

DOCUMENT TITLE:

REGIONAL MAPPING REPORT - BULGARIA

Project: Improving RD and business policy conditions for transnational cooperation in the manufacturing industry

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TARGET GROUP ASSESSMENT

Has this deliverable addressed any of the target group indicated in the application form?

Yes / **No**

If yes, please describe the involvement of each individual target group in the table below.

Target group	Number reached by the deliverable	Description of target group involvement
SME		
Regional public authority		
National public authority		
Higher education and research		
Business support organisation		

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1 Introduction

The objective of regional mapping is to provide insight into the current state of the manufacturing sector, particularly functioning of support environment in Bulgaria from which production oriented small and medium enterprises (SME) can benefit on a long term. The regional report is drafted by following common methodology, which includes the analysis of supportive environment for manufacturing oriented companies - particularly smart specialization measures, priorities, indicators, implementation schemes, instruments, emerging trends in the manufacturing sector, analysis of existing support ecosystems and analysis of the main regional actors. Moreover, the supporting institutions and available support services are highlighted, in order to determine possible inclusion of these institutions in a common hub, and thus offer complementary services to SMEs and other target groups.

This report is provided as a single report, similar to reports from other countries, where each partner delivered mapping covering its own region. As a result, regional mapping reports are prepared for Austria, Slovenia, Croatia, Czech Republic, Germany, Hungary, Romania, Serbia, Slovakia and Slovenia.

After the introduction, Chapter 2 is providing strategic background for the Smart Specialization Strategy including top-down description of strategies and status of their evolution at a national level, background analyses supporting development of strategies and highlight Smart manufacturing topics.

Chapter 3 is presenting support environment by highlighting the support environment structure, detecting actors responsible for implementation of strategies and other supporting actors like clusters, technology parks, R&D centres, competence centres, University incubators, Business incubators.

Chapter 4 presents Smart Factory support schemes and programmes including list of currently available or future programmes, grants, loans, etc.

Chapter 5 provides national Smart Factory related projects in execution by the project partner or partnering organisations.

Chapter 6 presents list of regional actors relevant for area of Smart Factory whereas actors are grouped by relevance (User, Solution provider or User/solution provider)

2 Strategic background

Innovation Strategy for Smart Specialization (IS3) of Bulgarian is being developed according the Strategy of the European Union for smart, sustainable and inclusive growth – Europe 2020. The Strategy aims to achieve thematic goal 1 of the Art. 9 Regulation (EU) 1300/2013– Strengthening research, technological development and innovation.

IS3 was being elaborated according the National Development Plan – Bulgaria 2020¹ and the Action Plan for the Danube Strategy².

The Innovation Strategy for Smart Specialization is based on a process of entrepreneurial discovery for identifying the economic priorities within the research and innovation to create competitive advantage through the development and tuning country's strengths in research and development to industry needs. The aim is to respond to new challenges of the changing global markets and streaming investments in areas that have growing added value for the competitiveness of the economy on international markets.

Bulgaria has joined European Union in 2007 and ranked 12th in area and 16 in population. It has 22d place in GDP in 2012 and 2013. The country is under the currency board regime and characterized by industrialized free market economy, medium developed private sector and a relatively small domestic market.

According the latest edition of the Global Competitiveness Report Bulgaria occupies 57 place In terms of technology readiness the country has 44 position but has drop down in ranking of higher education and training index and labor market. In order to improve the competitiveness Bulgaria needs to focus its efforts on improving the quality of the labor force, stimulate demand and introduce new technologies as well as to promote innovations on the market, adopting foreign technologies and knowledge.

To overcome the financial crisis, Bulgaria needs to catch 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 attracting FDI and innovation policy on a sectorial level to build capacity in the labor force in order to adopt and introduce modern technologies and knowledge.

Government support of enterprises is based on two complementarity approaches:

- Creating favorable overall environment for business, which main objective is the implementation of policy to reduce the administrative and legal burdens, reduce obstacles for trade, privatization and de-monopolization, improving taxation and creating positive public attitude and entrepreneurial culture.
- Improving access to finance, both for startups and emerging businesses, by implementation of diverse programs to support the entrepreneurs and development of SMEs.

¹ <https://www.eufunds.bg/archive/documents/1357828564.pdf>

² <http://www.danube-region.eu/component/edocman/action-plan-eusdr-pdf>

The creation of favorable environment for support of SMEs, technologies transfer, access to funds and markets and building knowledge skills and workforce capacity corresponds to the **technology areas** for smart specialization identified below:

- Mechatronics and clean Technologies
- Information and Communication Technologies
- Biotechnology
- Nanotechnology
- Creative Industries, including cultural
- Pharmacy
- Food Industry

Objectives of Innovation Strategy for Smart Specialization of Bulgaria:

In the process of creation of the strategy, the active involvement of a wide range of representatives of all stakeholders – ministries, which are relevant to innovation policy, academia (research institutes and universities), business and NGOs, regional administrations and representatives of local authorities has been ensured. The Innovation strategy for smart specialization has been consulted by international experts, including the World Bank and the European Commission (technical assistance). The consultation meetings covering different sectors (food, pharmaceutical industries, creative industries, electronics, mechanical engineering, information and communication technologies), as well as meetings on specialized topics (eco-innovation and resource, intellectual property, etc.) have been realized. The meetings were organized both at national level and regional level to take account of the specificities of different regions. A list of all participants in the discussions is available. It is planned the consultation process to continue during the whole period of realization of RIS3. The broad public debate on the subject, conducted over the last 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 be chosen paths of realization. The main task of the strategy in the European context is to identify the unique characteristics and potential of the country to develop in areas where there are competitive advantages. To improve the position of Bulgaria in terms of competitiveness and to move the country up in the world and European rankings lists, the strategy should become **an engine for innovation for export, creation of new jobs and growth**. Therefore, **long-term vision for the economic future of Bulgaria**, which is adopted by the document, is a comprehensive and shared by all stakeholders. The main elements of the innovation system and their relationships are considered in a detailed analysis: research system, research and innovation infrastructure, human capital, SMEs, financing, clusters, digital growth, integration into the European Research Area, patent activity, the science - business internationalization of enterprises sustainable development. On the basis of the consultation process, analysis and SWOT analysis the vision of RIS3 is brought out and the two main strategic objectives, which are mutually complementary and suggest strengthening the synergies between sustainable and smart growth, namely:

Strategic goal: By 2020, Bulgaria to pass from the group of "modest innovators" in the group of "moderate innovators" by:

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

Objective 2: Support innovation for resource efficiency and ICT applications in the enterprises throughout the whole industry (for accelerated absorption of technologies)

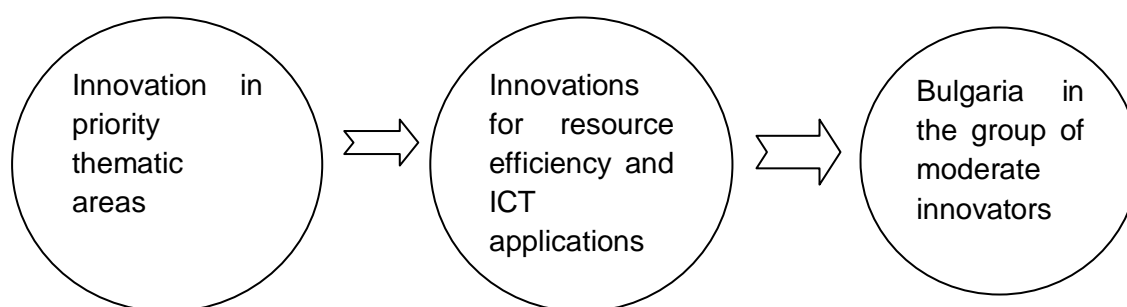


Figure 1 Objectives of IS3

From Technological areas to thematic areas:

The cross-analysis and the e.d.p. are a starting point for identifying technology areas for smart specialization. The logic of identification is the finding of the intersection between the strong areas of scientific and technological development and entrepreneurial activity. The scientific areas are in line with National Strategy for Promotion of Scientific Research 2020³. The areas received as a result should be seen through the prism of expectations for niche markets and market potential (EU and globally):

³ [file:///C:/Users/User/Downloads/national_research_strategy-2020%20\(3\).pdf](file:///C:/Users/User/Downloads/national_research_strategy-2020%20(3).pdf)

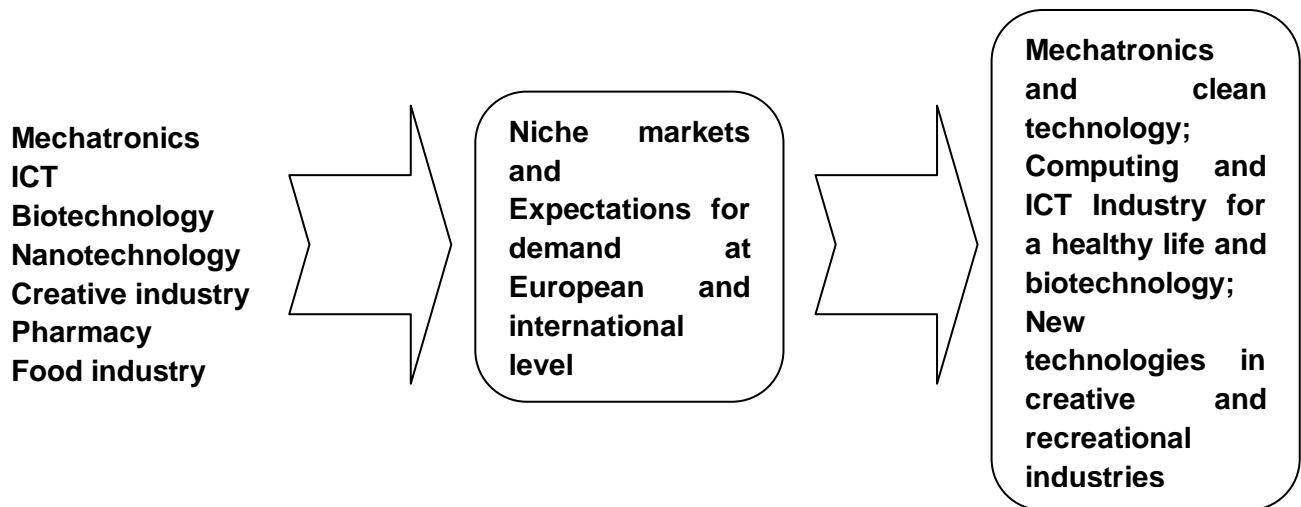


Figure 2 Process of identifying product and technology niches

The main activity carried out within the strategy in the European sense was to identify the unique characteristics and potential of the country to develop in “smart” areas where there are competitive advantages, and create new domain to identify/find entrepreneurial opportunities and ensure effective process of entrepreneurial discovery in Mechatronics ICT Biotechnology Nanotechnology Creative industry Pharmacy Food industry Niche markets and Expectations for demand et European and international level Mechatronics and clean technology Computing and ICT Industry for a healthy life and biotechnology New technologies in creative and recreational industry the future. The approach adopted for the analysis of the innovation system in Bulgaria and consultations is combined – vertical and horizontal.

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 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.

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.

In order, 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.

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 1 – Vertical dimension

The vertical activities under Strategic Objective 1 are determined by the identified country-specific thematic areas in which Bulgaria has a competitive advantage at the present moment. Thus defined, they will be subject to change, given a proven interest and capacity both by industry and academia and nongovernmental organization.

Following priority directions are identified in the framework of thematic area Mechatronics and Clean Technologies:

- Production of basic elements, details, components and supply, part or wholly constituting mechatronic aggregate
 - Maching 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
 - CleanTech 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)

Priority directions in the framework of thematic area Informatics, Information Technologies and Communications:

- production, especially Fables 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;
- 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;

Priority directions in the framework of thematic area Industry for healthy life and biotechnology:

- 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, biocosmetics 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 aging
- "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 Economy

Priority directions in the framework of thematic area New Technologies in creative and recreational 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 more flexible in planning the expenditures;

- Specifics in identifying the participants in schemes for financing and non-distinction the belonging in defined economic categories /activities;
- 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)

Horizontal activities under Objective 1

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. The activities are grouped as follows:

- Activities leading to an effective research and business partnership
- Activities leading to high quality human resources
- Activities leading to an adequate environment and infrastructure for innovation, including digital growth and electronic governance

.Activities under Objective 2 - Support innovation for resource efficiency and ICT applications in the enterprises throughout the whole industry (for accelerated absorption of technologies)

Resource efficiency activities:

- Developing an adequate to the market and global trends framework for “green jobs” and measures to promote their development;
- Build new skills in managers and specialists;
- Innovation for resource efficiency in the water sector;
- Innovation for resource efficiency in the waste sector;

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, optimisation 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.

2.1 Coordinated governance of IS3

The IS3 is the main strategic document of Republic of Bulgaria in the field of competitiveness development and innovation. It has very complicated governance including vertical, horizontal and temporal representatives. Responsible institution for implementation of the strategy is the Government. It should be able to guide the development of the innovation system through the joint efforts of the public and private sector and the business is responsible for turning the knowledge in to innovation and wealth.

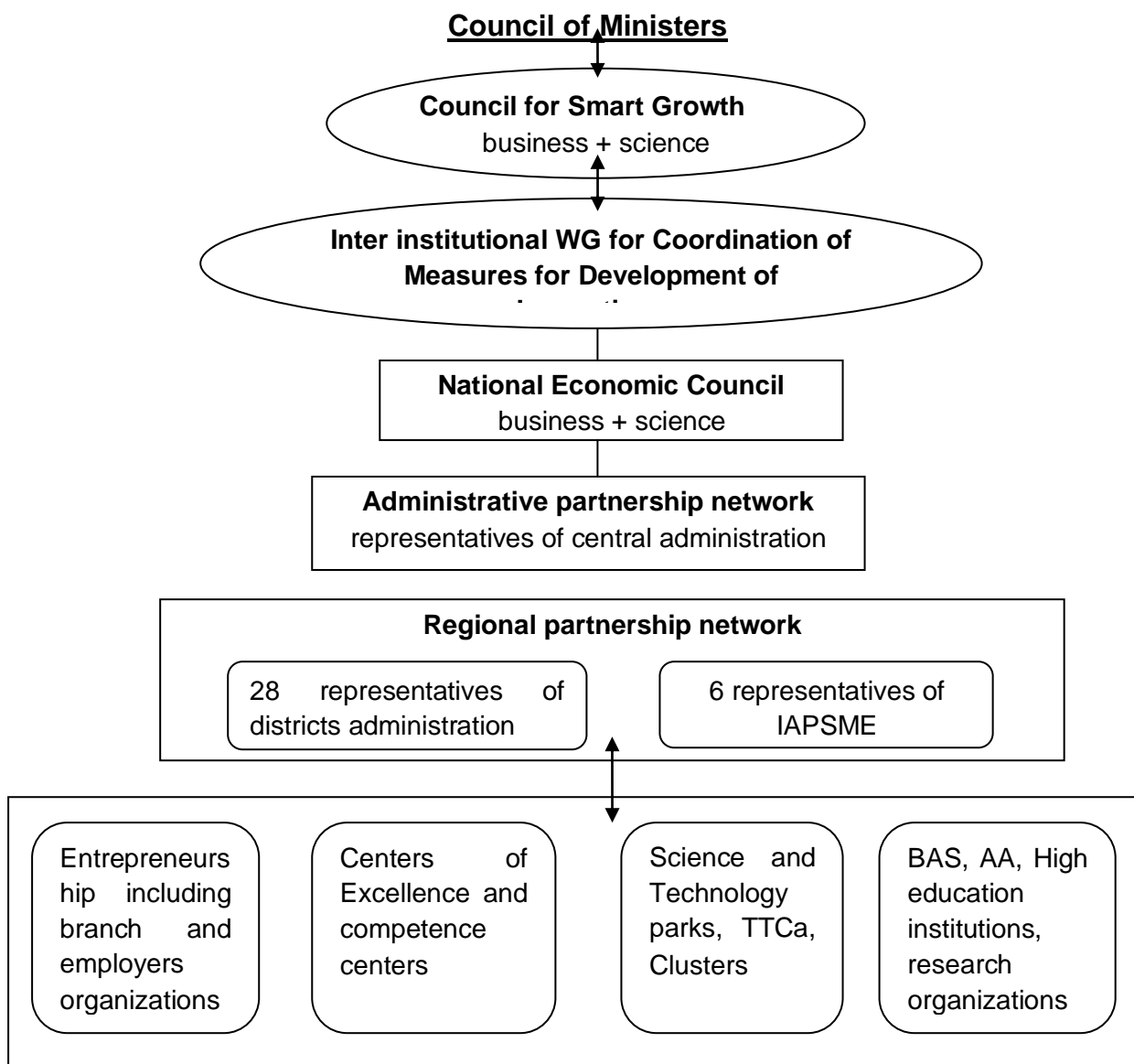


Figure 3 Organizational Structure and Dialogue with partners

The fulfilment of the responsibilities of the Bulgarian government is based on the Division of Labour Model⁴ which clearly defines the responsibilities of the Ministry of the Economy for industrial innovation and technology, the Ministry of Education and Science for the responsibility of human resources and research, the Ministry of Transport, Information Technologies and Communications – for ICT.

The danger in the model is remoteness of education and research policies from the business and limited innovation policy.

Council of Ministers

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

Council for Smart Growth

Determines the major policy areas – thematic areas, vision, strategic objectives; coordinates the implementation of IS3, monitors the implementation of IS3. The President of the Council is the Prime Minister of Republic of Bulgaria. Members of the Council are the ministers or their deputies of the responsible for the policy making in the field of science and education - Ministry of Science and Education, industrial innovation - Ministry of Economy, ICT – Ministry of Transport Information technologies and Communications, innovation in agriculture – Ministry of Agriculture and Food. In the Council, there are 4 industry representatives – prominent businessmen from the priority technology sectors of the economy and 4 representatives of the academia. The Council holds regular meetings.

National Economic Council

Analyses and proposes measures to support innovation and investment activities to increase the competitive of the economy. Draw recommendations and advice government on issues of general economic development of the country. Develops and offers economic and legislative regulations to encourage investments in the country. Organize, analyse and control the interaction between the executive authorities, other public bodies and the business. It may establishes a working groups on specific issues related to direct fulfilment of its functions.

The coordination of the policies of the responsible ministries is carried out by a **peer network at central level under the auspices of the Minister of Economy.**

Financial instruments for the realization of IS3 are Operational Program Innovation and Competitiveness, Development of Human Resources and Science and Education for Smart Growth – with EU funds and from the state budget.

Policy coordination at regional level will be carried out by the **partnership network at regional level** under the auspice of the Ministry of Economy. It includes representatives of 28 regions.

⁴ Input for Bulgaria's Research and Innovation Strategies for Smart Specialization, World Bank

System of monitoring and evaluation of IS3

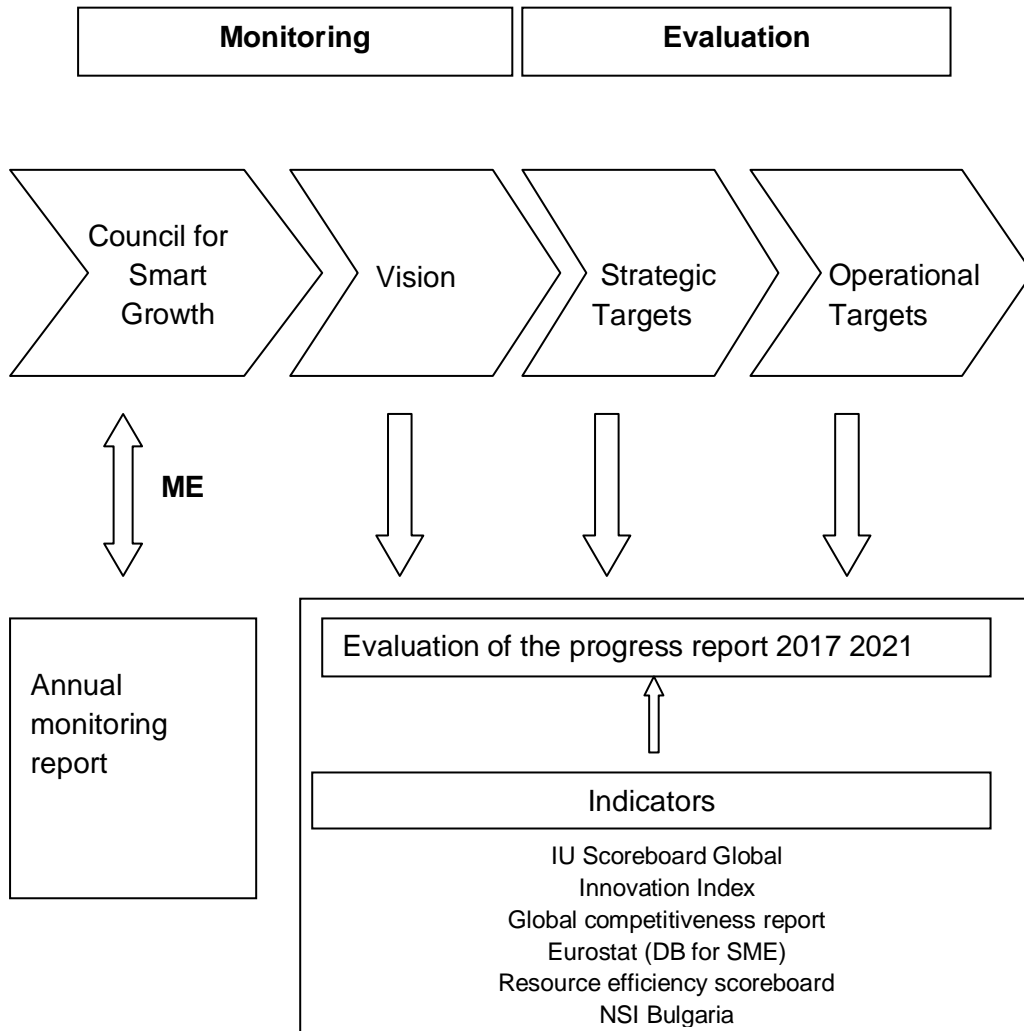


Figure 4 Proses of monitoring and evaluation of IS3

The annual report is prepared by Ministry of Economy and it 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 States⁴⁵;
- Review the on-going innovation policy in Bulgaria and making proposals for policy changes, if necessary

2.2 Bulgaria's Smart Specialisation Strategy (IS3)

Smart Specialisation is a strategic approach to economic development through targeted support to Research and Innovation (R&I). It will be the basis for Structural Fund investments in R&I as part of the future Cohesion Policy's contribution to the Europe 2020 jobs and growth agenda. More generally, smart specialisation involves a process of developing a vision, identifying competitive advantage, setting strategic priorities and making use of smart policies to maximise the knowledge-based development potential of any region, strong or weak, high-tech or low-tech. Bulgaria's Innovation Strategy for Smart Specialization goal is Bulgaria to move from the group of "modest innovators" into the group of "moderate innovators".

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;

IS3 is based on the analyses and conclusions of the implementation of the Innovation Strategy of the Republic of Bulgaria (2004) and lessons learned from the implementation of the Operational Programme "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 Programme⁵, National Development Program Bulgaria 2020⁶. IS3 is being developed and will be implemented nationwide in coordination and to supplement the National Strategy for Scientific Research 2020⁷, National Roadmap for Research Infrastructure⁸. IS3 is coordinated with the "National Strategy for the Promotion of Small and Medium Enterprises 2014-2020"⁹, 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)¹⁰ and the National Concept for promotion of active life among old people (2012-2030)¹¹.

⁵ http://ec.europa.eu/europe2020/pdf/csr2016/nrp2016_bulgaria_en.pdf

⁶ <https://www.eufunds.bg/archive/documents/1357828564.pdf>

⁷ <http://www.strategy.bg/StrategicDocuments/View.aspx?lang=bg-BG&Id=684>

⁸ https://ec.europa.eu/research/infrastructures/pdf/roadmaps/bulgaria_national_roadmap_2010.pdf#view=fit&pagemode=none

⁹ <https://www.mi.government.bg/en/themes/national-strategy-for-small-and-medium-sized-enterprises-2014-2020-small-business-act-11-285.html>

¹⁰ <http://www.strategy.bg/StrategicDocuments/View.aspx?lang=bg-BG&Id=778>

¹¹ <http://www.strategy.bg/StrategicDocuments/View.aspx?lang=bg-BG&Id=764>

During this planning period it is not provided for the development of innovative strategies for smart specialization on regional level (classification NUTS II), however the needs and challenges at regional level are the basis of this document and a key element in the strategy implementation.

2.3 Concept for introduction of Industry 4.0 in Bulgaria

Bulgaria is lagging behind the introduction of Industry 4.0.

Bulgaria ranks 27th among the 28 EU Member States, according to the European Commission's Digital Imaging Index¹² (DESI) index for 2016. Bulgaria falls into the group of lagging countries that show results below the average for the EU and are progressing more slowly than the EU as a whole. Bulgarians using the Internet on a regular basis carry a wide variety of online activities, but generally the low levels of digital literacy hinder their widespread use by citizens and businesses.

The European Commission (EC) identifies the business in Bulgaria as insufficiently innovative and the rate of innovation is very small - 1.8%. This places the country at one of the last places in the European Union (EU) where this percentage is 2.5%.

The EU has developed a methodology for reporting EU Member States' progress towards a digital economy and a digital society based on five key indicators - connectivity, human capital, internet use, digital integration, digital public services, research.¹³

Bulgaria is still lagging behind in the digitization of business. In the field of e-commerce, SMEs rarely sell online and their e-sales turnover is the lowest in the EU.

Although more than half (58%) of Bulgarians are connected online, two thirds have no basic digital skills and the number of graduates in science, engineering, engineering and mathematics has not increased despite the growing labour market demand for such experts. Studies have shown that Bulgarians use a lot of internet for video chatting and social networking, but they do far fewer online activities than others in the EU.

It is noted that Bulgaria has made progress in providing public online services, making it one of the EU countries defining the new trends. However, citizens do not use e-government services as others in the EU.

Bulgaria's achievements in terms of human capital are well below the EU average. Despite the availability of highly qualified Bulgarian specialists in the field of Information and Communication Technologies (ICT), there is a shortage of programmers in Bulgaria.

The implementation of digital technologies by enterprises in Bulgaria is below the EU average and progress in this area is limited. Although more and more small and medium-sized enterprises (SMEs) are selling online, their number remains small - 6% in the country and 3% in other EU Member States.

¹² The DESI index is an online tool that measures the progress of EU Member States towards a digital economy and a digital society.

¹³ <https://ec.europa.eu/digital-single-market/en/european-digital-progress-report>

It is important to note that 74% of the ICT companies are export-oriented and this limits the use of their services on the national market.

A PWC survey among 103 business representatives in Bulgaria shows that despite the confidence in companies' growth over the next three years and the willingness to hire staff, the majority of Bulgarian managers are unaware of the importance of technological changes on the business or the technological prerequisites for new business models¹⁴.

The relative share of enterprises whose business processes are automated with those of their suppliers and / or customers for 2015 is highest for large companies with more than 250 employees - 34% respectively. For small and medium-sized companies, it is relatively low - below 25% of these organizations use automation in supply chain management.

The Concept for introduction of Industry 4.0 in Bulgaria was elaborated and approved by the Bulgarian Parliament in April 2017. It is the prerequisites for the modernization, automation and competitive positioning of the Bulgarian economy in the medium to long term period 2017 – 2030. The concept is in support of the ISIS and the priority area "Stimulating the wide use of ICT by enterprises, especially SMEs, citizens and the public sector, to address the major economic and social challenges.

In general, the results for the implementation of Industry 4.0 are in line with those of IS3 - by supporting competitiveness and attracting attractive foreign direct investment.

The vision of the concept is by 2030 Bulgaria to be recognized as a regional centre of the digital economy through the deployment of technologies, business models and processes from Industry 4.0 and the ubiquitous use of digital technologies in manufacturing processes.

The main area of intervention is the Digitalization of business, export orientation and competitiveness (in order to reach the average European level of the DESI index).

- Intervention 1 Accelerated integration of Bulgaria in European and international programs, initiatives and networks related to the development and implementation of Industry 4.0.
- Intervention 2 Technological upgrading of the Bulgarian economy through introduction of standards, construction of infrastructure, development of specific mechanisms to stimulate the development and market introduction of technological innovations (new products, services and production processes) through the technologies of Industry 4.0.
- Intervention 3 Building human, scientific, organizational and institutional capacity for development of Industry 4.0 in Bulgaria.

¹⁴ PwC's Global Survey of Business Leaders (CEO Survey) is being drafted for the 20th time. It includes 1379 top managers from 79 countries. In Bulgaria, the consultation is held for a second consecutive year. 103 business representatives in the country were interviewed, 54 per cent of them operating in the consumer goods and services sector, 33 per cent in the financial sector and 13 per cent in technology and communications. Polls were conducted between September 26 and December 5, 2016

2.4 International dimension

Bulgaria is a part of EU Strategy for Danube Region and the EU Strategy for the Black Sea. The important factor which will support the development of the innovative and high-tech potential of Bulgarian business 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. Bulgaria has taken steps to join the SP "Biotechnology" (BBI), "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.

3 Support environment

Supporting institutions for business oriented SMEs are chambers of commerce, chambers of crafts, centres of excellence, research centres, development centres, competence centres, technology centres, technology parks, incubators and other operating in the eligible program area.

All these institutions promote the emergence of new competitive companies that promise high added value and equitable regional development. Incubators support the realization of entrepreneurial ideas, the creation and development of enterprises, stimulating environment, subsidised leases of premises and administrative, intellectual services and other services for its tenants. Technology parks in one location bringing together business development, research and operations of new technology companies, its members while offering a supportive environment consultancy, easy exchange of information, transfer of knowledge, the necessary infrastructure and the like.

3.1 Cluster

Clusters represent a form of informal networking among businesses and other organizations in the sector in a given geographical area, which offers plenty of benefits of cooperation. Connectivity is based on common interests, the basic idea of clustering is based on cooperation, including companies that have market competition, which is somewhat illogical, but understandable since it is a common interest in development cooperation, transfer of knowledge and the development of new competences.

Organizational forms of business clusters are different and depend on each cluster, scope and content. All clusters have in common is that it is a common entrepreneurial activity in a particular environment, focused on the broader global market. Companies within the cluster are specialized and complementary but competing at the same time. In this way may be associated companies acquire larger and more complex transactions that create higher added value and increase their visibility in the market. Membership and participation in the cluster of micro, small, medium and large companies makes contact with partner organizations abroad. These may be companies, institutes, universities and other organizations of interest in terms of members. Organizations and individuals to find themselves in a network of international projects and partners from all over Europe or even the world's countries.

The objective of fostering the entrepreneurial clusters is to strengthen the infrastructure established at local, regional, national and international level and support the identified clusters at a certain level. Cooperation in research and development projects, the members of the cluster enables learning, networking and the development of competencies. Companies can spend a lot of time developing and training, participate in workshops, development and innovation of business models and the like. For micro, small and medium-sized enterprises means integration

into clusters, a good opportunity and solution to consolidate its position in the domestic market and the penetration of foreign markets. Affected companies easier to overcome challenges in the areas of foreign market entry, promotion, marketing, take on larger and more complex transactions, investments, technological development, and so on.

In Europe, there are more than 2,000 different industrial clusters, of which there are about 150 of those who are among the leaders in the world in terms of focus, specialization, size and employment. Around 40% of European jobs is based on clusters; and clustering of micro, small and medium-sized enterprises leads to more innovation and growth.

3.2 Clusters in Bulgaria

Development and Implementation of cluster policy is a proven way to increase the competitiveness and internationalization of SMEs. Bulgaria has supported cluster development since 2004 with the financial support of PHARE program. During the implementation of OP” Competitiveness 2013 -2017 development of clusters was supported by concrete schemes “Support for cluster development in Bulgaria,” with total amount of 15.100 mil euro.

According to CIELA¹⁵ there are 190 operating clusters in Bulgaria but after the performed analysis by the Association of Business Clusters¹⁶ in Bulgaria the real operating organizations as clusters are not more than 10.

Current operational program Innovation and Competitiveness has introduced categorization system in order to evaluate the level of development of the clusters organizations applying for financial support (developed, developing and new). The financial support for the tree groups will be different according the categorization. ¹⁷Here is the list of developed clusters in Bulgaria, which respond to the National Strategy for Smart Specialization and are connected with Manufacturing:

1. Automotive Cluster Bulgaria
2. Bulgarian Furniture Cluster
3. Industrial Cluster Srednogorei
4. Bulgarian Telecommunication Cluster

¹⁵ CIELA is the main informational system in Bulgaria.

¹⁶ <http://abclusters.org/en/>

¹⁷ See page 24. Innovation Strategy for Smart Specialization of Bulgaria

3.3 Centres of excellence and Centres of competence

Centres of Excellence and Centres of Competence are measures for development of the scientific and research infrastructure of Bulgaria financing under Priority Axes 1 of the Operational Programme Science and Education for Smart Growth 2014-2020. They are seen as hubs of high – quality research and innovation for priority areas of RIS3 in Bulgaria as well as complementarity investment for the implementation of national target for 1,5 % investment of GDP in R&D¹⁸.

In August, 2016 Bulgarian Ministry of Education and Science announced 2 call for project proposals under Priority Axis 1 "Research and Technological Development":

- "Establishment and Development of Centres of Excellence¹⁹" with a budget of 200 million BGN;
- "Construction and Development of Centres of Competence²⁰" with a budget of 150 million BGN;

The deadline for project proposal submission was 23.01.2017.

The calls will support the creation of 1 centre of excellence and two centres of competences.

44 project proposals have been submitted under the two procedures.

Under the H2020, Teaming call Phase 1, 2 centres of Excellence in Bulgaria was been funded and start implementation.

- PlantaSYST - Establishment of a Centre of Plant Systems Biology and Biotechnology for the translation of fundamental research (Medicine, Life Sciences); EU Contribution EUR 494 726 EUR

PlantaSYST is a joint initiative of three Bulgarian research institutes located in Plovdiv (Institute of Molecular Biology and Biotechnology, Maritsa Vegetable Crops Research Institute, and the Stefan Angeloff Institute of Microbiology, Laboratory of Applied Biotechnology) and two institutes located in Potsdam, Germany (Potsdam University and Max Planck Institute of Molecular Plant Physiology).

The ambition of CPSBB is to stand at the forefront of plant sciences in Bulgaria and Eastern Europe by integrating molecular biology, functional genomics, metabolomics, bioinformatics, bioprocessing, and long-standing expertise in practical plant genetics and breeding, to unravel the plant biology and translating the scientific knowledge into new horticultural and industrial applications. The CPSBB will take a leading role in educating next-generation early-stage researchers (ESR) in the fields of molecular breeding, plant systems biology and biotechnology.

¹⁸ See page 36. Operational Programme Science and Education for Smart Growth 2014-2020

¹⁹ <http://sf.mon.bg/?go=news&p=detail&newsId=412>

²⁰ <http://sf.mon.bg/?go=news&p=detail&newsId=411>

- MAC - Mathematical Modelling and Advanced Computing (ICT); EU Contribution - 370 299 Euro

The goal of the project is to present a long term vision for a new Centre of Excellence (CoE) for Mathematical Modelling and Advanced Computing in Science and Engineering and a business plan for its establishment. The founders of the center are the two leading scientific institutions in Bulgaria in the area of Mathematical Modelling and Advanced Computing – the Institute of Information and Communication Technologies (IICT) – coordinator, and the Institute of Mathematics and Informatics (IMI), both from the Bulgarian Academy of Sciences, jointly with the advanced partner Vienna University of Technology (TU Wien).

The CoE concentrates its activities in four key areas with high potential for first-rate scientific achievements and innovations: (i) Mathematical Modelling; (ii) Advanced Computing; (iii) Content Technologies, Intelligent Interfaces and Knowledge Processing; (iv) Flagship Applications in Science and Engineering. They are primarily focused on scientific excellence and technology breakthroughs.

The CoE is supported by the e-infrastructure "National Centre for High Performance and Distributed Computing", which combines hardware, software, middleware, and services, coordinated by IICT. This infrastructure is a part of the Bulgarian National Road Map for Research Infrastructures.

The CoE is aimed at developing new mathematical approaches and advanced computing tools for efficient solutions of problems with high scientific and social impact.

The expected impact includes development of new approaches based on the most recent achievements in MM and AC. The planned four key areas will significantly contribute to the priorities of all thematic areas of the Bulgarian IS3 with a particular focus on:

- 3D digitalization, visualization and prototyping;
- Big Data, Grid and Cloud technologies;
- Wireless sensor networks and wireless communication/control;
- Language technologies;
- Green economy and clean technologies;
- Personalized medicine, diagnostics and individual therapy, therapeutic and medicinal forms and tools;
- Nano-technologies in medicine.

3.4 Research centres

The research centres are institutions aimed at exploring, normally a specified area. Carry out basic and applied research, including using non-traditional techniques. They establish by many universities, with a view to implementing the specific research and educational activities. Most research centres demonstrates the scientific results of their work.

The Bulgarian Academy of Sciences²¹ is established in 1869. The Academy, located in Sofia, is autonomous and has a Society of Academicians, Correspondent Members and Foreign Members. It publishes and circulates different scientific works, encyclopedias, dictionaries and journals, and runs its own publishing house.

The Bulgarian Academy of Sciences is the biggest national research organization, which comprises 41 research institutes, united in nine research fields., more broadly united under three main branches: Natural, mathematical and engineering sciences, Biological, medical and agrarian sciences and Social sciences, humanities and art. Each consists of independent scientific institutes, laboratories and other sections.

The Academy is the nation's foremost scientific organization that conducts basic and applied research in the fields of the natural, technical and social sciences. BAS also organizes training activities and participates in the formulation of the national policy for science and technology. BAS has bilateral agreements with scientific organizations in 45 countries and such governmental organizations as WMO and UNESCO. The Academy is a member of more than 20 international nongovernmental organizations. It has its own publishing house.

3.4 Technology Parks

Technology and Innovation Network (T+IN)

<http://sofiatech.bg/en/>

Technology and Innovation Network (T+IN) or "Sofia Tech Park" is the first science and technology park in Bulgaria designed and created to act as a platform for the exchange of knowledge and ideas between academia, business, government and society. Sofia Tech Park JSC was founded in early June 2012. It is owned by the Ministry of Economy and the State Consolidation Company. The Park has the following main objectives:

- Strengthening the competitiveness of science and entrepreneurship in Bulgaria by improving the exchange of knowledge between academia and the business community
- Becoming a platform for the development of start-up companies and innovative ideas
- Accelerating the process of commercialization of research.

The park has several infrastructural parts:

- **Experimentarium** - A space open to the general public where visitors and students can interact with science and technology, while companies could present their innovative products. The Experimentarium is the place where everyone can see clearly the results of scientific research and technological transfer. Here, one can also enjoy the presentations of various innovative services and products, equipment and machinery.
- **Incubator** – This place is specifically designed for working, networking and supporting startup companies to develop their ideas into successful business ventures, while it also provides them with the opportunity to access various funding sources. This is the place that gathers young entrepreneurs, mentors, accelerators and investment funds under the same roof. The incubator is intended for startup and spin-off companies that need help in the first years of their existence. The incubator can provide such companies with

²¹ <http://bas.bg/>

consulting services, fully equipped office space, conference halls for shared use, workshop space with a prototyping equipment, recreational areas, etc

- **Innovation Forum** - is a meeting place and a hosting venue for various events. It facilitates the formation of an ecosystem in the field of high tech knowledge and innovation transfer, as it offers scientists and entrepreneurs the opportunity to exchange knowledge and ideas.
- **Laboratory Complex** is one of the keystones of T+IN, consisting of 11 laboratories and managed by an independent consortium, established specifically for that purpose. Among the members of the consortium we can see some of the leading academic institutions such as Sofia University, Technical University of Sofia, Medical University of Sofia, and the Bulgarian Academy of Science. Laboratories within the complex carry out independent and collaborative research and development activities.

Bioinformatics Lab – BioInfoTech

The main objective of the lab is to develop the capacity of Bulgarian science in the field of bioelectronics, bioinformatics and biotechnology. It's role is also to establish itself as a modern centre for technological knowledge, scientific research, education and training of professionals, research and development activities and innovation.

Biopharmaceutical Laboratory Complex – BioPharm

It includes three well integrated laboratories and a supporting analytical centre:

- Laboratory for extraction of natural products and synthesis of bioactive compounds;
- “In vitro” laboratory for evaluation of biological activity and toxicity;
- Pharmaceutical development and characterization and “In Silico” design.

The lab complex is designed to perform problem-driven and industry oriented R&D directed to efficient, value-added and environmentally-friendly utilization of the national bio-resources and valorization of industry by products and bio-wastes to obtain products with high added value.

Artificial Intelligence and CAD Systems Laboratory

The laboratory aims, in collaboration with research organizations and industrial clusters, to become a leading centre that facilitates the access to specialized software and CAD systems and contributes to the development and maintenance of highly qualified specialists in the field of artificial intelligence.

Intelligent Communication Infrastructures Laboratory

The laboratory aims to create a unique platform for validation and certification of industrial solutions and components in the railway signalling sector (ERTMS) and board computers.

Micro Nano Lab – MINOLab

The laboratory aims to create, maintain and develop an environment for applied and innovative scientific research, testing, analysing, designing and prototyping in the field of micro- and nano electronics, bioelectronics and nanotechnology applications. The main objective of the lab is to solve problems and tasks arising from applications in electronics, microelectronics and nano electronics, development of high-tech, affordable methods and tools for design, modelling and testing.

Cyber Security Lab

It is the laboratory's mission, within five years of its opening, to become a regional Eastern European center of competence on the issues of cyber security, to perform scientific research activities

3D Creativity and New Products Rapid Prototyping Laboratory

The main objective of the rapid prototyping laboratory is to develop a research capacity for the application of innovative technologies for materialization of virtual 3D models with complex forms in a very short time. This lab's mission is to create innovative practices and to build unique and accessible opportunities for research and development in the field of 3D creativity through systems for quick physical manifestation of new ideas and products in order to shorten the time to market. and create partnerships on a global scale.

High Performance Computing Laboratory

The mission of the HPC laboratory is to deliver reliable, sustainable computing resources and services to facilitate the use of high performance computing and to meet the small scale and midrange computational demands of the scientific research community in the academic institutions and high-tech SMEs located all over the country and the region.

3.5 University and Business incubators

The primary purpose of the incubators is to increase the potential for growth and survival of young firms by providing modular buildings, common technical infrastructure, managerial support and other support services. Business incubators are support organizations that assist in the creation, speeding up and long-term performance of the companies in that they provide space for the operation, advisory services, and opportunities for networking and collaboration with other companies.

Here is the information for University and Business Incubators in Bulgaria

Sofia Tech Park Business Incubator

The Sofia Tech Park Business Incubator has about 6,200 square meters of office space designed for start-ups that develop innovative products in the three major focal areas of the Science and Technology Park - Information and Telecommunication Technologies, Life Sciences and Green Energy. The space is specially designed for office, networking, and start-up companies to develop their ideas in a successful business, as well as access to different sources of funding.

Already 30 high technology companies, including 25 start-ups, work and develop their innovative business ideas in the Sofia Tech Park office areas. At present, incubator members are companies that offer IT services, software innovations in livestock, security, create new products, develop new materials, and more. Here are well-established organizations such as Cleantech Clean Technology Network, Microsoft Innovation Center, Eleven Accelerator, Tech Tour Network, Junior Achievement Bulgaria.

Business Incubator in Ecobiotechnology at Sofia University

The Business Incubator for Students and PhD students in the field of eco-biotechnology was created with the financial, intellectual and material participation of the Sofia Waste Treatment Enterprise and the Ecological Biotechnology Master's Program. Partners are the Faculty of Biology of the Sofia University "St. Kliment Ohridski" and the Sofia Municipality. The Incubator conducts training in green technologies for biogas, compost, water purification from household waste degradation, quality standards and risk management.

Business incubator JUNIOR at Rousse University

Founded in 2002 by the University of Rousse in cooperation with the Business Center for Support of Small and Medium Enterprises. The incubator prepares young people for real business conditions.

High-Tech Business Incubator – Burgas

Supports the creation and development of high technology, their popularization among industrial companies and the public, as well as the organization and conduct of courses, seminars. Marketing and consultancy assistance for start-ups and established companies and businesses.

High-Tech Business Incubator – Varna

Created in 2002 by the Regional Agency for Entrepreneurship and Innovation - VARNA together with the Ministry of Regional Development and Public Works. The Objectives of the incubator are directly linked with the Agency's activities: To support starting and active high-technology SMEs in the high-technology sector; To create appropriate innovative environment for development of Regional SMEs in the high-technology field and strengthening the level of their competitiveness; To help the increase of the high-technology production share in North-East Region districts; To stimulate technology transfer; To create conditions for the development of highly qualified young specialists; To turn the High-Technology Business Incubator into Regional innovative centre; To develop a High-Technology Park; To create conditions for technology-oriented enterprises to commercialize their innovative products; To create conditions for attracting local and foreign investors.

4 Smart Factory support schemes and programmes

The Smart Factory activities are supported mainly by two operational programs: Operational program Innovation and Competitiveness and Operational Program “Science and Education for Smart Growth”

Operational program “Innovation and Competitiveness”

The program has direct impact to the smart growth (under priority axes 1, 2) and sustainable growth (under priority axes 3 and 4), aiming at complementary effect in terms of inclusive growth. OPIC has the following objectives:

- Increasing the competitiveness of the economy by providing a favourable business environment, promoting investments, applying innovative solutions and increasing resource efficiency.
- Support innovation and investment activities to increase the competitiveness of the economy;
- Energy security and increasing resource efficiency

The contribution of OPIC 2014-2020 to addressing the main needs and challenges of the Bulgarian economy restated Industry 4.0 are the following:

- Technological development and innovation – interventions under TO 1 (Investment priority (IP) Art. 5(1) (b) of ERDF Regulation;
 - Access to finance for supporting entrepreneurship– interventions under TO 3 (IP Art. 5(3) (a) of ERDF Regulation;
 - Capacity for SMEs growth– interventions under TO 3 (IP Art. 5(3) (d) of ERDF Regulation;
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Table 1 Overview of the investment strategy of OPIC on Priority Axes 1 and 2

Priority Axis	Fund	Union Support (EUR)	Proportion of total Union support for the OP	Thematic Objective	Investment Priority	Specific objectives corresponding to the investment priority	Common and programme-specific result indicators
Technological development and innovation	ERDF	250,990,169	85%	TO 1 Strengthening research and development, technological development and innovations	Technological development and innovations	Increased innovation activity of enterprises	Share of innovative enterprises; Non-R&D innovation expenditure
Entrepreneurship and Capacity for growth	ERDF	97,217,060	85%	TO 3 Enhancing the competitiveness of SMEs	Access to finance for supporting entrepreneur	Improving the survival rate of SMEs including	Number of enterprise survivals up to two

					ship	through stimulating entrepreneurs hip	years
Entrepreneurship and Capacity for growth	ERDF	495,651,181	85%	TO 3 Enhancing the competitiveness of SMEs	Capacity for SMEs to grow	Strengthening productivity and export potential of Bulgarian SMEs	Export volume of goods and services achieved by SMEs Productivity of SMEs

Expected results from the implementation of OPIC:

- supporting more than 7,000 enterprises;
- mobilizing more than EUR 1 bln. private investments;
- increasing the share of innovative enterprises;
- increasing the productivity of SMEs;
- contribution to reducing the energy intensity of the economy

Operational Program “Science and Education for Smart Growth”

The OP Science and Education aims to identify systematic and targeted interventions to promote the regional smart specialization and the integration of the scientific organizations and key economic entities, in order to improve the overall economic development of the regions outside Sofia city.

Based on the identified challenges in Bulgaria’s research and innovation environment, the OP Science and Education will support actions in the three following fields:

- Creating and developing Centres of Excellence (CoE) and Centres of Competence (CoC) in the RIS3 areas. These centres will address the need for building modern research complexes which are focused on the areas with the greatest potential to increase the competitiveness of the Bulgarian economy.
- Improving the territorial and thematic distribution of research infrastructures, with a view to regional smart specialization. The investment will be focused on leading scientific organizations with proven achievements and capacity to develop in the RIS3 areas, with a special focus on creating partnerships with the regional business. The activities will facilitate the transfer of knowledge and practices from the science and education sector to the business, and higher education will be tuned to the needs of the labour market in terms of highly-skilled professionals.
- Increasing the participation of Bulgarian researchers in international cooperation. In order to involve actively Bulgarian researchers in the European Research Area, support will be given to centres and consortia which have the potential to effectively participate in Horizon 2020 Programme or/and could play an important role in the implementation of the ESFRI Roadmap, as long as the above conditions fall within the scope of the priority areas of RIS3.

4.1 Financial environment

Bulgaria is a country in which SMEs have free access to financing in all phases of the life cycle of an enterprise of seed and start-up capital through venture capital, growth capital, mezzanine financing and credit guarantees. Creditors' rights are protected, and the payment of debts incurred becomes time.

4.2 IS3 Support measures

The RIS3 supporting measures are connected with the several operational programs and funds supporting the development of innovation, science and research.

4.2.1 Operational Programme Science and Education for Smart Growth 2017-2020

OP Science and Education aims to increase significantly the funding in R&D activities, mobilizing both public and private investments, with a special focus on research excellence; provide systemic support to market-oriented R&D activities and develop leading research centres, equipped with modern research infrastructure and equipment, able to conduct top-level research and innovations at European level.

Bulgaria's research system remains highly concentrated in institutional and geographic terms. The top five institutions, all of them being located in Sofia city region, produce about 75% of the total publications. The other major research hubs are Plovdiv, Varna and the Danube region, and in particular Ruse and Pleven. With few exceptions, most of the collaboration between universities and industry are based on the historical development of the research organisations and schools of higher education, without systematic development of those specific research structures (laboratories, specialised equipment, etc.) which could provide business-oriented services in the public research organisations. The OP Science and Education aims to identify systematic and targeted interventions to promote the regional smart specialisation and the integration of the scientific organisations and key economic entities, in order to improve the overall economic development of the regions outside Sofia city.

Based on the identified challenges in Bulgaria's research and innovation environment, the OP Science and Education is supporting actions in the three following fields:

- Creating and developing Centres of Excellence (CoE) and Centres of Competence (CoC) in the RIS3 areas. These centres will address the need for building modern research complexes which are focused on the areas with the greatest potential to increase the competitiveness of the Bulgarian economy.
- Improving the territorial and thematic distribution of research infrastructures, with a view to regional smart specialization. The investment will be focused on leading scientific organisations with proven achievements and capacity to develop in the RIS3 areas, with a special focus on creating partnerships with the regional business. The activities will facilitate the transfer of knowledge and practices from the science and education sector to the business, and higher education will be tuned to the needs of the labour market in terms of highly-skilled professionals.
- Increasing the participation of Bulgarian researchers in international cooperation. In order to involve actively Bulgarian researchers in the European Research Area, support will be given to centres and consortia which have the potential to effectively participate in Horizon 2020 Programme or/and could play an important role in the implementation of the

ESFRI Roadmap, as long as the above conditions fall within the scope of the priority areas of RIS3.

4.2.2 National Innovation Fund

The strategic goals of the National Innovation Fund are to increase the competitiveness of the Bulgarian economy through the encouragement of market-oriented applied research for the needs of industry as well to create the necessary background for public investments in innovations according to the Innovation Strategy of Bulgaria.

The operational goals of the fund are:

- To subsidize part of the costs for market-oriented applied research, R&D projects intended to be implemented in the industry.
- To fulfil the measurements stated in the Innovation strategy
- To make use of the opportunities which are provided in the Bulgarian Law on State Aid to support the innovative companies

The fund is managed by the Bulgarian Small and Medium Enterprise Promotion Support Agency
Two kinds of projects eligible to apply for the fund are:

- Scientific applied research project
- Feasibility studies

For the subsidy may apply all legal entities registered under the Bulgarian Commercial Law in case they realize their project in the country alone or in partnership with other entities registered by the trade Law, Universities, Bulgarian Academy of Science, scientific organizations and teams. The budget of the Innovation Fund for 2005 is 5 mln. BGN.

4.2.3 The National Science and Research Fund

The national Science and Research Fund is a legal entity to the Ministry of Education and Science. It promotes the research initiatives at national, regional and international level. Six standing expert committees are operating at the NSR Fund, reflecting the priority research areas:

- mathematics and informatics,
- natural sciences, biology and medical sciences,
- agricultural sciences,
- technical sciences,
- Public sciences
- humanitarian sciences.

The standing commissions take decisions for the funds allocation by the submitted projects in compliance with the rules, included in the Research Promotion Act and in the NSR Fund statute. The key programme, in which NSR Fund is currently participating, is called "Scientific Research Potential Development". It is operating under three strategic priority modules:

- improvement of the scientific research infrastructures in the universities and research institutes;
- modernization of the scientific research equipment in the universities, specialized laboratories and research institutes.

NS fund is promoting the scientific research in the priority directions of the National Research Development Strategy through:

- financial support to the scientific organizations and the higher educational institutions based on project-programme financing;
- financing of projects, developments and demonstration projects in scientific directions, determined by the Fund;
- financing of 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 life quality, biotechnologies and ecologically clean foods;
3. New materials and technologies;
4. Cultural and historical heritage, socio-economic development and management;
5. Information and communication technologies.

4.2.4 Development of research infrastructure

During September 2010, the government approved "National Roadmap for Research Infrastructures" with Decision No 692 of the Council of Ministers. The approval of the Roadmap gives priority to seven national research infrastructures in specific scientific areas and encourages the inter-sectorial and cross-border collaboration. These infrastructures received national financing to perform feasibility studies on the readiness of the consortiums for building the facilities and on the legal aspects for regulating the maintenance activities and developing free access rights.

In 2013 the Ministry of Education and Science published an invitation for submitting offers for updating of the National Roadmap, comprising also basic criteria for their evaluation.

The process of updating passed a preliminary survey for correspondence of the offers with the basic criteria and international expert evaluation and verification with the assistance of experts of the European strategic forum for research infrastructure (EESFRI). On national level the preliminary survey was conducted by an inter-institutional working group with representatives of the Bulgarian Academy of Science, universities, NGOs and ministries.

The elaborated Roadmap is one of the factors in the process of defining the Thematic areas in the ISSS.

The assessment methodology in respect of proposals for national roadmap updates comprises the following main criteria:

1. Scientific and technological quality of the research infrastructure
2. Management capacity
3. Budget and sustainability

With a decision of the Council of Ministers No 569 of 2014 the Roadmap, which accounts for the progress related to the development of the existing infrastructures and for validation of new project proposals, was updated.

Based on the preliminary evaluations, four groups of projects were outlined:

In the field of biology and medicine:

- Infrastructure for genome, proteome and metabolome studies (with potential for accession to BBMRI-ERIC. Accession to EuroBioImaging-ERIC and EATRIS is under consideration)
- National Centre for Biological Microscopy and Biomedical Imaging Methods (potential for accession to EuroBioImaging-ERIC)
- Research infrastructure for applied genomics, pharmacogenomics and development of anti-infection agents (for the phase of feasibility study)

In the field of material science:

- Distributed infrastructure for sustainable development in the field of maritime studies (bound to the participation of Bulgaria in the European infrastructure EURO-ARGO)
- Regional Centre for Astronomical Research and Education (RCARE)
- National infrastructure for energy conservation and hydrogen energy production (for feasibility study phase)

In the field of the natural and engineering sciences:

- High-tech infrastructure for computer modelling, simulations and implementation in the industry, medicine, pharmacy, energy production, transport, etc. (member of EGI.eu and PRACE)
- Infrastructure for development and transfer of micro and nanotechnologies in the electronics and product development based on such technologies
- Searching for opportunities, after mandatory dialogue with representatives of the education, science and business, for joint activity with leading institutions and organizations in EU for CEE Regional Centre for Transferring Micro- and Nanotechnologies into Market Products

In the field of the social sciences:

- Distributed infrastructure – National interdisciplinary electronic infrastructure for culture, humanitaristics, integration and development of the electronic resources for Bulgarian language (ClaDa)
- Balkan Sociological Survey – network in the field of the social studies with regional importance (ESS)

The timely implementation is considered particularly important with view of expanding the boundaries of the knowledge in the respective fields. Two groups of projects are planned.

The first group contains nine projects, which have building readiness and are of strategic importance for Bulgaria. Based on the performed international expert evaluation according to established criteria, Nine national infrastructure complexes of national importance have been suggested. Six out of them have potential to participate in Pan-European scientific infrastructures. The suggested infrastructure complexes are as follows:

1. National University Complex for Biomedical and Applied Research (BBMRI) 44
2. Centre for Modern Microscopy for Fundamental and Applied Research in Biology, Medicine and Biotechnologies (EuroBioImaging);

3. Infrastructure for Sustainable Marine Research Development, linked also to the participation of Bulgaria in the European Infrastructure Euro-Argo;
4. Scientific infrastructure “Energy Conservation and Hydrogen Energy Production”;
5. European Social Survey for Bulgaria (ESS);
6. National Centre for Highly Productive and Distributed Calculations (EGI and PRACE);
7. National Interdisciplinary Research E-Infrastructure for Resources and Technologies for the Bulgarian Language and Cultural Heritage, integrated in the frameworks of the European Infrastructures CLARIN and DARIAH (CLADA-BG);
8. Regional Centre for Astronomical Research and Education (RCARE);
9. National Cyclotron Centre – infrastructure for applied research and innovations with educational functions in the fields of nuclear medicine, nuclear physics, nuclear energy, radiochemistry, radiopharmacy, accelerating equipment, and centralized radiopharmacy for production of PET radiopharmaceuticals for the needs of the nuclear medicine.

The second group contains five additional projects:

1. Distributed infrastructure of centres for production and research of new materials and their applications for conservation, access and e-storage of artefacts (INFRAMAT);
2. Research and innovations in the agriculture and foods;
3. Alliance for Cell Technologies – ACT;
4. National Geo-Information Centre;
5. Eco and Energy Saving Technologies

These projects have potential to reach stage of implementation readiness by 2015-2016 and will receive support for feasibility studies. Based on regular international assessment, new national infrastructures and/or building-on existing scientific complexes with regional and European importance can be suggested. The modernization of the scientific infrastructure needs combined financing for the different components of the scientific complexes, and more especially: target financing from the state budget; programme-competition financing through the National Science and Research Fund (NSR Fund) and Operational Programme “Science and Education for Smart Growth” (OP SESG); financing through the EU Framework Programmes and other financial instruments.

During the programming period 2007-2013, OP “Competitiveness” (OPC) supported the creation and strengthening of Technology Transfer Offices and Technology Centres in different economic activities:

- Research and development activity (72) – 7 centres, of which 4 in Sofia and one in each of the cities Plovdiv, Dobrich and Kazanlak;
- Education (85)– 4 centres, one in each of the cities Sofia, Plovdiv, Varna and Burgas
- Activities of non-governmental organizations (94) – 4 centres, 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 centres in Sofia;
- Human health care (86) – 5 centres, 3 of which in Plovdiv and 2 in Sofia;
- Architectural and engineering activities, technical tests and analyses – one centre in Pernik, and
- Construction of facilities (42) – one centre in Kazanlak.

Bulgaria received support during the creation of Technology Transfer Centres also through PHARE programme with negotiated funds amounting to BGN 495 259.35 (grant – BGN 371 048.00 and cofinancing – BGN 124 211,34). With the financial support of public and private organizations 9 centres were created, mainly in higher educational institutions in the cities Sofia, Ruse, Varna, Burgas, Plovdiv, Gabrovo, Veliko Tarnovo, Pleven and Lovech.

4.2.5 Human resources

The key challenges faces human resources in Bulgaria are similar to Europe:

- Needs to update the education /high, secondary and vocational/ to the needs of the industry and business.
- Brain drain

The following activities will be performed in order to secure development of the human resources in Bulgaria.

- Strengthening the link between higher education and the requirements of the labour market; stimulating the training in technical and engineering specialties; enhancing the practical application of higher education;
- Reforming vocational education and promoting lifelong learning.
- Internationalisation of innovation to further improve the quality of research and management of the phenomenon of “brain drain”

4.2.6 Activities leading to an effective research and business partnership

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, commercialisation, 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.

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 organisations 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).

Promotion of transfer, exploitation and commercialisation 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 market.

4.2.7 Entrepreneurship and innovation

The aim is to provide related, tailored and predictable/permanent support in all phases of company growth (from the pre-seed and start-up phase to the growth and maturity phase), and comprehensive support services.

4.2.7.1 Newly established enterprises and knowledge transfer

According to national report of the Global Entrepreneurship Monitor (GEM) Bulgaria²², 57.5% of the adult population in Bulgaria see entrepreneurship as a good career choice, 15.8 % stated that there are good opportunities for starting a business in the area in which they live. The level of total early-stage entrepreneurial activity in Bulgaria is 3.46%, including 1.95% of the adult population engaged in emerging entrepreneurial ventures - in the registration period and another 1.51% - new owners business - over the last 42 months. Regardless of the very low levels of this indicator in the country, a relatively large percentage of these entrepreneurial initiatives survive long enough to become established businesses.

In the recent years, entrepreneurial ecosystem in Bulgaria started to develop rapidly. Sofia established a strong network of entrepreneurial organizations and events, funds and business angels, successful companies, and entrepreneurs and in 2015 it was proclaimed by Forbes as one of the top 10 destinations for business start-ups.

²² 2015/16 GEM National report on entrepreneurship in Bulgaria: Baseline of the Bulgarian entrepreneurship ecosystem - http://bvca.bg/wp-content/uploads/2015/12/GEM_Bulgaria_1516-Annual-Report-EN.pdf

The IT industry in Bulgaria is one of the main causes for the development of the entrepreneurial environment in the country. It consists of international companies with offices in the country, Bulgarian product companies, which are, positioned globally, a large number of outsourcing companies; as well as IT academies. The sector includes both well established businesses, which have been operating for more than a decade, as well as a significant share of newfound companies. There is an evident trend towards more active registration of digital companies in the period after 2010. However, there are also experienced companies – approximately 13% of them operate from 10 or more years²³.

Some of the key factors to attract investors in Bulgaria are: the low tax rate of 10 %, strategic location, affordable prices, access to talent and the relatively low price (in comparison to the rest of Europe and the US) at which entrepreneurs can gain access to talents. There are plenty of extremely talented developers, and the local economy is actually adjusting to the growing need for more specialists in this field. Nearly 90% of graduates can freely speak English and have quite good soft skills. In addition to this Bulgaria has the second-fastest broadband in the world after South Korea.

The creation of accelerators, the existing financial mechanisms for investment in start-up companies, and the establishment of a co-working culture stimulate the development of digital ecosystem in the country.

Accelerators and existing financial mechanisms for investment in start-up companies:

The Joint European Resources for Micro to Medium Enterprises (JEREMIE), a joint initiative of the European Commission, the European Investment Fund (EIF) and other financial institutions allocated 21 million euro into locally registered startups in the 2012-2015 period

The two funds established at two accelerators – Eleven and LAUNCHub (both set up in 2012) – have funded close to 200 startups with 21 million euro, the most successful of which have raised a further 20 million euro from third-party investors. The average investment per startup is estimated at about 120,000 euro, ranging between 25,000 and 200,000 euro per company. Most of these companies operate in IT sector. Other Bulgarian seed and Venture capital funds are NEVEQ I and II with 46 million euro under management, Black Peak Capital - co-investment fund with target tickets of \$1-7M, and Empower Capital - doesn't have a focus on tech companies and prefer to invest in the real sector.

Bulgaria has taken the strategic decision to implement the financial instruments under its operational programmes (OP) via a national investment vehicle structured as Fund Manager of Financial Instruments in Bulgaria.

²³ The first national study of the digital ecosystem in Bulgaria, conducted by EDIT.bg, <http://bvca.bg/wp-content/uploads/2015/12/innovationship-edit-report-2016.pdf>

The Fund Manager of Financial Instruments in Bulgaria EAD (FMFIB) was established by Bulgaria's Council of Ministers as a special-purpose vehicle fully owned by the State to manage the financial instruments designed to support the implementation of programmes co-financed from the European Structural and Investment Funds, i.e. OP Human Resource Development 2014-2020, OP Innovations and Competitiveness 2014-2020, OP Regions in Growth 2014-2020 and OP Environment 2014-2020, the Rural Development Programme 2014-2020 and the Maritime and Fisheries Programme 2014-2020.

Financing with risk sharing is envisaged in the following Operational Programmes with which the FMFIB has signed financing agreements:

- OP Human Resource Development 2014-2020 (OPHRD): Risk-sharing micro-finance facility for business start-ups, social enterprises and vulnerable groups of individuals;
- OP Innovations and Competitiveness 2014-2020 (OPIC): Risk-sharing micro-finance facility;
- OP Regions in Growth 2014-2020 (OPRG): Urban Development Funds.

Currently, OPs contribute funds earmarked for financial instruments in the total amount of 606 million euro. The financial instruments are expected to mobilize support and capital from the private sector and fully leveraged FMFIB is expected to facilitate the investment of 1.4 billion euro in the Bulgarian economy (including its own dedicated resources)

FMFIB is working actively in preparation of the Technology Transfer Fund and the Seed/Acceleration and Start-up Fund.

The Mezzanine / Growth Fund is expected to start with a budget of € 40 million from OPIC 2014-2020, with private funding expected to be nearly € 27 million. The Fund will invest in small and medium-sized enterprises (SMEs) with growth potential and a mature development phase, primarily through equity and quasi-equity. The "Mezzanine / Growth Fund" can provide access to alternative financing for high growth SMEs and expansion plans in Bulgaria and abroad, to support the expansion of production and capacity as well as the development of new products SME Initiative. The European Investment Fund (EIF), part of the European Investment Bank Group, has signed the first SME Initiative guarantee transactions in Bulgaria, with the following commercial banks: United Bulgarian Bank, Raiffeisenbank Bulgaria, UniCredit Bulbank, Procredit Bank and CIBANK.

These agreements aim to improve access to finance for over 4,000 Bulgarian SMEs, including micro companies and start-ups, by ensuring that the banks committed to the SME Initiative offer financing at lower interest rates. The five guarantee transactions will generate a total of EUR 385 million of finance to SMEs in Bulgaria, covering two thirds of the target EUR 600 million of total funding available under the initiative.

Angel financing is crucial for start-ups to get through the "death stage" but is confidential in nature, especially in nascent ecosystems. In Bulgaria, there is still not fully developed system of business angels. Unfortunately, their number here is still very small.

4.2.7.2 Growth and development of SMEs

The National SME Promotion Strategy aims to provide adequate state support for SMEs, stimulate the creation of new businesses and promote entrepreneurship. The implementation of the Strategy's objectives is a key to changing the structure of the Bulgarian economy from low to medium-tech activities to the development of high-tech sectors and intensive knowledge-based services.

Strategic goal 2.2. of the Strategy provides for State aid for SMEs to be available under all competition rules and is clearly intended to promote a more innovative and entrepreneurial business environment. The envisaged state support for this objective includes activities directly related to the digitization and implementation of elements of Industry 4.0 in the Bulgarian enterprises, such as:

- Technology transfer activities and improvement of cooperation networks between SMEs, universities, educational institutions of all kinds, regional authorities, research and development centers, science and technology parks, etc .;
- R & D support specifically for SMEs, including access to R & D services in research centers;
- Supporting SMEs to promote environmentally friendly products and production processes;
- Measures to promote e-commerce, training and education, networking for cooperation, etc .;
- Measures to improve SMEs' access to more efficient use of ICT.

The strategy also envisages the state's commitment to SME investment in energy efficiency, resource efficiency and green products and services..

In a survey of the German-Bulgarian Chamber of Industry and Commerce "Industry 4.0 in Bulgaria" more than 80% of respondents appreciate the role of digitalization in their company as "decisive" or "very significant". With regard to the current level of digitization, more than half of respondents said it was above the average. Nearly 90% of businesses up to three years have already taken steps towards digitizing processes. 64% respond that they have a department or employee responsible for this. More than 70% of respondents will invest up to 3% of their turnover over the next five years.

Prerequisites for technological change are major investments for large and small and medium-sized companies. Among the leading incentives for companies to digitize processes are increased efficiency, better planning and management, increased productivity. According to the surveyed companies, Bulgaria should be active and influence the creation of the new principles in order to secure its position in the competitive environment

4.2.7.3 Internationalisation and FDI

Two Agencies under the umbrella of Ministry of Economy are responsible for Internationalization and attracting FDI. This is Small and Medium Size Promotion Agency and InvestBulgaria Agency.

FDI

The policy of FDI promotion, mainly through the implementation of special legislation²⁴ is aimed to increase 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.

The government 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, medicine and etc;
- Information and Communication Technologies and scientific research;
- Technological and Industrial Parks for high –tech industries and innovation;

²⁴ Investment Promotion Act and its Implementation Regulations

4.3 Supporting Operational Programs

There are several ministries responsible for support of SMEs, Innovation and Digitalization in Bulgaria. They manage different funds related to information and communication technologies, SME growth and manufacturing, entrepreneurship and ect .

- Ministry of Economy is managing authority of Operational Program Innovation and Competitiveness.²⁵
- Ministry of science and education, is managing Operational Programme Science and Education for Smart Growth²⁶
- Ministry of social development, is managing the Operational program Development of Human Resources²⁷
- Ministry of Transport, Information technologies and communications responsible for development of national broadband network.

²⁵ <http://www.opcompetitiveness.bg/index.php>

²⁶ <http://sf.mon.bg/?go=page&pageId=84>

²⁷ <http://ophrd.government.bg/>