aims to introduce a methodology that is based not on the exclusion but on the possibilities of gradual prioritization by means of the ESIF.

This way regional capacity will be gradually build based on regional specialization through European support and will create conditions for natural clustering which could lead to regional smart specialization strategies in Bulgaria in the future:

Regional Bonus System

North West Region	North Central Region	North East Region
Mechatronics and Clean Tech	*Mechatronics and Clean Tech*	*Mechatronics and Clean Tech*
Industry for Healthy lifestyle and Bio Tech	*Industry for Healthy lifestyle and Bio Tech*	*Industry for Healthy lifestyle and Bio Tech*
New Technologies in the Creative and Re-creative Industries	*Informatics and ICT*	*New Technologies in the Creative and Re-creative Industries*
South West Region	**South Central Region**	**South East Region**
Informatics and ICT	*Informatics and ICT*	*New Technologies in the Creative and Re-creative Industries*
New Technologies in the Creative and Re- creative Industries	*Mechatronics and Clean Tech*	*Mechatronics and Clean Tech*
Industry for Healthy lifestyle and Bio Tech	*Industry for Healthy lifestyle and Bio Tech*	*Industry for Healthy lifestyle and Bio Tech*

Brief information on regions and areas (database of the ME and the regional partner network)

North-Western Region

The region includes the districts of Vidin, Vratsa, Montana, Lovetch and Pleven. According to a deliberate policy of the government to support the development of the North-West region (with the lowest GDP/capita in the whole EU) will be encouraged RIS3 capacity in the three thematic areas of ISSS: *Mechatronics and Clean Tech, New Technologies in the Creative and Re-creative Industries, Industry for Healthy lifestyle and Bio Tech*

North Central region,

Veliko Turnovo. Given the specificity, the existing infrastructure, types and forms of scientific and business development, personnel and administrative capacity, smart specialization in Veliko Tarnovo should evolve priority in the thematic areas "Informatics and ICT" and "Industry for Healthy lifestyle and Bio Tech".

Gabrovo. The RIS3 Capacity of Gabrovo is concentrated in the thematic area "Informatics and ICT" and "Mechatronics and clean technologies". The area is an established industrial center with a stable group of SMEs. Industry development enablers are traditions, constructed facilities, availability of professional technical colleges, technical university. The university plans the creation of innovative Center of competence "Eco and energy-saving technologies", with the following directions: Electro mobiles, laser technologies, systems for environment and material recognition, power electronics design in engineering, photovoltaic systems, energy-efficient lighting systems.

Razgrad. Industrial strengths of the area are in the field of pharmaceuticals, biotechnology, and manufacturing of preparations for veterinary medicine and in ceramics. There is a thriving food-processing industry; resources; the leading companies actively implement new products and technologies. Vocational education corresponds to the specialization of the economy, the well-functioning Branch of Ruse University — has 3 specialties, chemical technology, food technology and biotechnology. There are cultural objects from regional and national importance (including archaeological reserve 'Sborjanovo" under the protection of UNESCO). These strengths address available RIS3 capacity on the areas "Industry for Healthy lifestyle and Bio Tech" and "New Technologies in the Creative and Re-creative Industries".

Rousse. The sectorial composition of the area is relatively stable and is driven primarily by economic activities in the metallurgy, engineering and metal processing — river and sea ships, hydraulic equipment, agricultural machines, units and components. Chemical industry has emerged in the production of motor and industrial oils, paints and varnishes, foiled plastic products, products of expanded polystyrene insulation materials. Textiles and clothing are among the most relevant for industrial development. Among the food and beverage products are mainly produced and processed meat and fish, canned vegetables, vegetable and animal fats, dairy products, milling products, prepared animal feeds, bakery products, food preparations, sugar, coffee, tea, pastry and drinks. Ruse region occupies a special position in the Bulgarian national history and has a rich cultural and historical heritage, including monuments of global importance as the Ivanovo rock churches. The area has unique landscapes such as the Danube coast, the natural park "Ruse Lom", etc. In close proximity are favored reserve "Srebarna", included in the list of the UNESCO World Heritage, Thrace tomb near the town of Isperih, also an UNESCO object, Veliko Tarnovo and Arbanasi. Based on landscapes, traditions and strengths of the area, the capacity for smart specialization should be directed to the thematic areas of ISSS "Informatics and ICT" and "New Technologies in the Creative and Re-creative Industries".

Silistra. There is capacity in the development of food-processing, clothing, mechanical engineering and metal processing industries, forest-based industries, construction, construction materials, less developed are electronics and alternative sources of electrical energy. Clean technologies are at the heart of regional development. As a whole, the capacity for smart specialization is in "Mechatronics and clean technologies" and "Industry for Healthy lifestyle and Bio Tech".

North-Eastern Region

Varna. The economic structure of the area is varied. This relates primarily to port operations, shipping, shipbuilding, ship repair, tourism, chemical industry, engineering, textile production, food processing, furniture manufacturing, construction and agriculture. The available scientific potential for innovation is focused on the maritime industry, information technology, tourism, services and energy. It is in these economic activities are developed new high-tech industries creating high added value, attracting investments in IP-intensive production

activities. At the territory of the area operates 'Maritime Cluster'. This available innovation capacity directs the smart specialization in the area to two of the thematic areas of ISSS — "Industry for Healthy lifestyle and Bio Tech" and "New Technologies in the Creative and Re-creative Industries".

Dobrich. The available capacity for RIS3 leads to the thematic area "Industry for Healthy lifestyle and Bio Tech" and "New Technologies in the Creative and Re-creative Industries"— Dobrudja Agricultural Institute, producing conventional seeds for cereals, valued high in many countries (lavender for the purposes of pharmaceutical and cosmetics), an international college, which prepares high skilled personnel for tourism, etc.

Targovishte. The summarized opinion of stakeholders on the available capacity for RIS3 determines the thematic area "Mechatronics and clean technologies" and "Industry for Healthy lifestyle and Bio Tech". Furthermore, there is available capacity and in other thematic areas, primarily in the field of alternative tourism, cultural tourism, wine tourism, spa, etc.

Shumen. The summarized opinion of stakeholders on the available capacity for RIS3 determines the thematic area 'Industry for Healthy lifestyle and Bio Tech" and "New Technologies in the Creative and Re-creative Industries — capacity for alternative sport and tourism, rich biodiversity, all levels of education, scientific institutes in the field of agro-business, cultural heritage, etc.

South Western Region

Blagoevgrad. The industry is a highly polarized in municipalities. For example, in the municipality of Blagoevgrad are concentrated over 50 % of manufacturing industry leaded by engineering and electronics. The textile, knitwear and clothing industry has traditionally been one of the main and most relevant sectors for industrial development with export orientation. Food processing industry is highly developed, including activities relating to the production and processing of meat, processing and preserving of fruit and vegetables, producing of vegetable and animal fats, dairy products, milling products, prepared animal feeds, bakery products, food preparations, pasta, soft drinks and alcohol. In the Municipality of Gotse Delchev local economy is specialized in the manufacturing industry (manufacture of textile, underwear, shoes), the food processing industry and construction. Municipality of Bansko and Sandanski have highly developed tourism and construction sectors. The favorable climatic conditions determine the development of agriculture.

In the county center — Blagoevgrad are operating two higher education institutions of national importance: South-west university "Neofit Rilski" — Blagoevgrad and the American University in Bulgaria -Blagoevgrad. The universities emit high skilled labor force in the fields of social sciences and humanities, law, economics and business administration. There are also several Colleges — Medical College in the structure of Medical University — Sofia as a separate legal entity, Technical College in the structure of South-west university "Neofit Rilski" without legal entity separation and the private College of Tourism — Blagoevgrad. This capacity directs smart specialization of the area to two of the thematic areas of ISSS, namely "Informatics and ICT" and "New Technologies in the Creative and Re-creative Industries".

Kyustendil. The RIS3 Capacity of the area is concentrated in the thematic area "Industry for Healthy lifestyle and Bio Tech" (availability of resources and capacity for the development of organic farming, processing industry, bio products, including forestry, development of SPA & wellness) and "New Technologies in the Creative and Re-creative Industries' (exclusive intensity of historical and cultural monuments, traditions in arts and music school, eminent artists, cultural institutions, creative unions of architect, artists, writers, inventors, etc.).

Pernik. The strengths of the area are linked to its strategic location and proximity to Sofia and to the key transport arteries to two external markets. There is a developed industrial center, deposits of minerals, resources for RES, well-developed heritage infrastructure, active sport clubs. 2010 opened the European Institute of Technology. The academic profile of the university bachelor's and Master's courses is in advanced informatics and computer science, communication and computer networks and systems architecture and urban management, civil engineering and innovative entrepreneurship. This training in all disciplines is provided in the Bulgarian and English language. These characteristics define the thematic areas of ISSS — i.e. "Informatics and ICT" and "New Technologies in the Creative and Re-creative Industries.

Sofia. In the capital the RIS3 capacity covers all thematic areas of ISSS. Therefore, the choice of two of them complies with capacity of the other areas of the South-West region. Such additional support will receive the

thematic areas "Information technology and ICT" and "New Technologies in the Creative and Re-creative Industries." In addition, Sofia city is in the process of finalizing its own strategy for smart specialization.

Sofia District. The proximity to the capital leads to a steady trend of relocation of industrial production and defines the great diversity in its structure. At the same time, proximity allows the use of science and innovation infrastructure of the capital. At the territory of the area operates actively cluster "Srednogorie med industrial cluster" — which includes companies from the extraction and processing of copper and copper concentrate, gold ores, high-tech companies, optical and optoelectronic devices and systems, research and educational organizations. The RIS3 capacity is concentrated in the thematic area "informatics and ICT" and "Mechatronics and clean technologies"

South Central Region

Kardzhali. RIS3 capacity is linked to the thematic areas "Industry for Healthy lifestyle and Bio Tech" and "New Technologies in the Creative and Re-creative Industries, production and processing of herbs, bio food, cultural — historical heritage, natural phenomena. The subsidiary of University of mining and geology "St. Ivan Rilski" prepares qualified staff both in the field of clean technology and ICT related to the three thematic areas of ISSS.

Plovdiv. The RIS3 capacity of the area is concentrated in the thematic area "Informatics and ICT" and "Industry for Healthy lifestyle and BioTech". Crucial to the development of the area are the food industries, which have extensive production specialization (fresh meat, milk processing, flour-milling, confectionery, drinks, etc.). Under fast pace development is the industry for a healthy life and biotechnology in the field of plant science. For example approved is a project "Planta Syst" under Horizon 2020 with the coordinator: Institute of Molecular Biology and Biotechnology — Plovdiv. Through the integration of molecular biology, functional genomics, metabolomics, bioinformatics and agricultural sciences with a long-standing expertise in practical plant genetics and selections, such center and other developments of similar thematic would put Plovdiv Region at the forefront of this field. Highly developed is the processing industry for aromatics and spices raw materials. The cluster 'Information and Communication Technologies' is constantly expanding. The area has rich heritage features (Plovdiv was chosen as European Capital of Culture for the year 2019), which can be developed rapidly based on ICT.

Pazardjik. The summarized opinion of the stakeholders is indicating available RIS3 capacity in the thematic area "Mechatronics and clean technologies" and "Industry for Healthy lifestyle and Bio Tech". There is presence of traditions and long-standing experience in integrating mechanics and electronics with a focus on design and manufacturing of high-tech products, automotive equipment, parts, components, systems. Experience in the production of medicinal products and food supplements for veterinary and human medicine and natural features and conditions for organic agriculture and stockbreeding puts focus on medicinal products and pharmaceutical forms, medical and spa tourism, clean manufacturing processes, storage and processing of Bulgarian specific food and cosmetics.

Smolyan. The RIS3 capacity of the Smolyan region is concentrated in the thematic area "Industry for Healthy lifestyle and Bio Tech" and "Mechatronics and clean technologies". Larger companies have research and development units that develop and deploy new products and technologies. In the area of light industry capacity is in the field of cosmetic, clothing, food, textile industry. Educational structure offers all level skill levels. In the area operates the National Astronomic Observatory (the largest in the Balkans), which has a rich cultural and historical heritage.

Haskovo. In the regional economy has the highest relative share of services, followed by industry and the agricultural sector that is second higher than that for the country. Tourism has a great potential. Improving the quality of life in the area is linked with the support of the strengths of the area of deployment of innovations, the balanced development of towns and rural areas, environmental protection. The capacity of the area concerning development of bio-agriculture, and alternative tourism remains unused. The above points towards smart specialization in the areas: "Industry for Healthy lifestyle and Bio Tech" and "New Technologies in the Creative and Recreative Industries".

South East Region

Bourgas. RIS3 capacity of the region is in product and technology niches such as tourism (environmental, health, cultural, etc.) and wellness; Chemical products and technologies; Information and communication technologies, services and telecommunications; Marine biology, aquaculture and fish farming; Biotechnology,

organic food and bio-based products; Manufacture of motor vehicles and electric cars; Energetic technologies and biofuels; Processing and light industries. The Office for transfer of innovative technologies in businesses of South-Eastern region assists to improving innovation infrastructure, industrial capacity, export profile and competitiveness of enterprises in the south-eastern region of Bulgaria, supporting them in search process and introduction of new services and innovative solutions in the field of information technologies and their applications. Priorities are information technologies, environmental and energy-saving technologies and economic analyses and assessments. As a University and Research Center interests are focused on ICT, materials and material sciences, environmental protection and water, RES, biomedicine, molecular modeling linked to eco- toxicology. As a result, the priority thematic areas for RIS3 are "Mechatronics and clean technologies" and "Industry for Healthy lifestyle and BioTech".

Sliven. The available RIS3 capacity is concentrated in the thematic area "Mechatronics and clean technologies" (capacity in the field of automotive — prototypes with electrical and hybrid propulsion, network and innovative technology for an accelerated battery charging with electricity, availability of critical mass for development of design center focusing transportation, textiles and design and Cluster Mechatronics and clean technologies", developed ICT sector fostering mechanical engineering) and "New Technologies in the Creative and Re-creative Industries (focus on developing smartphone apps and digital guides for advertising and visits to objects related to cultural, historical and alternative tourism in the region, electronic platforms for advertising and promotion of alternative tourism in the region).

Stara Zagora. The analysis of strengths addressed the available RIS3 capacity of the area to the thematic area "Mechatronics and clean technologies" ("Research and Development" in engineering and technology, medical sciences, agricultural sciences — mechanics, electronics, nanotechnologies, management systems, software to clean technologies (eco mobility) storage and energy saving; Architectural and engineering activities; Consultancy in the field of management; Manufacture of instruments and appliances for measuring, testing and navigation, Manufacture of radio, television and communication equipment and appliances) and "Industry for Healthy lifestyle and Bio Tech" ("R & D on clean manufacturing processes, technologies at the service of medicine, medical and spa tourism; Business practices for clean production, storage and processing of specific food and cosmetics (bio-) products, medicines, substances and products and competitive bio-based products with curative medical effects, organic farming, production of food and non-food bio-based products, including for therapeutic and cosmetic properties (hip, rose etc.), export orientation of biological and pharmaceutical products, certification and development laboratories.

Yambol. Yambol Region has the potential to attract investors in the manufacturing industry and particularly in the processing of fruit and vegetables. The territory of the area has the potential for exploitation of energy from air currents. Favorable geographic location, high proportion of arable agricultural land and green clean environment are a prerequisite for the development of a prosperous farming. The existence of large cultivated agricultural areas, traditional cereal production, vegetable and animal husbandry outline potential which should be exploited. The development of efficient agriculture is one of the main possibilities for improving the labour market, supporting and encouraging businesses and enhancing investment. It is these circumstances justify the choice for the thematic areas "Industry for a healthy life and biotechnology and "new technologies in creative and recreational industries.

The existence of regional specialization and the density of enterprises is the basis for the implementation of a cluster policy in the various economic activities.

In the programming period 2014-2020, the European Union emphasizes its **Territorial Agenda**, which focuses on the territorial dimension of European cohesion policy and strategy "Europe 2020". The following challenges and threats for regions are identified:

- Increasing globalization: structural changes after the global economic crisis;
- Changes to the integration of the European Union and growing interdependencies between regions;
- The demographic situation in different areas. Challenges and social isolation of vulnerable groups;
- Climate change and risks to the environment: the effects in the various geographical areas;
- The increasing energy challenges that threaten regional competitiveness;

- Loss of biodiversity, endangered species, risks to the landscape and cultural heritage.

The National Concept for Spatial Development 2025 takes into account these challenges and emphasizes the role of urban centres as a key factor for sustainable economic growth. Integrated plans for urban regeneration and development have been developed, with identified areas for economic development. The idea is that in the future these areas would become an attractive feature for foreign investors in industrial development and for clusters and innovation cooperation. Some of these cities have the potential to become "smart cities", including in the European Innovation Partnership on Smart Cities and Communities (EIP-SCC).

1.8. Quantitative analysis for identifying potential areas for intensive innovation development

1.8.1. Methodological Approach

This analysis focuses on economic activities (second level of aggregation under KID 2008), distributed by level of technological intensity, according to the classification of the OECD and Eurostat. Such clustering allows obtaining a clearer assessment of the status and potential development of medium and high-technology sectors. The classification does not include activities in mining industries and agriculture. Thus, the analysis includes 82 activities in the field of industry and services. **Identifying the potential** of each economic activity is carried out by using various indicators grouped into two factors - internal (production volume, turnover, added value - as a share of total value added and as a share of the total output, labor productivity, number of employed, number of enterprises and investments in long-term fixed assets) and external factors (export, import and availability of competitive advantages, production and export specialization[14]). The values of all indicators are adjusted according to the overall assessments of industry and services. Thus they are comparable and allow aggregation and the obtaining of estimates for the internal and external factors. In turn, the sum of these two factors gives the final assessment for each economic activity.

Identifying the potential of the economic activities by using only quantitative analysis would narrow down the basis for subsequent cross-analysis where we want to combine these results with those of the qualitative analysis. Therefore, the first step is identifying the economic activities with a higher degree of processing to the final product i: including all medium-high and high-tech activities and knowledge-intensive high-tech services (as recommended by the European Commission)). From the remaining economic activity groups the three top rated ones are selected. This highlights the strengths of the economy and shows the location of high-tech knowledge-intensive activities and services.

1.8.2 Results

The initial sample of 82 economic activities is synthesized to 33, which on the one hand reflects well Bulgaria economy, and on the other hand have the potential to transform it into a knowledge-based economy (see Annex "Tables and Statistics"). The industry structure is headed by medium and low-tech activities (refining of petroleum products, tobacco and manufacture of basic metals), followed by medium and high-tech activities (chemicals, medicinal substances and products, ICT, electronic and optical products, etc.). Except for retail, services are headed by a group of high-tech knowledge-intensive services (telecommunications services, IT, research and development), a fact proving the capacity for innovation and technological development.

[14] Balassa methodology is used.

1.9. SWOT analysis of the socio-economic conditions

Strengths	Weaknesses
• Macroeconomic stability and low taxes; • Well-developed distribution network and good relations with neighbor countries; • Well-developed telecommunications services such in IT, research and development; • High share of population with secondary and higher education; • Rich cultural and historical cultural and historical heritage; • Increasing exports and FDI.	• Ageing population; • Small and not sophisticated national market; • Specialization in low-tech sectors • Low labor productivity; • Relatively low economic activity of the population of working age; • High share of youth unemployment and long-term unemployment; • High dependence of the economy on imported resources and energy; • Low energy efficiency; • High share of informal sector; • Lengthy bureaucratic rules for investments (licenses and permits).
Opportunities	**Threats**
• Act as gateway to the EU for global FDI flows • Access to EU markets, • Access to non-EU markets such as Russia, CIS and the Middle East • New electronic administrative services • Potential of cluster externalities	• Slow-down of economic growth of trading partners • Increasing negative demographic trend • Ineffective absorption of EU structural and national funds and other financial instruments • Increasing competition from third world countries in the Balkans and Asia • Economic sanctions on Russia

Macro-economic and structural policies are needed to exploit opportunities and prepare to face threats or at least mitigate their damage, if they occur. In that sense policies need to:

- Exploit strengths by focusing on ICT and cultural heritage, as well as give opportunities to the well-educated to remain in the country
- Address weaknesses through focusing on clean energy and again improve the opportunities to the labor force
- Exploit opportunities by supporting competitiveness (through innovation as low labor cost is not ensuring quality of life) to exploit global market opportunities and attract FDI
- Prepare for potentially higher global competition by support competitiveness in areas where the Bulgarian economy is strong.

2. CAPACITY FOR INNOVATION AND RESEARCH PERFORMANCE

2.1. Innovation capacity of the firms

The entrepreneurship in Bulgaria looks quite dynamic from view point of the number of new firms, especially before the 2008 crisis. Irrespective of that, the entrepreneurship is limited with regard to the innovation activities in the new firms. The small and medium enterprises (SMEs) are not often among the innovators: only 16% of the Bulgarian SMEs have had innovation activities in the period 2004-2008, which represents the lowest percentage within EU. It seems that the innovation activity is limited by and large to the large companies, while the small and medium enterprises are to a high extent the traditional firms which in that respect seem to be in a standstill. The innovative SMEs are most frequently "lonely riders" – i.e. they develop innovations for themselves, but do not collaborate with external partners. Their innovations focus is on labor cost reduction and not on technology improvements.

Additionally, large Bulgarian firms have poor organizational capacity and are not competitive on the export markets. They need improvements of the production potential and are cut off from the regional and global value chains.

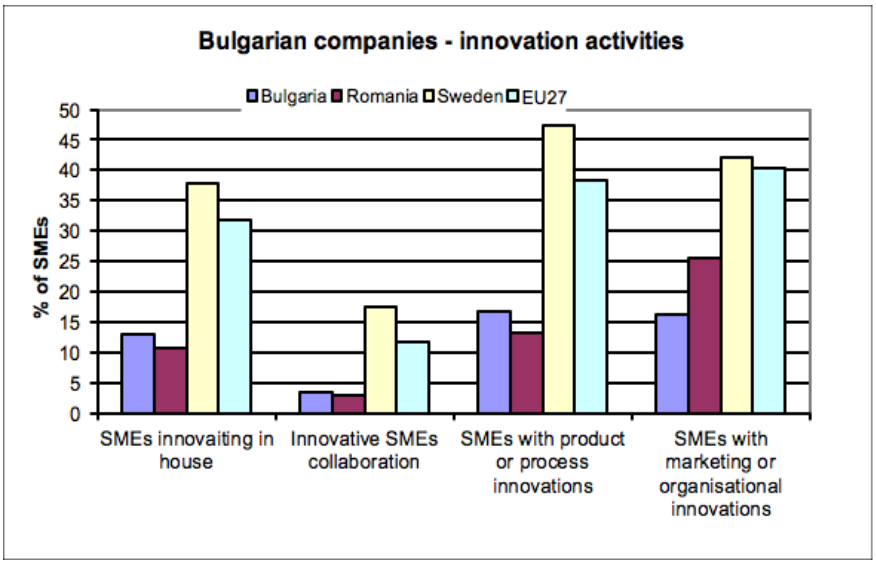
In Bulgaria, as well as in the other EU member countries, SMEs are of structural importance for the economy and main driver for economic growth. In 2011, there were 365 484 SMEs in total in Bulgaria, which was by 0.2% less than in 2010. For the period 2008-2011, the number of the enterprises has increased by slightly more than 27 000 (10%). The entrepreneurial sector in Bulgaria is dominated by micro enterprises with less than 10 employees. These enterprises represent 91% of all companies and provide employment to 29% of the work force during the period 2008-2010. 75.5% employees in the country are working in SMEs (defined by EU as companies with less than 250 employees). A study, carried out under the Seventh Framework Program has established that SMEs contribute 37.8% of the total value added in the economy and 31% of GDP. Moreover, micro enterprises incur the smallest R&D costs and generate the lowest levels of the value added. Although the high levels of new firms registration during the period 2004 -2009 may be an indicator of dynamic entrepreneurship (7.09 new firms per 1000 people in active age created compared with an average value of 4.86 for EU), indicators show that the Bulgarian SMEs are much less innovative than the companies in the remaining part of Europe. The sectoral distribution of SMEs shows a clearly expressed concentration of enterprises mostly in the retail trade. In the R&D field, where the labor productivity is closest to the average labor productivity levels in EU, the number of SMEs is three times higher than the one in countries like Slovakia, Hungary, Austria and Denmark, in which the size of the labor force is comparable with the one in Bulgaria.

The small and medium enterprises (SMEs) in Bulgaria make a significant contribution to the development of the economy – i.e. they generate more than 60% of the value added, 67% of the turnover, and 75% of the employment among all of the enterprises. The Bulgarian SMEs are not frequently innovators. During the recent years (2006-2010), the share of innovative enterprises with a number of employees 10-49 is about 20%. Only 14% of them have technological innovations, around 5% of them have sold new or improved products on the market, whose turnover is only 1.5% of the total, and 18% of them have accomplished innovative collaboration. The things look slightly better in the group of the enterprises with a number of employees 50-249. On the average there are 33% innovative enterprises, out of which 29% with technological innovations, 10% of them have sold new or improved products on the market, whose turnover is only 3.2% of the total, and 20% of them have accomplished innovative collaboration.[15] In one way or another, these data are among the lowest in the European Union. To a high

[15] National Statistical Institute

extent the Bulgarian SMEs introduce innovations related to cost reduction and to a much smaller degree innovations related to new products and processes. 2/3 of the medium enterprises and about 1/3 of the micro and small enterprises have performed similar activities. The least frequently met innovation activities are the ones related to the implementation of joint educational projects involving the business and the academic communities – only about 9% of SMEs have participated in such projects.[16]

SMEs are facing a series of impediments to become innovative. These impediments have a negative effect on their growth potential and in many cases on their survival. Therefore, main aim of the policy is the overcoming of these obstacles in order to provide an opportunity to the small companies with a limited impact on the economy to become innovators with a high impact, actively involved in the development of new products and processes.



Source: Innovation Union Scoreboard 2014

Although the innovation capacity of the Bulgarian companies has been improved after the accession of Bulgaria to the European Union and the start of OP "Competitiveness", the whole picture in this field nowadays shows achievements, which are significantly below the capacity. The Bulgarian companies are spending 0.39 % of GDP for R&D, compared with 1.31% in EU – i.e. the percentage is about 3 times lower. The ratio is similar for the public expenditures. The Bulgarian companies occupy 105 and 106 place in the world with regard to innovation and business comprehensity[17].

The studies show that the aptitude for innovations of the Bulgarian companies is positive and considerably correlates to their R&D costs and the connected with that investments in technological infrastructure, as well as that their production is increasing together with their innovation efforts, no matter whether the company is new on the market or not. [18]

As has been mentioned, Bulgaria is one of the countries, which are modest innovators. It occupies the last place in the ranking of the EU member states. In one and the same spheres Bulgaria is simultaneously showing strengths and weaknesses – a fact, which defines the innovation system of our country as

[16] Analysis of the situation and Factors for Development of SMEs in Bulgaria: 2011-1012 – BSMEPA and NOEMA

[17] The Global Competitiveness Report 2013-2014

[18] World Bank Report, Input to Bulgaria's Research and Innovation Strategy for Smart Specialization

imbalanced. The indicators of the innovation leaders show that the balanced innovation system is a precondition for success.

With view of RIS3 logics, the strategy focuses on the identification of the strengths and the thematic fields with growth potential. The approach is complex and the Strategy will also address the main reasons for the unused potential of the country in the innovation field – i.e. low volume of public and private investments in research, "brain drain", insufficient mutual interrelation between the scientific achievements and the needs of the industry, restructuring of the research financing from institutional into project and program financing, need for clear vision and priorities.

ICT plays the leading role regarding the determination of the innovativeness level; on the second place is the implementation of business and marketing strategies; on the third place is the human resource development. Wider implementation of good practices results in higher innovativeness. The second important factor, determining the innovativeness level, is the access to financing. On the third place, regarding the determination of the innovativeness level, are the internationalization and activity related to the intellectual property.

According to the conducted SME surveys in the beginning of 2013, 30% of the entrepreneurs in the industry have declared that they sufficient financial resources for intellectual property registration. The share of the industrial SMEs with own registered trademark in Bulgaria or abroad is 42%. The share of the micro enterprises with such registration is 27%, of the small — 47%, and of the medium — 61%. The enterprises which own national patents are 20%. Registered patent has 12% of the micro enterprises, this share for the small companies being 21% and for the medium ones — 32%. The share of the micro enterprises, which have declared that they have financial resources to register intellectual property, is 20%. This share of the small companies is 31%, and of the medium — 43%.

Every three of four industrial SMEs have a company web page. 78% of the enterprises have electronic signature of the managers. 45% of the companies have possibilities for on-line orders and sales and 40% provide possibility for on-line payments. Customer Relationships Management (CRM) system have 18% of SMEs. The same is the share of these, which have introduced Supplier Relationship Management (SRM) System and approximately this (17%) is the share of the companies, which have used integrated management system for almost all processes.

The prevailing part of the managers of industrial enterprises thinks that their employees are sufficiently well qualified (80%), and familiarized with the good practices in the sector (81%). More than the half of the SMEs have ensured trainings of their employees and/or managers during the last year — 53%. External specialized sale management trainings have been attended by 17% of the companies – trainings related to the company professional field - 22% and trainings related to ICT applications — 10%.

More than half of the enterprises in the industry use developed short-term business plans with 1-2 years horizon - 57%. A significantly lower share — 17% have mid-term plans, while only 8% of the SMEs[19] develop long-term plans.

[19] A Study of Entrepreneurship and Prospects for Innovations Development in SMEs (2012—2013)

The lagging behind of the innovation capacities compared to the European level (Innovation Union Scoreboard 2014)			
	EU	**BG**	**EU=100**
Human resources	0.583	0.440	75.5
Research systems	0.539	0.133	24.7
Finance & support	**0.558**	**0.057**	**10.2**
Firm investment	0.417	0.133	31.9
Linkages & entrepreneurship	0.550	0.121	22.0
Intellectual assets	0.564	0.255	45.2
Innovators	**0.549**	**0.047**	**8.6**
Economic effects	0.595	0.216	36.3

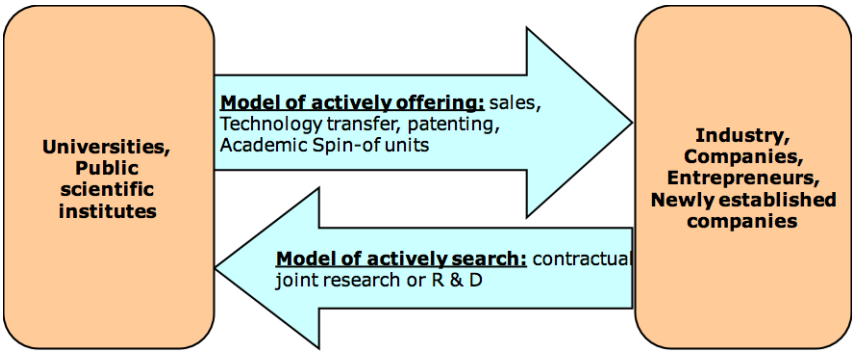
Irrespective of the outlined strengths, in our opinion the gap from the best world achievements remains significant, especially in the field of investments, basic infrastructure, knowledge creation, dissemination and acquisition, creative goods and services, scientific research and ICT, as cited in the Global Innovation Index 2014 and Global Competitiveness Index 2014.

2.2. Research performance

The innovation generated on the basis of scientific research is a significant factor for the public progress and for the growth of the economy. Science is a main factor, pushing forward the limits of the technological development. Fundamental scientific discoveries, which fully renovate the set of instruments for the development of the mankind, create new technological platforms as the revolution in the sphere of genetics and the subsequent development of the biotechnologies, which resulted in improvements in the sphere of health and agriculture. R&D generates new products and technologies, business models through the successful application of new knowledge.

The commercialization of the results from the scientific research is a guarantee for long-term viability of the national system for scientific research. The transfer of knowledge is bidirectional – the model "active supply" refers to commercial application of the knowledge acquired from the system for scientific research, through the rules for the intellectual property, technological transfer and the so called spin-off companies, and the model of "active demand" is in the events when the companies receive support from

the researchers, because they concluded contracts for cooperation/partnership. The knowledge generated by research institutes spreads out under various channels –mobility of the academic staff, scientific publications, conferences, investigations under contracts with the industry and patenting of university discoveries and inventions[20].



RDA – Research Development Activities

The research activity becomes more and more multi-disciplinary at a global level. Modern scientific investigations are of a complex and inter-disciplinary nature. Some spheres, as mathematics, for instance, are so intertwined in the research system that they do not have a separate label. One of the consequences is that the innovation usually occurs on the border or within the zone of intersection of the various disciplines. Bulgaria should enhance the interactions amongst the scientists working in various spheres to be in a position to make use of this tendency. [21]

The creation of knowledge develops faster and faster and the scientific outlook moves farther and farther on. These circumstances create a competitive pressure, in fact the competition is so tense that the states are obligated to invest and move forward simply aimed at not lagging behind their relative position. Countries as Bulgaria need a vital research system which is internationally connected aimed at their being able to master and benefit economically from the knowledge generated throughout the world. [22]

The structure of the patents of Bulgarian patent holders indicates the highest activity of the group of the natural persons who hold 765 patents (68.3 %), followed by the business sector with 276 patents (23.3 %), the state sector - 89 patents (6.8%) and sector "Higher Education" - 18 patents (1.6 %). The share of the Bulgarian Academy of Sciences in the total number of Bulgarian patents adds up to 5.2 % and is 3.5 times bigger than the share of sector "Higher Education". The Bulgarian Academy of Sciences has nearly 81 % of the patents in the state sector. The analysis of the structure in the last decade indicates increase of

[20] Иновации.бг, Фондация "Приложни изследвания и комуникации· 2013

21 Рафълс, Портър, Лайдерсдорф (2009 г.). Карти с наслагване на научните дисциплини: нов инструмент за определяне на стратегии в научно-изследователската област. Серия работни документи на SPRU в електронен формат. Доклад 179.

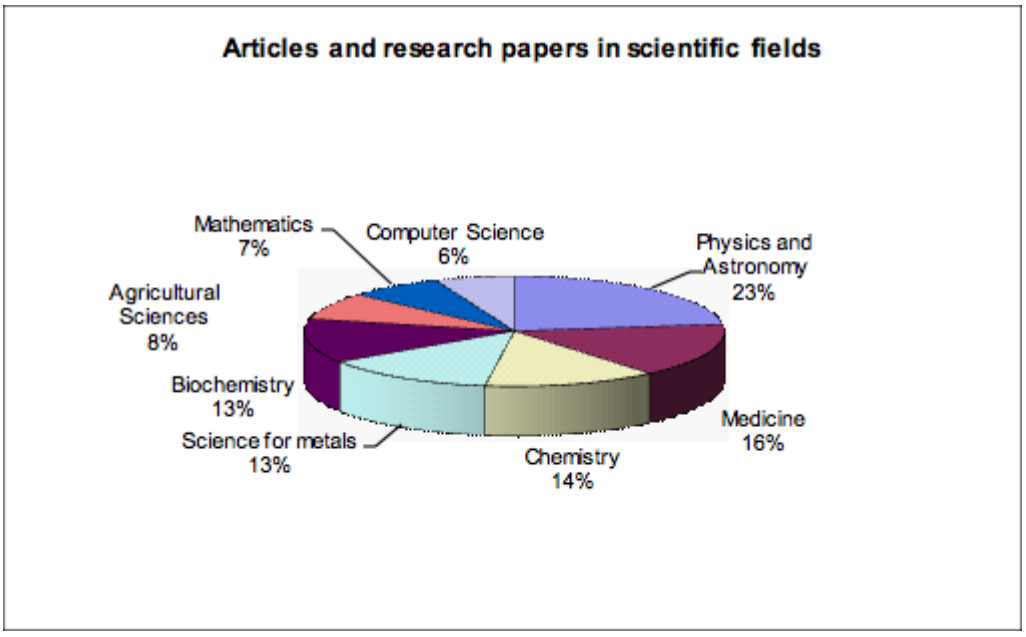
22 Доклад СБ, Принос към Стратегията за интелигентна специализация в областта на научните изследвания и иновациите на България

the shares of the business and the state, which forms a tendency of overcoming the low degree of institutionalization of the patent activity in Bulgaria.

The analysis of the Bulgarian patent activity before the European Patent Office (EPO) indicates that in the last decade at the average per year 4 to 5 patents were issued to Bulgarian applicants. Nearly 40 % of the issued patents – mechanics, lighting, heating, engines and pumps (10 nos.), special machines (4 nos.), pharmacy (4 nos.) and medical equipment (3 nos.) are concentrated in 5 technological spheres.

The Bulgarian patent activity before the United States Patent and Trademark Office is significantly bigger due to the great interest of the Bulgarian companies to enter the American market and the simplified administrative procedures. 208 nos. of American patents (with submitted 744 requests) were issued during the period 2000 - 2012. This is evidence for enhanced interest of Bulgarian applicants in patenting and economic realization of their technological products on the territory of the USA – computer systems for transmission and processing of data (19%), management of databases or structures of data (18%), development, installation and control of software (14%) and so on.

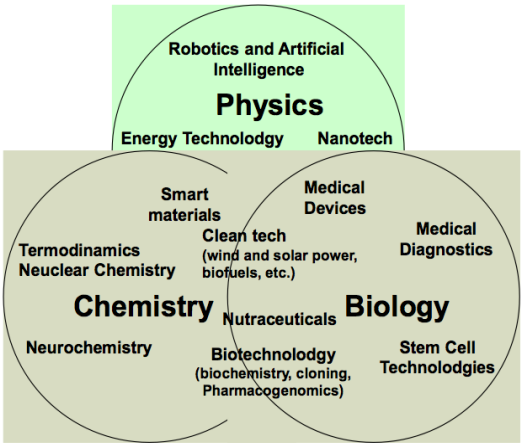
The scientific productivity measured in conformity with the volume of the scientific publications slightly improved during the period of Lisbon Strategy (2000-2010). The total number of articles and scientific reports (published in editions officiated by Scopus) during the period 1990 - 2012, is 43 478, of the 44% belong to the Bulgarian Academy of Sciences (BAS) and 52% to sector "Higher Education" and are distributed mainly amongst 8 leading universities in Bulgaria – Sofia University, the Medical University - Sofia, the Technical University - Sofia, the University of Chemical Technology - Sofia, Plovdiv University, the Medical University - Varna, the Medical University - Plovdiv, Ruse University and several with smaller publication activity. Out of a total of 51 higher schools in the country only 17 (one third) are included in the database with published articles and scientific reports. The national research units in the sphere of medicine register serious participation as well.



Source: Innovation BG

The changes in the global trends suggest the occurrence of new high impact technologies through convergence of scientific subjects. According to studies[23], the biotechnologies, nanotechnologies and clean technologies will be of highest interest for the investors. Nowadays investment agencies in some European countries are already promoting these new technologies. The investments in industries with high value added are encouraged and the attention is focused on the leading industries - ICT, pharmacy and electronics, as well as on clean technologies, life sciences, automobile building, machine building and instrument making, health care, chemical industry, logistics, tourism & wellness (in descending order).

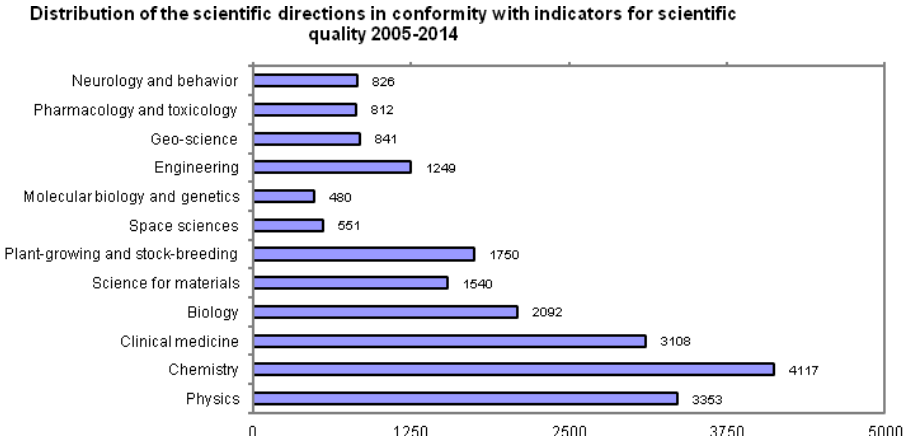
Industries with high investor interest in the future



Source: Ministry of Economy 2014.

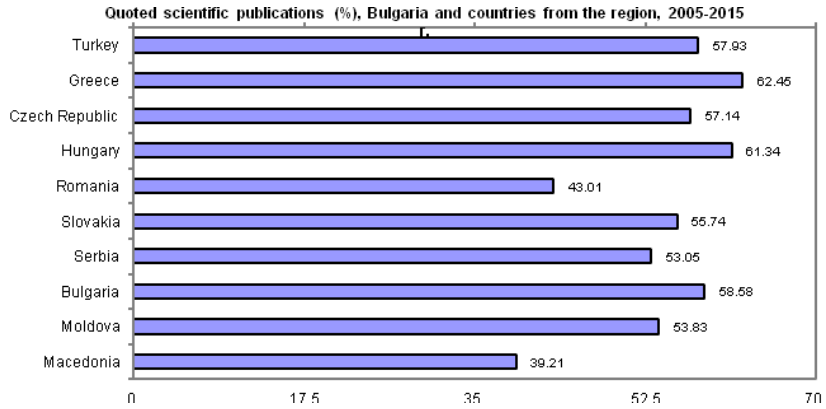
The Bulgarian scientists are presented in all the 26 spheres of the science, included in the international database (Web of Science, Scopus). The directions "Physics and Astronomy" (17 % of all the publications); "Chemistry" (12 %); "Sciences for the Materials" (11 %); "Biochemistry, Genetics and Molecular Biology" (10 %); "Medicine" (9 %); "Engineering Sciences" (8 %) are leading for the country. The most frequently quoted Bulgarian articles are from the sphere of bio-chemistry and molecular biology (12.3 times), physics (11.2 times), chemistry (10.8 times), sciences for polymers (10.5 times), pharmacology and pharmaceutics (10 times), sciences for materials (9.4 times) and so on. The data refer to the period 2005-2014.

[23] A.T. Kearney, Strategic Analysis Project Report for Bulgaria, January, 28th, 2011



Source: InCites, Web of Science, 2016

The quoted scientific publications for the period 2005-2015 for Bulgaria and countries from the region are presented in the graph herein below. Bulgaria is placed after Greece and Hungary amongst the investigated 10 states, which shows the good quality of the scientific research.



Source: In Cites, Web of Science, 2016

The joint international research activity of the Bulgarian scientific community is implemented with research units from 144 states, above all with Germany in the sphere of the areas of mutual interest – "Physics and Astronomy", "Chemistry", "Sciences for Materials", "Bio-Chemistry, Genetics and Molecular Biology", "Medicine".

2.3. Human capital in the scientific research and innovations

The human capital is in the basis of the competitiveness of the economies and our innovation and research potential.

One of the most significant factors, which exert direct influence over the human capital, is education. The real competitive advantage of a nation consists of its capacity to provide permanently highly educated human resources. This process requires a long-term vision and careful planning. The process of provision of highly educated human resources requires a long-term vision and careful planning as trained staff

which the economy needs, in particular in the industries with high added value, may not be provided easily and fast.

In the Report on Global Competitiveness 2016-2017 Bulgaria is ranked 50th place out of 138 economies but only in the 91st place with regard to quality of the educational system in the higher education, in the 67th and in the 75th place for training in mathematics and science. What is alarming is that the tendencies are negative as compared to these indicators in preceding years.

In conformity with an investigation of the Program for International Student Assessment by the Organization for Economic Cooperation and Development (PISA) for the degree of use of scientific knowledge by the 15-year-old, Bulgaria is in the 28th place from 29 investigated European states. The number of young people with completed secondary education is reduced in the country because of the low influx and the high percentage of pupils who drop out early from school – 12,5 %. In parallel with this Bulgaria has one of the most challenging demographic profiles in the EU and the world, where it is expected that the population will decrease by 27 per cent during the period between 2010 and 2060, which will expert direct impact over the sector of the higher education. The interest of the young people in the natural and engineering sciences, at this time is low – only 24% (in conformity with data of the National Statistical Institute) of the students choose to study natural sciences, mathematics, technical sciences and architecture.

After the accession of Bulgaria to the EU in 2007, the system of the higher education helps the country to enhance its social and economic rapprochement with the remaining part of Europe. But, regardless of the achievements from the last decade, the higher education continues to be faced by challenges related to the quality, the efficiency with regard to the realization on the labor market.

Indicators are included in the statistics with regard to the personnel employed in the sphere of science and technologies for measurement of the economy based on the knowledge and development. According to the analysis of the personnel dealing with Research and Development Activities 12.3 thousand are employed in this area in Bulgaria, of which (in conformity with data of Eurostat 2015) 43% in the Bulgarian Academy of Sciences and the Academy of Agriculture, 33% in the higher schools and 22% in the innovation companies. This distribution differs from the average values in EC28, where the share of the employed in the innovation companies - 48% has superiority. The personnel occupied with Research and Development Activities with regard to all the employed is 0.5%, with 1.1% for EC28.

The building up of highly qualified and trained staff is of key significance for improvement of the competitiveness of the economy, increase of the potential for realization of innovations and enhancement of the attractiveness of the country for implementation of investments.

The review of the personnel occupied with scientific research with regard to degree of education shows growth of the number of medical doctors, which could be explained by the bigger and bigger number of young research staff in the higher education and their aspiration for promotion in the career. The tendency has been pronouncedly upward after year 2000.

The distribution per age shows that the relative share of PhD students aged 25 to 29 (35.7%) is the biggest, followed by those aged 40 and more (24.5%) and those aged 30 to 34, who represent 21.8% of all the PhD students.

The data of the National Statistical Institute indicate that the research staff in the sphere of natural sciences continues to predominate followed by the staff in the technical and agricultural sciences.

The private sector plays an important role for the education of quality. The state should encourage the cooperation between the business and the educational institutions. It is necessary to provide conditions for adequate training of the students for work in real working environment. The introduction of a dual system of training will guarantee the smooth transition from training to labor realization.

It is necessary to increase the entrepreneurship orientation amongst young people, the training in entrepreneurship should become an integral part of the curricula. The Schools of Arts (in total 23 schools in 15 populated areas in the country), do not conduct training in entrepreneurship, and the pupils in these schools are the future of the creative industries in the country. The pilot project "Starts" has started up, through which the pupils pass through training and mentoring in entrepreneurship and protection of the intellectual property and create their training entity which operates within the framework of the school year.

The conduct of training in the higher schools in the sphere of ICT may not fully satisfy the requirements of the industry with regard to the human capital. One of the reasons is the absence of focus on ICT in secondary education. There are no experts in the sector, and in spite of the great number of graduates with ICT specialties in the higher schools (about 3 thousand per year), the quality of the education in ICT does not improve in most higher schools.

A small number of the entrepreneurs pay special attention to the quality of the manpower, which is noticed by the limited investments of the enterprises in Continuing Vocational Training (CVT). Only 22% of the employees are engaged in CVT which is related to 1.1% of the total expenditures for labor. This places Bulgaria in the lower end of the scale in Europe and speaks about potential problems with the possibilities for mastering new knowledge and technologies.

Percentage of the employees (all the enterprises) participating in CVT courses and expenditures for CVT courses as % of the total expenditures for labor (all the enterprises)

All types of enterprises	Percentage of the employees, participating in CVT courses		Share of the expenditures for CVT courses as a % of all the expenditures for labor	
	2005	2010	2005	2010
Total for all the companies	15	22	1.1	1.1
With 10 to 49 employees	6	8	0.8	0.8
With 50 to 249 employees	12	16	1.3	1.2
With more than 250 employees	23	44	1.1	1.3

Source: EUROSTAT 2014

Leading enterprises from the highly technological sectors started up their own initiatives for training staff. The large-scale initiative of Company Telerik represents a peculiar revolution in the ICT sector. Through its Academy for software engineers the Company presents of quality, free of charge and accessible for all the young people training, which provides a successful career start-up in the dynamically developing software industry. Solely during the academic year 2012-2013 over 12 000 persons took part in the trainings of the Academy (in an attendance and in a remote manner). The Company was selected as the Best Employer in Bulgaria in 2007, 2010 and 2012 and it is regularly distinguished as one of the best Employers in Central and Eastern Europe.

2.4. National investments in research, technology and innovations

Landscape of the National Research System

R&D Funding

The total gross domestic expenditure on R&D (GERD) in Bulgaria for 2015 reached €430.4 m, increasing by 20% compared to 2014. Three main sources channeled R&D funding in 2015, namely: the business sector (25%), the government (30%), and foreign funding (45%). The total GERD follows an upward trend from 2005 onwards. On the other hand, starting in 2010, the direct support from the government declined. Support from EU, remained almost stable in size. Yet, it is very low in comparison to the other sources of R&D financing.

Human Resources

As per 2015 NSI data, 53 % of the researchers in the country are women, while 47% are men. The age groups are distributed almost equally - 21 % of all researchers are in the age group of up to 34, whereas 27 % of all are in the age group between 35 and 44. Scientists between 45 and 54 and between 55 and 64 are 23 % and 24 %, respectively. Insignificant percentage of all scientists falls in the group of 65 or over – 5 %. Yet, the scientific community does require that every year there is a cohort of young scientists to enter in order to reach the EU-average levels. Bulgaria is lagging behind to the EU average as of share of researchers to the total labor force.

Bulgarian Participation in Horizon 2020

The participation of Bulgarian researchers in European competitive calls for funding research is essential. However, the data show that Bulgaria's participation is to a large extent limited and comparatively lower to neighboring countries. There are between 160-180 publications per year (per 1 m. inhabitants) which have been published in co-authorship with foreign researchers in international refereed journals and the increase is by less than 10 % on an annual basis. Romania and Serbia do have much higher increase of common publications, which means that Bulgarian scientists do lose significantly their positions in the international scientific ranking. Bulgaria has attracted 12.8 EUR per capita in the 7th framework program, which precedes Horizon 2020. This is six times less than the EU average of 78.9 EUR per capita. The success rate of projects with Bulgarian participation is 15.4 %, which is also lower compared to EU average of 20.4%.

Between 2014 and 2016, most of the Bulgarian research institutes and universities have applied through the Societal Challenges (97 projects), followed by Excellent Science (43) and Industrial leadership (40).

In fact, Bulgaria ranks last in the EU-28 context in terms of received Horizon 2020 funds per capita in the first two years of the program. Therefore, the trend in Horizon 2020 does demonstrate even lower outcomes compared to the 7th Framework program as Bulgarian participants have attracted 1.55 EUR per capita on an annual basis, whereas the EU average is 14.60 EUR.

There are 21 projects, financed under Horizon 2020. Overall, they have generated €1.9 m for Bulgarian research institutions since 2015, which is highly unsatisfactory and it demonstrates the weakness of the national research system.

- Research Infrastructures[24]

The research infrastructure is the main pillar in the national scientific and innovation eco-system of each member-state of the European Union (EU). Available infrastructure with modern equipment and good organization of access for use, aimed at the implementation of research and development activities represents this foundation, which is needed to create a critical mass of material, financial and human resources and technological knowledge.

The challenges, lying ahead are related to the sustainable financing of the local infrastructure and the access to the Pan-European infrastructures as well as to attraction of the interest of the scientists and assessment of the benefits for the broader scientific community and the society as a whole.

The sustainable funding of the life cycle is mandatory. The increased number of new research infrastructures and the enhanced interest of the new generation of scientists in participation require a careful analysis of the capability of the country to cover the full membership in a lot in number research infrastructures.

The National Research Infrastructure Roadmap 2017-2022 presents the main methods for selection of the national research infrastructures and their relevant prioritization at a European and national level. It describes in brief also the main sources and the financial framework. New update of the NRIR is anticipated for 2018, after making an international assessment of the activities of all the sites included in it and to take stock of the results of open competitive calls ongoing for the creation of centers of excellence and centers of competence to be financed under OP SESG, which will be automatically included in the updated NRIR.

The NRIR is based on a Diagnostic Review of RIs and Research Equipment of Bulgaria prepared by the Ministry of Education and Science in April 2017. It was set up as a document, which provides an overview of the existing research equipment and facilities and a basis for support of the calls under OPSESG and OPIC. Essentially, it outlines the potential of the available RIs of European, national and regional significance.

Four main research areas were analyzed as follows: (1) physical sciences, material science and engineering; (2) medical and agro-bio sciences; (3) social and humanitarian sciences; and (4) electronic infrastructure for multi-disciplinary research. The available laboratories and equipment of universities and research institutes, the human capacity and the financial resource were **evaluated** in these directions. SWOT analysis supplemented the analysis and further to that a regional analysis of specialization under these four thematic directions was also presented.

The fact that the e-infrastructures, mainly concentrated in the capital, most broadly participate in Pan-European Projects as compared to the remaining scientific areas is outlined amongst the main conclusions. These infrastructures are also amongst the best financed in the last five years.

Another conclusion from the analysis is that most of the infrastructures in the scientific area "Physical Sciences, Material Science and Engineering" are of national significance. This is the research area with the

[24] The definition for Research Infrastructures (RI) I was confirmed in 2014 in respect to EU's state aid regulations, as: facilities, resources and connected services, which are used by the scientific community in order to conduct research in specific areas of knowledge and cover scientific facility or a package of instruments, knowledge resources, as collections, archives or structured scientific information or communication and technologically-based infrastructure, as grid, calculation network, software and communication, or any other structure, which is unique by character and it is sufficient for conducting scientific research. Such an infrastructure could be concentrated at one location or distributed (organized network of resources) as per art.2 (a) of EU regulation No 723/2009 from June 25, 2009 of the legal framework of the EU for Consortiums of European RI. In the current chapter of the document the term "infrastructure" is used in the meaning of units, equipment and facilities.

biggest percentage of outdated infrastructure, but at the same time it has the highest percentage of modernized infrastructure for the last three years compared to overall number of units or facilities.

The medical and agro-bio sciences have a big number of infrastructures of regional significance. The regional measurement refers to a great degree to the research infrastructures in the sphere of agro-bio sciences. This is also the scientific direction with the least financing for scientific research and for equipment in the last five years and at the same time the infrastructures in the medical sciences are with the highest share of new equipment and apparatuses purchased in the last five years.

The research infrastructure in the sphere of the social and humanitarian sciences is most uniformly distributed in the country, and at the same time it has the least financing on a competitive principle for the last five years.

As a whole, the Diagnostic Review generalizes that there are **12 RIs of European significance, 84 of national significance and 65 of regional significance available at hand**. About 40% of the RIs have attracted only 100,000 Euro per year for the last five years, which is quite insignificant. The European financing is the main source of projects for purchase of new equipment and instruments. About 30% of the entire RI has been in operation in the last 15 years or more and the attracted financing adds up to 25,000 Euro per year for about 30% of the entire infrastructure.[25]

Thematic Specialization

Physics, Material Science and Engineering

There are 57 research infrastructures in the Physical, Material Science and Engineering (PME) research area that are located in 15 scientific organizations in Bulgaria. Most of the scientific organizations are situated in Sofia, the capital of Bulgaria (10 scientific organizations), which falls in the **Southwestern economic region**. The other five organizations are situated in the **North-eastern region**, (TU - Varna), **North-Central region** (TU - Gabrovo), **South-central region** (Central laboratory of applied physics – Plovdiv - BAS), **South-Western region** (Blagoevgrad), and **South-eastern region** (University "Prof. A. Zlatarov" - Bourgas) of the country. Thus, they cover the whole territory of the country, except **North-western region** where there is no research infrastructure identified. Overall, 66 % of the research infrastructures are located in the capital of Bulgaria, while 34 % are in the rest of the country. This is too much of a concentration of the PME research infrastructures and there is a need to channel more funding in this area to other economic regions.

Medicine and Agro-Bio Science

Leading organization in the field are the Bulgarian Academy of Science and the Medical Universities. There are overall 61 research infrastructures in this research area, 20 being in medical science. In terms of **regional specialization**, 42 % of the infrastructures are situated in Sofia, while 58% in the rest of the country. Majority of the research infrastructures in the medical sciences are situated in the **South-western region**. For example, the Medical University - Sofia (3 Infrastructures, one of them together with Medical University - Plovdiv), Sofia University "St. Kliment Ohridski" (1 infrastructure registered as "Allianz for Cell Technology" together with associations (NGOs) and private companies), Bulgarian Academy of Sciences (3 infrastructures, two of them are situated in the Institute of Molecular Biology), and South-West University "Neofit Rilski" (2 infrastructures). As far as research infrastructures of the agro-bio sciences research area is concerned, they are located throughout the country (institutes of the Agricultural Academy). In **South-Western region** and mainly in the capital of Bulgaria – 8 research institutes one university and Sofia Tech Park are found. Three institute and three universities are located in Plovdiv – **South Central region**. In the **South Eastern region,** we found 3 institutes and one university. In **North Eastern region** we found 2 institutes. In **North Central region** we

[25] For more information, See Diagnostic Review of RIs and Equipment (Ministry of Education and Science, April 2017)..

have four institutes. **North-western region** has no representatives of these research areas. Therefore, there is a need to further strengthen the regional specialization in both, the medicine and agro-bio science research areas.

Social Sciences and Humanities

There are 29 research infrastructures in the social science and humanities field, located in 20 key research institutions and universities. The **regional specialization** is structured as follows. The infrastructure of these research institutes and universities are situated mostly in Sofia (8 institutions), **South-Western region**. Three of them are situated in the **North-Central Region** (Gabrovo, V. Tarnovo, Rouse), two Organizations are situated in the **South-Western Region** (Blagoevgrad), three organizations are situated in the **South-Central Region** (Plovdiv), two organizations are situated in the **South-Eastern Region** (Stara Zagora, Bourgas) and two Organizations are situated in the **North-Eastern Region** (Varna). No research infrastructures are declared in the **North-Western Region**. Overall, 62 % of the available infrastructures are present in the capital of Bulgaria and 38 % are found in the rest of the country (Plovdiv, Blagoevgrad, Varna, Rousse, V.Tarnovo, St.Zagora and Gabrovo). Therefore, there is a large concentration of the social sciences and humanities research infrastructures in the capital of Bulgaria and more funds need to be distributed at the regional levels.

E-infrastructures for multidisciplinary research

There are only five universities, one institute of the Bulgarian Academy of Sciences and Sofia Tech Park which are active in the e-infrastructures field. Overall, there are **14 Infrastructures** available and the infrastructure is very concentrated in the capital of Bulgaria (86 % of all) with some presence in North-Central, North-Eastern and South-eastern regions. Too much concentration in the capital of Bulgaria for e-infrastructures does require a policy for strengthening regional actors to establish new e-infrastructures throughout the country.

Regional Specialization

(Comment: *these analyses are not conclusive so far on the way to describe regional business demand in the rest of the present version of the RIS3 strategy*)

The Diagnostic Review of RIs and Research Equipment also identifies some potential but also some gaps at regional level to support smart specialization areas from the perspective of the research infrastructure, as follows:

(Comment: *to keep consistency, it preferable to copy paste the corresponding text that we find in the final draft NRIR - as follows*)

- North-West has a huge gap compared to all other regions as research infrastructure is available only in the healthy life industries and bio-technologies. It is crucial that this region is supported through European and national funding in the areas that have already demonstrated research and business potential. Yet, government policies need to incentivize businesses and researchers to cooperate in areas which are new to the region.
- North-Central does have a potential to specialize more in ICT, but the potential of using and further strengthening the research infrastructure in healthy life industries and biotechnologies is there. Therefore, there is a need to channel funding for new equipment in all three priority areas.
- North-Eastern does have a high specialization in the mechatronics and clean technologies field but it could strengthen its potential also in the healthy life industries and biotech, as well as in the creative and recreational industries, where there is a priority under Bulgaria's IS 3.
- South-Western stands far ahead of the other regions in terms of presence of research infrastructure in all four IS 3 priority areas. Moreover, Bulgarian research infrastructures which are integrated in Pan-

European partnerships are exclusively coordinated by research institutes and universities, which are located in the capital of Bulgaria.

- South-Central faces the highest gap in terms of available research infrastructure and priorities under Bulgaria's IS 3. Moreover, there is no capacity in research e-infrastructures, whereas the ICT industry will be supported through OP Innovation and Competitiveness. Finally, there is limited research infrastructure in mechatronics and clean technologies area.
- South-Eastern does have available strong research infrastructure in the mechatronics and clean technologies, as well as in the health life industries and biotech areas, which are also priorities in the IS 3. Limited research infrastructure in the creative and recreational industries would need to be improved.

Overall, the Diagnostic Review of RIs and Research Equipment in Bulgaria concludes that there is uneven distribution of research equipment and scientific potential at the regional level. The strategy is aimed at supporting the most developed infrastructure with potential in the thematic areas of IS3 at national and regional levels. In the regions, the cooperation between public research institutions and local industries will be encouraged.

OPC Support of RIs in 2007-2013

Research and Innovation Infrastructure supported under OP "Competitiveness" (OPC) 2007-2013 During the programming period 2007-2013, OP "Competitiveness" (OPC) supported the creation and strengthening of Technology Transfer Offices and Technology Centers in different economic activities:

- Research and development activity (72) – 7 centers, of which 4 in Sofia and one in each of the cities Plovdiv, Dobrich and Kazanlak;
- Education (85)– 4 centers, one in each of the cities Sofia, Plovdiv, Varna and Bourgas
- Activities of non-governmental organizations (94) – 4 centers, of which 3 in Sofia and one in Plovdiv;
- Central office activities (70) – 1 in Sofia;
- Professional activities in the field of design, photography, translation, etc. (74) – 2 centers in Sofia;
- Human health care (86) – 5 centers, 3 of which in Plovdiv and 2 in Sofia;
- Architectural and engineering activities, technical tests and analyses – one center in Pernik, and
- Construction of facilities (42) – one center in Kazanlak.

Bulgaria received support during the creation of Technology Transfer Centers also through PHARE program with negotiated funds amounting to EUR 253 222 (grant – EUR 189 714 and co-financing – EUR 63 508). With the financial support of public and private organizations 9 centers were created, mainly in higher educational institutions in the cities Sofia, Ruse, Varna, Bourgas, Plovdiv, Gabrovo, Veliko Tarnovo, Pleven and Lovech.

Sofia Tech Park is the first scientific and technological park in Bulgaria, that will be established within the next 3 years. The main task of the Park is the implementation of projects, whose immediate objective is to facilitate the development of the research, innovation and technological capacity of Republic of Bulgaria, which should turn into a prestigious location for the world, regional and national research and innovative companies, giving example for economy of knowledge in Bulgaria and on the Balkans Region.

For this purpose, Sofia Tech Park AD is partnering with private and public clients to create and manage unique innovation environment, set up and implement educational programs, and simultaneously provide supporting services regarding the commercialization of new technologies, products and services. Sofia Tech Park AD is partnering with leading universities, the Bulgarian Academy of Science (BAS), business clusters, big international companies, Sofia Municipality, MES, MLSP, non-governmental organizations, etc. during the implementation of the project, and simultaneously will be responsible for the overall

organization for its implementation, accompanying marketing activity, financing, rental, construction and other activities.

As a project output, within the framework of the next three years a scientific infrastructure for over EUR 10 million should be put into operation, which will support the Bulgarian innovative business. About 40 000 sq. m. new and renovated building premises should be created, which will accommodate applied science laboratories, common incubator, innovative lecture /educational/ discussion forums, space for demonstration of new technologies, office areas and a parking lot.

JEREMIE

In Bulgaria, the JEREMIE Holding Fund (JHF) is financed by the European Regional Development Fund and co-financed 15% by the state budget under OPC. The budget amounts to EUR 199 million. The main objective is the improvement of SMEs access to financing through different financial engineering instruments. JEREMIE initiative in Bulgaria envisions a balanced combination of debt instruments, as well as share capital instruments, which should address the existing big differences between the supply and demand of financial engineering instruments in Bulgaria. Among the various financial instruments are:

"Loan Portfolio Loss Guarantees" for providing preferential conditions under the credits, drawn by SMEs, and in the same time providing opportunity for the banks to finance more and riskier SMEs, which without the availability of the guarantees they would not have financed. As of 31.12.2012, 1 478 credits have been issued to SMEs amounting in total to EUR 87 million.

"Instrument for entrepreneurship promotion and initial financing provision" - the objective of the instrument is to provide support to innovative start-ups under the form of share investments. The instrument is characterized by two financing phases, compliant with the development of the enterprise and opportunity for consultations by a group of professionals in different business sectors (mentors). The total instrument budget is EUR 21.21 million, out of which EUR 0.21 million is private financing.

Two funds have been created: Eleven and LAUNC Hub. Eleven manages a fund with EUR 12 million capital, aiming at accomplishing about 200 investments in innovative start-ups. The investment in one company from the fund's portfolio is between EUR 25 000 and EUR 200 000. The other selected manager – LAUNC Hub manages a fund with capital EUR 9 million, focused on the information and communication technologies. The objective is to make approximately 120 investments during the next four years. Each one of the investments is expected to be between EUR 30 000 and EUR 200 000 and to be made in start-ups from Bulgaria and the region. During the last two years, the Starting Business Funds Eleven and LAUNC Hub have invested about EUR 6 million in 92 companies. Eleven already has 57 projects and 150 founders, financed with its resources, and LAUNC Hub has invested in 35 projects in total.

Risk Capital Fund under OPC - the main objective of the instrument is to make investments at initial development stage in SMEs, registered and having main position in the economic activity in Bulgaria. The total budget of the instrument is EUR 30 million, out of which EUR 9 million – private financing.

Mezzanine Fund – with budget under OPC of EUR 60 million, out of which EUR 30 million private financing. The aim of the instrument is to make investments mainly in enterprises, which are registered and have main place of their economic activity in Bulgaria. The instrument is combined – i.e. for share investments and loans.

Instrument providing financing through risk sharing - the objective of the instrument is to support SMEs, providing loans at lower than 50% interest rate reduction for the issued loan and reduction of the fees, commissions and collaterals related to the credits. The total instrument budget is EUR 300 million, out of which EUR 150 million is private financing.

- **Programs for rendering assistance to the research activity**

Fund "Scientific Research", which is a legal entity to the Ministry of Education and Science renders assistance on a project principle to the research initiatives at a national, regional and international level. Six

Permanent Expert Committees work in the Fund "Scientific Research" reflecting the research priority spheres: mathematics and informatics, natural sciences, biology and medical sciences, agricultural sciences, technical sciences, public sciences and humanitarian sciences. The permanent committees make a decision for the distribution of the funds under the presented projects in conformity with the rules input in the Scientific Research Encouragement Act and in the Articles of Association of the Fund "Scientific Research". The key program, which the Fund "Scientific Research" participates at present in, is called "Development of the Scientific Research Potential". It works under three strategic priority modules: improvement of the research infrastructure in the universities and the research institutes; modernization of the scientific research equipment in the universities, the specialized laboratories and the research institutes.

The Fund "Scientific Research" encourages the scientific research in the priority directions of the National Research Development Strategy by:

1. Rendering financial assistance to the scientific organizations and the higher schools on the basis of project-program financing;
2. Financing projects, developments and demonstration projects in the scientific directions defined by the Fund;
3. Financing projects, developments and demonstration projects of young scientists.

The priority directions of the National Research Development Strategy 2020 are:

1. Energy, energy efficiency and transport. Development of green and eco-technologies;
2. Health and quality of life, bio-technologies and ecologically clean foods;
3. New materials and technologies;
4. Cultural historical heritage, social economic development and management;
5. Information and communication technologies

The activity of the Fund "Scientific Research" is directed fully at the realization of the policy of the Ministry of Education and Science for encouragement of fundamental and applied scientific research in conformity with the National Scientific Research Strategy with proven significance and international recognition as well as the dissemination of the scientific results related to:

1. Rational solution of important problems of the country in the sphere of the economy, the public processes and of the human resources;
2. Sustainable development of the national identity, the Bulgarian history and national culture;
3. Accelerated development of the scientific-applied (engineering) sciences and of the modern innovations;
4. Creation of new scientific knowledge for building up of economy of knowledge and so on.

The National Innovation Fund (NIF) has been operating at the Ministry of Economy and Energy since 2005, promoting the private investments in the development of competitive and knowledge based industry in Bulgaria. The Bulgarian Small and Medium Enterprises Promotion Agency is administering the Fund. The direct objective of the fund is to encourage the implementation of scientific research and development projects and technical feasibility study projects with the aim to create new or develop existing products, processes or services for increasing the economic efficiency, improving the innovative potential and enterprise technological level, and promoting the dynamics of the innovative processes. The interest towards this financial instrument has remained unchanged throughout the years.

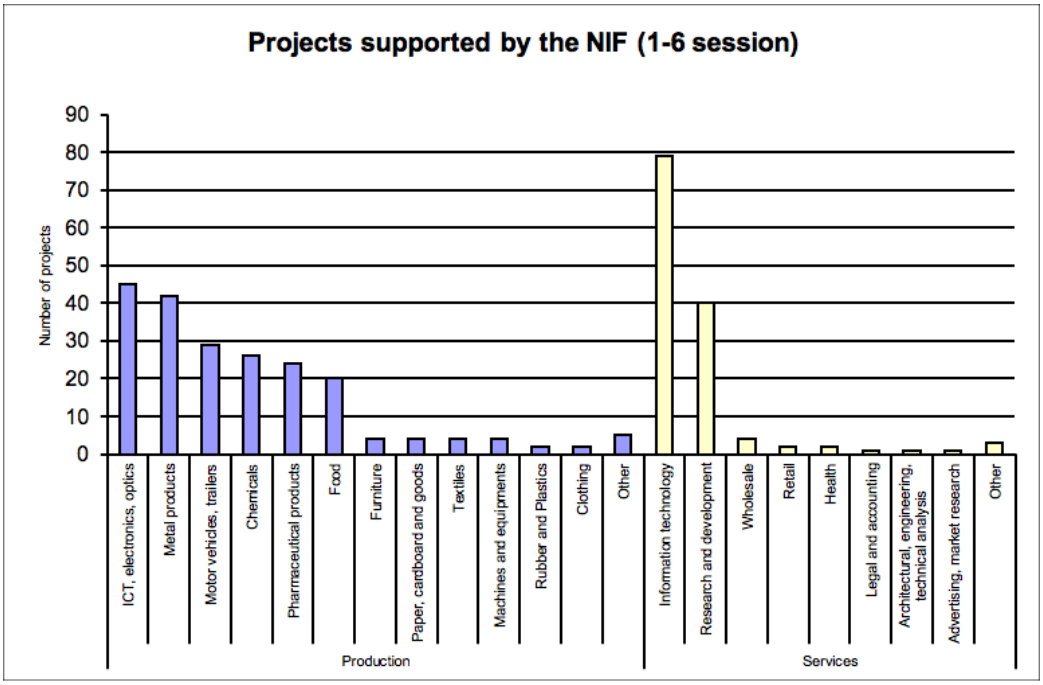
NIF session	Submitted project proposals	Signed contracts	% signed contracts	Negotiated subsidy (EUR)
I (2005)	118	43	36	3 350 000
II (2005)	120	67	56	4 150 000
III (2006)	146	108	74	8 300 000
IV (2006)	168	91	54	8 450 000
V (2008)	123	60	49	6 000 000
VI (2012)	67	36	54	4 555 000
VII (2014)	152	52	34	4 990 049
Total	**742**	**457**	**47**	**39 795 049**

During 2013 the evaluation performed by an independent organization was completed. It analyzed the results achieved by the enterprises for a period up to three years after completion of projects, financed by NIF. These enterprises show improvement in a series of indicators, such as:

- 79,3% of the firms have introduced new products to the market
- 38,5 % of the firms have increased their staff number
- 65,5% have entered new markets
- 68% have increased their profit
- 71,4% have increased their net sales revenue, etc.

The data from the analysis provide convincing evidences for the need for this financial scheme and the serious interest on the part of the business is a ground for continuation and expansion of the NIF activity.

Priority directions for support have been determined for each NIF competitive procedure. The biggest is the activity of the companies, operating in the sectors of ICT, metal products and R&D. The percentage of projects in the sphere of chemical products, medicinal substances and food products is high.



Source: The Bulgarian Small and Medium Enterprises Promotion Agency,

The discussions held with the business on the effect of the implemented financial instruments (the competitive procedures of OPC, NIF) imposed the understanding of the need for a change in the enterprise support model. The evaluations of the projects and the assessment of the implementation of the signed contracts should concentrate on the actual outputs of the enterprises (productivity increase, introduction of new energy efficient, resource efficient, environmentally friendly technologies, etc.) and not on the number of invoices and the reporting of accomplished activities.

- **Financing the innovation activity of the enterprises**

The access to financing is one of the most serious limitations for the growth and the entrepreneurial initiative. The entrepreneurs are facing special difficulties to raise funds at the early stages of their economic activity, particularly under the current crisis. Therefore, the widening and strengthening of the financial instruments for entrepreneurs is a key element of the support to the entrepreneurs. SMEs depend largely on bank loans for their external financing and practically they have very small number of alternatives.

Among the state programs supporting small and medium enterprises is the Bulgarian Development Bank AD (BDB AD). The institution is using its position on the Bulgarian bank market during the implementation of the state economic policy. The main focus of BDB is on: SMEs, project financing for export oriented enterprises, investment banking and public projects of national importance. BDB has its own banking group for implementing its objectives:

1. Bulgarian Development Bank AD (BDB AD)
2. National Guarantee Fund (NGF)
3. Capital Investments Fund (CIF)

2.5. National investments in technologies and innovations

- **Participation of the business sector (in particular Small and Medium Enterprises) in Programs of the EU**

The participation of the Bulgarian enterprises in international programs increases. From 2011 Bulgaria became an effective member of the European Initiative EUREKA. Administrative capacity for the popularization of the possibilities of the initiative and the multitude of programs it realizes has been built up in the last few years. Since 2013 our country has also been a member of Eureka-Tourism, one of the so called Umbrella Initiatives. Since 2011 Bulgaria has been a full member of the joint European Program EUROSTARS. In 2011 and 2012 a massive information campaign was conducted for the rules of application and the possibilities this Program creates. As a result of which 8 Bulgarian enterprises applied during the second competition session in 2012, and in 2014 a contract was concluded with the first company with a classified project - Company "IMG – Technology".

Bulgaria plans to conclude an agreement for cooperation with the European Space Agency (ESA), to create possibility for the Bulgarian Small and Medium Enterprises and research organizations to participate in projects for introduction of highly technological products and services. 1 300 000 Euro of national funds were set aside for the purpose for 2014.

From 2014 Bulgaria has also undertaken the initiative for participation in three of the Joint European Enterprises – ECSEL (Electronic Components and Systems for European Leadership), Bio-Technological Production and Fuel Cells and Hydrogen.

- **Participation of the business sector in Global Innovation Networks and Technological Platforms**

Enterprise Europe Network. In Bulgaria the network unites 14 organizations, localized in Sofia, Plovdiv, Sandanski, Stara Zagora, Vratsa, Yambol, Dobrich and Ruse.

- **Participation of the scientific organizations in European Programs and Global Innovation Networks and Technological Platforms**

Participation of Bulgaria in the 7th Framework Program[26]

Main data

As of 06.10.2014, the total number of admissible project proposals was 3.263 under 487 competitions, which 4110 scientific organizations from Bulgaria were included in (0.79% of all the 28 countries) and 933.7 million Euro (0.48%) were requested from all the member-states.

Amongst the countries from EU 28 Bulgaria was classified in the 20th place with regard to the number of applying organizations and requested financing.

Bulgaria had a result of 16.4% with average value for EU28 of 20.5%

The applying Small and Medium Enterprises from Bulgaria have a result 15.21%, which is lower than the average value for the EU of 20.19%. The successful Small and Medium Enterprises received European financing in the amount of 27.25 million Euro, which is 27.63 % of the total budget for Bulgaria.

The attracted funds from the competitions of the European Research Council and Marie Curie are in the amount of 7.78 million Euro.

Within the framework of the 7th Framework Program the Bulgarian scientific organizations registered cooperation with Great Britain (976), Germany (857), Italy (826), Spain (712) and France (632)

In the institutional distribution of the Bulgarian participation in the Seventh Framework Program a leading role have the higher schools (33 %), followed by the research units (31 %), the business organizations (28,6%), the public organizations (about 10 %) and other organizations with the same share.

The success of the institutes of the Bulgarian Academy of Sciences, in particular in the sphere of Information and Communication Technologies and Physics, is a result of the internal institutional reforms and

[26] Source: Seventh FP7 Monitoring Report, 11 March 2015, Country Profile: Bulgaria

the improved program-project activity. As a whole the Bulgarian Academy of Sciences passes to a model of combined state and attracted financing, which results in the positive tendency. In 2005 the ratio 96% to 31%, with 58% to 42% in 2015.

- **Bilateral agreements in the sphere of scientific research and innovations**

The international cooperation in the sphere of science and technologies is based on bilateral and multilateral international agreements and the implementation of joint scientific programs. The Ministry of Education and Science at the moment has over 15 current agreements for bilateral scientific and technical cooperation with a broad geographical scope. In the last few years bilateral programs for cooperation in the sphere of scientific research with **China, India, Korea, the USA, Brazil, Ukraine, Germany, Austria, France, Slovenia, Slovakia, Russia, Romania and the Former Yugoslav Republic Macedonia** have been implemented.

In 2011 the implementation of the **Bulgarian-Swiss Program for Overcoming the Economic and Social Disparities in the Enlarged EU** commenced, on the basis of which two funds with national co-financing were created – Fund "Scientific Exchange" and Fund "Scientific Research" with period of effect 2011-2016. 22 scholarship programs in the sphere of biology, biochemistry and medicine, the philosophical investigations, chemistry, phyto-chemistry, ecology, physics, pharmacy and others were realized within the framework of the program for scientific exchange, and the implemented scientific research projects are from the sphere of ecology, microbiology, agriculture, waste management, social inequalities, development of medicinal forms and innovative construction materials.

Bulgaria also participates in the European Organization for Nuclear Research (CERN), the European Scientific Foundation (ESF), the International Thermonuclear Experimental Reactor (ITER), the European Molecular Biology Organization (EMBO), the European Metrology Research Program, (EUMETSAT) and is a member of the Convention for the creation of the European Center for Medium-Range Weather Forecasts.

Participation of Bulgaria in "Horizon 2020" (2014-2020)

In the first three years (2014-2016) of the realization of the Framework Program the total number of the submitted in the European Commission (EC) admissible project proposals from all the participating in "Horizon 2020" countries was 120 000, as a result of which there are 11 000 signed contracts for financing available at hand. For comparison – for the complete seven-year period of the preceding 7th Framework Program 135 800 admissible project proposals were submitted and 25 300 contracts for financing were concluded.

As of the end of 2016, 150 Bulgarian organizations participated in the implementation of 252 projects in conformity with "Horizon 2020", and the net European financing for our country was approximately 42 million Euro. This sets Bulgaria in the 24th place of 28 member-states of the EU with regard to participation and utilization of funds under the Program.

The data from the information system ECORDA of the EC indicate that there is the biggest share of attracted monetary funds from "Horizon 2020" in Bulgaria under directions "Secure, Clean and Efficient Energy" (approximately 6,8 million Euro), "Information and Communication Technologies" (approximately 3,5 million Euro) and activities under Program "Maria Sklodovska-Curie" (approximately 3,3 million Euro).

2.6. Qualitative analysis for identification of potential spheres for intensive innovation development

2.6.1 Methodological Approach:

Subject of the analysis are the economic activities (second level of aggregation according to the Classification of Economic Activities (CEA 2008), assigned by level of technological intensity, according to the OECD classification and EUROSTAT. Similar grouping allows the obtaining of a clearer assessment of the condition and possibilities for development of medium and high-tech sectors. The classification does not include the activities of the mining industry and the agrarian sector. The analysis includes 82 activities from the industry and services. **The identification of the potential** of each economic activity is performed with the help of different indicators. They measure the attitude of the state and the business activity related to the quality development of the economic activities and services: state support for creation and development of technology transfer offices and centers; financed projects under NIF; financed projects under OP "Competitiveness of the Bulgarian Economy" 2007-2013; number of patent holding firms, number of trademark owning firms. The value of all indicators has been recalculated with regard to the total scores for the industry and the sphere of the services. Thus, they become comparable and allow their summing and obtaining of aggregated score for each economic activity.

The potential of the economic activities is estimated similar it has been done in the quantitative analysis – all medium and high-tech activities and the knowledge intensive? high-tech services are included (pursuant to the EC requirement for orientation towards activities with a higher degree of reprocessing of the end product). From the remaining groups of economic activities and services the three ones, which have the maximum scores, are selected.

2.6.2 Results

The initial sample of 82 economic activities and services is narrowed to 31, on which the state support and the business activity is concentrated. The state support is expressed in allocation of financial resources based on project proposals – i.e. underlying is the entrepreneurship activity of the business and the research units, oriented towards raising the scientific and technological level and acceleration of the innovation processes.

Within the framework of the industry, the ranking is headed by low and medium-tech activities such as food products and metal items. But after that there is a whole group of medium and high-tech activities (ICT, electronic and optical products, chemical products, machines and equipment, electrical facilities, medicinal substances and products). This in practice is a sign of policy shift towards a high-tech change in the economy.

If we shall again exclude the commercial services and the services of the non-governmental organizations (outside the clusters registered as such), it will appear that the sphere of the services is oriented towards knowledge intensive high-tech and market services. These include information technologies, scientific studies and experimental developments, human health care, architectural and engineering services and technical tests and analyses, educational services, etc. – i.e. the sphere of the services follows the established trend towards a high-tech change of the economy.

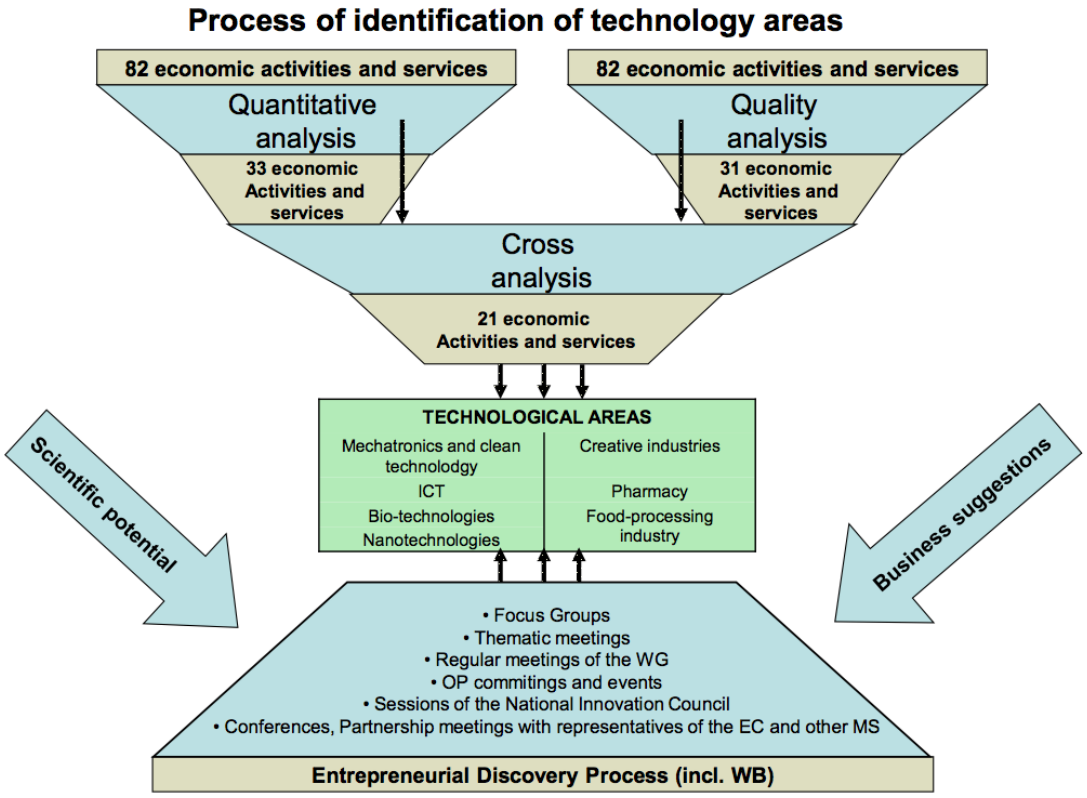
2.7. Cross analysis for identifying potential technological spheres for intensive innovation development (specialization)

2.7.1 Methodological Approach:

The results from the quantitative and the qualitative analysis, summarized in the previous sections , are subject of this analysis. The objective is to outline the economic activities and services for which the quantitative assessment is supplemented by a qualitative one and vice versa. This is interpreted as a strength, which creates capacity and future potential for accelerated technological and innovation development. And the opposite – these activities and services, which have only one of the two assessments, are eliminated from the identification process. In this manner, 21 economic activities and

services (Annex "Tables and Statistics") have been identified, which are considered as a reference point for identifying technological areas for smart specialization. The identification logic is to find cross points between economic activities and services and scientific fields, in which the support of the state and of the business for research and innovation activities are concentrated.

2.7.2 Results



The approach allows the identification of the following technological fields with potential for innovation specialization:

- **Identification of technological field "Mechatronics and Clean Technologies"**

		R & D expenditure by field of science during the 2008-2012					
		Medical sciences (31.1%)	Technical sciences (25.1%)	Natural sciences, mathematics and informatics (24.6%)	Agricultural sciences (11.0%)	Humanities (5.1%)	Social Sciences (3.0%)
	Economic activities						
26	Manufacture of computer, electronic and optical products	Technological area **Mechatronics and clean tecchnolodgies** Mechatronics *(mechanics, electronics, software, management systems)* Clean technologies *(electric vehicles, fuel cells, hydrogen society)*					
28	Manufacture of machinery and equipment n.e.c.						
27	Manufacture of electrical equipment						
29	Manufacture of motor vehicles, trailers and semi-trailers						
	Services						
62	Computer programming, consultancy and related activities						
72	Scientific research and development						
71	Architectural and engineering activities; technical testing and analysis						

- **Identification of technological field "ICT"**

		R & D expenditure by field of science during the 2008-2012					
		Medical sciences (31.1%)	Technical sciences (25.1%)	Natural sciences, mathematics and informatics (24.6%)	Agricultural sciences (11.0%)	Humanities (5.1%)	Social Sciences (3.0%)
	Economic activities						
26	Manufacture of computer, electronic and optical products	Technological area **Information and communication technologies** *Applied Informatics (software)*					
	Services						
61	Telecommunications						
62	Computer programming, consultancy and related activities						
72	Scientific research and development						
63	Information service activities						

- **Identification of technological field "Biotechnologies"**

		R & D expenditure by field of science during the 2008-2012					
		Medical sciences (31.1%)	Technical sciences (25.1%)	Natural sciences, mathematics and informatics (24.6%)	Agricultural sciences (11.0%)	Humanities (5.1%)	Social Sciences (3.0%)
	Economic activities						
26	Manufacture of computer, electronic and optical products	Technological area **Biotechnology** *(food, cosmetics, paper, packaging)*					
10	Manufacture of food products						
	Services						
62	Computer programming, consultancy and related activities						
72	Scientific research and development						

- **Identification of technological field "Nanotechnologies"**

		R & D expenditure by field of science during the 2008-2012					
		Medical sciences (31.1%)	Technical sciences (25.1%)	Natural sciences, mathematics and informatics (24.6%)	Agricultural sciences (11.0%)	Humanities (5.1%)	Social Sciences (3.0%)
	Economic activities						
21	Manufacture of basic pharmaceutical products and pharmaceutical preparations	Technological area **Nanotechnology** *(medicine, electronics, new products, textiles and clothing, cosmetics)*					
26	Manufacture of computer, electronic and optical products						
20	Manufacture of chemicals and chemical products						
25	Manufacture of fabricated metal products, except machinery and equipment						
23	Manufacture of other non-metallic mineral products						
14	Manufacture of wearing apparel						
	Services						
62	Computer programming, consultancy and related activities						
72	Scientific research and development						
71	Architectural and engineering activities; technical testing and analysis						

- **Identification of technological field "Creative Industries", including cultural industries**

		R & D expenditure by field of science during the 2008-2012					
		Medical sciences (31.1%)	Technical sciences (25.1%)	Natural sciences, mathematics and informatics (24.6%)	Agricultural sciences (11.0%)	Humanities (5.1%)	Social Sciences (3.0%)
	Economic activities						
26	Manufacture of computer, electronic and optical products	Technological area **Creative Industries, including cultural** *(Production of movies and TV shows, and broadcasting radio and television programs, sound recording and music publishing)*					
	Services						
62	Computer programming, consultancy and related activities						
72	Scientific research and development						
63	Information service activities						
59	Motion picture, video and television programme production, sound recording and music publishing activities						
60	Programming and broadcasting activities						

- **Identification of technological field "Pharmacy"**

		R & D expenditure by field of science during the 2008-2012					
		Medical sciences (31.1%)	Technical sciences (25.1%)	Natural sciences, mathematics and informatics (24.6%)	Agricultural sciences (11.0%)	Humanities (5.1%)	Social Sciences (3.0%)
	Economic activities						
21	Manufacture of basic pharmaceutical products and pharmaceutical preparations	Technological area **Pharmacy**					
	Services						
62	Computer programming, consultancy and related activities						
72	Scientific research and development						

- **Identification of technological field "Foodstuff Industry"**

		R & D expenditure by field of science during the 2008-2012					
		Medical sciences (31.1%)	Technical sciences (25.1%)	Natural sciences, mathematics and informatics (24.6%)	Agricultural sciences (11.0%)	Humanities (5.1%)	Social Sciences (3.0%)
	Economic activities						
10	Manufacture of food products	Technological area **Food Industry** *(ecologically clean products)*					
28	Manufacture of machinery and equipment n.e.c.						
	Services						
62	Computer programming, consultancy and related activities						
72	Scientific research and development						
46	Wholesale trade, except of motor vehicles and motorcycles						

The identified technological areas as result of this analysis are as follows: Mechatronics and clean technologies, ICT, Biotechnology, Nanotechnology, Creative industries, Pharmacy, Food industry. With

reference to the existing and expected tendencies these technological areas are summarized in four thematic fields (Mechatronics and clean technologies, Informatics and ICT, Industry for health life and biotechnology, New technologies in creative and recreation industry) that reflect the existing potential and future opportunities for smart specialization of the country.

2.8. SWOT analysis of the innovation and scientific research potential

Strengths	Weaknesses
• A few high growth enterprises ; • Accumulated experience and investments in mechatronics-related industries; • High share of the university graduates; • Tradition in the fundamental research including biotechnology; • Highly qualified researchers in the field of physics, chemistry, computer technologies and biotechnologies; • High growth in the cultural and creative industries.	• Limited innovation dynamics as demonstrated by global patenting and high-tech exports ; • Inefficient educational system and shortage of qualified work force (despite the high share of graduates); • Low share of GERD/GDP; • Low share of BERD/GDP; • Low propensity of SMEs to network for innovation activities; • Limited business-academia cooperation; • "Brain drain"; • Low entrepreneurial and innovation culture.
Opportunities	**Threats**
• Emerging strengths can attract investments in leading high-tech sectors; • Availability of EU competitive funds and performance reserve towards improving the innovation; • Innovation and entrepreneurial culture of the young generation; • Bulgarian Diaspora scientists and potential of brain circulation; • Increasing global research collaboration trends.	• Ageing of highly qualified professors and researchers; • Opportunities for qualified researchers to work abroad with better conditions; • Rapidly changing environment.

Policies need to:

- Build on strengths hence invest in mechatronics and bio-tech related sectors and nurture fundamental research that can harness entrepreneurial discovery;
- Eliminate weaknesses by improving the educational quality of labor force rather than limit success in high shares of educated labor force;
- Exploit opportunities via competitive funding of the EU through support to excellence, take advantage of the existence of the Bulgarian Diaspora by helping researchers to repatriate provisionally or permanently and share their knowledge, give the young generation better opportunities to enterprise, focus on few clusters with potential to attract investors;
- Mitigate the effect of threats by training and hiring new researchers to make up for the ageing qualified personnel and compete with other countries attracting them, as well as exploit flexibility and SS to adapt to changing global competitive pressures.

3. ICT AND ICT POTENTIAL

Information and communication technologies (ICT) are one of the key drivers for building a competitive economy based on knowledge and innovation. The ICT sector policy is a sectoral horizontal policy with an impact on all social and economic sectors, and as such, it can be performed only through concerted and coordinated efforts of all state institutions and with the participation of the representative organizations of the business and civil society. This policy should contribute to smart, sustainable and inclusive digital growth to ensure maximum use of the innovative economic and social potential of ICT.

3.1. Review of the existing infrastructure and existing services

- ***Broadband infrastructure / access***

The Digital Agenda for Europe highlights the need to ensure the development and deployment of high-speed broadband access for all and to facilitate investment in the new very fast open and competitive Internet networks that will be the arteries of a future economy and an essential prerequisite for widespread use of ICT-based e-services for citizens, businesses and government.

Bulgaria has high, but uneven broadband coverage. For example, the capital Sofia, is first in terms of Next Generation Access (NGA) coverage. Tourist areas, such as the coastal areas, are among the leading with 100% standard fixed broadband coverage. The coverage in most of the regions is between 80% and 94%. Those in northwestern Bulgaria have the lowest coverage values starting below 50% and reaching only up to 70%.

In Bulgaria, 98,8% of the of the households access to broadband Internet, but there is difference between the regions. According to data from the National Statistical Institute (NSI) in 2016, 63.5% of households have Internet access, and by development regions, these data are respectively SWR - 64.9%; SCR - 64.9%; SER - 60.9%; NER - 67.3%; NCR - 61.5%; and NWR - 58.6%. A main problem is the lack of internet access in nearly 4 000 villages in remote and scarcely populated areas which makes them less dynamic, with reduced competitiveness and less attractive to investors and citizens.

While in 2017 the fixed broadband coverage of households is 95 %, the main challenge is to increase the broadband subscribers. Only 57% of homes subscribe to fixed broadband (27th in the EU) limiting Bulgaria's ability to exploit the benefits of the digital economy. Networks capable of providing at least 30 Mbps (NGA) are available to more than two-thirds (74%) of Bulgarian homes, which is still below the EU average (76%). Bulgaria's strength is in terms of take-up of high-speed broadband, with more than half (55%) of fixed Internet subscriptions offering high-speed connections (11th in the EU), above the EU average.

Due to the presence of "market failure" in the most underdeveloped regions, a state intervention is needed to ensure broadband access in these areas. Simultaneously, it is necessary to support the increase of digital literacy of citizens, the development of e-government services, deployment of ICT in enterprises to secure the demand for broadband Internet and ICT-based applications and services in order to overcome the digital divide and to stimulate digital growth mainly in the lagging behind regions.

- ***e-Government***

Electronic delivery of public services is a key driver for improving the business environment and is particularly important in times of austerity, in which there is pressure on government finances. Investments in setting up e-government shall stimulate further growth of the ICT sector in Bulgaria as they are implemented on the basis of contracts and various forms of public-private partnerships.

According to a survey of the National Statistic Institute in 2016, 18.4% of individuals used the global network for interaction with the public administration. The most significant was the share of individuals who obtained information from public administration's websites (15.0%), followed by the share of

individuals who downloaded official forms (9.3%) and those who submitted completed forms (6.5%) in the last twelve months.

As a whole, Bulgaria's performance with respect to digital public services remains well below the EU average One particular area showed strong progress though, Open Data, where Bulgaria comes in 7th place, i.e. rising two positions since 2016. On 5 April 2016, Bulgaria adopted a Roadmap for implementation of the Strategy for the Development of e-Government for the period 2016-2020. It outlines the measures and activities for the implementation of the strategic goals, as well as the institutions responsible and the financial resources required.

The Electronic Governance Act was amended in June 2016, introducing a key change: the establishment of a new State e-Government Agency (SEGA), the aim of which is to conduct e-governance policies. SEGA has only been operational since 1 December 2016 and recently (on 14 February 2017) launched its website – https://www.e-gov.bg SEGA aims to centralize all processes related to e-Government. It is tasked with issuing and introducing control-related policies, rules, regulations and good practices in the field of electronic governance, strategic planning, budget planning and control, coordinating all sector-related policies and interdepartmental projects. The agency is also responsible for maintaining the central registers, the government cloud (G-cloud) and the communication network of the State Administration.

- ***Education, research and innovation e-infrastructure***

ICT infrastructure (communication infrastructure, equipment and specialized software applications) in the system of education and science is largely physically and morally outdated. Although, upgrading of computers in schools began in 2012, terminal jobs were equipped only in 500 schools out of more than 2300 schools in the education system. There have been no serious efforts to create a modern cloud infrastructure based on which to set up conditions for the creation of and access to modern educational content thus creating a student-oriented learning environment.

An important part of research infrastructure is the electronic research infrastructure (e-Infrastructure), which is a new research environment in which all researchers - whether working within their organization or in national or multinational scientific initiatives have shared remote access to unique or distributed scientific equipment and research data, regardless of their type and location in the world. The most significant Bulgarian research e-infrastructures acting as elements of the European research e-infrastructures in Bulgaria. are included in the Roadmap for National Scientific Infrastructure and need investment support for further modernization and integration with the European research infrastructures

- ***ICT clusters***

Innovation infrastructure in ICT is offered by the established ICT clusters that act as platforms for the development of innovative companies and innovative ideas and catalyze the process of commercialization of research:

The **"Cluster information and communication technologies"** foundation is a cluster initiative supporting and encouraging the creation and development of clusters in the field of information and communication technologies in Bulgaria and has established itself as a center of cluster knowledge in Bulgaria. The organization is a member of several European cluster platforms and networks and maintains very good relations with many European and global partners. The main objective of the organization is to increase the competitiveness of the small and medium-size enterprises in the ICT sector by promoting cooperation and creating new business opportunities the foundation is particularly effective in its support for small and medium-size enterprises in the ICT sector with regard to technology, research and development and the creation of management skills.

"**ICT Cluster Plovdiv**" encourages, fosters, and develops the collaboration and cooperation of private companies, educational institutions and state institutions in the area of ICT, creating favorable conditions for their development and enhancing their competitiveness at national and international level.

A targeted support is needed for the development of ICT clusters to take advantage of their potential to enhance the competitiveness of science and entrepreneurship in Bulgaria by improving the exchange of knowledge between academia and the business community. They can be used as locomotives for regional smart specialization in Bulgaria.

3.2. Review of the expansion / development of the infrastructure

Bulgaria is among the most advanced Member States in terms of the speed of the provided broadband access - more than 98.8% of the lines have speed above 2 Mbps, and over 74.1% have speed between 10 and 30 Mbps, which makes them ready for future Internet applications, such as high definition television and high quality video calls. This is largely due to the fact that the share of inherited outdated infrastructure is too small and much of the newly built fixed broadband lines are FTT'x technology-based i.e. based on optical fibers. This creates a good basis for the forthcoming widespread deployment of Next Generation Access networks (NGA - Next Generation Access). MTITC drafted a National Plan for building Next Generation Access Networks, whose target is to achieve full coverage throughout the country by 2020 at a speed exceeding 30 Mb/s and 90% access with a speed above 100 Mb/s and to increase the share of the population that uses Internet and electronic services to 75%. It is pending adoption by the Council of Ministers. Briefly, the draft National Plan for Next Generation Access Networks (NGN) includes:

• Investment projects for building broadband access in remote, sparsely populated and rural areas, financed by the new operational programs, the state budget and public-private partnerships in the period 2014-2020.

• Technological renovation and upgrade of existing broadband networks aiming at achieving necessary parameters ensuring possibilities for provision of new, modern electronic services with considerably higher speed in the period 2014-2020.

• Step by step building of Next Generation Access networks (NGA) in the period 2015-2020.

The activities under the Plan shall be financed by the new operational programs and various public-private partnerships.

Meanwhile, the first project for setting up broadband infrastructure in rural areas has been implemented, funded with EUR 20 million through OP Regional Development. This is the largest project in this area for the whole programming period 2007-2013. Within the frames of the Single Electronic Communications Network of State Administration, the project shall provide high speed NGA Internet to 29 municipal centers and 24 small settlements located on an area of 7 919 square kilometers (7% of the territory of the country), with population of 277 765 (4% of the entire population of the country), which will create prerequisites for e-Government development in these regions. Part of the newly built infrastructure under the project will be available for use by the business for the development of the telecommunication market and it will be provided to telecommunication operators by tender procedures. 27

3.3. Expenditures and investments in ICT by enterprises

Expenditures in the last years incurred by enterprises in Bulgaria were about EUR 1,5 bln. with a trend to increase. Small enterprises (with an average headcount of less than 50 people) have incurred most of the

27 Project BG161PO001 / 2.2-01 / 2011 "Support for the development of critical, secure, safe and reliable public ICT infrastructure" with beneficiary EA "Electronic Communications Networks and information Systems."

ICT costs (abt. 30%), while the larger enterprises with average headcount of more than 250 people have incurred less ICT costs. Most of the companies` expenditures have been for IT services and telecommunications goods, and least costs by the enterprises are made for ICT leases.

Investments made by enterprises in Bulgaria in the last years amount to over than EUR 200 mln. Investments in ICT by small enterprises (with an average headcount of less than 50 people) are comparable to those of large enterprises with average headcount of more than 250. The most investments made are for IT and communications goods. the least investments were made for consumer electronic equipment and other ICT goods.

Overall expenditures and investments that businesses make for ICT products and services are still low, indicating a low level of implementation of ICT.

3.4. Mapping the ICT sector

The Bulgarian ICT sector includes sub-sectors like: production of computer hardware, software developers; software integrators, telecom services (Internet and telephone services) and IT consultants. It has been one of the driving forces behind the countries steady growth over the past few years. With an average annual increase of 17% since 2007, the ICT sector is one of the fastest growing sector of the economy. It generates 10% of the Bulgarian GDP and employs the third largest contingent of ICT specialists in the world. The software industry is the most rapidly developing segment. Total incomes in 2016 reached 1 billion and 20 million euros. This is over 600% growth compared to 139.4 million euro in 2006. That means that 10 years after the entry of Bulgaria into the European Union the software industry has established a firm place in the Bulgarian economy and continues its stable development. If the pace of revenue growth remains unchanged, in 2021 it would reach 4.5% of GDP, which would have ranked the ICT industry among the largest in the country. Data comes from the independent consulting company CBN Pannoff, Stoytcheff& Co. that has been analyzing ICT markets and businesses in the country for 26 years.

The ICT sector in Bulgaria is very viable. For the last years, it has continued to create new jobs and the average wages have continuously increased. Almost 20 000 people occupy ICT positions today compared to 5 000 in 2016, which is 300% growth. Over 90% are young professionals up to 35 years of age, one third of all IT specialists are women. The sector employs some of the most highly skilled and well-paid professionals in Bulgaria. The annual survey of the Bulgarian Association of Software Companies (BASCOM) shows that the average wage in the sector is four times higher than the country average. Programmers and Project Managers standard is similar to experts working in countries like the UK. Sofia is the center of the ICT sector where more than 85% of the employed are concentrated. In the last few years, Plovdiv is becoming a second center of ICT industry with 15 % annual growth of employed ICT professionals.

The ICT sector is highly export oriented. According to a study of BASSCOM 70% of revenues in 2016 are generated by export oriented software business. However, the shortage of qualified professionals has become one of the leading challenges during the last years, since it leads to slowing down the potential growth. The Bulgarian education system still cannot meet the human capital requirements.

The sector has a high R&D intensity and as per the MTITC data, the expenditures for R&D in the ICT sector account for 11% of the total R & D expenditures in the economy. The R&D and innovations potential of the ICT sector is confirmed by its successful participation in the Seventh Framework Program (FP7)and the HORISON 2020 Programs of the EU. Based on the MTITC data, at the end of FP7 the ICT received EUR 15 745 563; out of 67 projects with 92 participants the largest is the share of the high-tech SMEs - 40%. The funding received up to the moment from HORISON 2020 is EUR 3 463 790 for 12 ICT projects with 14 Bulgarian participants, 60% of them SMEs.

Foreign investments in the ICT sector are considerable. Among the largest sources of foreign direct investments in the sphere of ICT in Bulgaria are the mobile operators, which are owned by foreign giants as Telecom Austria Group, Norwegian Telenor / OTE, and other .. Apart from the information infrastructure, investments in Bulgaria are made in much "smarter" IT activities, Over the past decade Bulgaria and the ICT sector have established as a successful model not only for external centers for customer service and manufacturing software and hardware at low prices, but also for providing conditions for research and innovation, satisfying the high demands of multinational companies. This led to an increase in foreign investments, especially in the sub-sector "Activities in the field of IT", which covers most of the knowledge-intensive and innovative companies In many cases, foreign investments and the establishment of global companies in the Bulgarian ICT sector followed the pattern of acquisition of Bulgarian companies with which the foreign companies have had partnership relations. The presence of R&D units of large ICT companies (SAP Labs, Siemens, Johnson Controls, VMWare, Nemetchek, Sitel, Codix, Epic Electronics and more.) and the presence of Bulgarian companies creating innovative products and services for large multinational companies or in partnership with them (Sirma Solutions, Fadata, Interconsult Bulgaria, TechnoLogica, Datex, Telerik, MusalaSoft, Bianor, Hemimont, Telelink, Chaos Group, Rila Solutions, AMK Drives and Controls, Optics, Samel-90, Daisy Technology etc. .), creates conditions for the growing visibility of the country internationally and for establishing it as a destination for outsourcing services and high-tech innovative developments. According to the latest data from NSI, the **Foreign direct investments in ICT** at the end of 2015 amounted to MEUR 303. 398 for the subsector "IT and other information Services" and MEUR 1378, 012 for the subsector „Telecommunications".

The Digital landscape is complex as it is highly volatile with important local weaknesses but rapid progress in both technological opportunities and funding schemes supported by the EU. In that sense policies can make a rapid contribution to growth or fail. What is needed in particular is speed in the:

- Modernization and development of research e-infrastructure - an opportunity for scientific excellence and utilization in the economy and social sectors;
- Development of centers of excellence in key ICT areas - an opportunity to enhance the competitiveness of research organizations and innovative companies on a global level;
- Selection and focus on niches in ICT requiring specific knowledge and higher skills;
- Expanding the scope of ICT products and services offered ranging from outsourcing to developing their own software products, R&D activities and sale of own brands hardware.

3.5. Social factors / penetration of ICT and compliance with European Digital Agenda

A review of the data relating to Bulgaria's progress towards the objectives of the Digital Agenda for Europe at the end of 2016 (Digital Agenda for Europe) shows the following:

Purpose	Term	EU progress %	Bulgaria progress %
Basic broadband access for100% of the population	2013	100	100
Broadband at 30 Mbps and more for 100% of the population	2020	37	55
Broadband at above 100 Mbps for 50% of the population	2020	15	4

33% of SMEs sell online	2015	17	8
50% of the population buy online	2015	55	17
20% of the population buy online cross-border	2015	18	7
75% of the population use the Internet regularly	2015	79	58
60% of disadvantaged people use the Internet regularly	2015	57	31
15% of the population have never used the Internet	2015	14	33
50% of the population use e-Government services	2015	48	19
25% of the population use e-Government services provided entirely online.	2015	28	7
100% increase in public spending on research and technological development	2020	-	-

Source: Digital Agenda Scoreboard 2016, DESI 2017, EDPR 2017, NSI 2016

Some of these results are excellent, but others raise concern and need adequate measures to address the lagging.

Human Capital

Adequate computer and Internet skills (digital literacy) are essential for the expansion of demand and use of ICT and ICT-based services and the development of economic sectors with high innovation potential.

In Human capital, Bulgaria's performance is well below EU average; but recently Bulgaria made some progress. Only a quarter (26%) of its citizens possess even basic digital skills. The lack of necessary skills is a barrier to internet usage, particularly common among older people in rural areas and among ethnic minorities.

On the positive side, the share of ICT specialists in the workforce is rising, which is a very good sign for the Bulgarian economy. Every fifth enterprise (19.9%) had employees for whom the main job was to develop, operate or maintain ICT systems or applications. Large companies with 250 or more persons employed offered most jobs for ICT specialists (61.1%), while among the small enterprises with 10 - 49 persons employed the relative share was 16.2%. E-skills are mandatory for the workers but only 7.9% of the employers provide some kind of training to improve the qualification of the employees in the ICT area.

In 2016 8.9% of the enterprises recruited or tried to recruit ICT specialists and 39.2% of them had difficulties to fill the vacancies. However, the number of STEM (science, technology and mathematics) graduates remained the same (1.4% of graduates) posing some risks for Bulgaria's capacity to fulfil increased demand for ICT skilled specialists.

A number of IT companies10, have set-up their own academies and provide extensive IT training to students; however, this form of alternative education is not recognized by the Government. The Digital National Alliance (DNA) leads many initiatives aiming at improving the digital skills of different groups – students, teachers, women, etc. – free of charge. Currently the DNA is undertaking a joint project with the Ministry of Education and Science targeting teachers from primary schools, since they are key in spreading digital skills. A new law foresees additional time for teachers to develop new skills and the aim of the project is to integrate the use of technology much more into the learning process and make it more attractive.

Bulgaria could benefit from a digital skills strategy for equipping the workforce with the required digital skills and supporting existing private initiatives. Interventions are needed at all levels of the education system and the system of training and retraining of employed, unemployed and disadvantaged people and groups to increase the digital literacy of citizens and avoid the so-called digital exclusion.

Use of the Internet by citizens

Bulgarians are intensive Internet users when it comes to making on-line video calls and using social networks. In 2016 more people are getting online; 58% of individuals regularly use the Internet, up from 55%; However, on average, they engage in online activities much less than other Europeans. Bulgarian Internet users engage the least in online transactions such as online banking (7%) and online shopping (27%). According to NSI survey for 2016 there is a stable trend of growth in the regular internet usage by the individuals and in comparison to the previous year an increase of 3.5 percentage points was registered.

The most active web users were the young people aged between 16 and 24 years, as 87.2% of them use the internet every day or at least once a week. While age is increasing, the desire and need of the persons to be present in the global network decreases and only 12.9% of the individuals aged between 65 and 74 years surf regularly.

There were significant differences in the regular use of the internet by education - while 86.6% of those with tertiary education regularly used the global network, only 28.5% of the individuals with basic or lower education benefited from the opportunities that it provides. The employment situation also affects the activity of the individuals in the global network. It was most often used by students (not in the labor force), 95.3% of them surf regularly, and among employees and self-employed persons the relative share was 74.9%. Almost half of the unemployed also regularly benefited from the opportunities provided by the internet (44.4%).

Use of ICT and Internet by enterprises

The results of the NSI survey for 2016 showed that 93.7% of the enterprises with 10 or more persons employed used computers , as among the big enterprises with 250 and more persons employed the relative share was 100.0%. High-speed and reliable internet access is a basic necessity for the enterprises and during the current year 91.3% of them had permanent connection with the global network. The enterprises mainly used DSL or other type fixed broadband connection (72.2%), and 41.2% of them used mobile broadband connection. The speed of internet connections has also increased and more than a half of the enterprises using fixed broadband connection had a connection with download speed more than 30 Mbps. More than a half of the enterprises (50.7%) maintained their own website, the highest proportion

was in the group of enterprises with 250 and more persons employed (86.3%). The website was mainly used for presenting goods or services (81.4%), links or references to the enterprise's social media profiles (31.1%), as well as offered possibility for online ordering or reservations of goods or services (25.9%). The largest proportion was in sectors ‘Information and communication’ (88.4%) and ‘Professional,

scientific and technical activities' (73.2%), and least enterprises took advantage of this functionality in sector 'Transportation and storage' - 37.0%.

7.2% of the enterprises perform 'big data' analysis, as the most active were the big enterprises with 250 or more persons employed (23.1%). The main data source used by the enterprises was geolocation data from the use of portable devices (66.5%), and enterprises' data from smart devices or sensors, as well as data generated from social media were used respectively by 32.4% and 31.7% of the enterprises. Mainly the 'big data' analysis were performed by own employees of the enterprise (83.1%).

E-Commerce

Results of the 2016 survey showed that 8.6% of the enterprises have received orders online during the previous calendar year, as a lot of them offer their clients the opportunity to pay online, by a credit or debit card, by direct debit authorization or via 3rd party accounts - 40.0% . Most of the enterprises were selling to final customers (74.2%) and 57.6% offered their products to other companies or public institutions.

Enterprises face serious obstacles which prevent them from selling online, since most of the products or services are not suitable for web sales (60.8%)2 while 26.9% believe that the cost of introducing web sales was, or would have been, too high compared to the benefits. In 2015, 10.7% of the enterprises preformed online purchases and most active in the use of e-commerce to improve their business were the large enterprises, 22.1% of which purchased goods or services online and 17.4% sold over the internet. Particularly, SMEs rarely sell online - only 5% of SMEs currently - and their turnover from online sales is low, only 1.7% of total turnover. This can be explained by the age gap: SME owners are often older than potential customers and lack the necessary skills to operate online.

Use of digital public services

As a whole, Bulgaria's performance with respect to digital public services remains well below the EU average. In 2016, 18.4% of individuals used the global network for interaction with the public administration. The most significant was the share of individuals who obtained information from public administration's websites (15.0%), followed by the share of individuals who downloaded official forms (9.3%) and those who submitted completed forms (6.5%) in the last twelve months.

Significant progress has been made in the area of Open Data, for which Bulgaria has become a trendsetter in Europe Top 10. The open data portal (https://opendata.government.bg/) is a central web-based public information system that allows publishing and management of reusable information in an open, machine-readable format. The platform is constructed in a manner that allows complete extraction of the published information or parts of it. Data are freely available and can be used for commercial or non-commercial purposes, as well as for applications development based on them.

3.6. SWOT and ICT potential

Strengths	Weaknesses
• High level of broadband coverage and high-speed broadband; • High penetration of broadband access of at least 30 Mbps; • High level of Internet access for the households on a national scale; • High level of broadband Internet access of enterprises; • Accelerated pace of development of e-governance; • 100% connectivity of all schools in Bulgaria to the Internet; • High level of usage of public e-services by businesses; • Steady growth in the ICT sector (including. exports); • Higher wages in the ICT sector much above other sectors; • High potential for research and innovation in the ICT sector; • Active presence of leading multinational companies, with research centers and BPO centers in the country; • Positioning the country as location for the detection of near-shore centers; • Traditionally good educational system in the field; • Availability of local investment funds with a focus on ICT; • Interaction with the big international companies; • Availability of ICT clusters in the regions will lead to higher smart growth at regional level.	• Uneven broadband coverage (regional imbalances) with low penetration of broadband access in remote, sparsely populated and rural areas; • The Single Electronic Communications Network of the State Administration does not provide fiber optic connectivity to all public administrative structures; • Small number of public e-services that are offered only online; • Lack of cross border interoperability of the information infrastructure for services with major economic and social importance; • Falling behind in the implementation of e-procurement; • Falling behind in the modernization of the ICT infrastructure for education and research and declining quality of education in ICT; • Low level of digital literacy of the population compared to the average for EU; • Low level of usage of the Internet and Internet-based services by the population, 41% of the population have never used the Internet; • Low level of usage of the Internet by disadvantaged people; • Low level of implementation and use of ICT by SMEs in other industrial sectors; • Low level of digital literacy of the population; • Low level of investments in ICT by enterprises; • Low level of development of e-commerce compared to the average for EU; • Falling behind in the modernization of the ICT infrastructure in education and science; • Shortage of ICT specialists "Brain drain" in the ICT sector increases; • Strong concentration of the ICT business in Sofia; • Small local market, limiting the opportunities for demand growth.

Opportunities	Threats
• Next-Generation Access networks (NGA) • Potential of e-governance and mainstreaming ICT in enterprises • Increased demand of software products and services in the world • Penetration of the markets in the region • Development of the industry in the towns outside Sofia • Increasing multinational investments in ICT sector.	• Digital "exclusion" of remote, sparsely populated and rural areas and disadvantaged people; • Stagnation in the development of ICT infrastructure and e-governance; • The dysfunctional ecosystem for innovations (science-education-innovations); • Without large scale implementation and usage of ICT in the industrial sectors and especially by SMEs, their growth and export potential shall be limited; • Inability of the education and training system to cover the needs of the ICT. industry for qualified staff; • Impossibility for retaining of highly qualified experts; • Failure to stimulate demand in the public sector.

As a result of the analyses the following priority areas of activity are highlighted to achieve smart, sustainable and inclusive digital growth in 2014-2020. They are selected in a way to secure balanced support for demand and supply of ICT and to achieve sustainable economic and social benefits from their broad implementation.

- Securing high speed and ultra-high speed broadband access all over the country by development and modernizing of the broadband infrastructure;
- Accelerated development of e-governance and public e-services, including trans-border e-services of high economic and society interest;
- Development of balanced innovative eco system in the area of ICT through support of research and innovations and growth of ICT sector;
- Promotion of broad use of ICT by the enterprises, particularly SME's, citizens and public sector to cope with main economic and social challenges.

4. SUMMARIZED SWOT ANALYSIS

Conclusions for further necessary action are based on summarized SWOT analysis.

Macro-economic and structural policies are needed to exploit opportunities and prepare to face threats or at least mitigate their damage, if they occur. In that sense policies need to:

- Exploit strengths by focusing on ICT and cultural heritage, as well as give opportunities to the well-educated to remain in the country
- Address weaknesses by focusing on clean energy and again improve the opportunities to the labor force
- Exploit opportunities by supporting competitiveness (through innovation as low labor cost is not ensuring quality of life) to exploit global market opportunities and attract FDI

Prepare for potentially higher global competition by support competitiveness in areas where the Bulgarian economy is strong.

Policies need to:

- Build on strengths hence invest in mechatronics and bio-tech related sectors and nurture fundamental research that can harness entrepreneurial discovery;
- Eliminate weaknesses by improving the quality to the educated labor force rather than limit success in high shares of educated labor force;
- Exploit opportunities by addressing competitive funding of the EU through support to excellence, take advantage of the existence of the Bulgarian Diaspora by helping researchers to repatriate provisionally or permanently and share their knowledge, give the young generation better opportunities to enterprise, focus on few clusters with potential to attract investors;

Mitigate the effect of threats by training and hiring new researchers to make up for the ageing qualified personnel and compete with other countries attracting them, as well as exploit flexibility and SS to adapt to changing global competitive pressures.

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- Promotion of broad use of ICT by the enterprises, particularly SME's, citizens and public sector to cope with main economic and social challenges.

Strengths

- Macroeconomic stability and low taxes;
- Well-developed distribution network and good relations with neighbor countries;
- Well-developed telecommunications services in IT sector, research and development;
- High share of population with secondary and higher education;
- Rich cultural and historical heritage;
- Increasing exports and FDI;
- Availability of a few high growth enterprises;
- Accumulated experience and investments in mechatronics-related industries;
- High share of the university graduates;
- Tradition in the fundamental research including biotechnology;
- Highly qualified researchers in the field of physics, chemistry, computer technologies and biotechnologies;
- High growth in the cultural and creative industries;
- High level of broadband coverage and high-speed broadband;
- High penetration of broadband access of at least 30 Mbps;
- High level of Internet access for the households on a national scale;
- High level of broadband Internet access of enterprises;
- Accelerated pace of development of e-governance;
- 100% connectivity of all schools in Bulgaria to the Internet;
- High level of usage of public e-services by businesses;
- Steady growth in the ICT sector (including. exports);
- Higher wages in the ICT sector much above other sectors;
- High potential for research and innovation in the ICT sector;
- Active presence of leading multinational companies, with

Weaknesses

- Ageing population;
- Small and not sophisticated national market;
- Specialization in low-tech sectors
- Low labor productivity;
- Relatively low economic activity of the population of working age;
- High share of youth unemployment and long-term unemployment;
- High dependence of the economy on imported resources and energy;
- Low energy efficiency;
- High share of informal sector;
- Bureaucracy for investments (licenses and permits);
- Limited innovation dynamics as demonstrated by global patenting and high-tech exports ;
- Inefficient educational system and shortage of qualified work force (despite the high share of graduates);
- Low share of GERD/GDP;
- Low share of BERD/GDP;
- Low propensity of SMEs to network for innovation activities;
- Limited business-academia cooperation;
- “Brain drain”;
- Low entrepreneurial and innovation culture;
- Uneven broadband coverage (regional imbalances) with low penetration of broadband access in remote, sparsely populated and rural areas;
- The Single Electronic Communications Network of the State Administration does not provide fiber optic connectivity to all public administrative structures;
- Small number of public e-services that are offered only online;
- Lack of cross border interoperability of the information infrastructure for services with major economic and social importance;
- Falling behind in the implementation of e-procurement;
- Falling behind in the modernization of the ICT infrastructure for education and research and declining quality of education in ICT;
- Low level of digital literacy of the population compared to the average for EU;

research centers and BPO centers in the country; • Positioning the country as location for the detection of near-shore centers; • Traditionally good educational system in the field; • Availability of local investment funds with a focus on ICT; • Interaction with the big international companies; • Availability of ICT clusters in the regions will lead to higher smart growth at regional level.	• Low level of usage of the Internet and Internet-based services by the population, 41% of the population have never used the Internet; • Low level of usage of the Internet by disadvantaged people; • Low level of implementation and use of ICT by SMEs in other industrial sectors; • Low level of digital literacy of the population; • Low level of investments in ICT by enterprises; • Low level of development of e-commerce compared to the average for EU; • Falling behind in the modernization of the ICT infrastructure in education and science; • Shortage of ICT specialists "Brain drain" in the ICT sector increases; • Strong concentration of the ICT business in Sofia; • Small local market, limiting the opportunities for demand growth.

Opportunities	Threats
• Act as gateway to the EU for global FDI flows; • Access to EU markets; • Access to non-EU markets such as Russia, CIS and the Middle East; • New electronic administrative services; • Potential of cluster externalities; • Emerging strengths can attract investments in leading high-tech sectors; • Availability of EU competitive funds and performance reserve towards improving the innovation; • Innovation and entrepreneurial culture of the young generation; • Bulgarian Diaspora scientists and potential of brain circulation; • Increasing global research collaboration trends; • Next-Generation Access networks (NGA) • Potential of e-governance and mainstreaming ICT in enterprises • Increased demand of software products and services in the world • Penetration of the markets in the region • Development of the industry in the towns outside Sofia • Increasing multinational investments in ICT sector.	• Slow-down of economic growth of trading partners; • Rapidly increasing competitiveness of current competitors; • Increasing negative demographic trend; • Ineffective absorption of EU structural and national funds and other financial instruments; • Increasing competition from third world countries in the Balkans and Asia; • Economic sanctions on Russia; • Ageing of highly qualified professors and researchers; • Opportunities for qualified researchers to work abroad with better conditions; • Rapidly changing environment. • Digital "exclusion" of remote, sparsely populated and rural areas and disadvantaged people; • Stagnation in the development of ICT infrastructure and e-governance; • The dysfunctional ecosystem for innovations (science-education-innovations); • Without large scale implementation and usage of ICT in the industrial sectors and especially by SMEs, their growth and export potential shall be limited; • Inability of the education and training system to cover the needs of the ICT. • Impossibility for retaining of highly qualified experts; • Failure to stimulate demand in the public sector.

5. INNOVATION STRATEGY FOR SMART SPECIALIZATION 2014-2020

5.1. Vision

Vision: By 2020 Bulgaria must make a qualitative leap in its innovation performance at EU level to tackle public challenges in the field of demography (reverse brain drain and youth entrepreneurship), sustainable development, intellectual capital and the nation's health.

Strategic Goal: By 2020, Bulgaria will move from the group of "modest innovators"[28] to the "moderate innovators" group.

[28] IU Scoreboard – Innovation Scoreboard

Each year the European Commission published an Innovations Score board where based on integrated methodology each EU country is assessed and compared in terms of its performance. Trends and progress of each Member State are evaluated. Evaluation is made by using a set of indicators that allow assessing human resources, funding and support for businesses, corporate investment, networks and entrepreneurship, intellectual property, innovators and economic effects. Tracking changes in the value of these indicators will allow taking effective management decisions. The required growth rate and the values which the country should reach are described in Section 8 of the Strategy. Tracking change in the value of indicators is the external measurement of the effectiveness of innovation policy.

In practice, this change in the indicators will be implemented with the aim to promote:

- Innovation, research and development of human capital,
- Investment in high-tech areas in which Bulgaria has traditions, good professionals and successfully competes in the international market,
- Emerging export-oriented industries.

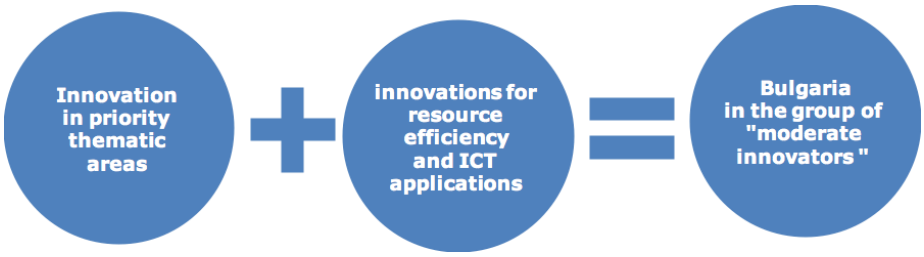
Development of areas with growth potential will attract young people and reduce the "brain drain." It will improve living conditions and nutrition of the population and many other factors which affect the life of people, including general labor conditions.

Innovation strategy for smart specialization is a new approach to economic development, which is based on targeted support for identified technological niches that are promising and where business is interested to invest, and where human potential is available.

The strategic goal will be realized by achieving two operational objectives:

Objective 1: Focus the investment for the development of innovation potential in the smart thematic areas (for creation and development of new technologies leading to competitive advantages and increase in the added value of domestic products and services).

Objective 2: Support for accelerated absorption of technologies, methods and others. Improving resource efficiency and application of ICT in enterprises from all industries



Monitoring and evaluation of the implementation of the strategy is based on the EU Innovation Scoreboard performance indicators[29]. In respect of objective 1, sector-specific indicators of development are used. With regard to Objective 2, the approach of indicators from the Scoreboard for resource-efficiency in EU is used (Resource Efficiency Scoreboard, excluding the "Nature and Eco-systems") and a

[29] Innovation Union Scoreboard

panel of EU digital agenda (Digital Agenda Scoreboard) for businesses (% SMEs using ICT based applications, % SMEs selling online).

The Innovation strategy for smart specialization will mainly be implemented through the operational programs financed by EU funds. Individual operational programs are developed with specific monitoring procedures and indicators, so they are not considered here. These indicators are agreed with the EC.

Achieving these objectives will be realized through the development of "the entrepreneurial discovery process".

5.2. Description of Objectives

5.2.1. Wide consultation procedure

Shaping the vision, strategic objectives and operational objectives, as well as identification of technology areas is realized based on in-depth analyses, continuous communications - meetings, focus groups (under the guidance of experts from the World Bank), thematic meetings to identify potential in specific research areas, business areas, inquiries and e-mail responses. Any suggestions, comments and opinions are summarized and carefully considered and accordingly incorporated in the strategy texts. Only on the topic of clusters there is a feedback from representatives of more than 230 enterprises. For two years and a half, all versions of the strategy have been communicated to all employers' organizations and the majority of professional organizations covering over 70 000 businesses and organizations. The draft strategy was presented at various forums and events, including meetings of the Regional Development Councils - either initiated by the leading ministry or at the initiative of the Councils themselves. As a result of the discussions, we have received feedback expressing the opinion of the relevant local authorities with suggestions for the potential of businesses and universities (Regional Administrations of Bourgas, Ruse, Stara Zagora, Smolyan and others). When starting the process of developing the strategy, the representatives of the central authorities and their regional representatives were more active[30]. With the expansion of the discussions on Operational Programs and on the Partnership Agreement, businesses and the academia became more involved and actively participated in the discussion of the text of the document. The team developing the document was provided with detailed analytical materials for the global trends, the capacity of scientific and research organizations, the capacity of enterprises, evidence of successfully completed projects.

During the development of the Strategy on the website of the Ministry of Economy and Energy all versions of the strategy were published chronologically and the whole process of development of the document can be traced[31]

Under the support and advice of EC consultants the current version of the document was prepared. It was presented jointly to the public along with the goals, objectives of smart specialization and technology areas were formulated and discussed in order to:

- Secure ownership of the vision by all key stakeholders;
- Identify and developed specific potential and strengths;
- Develop more adequate goal setting and basis for the monitoring and evaluation
- Share opportunities that did not exist at individual enterprise level or for a scientific institution;
- Identify emerging areas and niches;

[30] Many of the regional administrations organized a consultation with the general public or the scientific community and sent us feedback on the discussed issues and text of the Strategy.

[31] http://www.mi.government.bg/bg/themes/inovacionna-strategiya-za-inteligentna-specializaciya-1193-287.html

- Focus national and European funds in the areas of comparative advantages on regional and national level.

This document does not represent the end of a 3-years work,but the beginning of a longer-term partnership process. The very concept implies that entrepreneurs, representatives of science and the NGO sector, universities and others, namely all stakeholders will continue to discover, to experiment and learn new ways to promote and develop comparative advantages and to exploit niche markets both for research-based innovation and for non-technological and other types of innovation.

The identification of strengths and weaknesses of the innovation system started with the signing of an agreement for the provision of consultancy services by the World Bank. As a result, a team of experts from the World Bank and world-renowned capacities was formed and a report was produced[32]. A group with representatives from concerned ministries developed a draft document under the guidance of the Ministry of Economy, which includes the strategic documents of concerned topic. The strategy summarizes the lessons learned in the basic analytical instruments developed in relation with the preparation of the new programming period 2014-2020.

Based on quantitative analysis (Section 1.7) and qualitative analysis (Section 2.15) we sought for a cross intersection analysis (Section 2.16) where the quantitative assessment of the potential of each industry and the quality assessment cross. Quantitative assessment identifies the strengths of the economy. Qualitative analysis summarizes the state support of economic activities, either through the National Innovation Fund, OPC, NSF and other public instruments. The cross analysis connects the strengths of the Bulgarian economy identified in the quantitative and qualitative analysis and defines future potential for accelerated technological development.

5.2.2. From technology areas to thematic areas

The logic of identification is finding the intersection between the group of economic activities and services and areas of science, in which business expenditure and the state support for scientific research and development are focused. Based on this analysis, the following technology areas were identified:

- Mechatronics and clean technologies
- Information and communication technologies
- Biotechnology
- Nanotechnology
- Creative industries, including cultural
- Pharmacy
- Food industry.

These areas were identified based on discussions with the scientific community, meetings, interest claimed by business, and opinions received on specific thematic areas.

In addition, it is imperative to take into account internationalization, both upstream (research and education), and downstream (services, value generating activities). The question "how to mobilize limited internal sources through various forms of international research, technology and innovation partnership

[32] http://www.mi.government.bg/files/useruploads/files/innovations/ris3reportaug2013bg.pdf

and how to integrate the country into the supply chains at international and global level" is among the key objectives of the process of Innovation Strategy for Smart Specialization.

Extremely important is the role of internationalization of the innovation process in Bulgaria and integration of Bulgarian research and innovation in the overall framework for successful entrepreneurship in the EU. This is certainly the most difficult and lengthy process that leads however to real advances in research and innovation, and also to sustainable competitiveness of the country.

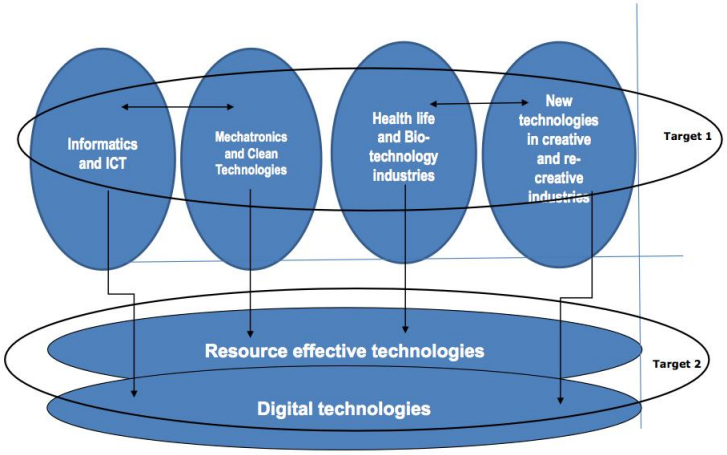
Taking into account European and world trends, the support of the consultants appointed by the EC, talks with leading exports of the Platform during the peer review, a number of product and technology niches have been identified, on which all parties have agreed. These issues will be discussed again at a later stage.

Process of identifying product and technology niches

The broad public debate on the subject conducted over the past two years is an expression of the will to find common ground between the participants in the innovation system so that they can unite around a common vision for the future and paths of realization can be chosen. The main activity carried out within the strategy was to identify the unique characteristics and potential of the country to develop in "smart" areas where there are competitive advantages, and create new domains to identify/find entrepreneurial opportunities and ensure effective process of entrepreneurial discovery in the future. The approach adopted for the analysis of the innovation system in Bulgaria and consultations is combined – vertical and horizontal.

Objective 1: Concentrating investments on the development of innovation potential in the identified thematic areas (for creation and development of new technologies, leading to competitive advantages and increasing the added value of domestic products and services)

Objective 2: Supporting the accelerated absorption of technologies, methods and others. Improving resource efficiency and application of ICT in enterprises from all industries



5.2.3 Objectives and development of Bulgaria

Scientific research is most useful as a source of new knowledge provided to industrial sectors, many of which can also be low-tech, which is the main source of added value, exports and employment creation. Analysis and in-depth discussions with entrepreneurs and other business representatives suggest that the criteria for smart specialization and a comprehensive approach focused only on research-based on growth will not be efficient enough for Bulgaria. Scientific research is rarely a direct source of growth. The share of sectors based on research or high-tech industries in the economy is usually quite small.

The main driver of productivity in Bulgaria is the so called production capacity or ability to produce on the basis of leading international quality standards with widely available, i.e. standard technologies. This does not mean that investments in scientific research are not important. The scope of necessary activities exceeds stimulating research only and should include the promotion of investment in the development of human capacity and promoting technological development and modernization of enterprises in order to improve the ability for technological change and innovation. Support only for scientific research in specific areas, ignoring the needs of industry (analysis and public consensus show so) would result in biased policies. Stimulation of innovation activity in certain areas of technology should lead to a reduction in resources used to increase productivity, will ensure consistent quality of production and achieve introduction and development of software and engineering activities to attract foreign investment from leading companies as well as strengthen cooperation and internationalization of the industry.

Focusing the Strategy on scientific research only as a direct source of growth will ignore major drivers of growth in the Bulgarian economy - now and in the near future, which will limit the effect of this strategy. The conventional approach would be to support scientific research within the thematic areas, ignoring processes of constantly catching up by sectors and companies. Analysis and public consensus suggests that this will lead to distorted policies that do not relate to the areas of real demand for technological support in the local economy and society.

Bulgaria should focus on industrial and technological modernization, with a complementary focus on research- based growth. Industry is a term used broadly to refer to the entire industry, including the cross-cutting services sector. Also, the term "technology" does not refer only to equipment but covers a wider range of options, many of which are intangible in nature and which are necessary for the production of competitive products and services and to respond to other socio-economic challenges. Industrial modernization is best described as a process specific to the sector. Modernization processes are

diverse and cannot easily be covered by common factors. However, it is possible to select a combination of common and sector-specific criteria. The final result cannot be a not so elegant matrix on the basis of readily available statistical data, but the aim is mainly applicability, not accuracy and inapplicability.

Industrial and technological modernization cannot be an isolated sole process, i.e. based only on internal resources, without the participation of foreign partners and participants. Catching up done by Bulgaria to reach average levels of income in the EU requires catching up in terms of productivity, which in the medium term is not possible without ICT solutions, both innovative for the country and resource-efficient. This modernization occurs largely through improvements in production potential and on the basis of imported equipment and raw materials rather than through scientific research. To become competitive, Bulgaria must build capacity to absorb and adapt foreign technologies and knowledge. This will require innovative policies, or rather there is a need to make a mix of technologies and introduce elements such as non-waste technology and ICT approaches in traditional industries.

Measures for the implementation of the Innovative smart-growth strategy will be provided and implemented mainly by the Operational Program „Innovation and Competitiveness" and the Operational Program "Science and Education for Smart Growth."

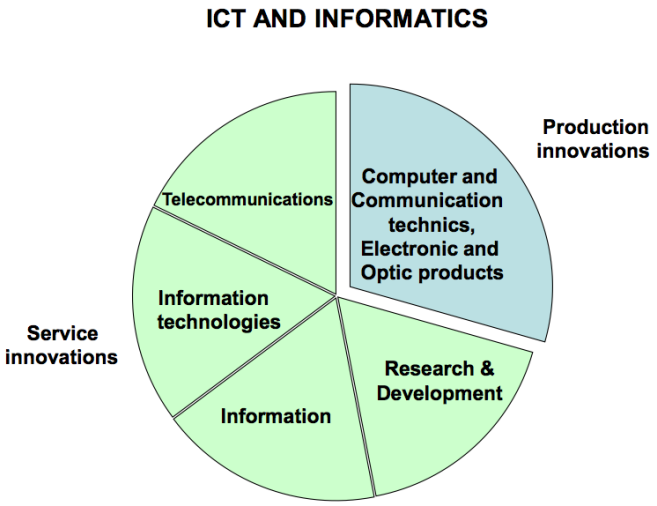
5.3. Description of the thematic areas and basic activities

Objective 1: Focus the investment for the development of innovation potential in the smart thematic areas (for creation and development of new technologies leading to competitive advantages and increase in the added value of domestic products and services).

5.3.1. Description of the thematic areas

Within RIS3 four thematic areas were identified for the country where Bulgaria has competitive advantage at this time. This way the areas defined could be changed due to shown interest and capacity from the side of industry as well as from the side of academy circles and NGO's. The society headed by the political management has to unite around common vision and activities for the progress of the society and solving social-economic challenges.

5.3.1.1. Thematic area "Informatics and information and communication technologies"



Bulgaria is well known as an ICT oriented country Some of the activities and facts that characterize the past of the industry in the country are: the first electronic digital device Atanasoff - Berry; the largest production of personal computers (Pravetz, IMCO) in Eastern Europe; the production of IBM compatible mainframe computers; design and prototype of the first digital watch and the first digital calculator; highly educated and qualified human resources and others. Until 1990, Bulgaria has specialized in manufacturing computer hardware and software development and production within the Council for Mutual Economic Assistance.

Over the past two decades, ICT activities in Bulgaria are mainly oriented towards the development of software and information systems. Bulgaria is still one of the major ICT outsourcing destinations. (Hewlett Packard, IBM, VMware, SAP Net Weaver, Software AG Development Centre Bulgaria, Coca-Cola Hellenic Centre for IT services in Sofia, Johnson Control Technology Centre Sofia.) Other ICT leaders present in Bulgaria with development activities and services are Microsoft, Cisco, EMC, Experian, Xerox, Ericsson and others.

This trend helps to increase and diversify the international skills to develop software and build international recognition. Moreover, the trend of outsourcing should support the development of Bulgarian software production. Telecommunications companies operating on Bulgarian territory introduce new voice and image convergence technologies as well as data transmission technologies via mobile devices.

New and emerging trends in ICT- cloud computing, mobile computing, social computing etc., are introduced in Bulgaria quickly but carefully. The attitude of the participants in this process is positive, with a critical assessment of the positive and negative sides, but generally open for acceptance. Data centers appear - both independent (with open access) and private or specialized. Social networks are

widely used by public institutions, private companies, and the media and by a considerable part of the citizens with warnings about security. Internet banking is gaining acceptance. The success of ELEVEN AND LAUNCHUB[33] (financed by JEREMIE Bulgaria) turned Bulgaria into a regional leader.

A major challenge for ICT is effective implementation of public-private partnership. The possibility of public-private partnership is inherently important incentive to attract investments to provide specialized services to the population.

Many Bulgarian professional associations are active in the field of ICT: Bulgarian Association of Information Technologies, Bulgarian Association of Software Companies, Bulgarian Web Association, Bulgarian ICT Cluster, Bulgarian Branch Association of Electronic Industry and Informatics, Telecommunications Association, Internet Society Bulgaria, Project Management Institute - Bulgaria Chapter, International Institute of Business Analysis, Sofia, Bulgaria Chapter, and others. These organizations are actively involved in a dialogue with the institutions for improving the sector.

Regional Software Engineering Excellence Centre of the European Software Institute - ESI Centre Bulgaria (ESI Centre Eastern Europe[34]) implemented large-scale projects at national and regional level in more than 12 countries. The Centre implemented leading strategic methodologies in the area of management and software engineering to increase the maturity of the sector in Eastern Europe.

National Centre for Supercomputing Applications (NCSA) is an important element of research infrastructure in the field of ICT in Bulgaria and the region. NCSA is a member of PRACE (Partnership for Advanced Computing in Europe), a research infrastructure with its own supercomputing resources (IBM Blue Gene / P supercomputer). Strong Bulgarian companies in the ICT sector exist mainly in the area of development and integration of software products, but also in communications, embedded systems and microelectronics with highly qualified specialists. Some of these companies are represented internationally on several continents. The success of these companies is also a result of good management and implementation of international standards.

Bulgaria attracted funding under a special initiative of the Bill and Melinda Gates Foundation (for libraries and community center) as well as for the Support of the e-Government Initiative based on free and open source software (FOSS) at local (municipal) level in Southeast Europe : the first e-government project in the region that uses free software and open source software (FOSS) to improve transparency in governance and public access to municipal services; Entrepreneurship Support (Job Opportunities through Business Support - Project JOBS): In Bulgaria, 43 business centers and business incubators support the development of micro and small businesses. However, the sector is facing many difficulties and challenges.

The following priority directions were identified within the framework of the thematic area "Informatics and ICT":

- production, especially Fabless and new approaches for design and/or assembling;
- ICT approaches in machine-building, medicine and cultural industries (in relation to the other three thematic areas), incl. digitalization of the cultural and historical heritage, entertaining and educational games;
- 3D digitalization, visualization and prototyping;
- Big Data, Grid and Cloud Technologies;
- wireless sensor networks and wireless communication/management;
- linguistic technologies;

[33] http://launchub.com/

[34] http://www.esicenter.bg/

- web-, hybrid and "native" applications, web-based applications for creating and commercializing of new services and products;
- exploiting new possibilities in relation to outsourcing and ICT-based services and systems

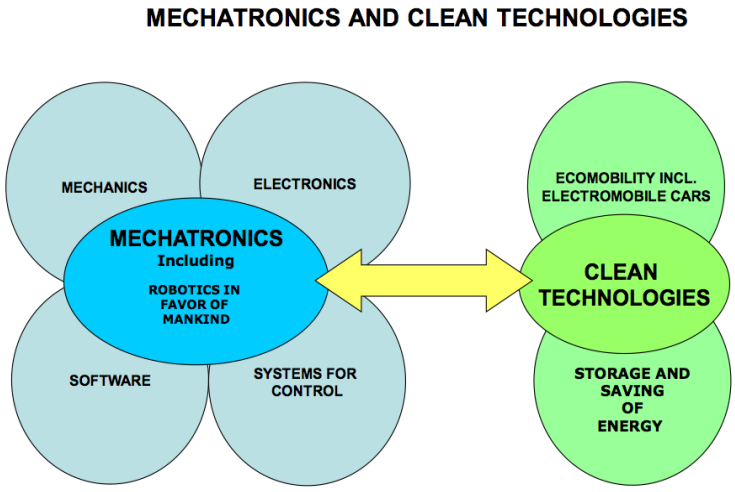
The following challenges were mentioned among the participants at the thematic area meetings:

- Necessity of establishment of lasting and sustainable relations between science – education - business;
- Shortage of qualified HR, that limits the growth even available interest and FDI flow;
- Relatively adequate infrastructure with the exception of laboratories for testing and certifying, etc.;
- Creating and development of data base or a network scientific elaborations, waiting for market realization, as well as dissemination results of scientific projects;
- Internationalization, modern methods for marketing, advertisement and attracting of investors, including additional development of management capacity and business models;
- Development of public – private partnership (PPP) in Bulgaria and EU;
- Additional capacity of Patent Office, which has to accelerate the time for patent registration.

The following models of financing were identified as eventually applicable:

- Grant schemes for collaboration science - business;
- Financial instruments, incl. Venture capital funds;
- Support for educational institutions in ICT area, for instance vouchers for attracting specialists and/or online and distance education;
- Support for governance and entrepreneurial capacity, for instance vouchers for participation in internationally recognizable accelerators;
- Support for certifying and other laboratories.

5.3.1.2. Thematic area „Mechatronics and clean technologies"



Mechatronics is registered as Trade Mark by Yaskawa Electric Corporation in Japan under Reg. No. "46-32714" in 1971. Afterwards the company releases on the market the right for using the term worldwide. In the EU countries exists French standard NF E 01-010 for mechatronics, which gives the following definition: "approach, aiming at synergic integration of mechanics, electronics and electro technics, theory (systems) of management, as computer sciences in planning and production, in order to improve and/or optimizing functionality".

Mechatronics is a strong side of Bulgaria, in compliance with the world trends in development of the most perspective and innovative areas of the engineering sciences, combining expertise and traditions with concrete European and international interest. The thematic area enables the country to directly join the global value chains. Projecting, production and using of mechatronic systems requires new engineering approach due to the common functioning of components of mechanics, optics, optic-electronics, electro technics and electronics. Mechatronics is not simply a combination of comprising key components, but it is mutual penetration and/or merging of mechanical, electronic and computer structures for realizing of a total, functionally of full value product, named "mechatronic product" or "mechatronic fabric". It is not less important, that Bulgaria has a specific capacity as regards robotics, artificial intellect and intelligent devices and contemporary/intelligent production systems. Bulgaria could also specialize in limited series with high added value.

The automatized machines and systems for automation in the country are typical examples for mechatronic approach with proved potential in the country.

The sustainable mobility is of key importance for the development of low carbon and resource effective economy and for the implementation of "Europe 2020" strategy. As a result of the discussion within the High Level Group CARS 21[35] the vision of the automobile branch development was consolidated. On this base was elaborated an Action plan for competitive and sustainable automobile sector, that together with other EU strategic documents in the package "climate-energy" defines trends and priorities in the future development. At the same time Europe urgently needs decarbonizing and invasion of alternative fuels in transport in order to decrease its dependency on petrol. At present this dependency amounts to 94%, within 84% of the petrol is imported, and this is connected with a huge financial resource and increase in expenditures for environment. On this base the package was adopted: Clean energy for transport. In the frame of this process Bulgaria is one of the nine EU members, that have supported the priority development of electro mobility with a common declaration. The technology is innovative and will give impetus in development in other sectors, that bring higher added value to the economy of the country. At the same time the electric mobility will contribute to achieving the objectives in the area of energy efficiency and renewable energy sources and will have positive influence on work and management of the energy system. From another side prerequisite are established for sustainable future of the transport, decreasing its dependency on petrol and substantial decrease of greenhouse emissions, a great part of them due to this sector, as well as to improve air quality in inhabited places and thus the health risks quality of life for the future generations. As a relatively new industry, that will develop in Europe and worldwide, there is potential for new subjects on the market. Bulgaria possess expertise and traditions in this area, and thus opportunities to find it's deserving place in this process.

Within the frame in the thematic area "Mechatronics and Clean Tech" the following priority directions were identified:

- Production of basic elements, details, components and supply, part or wholly constituting mechatronic aggregate
- Machine building and appliance building, incl. parts, components and systems, with focus on transport and energy sector
- Engineering, re-engineering and prolongation of the life-cycle of industrial machines, appliances and systems
- Robotics and process automation
- Design and construction of hi-tech products and/or participation in supra-national production chain, incl. in aero-space industry
- Bio-mechatronics
- Intelligent systems and appliances, intelligent homes – intelligent -cities
- Clean Tech with focus on transport and energy sector (storing, saving, effective distribution of energy, electric vehicles and eco-mobility, hydrogen-based models and technologies, no-pollution technologies, technologies and methods for inclusion of waste products and materials in other production)

The following challenges were discussed with the participants at the thematic meetings:

- Incentives for cooperation and establishment of cooperation along the whole value chain, as well as creating completed and complex products;

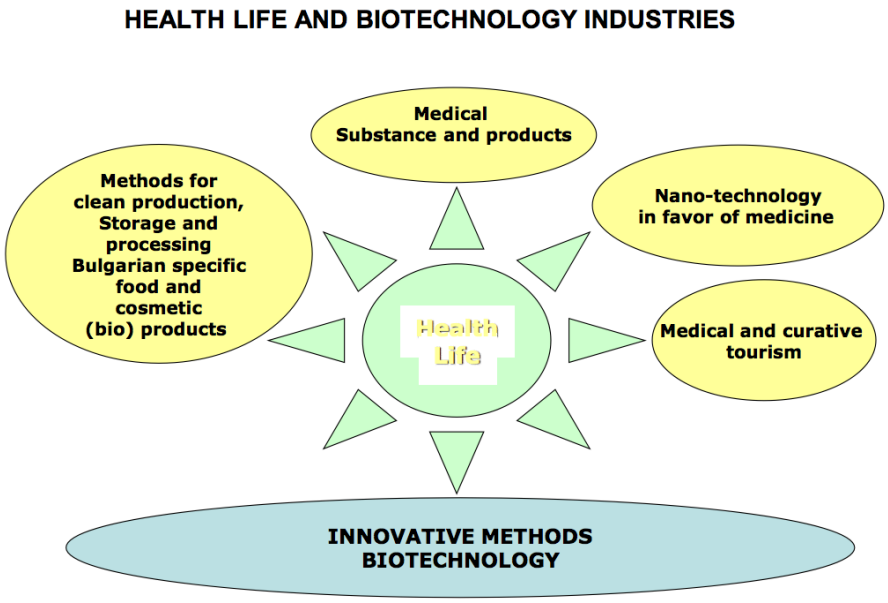
[35] Competitive Automotive Regulatory System for the 21st Century

- Need of additional cooperation science-business, cluster support, support for TTO's and other good practices of EU;
- Shortage of technical and engineering human resources;
- Adequate support to guarantee the quality;
- Internationalization, modern marketing methods, advertising and attracting investors, incl. additional development of management capacity and business models.

The following models for financing were defined as eventually applicable:

- Grant schemes/vouchers for cooperation science-business;
- Support for educational institutions in the field of technical sciences, for example vouchers for attracting specialists and/or online and distance education;
- Grant schemes, incl. specialized/and instrument/ to improve access to bridge financing;
- Scheme/instrument for covering short term trade risks, investment risk and risk for issuing bank guarantees under and for implementation of projects;
- Support for clusters and Technology Transfer Offices;
- Support for establishment of certified laboratories;
- Support for marketing and export activities.

5.3.1.3. Thematic area „Industry for a healthy life and bio-technology"



IS3 promotes innovative methods for clean production, preservation and processing, incl. packaging and accessibility of these products with focus on production applications:

- Technology of the fermenting food products – shaping, optimization and management of fermentation process. Beer production, uses as a major substance grown barley seeds (barley malt), and as biological agents to accelerate alcohol fermentation – yeast cultures of the *Saccharomyces family*.
- Bio-technology of the enzymes – production and use of leaven. In production of bread – adding of enzymes, increasing its durability.
- Production of yoghurts. Sour milk bacteria are used in these productions and enzymes for production of nutritive products like yoghurt and different types of cheese. Technologies on the base of biological processes in cheese production, for example, production of the needed yeast enzymes from bacteria cultures, instead of traditional methods for their extraction from animal's stomach.
- Production of wine and high alcoholic concentrates. Products containing carbohydrates are used as substance, that with the help of high productive cultures of the family *Saccharomyces are transforming into alcohol.*

- Production of vinegar. This production is based on the use of alcohol-containing substance, on which selected sour vinegar bacteria are activated.
- Production of natural aromatic products – etheric oils, natural distillated waters *(rose, lavender, chamomile, balm, sage, etc.) and extraction products.*

- **Medicines, substance and products**

Personalized medicine can offer a lot of opportunities for better treatment. For instance, if we give a patient the proper medicines, they would cause less side effects. This will diminish the suffering, as well as expenditure of resources. In other words – it will secure diagnostic and treatment of the proper patient in the proper time. Modern methods for treatment combine achievements in treatment of diseases, where informed decision for therapy is undertaken, taking into consideration individual characteristics of every individual patient. The target is to create a technology for better access of patients to treatment. There is a conceptual difference between mass used approach choosing the treatment and the approach, adopted by the personalized medicine: „The proper treatment for the proper patient in the proper time ". The advantages are focus on the right diagnosis, more effective and safe treatment, and shorter time needed for choosing the proper treatment, and at the end more rational use of financial resources.

Choosing this type of treatment needed medicines are diminished, due to the more precise prescription of doses, side reactions are lesser, and the opportunities to diagnose earlier the disease. As a major contribution on the side of the personalized medicine is the opportunity to focus on the prevention instead on the treatment and thus to increase the effectiveness of the health system as a whole, as well as to improve the quality and the access to the treatment.

A telling example for personalization in the medicine is the so called "pursuing diagnosis ", that has the aim to „select "patients, who could benefit from a given treatment. In most cases this diagnosis explores the DNA of the patient after taking a test piece from the damaged tissue.

In the world practice the more popular are practices, allowing the decoding of the whole genome of the patient, i.e. the full genetic information of every individual human being. This information enables a lot of diseases to be guessed, whose mechanism and reasons up to this moment had been unknown (for example, neuro-degenerative diseases, Alzheimer disease), as well as to identify new, unknown up today pathologic conditions.

- **Nano-technologies in favor of medicine**

The nanotechnology is a set of technologies that enable manipulation, exploration or using of very small (usually less than 100 nanometer) structures and systems. Nano-sciences and nano-technological achievements have potential to influence practically all areas of economic activities and aspects of every-day life, but IS3 is focused on innovation (new materials, devices and products) to improve health and long life.

- **Medical and health tourism**

The Strategy for sustainable development of the tourism in Bulgaria 2014-2030 enables development of re-creative, medical and healing tourism, as a tourism type with specific characteristics and good results in Bulgaria and as an additional element to thematic area „Industry for healthy life-style and bio-technologies ". Bulgarian territory is rich in (geo-) thermal and mineral waters with temperature between 20°C to 100°C. Water temperature does not exceed 50°C in about 72% of the sources in public property, and their capacity varies between 1 и 20 l/s for 75% of them. Their total dynamic resource amounts at about 4600 l/s. Bulgaria is one of the richest countries in Europe in mineral waters, enabling different, mainly healing application.

The offered products in medical and healing tourism activity are not mass and unified. There are possibilities for their personalization in accordance with the needs of every individual tourist. According to the available sources by regions, there is an option to address different needs (mud baths, types of mineral water). Orientation could be directed in accordance with the available medical centers, in order to cover medical standards for physiotherapy and rehabilitation, i.e. a complex service to be offered. This type of tourism is of special importance, taking into consideration the ageing of the population in EU and the expected demand on similar activities in Europe.

- **Bio-technologies**

Bio-technologies offer science and technology application on live beings, biological systems or their derivatives for creation or modifying with a defined aim of products, services or processes. The focus of IS3 is on healthy life-style (healing aims, healthy eating, natural cosmetics).

Definitions:

- Proteins and other molecules: synthesis */engineering of proteins and peptides (incl. big molecules hormones); improved methods for delivery of big molecules medicines, isolation of protein and purifying, signal, identification of cell receptors.*
- Technological bio-technological methods: fermentation with the help of bio-reactors*, Bioprocessing, bio-pulping, bio-bleaching, bio-desulphurization, bioremediation, bio-filtration, phytoremediation.*
- Bio-informatics: Creating data bases of genomes, protein consistencies, shaping of sophisticated bio-logical processes, incl. biology of systems*.*
- Nano-biotechnology: it concerns the instruments and processes of Nano- */ micro-production for building of devices for learning of the bio-systems and applications in delivery of healing and medicines, diagnostics, etc.*
- Bio-photonics: new contactless methods for diagnostics of diseases (for instance, oncological) *, laser methods, photodynamic therapy, production of medical instruments.*

In the frame of thematic area „Industry for healthy life-style and bio-technologies" the following priority directions were identified:

- Methods for clean production, conservation and reaching the final consumer of specific Bulgarian products and elements (yogurt, honey, breads, milk products, etheric oils, herbal products, bio-cosmetics and bio-products)
- Production of specialized food and drink (baby, children, "astronaut")
- Production of instruments, equipment and consumables for medical and dental diagnostics and treatment and therapy and/or participation in supra-national production chain
- Personal medicine, diagnostics and individual therapy, healing forms and substances
- Medical and healing tourism with accent on personalization possibilities (personal tourism)
- Nano-technologies in medicine
- Bio-technologies serving the needs of healthy life and ageing
- "Blue" technologies and application of new methods and technologies in sustainable use of sea and river resources
- Production plants for the extraction of clean electricity and industrial water
- Green/bio based economy (in accordance with the scope of definition of „Innovations for sustainable growth: Bio-economy for Europe "). Bio-base products are ''products, that are entirely or partially produced from materials of biologic origin, with exception of materials, imbedded in geological formations and/or focalized".

The following challenges were discussed with the participants at the thematic meetings:

- Need for establishment of durable and sustainable relations among science-education-business;
- Incentives to retain the available and attracting foreign human resources? HR;
- Additional reforms in the areas of high and higher education for strengthening the practical focus and covering needs of the labor market;
- Support for adoption of good EU practices, especially management capacity;
- Creation and development of a data base or a network of R&D results, waiting for market realization, as well as dissemination of results of science projects;
- Internationalization and advertisement with focus on guarantee and durable quality.

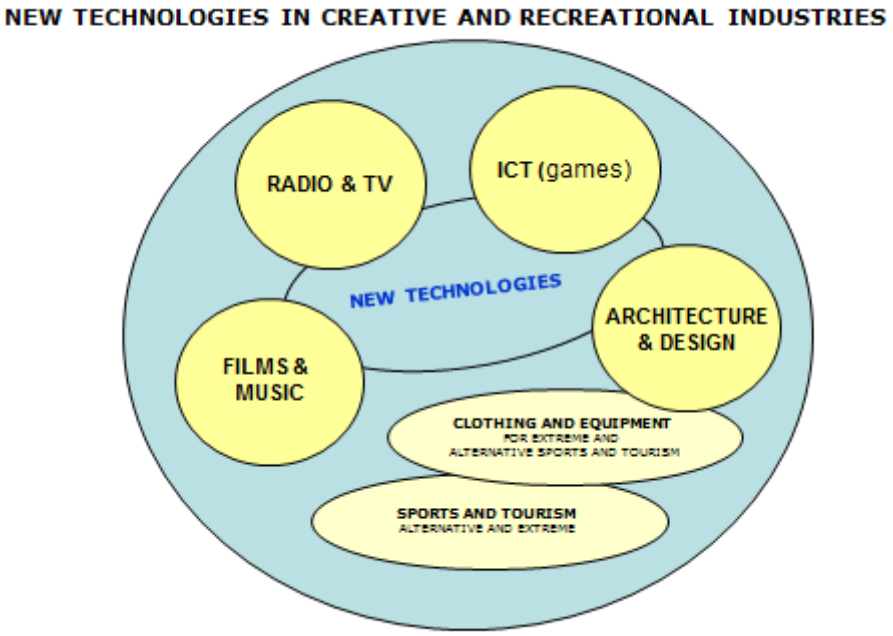
The following models of financing were identified as eventually applicable:

- Grant schemes/vouchers for cooperation science-business;
- Support for marketing and export activities;
- Support for governance/management capacity;
- Certification, quality control.

It has to be taken into consideration that innovations are a horizontal priority within Rural Development Program 2014-2020. Concerning the food industry RDP 2014-2020 encompasses a larger spectrum of possibilities for financing, i.e. in all RDP chosen sectors (1. Milk and dairy products, including bird eggs; 2.

Meat and meat products; 3. Fruit and vegetables, including mushrooms; 4. Bee honey; 5. Grain, flour and farina products; 6. Plant and animal oils and butter; 7. Technical and medical crops, incl. rose and herbs; 8. Ready-made food for agricultural animals; 9. Grape must, wine and vinegar; 10. Production of energy through the use of plant and animal products with the exception of bio-mass from fish products.)

5.3.1.4.Thematic area „New technologies in creative and recreational industries"[36]



Europe 2020

In accordance with the strategy Europe 2020 the role of EC and member-states in general is to ensure opportunities for the creative and re-creative industries to contribute to the growth and employment in Europe. In details it means direct finance and technical support in the form of grants and financial instruments as well as by creating networks, platforms and other systematic approaches promoting these industries.

General Regulations and OPIC

Creative industries are also emphasized in in the Regulations (EU) № 1301/2013 of the European Parliament and of the Council of the December 17th, 2013 concerning the European Development and Regional Fund Development and special orders in relation to objective "Investments in growth and employment": „It is necessary to promote innovation and development of SME's in new emerging areas, connected with the European and regional challenges, for instance creative and culture sector and innovation services, reflecting new societal requirements, or with products and services, linked with the ageing of the population, taking care and public health, innovation in environment, low-carbon economy and effectiveness of the resources."

Through OPIC Priority Ax 1 will finance projects in the thematic areas of IS3. In addition, in OPIC Priority Ax 2 it is envisaged: „In view of the essential significance of definite specific areas, connected with the European and regional challenges, support will be given to enterprises in specific areas, for instance creative and cultural industries, enterprises developing new products and services, linked with the ageing of the population, taking care and public health, incl. social entrepreneurship."

The European Commission has highlighted the role of the cultural and creative industries and the sustainable forms of tourism in the following documents:

- EC Green Book of the 27th of April, 2010, named "Unlocking the potential other cultural and creative industries" (COM (2010)0183);

[36]The definition of creative industries states 12 industries, namely: advertising, architecture, arts and antique markets, crafts, design (including communication design), fashion design, film, video and photography, software, computer games and electronic publishing, music, visual and performing arts, publishing, television, radio

- EC Communication to the European Parliament, Council, European Economic and Social Committee and Committee of the Regions of the 30th of June, 2010 named „Europe, world touristic destination Number 1 – new policy framework for tourism in Europe "(COM (2010)0352);
- Communication of EC to the European Parliament, Council, European Economic and Social Committee and Committee of the Regions of the 26th of September, 2012, named "Promoting of cultural and creative sectors for growth and employment in EC" (COM (2012)0537).

The European Parliament also highlighted the importance of the cultural and creative sectors in the Resolution of the 12th of September, 2013, concerning promoting of the European cultural and creative sectors as a source of economic growth and employment (2012/2302(INI)). The Resolution focuses on the following issues:

- Conditions needed for development of cultural and creative sectors
- Work conditions for specialists in cultural and creative sectors
- Education and training
- Financing of cultural and creative sectors
- Opportunities and challenges of the digitalization, globalization and access to international markets
- Local and regional development.

Strategy for sustainable development of tourism in Bulgaria 2014-2030

The strategy has the task to ensure sustainable competitiveness of Bulgaria as a tourist destination, to support sustainable development of the tourist industry, to rely mostly on the information, selected in market studies, reports, analysis and forecasts, i.e. international sources like UN World Tourist Organization, European Tourist Commission, World Tourism & Travel Council, Euro monitor, Eurostat, etc., to take account of expectations and intentions of all stakeholders, to be adapted with the requirements to establish right, realistic and stable positioning of Bulgaria on the target markets and to be flexible. The strategy gives „accent on development of specialized touristic products, having potential to overcome the season dependency and establishing special emotional connection with Bulgaria."

The following priority directions were identified within the thematic area „New technologies in creative and re-creative industries ":

- Cultural and creative industries (as defined by European Commission)
- Computer and mobile applications and games with tuition, marketing or entertaining character
- Alternative tourism (rural, eco-, cultural and festival) and extreme tourism and sports (niche tourism)
- Production of goods and products with direct application in these spheres (mountain bike, costumes, climbing walls, equipment, print materials and specialized costumes, dress, etc.)

The following challenges were discussed with the participants at the thematic area meetings:

- New financial instruments, especially with quicker effect and more flexible in planning the expenditures;
- Specifics in identifying the participants in schemes for financing and not distinguishing between different economic categories/activities of the creative industries.;
- Capacity for developing and management projects with external financing;
- Digitalization of available resources;
- Incentives for international presence, marketing and advertisement;
- Promoting Public Private Partnership (PPP).

The following models for financing were identified as eventually applicable:

- Grant schemes/vouchers for innovative technologies, business models and cooperation;
- Digitalization of the cultural historic inheritance;
- Support for marketing and export activities;
- Media Technology Park.

5.3.2. Basic activities under Objective 1

Creation of innovative strategies for smart specialization with clear objectives is a necessary but not a sufficient condition for the promotion of innovation. The ability of science to produce a sought after quality product and entrepreneurs' predisposition to experiment and to bear the associated risks depend largely on the availability of financial and other supportive environment. For the purpose of creating

conditions that foster innovation, the Strategy includes activities that meet the need of: a) closer links between research and business; b) a stronger focus on creating, attracting and retaining high quality human resource; c) an operating comprehensive environment and infrastructure conducive to innovation. Implementation of activities requires a clear source of funding.

5.3.2.1. Activities resulting in efficient cooperation science-business

1)	Stimulation of the cooperation both on the part of the demand and on the part of the supply.
2)	Purposeful efforts for encouragement of the cooperation through building up peak achievement centers, competent centers and regional centers.

1) Promotion of partnerships on the demand side and on the supply side

To improve partnerships between research institutes and entrepreneurs requires a combination of approaches for "active demand" and "high quality (research) supply".

- **On the demand side**

It is envisaged to support (mainly through OPIC) innovation in enterprises, including development and introduction of new products, processes and business models, adoption of best practices in the field of innovation. It is also possible to provide investment and consultancy support to the development of applicable business research/innovation in enterprises, technology transfer in the country, implementation of innovation in enterprises.

It is of key importance the development partnership for innovation between enterprises, between businesses and academia, and between businesses and other carriers of innovation potential. Partnership in the field of scientific research and technological development will be promoted between businesses and academia, and between enterprises, including clustering and participation in networks and platforms. Opportunities will be sought for partnership between enterprises and leading national academic and research groups, leading to the creation/development of innovative capacity and sharing of resources for development and implementation of innovative processes and products, copyright and license royalties, commercialization, increasing the volume of exports. Vouchers are an appropriate tool by which businesses can be encouraged to collaborate with academia and other carriers of innovative potential. It is also important to improve access to financing for the implementation of close-to-market investments, such as pilot lines, validation activities, advanced manufacturing capabilities.

The EU Strategy for the Danube Region also contains a priority in the development of the "knowledge-based society" (research, innovation, education and ICT). Examples of activities in this regard include the creation of living labs for development, validation and implementation of new products and services

through joint participation of consumers, academia and businesses in the innovation process (according to the Danube Strategy, Action Plan for the Danube Strategy, Priority Area 7) and facilitation of creative knowledge transfer through setting up new design centers and knowledge transfer schemes from the creative industries to the traditional enterprises (according to the Danube Strategy, Action Plan for the Danube strategy, Priority Area 8).

- **On the supply side**

The main element to stimulate research- business partnerships on the supply side is improving the quality of the research product and its conformity with the needs of the market and society. Directing the activities of research organizations to solving the problems of industry not only generates revenue for research institutes but also increases the market potential for doctoral students engaged in similar research. It is necessary to strike a balance between research with potential for patents, other forms of protection of intellectual property and licensing, and those that are a direct result of demand (contract research).

On the supply side, it is important to find common ground that will promote both agreements for research and identification and protection of the rights of intellectual property during the commercialization of research.

Promotion of transfer, exploitation and commercialization of the results of public research is crucial for the ability of research in Bulgaria to generate a significant economic impact. Knowledge and research generated by the public research system are disseminated through various channels – mobility of faculty, scientific publications, conferences, contract research with industry, "spin-off" and licensing of university innovation. These channels are crucial for turning research into commercial applications that bring in patent royalties for the establishment of entrepreneurial start-ups that create jobs for highly skilled professionals, and the development of new products and processes in established companies competitive on world markets.

Quality of supply is of key significance. Concrete steps in this direction are preparing an independent assessment of all research organizations with public funding (IOPF) and discussing and reaching an agreement on the road map. An important focus of the policy of developing and increasing the efficiency of research and innovation is to create sufficient incentives for the consolidation of research structures and research potential. By pooling financial resources, infrastructure and research staff the goal is to build and establish strong research units that can conduct high quality research and compete at European and global level. Also, in this way it will be possible to retain and attract leading scientists and young researchers with potential, based on regular independent assessments. The implementation of an effective system for assessing research activities is a component of any modern policy in the field of science. This system allows for monitoring the process of absorption of funds, the level of implementation of the research objectives and the results of the research. The assessment is important because it allows the state to analyze how effective research policy is and to outline measures for its improvement based on comparability and benchmarking the quality of research with international and European standards.

Moreover, enterprises could use the results of this assessment and seek forms of partnership with certain research structures. The assessment allows research organizations in their turn to formulate future research objectives and optimize their activities. By assessing the quality of research it is guaranteed openness and transparency in the spending of public funds and the possibility of conducting a targeted public debate on key issues of the national research policy.

The development of the research infrastructure is a significant element of Strategy Europe 2020. The research infrastructure occupies a fundamental place in the "triangle of the knowledge" and is a binding element of the three components of this triangle. The building up, the maintenance and the access to modern research infrastructures guarantee high quality of the research conducted, a modern process of training and possibility for attraction of intellectual potential, encouragement of the entrepreneurship through possibility for generation of new knowledge and their transfer to the economy of the country. The research infrastructure creates serious

prerequisites for the building up of regional scientific complexes, fulfilling specific for the area tasks. The research infrastructure is a natural place for building up and development of the public private partnerships and for the maintenance of sustainable connections between the participants in it. It is a foundation for the building up and the development of a traditional infrastructure and for offering new workplaces requiring specific competences. Further to everything else the research infrastructure stimulates the international scientific cooperation, thus enriching itself and expanding the accumulated experience and knowledge of various scientific collective teams. The availability of a modern base creates favorable conditions for the scientists and their families guaranteeing their free movement and not loss of intellectual potential.

In view of the assessment of the scientific research base and potential Operational Program Science and Education for Smart Growth (OP SESG) anticipates identification of the best scientific areas, groups and institutions which should be supported in a long-term plan and could develop as peak achievement centers and competence centers. This is necessary to keep the scientific resource of quality in Bulgaria, to attract new people to the scientific career and to preserve the good scientific schools. It is even more important that the Bulgarian and European enterprises could turn to these centers and rely on results of quality.

2) Purposeful efforts for encouragement of the cooperation through building up peak achievement centers, competent centers and regional centers

The development of research infrastructure is an important element of the Europe 2020 Strategy. Research infrastructure occupies a central place in the "knowledge triangle" and is a binding element of the three components of this triangle. Construction, maintenance and access to modern research infrastructures ensures high quality of research, modern learning process and a possibility to attract intellectual potential, promote entrepreneurship through the generation of new knowledge and its transfer to the country's economy. Research infrastructure creates solid prerequisites for the establishment of regional research centres performing specific regional tasks. Research infrastructure is a natural place for the construction and development of public-private partnerships and maintenance of sustainable relationships between participants. It is a foundation for the construction and development of traditional infrastructure and offering of new jobs requiring specific competences. Research infrastructure promotes *inter alia* international research partnership, thus enriching and expanding the experience and knowledge accumulated by various research groups. A modern framework creates favourable conditions for scientists and their families, guaranteeing their free movement, not loss of intellectual potential.

Given the assessment of the research base and potential, OP Science and Education for Smart Growth envisages the identification of the best research fields, groups and institutions to be supported in the long term and be able to develop as centres of excellence and centres of competence. This is necessary to keep the high quality scientific resources in Bulgaria, to attract new people to making scientific careers and to keep the best scientific schools. It is even more important that Bulgarian and European businesses can turn to these centres and rely on high quality results.

5.3.2.2. Activities resulting in improvement of human resource

1)	Strengthening of the connection between the higher education and the requirements on the labor market; stimulation of the training in technical and engineering specialties; enhancement of the practical application of the higher education
2)	Reforming the vocational training and qualification and encouragement of lifelong learning.
3)	Internationalization of the innovations for additional enhancement of the quality of the research activity and mastering the phenomenon "Brain-drain"

1) Strengthening of the connection between the higher education and the requirements on the labor market; stimulation of the training in technical and

engineering specialties; enhancement of the practical application of the higher education

A real idea of the realization of graduates with higher education in conformity with the individual professional directions is provided by the Rating Systems for Higher Schools in the Republic of Bulgaria developed by the Ministry of Education and Science through a project under Operational Program Human Resources Development 2007-2013 in 52 professional directions in conformity with 47 criteria – training process, scientific research, training environment, social-everyday and administrative services, prestige, realization and connections with the labor market. Prior to application everyone may find current information at the following address: http://rsvu.mon.bg

The efforts in this direction continue mainly under Operational Program Science and Education for Smart Growth through the provision of stimuli for cooperation between the higher schools and the business, inclusive of joint development of curricula and syllabuses and offering target scholarships for the students.

The creation of a popular information system with information about specialists in demand in each municipality, region, area from level 2 and graduates with certain specialties and not realized on the labor market again with regard to municipalities. Regions, areas from level 2 contributes to the avoidance of the discrepancy between the demand and the supply. On the basis of this information it is necessary to make a periodic analysis of the labor market and on this basis to plan the admission of students and PhD students in the higher schools and the scientific organizations.

The engineering education should be stimulated and improved. The relative share of the hired engineering employees in the industry is relatively low as compared to those from the countries from the EU. On the other hand, the enterprises will be encouraged to hire highly qualified staff for the objectives of the innovation activity, to accept for practice or specialization pupils and students, being encouraged later on (after completion of education) to employ them. The target group includes enterprises, higher schools and research centers as well as scientific specialists, consultants, pupils and students.

It is important to enhance the cooperation amongst the scientific organizations, the higher schools and the business at the training of students, post-graduate students, PhD students and the specialization of students shall be recognized as length of service. The introduction of vouchers for training and qualification in conformity with a request of the business is a key element for supplying the labor market not only with highly qualified specialists but also with such who will have a potential for realization.[37] It is necessary to improve the legislative environment aimed at providing the higher schools with possibility to create start-up enterprises by graduating students under the auspices of the lecturers and mentors for their development.

A lot of existing Small and Medium Enterprises do not have highly qualified personnel for development and introduction of new technologies and due to that they do not use their potential for innovations. Subsidization of existing companies is anticipated for the purpose at hiring PhD students and young highly qualified specialists. This is a part of the policy for enhancement of the innovativeness of the small companies which do not have financial and human resources for implementation of research and development activities.

2) Reforming the vocational training and qualification and encouragement of lifelong learning

Not only the higher but also the secondary /in particular the vocational/ education should be directed at building up attitudes and skills in young people for work in real market environment. The training should be concentrated maximally onto the acquisition of professional knowledge and skills which are directly orientated at the needs of the business – present and future. In this direction it is of significance that during their training the trainees should apply the things learned "in field work" – i.e. in real working environment. In this manner the possibilities increase that after the completion of the training the person should be able fast to adapt and to be realized professionally. The development of the curricula and syllabuses should be conformed to the real needs

[37] MOH

of the labor market of professions and specialties and the provision of a field for realization of the young people is a commitment of the business.

The location of the vocational schools may play an important role at the creation of clusters. A special program for modernization of the vocational schools may be thought over, through which to support the vocational schools in places, where significant Bulgarian (or foreign) private investments are made in the relevant sectors or such are planned.

Amendments in the specific legislation which regulates the vocational schools are also needed – as well as need of new flexible curricula, based on modular training, which provides grounds both for long-term and for short-term trainings; as well as of the creation of more training possibilities, which are well focused with regard to the contents and should be shorter than the traditional formal courses. The paths for obtaining education and qualification should be diversified and creating of high quality brief (from a few months to two years) trainings for the segments with heterogeneous skills.

It is necessary to improve the capacity of the organizations, offering services for vocational orientation and the training of specialists. Young people who have completed secondary education and those applying for higher education should have reliable information about the existing and potential career possibilities, they should have possibility for an informed choice at the selection of a specialty aimed at the provision of future realization. The transition from education to work should become smoother. The Program «Quick Start», offered by the Employment Agency is a good example for that. It was developed in conformity with the model of the Program Quick Start in the USA. The introduction of a system for validation of the informally acquired qualifications would be especially useful. This system could be used also for the validation of specialized skills, inclusive of, for instance, skills for programming.

Operational Program Human Resources Development anticipates additional enhancement of the system for lifelong learning. The objective is maximal rapprochement of the training and the needs of the market, as well as use of the potential for economic activity of a broader and broader share of the population.

3) Internationalization of the innovations for additional enhancement of the quality of the research activity and mastering the phenomena "Brain-drain"

The globalization of the economy and the scientific knowledge render assistance to the integration amongst the subjects of the business and the science in an international scale. The dynamizing of a single market of innovations and the encouragement of the openness will stimulate the innovative progress of the states if the competition is loyal. Priority in a European scale is the reduction of the interregional differences in all the spheres, which places the integration and the cooperation as a mandatory condition. The creation of national and transnational clusters will exert a favorable impact over the economic environment in the individual states. In the foreseeable future it would be good practice to create peculiar schools training future staff adequately to their needs also to these clusters / in parallel with the realization of innovative policies and diversification of the production /. During their training the staff could be useful also in the process of mastering new productions through work in the field area.

Support for expanded possibilities for inclusion in Horizon 2020 for Bulgarian scientific units and enterprises and potentially ECSEL Joint Undertaking is anticipated. Membership of Bulgaria in CERN, ESA, joint technological initiatives as: BBI (bio-based industries) and "FCH 2". Stimulation of the participation of the enterprises and the scientific organizations in European initiatives, networks, platforms and programs in the sphere of the scientific research and innovations is needed. The target group shall obligatorily include the enterprises and the research organizations. The expected result is enhancement of the role of the international research projects, acceleration of the transfer of new knowledge and increase of the intensity of the innovation process, retention and attraction of scientists of quality.

The quality of the research work in the universities should be additionally supported if it is expected from the universities to play a significant role in the innovations. Restructuring of the lecturing classes may be imposed to provide time for scientific and research activities of the scientists, in particular young scientists. Ratified scientists should also be attracted to these efforts focus should be added onto the attraction of young people who study abroad as well.

5.3.2.3. Activities leading to an adequate environment and infrastructure including e-governance

1). Developing an adequate and secure environment for the creation and dissemination of innovations
2). Broadband infrastructure and e-governance

1). Developing an adequate and secure environment for the creation and dissemination of innovations

Mutual cooperation between research and businesses largely depends on the development of a balanced ecosystem of innovation – technology parks, business incubators, clusters, and a system for the protection of intellectual property, including copyrights of Bulgarian patent holders abroad.

It is necessary to support the development of technology transfer offices and technology centers. Support will focus on increasing the capacity to identify studies of interest to the industry, management of the relationship between science and the business, patents and intellectual property rights, commercialization through licenses and start-ups, awareness of researchers concerning intellectual property rights and commercialization.

The support provided by OPIC for the development of environment and infrastructure for innovation and research includes the following:

- creation, development and accreditation of laboratories thematically focused on certification, testing and proof of concepts of experimental models and utility models, and other shared infrastructure to support development and innovation of enterprises, including Phase 2 of the project for Sofia Tech Park;

Supported laboratories will be thematically focused laboratories and high-tech laboratories for testing and technology verification, which provide open public access by sector to technological capabilities and tools, education and training and mentoring for prototyping of innovative ideas and products. This will reduce the risk associated with the launch of new products and ideas in the market, before their returns are proven. Targeted support for Sofia Tech Park aims to create the first completely new innovative scientific and technological eco-system of advanced level where innovative ideas and projects can be identified, promoted and developed; to create a focal point for co-active interaction of international and Bulgarian partners; to support connections between the existing knowledge-based institutions and the private sector to improve the commercialization of research. A national innovation environment on a global level will be established in order to stimulate the development of sectors with significant added value.

- support to the development of modern and new for the country business services related to the management of the intellectual property system, the Bulgarian standardization system and the system for accreditation of laboratories and new products;

The OPRD support includes specific measures for the development of areas with economic potential which are part of the integrated plans for urban rehabilitation and development. These industrial areas with their entire supporting infrastructure are a significant prerequisite for promoting innovative entrepreneurship activities along with the forms such as technology parks, laboratories and others. This approach may become a sound basis for the development of the concept of "smart cities".

2). Broadband infrastructure and e-governance

The "Digital Agenda for Europe" highlights the need to ensure the deployment and development of the networks for access to high-speed and ultra-high-speed Internet, which is the fundamental key prerequisite for achieving digital growth and providing modern electronic services to businesses and citizens through the development of e-governance. Broadband infrastructure plays an important role in the economic recovery and in providing a platform to support innovation in all economic sectors.

Imbalances in terms of broadband penetration lead to lower demand and use of Internet and electronic services. It is a fact that regions that are lagging behind in digital development are also lagging behind in socio-economic development. There is a risk that they remain "informationally disconnected" which will deepen the other differences. Development and modernization of broadband infrastructure in the period 2014-2020 will be carried out in accordance with the National Plan for Next Generation Access Infrastructure[38], within two priorities:

- **On the supply side** – ensuring equal access to high-speed and ultra-high-speed Internet through the development of broadband infrastructure to achieve full coverage of the country with access speeds higher than 30+ Mb/s;
- **On the demand side** - encouraging the use of services on broadband access networks so that at least 50% of households and 80% of businesses can subscribe to broadband access of over 100 Mb/s; opportunities to increase the digital literacy of citizens and their digital competences as part of the educational process and the general public and enhancing public awareness.

The plan includes:

- A plan of infrastructure investments based on economic analysis that takes into account the existing infrastructure and the published plans for private investment;
- Sustainable investment models that enhance competition and provide access to infrastructure and services;
- Defined goals related to the penetration and use of broadband Internet;
- Measures to encourage private investment;
- Measures to promote the use of broadband services.

Financing of the measures will be achieved through implementation of effective models for public-private partnership and the Rural Development Program.

The E-Governance Development Strategy 2014 – 2020 adopted by Decision No 163 of 21.03.2014 of the Council of Ministers[39] and the Roadmap[40] for its implementation provide for legal, institutional and investment measures in three main areas:

On the supply side – providing high quality, efficient and accessible electronic services; and transformation of the administration into digital administration through the integration of information processes.

On the demand side - Promoting e-governance services, facilitating access to them and providing free access to public information.

The main expected results of the implementation of the Strategy and the Roadmap are as follows:

- Building ultra-high-speed communication connectivity for next-generation access (NGA) to 264 municipality centers as well as to the buildings of public institutions in them (judiciary, prosecution, police, schools, hospitals);
- Connecting up to 200 registers of key importance in order to provide complex electronic services and 100% electronic document turnover between administrations;
- Providing a convenient mechanism for electronic identification of individuals in the electronic world;

[38] National Plan for Next Generation Access Infrastructure
http://www.mtitc.government.bg/upload/docs/Bulgarian_Plan_for_NGA_2013_Final.pdf

[39] Strategy for e-Government Development 2014-20120 http://www.mtitc.government.bg/upload/docs/2014-03/1_StrategiaRazvitieEU_RBulgaria_2014_2020.pdf

[40] Roadmap for the implementation of the Strategy for e-Government
http://www.mtitc.government.bg/upload/docs/MapRoad_eGov_2014_2020_FINAL.pdf

- Achieving a high degree of interoperability and network and information security at all levels, which are fundamental prerequisites for building trust in the public services;
- Providing a priority portfolio of complex electronic services of high economic and public interest available through a single portal for access to e-government services (SPAEGS);
- Making a transition to fully electronic public procurement – 50 % of the procedures in state and municipal administrations should become electronic (by 2017) and 100% of the procedures in state and municipal administration should become electronic (by 2020);
- Providing e-Justice services to ensure high efficiency of the judicial authorities and their administrations[41];
- Providing cross-border interoperability of public e-services of high economic and societal interest enabling entrepreneurs to start and run a business anywhere in Europe irrespective of their location. This is a necessary condition for the development of a digital single market within the EU.

Financing of measures will be implemented through the budgets of the central and local administrations, through the Operational Program "Good Governance" and the Connecting Europe Facility.

5.3.3. Basic activities under Objective 2

5.3.3.1. Resource efficiency activities

Bulgaria's backwardness in the field of "green markets" (energy efficiency technologies, technologies for recycling and treatment of waste, mobility and transport technologies, water supply and sewerage technologies, environmental and systems engineering, life sciences, nanotechnology, eco-design, etc.) should be assessed as an opportunity to participate in a relatively broader market. Because of the huge gap in this field, fast and efficient utilization of technology and knowledge is required and support for creation and implementation of own technologies and knowledge in the field of resource effectiveness in order to achieve a degree of integration in this market. A key role is played by the state, which should, especially through public procurement under OPRD and OPE 2014-2020, provide opportunities for the businesses to implement innovative solutions in the sectors of waste, water, energy efficiency and energy technologies.

To promote the implementation of sustainable production models it is necessary to show their economic effect (i.e. again measures for promotion, demonstration and visualization). To stimulate consumption, it is necessary to implement measures to promote and make pilot testing of new resource-efficient technologies and products. In many countries pilot and demonstration initiatives concerning resource-efficient technologies for the industry and households bringing these innovations closer to the business and society are popular.

Direct environmental aspects have been largely covered by the polluter pays principle, especially regarding effects on air, soil and water. However, the indirect aspects of the "green economy" have been poorly addressed in the country's economy, especially the intensive use of resources such as land, energy, water, forest areas, biodiversity, coastal zone and etc. or the generation of waste which can be avoided or waste can be reused.

[41] Including the provision of links to the web-pages of the judicial authorities; and the information system of the electronic register of the judicial authorities; ensuring interoperability of the different systems used by the judicial authorities to set up a link among them and to the information system of the Unified Information System for Combating Crime (UISCC); connecting the information systems of the judiciary authorities and the integrated environment for the exchange of electronic documents and pilot implementation of cross-border public e-services of high economic and societal interest with respect to their integration into the digital single market of the EU.

What is needed is an adequate set of incentives that allows the private sector to invest more so as to achieve greater resource efficiency. On the one hand, boosting the demand for products and services with good resource characteristics will stimulate innovation through the development of markets. But at the same time clear framework conditions are necessary to increase investor confidence, where such investments are made as they are considered riskier and have a longer return period.

The main challenge faced by the policy of promoting resource-efficient productions is the formation of public consciousness and culture regarding the issues of sustainability through information campaigns and education. Thus, sustainable patterns of behavior aimed at saving resources and energy, using renewables, recycling of waste, etc. "Green" demand for products and services, which is an incentive for businesses to invest in their production, has been generated. Such a demand needs to be supported by creating conditions for market equality of resource-efficient products and services and their equivalents through an effective tax and revenue policy, and targeted subsidies and opportunities for project financing.

Developing an adequate to the market and global trends framework for "green jobs" and measures to promote their development

Measures can be included to demonstrate to the business the economic benefits from the introduction of innovation associated with a more rational use of resources, energy efficiency (related to oil and gas dependence), reuse of waste and materials, etc.

Key is the significance of management of specific waste streams – recycling, reuse and/or recovery of raw materials and energy from agricultural waste (fruit-growing, floriculture and horticulture), waste from wood processing and the production of panels and furniture, sludge from wastewater treatment, end-of-life electrical and electronic equipment, batteries and accumulators, biodegradable waste, etc. It is particularly important to stimulate waste-free technologies and those for waste recovery and reuse.

To establish and manage all these technologies it is needed to build new skills by managers and specialists.

Innovation for resource efficiency in the water sector

Promoting the development of innovative solutions to tackle the challenges facing the water sector and supporting their market realization will create significant economic opportunities. Innovation must lead either to new products or services or improve the existing models of managing water resources at a lower price or at the same price but with high quality.

Innovation in the water sector can be achieved through the interaction between water users, research and technological development, and legal requirements and implemented as part of the initiative "European Innovation Partnership" which will directly benefit the activities of existing initiatives such as 7 Framework Program (FP7), Horizon 2020, joint planning initiative (JPI) on water as well as other European and national activities such as technology platforms.

In the forthcoming programming period measures should be realized in the following areas:

I. Water re-use and recovery (especially in areas with water shortages and drought)
II. Water and wastewater treatment, including resource recovery
III. Intelligent monitoring systems

Intelligent systems for water management with potential for export based on platforms for data from various sources, including monitoring of quantity and quality, data management and modelling; Platforms should include data sources from the water cycle and data sources from other related fields;

Innovation for resource efficiency in the waste sector

In the waste sector there are a number of challenges in terms of improving the separate collection and recycling, the processes of management of recycling and recovery of a number of waste streams, as well as

awareness and motivation of enterprises. On the one hand, attention should be paid to the replacement of conventional – exhaustible resources by new technological solutions or the use of recycled materials, and on the other hand, re-use and alternative use should be encouraged. Modern technologies provide a variety of opportunities in product design and in using waste as raw materials in previously unknown alternative applications and productions.

Measures are to be taken in the following areas:

I. Waste generation prevention.

II. Improve the processes of waste collection and separate collection, recycling and recovery.

III. Implement high-tech information and communication systems for reporting quantities of waste collected by the population.

5.3.3.2. Activities for ICT applications in the industrial sector

It is necessary to support the investments for use of ICT solutions, software applications and systems: Application software, System software, Development software (computer programming tools), designed specifically for the needs of the enterprise, as well as ready-made solutions that can be adapted in order to raise productivity.

Extensive use of ICT in the industry includes introduction of ICT applications, optimization of management, production processes, e-commerce and e-business, the provision of affordable interactive on-line services , better opportunities for flexible, distance and part-time work (including mothers), expanded use of ICT in the resource management activities, energy management, tracing of environmental characteristics and effects on climate change, environmental protection and monitoring in general, participation in international platforms, distance and online trainings for companies and employees, environmentally-friendly and energy-efficient transport and improved mobility by implementing smart transport systems, etc.

Development of ICT solutions on market principles depends entirely on the willingness of customers to use them, and this is determined by their access to new, previously unknown services at reasonable prices. Since the development and deployment of such services would be possible only when there is sufficient personnel in the ICT sector, and digital competence of the whole society – thus a closed circle is obtained, which will eventually hinder the development of the two key factors for building digital society.

It is in the untying of this closed circle where the state should play its role and through a well-targeted intervention give an impetus, leaving the further development to the market mechanisms. Furthermore, public institutions can become a generator of innovation and sustainable growth based on providing open access to digitized information – "open data" and services[42]. Efforts should be directed simultaneously at the two interrelated key factors. This will be achieved through concerted political, regulatory, economic and other measures of all institutions involved in the process.

[42] http://s3platform.jrc.ec.europa.eu/open-data

6. FINANCIAL PLAN

The financial plan defines and guarantees the ways in which IS3 and its objectives will be implemented. On the one hand, the activities receive a financial expression and a clear time schedule, the stakeholders in the innovation process being able to plan the rules that will have to be complied with in the implementation of their innovative projects and ideas. On the other hand, financing is in line with the objective that Bulgaria has set in the Europe 2020 Strategy and the National Reform Program in terms of R &D expenditure: reaching 1.5 percent of the GDP by 2020. The Strategy will be implemented through co-financing by the Operational Programs and the rest left to the state budget – by the budgets of the relative administration.

6.1. Policies and instruments, to be implemented through RIS3 2014-2020

Strategic object	Operational target	Sub-targets	Indicative activities	Instruments	Planned financial source	Indicative budget 2014-2020
Till 2020 Bulgaria to move from the group "modest innovators" to the group „moderate innovators"	**Objective 1**- Focus on the innovation potential in the identified thematic areas (to create and develop new technologies leading to competitive advantages and increase of added value in national products and services)	Effective collaborations science-business	a) Promotion collaborations on the demand side as well as on supply side	Grant schemes for supporting business innovation	OPIC	180 mln. euro (OPIC, PA1)
				Grant schemes/vouchers for joint projects/clusters	OPIC	83 mln. euro(OPIC, PA1)
				Grant schemes for intermediaries (TTO's, technology centers)	OPIC (Horizon 2020)	21 mln. euro (OPIC, PA1)
				Financial Instruments	OPIC	300 mln.euro (OPIC, revolving)
				National Science Fund Support	SRF (Horizon 2020)	84 mln.euro (SRF)
				National Innovation Fund Support	NIF (Horizon 2020)	59 mln.euro (NIF)
			b) Targeted efforts for promotion of collaborations	Centers of competence Centers of excellence Regional research centers Unique research infrastructures	OPSEIG	77 mln. euro (OPSESG, PA1) 102 mln. euro (OPSESG, PA1) 56 mln. euro (OPSESG, PA1) 30 mln. euro (OPSESG, PA1)
		Qualitative human resource	a) Enforcing the link between higher education and labour market; promoting education in technical and engineering field; increase practical application of higher education	Schemes for proffecional education and qualification	OPSEIG, other EU program	69.4 mln. euro (OPSESG, PA2)
				Investment in social innovation	OPHRD	10 mln. euro (OPHDR)
			b) Reforming vocational training and qualification and promoting long-life education	Schemes for vocational training and qualification Support for recognizing informally attained knowledge	OPSEIG, other EU program	18.9 mln. euro (OPSESG, PA2)
			c) Internationalization of innovations for additional increase of research activities quality and limitation of phenomenon "brain-drain"	Support for participation in international projects	OPSEIG, other EU program	21 mln. euro (under OPSESG PA1 for international cooperation)
			d) Development of innovative approaches in youth work and youth volunteering	Grant schemes for support of innovative approaches in youth work	National Program for Youth (NPY) 2016-2020	0.143 mln. euro (NPY)
		Adequate environment and infrastructure for innovations, incl. digital growth and e-governance	a) Development of adequate and secure environment for creation and distribution of innovations	Direct Support for phase II and upgrade of Sofia Tech Park, Grant scheme for laboratories for business needs	OPIC	33 mln. euro
				IPR Framework	OPIC	4.5 mln. euro
			6) e-infrastructure and e-governance	e-governance e- justice Programme for Rural Development (PRD)	OP good governance (OPGG) Program for Rural Development (PRD)	58.1 mln. euro (OPGG) 5.3 mln. euro (OPGG) 39.9 mln. euro (PRD)
	Objective 2 - Support for accelarated adoption of technologies, methods, etc., improving resource efficiency and ICT application in all industry enterprises	Innovations for resource effectivness	a) in the field water b) in the field waste c) information and publicity	Support for business cooperation	OPIC, OPE (Norvegian program, Horizon 2020)	60 mln. euro (OPIC, resource efficiency, PA3) 5 mln. euro (OPE)
		Innovations for introducing of ICT applications	ICT applications in all industry (software: Application software, System software, Development software (computer programming tools)	Grant schemes for supporting business innovation	OPIC (Horizon 2020, ECSEL JU)	50 mln. euro (OPIC, PA2)

6.2. Instruments for implementation in IS3 2014-2020

The correct planning and spending of resources to objects and sources of financing is a key element in the implementation of IS3. The first objective "Focus on the innovation capacity in identified TA (to establish and develop new technologies, leading to competitive advantages and increase of added value of national products and services)" will be implemented through 3 sub-objectives:

- *Effective collaborations science-business.* Main instruments for the implementation of this sub-objective are grant schemes, centers of competence, centers of excellence, centers of regional research, financial instruments, NSF and NIF, planned in OPIC, OPSESG and national budget. The indicative budget amounts at 992 ml. euro. Additional opportunities for financial support for the implementation of this objective are available within the frame of Horizon 2020.

Quality human resources. The main instruments for the implementation of this sub-objective are support for probations, PhD's, scholarships, awards, schemes for increasing knowledge, professional training, skills, qualification, professional training, participation at international projects, social innovation etc. planned mainly in OPSESG, as well as in OPHRD and the National Program for youth. The indicative budget amounts at 119.4 ml. euro. Additional opportunities for financial support to the implementation of this objective exist in different EU programs

- *Adequate environment and infrastructure for innovation, incl. digital growth and e-governance.* For the implementation of this sub-objective are planned instruments like Sofia Tech Park, innovation services for business, e-governance and e-justice, included in OPIC, OPGG and Program for Rural Development. The indicative budget amounts at 140.8 ml. Euro.

The second objective "Support for accelerated absorption of technologies, methods and other improving resource effectiveness and ICT application in all enterprises" will be implemented through 2 sub-objectives:

- *Innovation for resource effectiveness.* The support for business collaborations is the instrument planned for this purpose within the frames of OPIC and OPE. The indicative budget amounts at 65 ml. Euro. Additional opportunities for financial support for implementation of this objective exist within the frames of Norwegian program, Horizon 2020, NIF

- *Innovation for introducing of ICT applications.* The support for business investment in innovation is the instrument, planned for implementation of this objective under OPIC. The indicative budget amounts at 50 ml. Euro. Additional opportunities for financial support for the implementation of this objective exist in Horizon 2020, NIF, JU ECSEL.

The main source for financing of strategic goal of IS3 is ERDF, from where circa EURO 622.5 mln. are expected, from ESF – EURO 98.2 ml. and national financing at the amount of EURO 646.5 ml.

INSTRUMENTS DESCRIPTION BY GOALS AND OBJECTIVES OF STRATEGY

Strategic objective: Until 2020 Bulgaria to move from the group of "modest innovators" to the group of „moderate innovators"

Operational objective 1: Focus on the innovation potential in the identified thematic areas (to create and develop new technologies leading to competitive advantages and increase of added value in national products and services)

Sub- objective: Effective science-business collaborations

Indicative activities: Promoting *collaborations on the demand side as well as on supply side*

INSTRUMENTS:

Grant schemes for supporting business innovation. Non-repayable grant support for development and introduction of new products, processes and business models, incl. investment support, consultancy services for intellectual property rights, market analysis and commercialization of innovations.

Target beneficiaries: Enterprises developing/introducing innovation incl. existing enterprises

Grant schemes/vouchers for joint projects/clusters. Non-repayable grant support for implementation of cooperation projects - sharing resources for development and introduction of innovative processes and products, protection and transfer of intellectual property rights, commercialization of results, etc.

Target beneficiaries: Bulgarian enterprises in cooperation with other Bulgarian or European companies, universities and/or research organizations; Bulgarian start-up companies based on intellectual property transferred by Bulgarian or European universities/research organizations, consortia

Grant schemes/vouchers for joint projects/clusters. Non-repayable grant support for enhancing cluster approach for identification and structuring of partnerships with the aim of sharing resources for development and introduction of innovations, technology transfer needed for introducing innovations in individual companies within the cluster, etc.

Target beneficiaries: Clusters with potential for generating high value added activities

Grant schemes for intermediaries (TTO's, technology centers). Non-repayable grant support for supporting science-business relationship management, intellectual property rights, commercialization through licenses and start-ups, researcher's awareness about intellectual property rights and commercialization.

Target beneficiaries: New and existing technology transfer offices and technology centers

Financial Instrument. 1) Development of an equity instrument (such as technology transfer fund) to invest in new innovative enterprises, high technology enterprises, knowledge-based companies, new or existing spin-offs, innovative infrastructure and other participants in the innovation ecosystem. 2) A part of the budget of a debt instrument (such as first loss portfolio guarantee) or separately implemented by providing loans and/or leases for investment in assets and/or working capital for development, and/or launching, and/or marketing of a new or significantly improved product, service or production process, or a new marketing approach, or a new organization method.

Target beneficiaries: 1) Enterprises, Bulgarian enterprises in collaboration with other Bulgarian or European companies, universities and/or research organizations; research and innovation

infrastructures, innovation intermediaries, spin-off companies; high technology enterprises, enterprises specialized in R&D, knowledge-based companies and other participants in the innovation ecosystem. 2) Enterprises that develop/launch/introduce innovations, including existing companies, enterprises engaged with R&D, other knowledge-based companies.

Investment in social innovation. The envisaged resources under this instrument will contribute to transfer and introducing social innovations, good practice, partner's approaches, etc. on the labor market, social inclusion, health care, equal opportunities, labor conditions and building administrative capacity in them. Pilot application of developed innovative approaches and models is planned.

Target beneficiaries: Ministry of Labor and Social Policy, Ministry of Economy, Ministry of Health, Ministry of Youth and Sports, Ministry of Justice, Employment Agency, General Labor Inspectorate Executive Agency, Agency for People with Disabilities, State Agency for Child Protection, Centre for Human Resource Development and Regional Initiatives, State Company Bulgarian-German Vocational Training Centre, organizations providing intermediary services on the labor market, education and training organizations and institutions, employers, self-employed persons, social partners, municipalities and municipal districts, information and career guidance centers, entrepreneurship development centers, non-governmental organizations, financial institutions

National Science Fund Support. Non-repayable grant support for research projects, based on competitions in scientific fields in the priority areas of the National Strategy for Research - three year projects. The call for proposals "Ideas" - five year projects aimed at developing new ideas or concepts of leading researchers and research teams with proven excellence. Call for proposals "Young Scientists" promoting scientific development of young researchers and post-docs. Call for proposals for National research programs defined by the Council of Ministers on key areas of the economy and society. Non-repayable grants for bilateral programs for research.

Target beneficiaries: Research organizations and universities

National Innovation Fund Support. Promotes innovation by providing grant support for research and development projects aimed at developing new or significantly improved products, technologies or services.

Target beneficiaries: Bulgarian enterprises and Bulgarian enterprises in cooperation with other enterprises or universities and/or research organizations through their legal representatives.

Indicative activities: *b) Targeted efforts for promotion of collaborations*

INSTRUMENTS:

Centers of competence, Centers of excellence. Non-repayable grant support for centers of competence and centers of excellence which shall enhance the level and market orientation of the research activities of the leading scientific organizations in Bulgaria

Regional research centers. Non-repayable grant support for regional research centers in order to achieve a significant improvement of the territorial distribution of the research infrastructures, as well as to promote the regional specialization and the cooperation between the public research organizations and regional companies

Unique research infrastructures. Non-repayable grant support which will allow Bulgarian research organizations, with their unique infrastructure and specific expertise, to be included in Pan-European complexes

Target beneficiaries: Public and private research organizations (including the Bulgarian Academy of Sciences and the Agricultural Academy), research institutes, laboratories, higher education schools

and/or their primary units, R&D companies, consortia of research organizations and/or universities, centers of excellence and centers of competence (under SO1), MES and second-level spending units.

Sub- objective: Highly skilled human resources

Indicative activities: *a) Enforcing the link between higher education and labor market; promoting education in technical and engineering field; increase practical application of higher education*

INSTRUMENTS:

Schemes for professional education and qualification. Non-repayable grant support for practices, PhD and post-PhD, scholarships and medals, schemes for knowledge promotion, skills and qualification which will improve the links between vocational education and training and higher education and the mechanism for cooperation between vocational education and the business.

Target beneficiaries: MES and second-level spending units, including the National Agency for VET in Bulgaria (NAVET), other ministries acting as financing bodies for schools, higher education institutions and/or their basic units, schools, research organizations (including the Bulgarian Academy of Sciences and the Agricultural Academy), research institutes, nationally represented organizations of workers and employees and employers' organizations, employers, professional associations, youth associations, representative student organizations registered in accordance with the law, organizations registered under the Non-Profit Legal Entities Act, municipalities.

Indicative activities: *b) Reforming vocational training and qualification and promoting long-life education*

INSTRUMENTS:

Schemes for vocational training and qualification Non-repayable grant support which aims at the enhancement of the prospects for successful advancement of VET graduates in the labor market and improve the practical skills of school students for working in a real environment.

Support for recognizing informally attained knowledge. Non-repayable grant support for development of a functioning national system for validation of the results of non-formal learning and promotion of its use by all age groups over 16.

Target beneficiaries: MES and second-level spending units, including the National Agency for VET in Bulgaria (NAVET), other ministries acting as financing bodies for schools, higher education institutions and/or their basic units, schools, research organizations (including the Bulgarian Academy of Sciences and the Agricultural Academy), research institutes, nationally represented organizations of workers and employees and employers' organizations, employers, professional associations, youth associations, representative student organizations registered in accordance with the law, organizations registered under the Non-Profit Legal Entities Act, municipalities.

Indicative activities: *c) Internationalization of innovations for additional increase of research activities quality and limitation of phenomenon "brain-drain"*

INSTRUMENTS:

Support for participation in international projects. Non-repayable grant support which will lead to a significant intensification of the international and transnational activity of the Bulgarian research organizations, with the expected related increase of the scientific production (co-publications, expert reports, etc.) created and published via international cooperation.

Target beneficiaries: Public and private research organizations (including the Bulgarian Academy of Sciences and the Agricultural Academy), research institutes, laboratories, higher education schools

and/or their primary units, R&D companies, consortia of research organizations and/or universities, centers of excellence and centers of competence (under SO1), MES and second-level spending units.

Indicative activities: *d) Development of innovative approaches in youth work and youth volunteering*

INSTRUMENTS:

Grant schemes for support of innovative approaches in youth work. The envisaged resources under this instrument will contribute to development and introducing innovative practices and approaches of work in the area of youth volunteers and improvement of management practices for youth volunteer labor in Bulgaria, supporting personal and professional development of young people in the country, small villages and rural regions. The objective of the innovations is introducing and maintain of sustainable practices for working with young volunteers, their training, stimulation, monitoring and evaluation of work, as well as recognition of their achievements; promotion and organizing young people in volunteer initiatives; certifying and recognition of acquired knowledge, expertise and skills, learned by the young people during volunteer activities. The envisaged services will be rendered through projects, implemented within the framework of the National Youth Program (2016-2020)

Target beneficiaries: Youth organizations and organizations, working with and for youth people in Bulgaria, registered for non-profit activities and aiming and/or having subject of activity realizing youth activities.

Sub-target: Adequate environment and infrastructure for innovations, incl. digital growth and e-governance

Indicative activities: *a) Development of adequate and secure environment for creation and distribution of innovations*

INSTRUMENTS:

Direct Support for phase II and upgrade of Sofia Tech. Targeted support for Sofia Tech Park aiming at completing and up-grading the existing innovation environment which embraces all aspects of research, technological development and innovations for identification, promotion and development of innovative ideas and projects.

Target beneficiaries: Sofia Tech Park.

Grant scheme for laboratories for business needs. Support for construction, equipment and accreditation of thematically focused laboratories necessary to meet business needs of certification, standardized testing and technical verification, proof of concept, test models and utility models, prototyping and other shared infrastructure to support innovation activities of enterprises

Target beneficiaries: Enterprises developing/introducing innovations, clusters with potential for high value added, associations of companies as well as associations of companies with scientific organizations.

IPR Framework. Support for the development of modern and new for the country business services related to the system of intellectual property management

Target beneficiaries: Institutions of direct benefit to innovation activities of enterprises

Indicative activities: *б) e-infrastructure and e-governance*

INSTRUMENTS:

E-governance. Increase of e-services available to citizens and businesses - IT audit of the public administrations, Phased migration of administrative e-systems and services to the HPC, Digitalization of administrative registers and archives and conversion to electronic structured information, Ensuring interoperability and automated data exchange between information systems and registers, Development

and completion of information systems and services in accordance with the reform of the administrative service delivery model, Opening to the general public of registers and information in machine-readable format, collected and generated through the use of public resources ("open data"), Establishment of online system and call center supporting e-services users, Organizational establishment and development of the Single Systems Integrator, E-public procurement implementation and upgrade of e-customs, Development of a National Health Information System.

> **Target beneficiaries:** Central, regional and municipal administrations. Priority will be given to: Administration of the Council of Ministers, Ministry of Transport, Information Technologies and Communications, Ministry of Health, Public Procurement Agency, Archives State Agency, Customs Agency, National Revenue Agency, National Social Security Institute, National Association of Municipalities in the Republic of Bulgaria.

E- justice. Improve the accessibility and the accountability of the judiciary through the introduction of e-justice - Inventory taking and the analysis of the IT and the communication infrastructure, the information systems and the services, Delivery and instalment of communication equipment to further develop the virtual private network covering the buildings in the sector, ensuring reliable and secure exchange of information, Migration of the existing resources, systems and services to the e-governance hybrid private cloud, Development and implementation of paperless Single information system of courts (SISC), training of magistrates and employees to use the system, Development of new and upgrade of existing e-services delivered by the justice sector, Further development of the Unified Information System for Combating Crime (UISCC) and its interface with e-governance and e-justice systems, including the institutional Automated Information Systems (AIS), which ensure data and information exchange, Applying video-conferencing technologies in the justice sector.

> **Target beneficiaries:** Supreme Judicial Council, Inspectorate to the Supreme Judicial Council, Supreme Court of Cassation, Supreme Administrative Court, Prosecutor's Office of the Republic of Bulgaria, Ministry of Justice, Ministry of Interior, General Directorate "Execution of Penalties", National Legal Aid Bureau, State Agency for Child Protection, Training Academy to the Ministry of Interior, Commission for Withdrawal of Criminal Assets, National Institute of Justice, non-governmental and professional organizations, operating in the field of justice.

Program for Rural Development (PRD). Under sub-measure 7.3. of the PRD „Broadband infrastructure, including its creation, improvement and expansion, passive broadband infrastructure and provision of access to broadband and public e-government solutions of the RDP, broadband infrastructure shall be developed in the rural areas. It will enable the local administrations to participate in e-government, which shall be financed within the OP 'Good Governance'.

> **Target beneficiaries:** Executive Agency "Electronic Communication Networks and Information Systems", municipal administrations.

Operational objective 2: Support for accelerated adoption of technologies, methods, etc., improving resource efficiency and ICT application in all industry enterprises

Sub- objective: Innovations for resource effectiveness

Indicative activities: *In the field of water, waste, information and publicity*

INSTRUMENTS:

Support for business cooperation. 1) Non-repayable grant support for pilot and demonstration initiatives to increase the resource efficiency in enterprises or group of enterprises. 2) Implementation of demonstration /pilot projects for waste management. Forming zero waste society and enhancing public awareness for respecting the waste management hierarchy through: implementation of activities related to the implementation of projects for the collection, summary, dissemination and application of new, non -

traditional successful measures, practices and/or management approaches in the field of waste management; Introduction of new technologies and organizing information campaigns aimed at the prevention of waste generation and the formation of zero waste society.

Target beneficiaries: SMEs in the manufacturing industry, Legal entities; non-profit legal entities; municipalities

Sub- objective: Innovations for introducing of ICT applications

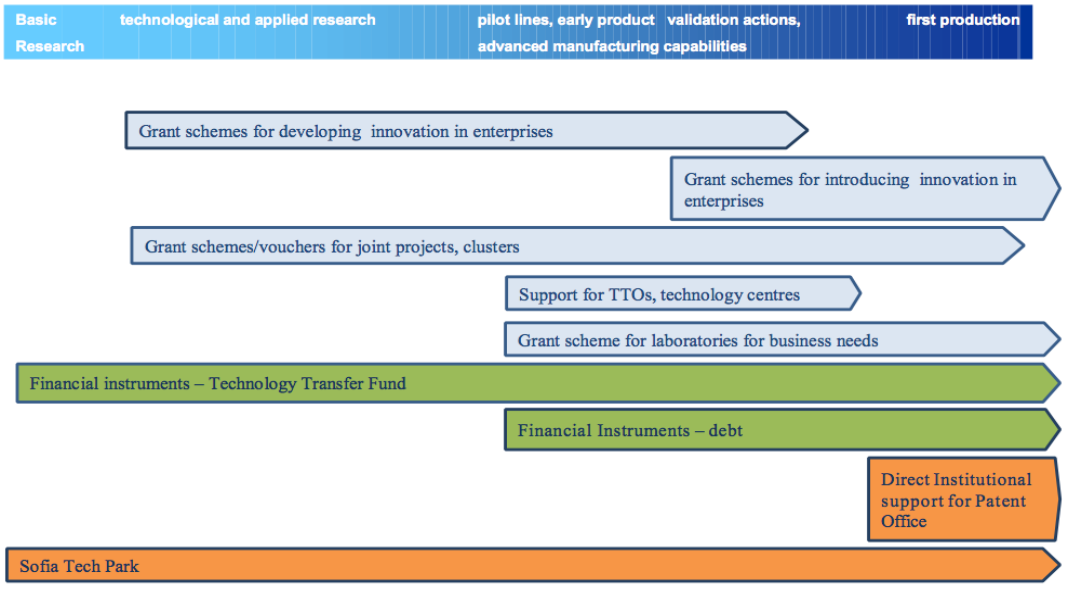
Indicative activities: *ICT applications in all industry (software: Application software, System software, Development software (computer programming tools)*

INSTRUMENTS:

Grant schemes for supporting business innovation. Non-repayable grant support for the growth of enterprises by promoting the use of ICT and services – development and implementation of ICT-based systems and applications, including "virtualized", "cloud" and "mobile" for business management, integration of various units and locations of a company, computer aided design, engineering and production, transformation of business and operating processes that lead to increased productivity and competitiveness; electronic business platforms to improve access to foreign markets, etc.

Target beneficiaries: SMEs in the priority sectors under the National Strategy for Promotion of SMEs

6.3. Policies and instruments according to the innovation value chain



6.4. Main sources of funding for RIS3

Operative goals	Delivery Area	Delivery instrument	Responsible institution	Mode of implementation	Indicative financial sources				
					ERDF	ESF	National public financing	National private financing	total
					Mln.euro				
Objective 1	Stimulating Demand	Grant schemes for supporting business innovation	MoE	Grant Schemes	107	-	19	54	180
	Stimulating cooperation directly	Grant schemes/vouchers for joint projects/clusters	MoE	Grant/Voucher Schemes	51	-	9	23	83
	Stimulating intermediaries	Grant schemes for intermediaries (TTO's, technology centers)	MoE	Grant Schemes	11	-	2	8	21
	Preconditions (environment for innovations)	Financial instruments	MoE, EIF	Technology Transfer Fund Debt instruments	51	-	9	240	300
	Stimulating Supply of Quality Research	National Science Fund Support	MES	Project Support	-	-	69	15	84
	Stimulating intermediaries	National Innovation Fund Support	MoE	Grant Schemes	-	-	36	23	59
	Infrastructure	Centers of competence	MES	Two-stage competitive procedure	65.45	-	11.55	-	77
	Infrastructure	Centers of Excellence	MES	Two-stage competitive procedure	86.7	-	15.3	-	102
	Infrastructure	Regional research centers	MES	Competitive procedure	47.6	-	8.4	-	56
	Infrastructure	Unique research infrastructures	MES	Direct support Competitive selection	19		11		30
	Strengthening the link between higher education, its practical application and the labor market	Schemes for proffecional education and qualification	MES	Direct support Competitive selection	59		10.4		69.4
		Investment in social innovation	MLSP	Transnational cooperation Danube partnerships for jobs and growth	-	9.5		0.5	10
	Vocational and training	Scheme for vocational education and training Support for recognition of informally acquired skills and knowledge	MES	Direct support Competitive selection Grant Schemes	16.1		2.8		18.9
	Stimulating synergies with H2020/international presence	Support for participation in international projects	MES	Project support	17.85		3.15		21
	Qualitative human resource	Grant schemes for support of innovative approaches in youth work	MYS	Grant Schemes			0.143		0.143
	Infrastructure	Direct support for Phase II and upgrade of Sofia Tech Park Grant scheme for laboratories for business needs	MoE, STP	Direct support Grant scheme	26	-	5	2	33
	Preconditions (environment for innovations)	IPR Framework	MoE	Institutional support for Patent office	4	-	0.5	-	4.5
	Infrastructure	e-governance e-justice PRD	CM, MTITC, MJ, MAF	Direct support		88.7	14.6		103.3
Objective 2	Stimulating Innovations for resource effectivness	Support for business cooperation	MoE MEW	Grant scheme for pilot and demonstration projects	35.25		5.75	24	65
	Stimulating innovations for introducing of ICT applications	Grant schemes for supporting business innovation	MoE	Grant scheme	25.5	-	4.5	20	50
	Total				**622.5**	**98.2**	**237.1**	**409.5**	**1367.2**

6.5. Financial plan for the implementation of RIS3

Strategic object	Operational target	Sub-targets	Planned financial source	Indicative Budget 2014-2020 (million euros)				2016	2017	2018	2019	2020	2021	2022
				Total	ERDF	ESF	National support							
Till 2020 Bulgaria to move from the group "modest innovators" to the group „moderate innovators"	**Objective 1-** Focus on the innovation potential in the identified thematic areas (to create and develop new technologies leading to competitive advantages and increase of added value in national products and services)	Effective collaborations science-business	OPIC, OPHRD, OPSEIG, NIF, SRF (Horizon 2020)	992	438.75		553.25	143	143	143	143	143	143	134
		Qualitative human resource	OPSEIG National Program for Youth (EU Programs)	119.44	92.95	9.5	16.99	17	17	17	17	17	17	17.44
		Adequate environment and infrastructure for innovations, incl. digital growth and e-governance	OPIC, OPGG, PRD	140.8	30	88.7	22.1	20	20	20	20	20	20	20.8
	Objective 2 - Support for accelarated adoption of technologies, methods, etc., improving resource efficiency and ICT application in all industry enterprises	Innovations for resource effectivness	OPIC, OPE (Norvegian program, Horizon 2020)	65	35.25		29.75	20	20	25				
		Innovations for introducing of ICT applications	OPIC (Horizon 2020, ECSEL JU)	50	25.5		24.5	25		25				
				1367.2	**622.5**	**98.2**	**646.6**	**225**	**200**	**230**	**180**	**180**	**180**	**172.2**

A **simulation model** has been developed for the needs of RIS3. It enables monitoring of the implementation of the national objective (1,5% R&D expenditures of BNP in 2020) and adopting of various ways of increasing expenditures depending on their current state. The national objective is achievable subject to following assumptions in the period 2014-2020.

- Changes in GDP in the period until 2020 – MF forecast, "Economic and Financial Policy Directorate";
- Full absorption of the EU funds for innovation in the amount of 1 billion EUR – average annual increase over the period 2014-2020 by 10%;
- Increase in public R & D expenditure in the period 2014-2020 – average annual increase by 15%;
- Increase in R & D expenditure in higher education in the period 2014-2020 – average annual increase by 16%
- Increase in R & D expenditures of the business in the period 2014-2020 – average annual increase by 16%;
- Increase in public R & D expenditure in the period 2014-2020 – average annual increase for not-for-profit organizations by 10%;

The model allows monitoring of the implementation of the national target (R & D expenditure equal to 1.5% of GDP in 2020) and adoption of different options to increase the types of costs depending on the current performance.

R & D expenditure by source of funds and sectors										
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Public expenditure, thousand levs										
Government	153 942	148 962	148 962	171 306	197 002	226 553	260 535	299 616	344 558	396 242
Higher Education	43 996	39 866	39 866	46 245	53 644	62 227	72 183	83 732	97 129	112 670
European funds, incl. national co-financing	-	-	-	250 000	275 000	302 500	332 750	366 025	402 628	442 890
Total public expenditure	197 938	188 828	188 828	467 551	525 646	591 279	665 468	749 373	844 315	951 802
% Of GDP (including funds from OP)	0.26	0.24	0.24	0.57	0.61	0.65	0.7	0.68	0.73	0.79
% Of GDP (excluding funds from OP)	0.26	0.24	0.24	0.27	0.29	0.32	0.35	0.35	0.38	0.42
% Of total R & D expenditure	46.08	38.07	38.07	56.78	56.04	55.31	54.59	53.87	53.17	52.48
Private expenditureq thousand levs										
R & D expenditure of companies	228 691	300 067	300 067	348 078	403 770	468 373	543 313	630 243	731 082	848 055
Non-profit organizations	2 937	7 043	7 043	7 747	8 522	9 374	10 312	11 343	12 477	13 725
Total private expenditure	231 629	307 110	307 110	355 825	412 292	477 748	553 625	641 586	743 559	861 780
% Of GDP (for businesses)	0,30	0.39	0.38	0.43	0.47	0.52	0.57	0.57	0.63	0.7
% Of total R & D expenditure	53.92	61.93	61.93	43.22	43.96	44.69	45.41	46.13	46.83	47.52
Total R & D expenditure in thousand levs	429 566	495 938	495 938	823 376	937 938	1 069 027	1 219 093	1 390 959	1 587 874	1 813 582
Total R & D expenditure (% of GDP)	0.57	0.64	0.63	1.01	1.09	1.18	1.28	1.27	1.38	1.5
including										
Government spending	0.2	0.19	0.19	0.21	0.23	0.25	0.27	0.27	0.3	0.33
Private expenditure	0.3	0.39	0.38	0.43	0.47	0.52	0.57	0.57	0.63	0.7
Higher Education	0.06	0.05	0.05	0.06	0.06	0.07	0.08	0.08	0.08	0.09
EU funds with nationwide co-financing, (% of GDP)				0.31	0.32	0.33	0.35	0.33	0.35	0.37

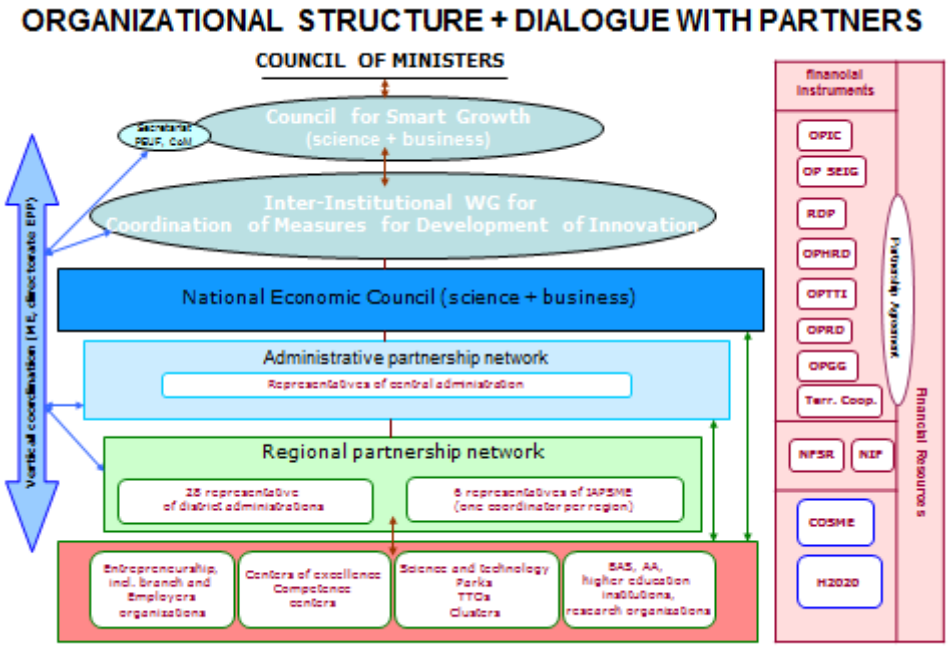
7. EFFECTIVE AND COORDINATED GOVERNANCE OF IS3

The process of innovation is complex and systemic and involves many participants and a long maturation period. Innovation-related policies require horizontal, vertical and temporal coordination in order to be effective. Achieving such coordination faces important challenges, the first of which is to achieve a national consensus on innovation as the correct path to economic growth. Then, the government should have a broad and long-term vision to be able to guide the development of an innovation system through

the joint efforts of the public and private sectors where the business is responsible for turning knowledge into innovation and wealth, and the government – for creating an environment that is conducive to long-term investment.

The main innovation-related difficulty is in its complexity, in the fact that innovation is an organic, non-linear phenomenon which depends on the merger of many factors and actors and their linkages. The role of the government to promote smart specialization is not limited to the support and dissemination of new products, processes and scientific achievements. The government plays an equally important role in the development of the human capital and knowledge, in promoting organizational improvements that are a basic prerequisite for innovation, in prioritizing the development of opportunities for research, and in considering the formation of human resources and needs for knowledge in the key sectors. Achieving these conditions is expensive and slow, with uncertain results, and the government should maintain a balance between strategic investments in the development of scientific discoveries and human capital formation in the long run, while also responding to the demand from the business for innovative products and processes in the short run. Sectoral specificities and long lag times require an effective coordination of these two important pillars.

The fulfilment of the responsibilities of the Bulgarian government is based on the Division of Labor Model"(World Bank, 2013) [43] (like Germany, Norway, Finland, Chile and the Netherlands), which clearly defines the responsibilities of the Ministry of Economy and Energy for industrial innovation and technology, the Ministry of Education and Science for the responsibility of human resources and research, the Ministry of Transport, Information Technology and Communications – for ICT, etc. For sustainable and efficient governance of the implementation of the Innovation Strategy for Smart Specialization, the following structure has been proposed:



[43] Input for Bulgaria's Research and Innovation Strategies for Smart Specialization, World Bank https://www.mi.government.bg/files/useruploads/files/innovations/full_report_3s.pdf

Council of Ministers

Approves IS3, updates it if necessary, coordinates the annual budget;

Council for Smart Growth

With a Decree of the Council of Ministers № 116 of May 12, 2015, a Council for smart growth was established as an advisory body to the Council of Ministers, which determines the development trends of the thematic areas of smart specialization, the vision, the strategic objectives, coordination and monitoring of the implementation of the Innovation Strategy for Smart Specialization of Bulgaria 2014-2020, (IS3). The Decree was adopted under Art. 21 and Art. 22a, Paragraph. 1 of the Law on Administration. The Council for Smart Growth shall:

- Determine the priorities in education, science, innovation, ICT;
- Coordinate the implementation of IS3;
- Review the annual reports on the implementation of IS3under the monitoring mechanism;
- Propose changes in the priority technology areas of IS3, if necessary. Proposals for changes/supplements shall be submitted by the leading ministry which is responsible for the issue under consideration;
- Adopt the activities to ensure the implementation of IS3. This set of activities shall be based on the three-year budget forecast and in accordance with the proposals of the business, science and academia. They will form the budget forecast for the next financial year;
- Coordinate policy management functions of the National Innovation Fund and the Fund "Scientific Research".

The Council shall consist of a chairman and members.

- President of the Council is the Prime Minister of the Republic of Bulgaria.
- Members of this Council are the ministers or their deputies of the leading ministries responsible for policy making in the field of education and science –Ministry of Science and Education, industrial innovation – Ministry of Economy and Energy, information and communication technologies – Ministry of Transport, Information Technology and Communications, innovation in agriculture – Ministry of Agriculture and Food. In the Council there are four industry representatives – prominent businessmen from the priority technological sectors of the economy and four representatives of the academia.
- The members of the CSG are determined by order of the Prime Minister of the Republic of Bulgaria on the proposal of the Minister of Economy, who consults with stakeholders. In order to determine Deputy Prime Minister and Deputy Ministers who participate in the Council's work as substitutes respectively Prime Minister and the Ministers.

In accordance with Order № H-121 of May the 2nd, 2015 the Prime Minister has determined the list of members of the CSG. CSG may decide on specific meetings invite other persons and institutions.

Council holds regular meetings at least once in six months.

• At least once a year, the Council holds an open meeting at which a wide range of representatives of business, labor organizations, professional organizations, research, scientific, academic organizations and other stakeholders are invited.

• President of the Council sets the agenda and the date of the next meeting, based on proposals by the Council members from previous meeting. Materials for the sessions must include a draft decision and the reasons for each question.

• The agenda and materials for the regular meetings shall be sent to the Council Secretariat at least seven days before the meeting date.

Extraordinary meetings of the Council are organized by a proposal of the President of the Council or at the request of more than half of its members. The agenda and materials for extraordinary meetings shall be prepared by persons, initiating their implementation, and sent to the Secretariat for consideration of the meeting no later than two working days before the meeting.

If necessary, the Council may establish working groups on specific issues related to the direct fulfillment of its functions. Working group members are not allowed to be members of the Council.

The Council shall adopt decisions by consensus. Members of the Board may apply dissenting opinion to the decisions. The minutes of the meeting shall be prepared by the record keeper of the secretariat of the Council, signed by the President of the Council and sent by the secretariat to its members within two days of the date of the session.

At the beginning of each meeting, the Chairman of the Board or appointed by him member report on the implementation of decisions of the previous meeting.

Directorate "Central coordinating unit" in the administration of the Council of Ministers shall provide administrative and organizational maintenance of the Council.

The Council Secretariat:
- organizes the preparation and conduct of Council sessions;
- defines recorder for keeping the minutes of the regular and extraordinary meetings of the Council;
- prepares the minutes of Council meetings;
- Keep records of meetings and accompanying materials;
- assist the President of the Council in its work;
- Performs other tasks assigned by the President of the Council.

The Ministry of Economy creates an operational unit, that supports the Secretariat under Art. 11 and performs operational and expert tasks related to the implementation of ISIS. The members of the operational unit are determined by the Minister of Economy.

With Ordinance P-70 dated 19 March 2015 it is created an inter-institutional Working Group for the coordination of the measures for the development of innovations, applied research and research and development activities. Members are representatives from CoM Administration, MES (MA and directorate "Science"), Ministry of Economy (MA and directorate "Economic Policies for Promotion"), MAF (RDP).

With the Statutory Act of the Ministry of Economy, adopted by Decree № 447 from 23.12.2014, the "Economic policies for promotion" directorate is set to "coordinate and participate in the implementation of the "entrepreneurial discovery", associated with the development and implementation of the Innovation Strategy for Smart Specialization of the Republic of Bulgaria 2014 - 2020"

Decree № 74 of March 27, 2015 created the National Economic Council (NEC) as an advisory body to the Council of Ministers with Decree was adopted pursuant to Art. 21 and Art. 22a para. 1 of the Law on Administration.

The Council, NEC:

1. analyzes and proposes measures to support innovation and investment activities to increase the competitiveness of the economy;
2. draw recommendations and advise the Government on issues of general economic development of the country;
3. develops and offers economic and legal regulators to encourage investment in the country;
4. organize, analyze and control the interaction between the executive authorities, other public bodies and businesses.

The Council shall consist of a chairman and members.
Chair of the Council is the Minister of Economy

-Members of the Council entitled with a right to vote are: Deputy Minister of Economy; Deputy Minister of Labor and Social Policy; Deputy Minister of Finance; Deputy Minister of Regional Development and Public Works; Deputy Minister of Foreign Affairs; Deputy Minister of Education and Science; Deputy Minister of Energy; Deputy Minister of Tourism; Deputy Minister of Environment and Water; Deputy Minister of Transport, Information Technology and Communications; Deputy Minister of Agriculture and Food; President of the Bulgarian Chamber of Commerce; President of the Bulgarian Industrial Association; Chairman of the Confederation of Employers and Industrialists in Bulgaria (CEIB); Chairman of the Board of the Association of Industrial Capital in Bulgaria

-representatives of the political cabinet of the Deputy Prime Ministers participate in the work of the Council with an advisory vote

- representatives of the Bulgarian Academy of Sciences

-Other (according to the theme, incl. representatives of the Legislature).

NEC may establish working groups on specific issues related to the direct fulfillment of its functions. Working group members may not be members of the council.

At the beginning of each meeting, the Chairman of the Board reports on the implementation of the decisions of the previous meeting. Every six months, at a regular meeting, the council reports on the implementation of decisions taken. On the website of the Ministry of Economy an information is published about Council meetings, the contacts of the Secretariat, a report on the work of the council and the decisions of its meetings.

The members of the Council are available on the website of the Ministry of Economy - http://www.mi.government.bg/bg/news/s-p-i-s-a-k-na-postoyannite-uchastnici-v-nacionalniya-ikonomicheski-savet-sazdaden-s-pms-74-27-03-201-2164.html.

The coordination of the policies of the responsible ministries shall be carried out by a **peer network at the central level** under the auspices of the Minister of Economy and Energy. (In Decision No 668/2012, as last amended in 2014, MEE is defined as the leading ministry for the development of IS3 – a mandatory precondition for the new programming period). An expert in the field of the policies within the competences of each ministry, which are relevant to the implementation of IS3, shall be determined. In this way the administrative capacity for in-depth knowledge of the topic will be built and an effective coordination of the issues and topics for consideration as set by the Council for Smart Growth will be carried out. The Peer Network at central level will participate in the preparation and provision of information on the implementation of IS3 and information related to the preparation of the annual report on the implementation of IS3.

The Peer Network at central level will participate in the Drafting of regular annual monitoring reports on the implementation of IS3, summarizing the information from all financial instruments of the leading ministries financed by national and EU funds.

A time schedule of the planned activities for the implementation of IS3 will be developed for each calendar year and an annual report on the review of implementation of IS3 will be prepared.
The documentation for each point of the agenda of the meetings of the Council for Smart Growth will be prepared by the relevant responsible ministry **(ME, MES, MTITC, and MAF)**. Each ministry, according to the time schedule for the preparation of the three-year budget process, shall include in the draft budget for the next year a set of measures to be implemented during the next calendar/fiscal year with national and European funding.

Financial instruments for the realization of IS3 are OPIC, SEIG and PDHR - with European funds and from the state budget in amounts not exceeding allocations for innovation with the laws of the state budget for each year of the forecast period to 2020.

Ensuring transparency of the management process of realization of IS3 will be guaranteed by the regular publication of information on meetings, actions, publication of analytical materials, related to summarizing and analyzing the bids, publication of minutes of meetings of CSG and NEC.

With an order RD-16-521 / 26.06.2015 of the Minister of Economy a list of members is nominated of the operational unit under Art. 12 of the Decree № 116/2015 for the establishment of a Council for Smart Growth. Operational Unit will assist the Secretariat under Art. 11 and will perform operational and expert tasks related to the implementation of IS3.

Policy coordination at regional level (NUTS III) will be carried out by a partnership network at regional level under the auspices of the Minister of Economy and Energy. With an Order of the Minister of Economy experts from all 28 regions of Bulgaria are appointed in the field of policies that relate to the implementation of IS3. Thus build administrative capacity for understanding in depth the themes and will be implemented effective coordination raised by the Council for smart growth issues and topics for consideration. Regional Partnership Network already participates in continuing the process of entrepreneurial discovery, as well as in the formulation of guidelines for regional specialization.

Peer network at regional level will be involved in the preparation and provision of information on the implementation IS3 focusing on regional issues. Partner Network will also support reporting and monitoring the implementation of ISIS. Schedule will be developed for each year of planned activities on the realization of IS3. It will be built on the administrative capacity to implement effective feedback from stakeholders at local level about the effects of the activities and policies. The information from this network will also form the annual monitoring report on the implementation of IS3.

7.1 Methodology for conducting and managing the entrepreneurial discovery process (EDP)

The EDP is the main precondition for ensuring allocation of public resources for R&D and innovation in the most effective way. This process takes into account the particular situation in different regions and aims to mobilize the local entrepreneurial potential. Based on the locally found areas of the long lasting cooperation between R&D, business, and central administration, the emerging areas of technological development have been identified which also have market potential. Based on this, the concrete proposals have been formulated for public support of RDI. The proposals have been elaborated by a team of representatives consisting of all interested parties which in turn have been approved at the political level and became the basis for amending the policies for the promotion of research and innovation. This process will be continuously monitored by tracking the strategy implementation and its results based on the range of indicators.

The majority of these indicators are spelled out in IS3 and they will form the part of the system for monitoring and evaluation of the IS3. The focus will be on linking output and outcome/impact indicators with the overall strategic objectives and the expected results rather just to the absorption of financial allocations.

The results of M&E of the IS3 programs and projects will feed into the update of the IS3 through continuation of EDP. The basis for the continuation of the EDP will be twofold: interim evaluations and the continuous stakeholders' consultations.

Interim evaluations will provide in-depth insights into the effectiveness, uptake and possible impacts of individual delivery instruments. Together with the continuous process of stakeholder consultations this should provide good understanding of how far are we from achieving the milestones and will allow for the revision of the IS3. This twofold process should give insights into which programs and projects should be extended, withdrawn, expanded or re-profiled.

M&E body[44] will come up with the evaluation plan of Bulgarian IS3, and will use the indicators presented in the IS3. This activity will also involve external experts in order to get objective assessment of the achieved results. Second key group of inputs into the update of the IS3 are views of stakeholders on the functioning and potential contributions and the effectiveness of the specific programs. This should represent continuation of the EDP and should provide 'insiders' view on the effectiveness of individual programs and their potential to achieve strategic objectives of the IS3.

It is important to recognize that the full R&D and economic results may not be obvious in this early stage of the IS3 implementation and hence it will be far too early to undertake impact evaluation. However, it will be possible to undertake implementation, process and interim output evaluations. Implementation evaluations look at how a program is being implemented and managed and its aim is to significantly improve second stage of implementation. Process evaluation should examine how to improve design, delivery, and the usefulness of the programs. Monitoring of outputs should ensure that achieved results correspond to targeted results at the given stage of the program.

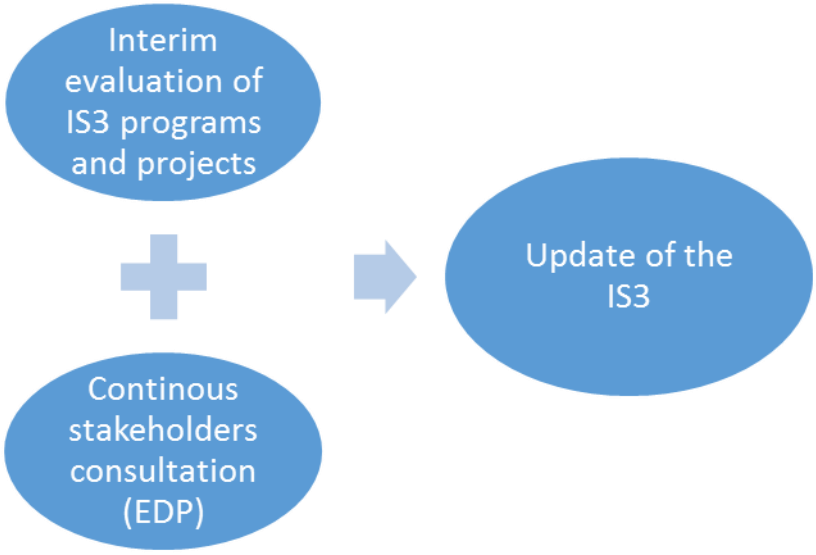
Different parts of the IS3 are supposed to interact and reinforce each other. This is aspect that M&E of IS3 needs to focus including whether the IS3 priorities, objectives and delivery mechanisms are corresponding to each other.

The key to successful M&E is integration and mutual feedback between views of stakeholders and results of M&E. As the use of many output and impact indicators will be at this stage very limited it is necessary to complement it with the qualitative insights of stakeholders through different forums, peer evaluations,

[44] It is envisaged that this will be an independent unit within the new agency for economic growth. The functions of a new independent M&E unit till the start of the new Agency will be fulfilled by the temporary unit for M&E established within the Ministry of Economy

focus groups, workshops etc. Equally, continuation of the EDP or consultations of the stakeholders needs to be based on as much as possible objective and neutral analysis. Hence, these two sides – EDP and M&E activities – should reinforce and complement each other both in terms of inputs and timing.

Two track process of updating of the IS3: EDP and interim-evaluations



The revision of the IS will be approved by the Council for Smart Growth based on the proposal by the Administrative Partnership Network. The proposal will be prepared by the Coordination Unit based on the inputs of M&E unit and on the outcomes of the EDP as outlined in table (see below).

7.2 Organigram of EDP

Governance level	Function	Document	Partnership	Term
Employer's organizations, science community representatives, individual entrepreneurs, cluster representatives, TTO's, TTC's	preparing proposals for change thematic sub-areas and relative procedures	proposals	local and municipal authorities, employer's organizations and science communities, individual entrepreneurs and coordination unit	current
Regional Partners Network	preparing and summerizing proposals in accordance with needs and challenges at regional level, identification of innovative potential	Submitted proposals in relation to regional capacity	local and municipal authorities, employer's organizations and science communities, individual entrepreneurs and coordination unit	current
	organizing meetings and ensuring dialogue with local authorities, science and research units, business organizations and local and regional entrepreneurs on issues for developing innovation poptential of planning regions (NUTS2)	meeting minutes	local and municipal authorities, employer's organizations and science communities and individual entrepreneurs	current
Administrative partner network	· to coordinate policies of responsible ministries, that have to do with the implementation of IS3	meeting minutes	coordination unit	current
	· to support and deepen the dialogue with stakeholders on the process of smart specialisation through rendering technical and expert help and information	information materialsинформационни материали	coordination unit	current
	· to participate in preparing and submitting info on IS3 implementation and info on preparing annual report on IS3 implementation by the coordination unit	information materials	coordination unit	current
	-preparing info from all financial instruments of leading institutions, financed with national and EU resources	results of call procedures	unit for M&E	once in three months
Mediators for the 6 planning regions (NUTS2)	ensuring communication among central and regional structures on the one side, and with the business on the other side	information materials and reports	local and municipal authorities, Regional partners network, business and coordination unit,	current
UNIT for M&E	summarizes information about all financial instruments for innovation of the leading institutions, financed with national and EU resources	Proposals for including new instruments	coordination unit and OP's	current
	gathering results on OP's, preparing current reports on the implementation of the set objects	current reports		once in three months
	preparing preliminary reports for the implementation of the objectives set on the base of OP results	preliminary report		на полугодие
	summarizes information for monitoring of IS3 in an annual report	Annual monitoring report		annualy
Operative (coordination) unit	gathering and summarizing information of the organized information days of OP's and Thematic meetings with stakeholders	Submitted proposals for changes	OPIC, OPSEIG, Unit for M&E, regional organizations	current
	elaborating annual program for planned activities on IS3 implementation	Annual plan for IS3 implementation with included EDP	IIWG for coordination of measures under IS3, CSG	annualy in december
	ensuring coordination among stakeholders, involved in IS3 implementation and organizing meetings and events	minutes of meetings, reports, proposals, info materials	all stakeholders	current
	preparing annual report on the stage of the implementation of IS3 objects on the base of submitted project proposals on EDP and the monitoring report	Annual report for EDP implementation and proposal for change of IS3	IWG for coordination of IS3 measures, CSG, Unit for M&E, Regional partners network, Administrative partners network, Mediators	annualy 30.11.2016
National Economic Council	preparing recommendations and consulting the government on issues of general economic development of the country; create opportunity for consultations among executive and legislative authorities and business representatives	Proposals for change of the annual report	Operative (coordination) unit	at least two times per year
IWG for coordination of IS3 measures for development of innovations, applied research and R&D of OPIC and OPSESG	ensuring coordination in programming, monitoring and implementation, evaluation and publicity of measures, linked with innovation and R&D	minutes of meetings	OPIC, OPSESG, Unit for M&E, Coordination unit, CSG	current
	monitoring compatibility with other national and European instruments in innovation area	minutes of meetings	OPIC, OPSESG, Unit for M&E, Coordination unit, CSG	current
	considering intermediate and annual report on IS3 implementation, discussing and achieving consensus on the proposals for changing thematic focus in IS3	minutes of meetingsпротоколи от срещи	OPIC, OPSESG, Unit for M&E, Coordination unit	two times per year
	monitoring the contribution of investments for the achieving the objectives and priorities of IS3	minutes of meetings	OPIC, OPSESG, Unit for M&E, Coordination unit, CSG	current
Council for Smart Growht	defining priorities in education, science, innovation, ICT; coordinating IS3 implementation; adopting a set of activities to ensure IS3 implementation on the base of the 3-years budget plan and programs of the Committees of every leading institution and in compliance with the business proposals, science and academic circles, that have to be included in the budget prognosis for the next budget year; coordinating policies on governance the functions of National Innovation Fund and Research and Science Fund.	decisions taken	coordination unit	at least two times per year

7.3 RIS3 - Action Plan

	Activities	2018 - 2023	Responsible institution
1	Organizing regular consultations with the Administrative and Regional Partner Networks	Q1, Q2	ME, MES
2	Organizing Regional events in every region (NUTS 2) for informing stakeholders and receiving feedback	Q2	ME, MES
3	Organizing a separate thematic event in every one of the four thematic areas	Q4	ME
4	Preparing detailed analyses on the progress of IS3 including information from OPIC, OPSESG, NIF and SRF	Q4	ME, MES
5	Public discussion of the analysis on the progress of IS3	Q4	ME, MES
6	Presenting the analyses to a meeting of the Council for Smart Growth and updating RIS3 sub-areas if necessary	Q4	ME, MES

8. MONITORING AND EVALUATION OF IS3

In its development the Innovation system develops from the linear to the interactive model. At the same time, it has a horizontal expression, which today more than ever requires a well-coordinated mechanism for monitoring and evaluation of policies among all stakeholders in the system, and adaptation of the institutions of the innovation system to the changing environment.

There is no standardized approach to the development of a system for monitoring and evaluation of the Innovation strategy for smart specialization. It is country-/ region -specific. In general, indicators should measure the change or development of activities that are globally competitive and have a bigger potential for creating added value. When the expected results are long-term, progress in the achievement of the objectives can be also measured by intermediate indicators.

Monitoring and evaluation of IS3 are two logically interrelated activities. **Monitoring tracks the progress of planned strategic objectives** – it provides quantitative and qualitative information on the

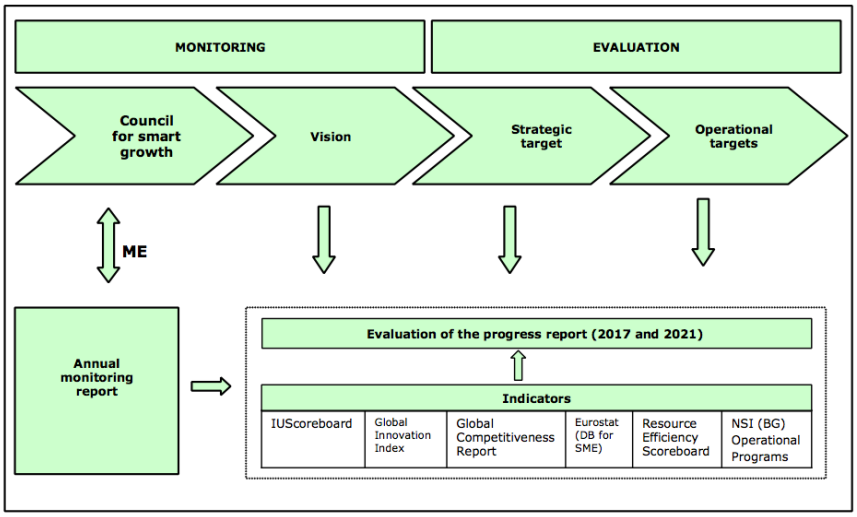
progress of a particular policy compared to set up baseline data or goals. Monitoring seeks to prove that the activities are performed; the money is spent for the intended purpose and the results are developing in the desired direction.

The evaluation provides a reasoned explanation of whether interventions achieve the desired result. The evaluation aims to assess also why and how desired results are achieved (or not achieved). It analyses the mechanisms leading to the result and takes into account the effects that are not planned.

Given these postulates, IS3 objectives and that the financial instruments for the implementation of IS3 are OPIC and OPSESG, OPGG and RDP – for ICT, the following indicators for monitoring and evaluation of policy have been determined: internationally recognized indicators have been selected, based on which the country can compare its position to that of other countries, either in the EU or in the world market. Baseline and average values for the EU (where available) are given and the growth rate, which must be achieved (where this can be specified) is determined.

For the purposes of monitoring, it is envisaged to conduct the monitoring using a report summarized by ME each year, together with peer networks at central and regional level and summarized information from the proposals received from stakeholders related to IS3. Initially, the report shall be submitted to the National Innovation Council and the National Research and Innovation Council for discussion by all stakeholders. After discussion and clarification of the need for changes in IS3, the Minister of Economy and Energy shall submit the report to the Council for Smart Growth.

System for monitoring and evaluation of RIS3



The annual report includes the following:

- Report on the implementation of the activities of the previous year, financed by the national budget and EU funds;
- Monitoring the implementation of the set indicators based on a comparative analysis of the innovation system in Bulgaria with the EU Member States;
- Review the on-going innovation policy in Bulgaria and making proposals for policy changes, if necessary.
- Action Plan in the next year

8.1 System of indicators for monitoring of IS3

8.1.1 Indicators for monitoring on level strategic goal

Indicators / strategic objective	Output indicator (involved organisations and related investments)				Outcome/result indicators (show change that can be credibly attributed to an intervention)				Impact (show changes in the productive structure of economy in terms of R&D, innovation, technology diffusion and knowledge			
	Indicator	Baseline Value (2015)	Current year Value	Source	Indicator	Baseline Value (2015)	Current year Value	Source	Indicator	Baseline Value (2015)	Target Value (2020)	Source
An innovation leap forward on EU level *(By 2020, Bulgaria will move from the group of "modest innovators" to the "moderate innovators" group)*	Total Government Budget for R&D (GBAORD) for support for incompany RTDI activities (€ and as % of GBAORD)			NSI	Number of domestic enterprises participating in EU research programmes			InCites	Human resources	0.497	0.549	IUScoreboard
					Number of New "Spin-outs" Created (No. and per 100 Million PPP$ of Research Funding)				Open, excelent research systems	0.126	0.29	IUScoreboard
					Public-private scientific co-publications (No. and per million of population)				Finance and support	0.089	0.394	IUScoreboard
					Proportion of researchers departing PRO/HEI moving directly to industry (No. and as % of all researchers				Firm investments	0.198	0.337	IUScoreboard
					Citation Impact Factor (citations per publication normalised to world average)				Linkages & entrepreneurship	0.057	0.308	IUScoreboard
					Total funding awarded to Bulgarian HEIs/PROs from EU Research Programmes € and as % of total funding available							
					European Research Council (ERC) funding secured by Bulgarian-based researchers/research teams							
	Financial support provided to enterprises to support applications to EU Horizon 2020			MES	Number scientific publications involving two or more HEIs/PROs in Bulgaria			WoS, SCOPUS, InCites	Intellectual assets	0.405	0.400	IUScoreboard
					Cumulative investment in physical infrastructure (buildings and equipment) for research in HEIs/PROs since 2015							
					Publications co-authored by researchers in Bulgaria and outside Bulgaria as a share of all Bulgarian publications							
					Royalty and license fees, payments (% of total trade)							
					Royalty and license fees, receipts (% of total trade)							
					ISO 9001 Quality management systems—Number of certificates certificates issued (per billion PPP$ GDP)				Innovators	0.170	0.387	IUScoreboard
	Number of enterprises supported through RTDI grants (No. of firms assisted and total value of grants approved)			OPIC	Number of international trademark applications issued through the Madrid System by country of origin (per billion PPP$ GDP)							
					National office resident trademark applications (Number of trademark applications issued to residents by the national office (per billion PPP$ GDP))				Economic effects	0.195	0.399	IUScoreboard
					Number of patent applications filed by residents at the national patent office (per billion PPP$ GDP							
					Number of international patent applications filed by residents at the Patent Cooperation Treaty (per billion PPP$ GDP)							
					Number of utility model applications filed by residents at the national patent office (per billion PPP$ GDP)							
					Number of scientific and technical journal articles (per billion PPP$ GDP)							
					Citable documents H index (The H index is the economy's number of published articles (H) that have received at least H citations in the last 5 year period).							

8.1.2 Indicators for monitoring on level operational targets

Operational objectives	Priority Thematic Areas, Resource efficiency and ICT applications	Output indicator (involved organisations and related investments)					Outcome/result indicators (show change that can be credibly attributed to an intervention)				Impact (show changes in the productive structure of economy in terms of R&D, innovation, technology diffusion and knowledge intensity)			
		Indicator	Number	Baseline Value (2015)	Current Value	Source	Euro	Baseline Value (2015)	Current Value	Source	Indicator	Baseline Value (2015)	Current Value	Source
Focus the investment for the development of innovation potential in the smart thematic areas (for creation and development of new technologies leading to competitive advantages and increase in the added value of domestic products and services)	Computing and ICT	Enterprises, supported to introduce new for the company products				OPIC				OPIC	ICT access, index			GII*
		Enterprises, supported to introduce new for the market products				OPIC				OPIC				
		Enterprises collaborating with R&D institutions				OPIC OPSESG				OPIC OPSESG				
		Enterprises, supported by Sofia Tech Park				OPIC				OPIC	ICT use, index			GII
		Supported enterprises				OPIC				OPIC				
		Newly built infrastructure complexes				OPSESG				OPSESG				
		Renewed infrastructures				OPSESG				OPSESG				
		Supported young researchers (aged up to 34 years) in the sphere of R&D activities				OPSESG				OPSESG	Total computer software spending (% of GDP)			GII
		Researchers working in improved RI facilities				OPSESG								
		Researchers working in improved RI facilities outside Sofia				OPSESG				OPSESG				
		New researchers in in supported entities				OPSESG				OPSESG				
		Researchers trained via international cooperation				OPSESG				OPSESG	Productivity (value added / employee), thousant euro			BNB
		Joint research projects developed between research organizations and businesses				OPSESG				OPSESG				
		Research organizations and universities participating in international technological initiatives and science research networks				OPSESG				OPSESG				
		Projects involving international cooperation				OPSESG				OPSESG	Total employment, thousant			BNB
		Supported RI complexes (including newly built ones), in total				OPSESG				OPSESG				
		Supported researchers, in total				OPSESG				OPSESG				
		Research projects including international cooperation), in total				OPSESG				OPSESG				

Continued

Mechatronics and clean technology	Enterprises, supported to introduce new for the company products				OPIC				OPIC	Value added, millioms euro			BNB
	Enterprises, supported to introduce new for the market products				OPIC				OPIC				
	Enterprises collaborating with R&D institutions				OPIC OPSESG				OPIC OPSESG				
	Enterprises, supported by Sofia Tech Park				OPIC				OPIC	Researchers, FTE/mn pop			GII
	Supported enterprises				OPIC	OPIC			OPIC				
	Newly built infrastructure complexes				OPSESG				OPSESG				
	Renewed infrastructures				OPSESG				OPSESG	Capacity for innovation			GCR**
	Supported young researchers (aged up to 34 years) in the sphere of R&D activities				OPSESG				OPSESG				
	Researchers working in improved RI facilities				OPSESG				OPSESG				
	Researchers working in improved RI facilities outside Sofia				OPSESG				OPSESG				
	New researchers in in supported entities				OPSESG				OPSESG	Quality of scientific research institutions			GCR
	Researchers trained via international cooperation				OPSESG				OPSESG				
	Joint research projects developed between research organizations and businesses				OPSESG				OPSESG				
	Research organizations and universities participating in international technological initiatives and science research networks				OPSESG				OPSESG	Company spending on R&D			GCR
	Projects involving international cooperation				OPSESG				OPSESG				
	Supported RI complexes (including newly built ones), in total				OPSESG				OPSESG				
	Supported researchers, in total				OPSESG				OPSESG				
	Research projects including international cooperation), in total				OPSESG				OPSESG	University-industry collaboration in R&D			GCR

Continued

Industry for a healthy life and biotechnology	Enterprises, supported to introduce new for the company products				OPIC				OPIC	University-industry collaboration in R&D			GCR
	Enterprises, supported to introduce new for the market products				OPIC				OPIC				
	Enterprises collaborating with R&D institutions				OPIC OPSESG				OPIC OPSESG	Availability of scientists and engineers			GCR
	Enterprises, supported by Sofia Tech Park				OPIC				OPIC				
	Supported enterprises				OPIC				OPIC				
	Newly built infrastructure complexes				OPSESG				OPSESG				
	Renewed infrastructures				OPSESG				OPSESG	PCT patents, applications/million pop			GCR
	Supported young researchers (aged up to 34 years) in the sphere of R&D activities				OPSESG				OPSESG				
	Researchers working in improved RI facilities				OPSESG				OPSESG				
	Researchers working in improved RI facilities outside Sofia				OPSESG				OPSESG	GDP per unit of energy use (PPP$ per kg of oil equivalent)			GII
	New researchers in supported entities				OPSESG				OPSESG				
	Researchers trained via international cooperation				OPSESG				OPSESG				
	Joint research projects developed between research organizations and businesses				OPSESG				OPSESG	Environmental Performance			GII
	Research organizations and universities participating in international technological initiatives and science research networks				OPSESG				OPSESG				
	Projects involving international cooperation				OPSESG				OPSESG				
	Supported RI complexes (including newly built ones), in total				OPSESG				OPSESG	ISO 14001 Environmental management systems—Number of certificates issued (per billion PPP$ GDP)			GII
	Supported researchers, in total				OPSESG				OPSESG				
	Research projects including international cooperation), in total				OPSESG				OPSESG				

Continued

New technologies in creative and recreational industry	Enterprises, supported to introduce new for the company products				OPIC				OPIC	Area under organic farming %			Resource Efficiency Scoreboard
	Enterprises, supported to introduce new for the market products				OPIC				OPIC				
	Enterprises collaborating with R&D institutions				OPIC OPSESG				OPICOPSESG				
	Enterprises, supported by Sofia Tech Park				OPIC				OPIC	Knowledge-intensive employment, %			GII
	Supported enterprises				OPIC				OPIC				
	Newly built infrastructure complexes				OPSESG				OPSESG	Cultural & creative servises exports, % of total trade			GII
	Renewed infrastructures				OPSESG				OPSESG				
	Supported young researchers (aged up to 34 years) in the sphere of R&D activities				OPSESG				OPSESG				
	Researchers working in improved RI facilities				OPSESG				OPSESG				
	Researchers working in improved RI facilities outside Sofia				OPSESG				OPSESG	Number of national feature films produced (per million population 15--69 years old)			GII
	New researchers in in supported entities				OPSESG				OPSESG				
	Researchers trained via international cooperation				OPSESG				OPSESG				
	Joint research projects developed between research organizations and businesses				OPSESG				OPSESG	Printing & publishing manufacture			GII
	Research organizations and universities participating in international technological initiatives and science research networks				OPSESG				OPSESG				
	Projects involving internationa cooperation				OPSESG				OPSESG	Creative goods exports (% of total trade)			GII
	Supported RI complexes (including newly built ones), in total				OPSESG				OPSESG				
	Supported researchers, in total				OPSESG				OPSESG				
	Research projects including international cooperation), in total				OPSESG				OPSESG				

Continued

Support for accelerated absorption of technologies, methods and others. Improving resource efficiency and application of ICT in enterprises from all industries.	Support for accelerated introduction of technologies, methods, etc., improving resource efficiency	Enterprises, supported to introduce new for the company products				OPIC				OPIC	Resource productivity, EUR per kg			Resource Efficiency Scoreboard
		Enterprises, supported to introduce new for the market products				OPIC				OPIC	Resource productivity index			Resource Efficiency Scoreboard
											Domestic material consumption, tonnes per capita			Resource Efficiency Scoreboard
											Water exploitation index			Resource Efficiency
											Water productivity, EUR per m 3			Resource Efficiency Scoreboard
		Enterprises collaborating with R&D institutions				OPIC OPSESG				OPIC	Greeenhouse gasses emission per capita, tonnes of CO2 equivalent			Resource Efficiency Scoreboard
										OPSESG	Energy productivity, EUR per kg of oil equivalent			Resource Efficiency Scoreboard
		Enterprises, supported by Sofia Tech Park				OPIC				OPIC	Share of renewable energy in gross final energy consumption, %			Resource Efficiency Scoreboard
											Recycling rate of municipal waste %			Resource Efficiency Scoreboard
		Supported enterprises				OPIC				OPIC	Urban population exposure to air pollution			Resource Efficiency Scoreboard
		Supported RI complexes (including newly built and renovated)				OPSESG				OPSESG	Capacity for innovation			GCR
		Supported researchers				OPSESG				OPSESG	Company spending on R&D			GCR
		Research organizations, universities and companies participating in international technological initiatives and science research networks for improvement of resource efficiency				OPSESG				OPSESG				
	Support for accelarated introduction of technologies, methods, etc., and ICT applications in all industry enterprises	Enterprises, supported to introduce new for the company products				OPIC				OPIC	Individuals using Internet, %			GCR
		Enterprises, supported to introduce new for the market products				OPIC				OPIC	Fixed broadband subscriptions per 1m pop			GCR
											Int'l Internet bandwidth, kb/s per user* .			GCR
		Enterprises collaborating with R&D institutions				OPIC OPSESG				OPIC OPSESG	Mobile broadband subscriptions/100 pop.*			GCR
		Enterprises, supported by Sofia Tech Park				OPIC				OPIC	ICT & business model creation			GII
		Supported enterprises				OPIC					Quality of scientific research institutions			GCR
		Supported new technologies, methods and ICT applications				OPSESG				OPSESG				
		Supported researchers (including young researchers aged up to 34 years) in the field of ICT				OPSESG				OPSESG	University-industry collaboration in R&D			GCR
		Joint research projects developed between research organizations and businesses in the field of ICT				OPSESG				OPSESG				

8.1.3 In the selection of projects under IS3, the following guiding principles shall be followed, when relevant:

- To lead to realization of activities in priority thematic areas of the Bulgarian S3, namely:
  - ✓ mechatronics and clean technologies
  - ✓ ICT and Informatics
  - ✓ industry for a healthy life-style and biotechnologies
  - ✓ new technologies in creative and recreational industries
- To ensure regional specialization according to S3 and/or contribute to specific development problems in a given territory and/or covering of specific regional gaps
- To prove existing effective collaboration and create strong and sustainable relationships between science-education-business and/or to stimulate cooperation and the establishment of cooperation in the entire value chain and establishing a comprehensive and integrated product
- To ensure synergic effect between ESIF, the Framework Programs in the period 2014-2020, Horizon 2020 and COSME, other public or private funds
- To prove technological and/or scientific expertise and operational capacities in relation to the S3 thematic areas
- To contribute to internationalization and/or modern methods of marketing, advertising and attracting investors, incl. further development of organizational and managerial capacity and business models
- To ensure compliance with the guiding principles of sustainable development, equal opportunities and non-discrimination, and gender equality

ANNEXES

Implemented actions in order to comply with the preliminary conditions 1.1 и 1.2

1. Improving organizational structure for governance RIS3 implementation and coordination with the OP's

- Establishment of Council for Smart Growth and definition of its functions
- Nominating „Promotion Economic Policies" as a Secretariat of RIS3
- Identifying stakeholders for participation at the National Innovation Council (NIC) and National Council for Science and Innovation (NCSI)
- Meetings of NIC and NCSI for discussing proposals of all stakeholders
- Development of Guidelines for M&E
- Established Inter Institutional Working Group for coordinated governance of OPIC and OPSESG
- Adoption of Rules for M&E of R&D activities, conducted by HEI's and research organizations and the activities of NFSR

2. Promotion of private investments in R&D

- Development of multiannual plan with indicative budget for implementation of RIS measures
- Support of innovative companies for development of new products and technologies with resources of the NIF

3. Joining the research infrastructure and the science priorities to the identified areas of RIS3

- Preparation of a Bulgarian map of the capacity of research infrastructure
- Update of the Roadmap of research infrastructure
- Update of the National Strategy for Science and Research

4. Ensuring synergy in solving national and regional challenges

- Establishment of Regional Partnership Network and Rule for its activities
- Organizing regional partnership event for discussing RIS3 (Northeast region, North Central region, Northwest region, Southeast region, South Central region, Southwest region)
- Actual picture of the innovation potential of regions on Level 2/Regions

5. Accelerating the Entrepreneurial Discovery Process, activating links between science and business through discovery of specific challenges and methods of their overcoming

- Thematic event „Informatics and ICT "
- Thematic event „New technologies in creative and re-creative industries "
- Thematic event „Mechatronics and clean technologies "
- Thematic event „Healthy life and bio-technologies "
- Annual meeting of academic circles with entrepreneurs and investors
- Summarizing and reflecting received comments and remarks
- Development of technological roadmaps linked with Thematic areas
- Approval of IS3 by the CoM

Tables and Statistics

Quantitative assessment of the innovation performance						
Indicators	Bulgaria	EU	Modest innovators	Moderate innovators	Innovators followers	Innovators leaders
	2013	*2013*	*Average*	*Average*	*Average*	*Average*
Human resources	0.440	0.583	0.527	0.492	0.657	0.728
Open, excellent research systems	0.133	0.539	0.111	0.280	0.606	0.638
Finance and support	0.057	0.558	0.332	0.348	0.552	0.755
Firm investments	0.133	0.417	0.192	0.290	0.437	0.591
Linkages & enterpreneurship	0.121	0.550	0.126	0.362	0.693	0.740
Intellectual assets	0.255	0.564	0.200	0.287	0.556	0.716
Innovators	0.047	0.549	0.152	0.398	0.561	0.659
Economic effects	0.216	0.595	0.321	0.433	0.558	0.576

Goal for Bulgaria in 2020 - average index of the Moderate innovators			
Indicators	Moderate innovators	Annual growth rate (%)	Required annual growth rate (%)
	Average	*2006-2013*	*2014-2020*
Human resources	0.492	2.3	1.9
Open, excellent research systems	0.280	4.5	13.2
Finance and support	0.348	-0.5	35.2
Firm investments	0.290	.1.4	13.9
Linkages & enterpreneurship	0.362	1.7	20.0
Intellectual assets	0.287	2.1	2.0
Innovators	0.398	0.7	42.8
Economic effects	0.433	1.2	12.3

It is envisaged to use the Summary Innovation Index, published annually in the IU Scoreboard of the Innovation Union, for the quantitative evaluation of the innovation performance of Bulgaria. The eight innovation spheres representing the state of the enabling factors for the implementation of innovation, the companies' activities and innovation outcomes are a convenient starting point because their indices are calculated based on uniform methodology and allow comparing the results achieved by Bulgaria with the results of all the other EU Member States and others included in the study.

Bulgaria is currently in the group of modest innovators and its aim is in 2020 to find a place in the upper group, that of moderate innovators. For this purpose, the average values and growth rate of "moderate innovators" in the period 2006-2013 were calculated for all innovation areas

Furthermore, the necessary growth rates of the indices of the innovation areas to achieve the target in 2020 are calculated.

Of course, the process is dynamic, and these rates have to be considered as minimum.

Results of quantitative analysis					
Quantitative factor					
Identified economic activities			Internal factors	External factors	Overall assessment
	Nace 2008	Production			
1	19	Manufacture of coke and refined petroleum products	500	27	526
2	12	Manufacture of tobacco products	389	4	393
3	24	Manufacture of basic metals	356	36	392
4	20	Manufacture of chemicals and chemical products	235	20	255
5	21	Manufacture of basic pharmaceutical products and pharmaceutical preparations	243	10	253
6	10	Manufacture of food products	197	37	235
7	23	Manufacture of other non-metallic mineral products	212	14	226
8	26	Manufacture of computer, electronic and optical products	205	12	217
9	11	Manufacture of beverages	207	2	209
10	28	Manufacture of machinery and equipment n.e.c.	180	28	208
11	27	Manufacture of electrical equipment	178	18	196
12	25	Manufacture of fabricated metal products, except machinery and equipment	164	15	179
13	14	Manufacture of wearing apparel	142	17	160
14	29	Manufacture of motor vehicles, trailers and semi-trailers	142	7	148
15	30	Manufacture of other transport equipment	130	4	134
16	13	Manufacture of tobacco products	130	4	131
		Services			
17	61	Telecommunications	481	0	481
18	46	Wholesale trade, except of motor vehicles and motorcycles	349	6	354
19	45	Wholesale and retail trade and repair of motor vehicles and motorcycles	150	156	306
20	62	Computer programming, consultancy and related activities	304	0	304
21	72	Scientific research and development	285	0	285
22	68	Real estate activities	246	0	246
23	52	Warehousing and support activities for transportation	234	0	234
24	70	Activities of head offices; management consultancy activities	224	0	224
25	50	Water transport	214	0	214
26	71	Architectural and engineering activities; technical testing and analysis	203	0	203
27	63	Information service activities	195	0	195
28	59	Motion picture, video and television programme production, sound recording and music publishing activities	173	7	180
29	58	Publishing activities	131	30	162
30	74	Other professional, scientific and technical activities	141	0	141
31	60	Programming and broadcasting activities	141	0	141
32	53	Postal and courier activities	114	0	114
33	75	Veterinary activities	89	0	89

The quantitative analysis has been made using multiple indicators and related data over the past five years for each economic activity in terms of internal factors (number of enterprises, employed persons, volume of production/services provided, turnover, added value - as share of the added value generated in the industry and services, and as share of the production/services, labor productivity, investment in fixed assets) and in terms of external factors (export, import, trade balance, realized competitive advantages – production and export specialization). The sum total of the assessment of internal and external factors gives the overall assessment of the quantitative factor. In turn, economic activities are grouped in terms of their technological intensity in high-, medium high-, medium low- and low-tech activities in the field of industry, and in knowledge-intensive market services, knowledge-intensive high-tech services, other

knowledge-intensive services, low knowledge-intensive market services and other low knowledge-intensive services.

Results of the qualitative analysis			
Qualitative factor			
Identified economic activities			Overall assessment
	Nace 2008	Production	
1	10	Manufacture of food products	59.4
2	25	Manufacture of fabricated metal products, except machinery and equipment	50.5
3	26	Manufacture of computer, electronic and optical products	34.7
4	20	Manufacture of chemicals and chemical products	34.0
5	28	Manufacture of machinery and equipment n.e.c.	28.1
6	27	Manufacture of electrical equipment	24.3
7	21	Manufacture of basic pharmaceutical products and pharmaceutical preparations	22.3
8	22	Manufacture of rubber and plastic products	20.2
9	14	Manufacture of wearing apparel	17.7
10	31	Manufacture of furniture	16.0
11	29	Manufacture of motor vehicles, trailers and semi-trailers	15.4
12	23	Manufacture of other non-metallic mineral products	13.8
13	30	Manufacture of other transport equipment	1.5
		Services	
14	62	Computer programming, consultancy and related activities	94.6
15	46	Wholesale trade, except of motor vehicles and motorcycles	90.6
16	72	Scientific research and development	64.9
17	86	Human health services	26.7
18	47	Retail trade, except of motor vehicles and motorcycles	25.9
19	94	Services of NPOs	22.8
20	71	Architectural and engineering activities; technical testing and analysis	19.3
21	85	Educational services	18.6
22	70	Activities of head offices; management consultancy activities	14.6
23	74	Other professional, scientific and technical activities	13.5
24	63	Information service activities	5.9
25	61	Telecommunications	5.6
26	55	Accommodation	5.0
27	77	Rental and leasing activities	4.0
28	59	Motion picture, video and television programme production, sound recording and music publishing activities	2.8
29	60	Programming and broadcasting activities	0.8
30	53	Postal and courier activities	0.8
31	96	Other personal services	0.7

The qualitative analysis has been made using the indicators and related data over the past five years for each economic activity such as: state support to offices and centers for technology transfer, projects funded by the National Innovation Fund (session 1-6), support to projects under OP CBI 2007-2013, number of companies holding patents, number of companies holding trademarks. Together, these

indicators measure the attitude of the state and the business activity in terms of the qualitative development of economic activities and services.

Results of cross analysis (quantitative + qualitative analysis)			
Quantitative factor + Quality factor			
Identified economic activities			Overall assessment
	Nace	Production	
1	10	Manufacture of food products	294
2	20	Manufacture of chemicals and chemical products	289
3	21	Manufacture of basic pharmaceutical products and pharmaceutical preparations	276
4	26	Manufacture of computer, electronic and optical products	251
5	23	Manufacture of other non-metallic mineral products	239
6	28	Manufacture of machinery and equipment n.e.c.	236
7	25	Manufacture of fabricated metal products, except machinery and equipment	229
8	27	Manufacture of electrical equipment	220
9	14	Manufacture of wearing apparel	178
10	29	Manufacture of motor vehicles, trailers and semi-trailers	164
		Services	
11	61	Telecommunications	487
12	46	Wholesale trade, except of motor vehicles and motorcycles	445
13	62	Computer programming, consultancy and related activities	398
14	72	Scientific research and development	349
15	70	Activities of head offices; management consultancy activities	239
16	71	Architectural and engineering activities; technical testing and analysis	223
17	63	Information service activities	201
18	59	Motion picture, video and television programme production, sound recording and music publishing activities	182
19	74	Other professional, scientific and technical activities	155
20	60	Programming and broadcasting activities	142
21	53	Postal and courier activities	115

Subject of this analysis is the reconciliation of the results of the quantitative and qualitative analysis. The aim is to identify economic activities and services for which quantitative evaluation is supplemented by a qualitative one and vice versa. This is interpreted as a strength that forms the capacity and future potential for accelerated technological innovation and development. Thus, 21 economic activities and services have been identified which are considered a starting point for identifying technology areas for smart specialization. The logic of identification is to locate the intersection point between the group of economic activities and services and the areas of science, where government and businesses expenditures for research and development are concentrated. Thus, seven technology areas have been identified: Mechatronics and clean technologies, ICT, Bio-technology, Nanotechnology, Creative Industries, Pharmaceuticals, and Food Industry. In view of the existing and expected market trends these technology areas have been summarized in four thematic areas (Mechatronics and clean technologies, Information and IC Technology, Industry for healthy life and bio-technology, new technologies in creative and recreational industries), which clearly reflect the existing potential and future opportunities for smart specialization of the country.

Bulgarian S3 priority selection: methodology

The method used in the selection of priorities is composed of 'quantitative' and 'qualitative' components which are then merged in the final selection of priorities.

1. Explanation of 'quantitative' methodology

'Quantitative' analysis is based on estimates of 'external' and 'internal' competitiveness of Bulgaria. External competitiveness is assessed by using indicators of revealed comparative advantage and share of sectors in export and import. Internal competitiveness combines a variety of sector-level indicators like shares in employment and productivity levels into a composite index (see below).

External competitiveness

Analysis of export competitiveness is based on **Balassa index [45] which captures the relative position of Bulgaria in 257 product groups** (corresponding to SITC rev4, level 3) relative to EU27 and Balkan economies (Albania, Serbia, FYR Macedonia, Montenegro and Turkey).

These results show that Bulgaria has relative comparative advantages in 85 out of 257 product groups. Shares of individual product groups in 85 groups in which Bulgaria has positive RCA are then taken as proxies of their relative importance.

This indicator is complemented by two additional indexes of **shares of individual product groups in export and import.** So, these indexes give us a picture of revealed comparative advantages but also a picture of the importance of individual product groups in trade.

Adding these three indexes give us the aggregate picture of the importance of individual products groups from 'external' or foreign trade perspective.

Internal competitiveness

The ranking of product (service) groups from the external side were complemented by their assessment from **the 'internal competitiveness' side**. Sectors are ranked regarding their share in industrial production, in turnover, in value added, in the share of value added in production, labor productivity compared to the economy, share in employment, in a number of enterprises, and investment in fixed assets. By **summing up values for individual sectors, we get indexes of 'internal competitiveness'** or sectors' importance in the economy. Although variables have the same weight, the value of the index is highly influenced by the values of relative labor productivity of individual sectors.

Finally, the overall ranking of sectors is derived **by simple summation of indexes of 'internal' and 'external 'competitiveness**.

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[45] The revealed comparative advantage (RCA) is an index used in international economics for calculating the relative advantage or disadvantage of a country in a certain class of goods or services as evidenced by trade flows. The RCA index of country I for product j is often measured by the product's share in the country's exports in relation to its share in world trade:

RCAij = (xij/Xit) / (xwj/Xwt)

Where xij and xwj are the values of country i's exports of product j and world exports of product j and where Xit and Xwt refer to the country's total exports and world total exports. A value of less than unity implies that the country has a revealed comparative disadvantage in the product. Similarly, if the index exceeds unity, the country is said to have a revealed comparative advantage in the product.

2. Explanation of 'qualitative' methodology

A method for calculating sectors which should be considered as priorities from 'qualitative' dimension is identical to the 'quantitative' method. The difference is in the type of indicators that are being used to estimate priorities from 'qualitative' perspective.

Indicators used are the following:

- number of organizations that have received state support for creation and development of technology transfer offices and centers by different sectors
- projects financed under National Innovation Fund by sectors
- projects funded projects under OP "Competitiveness of the Bulgarian Economy" 2007-2013 by sectors
- number of patent-holding firms by sectors
- number of trademarks owning firms by sectors

Each of these indicators has been than recalculated regarding the relative share of the respective sectors in the total value of the indicator. For example, shares of the project by sectors financed under National Innovation Fund add to 100. In the next step these shares across five above indicators have been summed up giving the overall relative share of sectors. This gave a ranking of sectors (separately for industry and for services) regarding their importance through policy support activities but also through own patenting and trademark activities.

3. Combining 'quantitative' and 'qualitative' rankings (cross-analysis)

In the final step rankings derived based on 'quantitative' and 'qualitative' methodology is summed up. Authors have opted to use cut off point of first ten ranked products and 11 first service activities which gave 21 priority sectors.

In the final step each of 21 industry/service areas have been related to one of seven thematic areas which underpin respective economic sector. For example, mechatronics and clean technologies underpin sectors computers and ICT technology, machinery and equipment, electrical equipment, automotive, IT services, R&D and architecture and engineering services. In overall, seven areas have been derived from the priority technology areas that are relevant for 21 priority sectors: Mechatronics and Clean Technologies, ICT, Biotechnologies, Nanotechnologies, Creative Industries, Pharmacy, and Foodstuff Industry. Each of these areas than has been linked to one of six R&D areas (medicine, technical sciences, natural science, math and ICT, agriculture, humanities and social sciences). For example, mechatronics and clean technologies are associated with technical and natural/ICT sciences.

4. Proceeding from technological to thematic areas of smart specialization

Taking into consideration the European and world trends of market demand, recognizing EU consultancy support, discussions with leading experts of the Platform during partnership's bench mark events and the necessity of better focusing of the strategy gradually emerged and crystallized the product and technology niches (thematic areas), around which the stakeholders united. The organized public discussion showed will to find a common language among the participants in the innovation system for identifying unique characteristics and the potential of the country to develop "smart" areas, where competitive advantages are available. In the core of process of identifying thematic areas emerged the industries with high

investor interest in future, based at the cross points among physics, chemistry and biology. Thus defined thematic areas outline new space for entrepreneurial opportunities and guarantee effective process of EDP in the future:

- Informatics and ICT
- Mechatronics and Clean Technologies
- Healthy way of life and biotechnologies
- New technologies in creative and re-creative industries

Brief description of the identified sub-areas per every thematic area where Bulgaria has capacity for smart specialization

Thematic area „Informatics and ICT"

1. Production, especially Fabless and new approaches for design and/or assembling;
   - **Fabless production:** It includes drafting and sale of hardware devices and semiconductor chips. "Fab" production of the devices is assigned as a task to a special producer. In many cases these producers are located in China and Thailand due to the low labor price. Thus Fabless companies using lower capital expenditures concentrate their resources on R&D and development of consumer market.
   - **Assembling** – putting together computer parts.

2. ICT access in machine building, medicine and creative industries (in link with other three thematic areas), incl. digitalization of cultural-historic inheritance, entertaining and educational games, embedded software

   - **Industrial robots:** Robots become more comprehensive and this increases their use in industry. The aim to use robots was the automation of industries for mass production, where special operations are repeated again and again in the same way. Auto production is an example for the use of large and comprehensive robots. They are used in painting, welding and assembling. The size of industrial robots varies to great extent and they could fulfil much more actions than a man could do. The aim of these robots is to replace the hard work of the operator and to achieve maximal repeat and speed of the operation. Industrial robots are used together with transport robotized complexes, that moving on marked transport pathways (for example electric cables under the earth), supply necessary materials. Often robots are part of automated lines or automated production machines. The area of assembling of electronic devices is one of the areas they are used. The reason is the big number of products and the necessity to make work easier. The main aim of the modern industrial robots is to increase labor productivity, quality of products and make them cheaper.
   - **Simulation:** This is an approach to analyze systems that are too complex for theoretic interpreting or expressing through formulas. During simulation process experiments are performed on given model in order to gain knowledge about system substance. In the context of the simulation it is about simulation system and simulator as a method for implementation or realizing of the simulation model. The simulation is abstraction of that is in the simulation system (structure, function and behavior). The work of the simulator with concrete parameters is described as a simulation experiment. The results of it afterwards could be interpreted and transferred to the simulation system.
   - **Digitalization:** Transforming of given signal (video, TV, sound, telephone impulses, etc.) into digital signals, that in their turn have to be spelled out and processed by electronic devices. Preferred format for storage and distribution of all kinds of information.
   - **Embedded software**

3. 3D digitalization, visualization and prototyping
   - **3D digitalization:** 3D scanning or digitalization (triple dimensional representation of objects) is a quick and precise method for transferring physical measures of given object into the computer. Thus in organic way the result is as usually named 3D scanned data. They are often represented through large scale digital model or 3D graphic image. After the scanned data is already in the computer all measures of the physical object could be used like length, width, height, volume, size of the object, object location, area/surface, etc. The device through which 3D information is gathered is called 3D scanner. There are

many different ways of gathering 3D information for a given physical object and this is the reason for the existence of many types of scanners.

- **Visualization:** 3D computer graphic that uses triple representation of geometry data (more often decarted), that could be processed with the help of computer program. The processing of these data includes performing of different calculations and rendering (a process of generating of digital image (visualization) from a model in computer graphic. Under model here it is meant the description of different objects and phenomena represented strictly in a special mathematic language or like a data massif) of two dimensional images. Similar images could be preserved in order to be viewed later on or showed in real time. 3D computer graphics often are named 3D models, despite of the existence of different opinions.
- **Prototyping – creation of initial sample, model through using modern technology for printing.** It enables the manufacturing of triple sized hard product in any form with the help of digital model. It includes putting in a row layers of the material in a way to shape the expected product. This way the technology is quite different in comparison to traditional technologies where in order to shape the product it is needed to remove material (for example cutting and processing in lathe machine). Triple sized print is based on digital technologies and is used in the performing of prototypes as well as in regular production in sectors like architecture, building, automotive production, airplanes production, biotechnologies, fashion, etc. Due to this technology amateurs and professionals create 3D printers, working with different materials like chocolate, metal, even sand.

4. Big Data, Grid and Cloud Technologies

- **Big Data:** This is a term for a group of data, that are so much big and comprehensive that the traditional applications for processing are not enough to manage. The challenges include analysis, selecting data, search, sharing, preservation, transfer, visualization, update and access. The term is often connected with analyses aiming development of prognoses, analyses of customer behavior, or other modern methods for data analyses, extracting use from the data. The correctness of Big Data could lead to more confident taking of decisions and better decisions, that could bring better operational effectiveness, decrease expenditures and diminish risks.
- **Grid Technology**. This is a technology gathering computer resources from different locations in order to achieve joint objective. GRID could be described as a distributing system with non-interactive loading, including a large number of files. This technology differs from traditional productivity of computer systems (for instance computing cluster) by that grid computers for every knot are tuned to fulfil a different application task. Grid could be very large.
- **Cloud Technology.** Cloud computing is supply of computing services, but not a product. This is a term from the area of IT, meaning use of shared resources, software and information, supplied to computers and other devices via Internet. The term combines notions like software as service SaaS, infrastructure as service IaaS, platform as service PaaS and other modern technologies, under the form of online business applications, accessible through web browser, meet computing needs during preserving software and user's data on their servers. In other word the term concerns as software applications, supplied under the form of web services, as well as access to hardware and system resources of data centers, offering these services. The mix of access to center's hardware is what is called "cloud". The tenants of the cloud, who are in their turn suppliers of cloud services, do not have to invest in infrastructure, to train staff, to buy software licences and even to understand how the systems in the cloud work for them. Open standards are of critical importance for the development of cloud computing and a lot of the basic technologies in the area have come from the software developers with open code. Due to the huge resources needed for supply and maintenance of clouds, there are relatively a few companies-suppliers of clouds, as follows: Amazon (Amazon Web Services), Google (Google App Engine), Microsoft (Microsoft Azure), Apple iCloud, Salesforce, Sun Microsystems, IBM, Oracle, VMWare, and a Bulgaria (Cloud bg).

5. Wireless sensor networks and wireless communication/management
    - **Wireless sensor network:** Wireless sensor network consists of distributed independent wireless sensor platforms (knots). They include one or several sensors, receiver-transmitter (enabling wireless communication) and managing computing block. They are used for measuring of different physical parameters like temperature, air humidity, infrared light, vibrations, pressure, etc. Their wireless communication and small size allows them to cover big areas like forests, bridges and buildings.
    - **Wireless communication:** This is a way to transmit information between two points through wireless technology for information and communication exchange, in contrast to wire communication where wire technologies are used. The most widespread wireless communication is the radio communication, which includes different types of fixed, mobile and portable devices, including communication radio walkie-talkie, cell telephones, personal digital assistants (PDA devices) and wireless network. Other examples for application of radio wireless technology include units of the Global Positioning System (GPS), devices opening garage doors, wireless computer mouse, computer keyboard, headgears, radio receivers, satellite TV, sky TV and wireless telephone.

6. Language technologies
    - **Language technologies:** These are technologies including processing of natural languages, computer linguistic and technologies for recognizing and generating speech. Language technologies are close linked to computer sciences, ICT, artificial intellect, linguistic and other science and science-applicable subjects. Linguistic technologies participate in creating applications for automatic translation, in creating contents and in management of multi-language information and knowledge in all European languages. These technologies support the development language-based interfaces for different systems – house electronic, machines and aggregates, automobiles, computers and robots. Modern language technologies are used in media.

7. Web, hybrid and "native" applications, web based applications for creating and exploitation of new services and products
    - **Web application:** This is an application to which users have access through network like Internet or Intranet. The term also could mean software application, written in maintained by browser program language (Java Script manage to render the application. Services for creating web applications are much more than development of nice and functional web-site. It means to create consecutively, professionally branded web presence, that offers the relative business directly to its present or potential clients.
    - **Native computing:** This is an application working without external support in contrast to the other, working in emulation (programs on platform, different from the written as an original). These programs are called „ native “.
    - **Hybrid application:** Hybrid application is application, that combines elements of „native“ and web applications. Native applications are developed for concrete platform and installed on a computing device. Web applications are general for a lot of platforms and are not installed locally, but they are accessible in internet through web browser. Hybrid applications often are cited in the context of mobile computers.

8. Using new opportunities in connection with outsourcing and ICT –based services and systems
    - **Outsourcing (outsourced production). Often called outsourcing** *(outsourcing from Outside Resource Using):* This is a concept for submitting internal functions of given company to be implemented by an external company. The company to which activities are outsourced is called outsource destination. The most usual reasons for using outsource are use of external (foreign) knowledge and skills, transferring of certain risks,

saving financial means, increasing productivity and/or quality, setting money free for company's basic activities.

Thematic area „Mechatronics and clean technologies"

Mechatronics is a registered trademark of the company Yaskawa Electric Corporation in Japan with registration No.46-32714 in 1971. Subsequently, the company marketed the right to use the word worldwide. In the countries of the European Union there is a French standard NF E 01-010 for mechatronics - an approach aimed at synergistic integration of mechanics, electronics, theory (systems) of management, as well as computer science in design and manufacturing in order to improve and/or optimize functionality.

Clean technologies. They are connected with waste-free economy; sustainable management and utilization of water; resource and materials efficiency; green energy - environmentally friendly use of mined fuels, hydrogen-based methods and technologies, technologies for energy storing, especially renewable energy, as well as energy saving; sustainable mobility - development of electric mobility and electric vehicles, alternative propulsion technologies, efficient use of alternative fuels.

1. Production of basic elements, components, assemblies and equipment, incorporated as part of a mechatronic unit or self-constituting such unit
   - **Detail.** Part of a machine, apparatus, device, which has a simple construction and cannot be disassembled more;
   - **Node.** A place where are gathered, merged, overlapped or crossed lines, parts, devices, etc.;
   - **Unit.** The unit (aggregate unit - from the Latin. "Aggregate" ("stack")) in engineering, especially in electrical and mechanical engineering, is a machine set by numerous interacting individual machines, appliances or devices. Usually as a unit are connected engine and machine to perform a specific technological function.

2. Mechanical and Precision engineering, incl. parts, components and systems, focusing on transport and energy
   - **Mechanical engineering** is a classical engineering science that is not limited to the pure construction of machines, motors, gearboxes, etc. Many special areas of engineering are related to other science areas as they complement them, expand and prove in practice their theoretical achievements. Mechanical engineering is a combination of research on basic principles and development of technological methods for manufacturing and mass production - a typical part of engineering. Physic laws are used, especially in the fields of mechanics and thermodynamics, design and research, incl. use of simulation environments and operating principle in development of technical devices. Nowadays through engineering science, mechanical engineering is the main field for construction of production machinery and development of other industries that use them - agriculture, transportation, manufacturing and conservation of food, construction;
   - The specialization "Technology of **Precision Engineering**" is a cognate with discipline "Technology of mechanical engineering", but there are a number of specific characteristics imposed by the nature of Precision engineering. These features are based

on the basic requirements for appliances in regard with the conditions for their operation. Actually, the devices are control and command units of machines, equipment and mechanisms. The devices' precision depends on the precision characteristics of the objects they are placed on. Therefore, the requirements to the devices characteristics are increased;

- **Component** – integral part.

3. Engineering, reengineering and extending the life cycle of industrial machinery, devices and systems
   - **Engineering**. Technical sciences, called engineering or engineering sciences are sciences that deal with the study of events associated with development of technology, development of new structures and technological processes. This is achieved through use of knowledge in physics, mathematics and by practical experiments directed to improve of tools, devices and appliances or creating new materials, processes and products for the needs of humanity. The purpose of engineering activity is invention, development, design, implementation, production, repair, servicing of machines, appliances, etc.
   - **Machine**. This is a complex mechanism or combination of mechanisms that performs mechanical movements for transformation of energy and materials to perform work for the collection, transmission, storage, processing and use of information. The machine eases, mechanizes and automates the physical and intellectual human labor and increases its productivity.
   - **System**. Specific order, under which are organized parts of the whole unit, consistent with relations between them.

4. Systems for automated and software assisted management with application in manufacturing
   - **Automation**. Automation is use of automated technical means, together with economic and mathematical methods and management systems, freeing human from participating in processes of production, transformation, transmission and use of energy, materials or information, significantly reducing the level of such participation or work demand of performing operations. Additional use of sensors, input devices, control devices (controllers), actuators, output devices, using electronic equipment and methods of calculations, sometimes imaginary copying human functions is required. Together with the term, automatically is used term automated, underlying the relatively high level of human participation in the process. Automation is one of the directions of scientific and technical progress.
   - **Software**. The software (provision of computer programs) is a set of all information, incl. instructions and data necessary for the operation of any electronic computing machine. It is used mainly in the field of information technologies.

5. Embedding renewable energy sources in robotic systems with artificial intelligence
   - **RES**. Renewable energy is that, which is obtained from sources that are considered naturally recovering or are practically inexhaustible. Renewable resources are sunlight, wind, rain, tides and geothermal energy.
   - **Robotics**. This is a branch of engineering, mechanical engineering, electrical engineering and informatics, which includes design, construction, management and application of robots, as well as computer systems needed for their control, receiving data from sensors and information processing. For example, application of these technologies is in industry - replacing humans in performing dangerous activities such as bombs disposal, exploration of shipwrecks and mines. It is classified according to the environment/condition of robots: fixed, terrestrial, submarine, air, space and polar;

- **Artificial Intelligence**. This is the science of concepts that allow computers to do things that seem reasonable for people. Artificial intelligence has the ability to analyze his environment and take actions that increase the possibility of achieving certain goals. Studying the possibilities of creating such devices, called intelligent agents is subject to a separate field of informatics. In other words, artificial intelligence is the science of concepts, methods and tools to create intelligent computer programs and research of natural intelligence by computer systems.

6. Creation of modern information centers for autonomous energy systems
   - **Energy system**. This is a set of power plants, electric and heat networks and consumers of electricity and heat energy connected in common regime and continuous production process, distribution and consumption of electricity and heat.

7. Robotics and processes automation, including 3-D modelling of robotic automation systems
   - **3-D Modelling.** This is a process of three-dimensional computer graphics, which is made of the mathematical network representing any three-dimensional object by through specific software. The product is called a 3D-model. It can be visualized as a two-dimensional image through a process called 3D Rendering or to be used in a computer simulation of physical event.

8. Design and manufacture of high-tech products and/or participation in transnational production chain, incl. aerospace industry
   - **High Tech**. High technology (high technology, high tech, hi-tech) is the common name of the newest and most advanced modern technologies. The transition to use high technology (and related technical innovations) is the most important characteristic of scientific revolutions and related technological development. High technologies are generally the most knowledge-intensive industries.
   - **Production chain**. Production process is the set of all actions of the workers and the labor tools needed for making products. As a result of the manufacturing process, raw materials and semi-finished products turn into finished products or service in a certain quantity, quality and variety. It covers the preparation of the production tools, receipt and storage of materials, organization of work and other activities that can generally be divided into basic, auxiliary and service processes.
   - **Aerospace**. Aerospace is the human effort in science, technology and business to fly in the Earth's atmosphere (aeronautics) and the surrounding area (aerospace). Aerospace organizations explore, design, produce, operate or maintain the aircraft and/or spacecraft. Aerospace activity is very diverse, with many commercial, industrial and military applications. Aerospace is not airspace that is physical space directly above the Earth. The end of the airspace and the beginning of space begins 100 km. above the Earth.

9. Bio-mechatronics.
   - This is an **interdisciplinary applied science** which aims to integrate biology, mechanics and electronics. It also includes the fields of robotics and neuroscience. Bio-mechatronic devices cover a wide range of applications in the development of prosthetic limbs to engineering solutions related to breathing, vision and cardiovascular system

10. Intelligent systems and devices, "smart homes" - "smart cities"
    - **Intelligent homes.** Home automation means system that controls home appliances remotely or automatically. The first home automation begins with appliances such as washing machines, etc. which are designed to reduce labor in the household. Some automated devices work independently without the need to communicate, such as programmable switches, while others are part of the Internet of Things. If they are included

in a network, they can be controlled remotely and they can send and receive data. These devices can be connected by sensors, microcontrollers, serving devices (servo motors, stepper motors, etc. which carry out some action) and by communication system. The remote control can vary from a simple remote control or smartphone with Bluetooth to PC or smartphone, which is connected to Internet on the other side of the world, Automated devices are usually connected via Wi-Fi or wiring, used for communication (Power-line communication) with a mutual device for the whole system, which is available through software. The application of this technology is very popular in thermostats, security systems, persiennes, lighting, fire detectors and door locks.

- **Smart City.** This is an urban development vision by integration of a large number of information and communication technologies (ICT) and the "Internet of Things" in order to manage the assets of a city. Assets of the city include, but are not limited to local services, information systems, schools, libraries, transport systems, hospitals, power plants, water supply systems, waste management, law enforcement and other community services. The purpose of building a "smart city" is to improve the quality of life through the use of technologies to improve the efficiency of services and meet the needs of the local residents. ICT allows city officials to interact directly with the community and the city's infrastructure. It allows monitoring of city, its development and reveals opportunities for better quality of life. By using sensors integrated with real-time monitoring, data are collected from individuals and devices - then processed and analyzed. The collected information and knowledge is a key to tackling the inefficiencies.

11. "Clean technologies" with focus on transport and energy (storage, saving and efficient distribution of energy, electric vehicles and eco-mobility, hydrogen-based models and technologies, waste technologies, technologies and methods for inclusion of waste materials from production in other industries).
    - **"Clean technology"** includes recycling, renewable energy sources (wind, solar, biomass, hydro energy, biofuels, etc.), information technologies, green transportation, electric vehicles, green chemistry, lighting, and many other applications that are now more energy efficient. "Clean technology" is a source for creation of electricity and fuels with less environmental impact and minimal pollution. It makes more energy efficient and environmentally friendly green buildings, transport and infrastructure.
    - **Electric vehicles.** Electric automobile or electric powered vehicle using one or more electric motors or traction motors for propulsion. The electric automobile could be charged by power collector system from outside the vehicle, or could be charged by self-contained battery or by a generator for converting fuel into electricity. Electric automobiles include road and rail vehicles, vessels above and below water, electric aircraft and electric spacecraft.
    - **Eco-mobility.** It is a term used to describe a journey through integrated, socially inclusive and environmentally friendly transportation options, including integration of walking, cycling, transmission and transportation. It enables individuals and organizations to access goods, services and information in a sustainable manner, while maintaining the quality of life of citizens and promoting social cohesion. Eco-mobility is a new approach to mobility which emphasizes the importance of public and non-motorized transport and promotes integrated use of all modes of transport in a city. Environmentally sustainable and socially inclusive, ecological mobile transport solutions have low or no emissions compared to private vehicles powered by fossil fuels. The inclusion of eco-mobility in the development of systems and policies movement will benefit local authorities in achieving international recognition for the city and its leadership.
    - **Hydrogen technologies.** These are technologies related to the production and use of hydrogen. Hydrogen technologies have many applications. Some are carbon neutral and may have a role in preventing climate change and possible future hydrogen economy.

Hydrogen is widely used chemical for various applications, including the production of ammonia, oil refining and energy. Hydrogen is not a primary energy source, but it is widely regarded as the ideal energy storage. By electrolysis, electricity converts water into its components - hydrogen and oxygen. They may be converted back into electricity using a fuel cell. There are a large number of different types of fuel cells and electrolysis.

- **Non-waste technologies.** This is an organization of the technological process during which industrial waste is minimized or completely used as secondary raw materials. This is a closed system, organized analogically with the environmental ecological systems. In this system, a person consciously creates and regulates the necessary technological cycle of raw materials, production and waste. These closed systems are not isolated and if they create any negative impacts on the environment, this impact is lower than a certain acceptable level.

Thematic area „Industry for healthy life and bio-technologies"

1. Methods for clean production, conservation and reaching the final consumer of specific Bulgarian products and elements (yogurt, honey, breads, milk products, etheric oils, herbal products, bio-cosmetics and bio-products)
   - **Technology for fermented foods:** It includes shaping, optimization and management of fermentation processes. Germinated barley malt is used as main substance in the production of beer, and as biological agents are used Saccharomyces cultures, performing alcoholic fermentation.
   - **Biotechnology of enzymes:** It consists of adding of enzymes improving qualitative parameters of the end product. For example, in production of bread enzymes are added in order to increase its durability.
   - **Production of sour-milk products:** Sour-milk bacteriums and enzymes are used in this production to receive foods like yoghurt and different types of cheese. For example, during cheese production through biological processes the needed enzymes ere produced from bacteriums instead of traditional methods for extracting from animal's stomach.
   - **Wine and high alcoholic spirits production:** As main substance in these technologies are used products containing carbohydrate. With the help of high productive cultures like Saccharomyces they are transformed into alcohol.
   - **Vinegar production:** This technology is using alcohol containing products, treated with selected sour-vinegar bacteriums.
   - **Production of natural aroma products** – etheric oils, natural distillated waters (rose, lavender, chamomile, common balm, salvia, etc.) and extracted products.
2. Production of specialized food and drink (baby, child, astronaut)
   - **Production of specialized food and beverages** is connected with achievement of concrete quality parameters depending on the target group of consumers – babies, children, sportsmen, people with health problems, astronaut, etc.
   - **Astronaut food:** This is food specially prepared for use in open space area. Due to the specific conditions for work and life of astronauts in weightlessness and long time spent in closed spacecraft there are special requirements towards space food in comparison to usual one.
3. Production of instruments, equipment and consumables for medical and dental diagnostics and treatment and therapy and/or participation in supra-national production chain
   - **Diagnostic –** section in clinic medicine studying content, methods and stages of the process of disease determination. Briefly it is a process of disease determination and assessment of separate biological parameters and social status of the patient, interpretation of results and their generalizing in diagnose.

- **Medical diagnostic –** this is a process of diagnose giving conclusion about the type of the disease and the condition of the patient expressed in medical terms.
- **Medical equipment** (medical technic, medical apparatus) is designed for support of diagnostic, monitoring and disease treatment.
- **Dental therapy** – in dental treatment, for instance in tissue damages due to various reasons (caries, fracture or inflammation process).
- Diagnostic equipment – includes medical apparatus for image diagnostic used for support in setting the diagnose. Examples are echography apparatus, kernel-magnetic resonance (MRI), positron-emission tomography (PET), scanners and X-ray apparatus.

4. Personal medicine, diagnostics and individual therapy, healing forms and substances
   - **Personal medicine (**individual or precise medicine). It combines diagnostic approaches from different areas (genetic, monocular biology, etc.), enabling medical treatment in conformity with individual parameters. The aim of the personal approach is to take into consideration distinctions in pliability to specific diseases as well as the effect of given treatment on different people. This information would make it easier to identify patients who could be treated by given medicine and to change treatment or modify it if it is of no effect.
   - **Medicines** (medical stuff, drugs) – active substance used in determined quantity to affect and improve the structure and function or for diagnose of disease. In order to be used they have to be processed in relative medicine form. The term medicine coincides with drug.
   - Medicine form – this is suitable for use and reception form. Medicine forms are powders, tablets, solutions, creams, etc. Usually under medical form is understood "medicine".

5. Medical and healing tourism with accent on personalization possibilities (personal tourism)
   - **Healing tourism** is specialized type of tourism that meets requirements of tourists for recovering or maintaining mentally or physical status as well as treatment using different modern methods and programs outside hospitals. The touristic product includes various services to achieve the aims of this tourism. Typical for the healing tourism is that other supporting services with fun character are not widely presented and nourishing could become part of the main touristic services – curative, diet. Depending on the type of prevailing services the healing tourism is called as spa tourism, curative-recovering, sanitary, climate-curative, climate-spa, health tourism.

6. Nano-technologies in service of the medicine
   - **Nanotechnology** is an area of the applied sciences as well as high technology, covering wide range of topics, but the main uniting topic is control over substance at micro level. The prefix "nano" in the word nanotechnology means one part of milliard. \it means one milliard part of one meter, i.e. nanometer (nm). The object of nanotechnology is studying and manipulating various nano-size materials.

7. Biotechnologies serving directly health way of life
   - **Biotechnologies** are technologies using live organisms, biological systems or their derivatives for creation or modifying products or processes. They are used in wide range of areas – from agriculture to medicine and heavy industry. Today biotechnologies are expected to be used for alternative foods, medical goods and vaccines from modified microorganisms. Biotechnologies are based on clean biotechnologies – genetics, microbiologic, molecular biologic, biochemistry, embryologic, cell biologic, and in many cases on other science areas – engineering chemistry, informatics, etc. Simultaneously modern biological sciences are close linked with biotechnology and use widely biotechnological technic means.
   - **Bioengineering:** It is known also as biomedical engineering – combining engineering expertise with medical needs for healthcare objectives. Bioengineering integrates

engineering sciences, biomedical and clinic practice for improving human's health in 3 levels - 1) Preliminary learning of live systems through engineering, biology, images and computer sciences as diagnostic instruments; 2) Improve the function of live systems through development of devices, systems and constructions on the base of biological and non-biological components; 3) Preventing damage for live systems through building models, devices in order to manage the behavior of live systems. The main advantages of bioengineering include development of artificial joints, magnetic resonance (MRI), arthroscopy, angioplasty, heart pacemaker, bioengineered skin, kidney dialyze and heart-lung machine.

8. "Blue" technologies and application of new methods and technologies in sustainable use of sea and river resources
   - **Blue technologies** are technologies, linked to sustainable economic development of water basins. Through them the innovations are directed to the economy of water basins.

9. Manufacture of installations for the production of clean electric industrial water
   - **Electric energy** is produced through processing primary energy resources – coal, nuclear fuel, water potential, etc. Electric generator transforms energy into mechanical energy (from water pressure), thermal (by fuel burning), electric (from wind's strength, rising tide, river's stream). The produced electric energy is transformed and transferred through network system to places, where it is distributed and supplied to end user.

10. Green/ bio based economy
    - **Green economy** is economy aiming at sustainable development through decreasing environmental risks. It is closely linked with ecological economy.
    - **Bio-based products** are entirely or partly produced from materials with biological origin, with the exception of materials integrated in geological formations and/or fossilized (in accordance with the definition in „Innovation for sustainable growth: Bio-economy for Europe").

Thematic area "New technologies in creative and re-creative industries"

1. Cultural and creative industries
   - **According to the definition of EC** these are architecture, archive library, artistic craft, audio-visual forms (films, TV, video games and multimedia), cultural heritage, design, incl. fashion design, festivals, music, scenic and visual arts, publishing, radio;
   - **Cultural industries** are industries that produce and distribute goods and services, and during their development attain special quality, use or objective, integrating or transferring cultural values, despite of eventual commercial value. Outside traditional art sectors (scenic, visual, cultural heritage – including in state sector), they include cinema, video records, TV and radio, video games, new medias, music, books and press.
   - **Creative industries originate from** are originated from individual work, skills and talent and have potential for creating goods and jobs by generating and use of intellectual property – advertisement and marketing, architecture, crafts, design (product, graphic and fashion), films, video, radio and photography, information technologies, software and computer services, publishing, museums, galleries and libraries, music, scenic and visual arts.

2. Computer and mobile applications and games with educational marketing and/or entertainment character
   - **Application** is a computer program designed for performance of a group coordinated functions, tasks or activities in favor of the consumer – text processing program, electronic tables, accounting application, web browser, multimedia player, air navigation simulator, games and picture editors. "General software" application concerns all applications, while "software system" is linked mainly with the work of computer.

3. Alternative (country, eco-, cultural, festival) and extreme tourism and sport (for promotion of unseasonal, not mass, but permanent niche tourism)
    - **Alternative tourism** is an alternative to mass tourism. This type could be defined as gathering of sustainable touristic forms and practices aimed simultaneously to satisfy individual needs and interests and to preservation of local nature and culture. The focus is on preservation natural environment, authentic atmosphere and food, preserved traditions. Alternative tourism could be divided into 5 types: cultural, country, eco, health and sport tourism.
    - **According to the statute of the Bulgarian association for alternative tourism** the following activities are included: marches with skis, with ski-shoes, mountain bicycle, horses, row-boats dips, diving, cave penetrating, climbing and mountain marches with a leader, religion, wine, traditional cuisine, ethnography, traditional music and crafts.
    - **Extreme tourism:** This is a niche in the touristic industry consisting of travels to dangerous places (mountains, jungle, deserts, caves, canyons, etc.) or participation in dangerous events. Extreme tourism is similar to extreme sport as in both exists risk element, but they differ in the extent of engagement and professionalism.

4. Production of goods and appliances with direct use in this area (for example regional dress, bicycles, climb walls, etc. goods for alternative and extreme sports, costumes, decors, materials for historic events, etc.

Main sources and documents used for the development of the Strategy

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- Country Fact Sheet for Bulgaria of the European Commission of July 2012
- Innovation Union Scoreboard 2014
- Global Competitiveness Report of the World Economic Forum
- Reports prepared by the World Bank in the implementation of the Agreement on technical assistance, etc.
    - Contribution to the Strategy for Smart Specialization in the field of research and innovation in Bulgaria, August 2013
    - Report on leading innovative infrastructure projects: Guidelines for feasibility study, December 2013
    - Contribution to the program for services for the commercialization of innovation in Bulgaria, Analysis of the current infrastructure, organizations and the picture of IPR; solutions for a more effective ecosystem for commercialization of innovation, September 2013
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    - Action Plan for services related to the commercialization of innovation, December 2013
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- How research and innovation can work for Bulgaria, January 2012

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- National Development Program: Bulgaria 2020;
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- National Scientific Research Strategy of the Republic of Bulgaria to 2020;
- National Spatial Development Concept for the period 2013-2025;
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- National Strategy for Development of Broadband Access;
- Bulgaria: Building Regional Research Centers, document, prepared for the Ministry of Education and Science, April 2017, unpublished paper
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- Analytical materials provided to us by the MES, MEW, MTITC, MAF, NAFA
- National Strategy for Regional Development of the Republic of Bulgaria in the period 2012-2020
- National Strategy for population demographic development in Bulgaria (2012-2030)
- National Concept for promotion of active life among old people (2012-2030).
- Analysis of Territorial Tourism Development, Strategy for Sustainable Tourism Development
- Data and analysis from the Investment, Innovation and Entrepreneurship Directorate, Department of Innovation and Entrepreneurship MEE http://www.mi.government.bg/bg/themes/inovacionna-strategiya-za-inteligentna-specializaciya-1193-287.html
  - Competitive advantages of Bulgarian export industries in 2013, 2014 – Part One, Part Two;
  - Regional specialization of the leading innovative activities (according to Europe 2020 Innovation Indicator);

- Global Innovation Index 2011, 2012, 2013;
- Innovation Indicator Europe 2020;
- Ranking of the Innovation Union - 2011, 2012, 2013, 2014;
- Innovation System of Bulgaria (as part of Global Competitiveness 2012-2013, 2013-2014, 2014-2015);
- Innovation and competitiveness of luxury goods consumers -oriented European industries

- http://www.mi.government.bg/bg/themes/inovacionna-strategiya-za-inteligentna-specializaciya-1193-287