

Pursuant to Article 38 of the Law on the Planning System of the Republic of Serbia (“Official Gazette of the Republic of Serbia”, No. 30/18)

The Government adopts

**SMART SPECIALISATION STRATEGY OF THE REPUBLIC OF
SERBIA FOR THE PERIOD 2020 TO 2027**

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List of Abbreviations

4S	Smart Specialization Strategy of the Republic of Serbia
CERN	European Organization for Nuclear Research
EBRD	European Bank for Reconstruction and Development
EDP	Entrepreneurial discovery process
ERP	Enterprise Resource Planning
JRC	European Commission's Joint Research Centre
NACE	The Statistical classification of economic activities in the European Community
RIS3	Research and Innovation Strategies for Smart Specialisation
UNIDO	United Nations Industrial Development Organization
VR	Virtual reality
GCI	Global Competitiveness Index
AP	Action Plan
GVA	Gross Value Added
GDP	Gross Domestic Product
GMO	Genetically Modified Organism
EC	European Commission
WB	Western Balkans
R&D	Research and Development
ICT	Information and Communications Technologies
IPA	Instrument for Pre-accession Assistance
IT	Information Technologies
CI	Creative Industries
KET	Key Enabling Technologies
IMF	International Monetary Fund
MSMEs	Micro, small and medium enterprises
MoE	Ministry of Economy
MoESTD	Ministry of Education, Science and Technological Development
MoAFW	Ministry of Agriculture, Forestry and Water Management
SMEs	Small and medium enterprises
MNC	Multinational companies
SRO	Scientific Research Organizations
DAS	Development Agency of Serbia
RoS	Republic of Serbia
RPPS	Republic Public Policy Secretariat
S3	Smart Specialization Strategy
FDI	Foreign direct investments
IF	Innovation Fund
SDG	Sustainable Development Goals

I GENERAL VISION

Serbia Creates Innovations

The Smart Specialization Strategy Serbia (4S) represents a part of a new paradigm of innovation policy which gathers decision-makers, academic and business communities and civil society with the aim of raising the competitiveness of the economy, economic growth and progress of the society through connection research, industrial and innovation forces with a limited number of priority economic areas. Directing resources to areas with the highest competition and innovation potentials, 4S helps the domestic economy to more efficiently use its potentials and better position itself in global markets and international value chains. By developing innovations, science and technology in identified priority areas, 4S is creating prerequisites for sustainable growth of the Republic of Serbia, simultaneously supporting structural diversification of the Serbian economy.

As a result of the overall entrepreneurial discovery process – EDP that was based on previously prepared analyses and implied an oriented dialogue between crucial representatives of the economic, academic, government and civil sectors, a summary review of a vision translated into individual priority areas is depicted on the following picture:

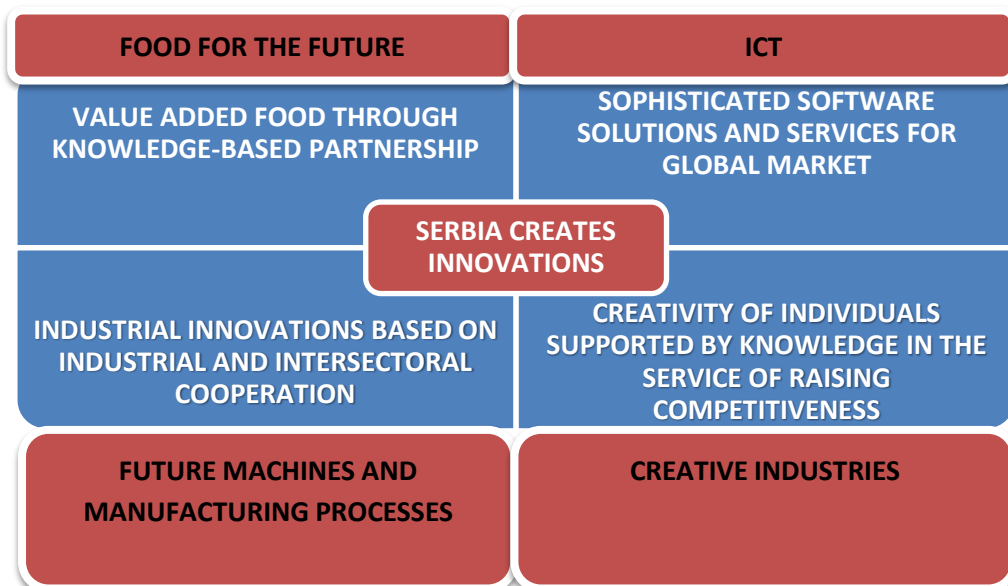


Figure 1. General vision and specific visions of priority areas

General vision of the Smart Specialization Strategy Serbia reads as follows:

Serbia Creates Innovations - Smart and creative Republic of Serbia, highly competitive in the world, recognized by its knowledge-based innovations, partnerships from domestic ecosystem and creativity of individuals in areas of:

- **Sustainable high-technology production of high value-added food for the future**
- **Sophisticated software solutions for global market and**
- **Inter-sectoral-based industrial innovations.**

General vision means that as of 2027, the Serbian economy will to a great extent be based on knowledge and innovations. Crucial priority strategy areas will be supported to create greater competitiveness and better positions in global supply chains. The Government will support through targeted measures an increase of innovation capacities of domestic companies which will lead to change in business models

and transfer to activities with greater added value and competitiveness based on innovations. The domestic scientific research sector will be stimulated to initiate cooperation with the business sector during the implementation of developmental and innovative activities to facilitate a more efficient production and logistic processes and greater implementation of information and communications technologies in intelligent applications in the industry.



As a result of planned measures of the Smart Specialization Strategy and other related policies, through innovations of products and processes, the business sector will become globally more competitive and will be linked to supply chains of other companies in a wider region in fast growing markets. Employment in a sophisticated production sector and information services will increase. In order to eliminate negative trends of lagging behind in innovations and of marginalization of companies, an efficient systemic support to companies based on combination on a long-term expert aid and financing will be created. By the year 2027, companies will use capacities of research, development and innovation centers, which will be supported for the needs of priority sectors of smart specialization, which will develop products, technologies and materials for the needs of a new generation.

II FRAMEWORK FOR ADOPTION OF SMART SPECIALIZATION STRATEGY

2.1. Socio-economic context

Socio-economic context of adoption of 4S is significantly different in the Republic of Serbia, not only relative to developed countries of the European Union, including relatively new members who in the past decade passed through transition from socialism and planned economy to the open market economy, but also relative to other countries of the former Yugoslavia in which socio-economic environment was formed on foundations and heritage of self-managing socialism as a unique failed attempt to establish a quasi-market economy where workers assume the role of owners and managing bodies of companies. The transition process in the Republic of Serbia started almost two decades later, on different foundations, under conditions in which the society, institutions and a major part of the economy suffered due to wars, UN sanctions and political circumstances which supported the establishment of bad practices of doing business and managing the economy¹.

The present Serbian economic scene is made up of business entities of very different economic strength, innovation potentials and development interests. Foreign companies established their branches in the Republic of Serbia as part of their strategic decisions, while following their strategies and using development potentials of their headquarters. Large public companies and state systems are prevailing in infrastructure areas and they are burdened, on the one hand, by a great number of employees and low selling prices of their services, and on the other, by the need for great investments in modernization of infrastructure which leaves a negligible space for investment in development and innovations. The third segment of large domestic companies is made up of large privatized systems which are doing business in traditionally poorly technologically equipped branches (for example, food industry). They base their business models on low costs and competitiveness in “old markets“ in the region - which also does not require the need for reliance on research and development. In the end, the rest of the economic sector is made up of a host of micro, small and mid-sized enterprises and entrepreneurs. Only a small portion of this segment is made up of innovative companies that are present in a global market, that were established at the initiative, on the knowledge and through efforts of local entrepreneurs.

In 2017, compared to the countries of the European Union and other surrounding European countries, Serbia was on the backend of the European ladder and only had a higher score than Bulgaria and Turkey (according to the Gini coefficient)². As a consequence of more than a decade of isolation during the 1990s and subsequently a transition period that began late and was interrupted by the World Economic Crisis, exactly when a layer of “transition losers” had already emerged and before transition could have a tangible positive effect on the strengthening of Serbia's middle class, meant that from relative equality from the period of socialism, society largely became economically polarized. All of these effects, accompanied by an aging population, increased poverty (a quarter of the population lives at the risk of poverty, according to the analyzed SILC surveys) and feelings of social insecurity resulted in outflows of both highly educated profiles and lower educated profiles that are of high demand, even including the non-qualified work force.

¹ Uvaliř, M., et al., 2019, The Serbian Economy Ten Years After the Global Economic Crisis

² http://appsso.eurostat.ec.europa.eu/nui/show.do?lang=en&dataset=ilc_di12

The national culture is certainly an important characteristic of the environment in which the smart specialization strategy will be implemented³. As the consequence of the said social movements and trends, the social environment in the Republic of Serbia is characterized by specific structure of dimensions of national structure expressed by index values on the scale from 0 to 100⁴. In the Republic of Serbia, the highest index is for uncertainty avoidance (index 92) which indicates firm rules when it comes to codes of behavior and small tolerance to ideas and actions that deviate from the usual one. The Serbian society is also characterized by a high power distance (index 86) which indicates that the managing structure in both organizations and state administration tend to be centralized and difficult to change with expressed requests for strict control and rules, and that information needed for decision making are exclusively in the hands of those in senior positions. Contrary to that, the Republic of Serbia is also characterized by a low value of individualism (index 25), that is, by the spirit of collectivism where individuals are recognized and supported by the group in exchange for the unreserved loyalty to the group. Index of inclination to meet their own wishes is also low in the Republic of Serbia (28) which indicates that the respect for strict social norms and abstention prevail relative to a desire of an individual to let them enjoy without limits. Dimensions and long-term orientation (index 52) and masculinity (index 43) indicate that neither long-term orientation nor short-term benefits orientation are particularly expressed in the Serbian society, and that Serbia has not been differentiated either as a society oriented to material benefits and competitive fight between individuals (men's society) or as a society oriented to the care of society for individuals (women's society).

The period in which the macroeconomic image of the Republic of Serbia was stabilized after fiscal consolidation and the period of favorable monetary conditions in important financial markets are behind us, which contributed to easing the domestic monetary policy and reducing the public debt. Measures of support to founding and developing companies, measures of attracting foreign companies and finding buyers for strategically important companies, resulted in significant decrease of unemployment in the past few years from a record rate of 24% from the period of the most severe effects of the global economic crisis. Also, exports have increased and foreign trade deficit decreased. The business environment has been improved and work is being done on further simplification of regulatory framework for doing business with the use of benefits of the upcoming digitalization. The public administration reform that started in 2014 is in progress and despite difficulties and requests for the comprehensiveness of the process, the position and culture of the public administration are changing, that is, it is turning to the needs of citizens and businesses.

Despite the implemented reforms and moves undertaken to resolve accumulated problems from the past, Serbia is still at the middle level of development and is generally facing problems to accelerate economic growth to the extent that would enable it to catch up with more developed economies of the European Union in terms of the standard of living parallel to institutional harmonization which is an integral part of the accession process⁵.

In the period after the global economic crisis, economic model of development was visibly changed from the one which until the crisis was based on the growth of domestic consumption (and the import)

³ Hofstede, G., Hofstede, G.J., and Miunkov, M., 2010. Cultures and organizations: software opf the mind. 3rd. Ed. New York: McGraw-Hill

⁴ <https://www.hofstede-insights.com/models/national-culture/>

⁵ The most important structural reforms for Serbia in the upcoming period are listed in the Economic Reform Program (<https://mfin.gov.rs/UserFiles/File/strategije/2019/Program%20ekonomskih%20reformi%202019%20-%202021.pdf>) which is passed and harmonized every year within the "European Semester" which is implemented as a "light" version of the Enlargement Plan of the EU from 2012 as an instrument of "new economic governance".

helped by foreign loans and investments in the service sector (financial sector, telecommunications and real estate), to a model which is based on the growth of domestic production and exports (primarily to Western European markets) which was helped by huge foreign investments in the production sector (primarily automobile industry). However, this model is based on attractiveness of the relatively cheap domestic workforce. Even though it was attractive due to ability to absorb a great part of unemployment and improve foreign trade balance, it does not lead to significant improvement of the standard of living and can reverse with the outflow of the workforce and increase costs.

Given everything that was said, the need to come out with a package of measures that would make significant progress in productivity, has matured, and this will be possible only if all scientific, academic and creative potentials are used to develop the knowledge-based economy. They undoubtedly exist and are the result of good heritage and several good strategies in this area which were implemented until the present time. Given relatively small domestic market, in order to valorize relatively large investments in research and development, it is necessary to connect with other markets, and European prospects are crucial in this regard. Also, due to a relatively limited market and the need for great investments, it is meaningful to opt for priorities in which Serbia can get involved in European and global value chains in the most productive way and direct its resources and efforts to these areas of both the science and the economy.

2.2. Overview of the research sector

In the past few decades, the Republic of Serbia managed to preserve its scientific and research potentials. Scientific research activity has significantly improved since 2002. This development is the result of the better overall economic opportunities, opening up of the country, as well as the public policy measures that have contributed to better governance in the public scientific research sector.

Scientific research activity in the Republic of Serbia is highly ranked on international ranking lists, which undoubtedly indicates the country's potential in this field and its international competitiveness and influence. However, economically significant scientific research activities of the Republic of Serbia are at a low level, since the results are dominated by the scientific papers published in domestic and international publications. According to a report from the National Council for Scientific and Technological Development (2019)⁶, 97.7% of the overall results of scientific and research work in 2017 are published scientific papers, while patents and technical solutions amount to 2.3%. There was the greatest number of technical solutions in electronics, telecommunications and information technologies, while there was the greatest number of patents in biotechnology and agriculture.

Results of the scientific research activity in the Republic of Serbia are particularly important considering relatively low level of financing. To be specific, gross expenditures for research and development (R&D) as a percentage of GDP in 2018 were 0.92% which is low when compared to the average recorded in the EU member states that amounted to 2.06% in the same year. In the recent period, the participation of Serbian scientific teams significantly expanded in the programs financed from the EU funds Horizon 2020. The Republic of Serbia records very low investments of the business sector

⁶ National Council for Scientific and Technological Development (2019). Report on the state of science in 2018, with proposals and suggestions for next year, Belgrade, October 2019

into research and development, which is partially a result of the structure of the economy dominated by low-tech industry and services (financial and telecommunication).

When observed by scientific fields, authors from Serbia are relatively well represented in the world in the areas of natural sciences, engineering, medicine and agricultural science. There is good heritage in these fields, and researches which mostly record significant results are focused on areas which require relatively smaller investments in equipment than average for an entire area. On the other hand, despite relatively low cost of research, Serbia does not stand out in social sciences and humanity, probably due to poor heritage⁷.

There are around 2,000 researchers per one million inhabitants in Serbia, which is higher than other countries of the Western Balkans, but less than developed EU countries from the region. There are around 15,000 researchers officially and this number has been on the rise. Of a total number of researchers, 51% are women, which is significantly above the European average. Given that the greatest number of researchers are in the public sector (institutions of higher education and institutes), the rise of the number of researchers has been halted since 2016 and even a mild decrease has been registered.

According to the structure of employees in research and development sector, the greatest number of researchers are employed in the areas of engineering and natural sciences, which together make more than 50% of the total number of researchers. More than 91% of researchers come from the public sector and the sector of higher education, while only 8.2% of researchers work in the business sector. When it comes to the number of researchers in the business sector, Serbia is significantly below the European average but also below the countries of the region. According to data from 2018, only 3.7% of doctors of science work in the business sector.

2.2.1. Serbia's position in the European Research Area

Republic of Serbia' strategic and legislative framework in the area of science, research and innovation is in line with the EU *Acquis Communautaire*. This fact was officially confirmed by the EU on 13 December, 2016 when the Negotiating Chapter 25 (Science and Research) was opened during an intergovernmental conference in Brussels and then temporarily closed. Thus, the Negotiating Chapter 25 became the first chapter the Republic of Serbia successfully closed in negotiations with the EU.

International cooperation is being conducted successfully – mostly through bilateral cooperation programs, cooperation within the region/macro region and EU programs. Bilateral scientific research cooperation is successfully being conducted with a host of countries. Regarding the macro region, the Republic of Serbia is extremely active in the implementation of the EU Strategy for the Danube Region where it coordinates the priority area 7 (the Knowledge Society) and together with other countries of the Danube Region is developing cooperation programs at multilateral level⁸. Participation in EU programs in which it realizes an integrated approach to a resolution of huge social challenges is crucial for the Republic of Serbia. A host of prospects within Horizon 2020 and other programs are open to it as part of the European Research Area. Also, the EU Pre-accession IPA funds are available to Serbia

⁷ Atanasijević J, Nikolić Z., Jeremić-Zec G., Pavlović O. & Vasiljević D. (2019). „Attaining Higher Productivity in Serbia: Can Higher Education Contribute More?“, *Public Policy Secretariat of the Republic of Serbia, World Bank project "Competitiveness and Jobs", unpublished working material, December, 2019*

⁸ Nedović V. and Štrbac D. (2016) Priority Area 7 – The Knowledge Society in the EU Strategy for the Danube Region. Foreign Affairs Booklets, Friedrich Ebert Foundation and European Movement in Serbia, page 19-22.

through which capacities of the scientific research community and the innovation ecosystem are being raised to a higher level.

An agreement signed in 2014 by the Government of Serbia and the European Union enabled participation of the Republic of Serbia in the Horizon 2020 program. According to the data from January 2020, 446 institutions from the Republic of Serbia are taking part in the program as part of 311 projects approved for financing, and the number of private sector participation is 149. EUR 102.6 million was approved to Serbian institutions to implement the projects. Out of the total amount of resources, private sector disbursed 31.1%. A majority of projects are in the area of Food, where success of our institutions is above 20%, followed by Energy, Information Technologies, etc.

Our institutions demonstrate a high level of activity in EUREKA and COST programs. Based on public calls for the financing of Eureka projects, 85 projects with participation of institutions from Serbia have been supported so far, and a total budget from public and private sector for the implementation of all project activities of all Serbian organizations on these projects from 2002 to date amounts to EUR 21.989 million.

The Republic of Serbia, as part of the former SFRY, was one of the founders of the COST Program in 1971⁹. After COST was restructured, Serbia joined the newly-founded COST Association in March 2014 and became a full member of the new structure of the Program. Participation of researchers from Serbia has been on the rise in recent years. Currently, institutions from Serbia are taking part in 291 COST actions, which is 89% of all active actions. The fact that the financing of our researchers in this program in 2018 exceeded one million EUR (1.041 million EUR) and that the funding of COST from the budget has been increased from 2.8% in 2017 to 3.6% in 2018, is particularly encouraging.

In 2012, the Republic of Serbia signed the Agreement with the European Center for Nuclear Research (CERN) and became an associate member state, and in March 2019 it became the 23rd state with the status of full member of CERN. At the moment, around 30 Serbian researches are taking part in the implementation of five scientific-research projects in CERN. Our scientists have contributed to about 700 publications based on results of researches in CERN, which were published in journals from the SCI list.

Cooperation between the Republic of Serbia and the Joint Research Center (JCR) of the European Commission is unfolding intensively at several levels and it has been widened in a part of drafting a Smart Specialization Strategy (S3), data exchange, use of infrastructure and data base, support in accession to the EU etc.

The Republic of Serbia is making significant investments in scientific-research infrastructure, which is an important element and integral part of the European Research Area and Innovation Union. The Republic of Serbia is also active in the European Strategic Forum for Research Infrastructure (*ESFRI*) and in four consortiums of the European Research Infrastructure Consortium (*ERIC*): *CERIC* (*Central European Research Infrastructure Consortium*) *ERIC*, *DARIAH* (*Digital Research Infrastructure for the Arts and Humanities*) *ERIC*, *ESS* (*European Social Survey*) *ERIC* and *CESSDA* (*Consortium of European Social Science Data Archives*) *ERIC*. By participation in Consortiums of European Research Infrastructure, the Republic of Serbia facilitates mobility of its researchers,

⁹ **COST Program** (*European Cooperation in the field of Scientific and Technical Research*) is an intergovernmental cooperation framework for the coordination of European cooperation of similar scientific and technical research, that are financed nationally, with the participation of at least seven institutions from the Member States. **COST** was established in 1971 (SFRY was one of the founding members).

exchange, and access to large research infrastructure which it does not possess. Large investments in infrastructure which facilitate support to scientific research, transfer of knowledge and technologies and development of innovations are underway.

Open science includes activities and services aimed at facilitating wider accessibility and transparency of data gathered and results published. With a view to implementing the above mentioned positive changes to the European scientific community, the Platform for Open Science was adopted in Serbia in July 2018.

2.3. Overview of the business sector

2.3.1. Main characteristics of the business sector in the Republic of Serbia

Looking at the macroeconomic indicators in recent years, the Republic of Serbia has been recording economic growth, low and stable inflation, fiscal surpluses, declining public debt, and a recovery in the labor market. The unemployment and inactivity rates are relatively high compared to the European Union average, however, with a significant downward trend in recent years. The unemployment rate in 2018 was 12.7%, continuing the declining trend of unemployment that started in 2013 (in 2012, the unemployment rate was 23.9%). Average net earnings are relatively low in international comparisons. According to June 2019, average net earnings were EUR 459. The highest average net earnings were recorded in the financial and insurance sectors (EUR 836) and in the information and communication sector (EUR 821).¹⁰

In the period from 2014 to 2018, the total gross value added in the Republic of Serbia increased by 38.66%, however regional differences in the degree of economic development are very pronounced.¹¹

The structure of the economy is dominated by micro-enterprises, which account for over 86% of the total number of enterprises. On the other hand, the largest number of employees work in large enterprises (43%) and the largest share of gross value added is achieved in large enterprises (49.6%). By sector of activity, the largest share in GVA was recorded by Manufacturing enterprises (31.3%), Wholesale and Retail Trade and Repair of motor vehicles (18.1%), Transport and Storage (9.0%) and Information and communications (8.7%), while the highest real growth of gross value added in the last year was recorded in the Construction sector (16.8%) and in the Information and communication sector (8.2%) (SORS, 2019).

After the global economic crisis of 2008, the structure of the economy has changed significantly - from the pre-crisis model based on imports, final consumption and expansion of services (financial services, real estate, trade) to the post-crisis model based on investments in manufacturing and export growth. Export growth, which increased by 46% between 2013 and 2017, was driven primarily by growth in exports of services, manufacturing and agriculture.

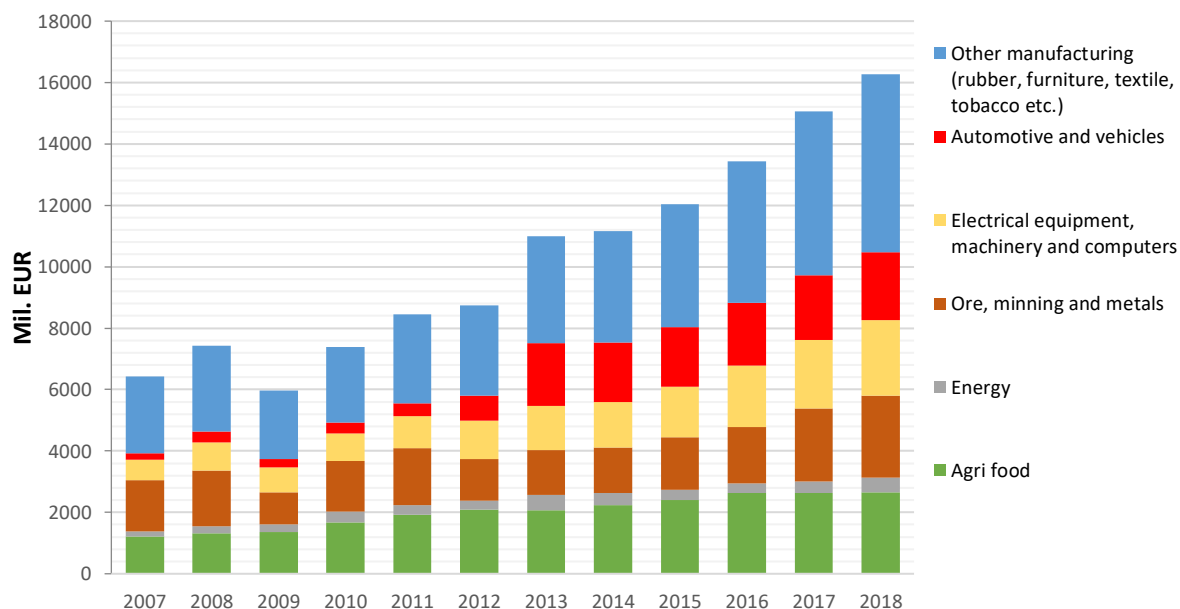
In manufacturing, significant growth in exports has been recorded since 2013 in the automotive industry (motor vehicles and trailers) as well as the mechanical and electrical industries (machinery and electrical equipment). Also, not intensive but rather stable growth is achieved in

¹⁰ SORS: Labor Force Survey

¹¹ SORS "Enterprises in the Republic of Serbia" – total GVA is only related to enterprises

agriculture and food industry (Chart 1). Over 53% of exports is realized with European Union countries. The most important foreign trade partners when it comes to exports are: the Federal Republic of Germany, the Italian Republic, Bosnia and Herzegovina, Romania and the Russian Federation.

Chart 1. Export structure in manufacturing activities



Source: Data processed by the author based on the SORS data

Despite the improved technological structure of industrial production and exports, low-tech products continue to prevail. Total exports of high-tech products compared to total exports in 2018 amounted to 1.9%. According to this indicator, the Republic of Serbia significantly lags behind the EU average (17.9%) as well as the EU member states in the region (*Eurostat Database*).

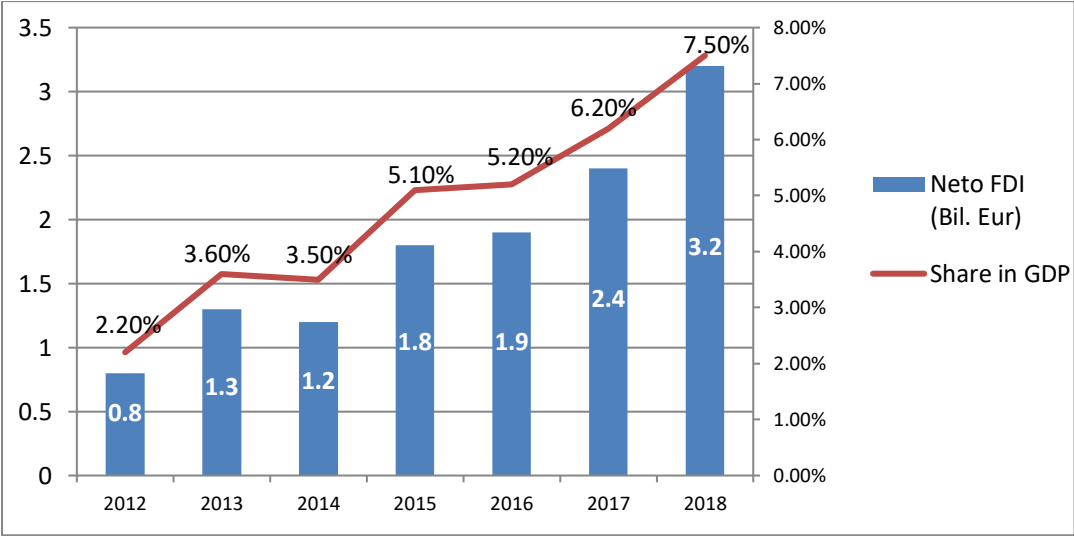
In recent years, Serbia has recorded an increase in total value added in the manufacturing sector and is today the most industrialized country in the Western Balkans, with production contributing almost 20 percent to GDP, comparable to levels in some of the new EU member states. After more than two decades of continuous de-industrialization, the trend of re-industrialization in the Republic of Serbia should help its faster economic recovery. However, production growth is recorded in low-tech industries, indicating a limited technological level of the Serbian economy. Looking at the structure of total value added by technology level, the structure has improved slightly over the period 2012-16, but is still very unfavorable compared to the EU. In 2016, as much as 64 percent of value added in Serbia was in the low-tech sectors (twice as high as in the EU28), while only 3.2 percent was in the high-tech sectors¹².

Foreign direct investments (FDI) play a significant role in changing the structure of the economy, the growth of industrial production and exports, especially in the post-crisis period. The Republic of Serbia is ranked number one in the *Greenfield FDI Performance Index* for 2019, which analyzes the inflow of greenfield investments relative to the size of the economy. In 2018, the FDI net inflow was € 3.2 billion, making it one of the best in the year (Chart 2). Within the manufacturing industry, the largest

¹² Uvalić M., Cerović B. & Atanasijević J. (2019). *The Serbian Economy Ten Years After the Global Economic Crisis, Economic Annals/EACES Workshop in memory of Professor Božidar Cerović, Faculty of Economics, University of Belgrade*

inflows of FDI are recorded in the metal, automotive and food industries. This has resulted in strong employment, manufacturing and export growth in the manufacturing industry.

Chart 1. Foreign direct investment in Serbia



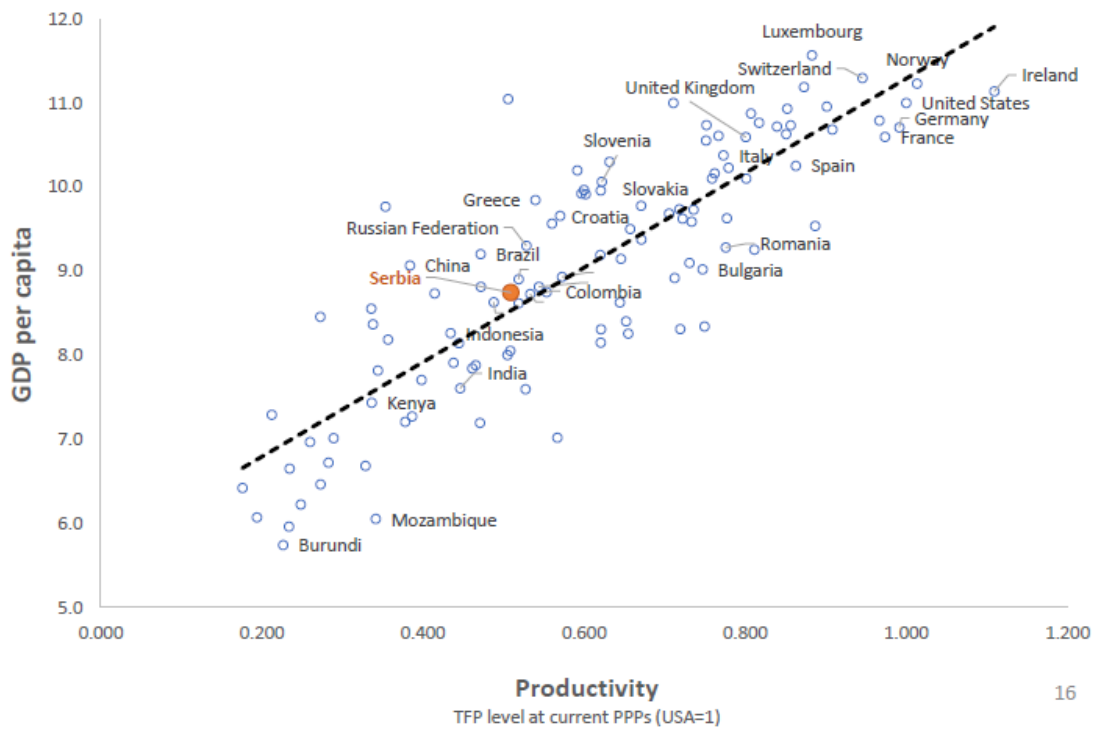
Source: NBS

The structure of production of the Republic of Serbia provides significant opportunities for further diversification and sophistication as a result of the diversity of production. This is largely a result of foreign direct investment, which influences the alignment of Serbian production with the needs of advanced European economies and thus increases the index of opportunity for the Serbian economy. Machines, machine components and appliances, electrical equipment and metals are the most promising product categories for industrial sophistication in Serbia today.¹³

Serbia has relatively low productivity compared to the EU average. The overall productivity of companies in Serbia is growing by 1.1% per year, however, to increase GDP growth by 1 percentage point, the current productivity growth should be doubled (Chart 3). High-growth companies (companies that have achieved a minimum turnover growth of 20% in the last 3 years) have created 61% of new jobs, but they account for only 5% of the total number of companies in the Republic of Serbia. Serbia is well below most European Union countries by number of high-growth companies. New private sector companies are a major source of growth and job creation in Serbia.¹⁴

Chart 2. Productivity to GDP ratio per capita

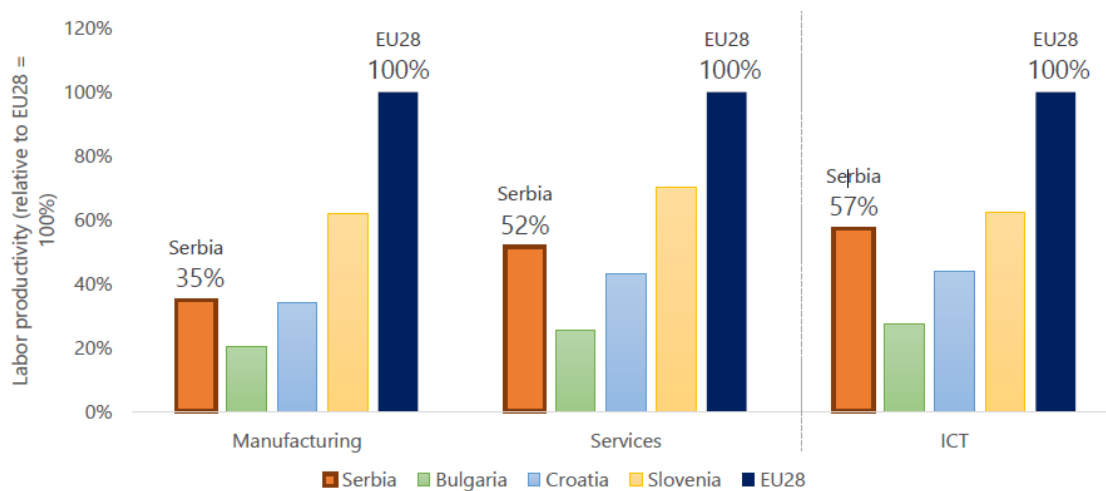
¹³ OECD (2019). *Unleashing the Transformation Potential for Growth in the Western Balkans*, OECD Publishing, Paris
¹⁴ World Bank (2019). *New growth agenda, Country economic memorandum for Serbia*, forthcoming



Source: World Bank (2019). *New growth agenda, Country economic memorandum for Serbia, forthcoming*

Productivity in the manufacturing sector of the Republic of Serbia is three times lower than the EU average, indicating that Serbia currently needs three times as much workforce to produce the same product as the EU company (Chart 4).

Chart 3. Productivity compared to the EU average (EU28=100)



Source: World Bank (2019). *New growth agenda, Country economic memorandum for Serbia, forthcoming*

2.3.2. Innovation of business entities in the Republic of Serbia

More than half of business entities in Serbia have been characterized as innovative with a significant upward trend in the number of innovative enterprises in the last 7 years (according to the European Community Innovation Survey 2016-2018 conducted by the Statistical Office of the Republic of Serbia). Enterprises, on the other hand, invest very little in R&D, while innovations are generally incremental in nature, i.e. there are very few businesses that have made radical innovations and developed a worldwide product through investing in R&D. This situation in the business sector is also reflected in the relatively low number of patents compared to other countries. Manufacturing businesses are more innovative than service businesses. The most significant barriers to innovation in non-innovative businesses are the high costs or lack of their own financial resources for innovation.

Since 2012, there has been a growing trend in the number of innovators among business entities. The largest share of innovators' businesses is in the Information and Communication sector (over 60%) and in the Manufacturing industry (over 58%) (Table 1).

Table 1. Share of innovative business entities by sectors of activity in the period 2012-2018. (%)

	2012-2014	2014-2016	2016-2018
Total	40.5	41.2	50.2
Agriculture, forestry and fishing	22.9	41.9	49.3
Mining	19.3	27.1	41.9
Manufacturing	42.7	47.9	58.2
Electricity, gas, steam and air conditioning supply	53.2	53.7	21.3
Water supply, sewerage, waste management and remediation activities	35.1	31.1	45.0
Construction	36.2	36.7	42.6
Wholesale and retail trade and repair of motor vehicles and motorcycles	40.7	31.0	42.8
Transportation and storage	31.7	37.3	42.0
Accommodation and food service activities	46.2	30.8	44.8
Information and communication	47.6	40.2	61.3
Financial and insurance activities	36.3	38.1	32.8
Real estate activities	26.9	8.5	41.6
Professional, scientific and technical activities	37.5	47.3	48.7
Administrative and support service activities	43.4	53.1	40.7

Source: Statistical Office of the Republic of Serbia, Indicators of innovative activities in the Republic of Serbia, author's work

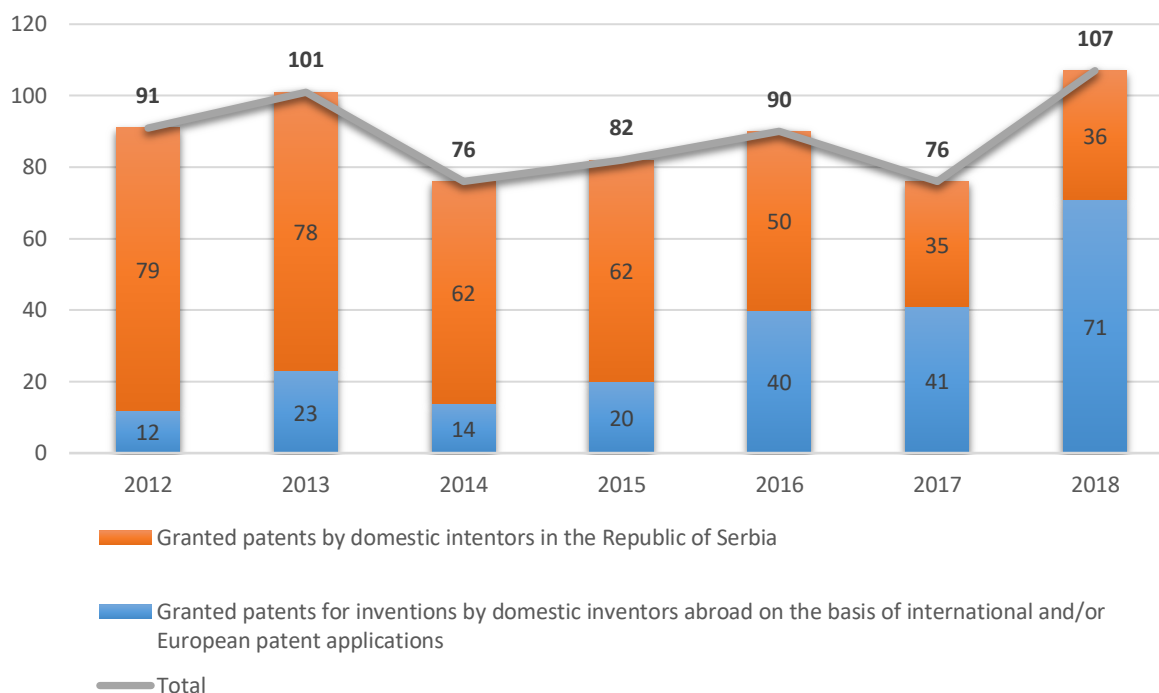
Businesses in Serbia have low investment in external R&D, indicating poor cooperation between the business and scientific and research sectors. According to the total expenditure structure for innovation activities, 24.1% of innovation expenditure relates to internal R&D activities. Compared to previous periods, there was a significant increase in internal research. Total external R&D expenditures have also increased from 1.8 to 3.6% over the previous period, however they are still relatively low. The largest percentage of expenditures falls under other innovative activities that are mostly related to the procurement of machinery, equipment, software and facilities.

Generally speaking, the business sector has a relatively low level of employees with a university degree. More than 15% of companies have no employees with higher education, but they are mostly small businesses. The largest number of medium-sized business entities employ from 1% to 4% of

highly educated employees, while almost one third of large business entities employ from 10% to 24% of highly educated employees.

The number of patent applications is at a low level, but the number of patents granted for inventions by domestic inventors abroad on the basis of international and / or European patent applications has grown over the last 7 years. (Chart 5).

Chart 1. Registered patents of domestic inventors



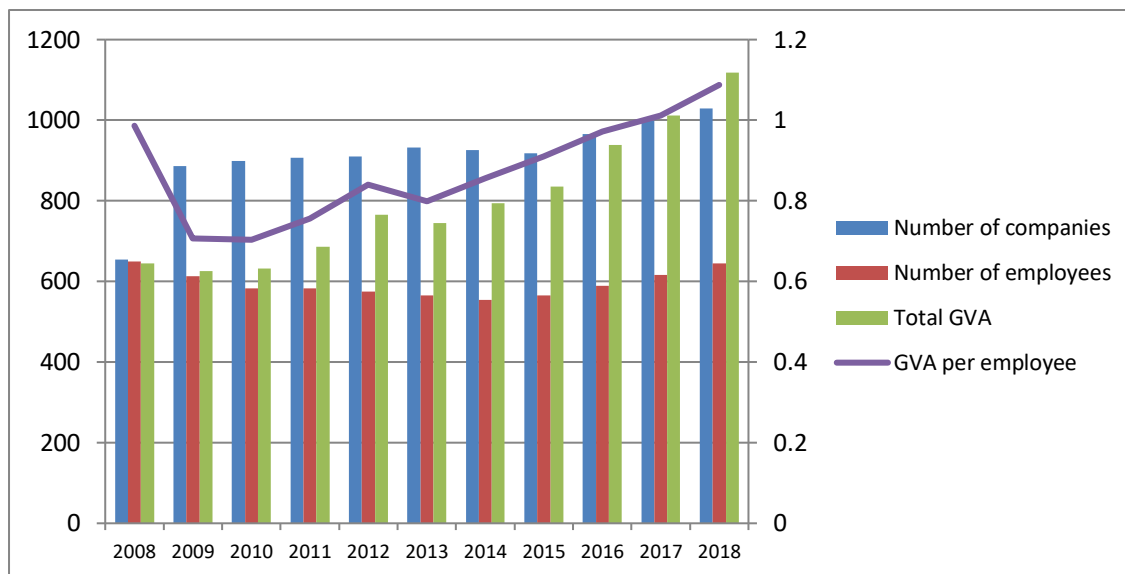
Source: Database of the RS Intellectual Property Office

Due to the low patent activity in the Republic of Serbia and due to the mentioned shortcomings of patents as an innovation indicator, patents represent only indirect results of innovative activities and do not provide a clear picture of the innovation potential of the economy.

2.3.3. Sector of micro-small and medium-sized enterprises and entrepreneurs in the Republic of Serbia

The micro, small and medium-sized enterprises (MSMEs) sector is an important segment of the Serbian economy, accounting for 99.5% of the total active enterprises, employing 57% of employees and participating with 50% in the GVA of Serbia. The global economic crisis has affected the MSME sector during the recessionary period after 2008. Positive recovery trends are particularly evident after 2014, when employment is rising and there is a continuous increase in GVA. Despite the pronounced recovery indicators of this sector, the level of GVA per employee in 2008 was reached only in 2017 with an upward trend in 2018 (Chart 6).

Chart 4. MSME Sector – Number of Companies, Employees and GVA 2008-2018



Source: Calculations by the authors on the basis of SORS: Enterprises in the Republic of Serbia, (2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018)

The largest number of MSMEs is concentrated in three sectors: Trade (32.7%), Manufacturing (16.9%) and Professional scientific, innovation and technical activities (12.6%). Manufacturing and Trade sectors dominate the observed performance of MSMEs: they employ more than 52.7% of employees, generate 49.3% of GVA, account for 85% of exports and 90% of imports (SORS).

In general, MSMEs in the manufacturing industry is characterized by unfavorable technological structure and low competitiveness of domestic industry. The manufacturing industry is dominated by products of low technological complexity that create products of low added value, low differentiation and weak competitive positions in the market.

The entrepreneurial sector in the Republic of Serbia is characterized by fragmentation, high frequency of shutting down and establishment of new entrepreneurial initiatives, instability in the basic business and employment activity, etc. In the last 5 years, there has been a significant increase in the number of entrepreneurs and the number of employees in Serbia. In the period from 2014 to 2018, total gross value added per employee increased by 18%. Observed by sectors, the highest growth in the number of entrepreneurs (164.34%) and the number of employees (190.62%) was recorded in the Information and Communication sector, as well as a significant increase in GVA per employee (16.72%). Other sectors also achieved a significant increase in GVA per employee, ranging from 4% to 24% in the observed period.

The overall conclusion is that MSMEs and the entrepreneurial sector are an important segment of the overall economy and have a significant impact on employment and GVA growth. Further growth and development of this sector is one of the important goals of the Smart Specialization Strategy in the Republic of Serbia.

2.4. Smart Specialization Strategy and public policy framework in the Republic of Serbia

Public policies do not act independently of each other, but rather interact, and it is important for them to be coherent so that already scarce resources are not duplicated or wasted. For this reason, the position

of the Smart Specialization Strategy in relation to other public policy documents in the Republic of Serbia that are relevant for 4S has been mapped. The conclusion is that 4S is directly related to a number of strategic documents in the field of: **(1) Science**¹⁵ - 4S builds on a number of major science and innovation reforms that have been done in the previous period under the auspices of the Science and Technology Development Strategy of the Republic of Serbia for the period 2016-2020 - “Research for Innovation”. **(2) Competitiveness** – as the main objective of the 4S is to connect the economy and science, it is very important to take into account a large number of public policies in the field of competitiveness that address key issues for the development of the Serbian economy. **(3) Agriculture** – a number of the objectives of the Agriculture and Rural Development Strategy 2014-2024 are coherent with development activities within the FOOD FOR THE FUTURE priority area. **(4) Education** – during the preparation of the Strategy, through the process of entrepreneurial discovery, a large number of initiatives and findings have been obtained aimed at creating new educational profiles for which there is a need in the labor market and with changing the education system from a “reproductive character” system to a system that provides applied knowledge and skills. **(5) Communication and digitalization** – public policies in the field of communication and digitalization aims to improve and develop the necessary infrastructure needed in order to ensure the conditions for the proper functioning of the ICT sector and creative industries. Also, additional goals of public policies in this field are to digitize the society in the Republic of Serbia and increase the productivity of all enterprises through a greater use of new technologies.

Public policies in the field of science

Scientific and technological development

The Strategy of Scientific and Technological Development of the Republic of Serbia for the period from 2016 to 2020 – “Research for Innovation” was adopted on March 3, 2016 and the holder of the Strategy is the Ministry of Education, Science and Technological Development. The general goal of the Strategy is to improve the efficiency and effectiveness of scientific and research system. In addition to the overall objective, the Strategy focuses on six specific objectives: (1) Promoting the excellence and relevance of scientific research in the Republic of Serbia; (2) Strengthening the link between science, economy and society to foster innovation; (3) Establishing an effective science and innovation management system in the Republic of Serbia; (4) Ensuring the excellence and availability of human resources for science and industry and social activities; (5) Improving international cooperation in the field of science and innovation; (6) Increasing investments in R&D through public financing and encouraging business sector investment in R&D. A new Science and Education Strategy is currently being prepared and it will also be in the scope of the MoESTD and it will merge science and education into one strategic document. The future document will, naturally, use all relevant findings obtained from the 4S process.

In the period from the adoption of the Strategy "Research for Innovation", a number of envisaged measures were implemented. Adoption of the Law on Science and Research (in July 2019) and the Law on the Science Fund of the Republic of Serbia (in December 2018) has made key steps in reforming the system of organization and financing of science, which will enable the implementation of a new model of financing research activities through institutional and competitive project financing.

The establishment and operation of the Science Fund of the Republic of Serbia will regulate and improve the area of support for scientific research, as the Fund performs the complete procedure and management

¹⁵ Although according to the division of public policies in the Republic of Serbia, science is classified as a competitive area, they are presented here separately because of the importance of considering science separately.

of competitive project calls. The first public call for funding for projects under the Young Researchers Excellence Program - PROMIS, was announced by the Science Fund of the Republic of Serbia in June 2019. The program is intended for excellent projects of young researchers at an early stage of their careers, enabling young doctors to define their own research programs, form their own teams and collaborate with appropriate laboratories and research centers in the Republic of Serbia and worldwide. Also, in the second half of 2019, two new programs were published: the Diaspora Cooperation Program and the Artificial Intelligence Development Program, and implementation of the new Idea Program and other support programs is expected in the coming period.

The institutional support of the Government through the Innovation Fund is to enable cooperation between investors and international donors to provide greater funding, to foster university-business cooperation in order to translate scientific achievements into the real economy, and to encourage small and medium-sized enterprises engaged in innovation activities. The Innovation Fund is constantly publishing calls for cooperation between science and industry, and through various programs (Figure 2), 141 projects and 264 companies were supported and 323 innovation vouchers were awarded, for which a total of EUR 18.6 million was allocated.

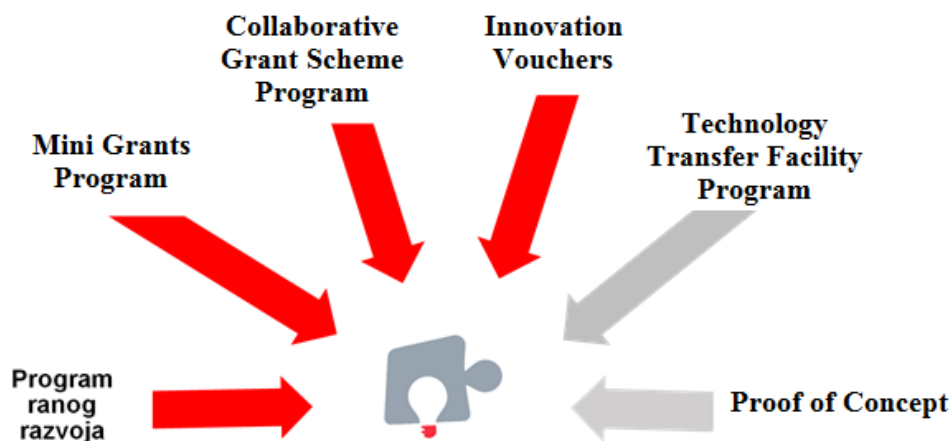


Figure 2. Programs of the Innovation Fund

Also, it is important to note that in June 2015, in the partnership of the Government, the City of Belgrade and the University of Belgrade, the first Science and Technological Park was established in Belgrade, with the surface of 16.446 m², with over 70 high-tech companies/teams today employing 700 employees. Following this successful example, investments and the construction of science and technology parks continues in Novi Sad, where the facility of 31.350 m² will be completed till the end of the year, and in Niš, where construction of a 14.000 m² facility began, and its completion is expected in April, and the expansion of capacities of the science and technological park in Čačak is also underway. This is an important step toward the creation of successful business ecosystems with large number of different stakeholders that will jointly create solutions for different challenges.

Smart Specialization Program in Research and Innovation

In 2015, the Autonomous Province of Vojvodina adopted the Smart Specialization Program in Research and Innovation for the period 2015-2020. The identified priorities of the Regional Program are: agricultural production and food industry, information and communication technologies, metal industry and tourism.

Other public policies in the area of competitiveness

Industry

The current Strategy for the Development of Industry expires in 2020 and a new Industrial Policy Strategy from 2021 to 2030 is currently underway to replace this policy document in the Republic of Serbia and which is extremely relevant to 4S.

As part of the drafting of the new strategy, a public-private dialogue has been organized and initiated by the Government, with the aim of creating conditions for improvement of industrial competitiveness, sustainable growth and economic development, as well as new employment. Through this public-private dialogue which was carried out in parallel with the 4S, the working groups collaborated and exchanged findings to make the Strategies work better in the future strategic framework of the Republic of Serbia. Also, the findings of the entrepreneurial discovery process have also been used in the development of Industrial Policy Strategy, which is in its nature, horizontal, while the 4S follows the principle of specialization and focuses on areas where competitive advantages are identified..

The overall objective of the new Industrial Policy Strategy is to raise competitiveness of the industry of the Republic of Serbia with a focus on industry-led development, which implies advanced production and high value-added services, based on the achievements of the Industrial Revolution 4.0. There are five specific objectives: (1) Raising the technological level of the industry and its transformation towards digitalization and automation; (2) Increased contribution of scientific and research solutions in the process of development and digitalization of the domestic industry; (3) Increasing the overall volume of investments in industry while ensuring a balance in the structure and quality of investments; (4) Increasing the level of value-added in industrial exports with increasing export volumes; (5) Transformation of industry from linear to circular model with reduced CO2 emissions.

Once the Action Plan is adopted and measures are further formulated through activities, it will be visible in which segments these two documents fit together and complement each other in terms of implementation.

Information technologies

The Strategy for Development of Information Technology Industry for 2017 – 2020 is a document that sets out strategic priorities in this area, which include: development of successful enterprises and products in the field of information technologies, improvement of the administrative environment suitable for the development of the IT industry, strengthening of human resources and modernization of businesses across all industries through encouraging the use of IT. The objectives of the Strategy are in line with the priorities of 4S, but it has been set until 2020 and it is difficult to plan for further integration of these strategic documents. The Strategy has implemented a number of measures, such as trainings with a total of 2,000 trainees so far that have gone through the IT Sector Retraining Program to mitigate the shortage of staff in the fast growing IT sector in the Republic of Serbia, support measures for entrepreneurship and start-up projects, support for entry into foreign markets and other relevant measures. Also, the section *Tax reliefs for R&D* lists the most relevant regulatory changes, some of which were made in accordance with measure 2 *Tax Policy Incentives*.

Artificial Intelligence

The findings from the EDP ranked artificial intelligence among the largest horizontal potentials of the ICT sector, and at the end of last year, the Strategy for the Development of Artificial Intelligence in the Republic of Serbia for the period 2020 – 2025 was adopted. The Strategy has five specific objectives: (1) Development of education focused on the needs of modern society and the economy conditioned by the advancement of artificial intelligence; (2) The development of science and innovation in the field of

artificial intelligence and its application; (3) Development of an economy based on artificial intelligence (branches of industry in which it applies); (4) Improving the assumptions for the development of artificial intelligence and public sector services through the use of artificial intelligence; and (5) Ethical and secure application of artificial intelligence. These specific objectives should contribute to the overall objective of the Strategy: The use of artificial intelligence in the function of economic growth, employment and better quality of life.

SMEs and entrepreneurship

Through the implementation of **the Strategy for Supporting the Development of Small and Medium-Sized Enterprises, Entrepreneurship and Competitiveness for the period from 2015 to 2020**, the conditions for operating of SMEs and entrepreneurs have been improved, the infrastructure to support of start-up companies developed through the establishment of incubators, start-up centers and science-technology parks, as well as through the establishment of financial support programs through grants.

Financial and non-financial support to this sector in 2016 was consolidated into the “Entrepreneurship Year” Program, which in 2017 grew into the “Entrepreneurship Decade” Program. Through this program in 2017, entrepreneurs had more than 30 programs and over 18 billion dinars available from the budget. Within its “Entrepreneurship Decade”, the Ministry of Economy provides systemic support, which includes both financial and non-financial support to the sector of small and medium-sized enterprises and entrepreneurship. Currently, within the “Entrepreneurship Decade” Program, there are a number of active programs that provide financial support to small and medium-sized enterprises and entrepreneurs (SMEE) and the following institutions are responsible for implementing these programs: **(1) Development Fund**¹⁶ - offers a large number of services available to the SMEE sector and mainly deals with crediting (investment loans, loans for permanent current assets, short-term loans, loans for maintaining current liquidity, start-up loans and a number of other loans). **(2) Export Credit and Insurance Agency of the Republic of Serbia j.s.c. Užice**¹⁷ - has an important role in the SMEE system and as the name of the agency implies, they assist exporters through active Programs that provide access to export guarantee services, export insurance, factoring and short-term loans. **(3) Development Agency of Serbia (DAS)**¹⁸ - DAS offers a wide range of services and calls are frequently launched, such as the currently active Small Business Support Program for the procurement of equipment, the SMEE Digital Transformation Support Program, the Financial Support Program for beneficiaries of IPA Territorial Cooperation projects and various other support programs.

There are also a number of non-financial support programs aimed at micro, small and medium-sized enterprises and entrepreneurs aiming at increasing capacity, providing necessary business information, mentoring entrepreneurs and a range of additional services.

¹⁶ Since its establishment on April 15, 1992, the Development Fund of the Republic of Serbia has focused its activities on fostering balanced regional development, including the development of underdeveloped areas, fostering competitiveness and liquidity of the Serbian economy, encouraging employment, as well as encouraging the production of goods intended for export.

¹⁷ AOFI - Export Credit and Insurance Agency of the Republic of Serbia j.s.c. Užice is an export credit agency of the Republic of Serbia which was founded on 15 July 2005 by the Law on the Export and Export Finance Agency of the Republic of Serbia (“Official Gazette of the Republic of Serbia”, No. 61/05). AOFI's activity is export insurance and financing for Serbian export-oriented companies.

¹⁸ Development Agency of Serbia (RAS) is an agency of the Government of the Republic of Serbia, established on January 11, 2016, under the Investment Act, which closed the Foreign Investment and Export Promotion Agency (SIEPA) and the National Regional Development Agency (NARR).

Information on all available financial support programs offered by the state institutions and agencies can be found on the Entrepreneurship Portal, which aims to provide updated information on what it takes to start a business, how to get the support for further business development, and how to achieve good business results.

Quality infrastructure

Quality infrastructure is regulated through the Strategy for the Improvement of the Quality Infrastructure System in the Republic of Serbia for the period 2015 to 2020. The area of quality infrastructure is particularly important in the areas of food production, production of machinery and manufacturing processes. For food products from the Republic of Serbia, especially those with higher added value, to compete in the target global markets, in addition to elementary quality system standards (such as HACCP¹⁹), certification of properties is increasingly required to confirm and prove higher product value added. In this domain, the quality infrastructure in the Republic of Serbia is not sufficiently developed, and the development was limited mainly to some niche markets recognized so far (products with geographical indications, organic products, products with Halal and Kosher certificates) and in this domain, in accordance with the priorities set by 4S, improvements are necessary.

Intellectual property

The Intellectual Property Development Strategy 2018 to 2022 is a Strategy that aims to support the development of intellectual property, to provide conditions for improving the enforcement of intellectual property rights, to align national legislation in this field with the EU acquis. In September 2019 the package of amendments to the law relating to intellectual property was adopted. The Law on Patents was improved, which regulates the protection and use of inventions arising from employment, taking into account the interests of the employer and the interests of the employee who creates an invention in employment, as well as the Law on Copyright and Related Rights that aims to establish a more effective national system of legal protection of copyright and related rights. The Law on Trademarks, which regulates the manner of obtaining and protection of a trademark in the turnover of goods and services, was adopted at the beginning of 2020.

Creative industries

The creative industries do not have an umbrella Strategy that regulates their development and strategic framework, but the Government has recognized the creative industries as one of the priority growing sectors of the economy and established the Creative Industries Council in 2018, as a special Council of the Prime Minister of the RS. The Council was established with the aim of supporting the development of creative industries through initiation of different measures and activities, as well as a construction of a network of partners in the creative industries and their connection and cooperation.

Upon the initiative of the Prime Minister of Serbia and upon the proposal of the Creative Industries Council, in 2019 a National Platform “Serbia Creates” was established. The Platform is aimed at promoting and supporting the development of creative industries through strategic measures, as well as through strengthening of cultural diplomacy and positioning of the Republic of Serbia globally as the country of creative, innovative and authentic people and ideas. The Platform “Serbia Creates” was

¹⁹ HACCP (Hazard Analysis and Critical Control Points) is a system for identifying, assessing and controlling food safety hazards. Unlike traditional product inspection at the end of the production process, HACCP is an integrated preventative system that ensures food safety in every part of the production and distribution process, thereby reducing the risk to public health

designed with the idea of recognizing, affirming and pointing out any type of creative work and success in the areas covered by the knowledge-based economy.

In the Office of IT and E-Government, in 2019 the Sector for Development, International Cooperation and Promotion of Digital, Innovative and Creative Activities was established. The main activities of the Sector include the policy proposals in the area of digital and creative activities; planning, analysis and coordination and monitoring of development of these activities; as well as coordination and providing support for international cooperation and doing business on the global market. One of the segments of work of the Sector is planning, analysis and coordination of initiatives for improvement of legal and business environment for growth of digital, innovative and creative activities; including active connection of public and private sector in the areas of digital, innovative and creative economy, with the aim of creating sustainable and integrated economy growth of the Republic of Serbia. This Sector is in charge of the Platform “Serbia Creates” and as such, it actively participates in the promotion of domestic and international services, technologies and products in the spheres of digital, innovative and creative activities and it also coordinates all state bodies that take part in domestic and international promotion of the stated activities.

Also, in cooperation with the Ministry of Economy and the Film Center of Serbia, an incentive program for the movie industry is available to actors in the field of CI, for which RSD 900,000,000.00 has been allocated. This program provides investors with a grant incentive through the reimbursement of 25% of the eligible costs incurred in the Republic of Serbia, with the aim of encouraging economic activities related to audiovisual production, by increasing employment, as well as promoting the potential of the Republic of Serbia in this activity, i.e. its infrastructure, production and service activities.

Tax reliefs for research and development

In the past two years, a set of amendments of important tax laws has been adopted in order to introduce R&D reliefs. The most important amendments include: **(1)** R&D costs are recognized as double expenses for the purpose of calculating corporate income tax; **(2)** Intellectual property income is taxed at a rate of 3% instead of the regular 15%. Combined with the R&D deduction, the corporate tax can be reduced to 0%; **(3)** Tax reliefs for investing in newly established start-ups - aims to facilitate startups with access to capital, as well as to encourage businesses to invest in startups. The proposed amendment stipulates that a taxpayer who invests in equity of a newly established start-up engaged in innovation activity is recognized as entitled to a tax credit in the amount of 30% of the investment sum (with a limit of RSD 100 million of tax credit); **(4)** Incentives for innovative start-ups - start-up founders do not pay income taxes and contributions in the first three years of business; and **(5)** Tax relief for employers employing new residents – companies that employ returnees and foreigners with special professional education that is difficult to find on the domestic labor market, are entitled to reduction of the basis for taxes and contributions of up to 70% in the period of 5 years.

Also, companies can profit from two established so-called *regulatory sandboxes*²⁰: **(1) FinTech sandbox** – where innovative payment solutions can be tested in a restricted market without regular pre-registration and **(2) MedTech sandbox** – where unregistered medical devices can be imported within 24 hours for research and development of innovative products, if the company is a member of the Science

²⁰ *Regulatory sandbox* is a special regulatory regime that allows companies, in accordance with an approved plan and under supervision of a competent authority, to test innovative solutions or business models on a limited number of users.

and Technology Park, or if it is a beneficiary of the funds for incentivizing innovation through the Innovation Fund in accordance with the law that regulates innovation activities.

Public policies in the field of communications and digitalization

Information Society and Electronic Communications

This set of strategic documents is important because they largely address the removal of current obstacles to the development of priority areas of ICT and creative industries. The Digital Agenda of Serbia, comprising the **Strategy for the Development of the Information Society in the Republic of Serbia until 2020** and the **Strategy for the Development of Electronic Communications in the Republic of Serbia 2010-2020** enabled the development of e-government, e-healthcare, e-justice, e-commerce and the use of ICT in education, science and culture.

Next Generation Networks

Investments in the electronic communications sector are one of the most significant drivers of GDP growth, reducing unemployment and modernizing society. In April 2018, the Government adopted the **Strategy for the Development of the Next Generation Networks by 2023**, which main objective aims to provide the necessary infrastructure for the development of the digital single market in the Republic of Serbia. One of the prerequisites for the further development of broadband networks is the existence of broadband accessibility maps that are created on the basis of data provided by operators. As the collected data was processed and the development of the WEB GIS application completed, negotiations are underway with operators to release data on the availability of broadband internet access to all citizens and companies.

Public policies in the field of agriculture and rural development

Agricultural policy reforms, defined in the **2014-2024 Agriculture and Rural Development Strategy**, respond to current challenges, such as: reducing the lag in technological development compared to competing countries and more effectively facing the agricultural sector with the effects of climate change, improving the business environment for farmers and entrepreneurs. The vast majority of indicators for monitoring the achievement of the goals of the agricultural and rural development strategy are precisely related to the improvements in the sub-areas of the 4S FOOD FOR FUTURE priorities. The synergy of the Agricultural Development and Rural Development Strategy with smart specialization needs also exists in the field of approaching creators and users of knowledge through the involvement of farmers with advisory work and the establishment of a system of records in agriculture.

Public policies in the field of education

The basic document related to education in the Republic of Serbia is the **Strategy for the Development of Education** and its implementation has created the basis for an interactive relationship between supply and demand in the labor market, but there is still a lack of adequate human resources in research organizations, industry, public sector, and there are no long-term measures to address this. As the education development strategy is timed to 2020, a new strategic document in the field of education has been drafted (as it was mentioned above), which should allow education and science reforms to be carried out in parallel. All the findings obtained during preparation of the 4S, and that are directly linked to education, will be used as valuable input and will represent a starting point for the new Science and Education Strategy that is currently being drafted.

In recent years, a number of measures have been implemented at all levels of education. In order to modernize **higher education**, short cycle programs have been introduced that can significantly improve the employability of graduates in the future, and study programs have been developed or revised at 15

faculties that recognize the information technology sector as a priority development area. In addition to that, the Universities in Belgrade, Kragujevac and Nis accredited four Master 4.0 programs, in cooperation with the “Digital Serbia” Initiative and the Ministry of Education, Science and Technological Development, with a single goal of connecting modern IT knowledge with business skills necessary for the development of digital products and services. Currently a new Master Program is being prepared, also in cooperation of the Initiative “Digital Serbia”, the Ministry of Education, Science and Technological Development and the Platform “Serbia Creates” in the area of creative industries, with special focus on the sector of video games and AV production.

2.4.1. Broader perspective of 4S

The United Nations Global Program to define the Roadmap for Science, Technology and Innovation to achieve sustainable development goals – Agenda 2030

Based on the analysis of smart specialization strategies in different countries and regions of Europe, it has been established that a large number of identified priorities directly contribute to the achievement of the sustainable development goals. On this basis, the EC Joint Research Center has further developed a methodological framework for smart specialization to incorporate sustainable development goals into the design, implementation and monitoring of the strategy. Smart specialization has been recognized as a potential methodology and has been implemented in the United Nations Global Pilot Program, where the Republic of Serbia has been invited and listed as one of the 5 pilot countries in this program, based on a well-implemented and positively evaluated process of entrepreneurial discovery and work on the smart specialization strategy. The objective of the pilot action is to further refine and utilize the existing framework to integrate the Sustainable Development Goals (SDG). The future Action plan of the Smart Specialization Strategy of the Republic of Serbia will thus grow into a Roadmap for Science, Technology and Innovation to achieve the Sustainable Development Goals. The EC Joint Research Center and the United Nations Industrial Development Organization (UNIDO) will provide expert support to map the sustainable development and Roadmap goals and further integrate them with industrial policy.

Smart specialization and macro-regional strategies of the EU

EU macro-regional strategies are an integrated framework endorsed by the European Council, which the European Structural and Investment Funds can support, among other things, to address the common challenges that Member states are facing, as well as other countries located in the same geographical area. This way, these countries can benefit from enhanced regional cooperation that contributes to the achievement of economic, social and territorial cohesion. There are four EU macro—regional strategies so far: EU Strategy for the Baltic Sea region (2009), EU Strategy for the Danube Region (2010), EU Strategy for the Adriatic-Ionian Region (2014) and EU Strategy for the Alpine Region (2015). The Republic of Serbia is currently actively participating in the implementation of two strategies: the EU Strategy for the Danube Region²¹ and the EU Strategy for the Adriatic-Ionian Region. Macro-regional strategies are important because they represent a good framework for developing specific policies in the areas of RIS3, especially with regard to integration into value chains and cooperation in the field of R&D at regional level.

EU Strategy for the Danube Region

²¹ Nedović, V. and Štrbac, D. (2016) Priority Area 7 – Knowledge Society in the EU Strategy for the Danube Region. Foreign Policy Booklets, Friedrich Ebert Foundation and the European Movement in Serbia, pages 19-22.

The European Union's Strategy for the Danube Region provides a good framework and opportunity for regional cooperation within the priority areas of smart specialization. The most relevant priority area of the EU Strategy for the Danube Region is the priority area 7 "Development of the Knowledge Society (research, education and ICT)". The Republic of Serbia was appointed as the coordinator of this priority area together with Slovakia, and as one of the objectives of the PA7 is the development of RIS3 in all countries of the Danube region (or their regions) by 2020, and a logical step in the next direction would be to plan future regional cooperation of new and existing RIS3. To achieve this, a detailed analysis of all regional strategies and their priority areas is needed to plan possible topics in which cooperation would be most promising. The strategy also addresses other important areas that are divided between the 4 pillars: (1) strengthening the region, (2) connecting the region, (3) building prosperity and (4) environmental protection. These 4 pillars are divided into 12 priority areas and each priority area could be important for future cooperation.

EU Strategy for the Adriatic-Ionian Region

The objective of the EU Strategy for the Adriatic-Ionian Region is to promote economic and social prosperity and growth in the region by improving its attractiveness, competitiveness and cohesion. From this point of view, this Strategy can be an important framework for future cooperation within the RIS3 framework, especially because of the Strategy's focus on further integration of the Western Balkans. But it seems that the current basis for future cooperation is not yet in full swing, as not all Western Balkan countries have developed their RIS3. The Strategy is based on four thematic priorities/pillars that present key challenges as well as key opportunities in the region: (1) Growth, (2) Connecting the region, (3) Environmental quality and (4) Sustainable tourism. A total of 8 countries are actively involved in the Adriatic-Ionian Strategy: four EU Member States (the Republic of Croatia, the Republic of Greece, the Italian Republic, the Republic of Slovenia) and four non-EU countries (the Republic of Albania, Bosnia and Herzegovina, Montenegro, the Republic of Serbia). The Republic of Serbia is currently coordinating pillar no. (2) *Connecting the region*, together with Italy, and the specific objectives of this pillar are: (1) Strengthening maritime safety and security and developing a competitive regional intermodal port system; (2) Develop reliable transport networks and intermodal connections; and (3) Achieving a well-integrated and functioning internal energy market that supports the three objective of the EU Energy Policy – competitiveness, security of supply and sustainability.

Global and regional value chains

In the past 25 years, exports have strongly contributed to growth and economic convergence in many small open economies. However, the Western Balkans (WB) region, consisting of small emerging market economies, has not fully exploited exports as a driver of growth and convergence. The lack of openness, reliance on low value-added products and poor competitiveness largely explain the insufficiently significant role of trade and exports in the economic performance of the region. The experience of countries that joined the European Union during or after 2004, shows that participation in global value chains can help small economic accelerate exports and increase income. Unfortunately, currently the Western Balkan countries are not well integrated into the dynamic value chains of Europe, and intraregional trade is also limited²².

RIS3 is a good framework that, if properly implemented, would allow greater involvement in global and regional value chains within priority areas. It is also important to note that the type of relationships that are present within value chains is important because developing countries face the risk of remaining

²² IMF (2019) *Lifting Growth in the Western Balkans: The Role of Global Value Chains and Services Exports*

“trapped” in activities with relatively low added value. Therefore, it is also necessary to determine what type of participation is taking place – market supply, hierarchical or modular relationship in the form of intracompany trade that takes place within the value chain of multinational companies (MNC), the ratio of “captured” supply dominated by the leading firm, or participation in a relationship that involves knowledge and technology sharing, with learning, innovation and new opportunities for development²³. It is the latter relationship, which involves the exchange of knowledge and technology, that would allow progress towards higher value-added segments of the value chain.

The findings of the preliminary EDP results indicate that certain ICT companies are already integrated in the higher segments of the value chain, especially in the area of research and development. Although companies in other priority areas are generally integrated in the low value-added segments – production, there is certainly great potential for additional integration. There are other factors that may influence additional integration, such as the favorable geographical position of the Republic of Serbia, which could allow integration into the value chains of horizontal MNCs that are motivated by the desire for production to occur near their customers in order to avoid trade costs. It is also important to note that the Republic of Serbia is currently the leader in attracting foreign direct investments (FDI) in the region. Even though most FDIs in the Republic of Serbia are not integrated with the local economy and represent labor-intensive FDIs, they still provide a huge opportunity for integration into certain segments of the value chain, which could be implemented using the *Tasks Occupations Stages Products (TOSP)* framework. The TOSP framework helps to understand the current position in the value chain and identifies opportunities for future positioning within global value chains.

In 2015, the European Commission recognized the value that interregional integration offers and launched three thematic platforms that were established to support interregional cooperation in the context of smart specialization through agriculture and food, energy and industrial modernization. These platforms contribute to building an increasing number of interregional partnerships across the EU and the ultimate goal is to establish European ecosystems for transnational and interregional cooperation in regions and countries with similar or complementary smart specialization priorities. Thematic partnerships also help regions improve their knowledge base in the region, leading to new development paths and a better position of global value chains and transnational shared innovation strategies.

The IMF findings say that by improving links with global value chains, the Western Balkan countries can raise GDP by 3-10%²⁴, which is why further mapping of positions in global and regional value chains is needed to fully understand all the options of integration. Also, a valuable opportunity could be to identify regions that have similar smart specialization priorities and that offer the possibility of integration into interregional value chains. For this reasons, comprehensive research on smart specialization strategies from neighboring countries and regions, as well as their priorities, is needed to clearly identify existing integration opportunities.

2.5. The process of designing RIS3 in Serbia

The 4S development process was formally initiated in late 2016 by the Ministry of Education, Science and Technological Development (MoESTD) and the Public Policy Secretariat of the Republic of Serbia. During this period, after a series of consultations, political consensus was

²³ Radosevic & Stancova (2015) *External Dimensions of Smart Specialisation: Opportunities and Challenges for Trans-Regional and Transnational Collaboration in the EU*

²⁴ IMF (2019) *Lifting Growth in the Western Balkans: The Role of Global Value Chains and Services Exports*

established and a decision was made at the national level to enter the process of drafting this strategy. Contact and communication lines were established with an international partner, DG JRC, and Serbia became the first non-EU country to join the Platform of Countries and Regions that have entered into the Smart Specialization Strategy. An Inter-ministerial working body for drafting the Strategy was formed, comprising representatives of the Ministry of Education, Science and Technological Development, Ministry of Economy, Ministry of Finance, Ministry of Labor, Employment, Veteran and Social Policy, Ministry of Trade, Tourism and Telecommunications, Ministry of Agriculture and Environmental Protection, Ministry of Culture and Information, Public Policy Secretariat, Provincial Secretariat for Economy and Tourism of AP Vojvodina, Serbian Chamber of Commerce and Serbian Academy of Sciences and Arts - SANU (Decision of the Government of the Republic of Serbia (“Official Gazette of the Republic of Serbia”, No. 95/16)). An inter-ministerial working body formed the sub-units, the Operational and Analytical Team (Figure 3). The Working Group itself and its subunits have followed the methodological framework developed by the JRC in their work. During 2017, a detailed quantitative analysis was made, i.e. mapping of economic, innovation and research potential of the Republic of Serbia in cooperation with relevant institutions in the country (Statistical Office, Intellectual Property Office, RPPS, Ministry of Education, Science and Technological Development, Ministry of Economy, Serbian Chamber of Commerce, University of Belgrade) and Fraunhofer Institute from Germany. On the basis of the identified areas within the framework of the quantitative analysis, in December 2017, an *ICT Innovation Camp* (software engineering) was held. In 2018, after a series of interviews with relevant stakeholders, a Qualitative Analysis was conducted, which actually identified potential priorities - areas with competitive advantage. In the drafting process, the MoESTD collaborated intensively with other public sector and non-governmental and private sector institutions and had the support of experts from the World Bank's project “Competitiveness and Jobs” as well as experts provided by the European Commission's JRC.

In March 2019, the entrepreneurial discovery process began and lasted until June 2019. During this period, 17 workshops were held, as detailed in Chapter 3.1.3. During this period, the Ministry of Economy started formal work on the preparation of the Industrial Strategy. In order to ensure the best possible coordination between the content of these two strategies (Industrial and 4S) and to take into account the EC Recommendation of the Annual Progress Report for 2018 suggesting that the results of Smart Specialization Strategy should be used in the elaboration of the Industrial Strategy, the Government established a Working Group (“Official Gazette of the Republic of Serbia”, Nos. 33/19 and 34/19) in May 2019 for developing both strategies. Furthermore, coordination meetings were held under the auspices of this body between the teams working on the preparation of these two strategies.

In order to carry out the EDP process and in line with the new requirements, a new structure was formed, consisting of a Coordination Body and an EDP team. The Coordination Body consisted of representatives of the Ministry of Education, Science and Technological Development, Public Policy Secretariat, Ministry of Economy, Serbian Chamber of Commerce and the Expert Team on the project “Competitiveness and Jobs”, whose role was to coordinate the process, direct it and adopt decisions. The broader EDP team consisted of the 4S drafting process coordinator, the chief EDP implementation advisor, the analytical advisor, and the coordinators and co-coordinators by area, who performed operational activities, prepared and organized workshops and proposed strategic decisions regarding the EDP. The EDP team worked under the auspices of the Coordination Body.

Since September 2019, writing of the text of the Smart Specialization Strategy "4S" began. The drafting of the strategy was done by the Strategy Writing Team consisting of the 4S coordinator, the chair of the Coordination Body, the expert support leader for the project “Competitiveness and Jobs”, analytical advisor, process coordinator adviser, and two area coordinators. During the writing of the strategy itself,

special emphasis was put on formulating a package of measures based on the results and recommendations derived from the EDP process. Given the complexity of the Government institutions and the range of topics covered by the recommendations, additional consultations were conducted with the departments outside the MoESTD, which are responsible for certain elements of the package of measures. In particular, there was a need for close coordination in the drafting of the measures itself, but also later in the elaboration of some EDP recommendations and implementation of the measures - with the Ministry of Agriculture, Forestry and Water Management, given the importance of the Food for the Future priorities under the 4S. In this regard, it was decided to establish a narrower group consisting of representatives of the Coordination Body and the Ministry of Agriculture, Forestry and Water Management, which would define the criteria for implementation of this measure, as well as indicators for monitoring implementation. The 4S Coordination Body will continue to exist after the adoption of the 4S and will be responsible for coordinating the implementation while monitoring and evaluation will be the responsibility of the MoESTD as the proponent of this strategy.

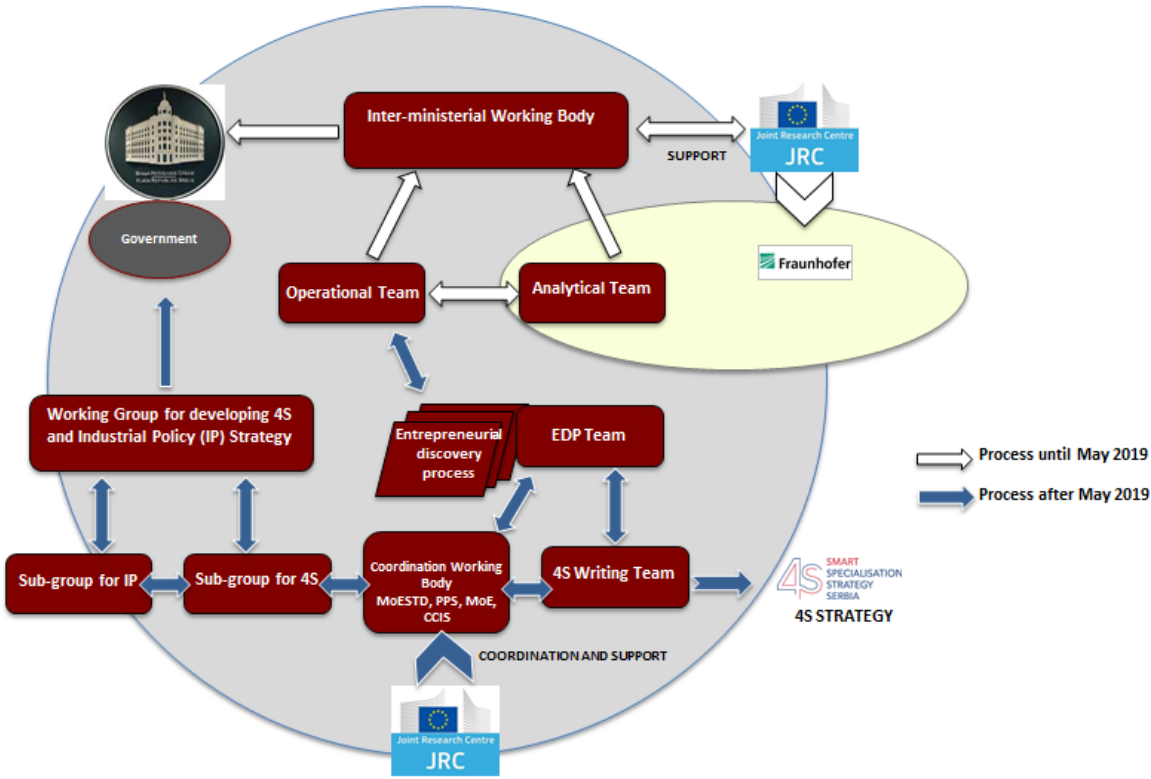


Figure 3. Organizational overview of the bodies in charge of drafting the 4S

The public dialogue, which involved the organization of targeted interviews and workshops of all representatives of the quadruple helix, resulted in the identification of priority thematic areas based on strengths and potential for research, development and innovation. Given that EDP is a continuous process, one of the adopted measures of the Strategy is the continuation of EDP activities. These activities relate to the organization of targeted dialogue and workshops with representatives of industry, academia and civil society in order to collect information that will serve as input for calls for funding for innovative projects that will focus on thematic priority areas.

III OVERVIEW AND ANALYSIS OF THE CURRENT SITUATION

3.1. Selection of priority areas

In order to identify potential priority areas of the Smart Specialization Strategy of the Republic of Serbia, empirical analysis provided a key basis for decision-making and a starting point for the organization the EDP with all stakeholders of the quadruple helix. The final selection of priorities was based on a detailed quantitative analysis of the economic, innovation and research potential of the Republic of Serbia²⁵, followed by a qualitative analysis based on over 155 interviews with key representatives of the business, research and government sector²⁶ and the entrepreneurial discovery process, which included the organization of workshops with all interested parties with a particular focus on business sector involvement (Figure 4). The process of selecting priority areas was fully in line with the framework defined by the *JRC*²⁷.

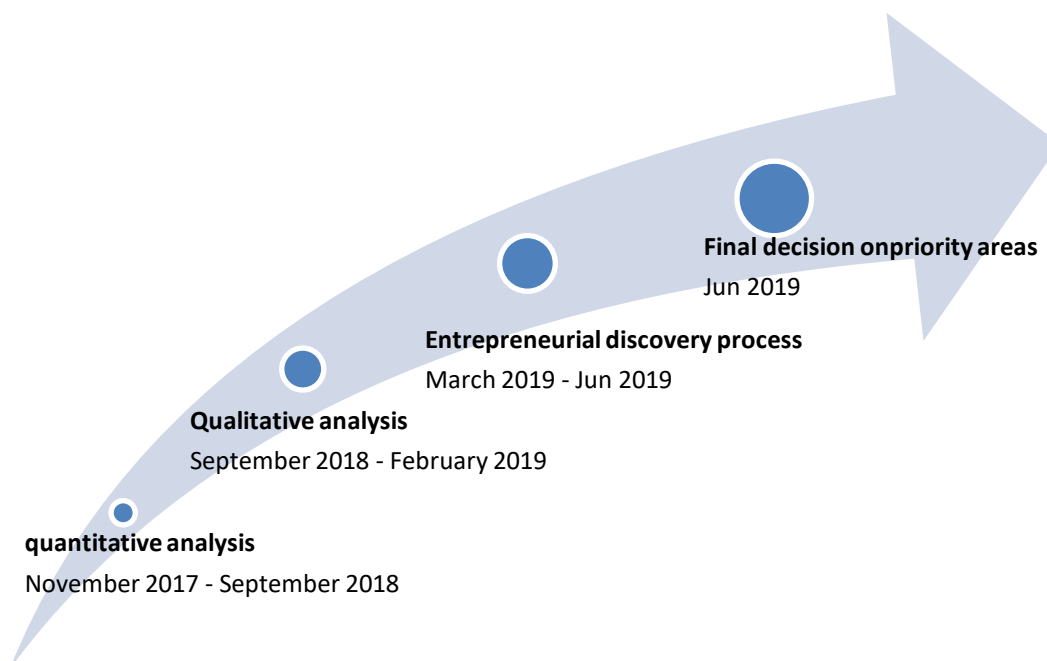


Figure 4. The process of identifying final priority areas

The process of selecting priority areas was based on the following principles:

- an inclusive and interactive bottom-up process in which participants from different areas (decision makers, businesses, universities) discover new potential activities and opportunities, as well as ways to apply the discovered potential,
- integration of entrepreneurial knowledge in different organizations through the creation of links and partnerships,

²⁵ Kroll H., Schnabl E. & Horvat Dj. (2017). *Mapping of economic, innovative and scientific potential in Serbia*, Joint Research Center of the European Commission

²⁶ Bole D., Živković L. & Nedović V. (2018). Izveštaj o kvalitativnoj analizi preliminarnih prioritarnih oblasti u procesu pametne specijalizacije u Republici Srbiji, radni dokument (Report on qualitative analysis of preliminary priority areas in the process of smart specialization in the Republic of Serbia, working document)

²⁷ Joint Research Center (JRC), the European Commission (2018). *Supporting an Innovation Agenda for the Western Balkans*, Luxembourg: Publications Office of the European Union, 2018

- exploring and opening of new technological and market opportunities that abound in attractive innovative solutions,
- regional coverage.

3.1.1. Quantitative analysis

The quantitative analysis included the following steps: (1) mapping of the economic, innovation and scientific potential of the Serbian regions and (2) mapping of the innovative and creative potential of the economy. Following the completion of mapping of the economic, innovation and scientific potential of the Republic of Serbia by a team of experts from the Fraunhofer ISI Institute in Karlsruhe, with the support of the *JRC* and the analytical team in the Republic of Serbia (December 2017), mapping of innovation and creativity potential implied a complementary analysis (December 2018) aimed at supplementing the previous analysis with new indicators exclusively related to innovation programs and identifying creative potential not covered by the previous report. In the text below, the key findings of the quantitative studies are presented.

Mapping the economic, innovation and scientific potential of the region of the Republic of Serbia

The methodology for mapping economic, innovation and scientific potential was based on identifying the comparative advantages of the regions of the Republic of Serbia in relation to the national level using the following indicators: economic potential (employment, exports); innovation potential (innovation companies, patents) and scientific potential (published papers on the ISI list). In order to identify comparative regional advantages, a multi-dimensional quantitative analysis was used and it identifies *NACE* sectors on the regional level that have comparative advantage compared to the national level. The indicator used to determine regional comparative advantage is *Location Quotient (LQ)*, which determines the ratio of the sector's share in the regional economy and in the national economy.

The final selection of potential priority areas contained three criteria:

1. **The value of the quotient LQ.** The LQ value had to be higher than 1.5. According to this criterion, the sector must in relative terms be 50% more important in the regional economy than for the national economy.
2. **Absolute size.** This criterion was used due to the fact that the sector is in the relative sense more important than at the national level irrelevant if in the absolute sense it is too small, i.e. employing only a few hundred people. Therefore, absolute size was an important and necessary criterion.
3. **Growth.** Although growth has not been used as a prerequisite for qualification, growth provides important additional information on the relevance of the sector. This criterion provided the answer to the question of whether the sector is growing or is it a legacy of earlier years that would require efforts aimed at economic transformation.

The main conclusions of the quantitative analysis for the regions in the Republic of Serbia are as follows:

Belgrade region is the strongest economic and university centre of the Republic of Serbia. The region is characterized by a particularly high share of services in the overall structure of the economy with a continuous trend of growth of services industry. The region has identified strong economic potential in the areas of information technology, R&D, creative industries as well as growing innovation potential in some areas of the processing industry (e.g. beverage industry,

etc.). Services play an important role for employment in this region and account for 80.6% of total GDP. The prevalence of university education employees is particularly pronounced in the information technology sector, financial services, scientific and technical activities, public administration and education, where it reaches more than 60%. Belgrade has on average the best qualification structure of the workforce in the Republic of Serbia and the greatest scientific potential.

The Vojvodina region can be characterized as partly industrial, partly agricultural. The comparative advantage of the region in comparison with other regions in the Republic of Serbia lies in the production of automobile parts, the petrochemical industry, the plastics industry and agriculture. Scientific and research potential is particularly pronounced in the field of information technology. The prevalence of university education employees is particularly high in the information technology sector, financial services, scientific and technical activities, public administration and education, where it reaches about 60% and thus is not significantly below Belgrade. In contrast to Belgrade, the share of people participating in vocational education and training is above the national average in engineering, manufacturing and construction, while below the national average in business, administration and law.

Šumadija and Western Serbia is a region characterized primarily by agriculture (including the food industry), and with the arrival of FIAT, this region began to grow in the automotive industry where it had a significant legacy. The region has a strong scientific base in the field of mechanical engineering and pharmacy and a pronounced growth in the production of general-purpose machinery. The regional share of higher education employees ranges near the national average in most industries. In the IT sector, the share is 32%, which is half the level found in Belgrade or Vojvodina. Also, more than 55% of agricultural workers have less than secondary education (Vojvodina 39%). What is positive is that the share of people involved in vocational education and training is above the national average in engineering, manufacturing and construction.

The Region of Southern and Eastern Serbia is the poorest region of the Republic of Serbia, with the lowest average net earnings and the highest unemployment rate. The region is characterized by strong agriculture, textiles and rubber industry with a good scientific base in the field of electrical engineering. Regional share of higher education employees is below the national average, even in financial services, scientific and technical activities, public administration and education and certainly in many other activities, including IT. The share of vocational education and training is around the national average, slightly above only in agriculture, forestry, fisheries, veterinary science and the natural sciences.

The results of the quantitative analysis showed that in the regions of Southern Serbia, the structure of employment and added value do not overlap. Although agriculture is still very important in determining employment and income, its contribution to national GDP is not significant.

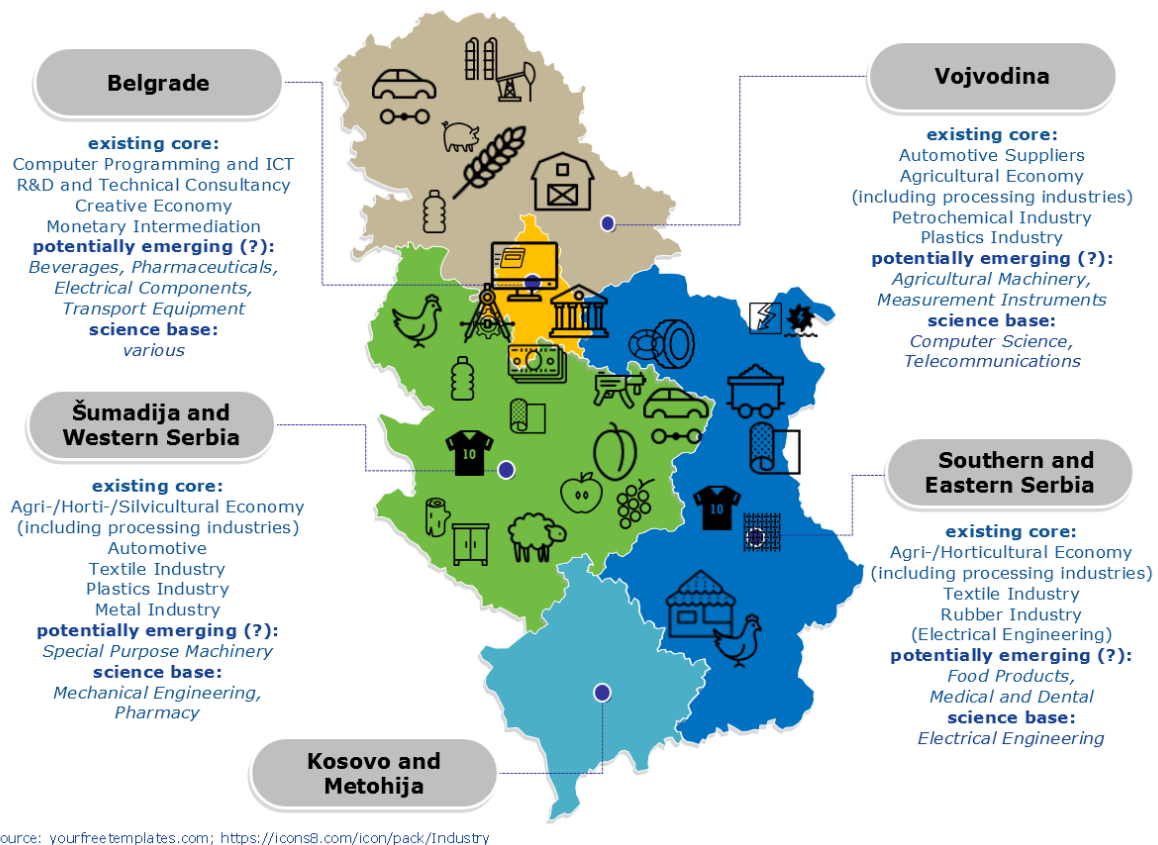


Figure 5. Potential priority domains in Serbia based on a quantitative analysis of the comparative advantages of the regions in relation to the national level

An additional conclusion of the quantitative analysis is that it would seem essential that an economy like Serbia's that still strongly depends on agriculture and various light industries also leverages on these potentials, rather than focusing on classic high-tech sectors alone. Data on the human capital of the region in the Republic of Serbia show that although a significant proportion of the population has secondary (i.e. middle school) education across the country, the majority with a college degree is concentrated in Belgrade and the Autonomous Province of Vojvodina. The obvious differences in the overall level of economic development of different regions (reflected in innovation and science) suggest that regional specializations and priority areas of Serbia must be developed in an integrated manner at the national level.

Finally, after a detailed examination of the results of the above-mentioned quantitative analysis at the regional level, it was noted that for the final determination of priorities, bearing in mind the overall level of development of the Serbian economy (the middle income level of the country with marked differences between regions) as well as the fact of its relatively small size and importance on a European and global scale, it would also be advisable to consider the comparative advantages at national level with respect to the region and the EU.

Mapping of the innovation and creative potential of the economy

Additional quantitative analysis was done with the aim of obtaining a comprehensive picture of the research and innovation potential of the Republic of Serbia and eliminating the shortcomings of the previously conducted study. In addition to data and indicators from official statistics, this

analysis relied on all other available information from the innovation ecosystem of the Republic of Serbia: the programs of the Innovation Fund and the European Bank for Reconstruction and Development, successful start-up companies, business clusters, incubators, etc. These additional analyses confirmed most of the findings from the mapping analysis described above. In addition, they indicated that other areas such as energy efficiency, key enabling technologies (KET), and environmental protection should be addressed. They also substantiated the conclusion that in addition to the regional, there should be a national approach to considering comparative advantages. Finally, they also indicated the need to look with some caution at some of the potential priorities derived from official statistics.

Based on the applications to the programs of the Innovation Fund to date, Serbia's greatest innovation potential exists in the ICT field, dominated by the software industry and software application development, followed by food and agriculture, mechanical engineering and energy efficiency (Table 2). It should be noted that project ideas in the field of energy efficiency are mainly related to solving identified problems of reducing energy consumption by applying the latest software solutions in which the main applicants are software companies.

Table 1. Overview of the number of applications submitted and the number of projects funded under the Collaborative Grant Scheme Program for joint business-academia projects, Mini Grants Program and the Matching Grants Program from 2011 to September 2019.

Industry sector	Number of applications submitted	Number of projects funded
ICT	345	35
Software and application development	127	14
Food industry and agriculture	117	14
Energy and energy efficiency	114	11
Mechanical engineering	99	17
Natural sciences	57	6
Electronics	52	6
Medical and therapeutic equipment	42	7
Environmental protection	41	3
Construction	30	5
New materials and nanotechnologies	27	2
Other Industries	27	2
TOTAL	1.078	122

Source: Innovation Fund

The statistics of the “Green Innovation Vouchers” programme, for which a call for proposals launched by the European Bank for Reconstruction and Development (EBRD) in 2018 shows that cooperation in the field of improvement and more efficient use of machinery and equipment, is dominant. The objectives of the call were the development and implementation of green technologies in all sectors of the economy, the reduction of environmental impacts, the promotion and support of the transition to the green economy, the enhancement of innovation capacity and competitiveness of SMEs, and support for applied research and development. 78 consortia (scientific research organizations and SMEs) have applied for the programme, of which 10 have been approved. Topics within which the projects were written are presented in Table 3.

Table 2. Applications for green innovation vouchers in 2018 by invitation of the EBRD by scientific area

Scientific area	Percentage of projects submitted for innovation vouchers
Machinery and equipment	27%
IT/IoT	21%
Energy/resource efficiency	18%
Waste management	18%
Renewable resources	8%
Sustainable products	8%

Source: EBRD

Based on the list of the most active clusters, it can be seen that the greatest potential for association in thematic areas is in the sectors of information and advanced technologies, agriculture and food, mechanical and metal industries. There are over a hundred clusters in the Republic of Serbia, but most are underdeveloped. An overview of the areas of the most active clusters indicates the potential for thematic priority areas:

- Automotive Cluster of Serbia, Belgrade
- ICT Network, Belgrade
- Cluster of Fashion and Clothing Industry of Serbia, Belgrade
- Pannonian Bee Cluster, Novi Sad
- Cluster of the Tourist Microregion of the City of Sremska Mitrovica, Sremska Mitrovica
- Cluster of Health, Wellness and Spa Tourism of Serbia, Belgrade
- Niš Cluster of Advanced Technologies, Niš
- Business Association ICT Cluster of Central Serbia, Kragujevac
- Vojvodina ICT Cluster, Novi Sad
- Vojvodina Organic Agriculture Cluster, Novi Sad
- Vojvodina Metal Cluster, Temerin

The general characteristic of business incubators in the Republic of Serbia is that they are at a lower level of development and that they should improve and standardize the services they provide, develop internal management capacities as well as introduce a performance management system to reach a higher level of development and offer value added services. There are currently 40 active business incubators in the Republic of Serbia, which is a significant increase over 2006 when only 5 business incubators were operating. They have good regional coverage and are mostly located in major cities. The establishment of business incubators in the Republic of Serbia was often not accompanied by their intensive development. In many cases, the services provided by incubators are minimal and oriented at administrative and accounting support. Few business incubators provide basic innovation services such as intellectual property protection. As a result of these problems and the economic crisis, the expected full impact of investing in business incubators has not been realized.²⁸

The role of business incubators as drivers of business ideas, innovation and entrepreneurship has not been adequately recognized and supported at national, regional and local levels. There is a lack of cooperation between local and national stakeholders as well as insufficient awareness of the importance of business incubators for the business ecosystem.²⁹

²⁸ GFA (2019). Study on the current situation of BIs in the Republic of Serbia, Projekat: Business incubators enabled to provide high value services to SMEs, Service Contract No. 48-00-00024/2017-28.

²⁹ GFA (2019). Study on the current situation of BIs in the Republic of Serbia, Projekat: Business incubators enabled to provide high value services to SMEs, Service Contract No. 48-00-00024/2017-28.

The Republic of Serbia has great potential for the growth and development of the creative industry (CI). The results of the quantitative analysis showed that the creative industries are one of the important potential priorities in the Belgrade region, which is Serbia's most important economic centre. In the last few years, the creative industries have become an increasingly important component of the contemporary Serbian economy and one of the key elements for accessing the creative economy and society. The potential of creative industries should not be viewed solely through the impact on economic development. Creative achievements influence the creation of the identity and image of cities and regions. That is why investments in creative industries are also investments in better quality of life and strengthening of local and national identity.

The structure of clusters in the creative industries shows that the Republic of Serbia is dominated by smaller clusters with up to 25 members. They belong to entrepreneurial type of clusters, they have been established to improve cooperation of micro companies and entrepreneurs, to provide access to information and enable cooperation. **Creative sector in the Republic of Serbia is characterized by large number of small and micro companies (23,8%) and entrepreneurs (67,5%).** Micro firms with up to 3 employees have a particularly high share. Of the total number of start-ups in the Republic of Serbia, 14.1% belong to the creative industries. New companies within this sector achieve annual growth of 3,25%, which is significantly higher than total economy average (2,1%). As regards to sector distribution of new entrepreneurs, leading sectors are design and creative services such as graphic design, film, video production, then programming and engineering activities.³⁰

Number of companies in this area indicates increasing tendencies in period 2014-2018 comparing to remaining section of Serbian economy. Average annual growth rate of legal entities within the broadly defined sector of CI was 6.2 percent in the period from 2014 to 2018, with the growth rate increasing year on year. The greatest number of companies and entrepreneurs was registered in the Belgrade region, and the total number of companies increased by 33.4% in 2018 compared to 2014. In the same period in the Vojvodina region, the number of companies increased by 29%³¹. In the period 2014-2018, GVA of the CI in the private sector, according to the narrow definition, had the growth of 64,9%, while according to the broader definition that growth was 24,1%. The average annual growth rate of GVA of the private sector creative industries was 18.1% and 7.5%. Relative share of the GVA of the private sector creative industries in the GDP is greater than the share of construction, and slightly less than the share of agriculture. The share of exports in the total business revenues of companies amounted to 8-11% of business revenues in the period 2014-2017, while in 2018 and 2019 it had the share of 10-14%. The cumulative export growth amounted to almost 100% according to the narrow definition and around 50% according to the wider definition³².

Considering the above mentioned growth indicators and positive trends of this sector as well as importance of creative industries for Government, creative industries are recognized as significant sector in future Strategy of smart specialization that needs to be further examined within targeted interviewing

³⁰ Mikić H., Radulović B. & Savić M. (2019). Creative industries in Serbia: methodological approaches and economic contribution, rad u pripremi

³¹ Србија Ствара (2019). Анализа економских ефеката сектора креативних индустрија на економију Србије, финални извештај, Економски факултет, Универзитет у Београду, 2019 (*Serbia Creates (2019). The Analysis of Economic Effects of the Creative Industries Sector to the Serbian Economy, Final Report, Faculty of Economics, University of Belgrade, 2019*)

³² Србија Ствара (2019). Анализа економских ефеката сектора креативних индустрија на економију Србије, финални извештај, Економски факултет, Универзитет у Београду, 2019 (*Serbia Creates (2019). The Analysis of Economic Effects of the Creative Industries Sector to the Serbian Economy, Final Report, Faculty of Economics, University of Belgrade, 2019*)

of most significant participants of this industries in the Republic of Serbia conducted in the scope of qualitative analysis.

Three areas have been noticed, from previous insights, which permeate all other areas: *Energy and energy efficiency, Key Enabling Technologies (KET), Environmental protection*. There are no significantly good economic indicators for these areas in Serbia, but they are globally propulsive and achieved results and potentials within identified priority areas may represent solid basis for exploitation of potentials of these propulsive sectors. Considering that these three areas have not been recognized in process of mapping economic, scientific and innovation potential, the text below provides the current situation in these areas in the Republic of Serbia.

Energy and energy efficiency

Republic of Serbia is a country with very low efficiency of energy use. Removal of omission that led to this position of the Republic of Serbia will be priority of public policies during following years. Capacity of the Republic of Serbia for development and innovation in energy and energy efficiency is viewed in existence of significant industry capacities for electrical equipment for power systems, long tradition and experience in design and construction of power plants, transmission lines, substations and control system with global export potentials, natural resources for production of energy from renewable sources, number of education institution and study programmes, scientific and research organizations that may support and improve industry competitiveness through research and development, as well as existing market demanding upgrade and expansion of production capacities.

The Faculty of Technical Sciences in Novi Sad with a large number of spin-off companies is excellent example of creating globally significant intellectual property as precondition for foreign investments in research and development and employment of high-tech staff. The important multidisciplinary topics for research, development and implementation of innovation are most certainly: smart networks, integration of renewable energy sources, advance systems for storage and distribution of energy, monitoring energy efficiency, development of smart cities, energy efficient lighting, sustainable biomass production, use of internet for infrastructure maintenance, etc.

Traditionally important and successful energy sector in Republic of Serbia has necessary human capacity for development of innovative products and services. Despite the fact that research and development have not been specifically recognized in Energy Sector Development of the Republic of Serbia to 2025 with projection to 2030, there are elements which require connection of economy and researchers. Strategy recognizes three priorities: 1) securing energy safety, 2) development of energy market within EU market and 3) establishment of sustainable energetics (by implementing measures of energy efficiency, use of renewable energy source and implementation of norms of environmental protection and reduction of environmental impacts).

Key Enabling Technologies (KET)

In the area of the KET in the Republic of Serbia, large EU companies and companies from other countries, such as China, increase their investment in production of advance technologies in the Republic of Serbia in the area of electric drive and accompanying systems for auto industry, production of rail vehicles and wind turbines, development IT centres of large companies, etc.). On the other hand, establishing companies and research infrastructure in this area is still in its initial phase. The support that these technologies provide to the priority areas is a chance that should be used to increase competitiveness and entering the global market.

Key Enabling Technologies includes: micro and nano-electronics, nanotechnology, industrial biotechnology, advanced materials, photonics and advanced production technologies. As regards to photonics, there is currently a smaller group of innovative and high-tech companies in the Republic of Serbia which mostly work for defence industry. There are smaller companies in production of advanced materials that are already engaged in development and use of composite materials. There is a large chance to use advanced material in sector in which the Republic of Serbia has potential such as machine and auto industry and Food industry. There are companies in Serbia in advanced production technologies and electronics that are connected to industrial automation, introduction of “custom” systems, robotization, connecting hardware and software etc. This area is very perspective, since State institutions have recognized digitalization and industry 4.0 as strategic goals. One positive example involves additive manufacturing technologies that are recognized by development-oriented domestic companies.. As regards to biotechnologies Serbia has good scientific potentials. Furthermore, there are several companies conducting successful business in Serbia with technologies of significant importance for maintaining and creating new competitive advantages on world market. In addition to the above mentioned, a group of companies organized around the Acceleration Technology Group of the Serbian Chamber of Commerce was identified, and these companies participate in the supply chain for the need of acceleration technologies, some of them being active suppliers to the *CERN*.

Due to its horizontal nature and importance to innovation system, identified technologies should be horizontally supported. KET create added value in different industrial chains within thematic priority areas – from material for equipment and devices to final products and services. Horizontal connection of identified companies with vertical priorities will contribute to successful implementation of concept of smart specialization in Serbia.

Environmental Protection

There have been numerous researches in the field of environmental protection in the Republic of Serbia for decades. Still, the industry based on “green” technologies, water and soil treatment or waste recycling has not been sufficiently represented until now. The European Union recognizes ecology as an area where major investments are needed in order for the Republic of Serbia to reach EU environmental standards. Environmental projects with regards to water treatment and protection are of particular importance in the countries of the Danube region. The interest of the European institutions is also reflected by a range of programmes available to researchers and companies to focus their cooperation towards sustainable development and environmental innovation, such as IPA Cross-border Co-operation Programme or green innovation vouchers. Although economic results in the field of renewable energy sources, recycling, reduction of exhaust emissions or environmental quality maintenance are not significant, the field of environmental innovations is a main priority of sustainable development in a long run.

Identification of proposals of priority areas for entrepreneurial discovery

Based on the results of Mapping of economic, scientific and innovation potential at the regional level, as well as Mapping of innovative and creative potential of economy at the national level presented above, the Working Group for the Smart Specialisation Strategy and the Inter-ministerial Working Body reviewed all findings and made a decision to examine 6 priority areas additionally, through targeted interviews with business, scientific and research sector. The purpose of that is to obtain additional info on the potentials of the Republic of Serbia and the final selection of priorities for entrepreneurial discovery:

1. Information and communication technologies
2. Production and processing of food and beverages
3. Creative industries
4. Production of machines and electric devices
5. Environmental protection and energy efficiency
6. Key enabling technologies

3.1.2. Qualitative analysis – interviews

The qualitative analysis was necessary to overcome the limits of the existing industry and science classifications and identify real priority areas and value chains they represent. One of the motives for the qualitative analysis is a better definition of the preliminary priority domains for the next phase of the general framework of smart specialization - EDP.

The interview methodology included answers to the following questions:

1. Who are the key actors in preliminary priority areas?
2. Which are the prevailing sub-specializations in the areas?
3. Where is globally the highest value in the value chain created, and what is the position of the Serbian actors in the global value chains?

Apart from answers to the above questions, the additional objectives referred to the following:

1. Collection of key information for the development of EDP process so that it would be adjusted to needs and abilities of stakeholders.
2. Identifying process “ambassadors” in each priority area – representatives of economic, scientific and civil sector, who quickly recognized the usefulness of EDP and who are influential enough to be able to provide participation of other important stakeholders, and ready to contribute to process through frequent provision of opinions and recommendations.

The Qualitative Analysis Report³³ is the result of the continued process of identifying the potential priorities of the Smart Specialisation Strategy in the Republic of Serbia. Between September 2018 and February 2019, a total of 155 interviews with relevant actors of business, scientific and research, and public sector were performed in order to obtain additional information within 6 preliminary identified priority areas during a quantitative analysis.

The main findings of the qualitative analysis for potential priority areas are as follows:

The ICT Sector is one of the most dynamic and fastest growing sectors in the Republic of Serbia in the last 10 years. Within this area, based on the systematic data obtained during the qualitative analysis, the following sub-areas have been proposed: Big Data and Business Analytics; Cloud computing; the Internet of Things; Software development; Embedded systems; Artificial Intelligence and *blockchain* technologies. The general conclusion for all sub-areas is that two prevalent business models have been identified: development of own solutions and outsourcing. Competitive advantage in the global market is based on the quality of workforce and competitive prices. Domestic IT companies provide mostly advanced level of services whose quality is recognized in the global market. Serbian IT companies generally do not create complete value chains, and do not see each other as competitors due to the huge

³³Bole D., Živković L. & Nedović V. (2018). Izveštaj o kvalitativnoj analizi preliminarnih prioritarnih oblasti u procesu pametne specijalizacije u Republici Srbiji, radni dokument

demand in the global market. Overlapping with other fields and technologies is very present due to the horizontal nature that allows the development of other areas. Accordingly, an important message of qualitative analysis is that during the EDP workshops special attention should be paid to the horizontal aspect of ICT and the linking of key companies in this field with other sectors. The overall conclusion is that it is difficult to say whether there is a critical mass of firms for particular sub-areas, and to explore this issue, EDP workshops should provide a clearer picture of the potential within each sub-area, as well as to define the final names of sub-areas within the ICT sector.

Interviews conducted in the area of Production and processing of food and beverages pointed out the high potential and numerous innovative trends in the field of food and beverage production through which the existing natural resources of Serbia in agricultural production are to be used, and through which the centuries-old tradition of Serbia as agricultural land translates into a modern development resource. In line with these observations, the area of food and beverage production and processing should be placed as one of the strategic directions of the Republic of Serbia, and in the process of designing a smart specialization strategy, the proposed name for this whole section should be: Food for the future. Within the broader area, based on the systematic data obtained in the interviews conducted, three key sub-areas have been proposed: High-tech agricultural production; Value Added Food Products and Sustainable food production chain. The overall conclusion is that in the identified sub-areas there is a critical mass of companies needed to successfully carry out the EDP process, that there is high potential that needs to be further explored and used in the entrepreneurial discovery process.

In the area of machine and electronic device manufacturing, a total of 31 interviews were conducted with relevant stakeholders from academia and industry. The proposed name for broader area was: Future Machines and Manufacturing Systems. Within this area, five key sub-areas have been proposed based on systematic data obtained during interviews: Specific purpose machines; Smart management information – industry 4.0; Premium tools and components for the automotive, rail and aerospace industries; Eco-friendly and sustainable fuel combustion plants and Solutions for smart environments. The overall conclusion of the Coordinator for this field is that there is a critical mass of stakeholders required to successfully complete the EDP process. Interviewees confirmed the potential of the sub-area as well as the current and future overlapping with other areas.

Interviews conducted in the field of Creative industries indicated high potential in certain segments, especially in high quality staff, but also indicated limitations in the area of infrastructure. Within this area, three key sub-areas have been proposed on the basis of systematic data obtained from interviews conducted: Creative digital audiovisual production; Video game industry; Smart and active packaging. The overall conclusion is that in the identified sub-areas of the Creative industry segment, there is a critical mass of stakeholders needed for successful completion of the EDP process. Interviewees confirmed the potential of the sub-area as well as the current and future overlapping with other areas.

In the field of Environment and Energy Efficiency, a total of 20 interviews were conducted. The proposed name of broader area was: Energy Efficient and Eco-smart Solutions. Based on the systematic data obtained through the interviews, a sub-area was identified: Eco-smart energy sources. Within this sub-area, the following potentials that require additional research have been identified: biomass (pellets, biodegradable waste); efficient batteries, residues from other waste treatment processes: dry farm residues (from cows, cattle, pigs, chickens), residues from the meat industry – their rehabilitation and further exploitation, treatment of municipal waste, Geothermal energy and Solar energy. The overall conclusion for this area is that there is innovation and scientific potential. Due to the horizontal nature and importance of the innovation system, the area of environmental protection and energy efficiency should be supported horizontally within the EDP workshops. Horizontal linking of identified companies in this field with key stakeholders in the field of mechanical and electrical industry as well as agriculture and food industry will contribute to the successful implementation of the concept of smart specialization in Serbia.

In the area of Key Enabling Technologies and Emerging Technologies, a total of 25 interviews were conducted with all relevant industry and academia stakeholders. The sub-areas identified during the interviews were: Photonics; Advanced materials; Advanced manufacturing technologies and electronics; Biotechnology; *Blockchain* technology and Autonomous Driving and Aviation Systems. The overall conclusion is that there is no critical mass of firms in this area, a strong research infrastructure or large research centers involved in the production of new technologies and materials. Due to the horizontal nature and importance of the innovation system, identified technologies should be supported horizontally. Horizontal linking of identified companies in this field with vertical priorities would contribute to successful implementation of the concept of smart specialization in the Republic of Serbia.

Summarizing the previous conclusions from the qualitative analysis and following the proposal of the coordinator and co-coordinator for individual areas, the proposals on how to name the broader areas and sub-areas obtained as a result of the qualitative analysis is as follows:

Vertical priority areas:

1. Information and Communication Technologies

- Big data and business analytics
- Cloud computing
- Internet of things
- Software development
- Embedded systems

2. Food for Future

- High-tech agriculture
- Value added food
- Sustainable agriculture and food production

3. Creative Industries

- Creative Digital Audiovisual Production
- Video game industry
- Smart and active packaging

4. Future Machines and Manufacturing Systems

- Special Purpose Machines
- Information in the service of smart control - Industry 4.0
- Premium tools and components for auto, railway and aviation industry
- Combustion devices using eco-friendly and sustainable fuels
- Smart environment solutions

Horizontal (supporting) areas:

1. Energy Efficient and Eco-smart Solutions

- Eco-smart energy sources

2. Key Enabling Technologies (KET) and Emerging Technologies

- Photonics
- Advanced materials
- Advanced production technologies and electronics

- Biotechnology
- Blockchain technologies
- Autonomous driving, aircraft systems and engineering

3.1.3. Entrepreneurial Discovery Process

Entrepreneurial Discovery Process is an interactive process, based on a targeted dialogue gathering various entities for the purpose of identifying priority areas of smart specialization and development of a suitable policy mix for their implementation.

For the purpose of identifying and validating the future priorities of the Smart Specialisation Strategy of the Republic of Serbia, between March and May 2019, 17 workshops were held, divided in three thematic areas. The objective of first thematic workshops (*SWOT*) was to identify key challenges in potential priority areas, and to create the final SWOT matrix that would identify key strengths, weaknesses, threats and opportunities in the priority area.. The second round of thematic workshops (*VISION*), on the basis of the results of first workshops, focused on confirming the priorities through defining the priority area vision and defining the objectives to be achieved in the next 3 to 5 years. The objective of the third round of workshops (*Policy Mix*) was to define measures and activities for achieving of the identified objectives. There were 17 workshops within the potential priority areas with more than 200 different participants. The process of organization of workshops for the purpose of identifying the final priority areas is presented on Figure 6.

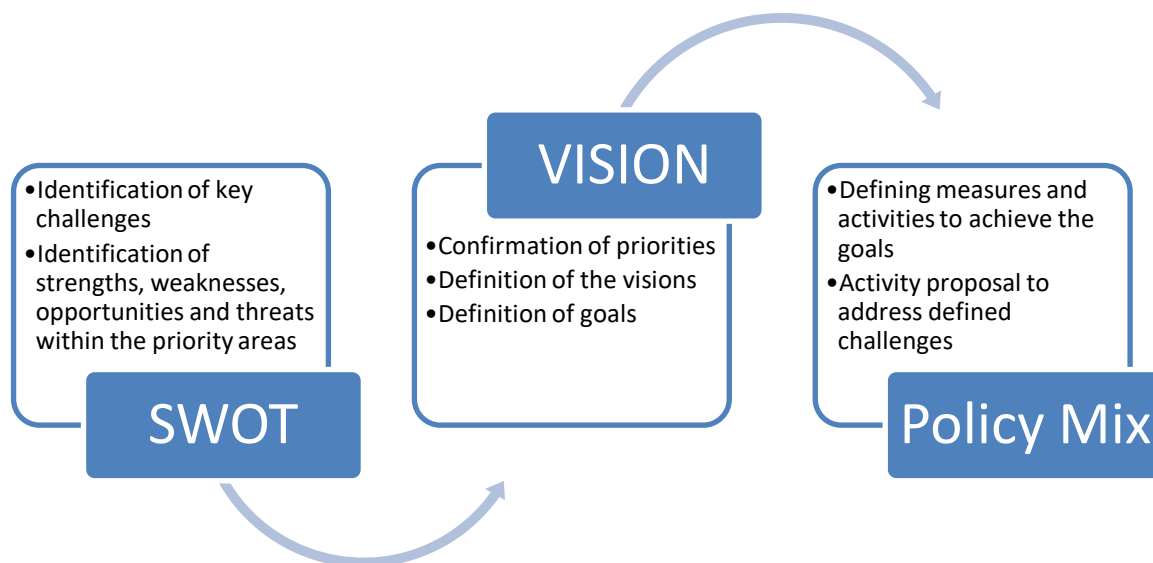


Figure 6. Process of organizing EDP workshops in Serbia

More than half of EDP workshop participants were the business sector representatives, which is an important performance indicator of the EDP. Apart from business sector participants, EDP workshops were attended by the representatives of scientific and education, public and civil sector (Figure 7).

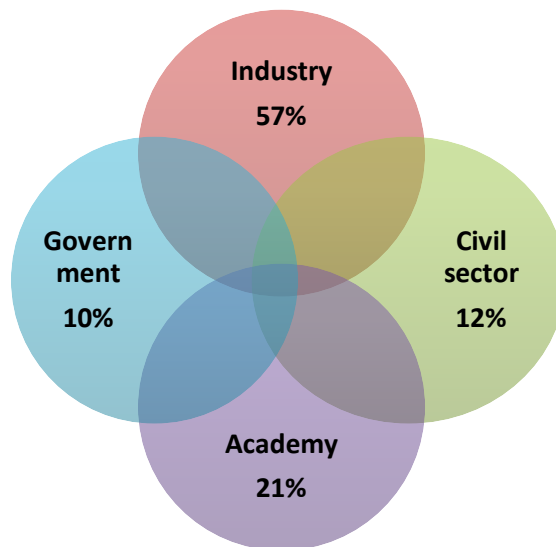


Figure 7. Participation structure at EDP workshops

The main results of EDP workshops were: confirmed priority areas, vision, objectives and measures for addressing the defined challenges. Workshops were held in the following Serbian towns and cities: Belgrade, Novi Sad, Niš, Kragujevac, Kraljevo and Gornji Milanovac. Workshops were facilitated by the coordinators for priority areas. There were between 30 and 50 participants at each workshop, and the decision-making was based on the consensus of all participants.

3.1.4 Final decision on priority areas

The final priority areas of the Smart Specialisation Strategy of the Republic of Serbia are the following: (1) Food for Future, (2) Information and Communication Technologies, (3) Future Machines and Manufacturing Systems, and (4) Creative Industry. This choice is the result of all presented analyses: quantitative and qualitative analysis and the EDP, following the European Commission’s methodology for developing Smart Specialisation Strategies.

Section 3.2 provides an overview of the state of play in the selected priority areas identified in the EDP.

3.2 State of play in priority areas identified in the entrepreneurial discovery process

The following section presents an overview of priority areas that is the result of summary reports obtained from workshops conducted within the entrepreneurial discovery process.

3.2.1 Food for Future

The economic significance of Serbia’s food sector is based on a number of advantages, including favourable environmental conditions for agriculture, extent and structure of arable land, a long tradition of food production, and proximity to the EU market. Global population is expected to grow in the coming decade, which will have a knock-on effect on increased demand for food products. Changing consumer habits and preferences have also resulted in increasing global demand for high quality, varied foodstuffs, opening great opportunities for increasing the volume

and quality of production in the Serbian agricultural and food sector. However, Serbian businesses in this sector wishing to compete in the global market face important challenges, such as: increasing productivity, improving environmental performance, and strengthening resilience of farming households to the weather, market trends, and other unforeseen economic developments. The greatest potential in this area lies in the innovative trend that is present, which involves the use of natural resources in an optimized way through which, the centuries-old tradition of the Republic of Serbia as an agricultural country, translates into a modern development resource. Capital investment is required to increase productivity in the agriculture and food sector, which is currently below European averages, but this cannot have a significant impact on productivity without additional investment in R&D and knowledge/education.³⁴

According to the Product Complexity Index (-0.79 in 2016), Serbia is the leading country in the Western Balkans and the closest to the global average (-0.52) when compared to nations that also have significant natural resources for the development of food industry. Although the Serbia is well below the European average by workforce productivity in the food-processing sector (which is compensated for by lower labour and energy costs), the PCI index reveals that Serbia has the greatest potential for the added value growth in this industry in the Western Balkans. Still, to improve competitiveness, productivity will have to grow faster than the expected increase in wages.³⁵

Although the sector is characterised by low product diversification (frozen raspberries account for 17% of total output), there is much room to promote competitiveness through continued diversification, technological modernisation, loss reduction, increases in product added value, greater commercialisation, and improved position in value chains. Some sectors are on the rise due to, for example, high-tech orchards (apples, apricots, peaches, cherries, sour cherries, raspberries, chokeberries, walnuts, hazelnuts, etc.), vegetable greenhouses (tomatoes, peppers, cucumbers, etc.), with horticulture products and vineyards also making use of new technologies. Modern plantations are mostly accompanied by new storage capacity (traditional and ultra-low-oxygen cold stores) or processing facilities (wineries) also owned by the growers, which allows direct access to markets.

Given the above considerations, “Food for Future” has been recognised as a strategic direction of the Republic of Serbia in the design and implementation of the Smart Specialisation Strategy. Findings of the SWOT workshop revealed much opportunity for inter-sectoral linkages in the “Food for Future” area. The participants noted the successful practice of using ICT in agricultural production and management of food supply chains. The potential of key advanced technologies was also emphasised, including industrial biotechnology, innovations coming from the creative industries (such as packaging), development of innovative machinery and equipment for use in new technological solutions, application of biomedical research, and the opportunities posed by traditional local cuisine for gastro-tourism. Key strengths, weaknesses, opportunities and threats of this sector in the Republic of Serbia identified in the entrepreneurial discovery process, are presented below.

Table 2. SWOT analysis of the Food for Future sector

STRENGTHS	WEAKNESSES
<ul style="list-style-type: none"> • Educated and highly qualified staff • Developed agricultural production/raw material inputs 	<ul style="list-style-type: none"> • Education system lacks up-to-date applied knowledge and practices • Low technology transfer from R&D to businesses

³⁴ Exploring the potential of agriculture in the Western Balkans. A Regional Report. World Bank Group, 2018.

³⁵ CEVES & CCIS (2019) Food and Drink Industry Performance and Value Chain Analysis with a focus on raspberries, Belgrade, December 2017

<ul style="list-style-type: none"> • Traditional products, biodiversity, non-GMO agriculture • Examples of successful export-oriented producers • Examples of successful innovations • Examples of successful inter-sectoral cooperation and diversification 	<ul style="list-style-type: none"> • Poor perception on the need of intellectual property protection • Lack of appropriate workforce • Poor demographics in rural areas • Underdeveloped technology infrastructure • Fragmented farms • Fragmented production capacity and sub-optimal industry clusters and other business association arrangements • Inadequate production structure – low added-value products • Under-utilised potential for inter-sectoral cooperation • Investment in insufficiently sustainable, insufficiently productive, and uncompetitive industries and technologies • Producer mistrust of domestic innovations
OPPORTUNITIES	THREATS
<ul style="list-style-type: none"> • Strengthening inter-sectoral cooperation and multidisciplinary arrangements • Intensive agricultural production • Greater share of added-value products through innovation • Certification and commercialisation of traditional foodstuffs • Exports to most favoured nation markets • Use of technologies and innovative sales and promotion arrangements • Greater efficiency in use and development of agricultural extension services 	<ul style="list-style-type: none"> • Out-migrations abroad and migrations of young people from rural areas • Poor technical preparedness for climate change • Higher EU agricultural subsidies • Lack of continuity in implementing incentive policies and strategies • Consumer mistrust of and resistance to innovations

As a result of the entrepreneurial discovery process, as well as through empirical research, the main priorities that will be supported in the area of Food for the Future are:

- **High-tech agriculture**
- **Value-added food products**
- **Sustainable food production chain**

During the entrepreneurial discovery process, the results of the SWOT analysis were interpreted through a Strategic orientation analysis where participants defined the future strategy orientation for each sub-area. This highly informative assessment showed that the strategy for the sub-sector of high-tech agriculture and value-added food products should focus on the identified strengths so as to ensure that Serbia takes advantage of its opportunities. By contrast, the strategy for the sustainable food production chain should focus on the weaknesses that threaten the opportunities.

High-tech agriculture

Agriculture in the Republic of Serbia is generally characterised by very low productivity, with low yields per hectare or per capita, and a lack of the processing industry. Yields are lower due to

inefficient uptake of modern agricultural machinery and agricultural technology and this is frequently compensated by lower labour, energy, and land costs, but faster growth of competitiveness requires greater productivity.

The number of producers successfully switching to high-tech agriculture has been increasing. Investments are being made in high-tech, labour-intensive production not only by agricultural producers, but also by investors using capital generated from other industries, and by foreign entities.

High-tech agriculture requires new resources, which generates innovations across numerous related fields, such as seed and crop production, production of mineral and microbiological fertilisers, production of physical infrastructure (poles, nets, irrigation systems), production of measuring and control equipment (sensors, data warehouses, information systems for data collection, processing and management), growth regulators, biological and chemical agents for pest and disease control, commercialisation of agricultural waste, packaging production, logistics systems, etc. Serbian entrepreneurs are already engaging in some of these activities, while in many other activities they have developmental potential.

Conventional plant and animal production is being supplemented by revolutionary modern technologies and arrangements, including molecular genetics, biotech, smart machines, logistics, and ICT solutions such as sensors, internet of things (IoT), geolocation, satellites, drones, robotics, artificial intelligence, and many other innovative technologies.

New ICT knowledge and innovations offer a wealth of opportunities for continuing development and transformation of agriculture in Serbia and the broader region. Digital agriculture permits synergy between innovators and the private sector and direct communication between innovators and other stakeholders, on the one hand, and farmers, academia, and R&D centres and institutes, on the other. Digital agriculture also has a key role to play in linking producers with markets and in shortening value chains and reducing transaction costs.³⁶

Value-added food products

The relationship between agriculture and the food industry, both in terms of GVA and export, indicates that the Republic of Serbia is among the countries that add the least value to the agricultural production through the processing chain.. The analysis of the state of play in agricultural production shows that Serbia's total added value in agricultural production is low due to short value chains and low productivity.³⁷ Evidence of short value chains includes:

- **Considerable export of raw materials and products of low degree of processing.** In 2016, Serbia exported agricultural products worth nearly €1bn, mostly cereals (primarily maize) and oilseeds and other industrial plants. These exports of raw materials indicates the lost value added to the food industry. Maize is almost exclusively exported raw, with soybean exports also increasing. As these crops are non-GMO, Serbia has a chance to brand and promote the products as such. Products are often marketed and exported as either raw or as finished even after undergoing only primary processing (such as flour milling, for cereals and soy, or freezing, for fruits and vegetables).

³⁶ *Exploring the potential of agriculture in the Western Balkans. A Regional Report. World Bank Group, 2018.*

³⁷ CEVES & CCIS (2019) Food and Drink Industry Performance and Value Chain Analysis with a focus on raspberries, Belgrade, December 2017

- **Limited share of more extensively processed products in exports and a large share of imported processed products in the market.** Luxury and expensive products account for a small proportion of total exports. For example, raspberries are exported in bulk, in packages of 5 to 10 kg, and not in ‘retail-oriented’ ready-made packaging or processed into functional value-added food products. Other agricultural products share similar issues. Although there are significant amounts of non-GMO soybeans, the volumes of soy cheese or soymilk are negligible. Even though confectionery products are the most expensive exports in the food industry, in addition to accounting for an unusually small share of Serbia’s exports, their quality and structure mean they mostly have lower added value. The potential is also under-utilised for the production of high-quality, high-value-added wine, herbal infusions, processed medicinal plants and herbs, apiculture products, etc.

One of the greatest opportunities for Serbia’s agriculture is to enhance the food production chain, and to transform Serbia from an exporter of agricultural products into an exporter of food and finished products based on raw produce. This suggests that the structural transformation of the agricultural and foodstuffs sector from agriculture to food processing, which offers greater potential for increasing value added to the economy and growth of exports, is a key priority in this area. The Republic of Serbia already has numerous food producers that successfully make food products and market them both at home and abroad. The confectionery industry, fruit and vegetable processing industry, oil industry, and other sectors are particularly prominent in this regard. Value-added products have a special role to play in the development of the food industry: these comprise a variety of food products in growing demand both in Serbia and abroad, including:

- *functional foods* or ‘nutraceuticals’ carrying nutritional or health claims (rich in fibre, protein, minerals, or antioxidants, and products containing probiotics, medicinal herbs, apiculture products, and the like);
- *enriched foods*, products with one or more added natural nutrients required for modern diets;
- *fortified foods* with added extra nutrients;
- *organic products*, with an emphasis on shifting from certified primary agricultural products to processed organic products (frozen or dried organic products, organic dairy products, etc.);
- *food for special dietary uses*, such as gluten-free products, products for diabetics, vegetarian products, products aimed at various consumer groups such as athletes, children, and the like;
- *products for the food manufacturing industry* (modified starches, baking mixes, etc.);
- *products obtained from raw materials with special characteristics* that have protected geographical indications (alcoholic and non-alcoholic beverages, dairy products, meat products, fruit and vegetable-based products, apiculture products, etc.);
- *products made using traditional methods* (e.g. meat products, dairy products, etc.);
- *innovative consumer-friendly products* (e.g. tea packaged in a teaspoon infuser); and
- *extended shelf-life products* that preserve the nutritionally valuable components of raw materials (e.g. freeze-dried fruit).

The findings of the EDP and public consultation reveal that stakeholders recognise the importance and necessity of investing in both cross-cutting and inter-sectoral innovations, such as biotech, biomedicine, and environmentally friendly solutions. With demand growing for food with labelled nutritional value and health benefits for consumers, biomedicine is able to make a major contribution to the production and marketing of value-added products in this sector. Consumers are also increasingly interested in the veracity of health safety and nutritional value claims, as well as in scientific, biomedical, and environmental proof of such statements. The same applies to biotechnology, including industrial biotechnology, as part of a horizontal priority in food production where value added is reflected in the

fact that food is toxicologically safe, free of contaminants or residues and that the production chain of both plant and animal food products is based on environmentally friendly technologies and processes that have a positive impact on health status.

Numerous products from these groups are already made by Serbia's successful food producers. Some of the products are exported, mostly to the neighbouring countries, but there are also examples of successful exports to more distant markets. A significant number of researchers are developing value-added products in the Republic of Serbia, which gives this field additional strength, but arrangements must be made whereby the numerous findings made and products developed actually enter production and markets.

Sustainable food production chain

Sustainability of the food supply chain requires the application of manufacturing practices, procedures, and technologies along the entire production and processing chain to ensure the products are competitive in the market whilst at the same time without degrading the natural resources on which agricultural production is based. Sustainability involves not only how food is produced, but also how it is distributed, packaged, and consumed. In agriculture, sustainable production is an integrated system of crop and livestock production that enables optimum utilisation of resources which in turn ensures maximum energy efficiency, superior product quality, and conservation of resources and biodiversity for agricultural production. In food production, sustainable production involves the complete utilisation of agricultural products so that all nutrients are used optimally, whilst waste is reduced to a minimum through its recovery and reuse. Sustainable production also involves taking measures to reduce losses and waste of agricultural and food products in the chain of production, storage, processing, distribution, and consumption. Sustainable agriculture also means the protection of soil fertility for future production, including reduction in the use of mineral fertilisers and pesticides, use of biological and organic fertilisers, application of biological pest control measures, use of biostimulators, crop rotation, avoidance of monoculture, and the like. Application of environmentally friendly principles in the food production chain and transition from intensive (conventional) to sustainable agriculture results in the establishment of a better ecological balance in the environment.

There are numerous examples of Serbian agriculture and food production companies that have achieved sustainability in production and are investing in innovations and supporting research aimed at improving sustainability, including:

- growing number of agricultural firms engaging in **integrated production;**
- numerous **biogas and biodiesel** production plants;
- firms using waste from food and nutrient production to make **secondary food products for human and animal consumption;**
- companies using by-products from food production to make **alternative food and non-food products;**
- numerous research projects in this field.

Companies that apply the principles of sustainable production further contribute to reducing costs, thereby increasing their competitiveness in the market. Sustainable production entails investment in energy facilities and other plants, which may foster the growth of mechanical engineering.

For this sub-sector to achieve its full potential, efforts must first be made to address a number of environmental deficiencies that limit the development and implementation of technologies aimed

at enhancing the sustainability of the food production chain. These include waste management regulation, pesticide use, and soil conservation and improvement. The EDP therefore identified areas of innovation (see Table 8) that ought to ensure the sustainability of Serbia's food production.

Vision of priority area

The stakeholders that participated in the workshops held in the EDP and targeted dialogue organised in the course of development of the Smart Specialisation Strategy have agreed on the final vision statement for the sector:

REPUBLIC OF SERBIA – A VALUE-ADDED FOOD PRODUCER THROUGH KNOWLEDGE-BASED PARTNERSHIP

3.2.2 Information and Communications Technology

The information and communication technologies (ICT) sector has been Serbia's fastest-growing industry over the past 10 years. A comparative assessment of employment in computer programming, consulting, and related activities shows that, between 2010 and 2015, Serbia recorded the highest employment growth in this sector compared to selected countries of the Danube region.³⁸ Moreover, according to data released by the National Bank of Serbia, exports of ICT services grew at a steady rate of over 20 percent annually from 2015 to 2018; coupled with y-o-y export growth of 26.8 percent over the first eight months of 2019, these data suggest that exports of ICT services have been increasing for the past five years³⁹. The revenue per employee value of the ICT sector is 6 times higher than the average for the whole economy.⁴⁰ Increased foreign workforce demand has caused significant increase in employment in this sector. An average of 200 new ICT companies are registered each year in the Republic of Serbia. Most start-ups employ developers and are focused on strong and liquid international IT markets.

On the other hand, the value of the domestic market has held steady at about €500mn for some years: the Republic of Serbia's per capita investment in IT is €75, compared to the European average of €800 and €150 at the time of accession in countries that joined the EU in 2004. For Serbia to reach this minimum IT investment and so prove it has made progress in achieving EU and global standards, the domestic market would have to record double-digit growth over the next five years. Such y-o-y growth (at a rate of 11 percent) was seen in 2019 and constitutes a sound basis for accelerated development of the Serbian market: this was identified as a key objective in the EDP as it reflects a number of other major components, primarily improved education and development of an entrepreneurial ecosystem.

Nationally, there are vast differences between Serbia's regions in terms of human capacity, capital, and availability of IT resources. The largest and most important companies are located in the three largest urban centres of Belgrade, Novi Sad, and Niš. Some two-thirds of all ICT staff (and software developers) work for businesses registered in Belgrade. Firms employing as much as one-

³⁸ Kleibrink, A., Radovanovic, N., Kroll, H., Horvat, D., Kutlaca D. & Zivkovic, L. (2018) *The Potential of ICT in Serbia: An Emerging Industry in the European Context*, JRC Technical Report, Luxembourg: Publications Office of the European Union, 2018

³⁹ http://www.nbs.rs/internet/cirilica/80/platni_bilans.html

⁴⁰ Matijević M. & Šolaja M. (2018). ICT in Serbia - At a Glance, Vojvodina ICT Cluster

quarter of all developers are located in Novi Sad.⁴¹ The greatest net assets, of some €212mn, are held by software exporting firms. Although Serbia's broadband quality is lower than in the EU, internet access has significantly improved in recent years. In addition, the quality of ICT infrastructure does not pose significant hurdles to the development of this industry in Serbia, as most ICT companies are concentrated in urban areas, where infrastructure quality is superior to the national average.⁴² The rapid growth of the sector is a strong indicator of existing and future potentials.

The ICT sector should, therefore, be accorded priority on two levels. The first is continued development and growth based on the sale of IT services and products in global markets. The second is the digital transformation of the economy and society as a whole, and here conditions should be created to use the initial successes of Serbia's IT sector to promote the growth of the national market and digital transformation. Both of these levels were identified in the EDP and the findings of the ICT sector SWOT analysis.

Table 3. SWOT analysis of the ICT Sector

STRENGTHS	WEAKNESSES
<ul style="list-style-type: none"> • Qualified workforce, with extensive engineering knowledge • Creativity and ability of Serbian firms to offer world-class solutions • Competitiveness based on lower costs and high-quality human resources • Above-average English language proficiency • Ability of Serbian companies to offer full service, including development, delivery, maintenance and support • Ubiquitous agile approach to business 	<ul style="list-style-type: none"> • Limited soft business skills and know-how at start-ups and companies • Simple outsourcing as prevailing business model • Poor collaboration between firms • Poor local linkages and exchange of knowledge between start-up founders, investors, and experts • Insufficient ICT professionals • Poor collaboration with R&D sector • ICT firms unwilling to hire students as interns • Some stakeholders falling behind in mastering latest technologies and knowledge
OPPORTUNITIES	THREATS
<ul style="list-style-type: none"> • Young people increasingly interested in IT and related fields • Strong entrepreneurial spirit. Growing number of start-ups that require just an idea, without major investment • Use and evolution of outsourcing business model. Greater orientation towards product development • Accessibility of global ICT market with high growth potential • EU funds • Annual growth rate of national ICT market estimated at 20 percent; creation of value chains • Inter-sectoral co-operation constitutes opportunity for innovation and progress 	<ul style="list-style-type: none"> • Education doesn't keep the pace with the development and needs of the ICT sector • Other sectors unwilling to adopt new ICT solutions • Countries at similar levels of development threaten to overtake the Republic of Serbia • Out-migration of highly qualified ICT experts • Decentralized system of support for disbursement and use of available EU funds • Inefficient mechanisms for commercialising R&D output produced by universities and institutes

⁴¹ Verbić S. (2017). Digitalna ekonomija u Srbiji 2017. godine, Tim za inovaciono preduzetništvo i inovacione tehnologije, Projekat Konkurentnost i zapošljavanje, RSJP, radni dokument

⁴² Matijević M. & Šolaja M. (2018). ICT in Serbia - At a Glance, Vojvodina ICT Cluster

<ul style="list-style-type: none"> • Potential of Serbian community abroad: use of knowledge and skills of Serbian businesspeople, experts, researchers, and scientists living abroad • Advent of new technologies • Non-formal ICT education • Use of new approaches and technologies in education • Alignment of ICT regulatory framework in EU accession process • Opening of access to public data • Intent of public administration to digitalise • Greater orientation to dual education at universities 	
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The key advantage of the Serbian ICT sector is its strong knowledge base and creativity of employees that enable Serbian ICT companies to offer world-class solutions and full service, from development to support. The global competitiveness of the sector is based on its lower costs and greater quality of human resources.

Growth of the export-oriented segment of Serbia’s ICT industry is predicated on ongoing growth in demand in foreign markets; this segment is primarily based on outsourcing model. Outsourcing firms account for as many as 138 of the 200 IT companies that earn the greatest proportion of their revenue from exports; the remaining 62 generate most of their revenue by selling their own products or services. The outsourcing sector employs as much as 82 percent of the workforce and accounts for 69 percent of all exports.⁴³ Of the 200 largest IT exporters, 88 were founded by foreign individuals or businesses; these firms employ 58 percent of the workforce, generate 54 percent of all export revenues, and do almost exclusively outsourced work.

The out-migrations of highly skilled IT professionals are a key threat to the growth and development of this sector. In addition to migrations abroad, much of this ‘brain drain’ is internal, as most firms and employees are based in one of only three cities, Belgrade, Novi Sad, and Niš. The supply of IT professionals in Serbia is currently much lower than demand.⁴⁴ Both the private and the public sector generate limited demand for domestic IT products and services. The lack of investment in infrastructure and human resources is caused by the lack of demand in the domestic market.⁴⁵

Serbia’s opportunities include the growing interest of young people in IT and related sectors: this ought to be accompanied by accelerated development of all aspects of an entrepreneurial system so as to ensure this interest is productively channelled. Whilst the export-oriented segment of the ICT industry has achieved annual growth of more than 20 percent, which is expected to continue, domestic demand has been much slower to pick up. Growth of the domestic IT market constitutes another key opportunity, not only for ICT development but also as a driver of growth in other sectors as well. Representatives of IT firms who took part in workshops held in the EDP highlighted major opportunities for innovation and advancement in cross-sectoral cooperation, public-private partnerships between faculties and companies aimed at specialising in highly profitable services, and,

⁴³ Matijević, M. (2017). IT u Srbiji, 2016-2017. SITO.

⁴⁴ ETF. (2017). ICT Sector Skills Needs Analysis in Vojvodina in a VET multilevel governance perspective. Turin: European Training Foundation.

⁴⁵ Verbić S. (2017). Digitalna ekonomija u Srbiji 2017. godine, Tim za inovaciono preduzetništvo i inovacione tehnologije, Projekat Konkurentnost i zapošljavanje, RSJP.

finally, opening access to public data. The readiness of public administration and businesses to digitalise, coupled with targeted measures designed to promote domestic demand and develop an entrepreneurial ecosystem, may create preconditions for significantly better utilisation of the national IT sector, as this industry will doubtlessly contribute much to these processes. It is indisputable that Serbia needs more rapid IT growth, but this growth depends on large-scale government procurement, large investments in the business sector, and the presence of global IT suppliers.

The EDP and empirical research have revealed that IT firms' business models are largely based on outsourcing model. Serbian companies provide outsourced services to clients by:

- a) working to specifications provided by clients;
- b) leasing out professionals on an hourly or daily basis to work directly for clients; or
- c) custom software development.

In all of these three cases, the client receiving IT services from the Serbian outsourcing company retains copyright to the end product. The first two options (a) and b)) are examples of low value-added services, whereas, by contrast, custom software development (c) is a higher value-added activity as it requires in-depth knowledge and specialisation (for a particular niche, client type, technology, etc.).

Large demand in global markets permits outsourced IT service providers to become profitable and grow as soon as they are set up. The key characteristic of this model is that payment for outsourced services is made on a one-off basis. The growth factor inherent in how the service is provided is that the firm can negotiate the number of experts whose labour (time) is required with its client. Hence, the more staff there are, the greater the revenue.

The outsourcing model is complemented by own product development. Here, instead of working to fulfil a client's order, the firm develops its own software solution, from idea to finished product, which is a stand-alone item distributed to customers under a licence. This business model usually requires significantly greater investment in development in terms of both time and money before the product is ready to be marketed and can generate revenue. Nevertheless, the work involved can be monetised more than once, and this business model also increases revenue per employee. The growth factors in this business model are product quality and demand.

Given these prevailing business models in the Serbian IT industry, the key IT priorities to be supported under the Smart Specialisation Strategy are:

- **Custom software development**
- **Own product development**

Custom software development

Custom software development is the design, production, installation, and maintenance of software applications for a specific user, function, or organisation. The software is designed to meet customer needs as an alternative to traditional, widely available software that is not be an option for the customer. Custom software development constitutes outsourcing that adds value to the client through specialisation in a particular technology, market, or client or group of clients, and the added value generates greater revenue. This form of outsourcing is characterised by a much closer and stronger relationship with the client, as well as by greater opportunities to develop new software, either the firm's own product or an application designed in collaboration with the client. Companies that engage in custom software development will commonly graduate to this tier after having first leased IT

professionals out directly or on an hourly or daily basis, or after having developed capacity to deliver added value for their clients through specialisation. There are dozens of Serbian firms operating in this sub-sector, and it accounts for a large proportion of the country's software exports. Custom software development will receive support under the Smart Specialisation Strategy to permit assistance to be provided to companies wishing to improve their outsourced business models.

Own product development

Firms that develop their own products constitute a smaller percentage of the Serbian IT industry. Their business models are based on the production of new and/or improved high-tech solutions in a wide range of sectors that include software, services, embedded systems, and combinations of all three. This area holds potential due to the fast returns possible on investment; if domestic demand increases, this model will significantly promote the development of other sectors of the Serbian economy.

Vision of priority area:

The stakeholders that participated in the workshops held in the EDP and targeted dialogue organised in the course of development of the Smart Specialisation Strategy have agreed on the final vision statement for the sector:

REPUBLIC OF SERBIA, SOURCE OF SOPHISTICATED HIGH-TECH SOLUTIONS AND SERVICES FOR THE GLOBAL MARKET.

3.2.3 Future Machines and Manufacturing Systems

The machinery and equipment manufacturing industry flourished in the Republic of Serbia during the 1980s. Despite a decline in the 1990s, knowledge, skills and heritage in this area have been a strong foundation for rapid development and growth in recent years. The machinery and equipment manufacturing sector in Serbia recorded average annual export growth of 12.6 percent between 2010 and 2016.⁴⁶ Although the largest exporters in this sector are foreign companies, there is also an upward trend in the number of domestic companies as well as the exports they generate (10.7 percent for medium-sized firms and 8.5 percent for small and micro enterprises).⁴⁷ Serbia registered an increase in gross value added in the machinery sector of 2.2 percent of GDP in 2012-2016⁴⁸, comparable to Central and Eastern European countries recognised as leaders in the field; this constitutes a comparative advantage over other Western Balkan economies that have been experiencing a decline in value added in this sector. The top export destination in this sector is Germany (accounting for 40 percent of all exports), whilst other countries (United States, Slovenia, Austria, Russia) are relatively smaller markets, with shares of between 4 and 6 percent in the total. Most exports are medium-tech products, whereas high-tech account for very little of the total volume exported.

⁴⁶ CEVES & CCIS (2019) *Machines and Electrical Equipment Sector Performance and Value Chain Analysis*, Belgrade, December 2017

⁴⁷ *Ibid.*

⁴⁸ OECD (2019). *Unleashing the Transformation Potential for Growth in the Western Balkans*, OECD Publishing, Paris

The price/quality ratio is an important component of the competitive advantage that Serbian companies enjoy in foreign markets. Serbian engineering firms rely on this advantage to be competitive, penetrate foreign markets, and work with well-established Western European partners, but this is not sufficient for sustainable export performance. Even though manufacturers are aware they have to develop and add value to their existing products and constantly improve the quality of both goods and production processes if they are to enhance their competitive advantages and remain viable in high-income markets, very few Serbian firms actually do so. The main reasons for the lack of continuous improvement are the absence of funds and human capacity, as well as insufficient linkages with R&D institutions; as such, adapting education programmes and research to the needs of businesses is a prerequisite for development and sustainability in the global market. An additional competitive advantage in the machinery and equipment manufacturing sector is the flexibility of small manufacturers, capable of producing moderately sophisticated parts and machines in relatively small batches, whose wealth of specialised know-how allows them to meet customer specifications. Competitiveness is also aided by the provision of ancillary design services to contractors and the availability of technologies under more favourable conditions.

Considering the available engineering know-how, shop-floor workers' expertise, and infrastructure, the machinery and equipment manufacturing industry has significant potential to attract investment. In order to further develop this sector, research and innovation policy should focus on connecting and networking key stakeholders as well as initiating cross-sectoral integration in order to add value to existing products and services. Also of key importance is the improvement of human resource development programs and systematic support for presenting this industry in global markets.

Table 4. SWOT analysis for Future Machines and Manufacturing Systems

STRENGTHS	WEAKNESSES
<ul style="list-style-type: none"> • Global competitiveness due to favourable price/quality ratio • Highly skilled engineering staff • Flexibility in responding to specific client requests • Rich industrial heritage • Many engineering schools 	<ul style="list-style-type: none"> • Out-migrations of highly-educated staff and inability to retain talent • Low productivity • Poor internal management quality: little awareness of need to become involved in development processes • Poor awareness of accessible funds and project financing • Obsolete equipment • Poor linkages between firms within sector
OPPORTUNITIES	THREATS
<ul style="list-style-type: none"> • Growing national economy • Large Serbian community abroad • Geographical position and proximity to European market • International free trade agreements • Foreign direct investment • Greater efficiency in using finance, including international funds • Industry 4.0 • Dual education • Demand for innovative products 	<ul style="list-style-type: none"> • Inadequate law implementation • Lack of brand awareness and poor product reputation in international markets • Expensive testing abroad • Out-migrations of qualified staff • Poor collaboration between academia and business • Education (both formal and non-formal) not aimed at acquisition of know-how and innovation • Underdeveloped system of alternative sources of finance

Based on a systematic assessment of the findings of quantitative and qualitative analysis and the EDP, the main priorities that will be supported by the Smart Specialization Strategy in the Republic of Serbia in the field of Future Machines and Manufacturing Systems are:

- **General and special-purpose machines;**
- **Information for smart management: Industry 4.0;** and
- **Smart components and tools**

General and special-purpose machines

Serbia boasts well-developed manufacturing of combustion devices (stoves, cookers, fireplaces, boilers), which has significant development potential for the production of units that use environmentally friendly and sustainable fuels and are able to reach fuel efficiency exceeding 90 percent. This sector can grow by increasing the degree of its automation, adapting to developments of Industry 4.0, and acquiring knowledge required to produce parts that currently must be imported (such as components required for automation and burners). These products are already exported yet are not recognised as Serbian-made; rather, they are sold under the brands of large firms mainly based in developed European economies.

A number of special-purpose machinery producers export their devices globally: these include makers of packaging lines, paper production machines, dryers, and medical equipment. Other players in this sector either manufacture sub-assemblies and individual parts or produce special-purpose materials using production processes such as metal alloying, heat treatment, and welding. Most of the processes are carried out using domestic infrastructure and pre-existing knowledge in conjunction with cutting-edge skills inherent to the latest global developments. There is much potential to strengthen individual processes undertaken by Serbian manufacturers and services industries in the production chain, which would enhance ancillary infrastructure for the production of machinery and components, as well as strengthen development and increase Serbian firms' competitiveness in the global market. Large-scale investment is needed mainly in production processes and quality control. Moreover, the sector is dominated by medium-sized companies, which generally lack the management and marketing skills needed to export their products worldwide and consolidate their positions in global markets. Most manufacturers in this sector work with large multinational firms and sell their products under these companies' brands.

Information for smart management: Industry 4.0

Based on the current state of play, as Serbia evolves to reach Industry 4.0, automation technology and process digitalisation are major priorities. Here, objectives include the development of systems integrators with dedicated system integration software, management, process management based on 'data to decision' feedback, automation in the food industry, water treatment, water supply, oil and gas refining, rubber processing, power industry, and energy and efficiency systems. Key companies in this area export over 60 percent of their production, and a major challenge here is to position Serbian firms in the global value chain. Companies in this sector have been taking part in national and international projects, though commonly as sub-contractors to large global corporations.

Smart components and tools

Development of the machinery and equipment manufacturing industry, accompanied by the growth of manufacturing within the Republic of Serbia, has necessitated the rehabilitation and modernisation of tooling fabrication plants and the creation of new production systems to accompany and promote industrial development through the production of components intended for broad industrial applications. These machine tools have to possess the requisite characteristics and quality, and must be manufactured to tight tolerances and be compatible with automated production lines. Development in this sector is also stimulated by constant rapid changes to product design, which call for the quick production of new tooling to high standards. Demand for these services has prompted responses from both Serbian machine tool makers and world-renowned firms (such as in the automotive industry), which has in turn caused swift growth of this field in the Republic of Serbia. Specialised Serbian tooling manufacturers emphasise their ability to deliver specific products within tight deadlines as a competitive advantage, and highlight the lack of visibility of Serbian products in the global market as a drawback. Despite this limitation, strong potential has been identified for growth of this sector in Serbia. This sector includes suppliers working for large global manufacturers in the *mobility industry* (automotive, rail, and aerospace industries). These multinationals rely on a network of subcontractors that manufacture exclusively products to their pre-defined specifications. Each manufacturer's production capacity and technology determine the value of that firm's products and its place in the value chain. If they increased their production efficiency and ensured appropriate quality control to meet '*first part good part*' requirements, Serbian manufacturers could attract significant investment from multinational firms in the mobility sector. Despite the limitations described above, substantial potential for growth of this sector has been identified in the Republic of Serbia.

Vision of priority area:

The stakeholders that participated in the workshops held in the EDP and targeted dialogue organised in the course of development of the Smart Specialisation Strategy have agreed on the final vision statement for the sector:

INDUSTRIAL INNOVATIONS BASED ON EFFECTIVE INTER-SECTORAL CO-OPERATION

3.2.4 Creative Industry

Creative industry is becoming an increasingly important part of the Serbian economy. The Serbian Government elected on 29 June 2017 recognised the significance of the creative sector and appointed the Prime Minister's Creative Industries Council, aimed at continuing to provide support to these industries. The Council has brought together a number of key organisations in a good example of how government, businesses, and civil society can work together to develop policies to promote the growth of the creative sector in the Republic of Serbia. Aside from the Council, the establishment of the Sector for Development, International Cooperation and Promotion of Digital, Innovative and Creative Activities within the Office for IT and eGovernment is very important, as well as the creation of the new national platform "Serbia Creates".

Serbia's creative industries are mainly composed of small businesses, sole traders, and small-scale studios that pursue flexible and innovative business models. Larger urban centres (Belgrade, Novi Sad, Niš) are seeing rapid growth and concentration of creative firms due to their significantly more

robust infrastructures and distribution networks and supply of creative professionals. The creative industry, as narrowly defined, has been growing at a rate of 5.6 percent, significantly faster than the Serbian average.⁴⁹

The table below shows the findings of SWOT analysis following guided dialogue organised during the EDP workshops, presenting the key strengths, weaknesses, threats and opportunities of Serbia’s creative industry. As ICT is viewed separately from the creative sector, even though it is formally classified as its part, Table 7 shows the SWOT analysis for creative industry according to a narrow definition, meaning excluding ICT.

Table 5. SWOT analysis for the creative industry

STRENGTHS	WEAKNESSES
<ul style="list-style-type: none"> • Heads of companies that have extensive specific knowledge and are innovation-oriented • Sound classical visual education, broad spectrum of basic knowledge and skills required by industry • English language proficiency better than European average • Price/quality ratio: greater quality at lower prices relative to global competition • Connections with Serbian community abroad (as source of contacts for work and recommendations) • Easily accessible global market with network of large clients • Firms that hold intellectual property and/or develop technologies able to attract foreign investment for growth • Number and concentration of market players 	<ul style="list-style-type: none"> • Poor transfer of highly specific knowledge through teams along vertical and horizontal hierarchies; large share of general knowledge • Poor career guidance in how existing education can be applied in industry • High overheads in terms of investment in software and hardware • Poorly concentrated high-performance infrastructure (broadband access, electricity, data security) • Under-utilised potential for inter-sectoral co-operation • Poor awareness of and application for EU funds • Poor recognition of Serbian high-tech products and services (low brand value)
OPPORTUNITIES	THREATS
<ul style="list-style-type: none"> • Serbian community abroad that can be better harnessed for inward knowledge transfer • Entry of large firms wishing to invest in R&D in Serbia rather than only seeing country as consumer market (such as EPIC/3Lateral) • Increasing number of creative industry start-ups • Integration of small firms and amalgamation of capacities • Low labour costs could permit high profit margins in target markets if service is positioned as innovative • Global growth in volume of digital content production and demand for knowledge and services in creative industry 	<ul style="list-style-type: none"> • Cheap workforce compared to developed countries • Education and classification of new occupations lags behind the development and needs of the creative industries sector • Difficulties with acquiring hardware and software • Out-migrations of experienced and skilled professionals • Poor awareness by Serbian clients of production process; poor business and professional ethics

⁴⁹ Mikić H., Radulović B. I Savić M. (2019). Creative industries in Serbia: methodological approaches and economic contribution, forthcoming

<ul style="list-style-type: none"> • Growth of virtual production worldwide • Number of markets Serbia has signed free trade agreements and tax treaties with • Incentive policies for audio-visual production pursued by Ministry of Economy and legislative incentives for intellectual property development • Availability of EU funds 	
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Based on a systematic assessment of the findings of quantitative and qualitative analysis and the EDP, the main priorities that will be supported by the Smart Specialization Strategy in the field of Creative Industry are:

- **Creative audio-visual production**
- **Video games and interactive media**
- **Smart packaging**

Creative audio-visual production

This sub-sector can be broadly termed creative production of audio-visual content with major involvement of digital tools, and includes: the production of 3D animation and visual effects, and the creation, using a variety of processes and methods, of partially or completely digitally generated images for use in feature films, television, advertising, animated films, and gaming, extending into virtual reality (VR), software applications, and upgrades using deep learning, artificial intelligence, and machine learning. Whilst high-tech development in this area takes place in R&D centres and corporate facilities abroad, some ten studios in Serbia actively produce high quality content for foreign markets. The actual number of firms and teams is far higher, as much work can be done online for foreign clients informally. This market began to develop in Serbia towards the end of 1990s, mirroring global developments, even though the country was completely isolated at the time and the practitioners were largely self-taught. Most players in the market have vocational degrees; insufficient domestic demand oriented them towards international clients from whom they learnt the trade and copied organisational arrangements and modes of operation, and are today virtually completely export-oriented, with foreign clients accounting for between 50 and 70 percent of their output. Also it is important to emphasize that this field has been seeing large-scale ‘brain drain’ for a decade, due to which there is now a large and highly successful community of Serbian computer graphics professionals abroad. Estimates put the value of the global visual effects industry at \$20.7bn by 2022, with US and European markets (where most current clients of Serbian firms are based) expected to grow by 9.9 and 11.2 percent, respectively. This constitutes major potential for Serbian studios.

Incentives introduced by the Ministry of Economy have tripled the volume of international work done by Serbian film, TV, and advertising firms from 2016 to 2018; given the strong annual growth rate, the value of this sector could easily reach €50mn to €60mn. In parallel, funding extended by the Ministry of Culture and investment made by broadcasters and cable operators in TV series has resulted in dramatic growth of the Serbian market. By contrast, advertising demand has been declining, with content producers increasingly turning to exports.

Low price (a ‘good price/quality ratio’) remains the main competitive advantage that Serbian firms enjoy in foreign markets. The industry faces challenges in finding steady work, as business is strongly cyclical, and distributing its own content (transitioning from subcontracting to content

creation). The teams here are successful because they are able to produce high quality content with only handfuls of people, but most companies and studios are suffering from growth crises: they will rather opt for being ‘*boutique studios*’ with few staff and fairly flat hierarchies than build structures and introduce procedures that facilitate growth and specialisation. Short chains exist, with larger studios using smaller ones as subcontractors at busier times. Managerial skills are lacking, as is shared infrastructure that would facilitate investment in fixed assets, where costs are inherently high due to the nature of the work (this would permit the development of a single production capacity with sufficient space, cyber security, optical network, space for testing and development, and room for growth to embrace new disciplines).

Numerous professional associations operate, complemented by the Serbia Film Association, a cluster of 60 members, primarily export-oriented providers of production services. In 2018, the sector contributed some 0.11 percent to total employment, with an average annual employment growth rate of 11.3 percent in the period from 2016-2018.

Academia has recognised the need to introduce new courses and modernise existing ones, including a greater focus on digital tools and creation of content relevant to today’s needs. The past four years have seen the accreditation of 12 new courses of study of importance for the creative industry.

Video games and interactive media

Serbia’s video game development industry is comprised of several large companies, each employing some 100 staff, and a large number of smaller studios and teams occupying various positions in the game production and distribution chain. In March 2018, the Serbian Gaming Association was established, which gathers together 70 firms with 1,280 employees; its aim is to foster the development of the gaming industry position as a sector apart from ICT in general and promote the growth of small gaming businesses and talents by attracting investment for game development. It is estimated that the broader community employs approximately 2,000 people in Serbia. The achievements to date are the result of skilled engineering work, but more investment is needed into the artistic side of the business. Co-operation with academia is stronger in Novi Sad, but only for education rather than R&D. Key stakeholders believe that any investment in education made today can make a significant impact only in five years.

Serbian players occupy advanced service positions in the global (and regional) value chain. They provide full service to end-users at prices that are completely competitive in the global market, and sometimes do some outsourced work for other firms or have specialised in a particular type of production service. Serbian companies work completely independently from one another and do not compete directly as their markets are global and they sell services to users abroad.

Outside of the commercial sector, a number of players and individual artists use digital technologies as a medium for artistic expression and create content that can be considered interactive media. These actors are isolated from industry; as such, their mapping and better networking could greatly improve the artistic quality and potential for innovation of the sector as a whole.

Smart packaging

The key strength of the smart packaging sub-sector lies in its use of new technology and readiness of firms’ owners to invest in equipment, human resources, and innovation to keep abreast of new developments. The key players in this market are large printing firms that clearly target specific territories and identify the following as future development trends:

- green materials (biodegradable materials, materials made using renewable resources): packaging based not on hydrocarbons but on nano-cellulose and starch;
- new dyes and pigments that will enable the transition to smart packaging formats; and
- use of ICT throughout the production process.

Packaging manufacturers are quite prepared to co-operate with food producers and ICT firms; existing large global purchasers operate in the pharmaceuticals, cosmetics, and retail sectors (all with significant demand for smart packaging). Geographical proximity means Serbia has significant export potential, in particular given the current strategy of offering good quality at prices lower than in Western or Central Europe. Safety is the key advantage of smart packaging for consumers: it prevents fraud and product tampering, preserves freshness, permits manufacturers to better communicate product performance, and reduces environmental impact.

Entrepreneurial discovery concluded that the smart packaging subsector should focus on closer integration into vertical chains involving designers, buyers, and advertising agencies and foster joint research and development to identify broader applications. Future iterations should expand the field to include design and concentrate on premium products able to derive the greatest benefit from the value added and customer experience generated by smart packaging. The *Design Hub* in Gornji Milanovac is an example of a firm working with clients to educate designers to ensure design evolves to match packaging production, so making the manufacturing process more efficient.

Vision of priority area:

The stakeholders that participated in the workshops held in the EDP and targeted dialogue organised in the course of development of the Smart Specialisation Strategy have agreed on the final vision statement for the sector:

THE CREATIVE INDUSTRY SUPPORTS INDIVIDUAL CONTENT CREATION AND ADDS VALUE TO OTHER SECTORS OF THE SERBIAN ECONOMY, SO HELPING POSITION THE REPUBLIC OF SERBIA AS A HIGH-TECH, GLOBALLY COMPETITIVE ECONOMY.

3.3 Cross-sectoral innovations

Priority areas defined in the Smart Specialisation Strategy hold much potential for cross-sectoral integration and creation of added value through joint innovation projects. Most priority areas are linked by the same or similar applications. Discussions in the EDP focused particularly on cross-sectoral cooperation and innovations. Stakeholder dialogue identified numerous initiatives and suggestions for future collaboration and networking.

Food for Future

The development of high-tech agricultural production fosters innovation in other related fields, especially in Key Enabling Technologies (KETs) and ICT, which are integral to the future growth and development of agriculture. Research and cross-sectoral innovations in horizontal priority areas, primarily nanotechnology, industrial biotechnology, advanced machinery, and sensor technologies, play a significant part in the development of value-added food products. ICT solutions (*Blockchain, Internet of Things, Big Data*) are crucial to the transformation of the food industry, enhancing transparency, efficiency, security, and collaboration across the entire food production chain. The development of key aspects of a sustainable food chain that reduces losses and waste of agricultural and food products is

closely linked to new developments in ICT and KETs. The table below shows the sectors and technologies identified as important for development of the food processing sector and cross-sectoral innovations.

Table 6. Horizontal technologies and sectors with potential for cross-sectoral innovation in the F3 field

High-tech agriculture	Value-added food	Sustainable agriculture and food production
ICT: Software industry	ICT: Databases	Environmental protection
Automation and robotics	ICT: Process optimisation	ICT: <i>Blockchain</i> technologies
Electronics, sensors	ICT: Smart packaging	ICT: <i>Internet of Things</i>
Genetics and physiology	ICT: Food traceability	Future machines and manufacturing systems
Molecular genetics	Biotech	Industrial biotech
Industrial biotech	Biomedicine	Energy
Future machines and manufacturing systems	Nanotechnology	Economics
Pharmacy	Energy efficiency	
Applied physics	Automation and robotics	
Sociology	Machines and manufacturing systems	
Creative industries – Advertising	Environmental protection – Packaging	
	Tourism and gastro-tourism	
	Creative industries – Promotion	
	Creative industries – Advertising	

Information and Communication Technology

A unique feature of ICT is its horizontal nature and applicability to nearly all other sectors. Accordingly, particular attention in EDP workshops was dedicated to the horizontal aspect of ICT and to linking key stakeholders in this field with other sectors. Information and communication technologies are key to the development of today’s digital economy: these include cloud computing, big data, mobile applications, IoT, and artificial intelligence. The greatest horizontal potential of the Serbian ICT sector lies in the following areas and technologies:

- big data and business analytics;
- cloud computing;
- IoT;
- embedded systems;
- artificial intelligence; and
- *Blockchain* technology.

Most Serbian big data and business analytics firms⁵⁰ have been initially developing Enterprise Resource Planning (ERP) solutions before moving to business development and analytics, in line with global

⁵⁰ Big data deals with large and growing sets of unstructured data that cannot be processed using standard databases, tools, and techniques, whilst business analytics refers to technologies, techniques, processes, and data analytics methods and involves human resources converting data into information to help companies better understand business processes and support decision-making.

trends. Other firms with different target markets also operate in this field, since they use big data and analytics for medical research rather than business. Most companies in this sub-sector work for end-customers and compete with Serbian and foreign firms in target markets. Not many companies are currently active in this field, but there is significant growth. The Western Balkans holds major potential for expansion, and some firms have begun to make inroads into other European markets as well. *Big data* and business analytics are increasingly being used in other areas. The best example is IoT, where many physical devices generate vast amounts of new data that need to be managed and analysed; the largest fields of application are medicine, financial services, demographic research, and agriculture.

The majority of firms that offer cloud computing services⁵¹ in the Republic of Serbia work for end customers and compete with domestic and foreign companies in target markets. There is much potential for growth due to the increasing use of IT in other sectors. Cloud computing requires a strong and stable internet access infrastructure. Given the recent progress made by Serbia in the development of ICT, domestic companies are expected to secure a stronger presence in this sector.

Most Serbian IoT⁵² companies are affiliated with EU-funded R&D projects. In Serbia, this technology has found the broadest horizontal application in the areas of agriculture, medicine, process automation, asset and infrastructure management, transportation, etc. There is strong potential in this field; global demand is on the rise.

The few Serbian firms that develop embedded software⁵³ are all well-established in the market. The biggest fields of application are the automotive industry, telecommunications, signal processing, power distribution and management, medicine, transportation, machinery, and production automation. There is high potential in this field due to development and automation in other sectors.

Even though there are no precise surveys or figures for the artificial intelligence (AI) market, most companies in this sector are SMEs focusing on a narrow range of products and the use of existing technologies. Larger IT firms sporadically make use of AI in major projects, but jobs such as these are fairly uncommon. There are limited linkages between local businesses using AI and between firms and academia, mostly as the vast majority of Serbian ICT companies are oriented towards global markets. Closer ties could be forged not only with science and mathematics schools, where the need for such collaboration is more obvious, but also with medical, agricultural, and forestry management schools as this could foster a cross-cutting approach to developing innovative solutions.

Some 150 *Blockchain* developers have been identified in the Republic of Serbia, mostly working for the foreign market, but also each increasingly producing their own solutions. *Blockchain* technologies can be applied in a variety of sectors, from data storage to financial transactions. There are also overlaps

⁵¹ Cloud computing is an on-demand service that has gained broad acceptance in enterprise data centres. The cloud enables central data to function as the internet and computing resources that are accessed in a secure and scalable manner.

⁵² The internet of things (IoT) is the interconnection of physical objects (including 'connected devices' and 'smart devices'), vehicles, buildings and other items with built-in electronics, software, sensors, and connectivity that allow objects to exchange data with the manufacturer, operator, and/or other connected devices, allowing them to directly integrate the physical world into computer-based systems, which leads to efficiency improvements, economic benefits, and reduced human effort.

⁵³ Embedded software is computer software, written for control machines or devices that are not normally considered computers. The software is optimised for the specific hardware it runs on and has limitations in terms of time and memory.

with other fields and technologies, such as ICT in general and software solutions, and applications are also possible in other areas such as finance.

Future Machines and Manufacturing Systems

Future Machines and Manufacturing Systems hold strong potential for cross-cutting linkages with other 4S priority sectors. In addition to being able to build vertical connections with related priority areas, this area can integrate with other broader priority areas, such as energy efficiency and environmental protection. Manufacturing of machinery and assemblies, development of manufacturing technology, and welding all involve energy efficiency and environmental protection considerations. Energy efficiency is a requirement for the actual production process that entails overlaps and opens possibilities for manufacturers and service providers specialising in energy efficiency to become involved in optimising facilities and production processes. Similarly, final products must be designed to comply with energy use requirements (energy efficiency, emissions control, tolerance to power input variations, etc.). Finally, the production processes, intended uses of products, and the components and materials used, must all meet European harmonized environmental standards.

Creative Industries

Creative industries interact the most with other priority areas in the fields of communications and advertising, where other sectors require video production and communication services, but also more and more design. Creative industries can develop data visualisations, simulations, and demonstrations for use in research and training in the field of machinery. There is potential for co-operation with all sectors on ‘serious gaming’ projects, but here the finances of these other areas can prove to be the constraint. Such projects are usually commissioned by the public sector (e.g. for police and armed forces training) and are time-consuming and expensive to develop, but incentives can be offered through innovative public procurement. Firms invest in R&D only in response to their clients’ needs rather pursuing general research, requiring other sectors to be aware of the likely benefits of video production.

Table 7. Technologies and sectors able to benefit from horizontal cross-sectoral innovations in creative industries

	Creative audio-visual production	Video games and interactive media	Smart packaging
ICT	High performance infrastructure, cyber security	Infrastructure, software customisation	Sensor development, intelligent packaging hardware, centralised R&D infrastructure, cloud services, data security
Food for Future	Data visualisation, simulation, training, advertising		Cold chains for perishable goods, high-value foods, premium organic products
Future Machines and	Conceptualisation of innovative technologies, machine assembly applications	Serious Gaming: training and teaching in virtual space	Customisation of smart packaging production plants

Manufacturing Systems			
Energy Efficiency and Environmental Protection			Environmental standards, biodegradable materials, organic dyes
Key Enabling Technologies	Data visualisation		Materials development

Closer collaboration with advertising agencies and clients is needed to develop smart designs that suit production capabilities, add value to products, and enhance customer experience. The potential of packaging as a communication tool can be further exploited. Closer collaboration with the creative audio-visual production sector allows the production of virtual reality (VR) or videos that build on the communication content of the packaging.

There is much potential in integrating the packaging sector with advertising agencies and designers to add value to products and develop higher-value packaging (better communication with niche markets and applications in the pharmaceuticals and cosmetic industries).

IV GOAL AND OBJECTIVES

4.1 Goal and objectives of Smart Specialisation

Upon completion of the EDP process, summary reports have been prepared by priority areas. Based on these reports, an Interim Report was prepared with the aim of summarizing and editing information from individual and summary reports of the EDP, which by their very nature contained a great deal of heterogeneous information. The objectives of the Strategy were derived from the Interim Report.

Given the broader context presented in Part 2 of this Strategy, the findings of the EDP for the 4S priority areas have informed the definition of the overall goal of the Smart Specialisation Strategy which aims to achieve the vision “Serbia Creates Innovation”:

Directed development of the Republic of Serbia towards a highly competitive economy through research, development, innovations, and entrepreneurial initiatives in the 4S areas.

Even though the EDP identified a set of seemingly different and quite numerous objectives, an in-depth analysis and systematic review of the findings revealed that all of the goals fit under five objectives:

1. **Research and development focused on 4S priorities;**
2. **Economic growth supported through R&D and collaboration among the quadruple helix participants;**
3. **Education focused on innovations and entrepreneurship;**
4. **Improved business environment through optimization and digitalization of procedures in 4S areas;**

5. Internationalization of the economy through involvement in regional and global value chains in the 4S areas.

Ongoing EDP was seen as a shared need and responsibility in each of the four priority fields, in line with best practices. Continuous EDP will ensure continuous dialogue with all stakeholders, focusing on: (a) monitoring of the Smart Specialisation Strategy, strengthening of links within the community, and development of the ecosystem; and (b) continuous harmonisation and streamlining of efforts to implement policies within the defined priority areas and of inter-sectoral co-operation.

The specific aspects of efforts required to meet each objective in each priority area were identified in the entrepreneurial discovery process. The EDP took place during the development of the Smart Specialisation Strategy and produced the initial needs framework, focusing on the achievement of the objectives for each individual priority area.

These five specific objectives will cut across all priority areas through policies focusing on people, idea-based linkages, education, targeted procurement and use of physical capacities, ecosystem development, promotion of cooperation and promotion of results, and creation of appropriate quality infrastructure.

The goal and objectives of the Smart Specialisation Strategy take account of the findings of the EDP are fully based on the objectives identified in the EDP workshops.

Key challenges in the field of **FOOD FOR FUTURE** (high-tech agriculture, value-added food, and sustainable food production chain) identified in the EDP relate to the introduction of long-term testing of soil quality, waste, food industry by-products, animal and plant varieties and breeds including native ones, and biodiversity; certification of traditional products; and research focused on innovative use of crops, reduction and re-use of waste, renewable energy, innovative environmentally friendly packaging, and new and traditional value-added food products based on scientific evidence. Development of research capacity requires strengthening pilot food R&D facilities and laboratories capable of all testing to allow the sophisticated new food products to be sold at a competitive advantage in the global market.

Expected effects for the Food for Future field	Indicators
Added value increased in the food production chain	<ul style="list-style-type: none"> • Added value per employee in food and beverage production • Number of companies responding to calls for 4S project funding

The three objectives set for **INFORMATION AND COMMUNICATION TECHNOLOGIES** (custom software development and development of own software products) aim at supporting new solutions using big data, business analytics, cloud computing, IoT, embedded systems, AI, and blockchain technologies. Particularly important are ICT solutions that ought to be deployed to enhance public administration and strategic decision-making. Here, the EDP identified the need to procure state-of-the-art technology for training and education facilities in this field and establish new R&D and business parks for ICT businesses and start-ups.

Expected effects for the field of Information and Communication Technologies	Indicators
Domestic ICT market developed	<ul style="list-style-type: none"> • Value of domestic ICT market

	<ul style="list-style-type: none"> • Number of companies responding to calls for 4S project funding
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The EDP for the **CREATIVE INDUSTRIES** identified the need to strengthen R&D in this area, hitherto not recognised or eligible for government funding. This is to facilitate the development of a strong creative industry based on knowledge derived from R&D in the arts and other related fields, particularly engineering, including ICT. Preliminary findings of the EDP indicate needs for research in the domains of creative audio-visual production, video games and interactive media, and smart packaging. The EDP also highlighted the need to improve creative firms' physical office capacities and hardware and software, in particular high-specification computer graphics infrastructure. Research and development infrastructure for smart packaging was also proposed to be established.

Expected effects for the field of Creative Industries	Indicators
Strengthening creative industries through focus on intellectual property protection	<ul style="list-style-type: none"> • Number of copyright contracts and patents • Number of companies responding to calls for 4S project funding

The EDP for the **FUTURE MACHINES AND MANUFACTURING SYSTEMS** found a need for applied research focusing on proof of concept and greater compatibility of general and special-purpose machines with emerging technologies, information for smart management (Industry 4.0) and smart components and tools. A space has been identified to enhance cross-sectoral cooperation in this area, as well as science and industry cooperation. Having that in mind, one of the important goals of this field is to improve the cooperation of companies with scientific research organizations through the initiation of joint research and development projects. Enhanced horizontal cooperation will increase the internal innovation and research capacity of firms in the field of Future machines and manufacturing systems.

Expected effects in the field of Future Machines and Manufacturing Systems	Indicators
Enhanced R&D capacities of the business sector through cooperation of science and economy	<ul style="list-style-type: none"> • R&D investments as a percentage of total investments of the business sector • Number of companies responding to calls for 4S project funding

The EDP for **CROSS-SECTORAL COOPERATION** found that:

- **INFORMATION AND COMMUNICATION TECHNOLOGIES** should support development in all priority areas as it constitutes the backbone of development in numerous other areas of the economy and society at large.
- **CREATIVE INDUSTRIES** and software development must be closely linked. Practical ICT applications are necessary for the sustainability and protection of natural resources through the development of smart solutions, making ICT closely linked to **FOOD FOR FUTURE**.
- Development needs of **FOOD FOR FUTURE** ought to drive innovation in all priority areas. This field can grow only if it is supported by cross-sectoral innovations and able to absorb them. The application of new knowledge derived from basic, natural, and social sciences and the

humanities is a prerequisite for development. Making the food production chain sustainable will require a range of energy efficient and environmentally smart solutions, whilst biotechnology, industrial biotechnology, and nanotechnology should become key technologies that drive developments in food production.

- Ongoing EDP ought to focus on in-depth analysis of options for cross-sectoral co-operation, especially in FUTURE MACHINES AND MANUFACTURING SYSTEMS and the CREATIVE INDUSTRY, where opportunities for cross-sectoral cooperation are yet to be fully explored.
- CREATIVE INDUSTRY can support promotion in all other fields and make a major contribution to building the country's image as a 'country that creates innovation'. Similarly, the development of smart packaging, including active and intelligent packaging, links this area to all three priority fields through their design, as one of the main sectors within the CI. Development and introduction of these technologies should add value to products in all priority areas.

The need to strengthen entrepreneurial education has been identified in each of the four priority areas. In addition, all sectors require more applied knowledge and would like to see academia working more closely with businesses as early as at the training stage, as well as stronger academic skills necessary for collaboration between researchers and other stakeholders.

All areas also recognised the need for more R&D at the company level, more opportunities for project co-financing with academia and other stakeholders, and public procurement of innovations. The stakeholders also called for greater protection of intellectual property rights and use of licensing, especially at the institutional level. All priority areas highlighted the need to make better use of, improve, or, where lacking, establish capacities for academia to transfer technology and knowledge to businesses and other stakeholders.

All priority areas identified the need to initiate, analyse, and monitor support to and implementation of R&D in the 4S areas **in consultation with the relevant line ministries.**

V Policy Mix

5.1 4S Policy Mix

Findings of the EDP and the foregoing analysis have informed the creation of a set of policy measures, compatible with the available funding, designed to achieve the objectives. These measures primarily relate to steering R&D by funding projects focused on 4S needs and strengthening cross-sectoral co-operation; building the required infrastructure, both R&D facilities and business support infrastructure in the 4S priority areas; strengthening and modernising education to suit the needs of the 4S priority areas; promoting R&D and innovation potentials and services offered in the 4S priority areas; and developing the ecosystem required for R&D and innovation to have the fullest possible impact on the emergence of a knowledge-based economy.

As all five specific objectives are universal across all four priority areas (notwithstanding the specific characteristics described in Part 4), most policy measures address all priority areas. A number of specific measures, however, target only one or several areas that have emerged in response to challenges identified by EDP. Most measures build on the results of long-standing R&D

reforms and will be funded from additional R&D and innovation budgets through new calls for projects, as well as through targeted institutional funding to build missing capacity for research immediately required by businesses in the fields of specialisation. Some policy measures entail the removal of regulatory constraints to doing business and growth of the fields of specialisation. Furthermore, many policies cover integration, networking, promotion, and enhancement of training curricula and ecosystem segments that permit the commercialisation of innovations. Due to the very low productivity of the economy in general and little reliance on R&D, most policies contain components that should encourage businesses, especially private ones, to become involved in R&D and so promote their own competitiveness globally and ensure better use of comparative advantages and potentials.

Most policy measures are to be funded from the central budget and are integrated into other policies pursued in these and related fields (see section 2.4 for details). In addition to the budget of the Ministry of Education, Science and Technological Development, efforts have been made to use R&D funds available to the Ministry of Agriculture, Forestry and Water Management for measures in support of this Strategy. Some policy measures are funded by donors and were initially designed as pilot measures.

The ongoing EDP process will serve as a platform for integrating other policy measures and all available sources of funding in the implementation of the Strategy. The adoption of the Strategy will not mean all possible measures have been exhausted: rather, annual reporting on the implementation of the Action Plan and the EDP process will serve to identify needs that may not have been specific enough for inclusion in the Action Plan policy mix, which will in turn inform the development of measures and adjustment of existing ones.

Objective 1: Research and development focused on 4S priorities

Much research that takes place in Serbia lacks focus on the priorities, and there are shortcomings in whole swathes of research capacity needed to fully utilise opportunities in the areas of specialisation. Measures to achieve this objective entail directing existing and new funding at R&D in areas where the Republic of Serbia has been demonstrated competitive advantages, as well as funnelling institutional funding for the public R&D sector into areas identified in the EDP as needed for the development of knowledge-based economy and society.

Most policy measures to be deployed for the achievement of this objective involve financial incentives that will help secure project-based human resources and create capacity and infrastructure for research in areas of smart specialisation.

Policy Measure 1.1: Competitive open calls in 4S fields. Under this measure, the Science Fund of the Republic of Serbia will advertise open calls for applications in the fields identified in the 4S process, namely Food for Future, Future Machines and Manufacturing Systems, ICT, Creative Industry, and R&D with potential for cross-sectoral innovations in these fields. The funding will be disbursed under the Science Fund's Programme "Development", which is in preparation and will focus on basic and applied research and technological development aimed at responding to specific needs of society and the economy. The first open call will be prepared during 2020, and the call for this Program will be published in 2021. The programme will involve open calls for concrete thematic projects aligned with the priorities of 4S. The total budget for a three-year program is €18 million.

Type of policy measure: Incentive

Monitoring and oversight entity: MoESTD (Science Fund of the Republic of Serbia)

Output indicator: Number of research projects supported

Baseline: 0 (2020)

Target: To be determined once first open call is advertised (2021)

Policy Measure 1.2: Open call for “Artificial Intelligence”. This measure will also be administered by the Science Fund of the Republic of Serbia and will involve an open call focusing on individuals and R&D organisations conducting research into artificial intelligence, a sub-sector of the 4S priority field of ICT. The key thematic areas of this programme are General Artificial Intelligence, Machine Learning, Planning, Understanding Knowledge, Computer Vision and Speech Communication, and Intelligent Systems. The total budget earmarked for this programme is €2.4mn, with individual project funding capped at €200,000. The programme will consist of two sub-programmes with budgets of €1.2mn each: one will be aimed at the development of basic AI research, and the other at AI applications in a variety of situations with the objective of promoting social, technological, and economic development.

Type of policy measure: Incentive

Monitoring and oversight entity: MoESTD (Science Fund of the Republic of Serbia)

Output indicator: Number of research projects supported

Baseline: 0 (2020)

Target: 12 (2021)

Policy Measure 1.3: Adoption of regulations to govern the amount of institutional funding to R&D organisations so as to promote relevance and excellence in 4S fields. This measure introduces the criteria for allocation of institutional funding to R&D organisations, both those regulated under the Science and Research Law and those in the academia sector. The funding methodologies will seek to address the lack of priority infrastructure and research in specific fields. As part of the entrepreneurial discovery process, it was concluded that development and commercialization of products in the Food for Future field and Future Machines and Manufacturing Systems is extremely important so that in the Republic of Serbia research into smart packaging and the provision of hardware and software for arts and design schools that would enable cross-cutting art/science research would be required.

Type of policy measure: Regulatory

Monitoring and oversight entity: MoESTD

Output indicator: Document adopted to govern allocation of institutional funding for R&D organisations

Baseline: 0 (No, 2020)

Target: 1 (Yes, 2021)

Policy Measure 1.4: Support for experimental and innovative projects combining art, science, and advanced technologies. This initiative seeks to promote the development of an innovative creative industry by supporting cross-cutting research and collaboration with ICT through funding for experimental and innovative projects that combine art and science. The programme will be piloted in 2020, when a number of calls for applications will be launched with a total budget of 3.000.000 RSD (Serbian dinars). Additional activities here will involve networking researchers and artists in workshops and at events. The MoESTD is responsible for this measure, and it will be implemented through the Center for Promotion of Science, in cooperation with the National Platform “Serbia Creates”.

Type of policy measure: Incentive

Monitoring and oversight entity: MESTD (Centre for the Promotion of Science)

Output indicator: Number of projects combining art and science

Baseline: 0 (2020)

Target: 5 (2021)

Objective 2: Economic growth supported through R&D and collaboration among the quadruple helix participants

Policy measures to achieve this objective should address shortcomings of the education system, in particular its lack of effectiveness in producing entrepreneurial skills required for bringing together and commercialising scientific results and overcoming financial barriers faced by young companies seeking to develop and monetise innovations. It was also noted that the absence of skills was compounded by the lack financial and other incentives to commercialise R&D results. There is also a lack of awareness and few linkages between businesses and the R&D community, and one set of policy measures is dedicated to promoting R&D and strengthening links and cooperation to further develop the research ecosystem. Unlike for the first objective, the measures needed here are not only financial in nature: what is needed is a mix of financial, communication-related, regulatory, but also, most importantly and most radically, educational efforts.

Financial support for joint applied research projects

The following six policy measures will be administered by the Innovation Fund, which has a long history of supporting innovative businesses to develop innovative products, processes, and services, aiding the creation of firm ties between R&D and businesses, and assisting with the establishment and empowerment of firms with innovative potential. The Innovation Fund will adapt its financial instruments and those provided with support from the World Bank (Policy Measure 2.4) to address the needs identified in the EDP, and will also focus on priorities in the 4S fields. These policy measures are numbered 2.1 through 2.6.

Policy Measure 2.1: 4S Voucher Programme. These Innovation Vouchers are a simple financial facility that allows SMEs to use R&D services provided by the research sector to enhance product innovations and become more competitive. The maximum amount to be disbursed per voucher is 800,000 dinars, where each voucher can cover up to 60 percent of the total cost of the service. Innovation Vouchers are distributed by open call.

Type of policy measure: Incentive

Monitoring and oversight entity: MoESTD (Innovation Fund)

Output indicator: Number of companies supported

Baseline: 0 (2020)

Target: 100 (2021)

Policy Measure 2.2: Programme to foster collaboration between public-sector R&D entities and businesses in 4S fields. This initiative seeks to enhance industrial research by motivating businesses and public-sector (majority state-owned) R&D facilities to engage in joint R&D projects aimed at the development or improvement of commercially viable products and services and new technologies able to significantly impact future development and holding market potential. The funding will be released to consortiums developing new commercially applicable technologies, services, and products in the 4S priority fields. These consortiums must be comprised of at least one business and one public R&D institution and may have up to five members. The Innovation Fund intends to award up to €300,000 EUR per project or up to 70 percent of the total project budget, with consortiums headed by micro- or small enterprises required to provide co-financing amounting to at least 30 percent of the project budget.

Type of policy measure: Incentive

Monitoring and oversight entity: MoESTD (Innovation Fund)

Output indicator: Number of links (consortiums) established between public R&D institutions and privately-held SMEs

Baseline: 0 (2020)

Target: 20 (2021)

Policy Measure 2.3: Programme to support innovative development projects in 4S fields. This initiative, also known as the Matching Grants Programme, is aimed at firms active in the 4S fields that need substantial finance to develop technological innovations and cover the costs of translating research findings into commercially viable products. The programme is open to MSMEs registered in the Republic of Serbia that develop innovations designed to meet market demand, are able to create new intellectual property, and are globally and nationally competitive. The Fund's contribution may not exceed €300,000 EUR, and projects are limited to 24 months. The Innovation Fund is able to cover up to 60 percent of the project budget, with the applicant required to secure the remaining 40 percent from other private sources.

Type of policy measure: Incentive

Monitoring and oversight entity: MoESTD (Innovation Fund)

Output indicators: Number of projects supported;

Baseline: 0 (2020);

Target: 15 (2021);

Policy Measure 2.4: Accelerator and sub-programme aimed at 4S start-ups. This initiative will comprise two components: one for the early (idea) stage, and the other for companies scaling up their operations. Each component will support 20 companies (teams of two founders each) annually, which will be subject to competitive selection by participating investors (including business angels, early-stage venture capital funds, and the like). Each component will include intensive training and mentoring programmes lasting two to three months. This programme will be implemented with financial support amounting to \$8,000,000 USD provided by the World Bank.

Type of policy measure: Incentive

Monitoring and oversight entity: MoESTD (Innovation Fund)

Output indicators: Number of companies graduating from the accelerator programme; Number of companies growing by at least 10% annually in the year following graduation from the programme

Baseline: 0 (2021); 0 (2021)

Target: 40 (2024); 25 (2025)

Policy Measure 2.5: Proof of Concept Programme for researchers at R&D facilities. This measure is designed to support innovations at R&D organisations from the earliest stages of development. It entails financial and mentoring support to establish the proof of concept of a new commercially viable product, process, or technology. This programme will place mentors at the disposal of project teams to support the creation of proofs of concept, business model development, and future growth.

Type of policy measure: Incentive

Monitoring and oversight entity: MESTD (Innovation Fund)

Output indicator: Number of projects

Baseline: 0 (2020)

Target: 30 (2021)

Policy Measure 2.6: Mini Grants Programme. This initiative is aimed at private businesses developing technological innovations that meet market demand and hold potential to create new intellectual property. The objective is to fund the development of commercially viable innovative technologies, products, and services and so promote innovative entrepreneurship and help these companies survive the critical R&D stage. The programme is open to majority Serbian-owned and Serbian-registered micro and small enterprises that are not older than five years at the time of applying, or core teams consisting of no more than five persons. The Innovation Fund can disburse up to €80,000 EUR for projects lasting up to one year; this funding can constitute no more than 70 percent of the total project budget. The applicant is required to secure at least 30 percent of the budget from other private sources.

Type of policy measure: Incentive

Monitoring and oversight entity: MESTD (Innovation Fund)

Output indicator: Number of projects

Baseline: 0 (2020)

Target: 20 (2021)

Policy Measure 2.7: Agriculture and food industry R&D incentives. This is a new programme to be implemented jointly by the Ministry of Agriculture, Forestry and Water Management and the MESTD and funded by the Ministry of Agriculture, Forestry and Water Management. The idea is to foster constructive collaboration between R&D teams and agricultural extension services, on the one hand, and agriculture and food industry businesses on the other so as to focus R&D on specific needs and improve the currently poor of technical sophistication in farming and food production. The Ministry of Agriculture has earmarked 65mn dinars for this measure.

Type of policy measure: Incentive

Monitoring and oversight entities: Ministry of Agriculture, Forestry and Water Management; MoESTD

Output indicator: Number of projects

Baseline: 0 (2020)

Target: 10 (2021)

Policy Measure 2.8: Pilot project to link fast-growing food production companies with the creative industry and ICT. This initiative is intended to enable horizontal linkages between food producers and the packaging and creative industry and the ICT sector whilst also building synergies with other industries, improving competitiveness, and attracting investment. The pilot will disburse \$10,000 each to five companies for improvements to smart packaging and the use of ICT to improve manufacturing processes and products. The selected firms will be involved in the project's activities, including preparation for a pitch session at the *Belgrade Food Show (BFS)*, participation in panels at both the *BFS* and *Agro Belgrade*, networking with Serbian and foreign buyers and retail chains, and other promotional activities.

Type of policy measure: Incentive

Monitoring and oversight entity: MoESTD (USAID)

Output indicator: Number of companies supported

Baseline: 0 (2020)

Target: 5 (2021)

Policy Measure 2.9: Competitive call to foster R&D contracting in 4S fields. The new Innovation Programme, administered by the Science Fund of the Republic of Serbia, aims at promoting projects where private-sector partners commission R&D from public research institutions for immediate application. Details of the project's budget and timeframe will be available once the Science Fund has adopted its annual work plan.

Type of policy measure: Incentive

Monitoring and oversight entity: MoESTD (Science Fund)

Output indicator: Number of R&D contracts

Baseline: 0 (2020)

Target: To be determined once first open call is advertised (2021)

Policy Measure 2.10: Pilot programme to develop public procurement arrangements for innovations in 4S fields. This initiative will support the use of new rules of the new Public Procurement Law, which will become effective in mid-2020. As suggested by a number of recommendations and findings, and in line with the EU's Directive 2014/24/EU, this piece of legislation introduces 'innovation partnerships'. The programme aims to overcome the lack of practical experience in procuring innovations by these means by piloting four procurement procedures in 4S fields during the action planning period. This measure will be co-ordinated by the Public Policy Secretariat and the MoESTD through the Innovation Fund, which will assist institutions interested in this form of procurement. Funds will come from the existing budgets of these institutions at any level of government, or, alternatively, donor support will be sought.

Type of policy measure: Incentive

Monitoring and oversight entities: MoESTD (Innovation Fund) and Public Policy Secretariat

Output indicator: Number of successfully piloted procurement procedures

Baseline: 0 (2020)

Target: 4 (2021)

Policy Measure 2.11: Creative Hub – Ložionica – Rebuilding the space of the Serbian Railways "Ložionica" into a creative hub as part of the infrastructure support to the creative industries sector, with accompanying program activities and infrastructure necessary for performing artistic programs, as well as fostering interdisciplinary collaboration between different areas of CI. The aim of building a creative hub in the former railway facility is to help incubate new art projects and provide business infrastructure to develop, network and partner between actors within the creative industries. The total value of implementation of this policy measure is 840 million RSD (Serbian dinars).

Type of policy measure: Incentive

Monitoring and oversight entities: Ministry of Culture and Information

Output indicator: Number of beneficiaries and implemented projects within the Hub

Baseline: 0 (2020)

Target: 20 (2022)

Policy Measure 2.12: Creative Embassy in London – Rebuilding and adapting "The Serbian House" in London as a new hub for promotion of creativity and technological innovation from the Republic of Serbia, and strengthening the Serbian brand as a destination with a strong creative industry and sources of innovative products, services and companies. The aim of the multifunctional space is to enable exhibition and business infrastructure as a business incubator for individuals and start-ups moving into

the UK market, as well as to provide strategic support for interaction with international organizations and individuals from creative industries, science and arts. The total value of implementation of this measure is 120 million RSD (Serbian dinars).

Type of policy measure: Incentive

Monitoring and oversight entities: Ministry of Foreign Affairs

Output indicator: Number of annual programs held

Baseline: 0 (2019)

Target: 12 (2022)

Promoting the significance of R&D for competitiveness and social development; Development of business innovation ecosystem

The EDP found that Serbian businesses were exceptionally poorly aware of the importance of R&D and had little confidence in the domestic R&D sector, even though Serbian researchers are highly successful (in 4S priority fields) when measured by strict global criteria. The various EDP stakeholders were also greatly appreciative of the networking opportunities afforded by the EDP for cooperation within the quadruple helix. These findings informed the design of a package of policy measures that aim to foster stronger ties between R&D and businesses and create an environment that acknowledged the significance of R&D for competitiveness of both society and businesses and its role in ensuring future welfare.

Policy Measure 2.13: Publicly available research infrastructure roadmap. Here, information should be released of both the available R&D infrastructure and types of research in 4S fields that businesses can commission from Serbian public-sector R&D facilities, primarily in the areas of Food for Future and Future Machines and Manufacturing Systems. This measure is the responsibility of the MoESTD but may be delegated to one of its subordinated entities to ensure the record is kept updated.

Type of measure: Awareness-raising and education

Monitoring and oversight entity: MoESTD

Output indicator: Research infrastructure roadmap publicly available and operational

Baseline: 0 (No, 2020)

Target: 1 (Yes, 2021)

Policy Measure 2.14: Continuation of the entrepreneurial discovery process. The EDP will continue in the form of regular workshops that will facilitate dialogue with all stakeholders, monitor implementation of the Strategy, and serve as a platform for strengthening intra-community linkages. Entrepreneurial discovery workshops will take place at least twice each year, or more frequently if required. The RIS3 Working group will be tasked with co-ordinating these events. This policy measure will also entail a targeted campaign to promote the 4S Strategy. In 2020, this measure will receive support under the World Bank's Competitiveness and Jobs Project.

Type of measure: Awareness-raising and education

Monitoring and oversight entity: MoESTD

Output indicators: Number of ED workshops held; Number of new organisations involved in the EDP

Baseline: 0 (2020); 0 (2020)

Target: 4 (2021); 50 (2021)

Objective 3: Education focused on innovations and entrepreneurship

Improving researchers' competencies and motivation to work with businesses

Collaboration between businesses and researchers ought to be empowered through support for capacity-building that aims to meet researchers' needs for training and enhance their ability to enter the national and global market. Additionally, an appropriate ecosystem should be created that will allow this policy to achieve its full impact.

Policy Measure 3.1: Training for researchers to improve cooperation with businesses. This measure is designed to train researchers so as to enhance their competencies to work with businesses, and will be implemented with support from the Joint Research Centre (JRC).

Type of measure: Provision of goods and services

Monitoring and oversight entity: MoESTD

Output indicator: Number of researchers trained

Baseline: 0 (2020)

Target: 50 (2021)

Policy Measure 3.2: Introduction of entrepreneurial skills training in 4S fields into university curricula. This measure will be implemented by means of open calls launched by the MoESTD for award of grants to universities for development of courses in entrepreneurship and related fields. It will also include involving practitioners/business people in teaching as visiting lecturers.

Type of measure: Incentive

Monitoring and oversight entity: MoESTD

Output indicator: Number of faculties/academies introducing entrepreneurship courses

Baseline: 0 (2020)

Target: To be determined in 2020

Policy Measure 3.3: Involvement of practitioners/businesspeople in teaching. Similarly to the preceding measure, this initiative will seek to involve as many businesspeople in teaching. This option is already available under current regulations but its practical use is limited.

Type of measure: Incentive

Monitoring and oversight entity: MoESTD

Output indicator: Number of courses that include businesspeople as teachers

Baseline: 0 (2020)

Target: To be determined in 2020

Policy Measure 3.4: University competition to promote innovation, entrepreneurship, and environmental awareness. This incentive will be piloted in the Food for Future field and will seek to promote innovations and creativity by helping students develop new eco-innovative products based on their own ideas and market them nationally and within Europe. The policy measure will be implemented by the Ministry of Agriculture, Forestry and Water Management and the MoESTD, with support from USAID. A total of €15,000 will be earmarked for the 2020 pilot; the initiative is also intended to remain sustainable thereafter.

Type of measure: Incentive

Monitoring and oversight entities: Ministry of Agriculture, Forestry and Water Management; MoESTD

Output indicator: Number of new eco-innovative products

Baseline: 0 (2020)

Target: 6 (2021)

Policy Measure 3.5: Amendments to the Regulation on the evaluation and quantitation of research results. This initiative is based on the EDP finding whereby academics and researchers in public R&D facilities lack systematic motivation to work with businesses, because their career advancement is largely driven by the publication of scholarly papers (and patent applications, where applicable). By contrast, applied research, where possible in collaboration with private firms or public enterprises, is not taken into consideration and researchers therefore do not see it as a priority. This regulatory measure entails amending the Regulation on the evaluation and quantitation of research results to alter the current scoring scale and so allow collaborative R&D contracts and their results to count towards teaching and academic promotions.

Type of measure: Regulatory

Monitoring and oversight entity: MoESTD

Output indicator: Regulation on the evaluation and quantitation of research results amended

Baseline: 0 (No, 2020)

Target: 1 (Yes, 2021)

Policy Measure 3.6: Master Program to connect the arts and information technology. This measure entails organising a competition to select and fund a multi-disciplinary three-semester master's programme in ICT, coding, data analysis, organisational sciences, and the arts, with at least one short course in each of these disciplines. This programme would meet the needs of the creative industry by introducing new university courses whilst at the same time permitting Serbian schools to train globally competitive graduates. This approach aims at enhancing existing comparative advantages by matching R&D and academic capacities with the needs of businesses.

Type of measure: Incentive

Monitoring and oversight entity: MoESTD

Output indicator: Number of students enrolled in master's programme

Baseline: 0 (2020)

Target: 35 (2021)

Objective 4 – Improved business conditions through optimization and digitalization of procedures in 4S areas

Simplifying regulations and creating predictable business environment is essential for investment planning and the development of priority areas identified in the Strategy proposal. In relation to the stated goal, the following measures will be defined:

Policy Measure 4.1: Analysis and simplification of all administrative procedures according to the needs of the 4S – This measure aims to analyse, simplify and digitize all administrative procedures that are important for the further development of the economy in the priority areas of 4S. As part of this measure, consultations will be organized as part of the continuation of the EDP on complicated administrative procedures to better define and identify problems. After analysing and identifying all the

procedures and processes that need to be modified, the work will be continued to simplify and digitize all the identified shortcomings and complex procedures that are relevant to the 4S priority areas. Funds for the implementation of the measure were provided through the IPA 2019 program as part of the EU support for competitiveness, research and development and innovation, with the amount of EUR 2.000.000 provided.

Type of measure: Incentive

Monitoring and oversight entity: MoE, PPS, Office for IT and eGovernment and MoAFW

Output indicator: Number of digitized processes/administrative procedures within the priority areas of 4S

Baseline: 0 (2020)

Target: 30 (2021)

Objective 5 – Internationalization of the economy through inclusion in regional and global value chains in 4S areas

Increased participation in global and regional value chains can significantly contribute to accelerated exports and revenue growth. In relation to the stated objective, the following measures have been identified:

Policy Measure 5.1: Establishing interregional partnerships within smart specialization thematic platforms – This measure aims to establish interregional partnerships within smart specialization thematic platforms. The process of establishing a new partnership begins by assessing the possibilities of interregional cooperation based on an analysis of similar and complementary smart specialization priorities. After identifying potential contributors, the regions jointly prepare a proposal that they share with the European Commission and which contains a description of the objectives, activities and measures envisaged, a description of the coherence of the RIS3 priorities, etc. It is also possible to join existing partnerships if partner countries agree. The expected results of interregional cooperation within these thematic platforms include the possibility of improving the position in regional value chains, better links between regional partners, strengthening the capacities needed to access EU funds and other financial and non-financial benefits. The necessary funding for the implementation of this measure will be provided within the budget of the MoESTD.

Type of measure: Incentive

Monitoring and oversight entity: MoESTD

Output indicator: Number of established partnerships within smart specialization thematic platforms

Baseline: 0 (2020)

Target: 1 (2021)

Policy Measure 5.2: Establishing cooperation with the countries in the region as part of the Smart Specialization – This measure aims to establish cooperation with countries in the region (Danube region, Adriatic-Ionian region, Western Balkans region) within the smart specialization priorities. Possible cooperation was already considered during a two-day regional conference held in Belgrade and a number of interesting proposals for cooperation with Montenegro arose during the event. However, proposals for cooperation are not sufficiently concrete and further coordination and cooperation needs to be put in place in order to define and specify future activities. The funds required for the implementation of this measure will be provided within the MoESTD budget.

Type of measure: Incentive

Monitoring and oversight entity: MoESTD

Output indicator: Established cooperation agreements

Baseline: 0 (2020)

Target: 1 (2021)

Measures to be elaborated in the EDP and inputs for other policies

Work on the 4S policy mix and consultations in the EDP for each priority field produced a number of ideas that were not sufficiently developed at the time but which nonetheless merit further elaboration for possible inclusion in the 4S policy mix or other policies at a later date. Some of these pertain to particular 4S fields, whilst others may improve the business environment in multiple fields, especially as regards agriculture. The EDP consultations also focused greatly on education. The prevailing opinion is that the existing programmes should be intensively harmonized to the market needs in terms of both content and enrolment quotas. Many of the issues identified exceed the scope of this Strategy and will be addressed elsewhere, specifically in the education development strategy.

Given the relatively few patents in the fields of Food for Future and Future Machines and Manufacturing Systems, activities planned in the 4S will additionally **analyse practices employed to commercialise innovations** and also look at how the volume of research compares with opportunities for further commercialisation by means of licensing agreements. The assessment will look at both the Republic of Serbia and other markets and its findings will be discussed in the EDP so as to inform the development of appropriate measures if intervention is found to be justified.

The 4S and ongoing **EDP** will also take a detailed look at options for introducing a special programme to fund **industrial doctoral courses** in 4S fields to incentivise researchers to work with businesses and promote competitiveness.

Several potential measures relate to options identified in the **EDP** for **improvements to the business environment**. Specifically, ICT workshops highlighted the need for better broadband access throughout the country. Here, future amendments to the Law on Electronic Communications will introduce net neutrality, whereby internet service providers (ISPs) will be required to allow access without restricting the use of any online content.

The Food for Future EDP found the need to **harmonise numerous regulations and establish registers of information on crop production measures** (such as pesticide use, etc.) **important for researchers**. As these findings were not sufficiently specific to allow a concrete policy measure to be designed, a Food for Future sub-group was established that will bring together relevant policymakers from the Ministry of Agriculture, Forestry and Water Management.

Several proposals concern **improvements in education, especially higher education**. Given the complexity of this system in terms of its regulation, governance and autonomy, as well as the ongoing reforms here, these EDP proposals will be additionally reviewed so that measures can be formulated. One of the directions will be to inventory all existing courses in the 4S fields and regularly assess the labour market to gather information required to systematically analyse needs for new curricula and set budget funding quotas. The National Qualifications Framework, currently under development, is a sound basis for developing these proposals.

Obstacles were also found to the **development of foreign markets**: it was concluded that investing in R&D is rarely profitable if the resulting products can be sold only nationally. The Development Agency of Serbia (DAS) has recently begun offering export promotion programmes. Additional consultations will be organised as part of the EDP to ensure the DAS takes 4S priorities into account link the Innovation Fund's programmes with those of the DAS.

VI. 4S IMPACT MONITORING AND EVALUATION

Monitoring and evaluation are integral and constituent parts of any successful strategy, and, as such, a necessity for a smart specialisation strategy as well. Accordingly, the 4S will be accompanied by a responsible and realistic Action Plan (AP) for its implementation. The AP will cover the period from 2020 to 2023 and will be adopted at the latest 90 days after the 4S is enacted; it will serve as the main means of monitoring the 4S. The AP is a document that is subject to change and may be revised as necessary, if monitoring and evaluation find that particular measures are not delivering the expected results. The 4S Strategy and AP have been developed in accordance with the Law on Planning System (*Official Gazette of the Republic of Serbia*, No. 30/18) and the accompanying Government Order.⁵⁴ The Law on Planning System of the Republic of Serbia, adopted in April 2018, regulates policy planning in the Republic of Serbia and is fully aligned with the JRC's methodological framework and best EU practice. Under this piece of legislation, if a policy document is proposed by a government body (in this case, the MoESTD), that body is required to notify the Government of the results of implementation of the relevant AP no later than 120 days following the end of each calendar year. Although action plans usually cover the whole of a strategy's validity period, in this case the AP is set to expire in 2023 as the full schedule of activities cannot be assessed at the time of adoption. Evaluation of the 2020-2023 AP will allow options for improvement to be identified, which will in turn permit an additional AP to be adopted to cover the remaining 4S Strategy period. Finally, the MoESTD will notify the Government of the results of implementation of the overall 4S Strategy within 120 days following the end of every third calendar year, and is also required to submit a final report no later than six months after implementation is complete (Law on Planning System of the Republic of Serbia, Article 43).

Managing the process of implementing the 4S strategy

The Ministry of Education, Science and Technological Development, as the holder of the Strategy, will be the responsible institution and the main body responsible for monitoring and implementation of the 4S. It will be supported by an internal unit to be established within the Ministry itself. They will be responsible for the day-to-day coordination of the strategy and the collection of inputs from relevant Ministries and Agencies involved in the implementation of specific measures and activities (Figure 5). As required by the Law on the Planning System, the MoESTD will be responsible for submitting annual reports to the Government on the results of the implementation of the Action Plan. While at the three-year level, they will report on the results of the implementation of the Strategy. 4S is a long-term innovation policy and tangible results cannot be measured reliably at the beginning of the implementation of the measures and it is therefore necessary to give time to better evaluate the effect of the measures and activities.

⁵⁴ Government Order on policy management methodology, policy impact assessment, and content of individual policy documents ("Official Gazette of the Republic of Serbia", No. 8/19).

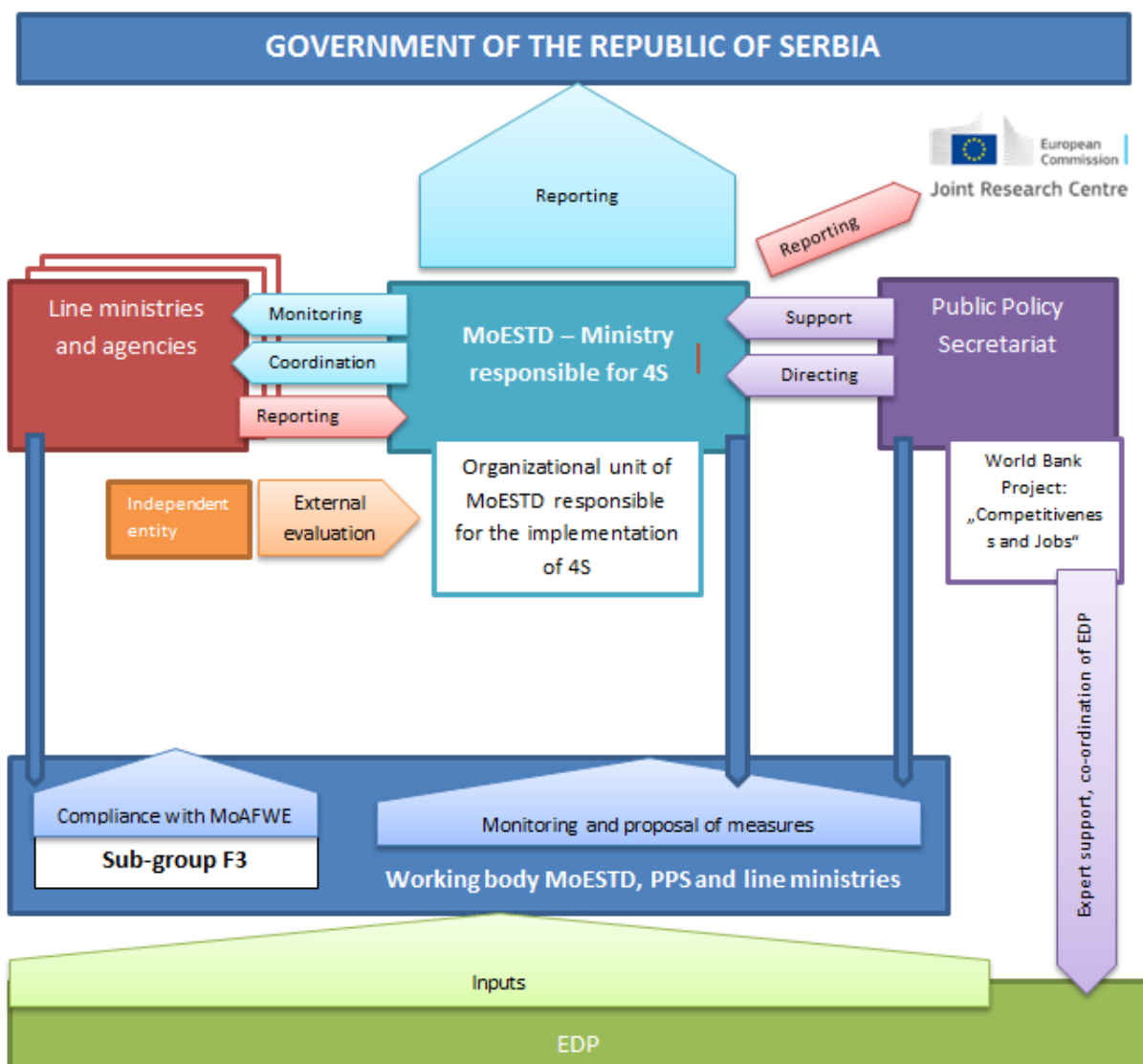


Figure 8. Authorities participating in implementation and monitoring

The working body of the MoESTD, the Public Policy Secretariat (PPS) and the competent ministries of RIS3 would be responsible for coordinating and monitoring the 4S Strategy. The mandate of this group will last for the duration of the strategy and will cover the task of supervision over implementation and monitoring. It will retain a similar composition of members and thus ensure the continuation of a well-managed process and involvement of all relevant stakeholders. Also, within this broad group, a new special working group will be established only for priority area “Food for Future”. This working group will include experts who participated in the EDP process in the F3 area and certain representatives from the Ministry of Agriculture, Forestry and Water Management. This is because during the development of the strategy and the analysis of relevant data and inputs from the EDP process, the need for such a body emerged given the complex and difficult regulatory framework in the agricultural sector. These working groups would receive monitoring reports, discuss all relevant information with the participants in the EDP, formulate tasks for the 4S team and assist in implementing the strategy as needed.

Since a fully transparent process is crucial and in order to provide quality implementation of the 4S Strategy, the EDP process will continue, and it will include continuous communication with the representatives of the EDP.

During implementation of the 4S Strategy, the MoESTD would have the technical support of the PPS (special organization of the Government of the Republic of Serbia that provides expert support to the Government and state bodies in the process of planning, development, adoption and coordination of public policy and implementation of regulatory platform). Also, during the first year of the Strategy, the World Bank's "Competitiveness and Jobs" project will provide expert support to the MoESTD.

The last control mechanism will be evaluations conducted by an independent body as needed.

Once the adoption of the 4S Strategy happens, and it is planned in February 2020, in the first half of 2020 a new set of measures will be launched. The first monitoring report is planned at the beginning of 2021. Interim evaluation will be conducted by the expert body in 2023 in order to harmonize the evaluation cycle with the EU Member States (Figure 9).

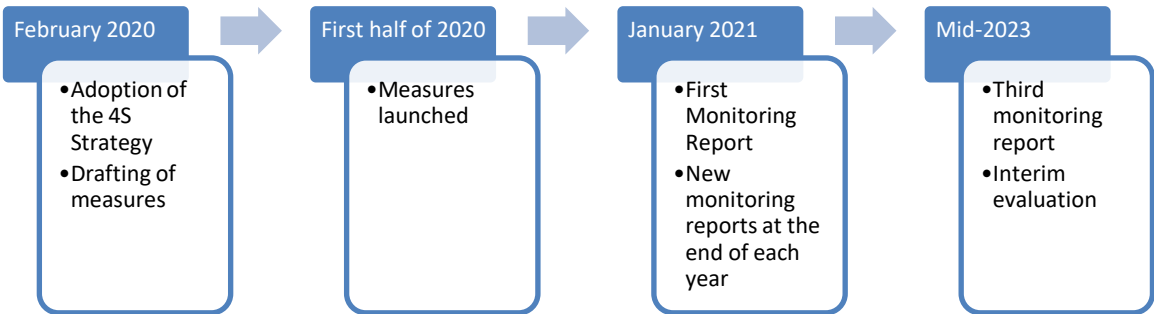


Figure 9. Strategy monitoring schedule

Indicators

Specific policy measures and activities will be monitored by means of quantitative and qualitative indicators, to be defined in the AP taking into account data and information obtained from all stakeholders responsible for implementation and other sources (Law on Planning System of the Republic of Serbia, Article 40, paragraph 5). Performance indicators are defined as quantitative and/or qualitative metrics used to monitor the achievement of policy goals or objectives relative to the baseline values of those metrics. They are divided into impact indicators (for goals), outcome indicators (at the objective level), and output indicators (for each policy measure).

The indicators were designed with reference to recommendations made by JRC consultants, inputs from all stakeholders, and analysis of existing information shared by the relevant Serbian and EU institutions. The tables below show impact, outcome, and output indicators. The indicators and policy measures will be elaborated in detail in the AP.

Table 8. Impact indicators (Goal)

Goal					
Directed development of the Republic of Serbia towards a highly competitive economy through research, development, innovations, and entrepreneurial initiatives in the 4S areas					
Impact indicator	Baseline	Baseline year	Source	Target value	Target year
Investment in R&D as percentage of GDP	0.92%	2018	SORS	1.5%	2027

Value added per employee	EUR 14,917	2017	SORS	EUR 18,000	2027
Employment in medium- and high-tech industries as percentage of total employment	4.5%	2018	Eurostat	8%	2027
Number of patents registered in Serbia and abroad by Serbian inventors, based on international and/or European patent applications	0%	2018	Serbian Intellectual Property Office	5%	2027

Table 9. Outcome indicators (Objectives)

Objective 1					
Research and development focused on 4S priorities					
Outcome indicators	Baseline	Baseline year	Source	Target value in 2022	Target value in 2027
Share of R&D papers in 4S fields in total number of R&D papers	42.1%	2018	OECD	50%	55%
Objective 2					
Economic growth supported through R&D and collaboration among the quadruple helix participants					
Outcome indicators	Baseline	Baseline year	Source	Target value in 2022	Target value in 2027
Share of high-tech exports in total exports	1.9%	2018	Eurostat	2.2%	3%
Company spending on R&D as percentage of GDP	0.36%	2018	SORS	0.45%	0.75%
Index of Multi-stakeholder collaboration	3.5	2018	GCI	3.7	4.0
Objective 3					
Education focused on innovations and entrepreneurship					
Outcome indicators	Baseline	Baseline year	Source	Target value in 2022	Target value in 2027
Entrepreneurship culture index	47.4	2018	GCI	48.5	50.0
Objective 4					

Improved business conditions through optimization and digitalization of procedures in the fields of 4S					
Outcome indicators	Baseline	Baseline year	Source	Target value in 2022	Target value in 2027
Achieved savings as a result of simplified administrative procedures	0%	2019	RPPS	10%	30%
Objective 5					
Internationalization of economy through inclusion into regional and global value chains in the 4S fields					
Outcome indicators	Baseline	Baseline year	Source	Target value in 2022	Target value in 2027
Total exports of goods in the field of 4S	€ 5955m	2019	SORS	€ 6150m	€ 6400m
Total exports of services in the field of 4S	€ 1135m	2018	NBS	€ 1400m	€ 1700m

Table 10. Outcome indicators, responsibilities, and funding for policy measures (see Chapter V for a detailed description of each measure)

No.	Policy Measure	Output indicator	Responsible entity	First year budget (RSD 000s)	Source of funding
1.1	Science Fund competitive open calls in 4S fields (Food for Future, Future Machines and Manufacturing Systems, ICT, Creative Industry): Development Programme	Number of supported projects	MoESTD, Science Fund	720,000	MoESTD/SF
1.2	Artificial Intelligence Programme	Number of supported research projects	MoESTD, Science Fund	72,000	MoESTD
1.3	Adoption of regulatory criteria to govern the amount of institutional funding to R&D organisations so as to promote relevance and excellence in 4S fields	Adopted document to govern allocation of institutional funding R&D organizations	MoESTD	0	MoESTD
1.4	Support programme for experimental and innovative projects combining art and science/technologies	Number of projects that connect science and art	MoESTD, Centre for the Promotion of Science	3,000	CPS
2.1	4S Voucher Programme	Number of supported companies	MoESTD, Innovation Fund	80,000	IF

2.2	Innovation Fund programme to co-finance collaboration between science and economy in the 4S fields, collaborative grant scheme	Number of established links (consortiums) between scientific and research organizations and economy	MoESTD, Innovation Fund	720,000	IF
2.3	Innovation Fund programme to finance innovative development projects in 4S fields	Number of supported projects	MoESTD, Innovation Fund	540,000	IF
2.4	Innovation Fund Accelerator, sub-programme aimed at 4S start-ups	Survival rate of Accelerator graduates	MoESTD, Innovation Fund	240,000	IF
2.5	Proof of Concept, Programme for researchers at R&D facilities	Number of vouchers issued	MoESTD, Innovation Fund	72,000	IF
2.6	Mini Grants Programme	Number of projects	MoESTD, Innovation Fund	192,000	IF
2.7	Agriculture and food industry R&D incentives	Number of contracts	MoESTD, MoAFW	65,000	MoAFW

2.8	Pilot project to link fast-growing food production companies with the creative industry and ICT	Number of companies supported	MoESTD (USAID)	6,000	USAID
2.9	Competitive call to additionally stimulate research contracts in 4S fields between R&D organizations and research beneficiaries	Number of R&D contracts	MoESTD (Science Fund)	0	SF
2.10	Pilot programme to develop public procurement arrangements for innovations in 4S fields	Four procurement procedures piloted successfully – innovative procurement	RPPS, MoESTD, Innovation Fund	0	
2.11	Creative Hub - Ložionica	Number of users and implemented projects under the Hub	Ministry of Culture and Information	280,000	MCI

2.12	Creative Embassy in London	Number of annual programs held	Ministry of Foreign Affairs	30,000	MFA
2.13	Publicly available register/map of R&D infrastructure and types of 4S research available in Serbia and relevant for businesses	Register of R&D infrastructure publicly available and operational	MoESTD	0	
2.14	Continuation of the entrepreneurial discovery process (EDP)	Number of EDP workshops held	MoESTD	3,500	Technical assistance as part of World Bank's Competitiveness and Jobs Project
3.1	Training for researchers to improve co-operation with businesses	Number of researchers trained	MoESTD	0	
3.2	Introduction of entrepreneurial skills training in 4S fields into university curricula: MoESTD open call for grants to universities for development of courses in entrepreneurship and related fields, including involvement of practitioners as visiting lecturers	Number of faculties/academies introducing entrepreneurship courses	MoESTD		
3.3	Involvement of practitioners/businesspeople in teaching: 4S pilot	Number of courses that include businesspeople as teachers	MoESTD		

3.4	University competition to promote innovation, entrepreneurship, and environmental awareness (pilot)	Number of new eco-innovative products	MoAFW and MoESTD	1,600	USAID, MoAFW
3.5	Amendments to Regulation on the evaluation and quantitation of research results	Adopted amended rulebook on evaluation, procedure, method of evaluation and quantitative presentation of R&D results of resesarchers	MoESTD	0	
3.6	Master Program to connect the arts and information technology	Number of students enrolled in master's programme	MoESTD	6,000	
4.1	Analysis and simplification of all administrative procedures according to the needs of the 4S	Number of digitized processes/administrative procedures in 4S priority areas	MoE, RPPS, Office for IT, MoAFW		IPA 2019
5.1	Establishing interregional partnerships within thematic platforms of smart specialization	Number of established partnerships within thematic platforms of smart specialization	MoESTD	0	MoESTD

5.2	Establishing cooperation with the countries in the region as part of the smart specialization	Cooperation agreement concluded	MoESTD	0	MoESTD
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Monitoring the implementation of the Strategy

The Ministry of Education, Science and Technological Development will report annually on the implementation of the Strategy through monitoring of the implementation and coordination of public policies in cooperation with the competent ministries, competent bodies and organizations.

The financial effects of the Strategy implementation will be provided in detail in the Action Plan, which will be adopted within 90 days from the date of adoption of the Strategy, in line with the medium-term expenditure framework of the budgetary procedure for 2020, as well as in accordance with the limits designated by the Ministry of Finance for the coming years for appropriate budget items.

The three-year implementation Action Plans and reports on the implementation of activities of this Strategy will be prepared by the Ministry of Education, Science and Technological Development in cooperation with the line ministries, competent bodies and organizations, business sector and faculties. The first three-year action plan for the implementation of the Smart Specialization Strategy in the Republic of Serbia will be adopted within 90 days of the adoption of the 4S Strategy, and other action plans will be adopted in accordance with Article 18 paragraph 7 of the Law on the Planning System of the Republic of Serbia.

VII FINAL PROVISIONS

This Strategy shall be published on the Government's website, the website of the Ministry of Education, Science and Technological Development, and on the eGovernment Portal, within seven working days from the day of its adoption.

This Strategy shall be published in the "Official Gazette of the Republic of Serbia".

05 Number: 153-1851/2020-1
In Belgrade, February 27, 2020

GOVERNMENT

PRIME MINISTER

Ana Brnabić

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APPENDIX 1

State of the science and research sector

In the past few decades, the Republic of Serbia managed to preserve its scientific and research potentials. Scientific research activity in the Republic of Serbia is highly ranked on international ranking lists, which undoubtedly speaks of a country's potential in this field and its international competitiveness and influence. Based on global research ranking by *SCImago Journal & Country Rank*, in 2019 the Republic of Serbia was in the 52nd place of a total of 230 countries. The H-index of the Serbian science is valued 220. Relative to other countries in the Western Balkans, Serbia has significantly greater production of scientific papers and greater global scientific influence. However, relative to the EU member states in the region, Serbia has a lower H-index. Citation of papers from the Republic of Serbia is on the rise, but is still lagging behind most of the EU member states from the region (Table 1).

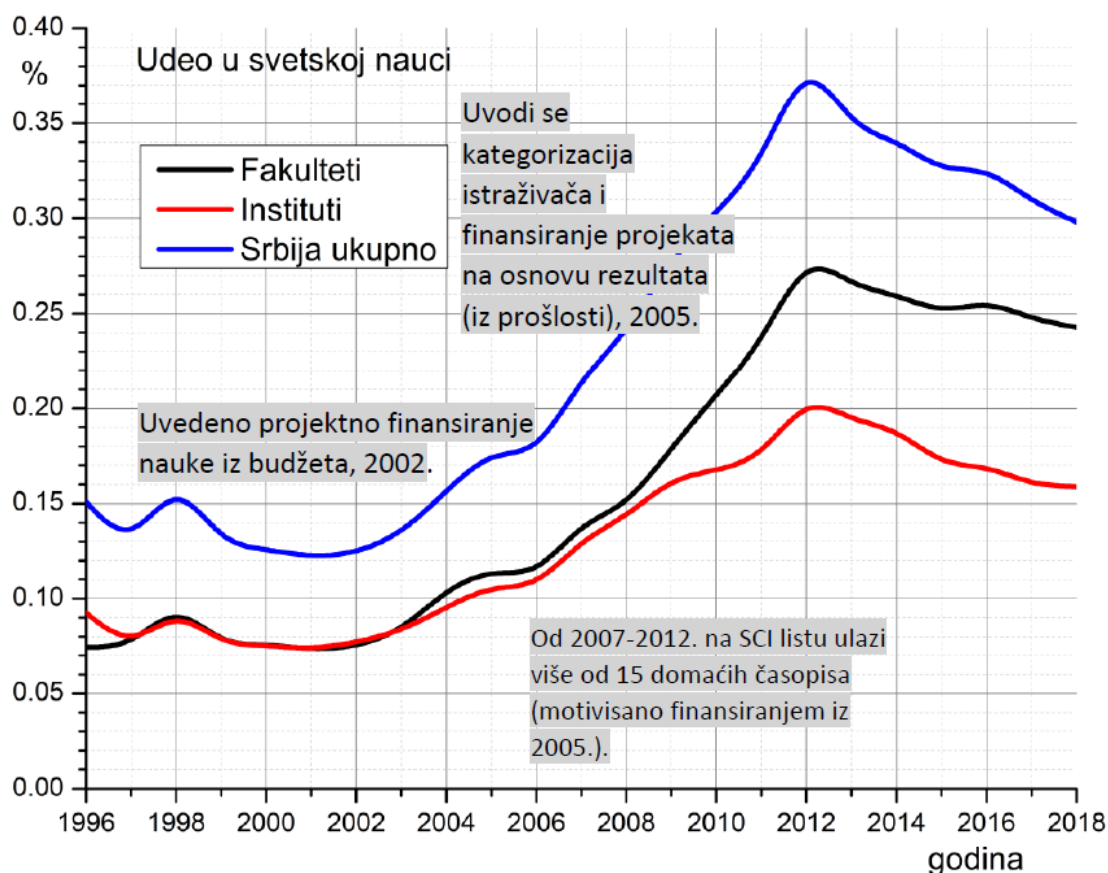
Table 11. Position of the Serbian science relative to the Western Balkans and countries of the region according to a global ranking published by *SCImago Journal & Country Rank* in 2019.

	Position on (SCImago) ranking list	Number of published scientific papers	Number of citations per paper	H Index
Albania	119	4.727	6,40	62
Bosnia and Herzegovina	94	12.226	5,74	91
Montenegro	124	3.920	5,36	51
North Macedonia	95	11.949	9,18	108
Republic of Serbia	52	91.280	8,56	220
Bulgaria	55	77.335	10,83	240
Croatia	49	104.865	9,12	259
Hungary	41	192.565	15,33	419
Romania	40	198.390	7,12	271
Slovenia	51	93.894	13,25	278

Source: SCImago Journal & Country Rank

Scientific and research activity has been particularly improved since 2002. This is the result of overall better economic circumstances, the opening of the country, but also of public policy measures which contributed to a better management of the sector of public scientific research system. Certain turning point that has been present since 2012 is the consequence of the lack of incentives in the financing system as there were no competitions for new scientific research projects until June 2019 (Atanasijevic et al. 2019) (Chart 1).

Chart 5. Share of published papers from Serbia in the total number of published papers in the world on the SCI list and crucial events that describe trends



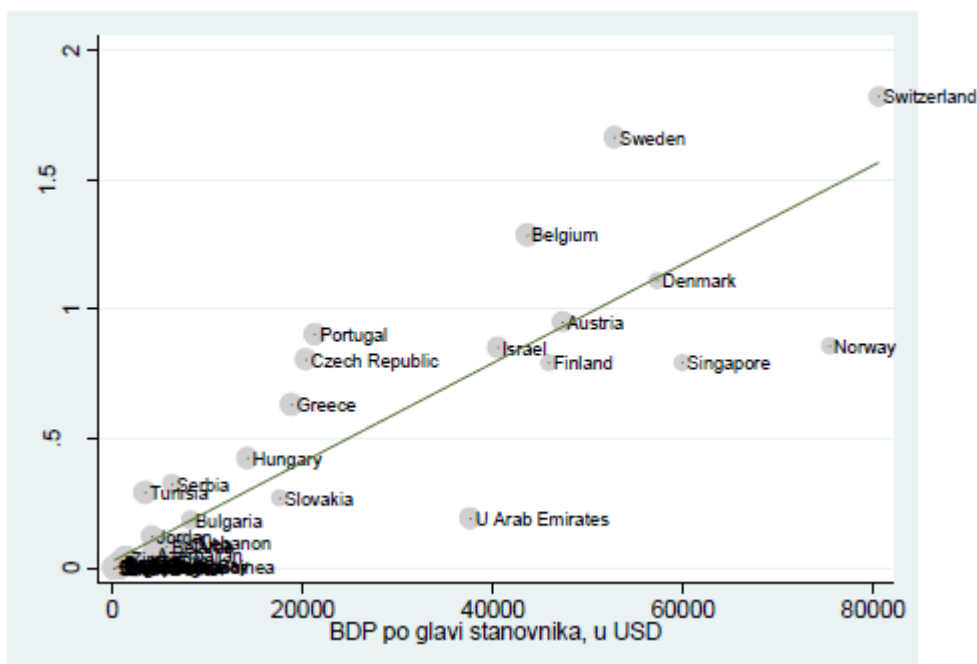
Source: Atanasijević J., Nikolić Z., Jeremić-Zec G., Pavlović O. & Vasiljević D. (2019). "Attaining Higher Productivity in Serbia: Can Higher Education Contribute More?", Public Policy Secretariat of the Republic of Serbia, World Bank project "Competitiveness and Jobs", unpublished working material, December, 2019

Results of the scientific research activity in the Republic of Serbia that could be of importance for the economy are at a low level as scientific papers published in domestic and international publications are dominant in results. According to a report from the National Council for Scientific and Technological Development (2019)⁵⁵, 97.7% of the overall results of scientific and research work in 2017 are published scientific papers, while patents and technical solutions amount to 2.3%. There was the greatest number of technical solutions in electronics, telecommunications and information technologies, while there was the greatest number of patents in biotechnology and agriculture.

Results of scientific research activity on the international scene are particularly important considering the economic development (measured by GDP per capita) (Chart 2). When observing the level of scientific research activity measured by the number of papers published by internationally relevant scientific journals, a correlation with the level of economic development for certain category of countries (measures by the number of residents) is clearly visible, while countries with greater number of residents are above fitted regression line and are not relevant for consideration in this context. (Atanasijević et al. 2019).

Chart 6. Share in the number of published articles in the world and GDP per capita in 2017 for comparable countries by the number of residents (4 to 15 million residents)

⁵⁵ National Council for Scientific and Technological Development (2019). Report on the state of science in 2018, with proposals and suggestions for next year, Belgrade, October 2019



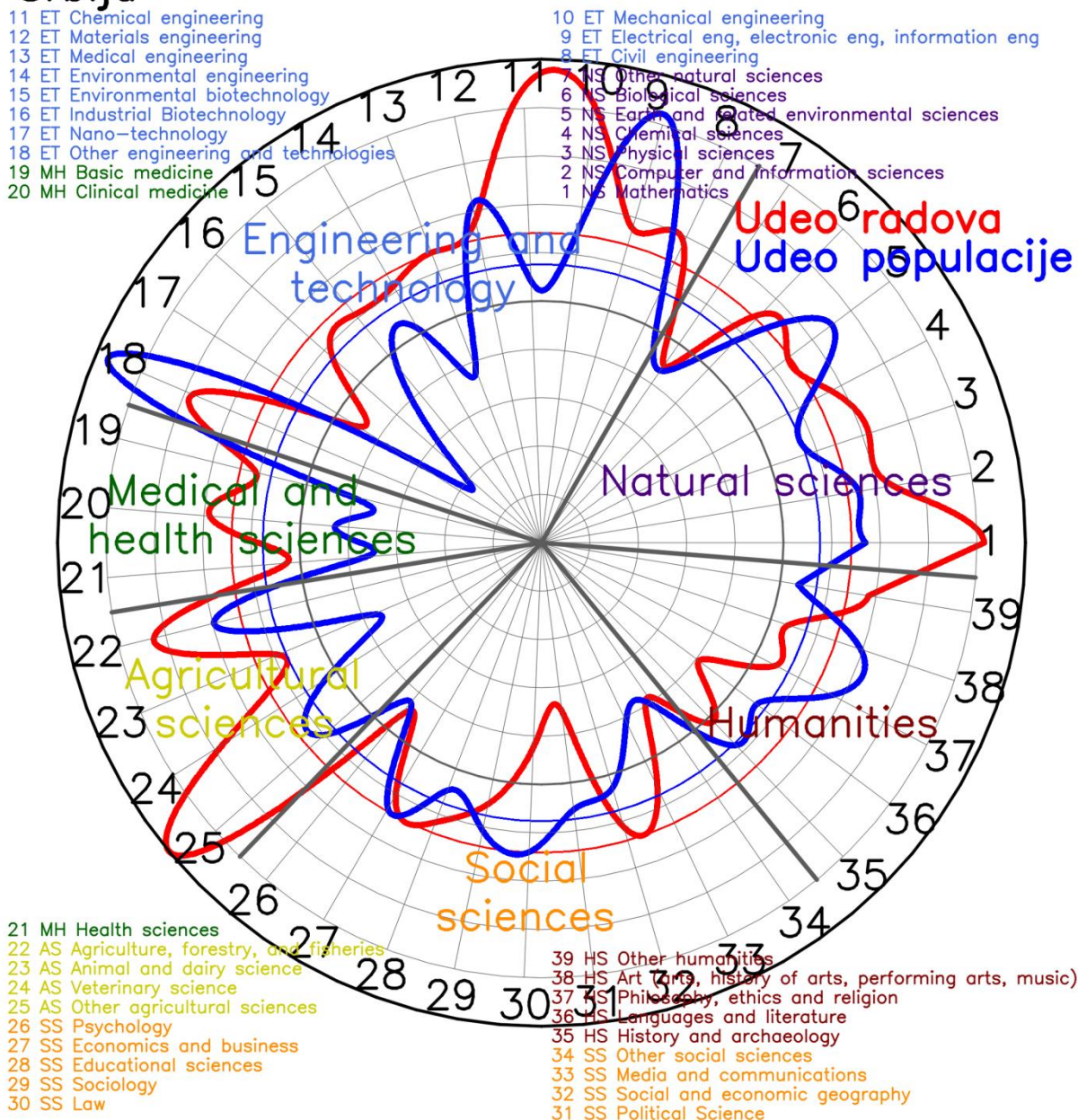
Source: Atanasijević J., Nikolić Z., Jeremić-Zec G., Pavlović O. & Vasiljević D. (2019). "Attaining Higher Productivity in Serbia: Can Higher Education Contribute More?", Public Policy Secretariat of the Republic of Serbia, World Bank project "Competitiveness and Jobs", unpublished working material, December, 2019

Results of scientific research activity in Serbia are particularly important in the light of relatively small financing. Gross expenditures for research and development (R&D) as a percentage of GDP in 2018 were 0.92%, which is significantly smaller than in the EU countries which in the same year amounted to 2.06% (Table 2). The participation of scientific teams from Serbia significantly grew in the past period in the EU-financed Horizon 2020 Program. Serbia is recording very small investments by business sector in research and development, which, to some degree, is influenced by the economic structure which is dominated by low technology industries and services (finances and telecommunications).

When observed by areas, authors from Serbia are relatively well represented in the world in the areas of natural sciences, engineering, medicine and agricultural science (Chart 3). There is good heritage in these fields, and researches which mostly record significant results are focused on areas which require relatively smaller investments in equipment than average for an entire area. Also, within the above mentioned areas, Serbia stands out in areas where no cooperation with technologically developed industry is needed. On the other hand, despite relatively low cost of research, Serbia does not stand out in social sciences and humanity, probably due to poor heritage (Atanasijević et al. 2019).

Chart 7. Serbia 2009-2018: Share in the number of papers in the world and in the global population of researchers in 39 scientific areas (OECD Frascati)

Srbija



Source: Atanasijević J., Nikolić Z., Jeremić-Zec G., Pavlović O. & Vasiljević D. (2019). “Attaining Higher Productivity in Serbia: Can Higher Education Contribute More?”, Public Policy Secretariat of the Republic of Serbia, World Bank project “Competitiveness and Jobs”, unpublished working material, December, 2019

There are around 2,000 researchers per one million inhabitants in Serbia, which is higher than other countries of the Western Balkans, but less than more developed EU countries from the region (Table 2). There are around 15,000 researchers officially (Table 3) and this number has been on the rise. Of a total number of researchers, 51% are women, which is significantly above the European average. Given that the greatest number of researchers are in the public sector (institutions of higher education and institutes), the rise of the number of researchers has been halted since 2016 and even a mild decrease has been registered.

Table 12. Comparative indicators of expenditures for R&D and the number of researchers in 2018.

	Total expenditures for R&D as a percentage of GDP (%)	Number of researchers (FTE) per one million inhabitants (%)
Albania	-	-
Bosnia and Herzegovina	0,20	463,9
Montenegro	0,32*	714,3*
North Macedonia	0,36	728,9
Serbia	0,92	2.079,2
Bulgaria	0,75	2.130,5
Croatia	0,86	1.865,4
Hungary	1,35	2.924,0
Romania	0,50	890,2
Slovenia	1,86	4.467,8
European Union – 28 countries	2,06	-

Sources: Eurostat Database, <https://ec.europa.eu/eurostat/data/database>; UNESCO Institute for Statistics, <http://data.uis.unesco.org>

*Data from 2016

Table 13. Trends in the total number of researchers (FTE) by sector in 2011-2018

	2011	2012	2013	2014	2015	2016	2017	2018
Total number of researchers (FTE)	11.720	11.802	12.342	13.026	14.657	15.015	14.557	14.535
Business sector (FTE)	149	276	372	1.421	1.406	1.993	1.549	1.192
Public sector (FTE)	2.869	3.040	3.097	2.874	3.049	2.987	2.993	3.061
Higher education sector (FTE)	8.700	8.482	8.870	8.728	10.196	10.029	10.014	10.281
Non-profit sector (FTE)	3	4	2	4	6	6	2	0,6

Source: Calculation by the author based on: Republic Statistical Office, Bulletin 648: Scientific research activity in the Republic of Serbia, 2019, Belgrade

According to the structure of employees in research and development sector, the greatest number of researchers are employed in the areas of engineering and natural sciences, which together make more than 50% of the total number of researchers. More than 91% of researchers come from the public sector and the sector of higher education, while only 8.2% of researchers work in the business sector (Table 4). When it comes to the number of researchers in the business sector, Serbia is significantly below the European average but also below the countries of the region. According to data from 2018, only 3.7% of doctors of science work in the business sector.

Table 14. Employed researchers by sectors and scientific areas expressed in full time equivalent (FTE) in 2018.

	Researchers FTE)		Doctors of science (FTE)	
	Total	Percentage	Total	Percentage
Republic of Serbia	14.534,9	100,00%	9.742,6	100,00%
Natural sciences	3.522,0	24,44%	2.362,3	24,25%
Engineering and technology	4.052,4	27,88%	2.281,4	23,42%
Medicine and health science	1.852,9	12,75%	1.232,9	12,65%
Agricultural science	1.103,0	7,59%	903,6	9,27%

Social sciences	2.551,1	17,55%	2.000,3	20,53%
Humanities	1.453,5	10,00%	962,1	9,88%
Business sector	1.192,1	8,20%	360,2	3,70%
Public sector	3.061,1	21,06%	2.219,1	22,78%
Higher education	10.281,1	70,73%	7.162,8	73,52%
Non-profit sector	0,6	0,01%	0,5	0,01%

Source: Calculation by the author based on: Republic Statistical Office, Bulletin 648: Scientific research activity in the Republic of Serbia, 2019, Belgrade.

Serbia's position in the European Research Area

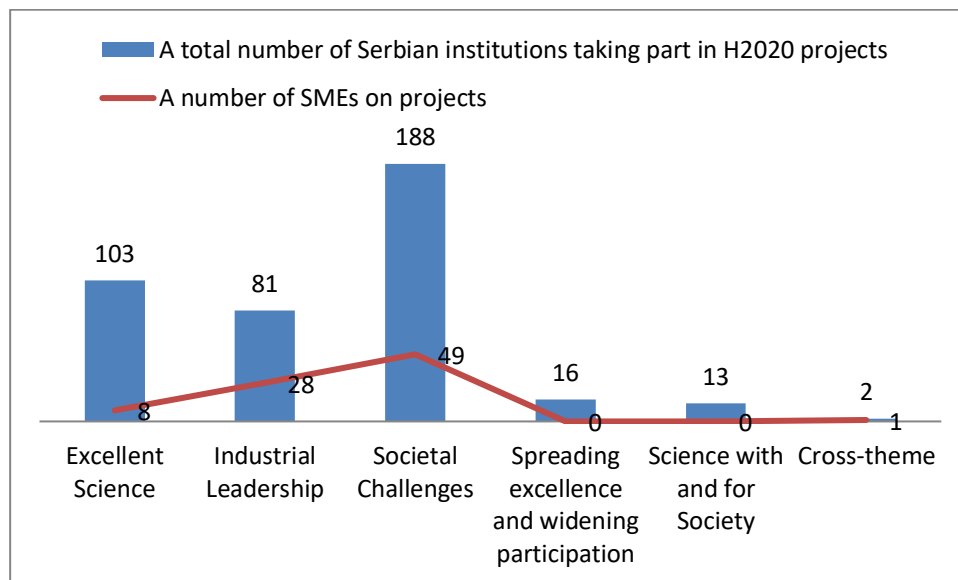
Republic of Serbia' strategic and legislative framework in the area of science, research and innovation is in line with the EU *Acquis Communautaire*. The fact was officially confirmed by the EU on 13 December, 2016 when the Negotiating Chapter 25 (Science and Research) was opened during an intergovernmental conference in Brussels and then temporarily closed. Thus, the Negotiating Chapter 25 became the first chapter the Republic of Serbia successfully closed in negotiations with the EU. The Republic of Serbia shares values, guidelines and priorities of the European Union, is taking part in the EU's framework programs and contributing to the EU's goals stipulated by the agreement on the functioning of the EU in this area. The Strategy on Scientific and Technological Development of the Republic of Serbia for 2016-2020, "Research for Innovation", represents a national roadmap for integration with the European Research Area, given that it accepts and sets measures for meeting the priorities and goals defined by the roadmap of the European Research Area. The Strategy on Scientific and Technological Development of the Republic of Serbia for the upcoming period is being prepared at the moment and it will include the relevant priorities of the 4S.

International cooperation is being conducted successfully – mostly through bilateral cooperation programs, cooperation within the region/macro region and EU programs. The fact that a foreigner was a co-author in 47.7% of the total number of papers published by the Serbian researchers in 2018 (SCImago base) testifies to a significant scope of international cooperation. Bilateral scientific research cooperation is successfully being conducted with a host of countries: France, Germany, Italy, Portugal, Slovenia, Croatia, Austria, Hungary, Slovakia, Belarus, Montenegro, and China outside of the European continent. Cooperation with Spain and Greece is being renewed, and is being established with India and Japan. Regarding the macro region, the Republic of Serbia is extremely active in the implementation of the EU Strategy for the Danube Region where it coordinates the priority area 7 (the Knowledge Society) and together with other countries of the Danube region is developing cooperation programs at multilateral level. Participation in EU programs in which it realizes an integrated approach to a resolution of huge social challenges is crucial for the Republic of Serbia. A host of prospects within Horizon 2020 and other programs are open to it as part of the European Research Area. Also, the EU Pre-accession IPA fund are available to Serbia through which capacities of the scientific research community and the innovation ecosystem are being raised to a higher level.

An agreement signed in 2014 by the Government of Serbia and the European Union enabled participation of the Republic of Serbia in the Horizon 2020 program. According to the data from January 2020, 446 institutions from the Republic of Serbia are taking part in the program as part of 311 projects approved for financing, and the number of private sector participation is 149. EUR 102.6 million was approved to Serbian institutions to implement the projects. Out of the total amount of resources, private sector disbursed 31.1%.. A majority of projects are in the area of Food, where success of our institutions is above 20%, followed by Energy, Information Technologies, etc. When it comes to pillars of financing, a majority of projects were financed within the pillar *Societal*

Challenges, then *Excellent Science* and *Industrial Leadership*. The participation of small and mid-sized companies is to a greater extent concentrated in thematic pillars *Societal Challenges* and *Industrial Leadership* (Chart 4).

Chart 8. Number of institutions that took part in Horizon 2020 by institution type

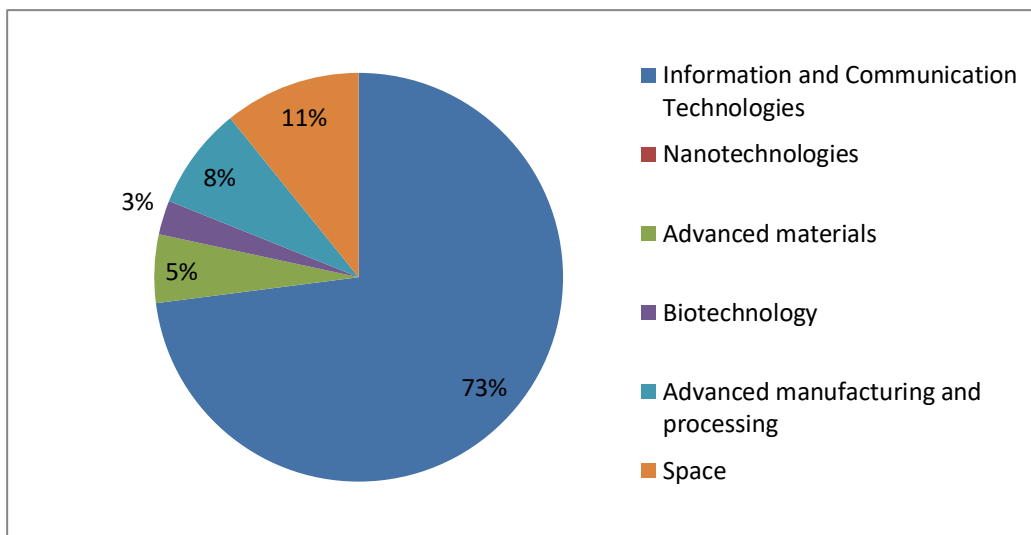


Source: Ministry of Education, Science and Technological Development

The Republic of Serbia received two grants from the most prestigious part of the Horizon 2020 Program, the European Research Council (ERC) intended for extraordinary research ideas/projects which move boundaries of science in given areas. In addition to this, as part of the H2020 *Teaming* Call to institutions in Serbia, the *Biosense* Institute has received the largest grant so far which will go to a Serbian institution for the implementation of the Antares project that stipulates the construction of an Excellence center in the area of implementation of information technologies in agriculture and environmental protection.

As part of thematic pillar *Industrial Leadership* and the priority area that aims to finance projects in the area of crucial developmental and industrial technologies, “Leadership in enabling and industrial technologies (LEIT)”, Serbia has 48 participations in 28 projects. The most dominant participation is in the area of information and communications technologies (Chart 5).

Chart 9. Participation of partners from Serbia by sectors in the priority area: “Leadership in enabling and industrial technologies (LEIT)”



Source: Ministry of Education, Science and Technological Development

Our institutions demonstrate a high level of activity in EUREKA and COST programs. In 2012, the Republic of Serbia became a full member of EUREKA⁵⁶ program in line with the Memorandum of Understanding on the EUREKA Secretariat and Members of EUREKA (“*Memorandum of Understanding on the EUREKA Secretariat between Members of EUREKA*”). Way of participation is precisely defined by an Act on financing projects within EUREKA program that was adopted in May 2009. Based on public calls for the financing of Eureka projects, 85 projects with participation of institutions from Serbia have been supported so far, and a total budget from public and private sector for the implementation of all project activities of all Serbian organizations on these projects from 2002 to date amounts to EUR 21.989 million.

The Republic of Serbia, as part of the former SFRY, was one of the founders of the COST Program in 1971. After COST was restructured, Serbia joined the newly-founded COST⁵⁷ Association in March 2014 and became a full member of the new structure of the Program. Participation of researchers from Serbia has been on the rise in recent years. Currently, institutions from Serbia are taking part in 291 COST actions, which is 89% of all active actions. The fact that the financing of our researchers in this program in 2018 exceeded one million EUR (1.041 million EUR) and that the funding of COST from the budget has been increased from 2.8% in 2017 to 3.6% in 2018, is particularly encouraging.

In 2012, the Republic of Serbia signed the Agreement with the European Center for Nuclear Research (CERN) and became an associate member state, and in March 2019 it became the 23rd state with the status of full member of CERN. At the moment, around 30 Serbian researches are taking part in the implementation of five scientific-research projects in CERN (ATLAS, SMS, N61/Shine, ISOLDE, GRID). Our scientists contributed some 700 publications based on results of

⁵⁶ **EUREKA** is European-orientated research and development network whose aims are: an increased productivity and competitiveness of the European industry and economy in the world market, cooperation between industries, small and mid-sized companies, innovation micro-organizations, institutes and universities within and outside national borders, development of market-oriented European technologies, services and products. Forty countries and the European Commission are taking part in the international Eureka initiative with whom implementers from Serbia can make up a consortium.

⁵⁷ **COST** (*European Cooperation in the field of Scientific and Technical Research*) is an intergovernmental framework for coordination of European cooperation of scientific and technical research, that are funded nationally, and with participation of at least seven institutions from Member States. **COST** was established in 1971 (SFRY was one of the founding members).

researches in CERN, which were published in journals from the SCI list. Except for the participation of researchers, the full membership status also facilitates the participation of Serbian industry in certain construction, supply and other projects. In addition to all this, in October 2019, the Republic of Serbia signed the roadmap for cooperation with the Joint Institute for Nuclear Research (JINR), an international scientific institution in Dubna, the Russian Federation.

Cooperation between the Republic of Serbia and the Joint Research Center (JRC) of the European Commission is unfolding intensively at several levels and it has been widened in a part of drafting a Smart Specialization Strategy (S3), data exchange, use of infrastructure and data base, support in accession to the EU etc. In November 2015, Serbia joined the Smart Specialization Strategy Platform, as the first non EU-member state.

The Republic of Serbia is making significant investments in scientific-research infrastructure, which is an important element and integral part of the European Research Area and Innovation Union. Serbia is also active in the European Strategic Forum for Research Infrastructure (ESFRI) and in four consortiums of the European Research Infrastructure Consortium (ERIC): CERIC (Central European Research Infrastructure Consortium) ERIC, DARIAH (Digital Research Infrastructure for the Arts and Humanities) ERIC, ESS (European Social Survey) ERIC and CESSDA (Consortium of European Social Science Data Archives) ERIC. By participation in Consortiums of European Research Infrastructure, Serbia facilitates mobility of its researchers, exchange, and access to large research infrastructure which it does not possess. Large investments in infrastructure which facilitate support to scientific researches, transfer of knowledge and technologies and development of innovations are underway. Approximately 34 million EUR are earmarked from the Budget of the Republic of Serbia for the period 2018-2021 for the construction of two scientific research parks (Novi Sad, Nis and Cacak), 10 million EUR for two universities, 14 million EUR for the construction of the *Biosens* institute and 5 million EUR for the construction of Verrocchio Center at the Institute of Physics in Belgrade. In order to achieve greater effect of infrastructural support, the Ministry of Education, Science and Technological Development, based on recommendations from the European Commission, adopted the first Research Infrastructure Roadmap in December 2018.

Open science includes activities and services aimed at facilitating wider accessibility and transparency of data gathered and results published. The above said particularly pertains to all researches financed from public budgets. Basic principles of Open Science are defined in the European Commission's documents (*Commission Recommendation (EU) 2018/790 of 25 April 2018 on access to and preservation of scientific information (No. 32018H0790), 2018*) and all researches financed by the European Commission are obliged to respect and apply these principles. With a view to implementing the said positive changes to the European scientific community, the Platform for Open Science was adopted in Serbia in July 2018. The Platform is intended for all participants of scientific research activities and pertains to results of research projects and programs financed fully or partially from the Budget of the Republic of Serbia. The Platform implies the implementation of four goals: 1) open access to scientific literature, 2) availability of data gathered in scientific researches, 3) transparency of scientific communication and methodology and 4) development of digital infrastructure.

The situation in the business sector

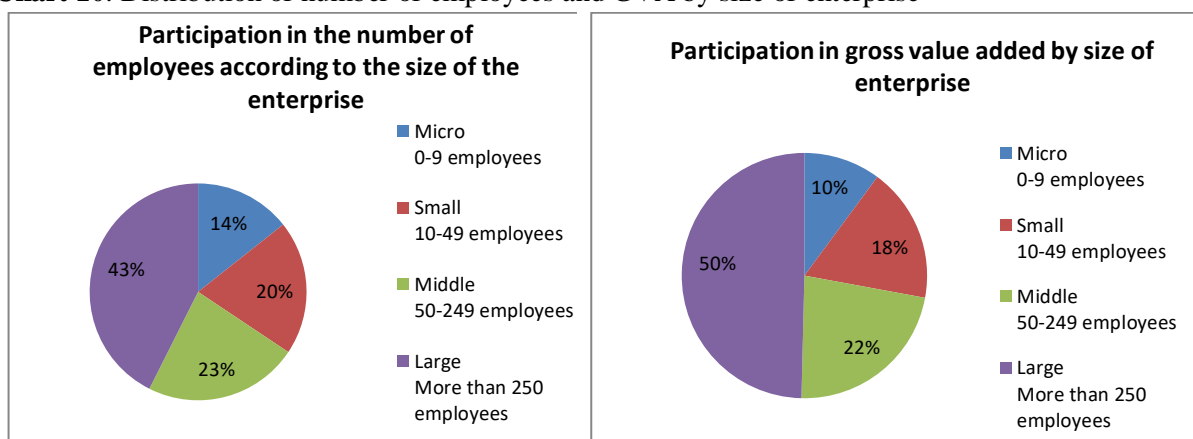
Main characteristics of the business sector in the Republic of Serbia

Looking at the macroeconomic indicators in recent years, the Republic of Serbia has been recording economic growth, low and stable inflation, fiscal surpluses, declining public debt, and a recovery in the labor market. The unemployment and inactivity rates are relatively high compared to the European Union average, however, with a significant downward trend in recent years. The unemployment rate in 2018 was 12.7%, continuing the declining trend of unemployment that started in 2013 (in 2012, the unemployment rate was 23.9%). The inactivity rate, although extremely high, has also declined compared to 2013 and stood at 45.5% in 2018. Average net earnings are relatively low in international comparisons. According to June 2019, average net earnings were EUR 460. The highest average net earnings were recorded in the financial and insurance sectors (EUR 830) and in the information and communication sector (EUR 820).⁵⁸

In the period from 2014 to 2018, the total gross value added in the Republic of Serbia increased by 38.66%, however regional differences in the degree of economic development are very pronounced. Belgrade Region is the most important economic and scientific research center of the Republic of Serbia. Vojvodina is the second region in terms of economic development, while the regions of Western Serbia and Šumadija, as well as Southern and Eastern Serbia, lag significantly behind the leading regions with markedly higher unemployment rates. There is a big difference between the north and south of the country and in terms of the total contribution to gross value added. Enterprises in the territory of Serbia-North achieved 78.7%, and enterprises in the territory of Serbia-South 21.3% of the total gross value added.

The structure of the economy is dominated by micro-enterprises, which account for over 86% of the total number of enterprises. On the other hand, the largest number of employees works in large enterprises (43%) and the largest share of gross value added is achieved in large enterprises (49.6%), (Chart 6). By sector of activity, the largest share in GVA was recorded by manufacturing enterprises (31.3%), wholesale and retail trade and repair of motor vehicles (18.1%), transport and storage (9.0%) and Information and communications (8.7%), while the highest real growth of gross value added in the last year was recorded in the construction sector (16.8%) and in the information and communication sector (8.2%) (SORS, 2019).

Chart 10. Distribution of number of employees and GVA by size of enterprise



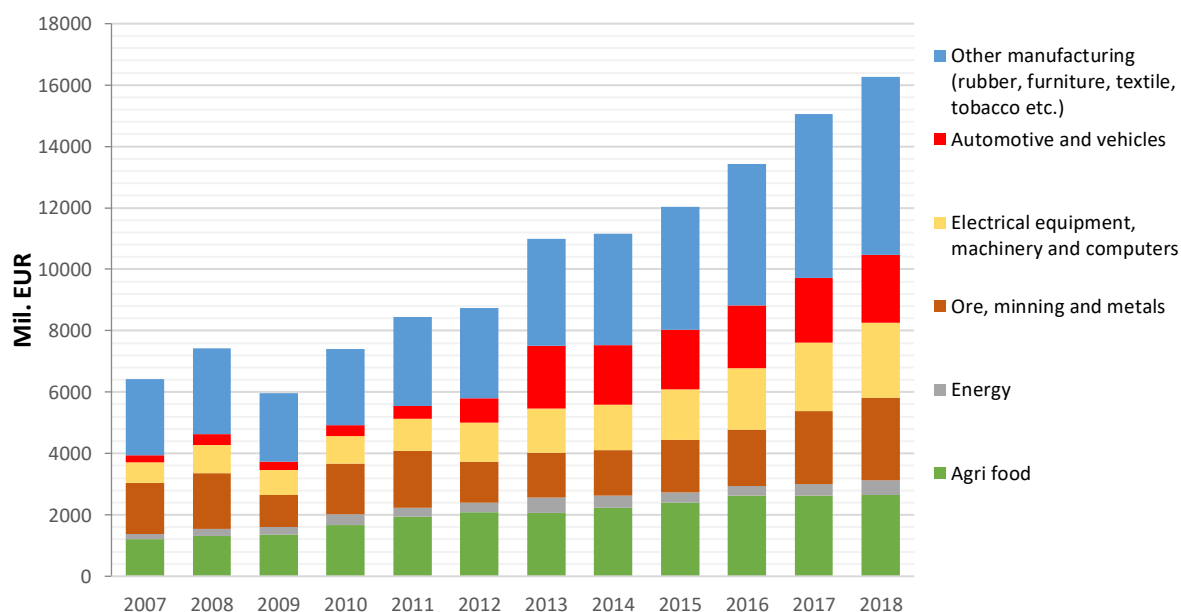
⁵⁸ SORS: Labor Force Survey

Source: SORS

After the global economic crisis of 2008, the structure of the economy has changed significantly - from the pre-crisis model based on imports, final consumption and expansion of services (financial services, real estate, trade) to the post-crisis model based on investments in manufacturing and export growth. Export growth, which increased by 46% between 2013 and 2017, was driven primarily by growth in exports of services, manufacturing and agriculture.

In manufacturing, significant growth in exports has been recorded since 2013 in the automotive industry (motor vehicles and trailers) as well as the mechanical and electrical industries (machinery and electrical equipment). Also, not intensive but rather stable growth is achieved in the food industry (Chart 7). Over 53% of exports is realized with European Union countries. The most important foreign trade partners when it comes to exports are: Germany, Italy, Bosnia and Herzegovina, Romania and the Russian Federation.

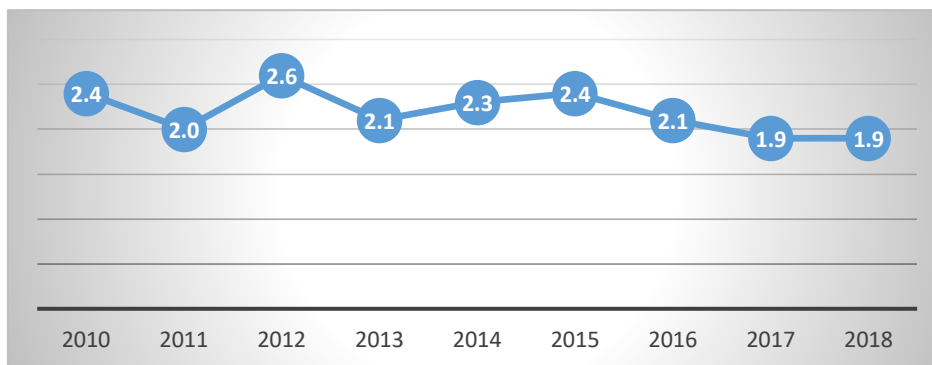
Chart 11. Export structure in manufacturing activities



Source: Data processed by the author based on the SORS data

Despite the improved technological structure of industrial production and exports, low-tech products continue to prevail. Total exports of high-tech products compared to total exports in 2018 amounted to 1.9% (Chart 8). According to this indicator, Serbia significantly lags behind the EU average (17.9%) as well as the EU member states in the region: Hungary (15.6%), Croatia (8.1%), Romania (8.4%), Bulgaria (5.9%) and Slovenia (5.8%) (*Eurostat Database*).

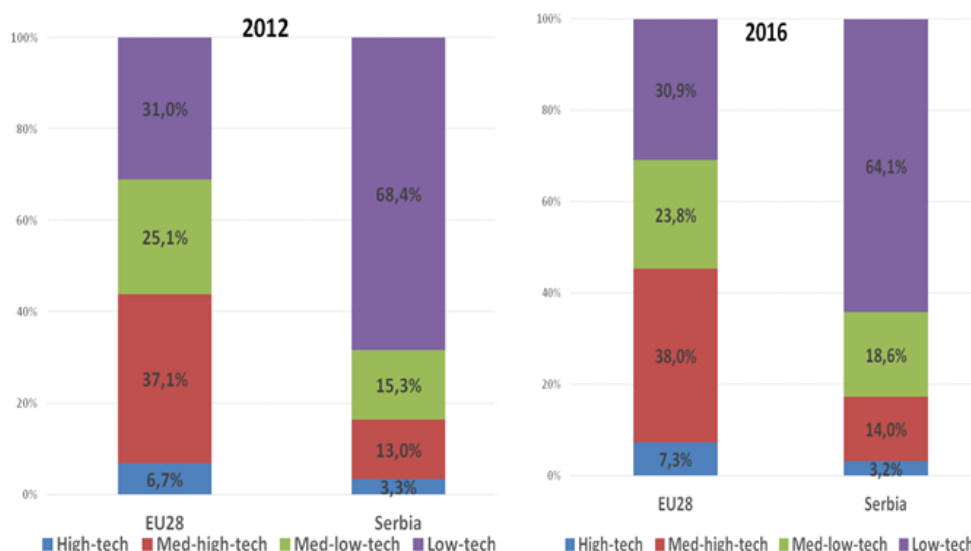
Chart 12. Share of exports of high-tech products in relation to total exports of the Republic of Serbia (%)



Source: Eurostat Database

In recent years, Serbia has recorded an increase in total value added in the manufacturing sector and is today the most industrialized country in the Western Balkans, with production contributing almost 20 percent to GDP, comparable to levels in some of the new EU member states. After more than two decades of continuous de-industrialization, the trend of re-industrialization in Serbia should help its faster economic recovery. However, production growth is recorded in low-tech industries, indicating a limited technological level of the Serbian economy. Looking at the structure of total value added by technology level, the structure has improved slightly over the period 2012-16, but is still very unfavorable compared to the EU. In 2016, as much as 64 percent of value added in Serbia was in the low-tech sectors (twice as high as in the EU28), while only 3.2 percent was in the high-tech sectors (Chart 9).

Chart 13. Republic of Serbia: Total value added in the manufacturing sector by technology levels, 2012 and 2016

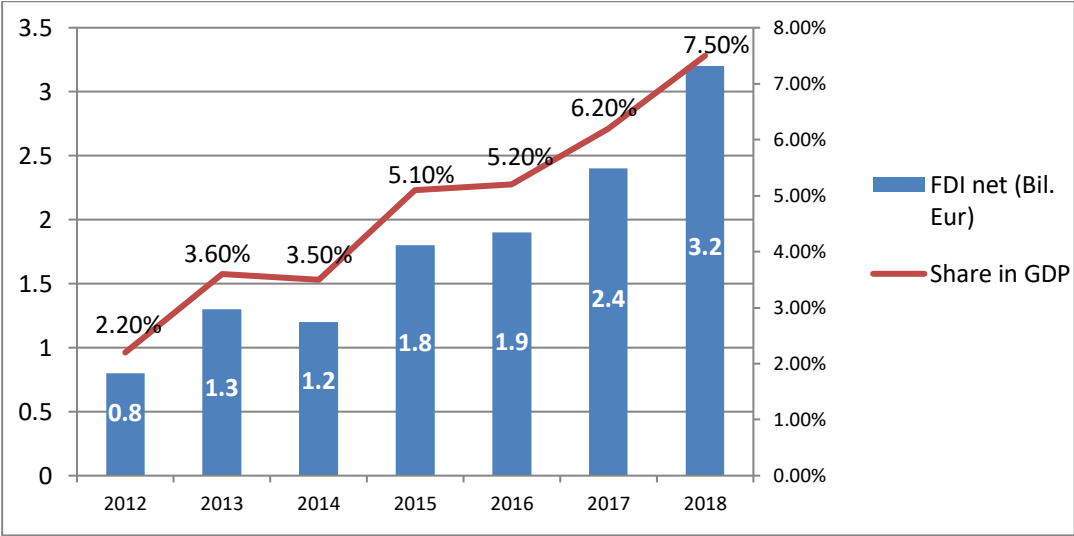


Source: Uvalic M., Cerović B. & Atanasijević J. (2018). The Serbian Economy Ten Years After the Global Economic Crisis, Economic Annals/EACES Workshop in memory of Professor Božidar Cerović, Faculty of Economics, University of Belgrade

Foreign direct investments (FDI) play a significant role in changing the structure of the economy, the growth of industrial production and exports, especially in the post-crisis period. Serbia is ranked number one in the *Greenfield FDI Performance Index* for 2019, which analyzes the inflow of greenfield investment relative to the size of the economy. In 2018, the FDI net inflow was € 3.2 billion, making it one of the best in the year (Chart 10). Within the manufacturing industry, the largest inflows

of FDI are recorded in the metal, automotive and food industries. This has resulted in strong employment, manufacturing and export growth in the manufacturing industry.

Chart 14. Foreign direct investment in Serbia



Source: NBS

The structure of production of the Republic of Serbia provides significant opportunities for further diversification and sophistication as a result of the diversity of production. This is largely a result of foreign direct investment, which influences the alignment of Serbian production with the needs of advanced European economies and thus increases the index of opportunity for the Serbian economy. Machines, machine components and appliances, electrical equipment and metals are the most promising product categories for industrial sophistication in Serbia today.⁵⁹ By analyzing the products for which Serbia has the highest exports, it can be concluded that the exports of products from Serbia are well distributed, filling both the peripheral and central nodes on the map. The most complex products include: vehicles, machinery and chemicals. Peripheral products are predominantly primary and resource based commodities such as refined oil, leather, fruits and vegetables (Figure 2).

⁵⁹ OECD (2019). Unleashing the Transformation Potential for Growth in the Western Balkans, OECD Publishing, Paris

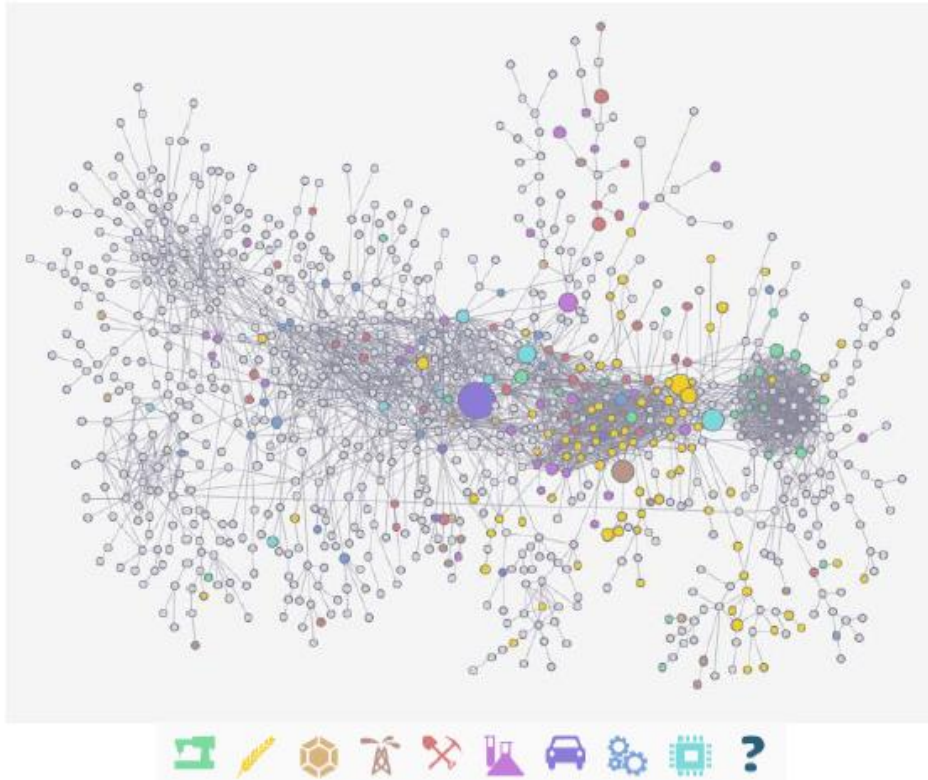


Figure 10. Mapping of Products Exported by Serbia (*The Product Space of Serbia 2016*)

Source: OECD (2019). *Unleashing the Transformation Potential for Growth in the Western Balkans*, OECD Publishing, Paris

*Note: The nodes in the figure represent the products. The size of the nodes is determined by the value of exports. Products are grouped by color as follows: textiles and furniture (green); vegetables and food (yellow); stone and glass (orange); minerals (brown); metals (red); chemicals and plastics (purple); transport vehicles (blue); machines (turquoise blue); electronics; and other.

Serbia has relatively low productivity compared to the EU average. The overall productivity of companies in Serbia is growing by 1.1% per year, however, to increase GDP growth by 1 percentage point, the current productivity growth should be doubled (Chart 11). High-growth companies (companies that have achieved a minimum turnover growth of 20% in the last 3 years) have created 61% of new jobs, but they account for only 5% of the total number of companies in Serbia. Serbia is well below most European Union countries by number of high-growth companies. New private sector companies are a major source of growth and job creation in the Republic of Serbia.⁶⁰

Chart 15. Productivity to GDP ratio per capita

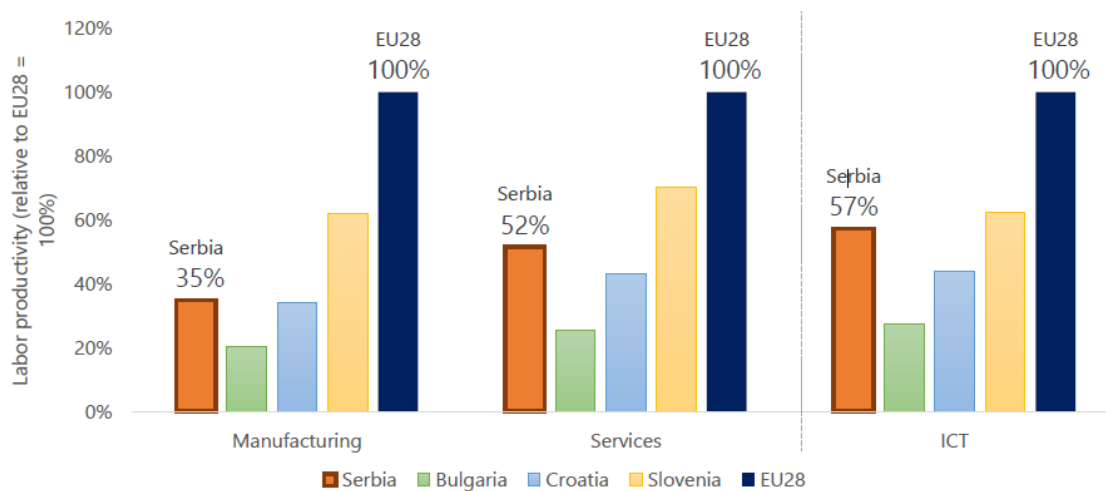
⁶⁰ World Bank (2019). *New growth agenda, Country economic memorandum for Serbia*, forthcoming



Source: World Bank (2019). New growth agenda, Country economic memorandum for Serbia, forthcoming

Productivity in the manufacturing sector of Serbia is three times lower than the EU average, indicating that Serbia currently needs three times as much workforce to produce the same product as the an EU company (Chart 12).

Chart 16. Productivity compared to the EU average (EU28=100)



Source: World Bank (2019). New growth agenda, Country economic memorandum for Serbia, forthcoming

Business competitiveness and business environment: the Republic of Serbia in international comparisons

Since 2014, Serbia has significantly improved its business environment and thus has progressed on the Doing Business list⁶¹. From a distant 93rd place, it reached its best result of 43rd place in 2018. The following year saw a small decline by 5 places, only to advance by 4 places in the latest report (*Doing Business Report 2020*) and rank 44th in the world (Table 5). According to the indicators in the 10 areas that determine the overall assessment of business conditions, the Republic of Serbia is best ranked in the areas of Obtaining Construction Permit (9th place), Trading across border (23rd place) and Minority Shareholder Protection (37th place).

According to the Global Economic Competitiveness Index (World Economic Forum)⁶², the Republic of Serbia is the leading country in the Western Balkans, but significantly lags behind the EU member states in the region (Table 5). In 2019, the Republic of Serbia, compared to 141 countries, ranks 72nd (7 places lower than last year). By analyzing the individual components of the Global Competitiveness Index, Serbia is best rated in the areas of Infrastructure, Business Dynamics, Labor Market, Skills and Innovation.

In the field of Innovation, the Republic of Serbia has made some progress over the last 5 years, however, it still lags significantly behind the European average and the individual countries of the Western Balkans (Table 5). According to the Global Innovation Index⁶³, in 2019, the Republic of Serbia ranks 57th on the list of 126 countries.

Compared to the Western Balkan countries and most other countries in the region, Serbia has the best connection between improving health and education outcomes, productivity and economic growth (Table 5). Serbia ranked 27th out of 157 countries according to the Human Capital Index⁶⁴ 2018.

⁶¹ The Doing Business (DB) rankings developed by the World Bank are based on an assessment of procedures, pricing and time required to execute them, pertaining to private sector operations. The DB methodology monitors local SMEs and measures the ease of doing business by reviewing regulations and putting them into practice. The DB structure consists of the following areas: Establishment of a business entity, Obtaining a building permit, Getting connected to the electricity grid, Registration of assets, Obtaining a loan, Protection of minority shareholders, Payment of taxes, Cross-border trade, Execution of contracts, and Bankruptcy resolution. (<https://www.doingbusiness.org/content/dam/doingBusiness/country/s/serbia/SRB.pdf>)

The Global Competitiveness Index (GCI) is a composite index developed by the World Economic Forum and is one of the most important indicators for measuring the performance and competitiveness of countries. According to this index, the competitiveness of a national economy is assessed against the situation in the following 12 pillars: Institutions, Infrastructure, ICT Adoption, Macroeconomic Stability, Healthcare, Skills, Commodity Market, Labor Market, Financial System, Market Size, Business Dynamics and Innovation. (http://www3.weforum.org/docs/WEF_TheGlobalCompetitivenessReport2019.pdf)

⁶³ The Global Innovation Index was developed by the World Intellectual Property Organization, Cornell University and INSEAD in 2007. The Global Innovation Index measures the competitiveness of countries in 7 key areas: Institutions, Human capital, Infrastructure, Market sophistication, Business sophistication, Technological development and innovation and Creative industry. (https://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2019.pdf)

⁶⁴ The Human Capital Index is developed by the World Bank, and it measures which countries are best at mobilizing the economic and professional potential of their citizens, i.e. how much capital each state loses due to existing education and health gaps. It consists of five indicators: Proportion of children surviving five years of age, expected years of schooling by age 18, consistent test scores as a measure of learning quality, proportion of fifteen-year-olds who will survive to age 60, and healthy growth among children (lag rates for children under 5). (<https://openknowledge.worldbank.org/bitstream/handle/10986/30498/33252.pdf?sequence=5&isAllowed=y>)

The Republic of Serbia is a moderate innovator according to the European Innovation Scoreboard 2019⁶⁵ with a score of 58.5 (Table 5). The best results are achieved in the areas of *Innovators* (sub-indicators: internal innovation and product and/or manufacturing process innovations) and *Company investments* (sub-indicators: number of companies providing ICT training and investing in non-R&D innovation). On the other hand, the Republic of Serbia achieves below-average results in the sub-indicators: the number of applications for design protection, the total expenditure on venture capital and the cost of R&D in the business sector.

Table 15. Overview of Serbia's position in relation to countries in the region according to global indices

	Global Innovation Index 2019	Global Competitiveness Index 2019	Doing Business Report 2020	Human Capital Index 2018	European Innovation Scoreboard 2019
	Ranked out of 141 countries	Ranked out of 129 countries	Ranked out of 190 countries	Ranked out 157 countries	Total score
Albania	83	81	82	56	-
Bosnia and Herzegovina	76	92	90	58	-
Montenegro	45	73	50	59	-
North Macedonia	59	82	17	88	39,9 (Modest)
Republic of Serbia	57	72	44	27	58,5 (Moderate)
Bulgaria	40	49	61	44	44,8 (Modest)
Croatia	44	63	51	36	54,8 (Moderate)
Hungary	33	47	52	38	63,4 (Moderate)
Romania	50	51	55	67	31,4 (Modest)
Slovenia	31	35	37	13	80,5 (Moderate)

Source: data processed by the author based on: WEF - The Global Competitiveness Report 2019; European Innovation Scoreboard 2019; Human Capital Index 2018; Global Innovation Index 2019; Doing Business 2020.

Innovation of business entities in the Republic of Serbia

More than half of business entities in Serbia have been characterized as innovative with a significant upward trend in innovative enterprises in the last 7 years (according to the European Community Innovation Survey 2016-2018 conducted by the Statistical Office of the Republic of Serbia). Enterprises, on the other hand, invest very little in R&D, while innovations are generally

⁶⁵ The Innovation Summary Index was developed by the European Commission in 2001. Innovation Index values are published in the European Innovation Scoreboard (EIS), with all countries falling into four categories: Innovation Leader, Strong Innovator, Moderate Innovator, and Modest Innovator. This index encompasses three main types of indicators: enablers, firm activities and outputs that have a total of 8 innovation dimensions that together make up 25 indicators. The drivers of innovation include three innovation dimensions: human resources; openness and excellence of research systems; financing and support. The company activities contain three innovation dimensions: company investment; networking and entrepreneurship; intellectual property. Outputs include two innovation dimensions: innovators and economic effects. Serbia has the weakest score in terms of openness and excellence in research systems and funding and support. (<https://ec.europa.eu/docsroom/documents/36281>)

incremental in nature, i.e. there are very few businesses that have made radical innovations and developed a worldwide product through investing in R&D. This situation in the business sector is also reflected in the relatively low number of patents compared to other countries. A percentage of 50.2% of innovative firms (Table 6) should be viewed with caution, taking into account the research methodology and subjective character that is characteristic of the questionnaires. The study also confirmed earlier conclusions about the size of the business entity as an important factor for innovation. Specifically, more than 69% of large businesses are innovative, 62% are medium-sized, while just over 47% of small businesses are innovative. Manufacturing businesses are more innovative than service businesses. The most significant barriers to innovation in non-innovative businesses are the high cost or lack of their own financial resources for innovation.

In the three observed periods covering the last 6 years (Table 6), there is a growing trend in the number of innovators among business entities; the share of innovators in this period has increased by 10%. The largest share of innovators' businesses is in the Information and Communication sector (over 60%) and in the Manufacturing industry (over 58%).

Table 16. Share of innovative business entities by sectors of activity in the period 2012-2018. (%)

	2012-2014	2014-2016	2016-2018
Total	40.5	41.2	50.2
Agriculture, forestry and fishing	22.9	41.9	49.3
Mining	19.3	27.1	41.9
Manufacturing	42.7	47.9	58.2
Electricity, gas, steam and air conditioning supply	53.2	53.7	21.3
Water supply, sewerage, waste management and remediation activities	35.1	31.1	45.0
Construction	36.2	36.7	42.6
Wholesale and retail trade and repair of motor vehicles and motorcycles	40.7	31.0	42.8
Transportation and storage	31.7	37.3	42.0
Accommodation and food service activities	46.2	30.8	44.8
Information and communication	47.6	40.2	61.3
Financial and insurance activities	36.3	38.1	32.8
Real estate activities	26.9	8.5	41.6
Professional, scientific and technical activities	37.5	47.3	48.7
Administrative and support service activities	43.4	53.1	40.7

Source: Statistical Office of the Republic of Serbia, Indicators of innovative activities in the Republic of Serbia, author's work

Businesses in Serbia have low investment in external R&D, indicating that there is room for improved cooperation between the business and scientific and research sectors. According to the total expenditure structure for innovation activities, 24.1% of innovation expenditure relates to internal R&D activities. Compared to previous periods, there was a significant increase in internal research. Total external R&D expenditures have also increased from 1.8 to 3.6% over the previous period, however they are still relatively low. The largest percentage of expenditures falls under other innovative activities that are mostly related to the procurement of machinery, equipment, software and facilities (Table 7). The revenue structure of the innovators is dominated by the share of revenue from the sale of unchanged or slightly changed products and amounts to over 86% in the period 2016-2018. Since 2012, there has been a noticeable increase in the share of sales of products/services that are new to the business entity, which has reached a share of 10% in the last two years (Table 7).

Table 17. Structure of expenditure for innovation activities and revenue structure of innovators

Structure of expenditure of innovative activities (%)			
	2012-2014	2014-2016	2016-2018
Internal R&D activities	12.3	18.9	24.1
External R&D	2.6	1.8	3.6
Other innovative activities	85.1	79.4	72.4
Revenue structure of innovators (%)			
	2012-2014	2014-2016	2016-2018
Product/service new to the market	3.0	5.8	3.6
Product/service new to the enterprise	5.0	9.3	10.1
Unchanged/negligible changed product/service	92.0	84.9	86.3

Source: Statistical Office of the Republic of Serbia, Indicators of innovative activities in the Republic of Serbia, author's work

Generally speaking, the business sector has a relatively low level of employees with a university degree, indicating that the domestic economy is unprepared for the transition to a knowledge-based economy. Almost 15% of companies have no employees with higher education, however they are mostly small businesses. The largest number of medium-sized business entities employ from 1% to 4% of highly educated persons, while almost one third of large business entities employ from 10% to 24% of highly educated employees (Table 8).

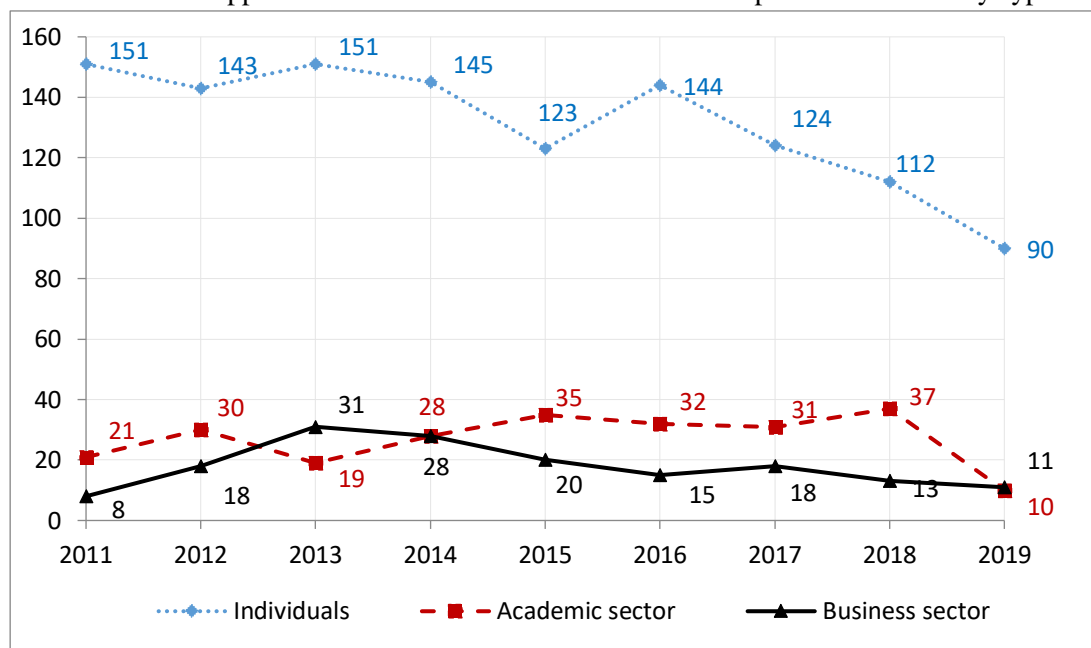
Table 1. Higher education or post-college education employees (%)

	0%	1–4%	5–9%	10–24%	25–49%	50–74%	75–100%
Total	15.10	21.16	12.05	16.14	10.40	8.00	17.15
Small	17.74	20.40	10.16	14.04	10.41	7.76	19.49
Medium	2.04	26.49	21.11	25.67	9.24	9.43	6.01
Large	0.34	18.85	23.60	31.58	15.11	8.15	2.38

Source: SORS (2019), Indicators of Innovative Activities in the Republic of Serbia, 2016–2018, Report No. 172

The number of patent applications of domestic inventors in the Republic of Serbia is at a relatively low level. In the last 8 years, the number of patent applications has ranged from 200 to 160 and has been steadily declining. According to this indicator, Serbia significantly lags behind the developed countries of Western Europe and some countries in the region. Over 70% of patent applications are filed by individuals, the academic and business sectors have a very low number of patent applications, but in the last 5 years, the academic sector has a negligibly higher number of applications compared to the business sector. (Chart 13).

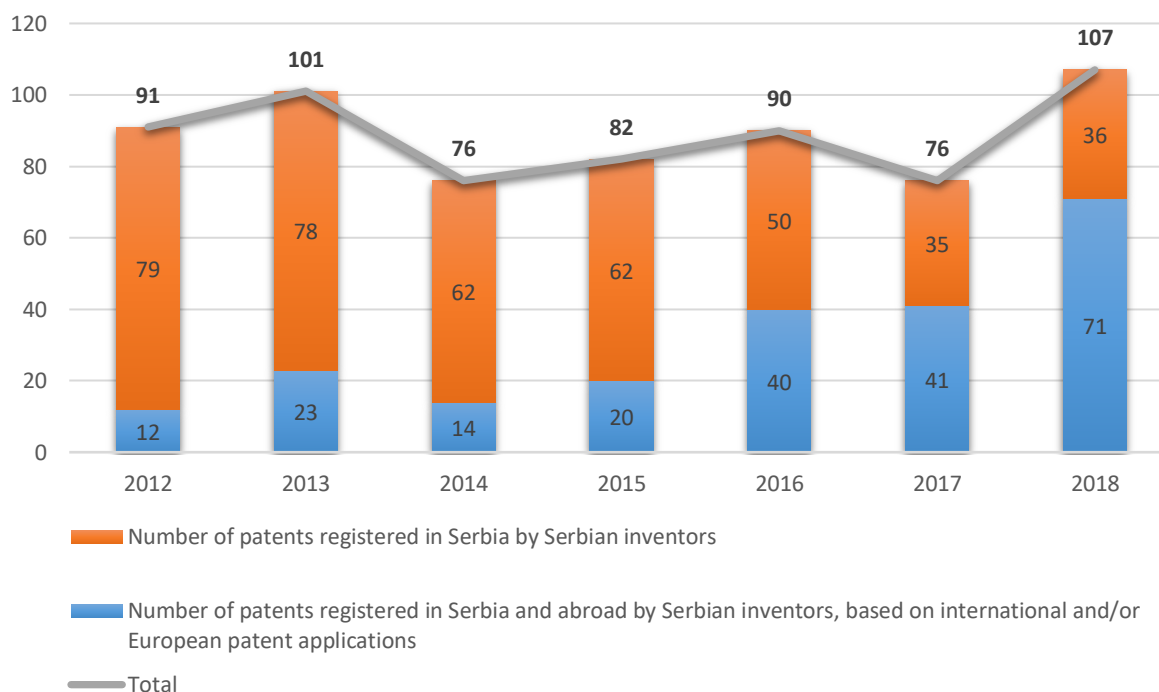
Chart 2. Patent applications of domestic inventors in the Republic of Serbia by type of applicants



Source: Database of the RS Intellectual Property Office

The number of patents registered is also low, with the number of patents granted for inventions by domestic inventors abroad, based on the international and/or European patent application, growing in the last 7 years (Chart 14).

Chart 3. Registered patents of domestic inventors



Source: Database of the RS Intellectual Property Office

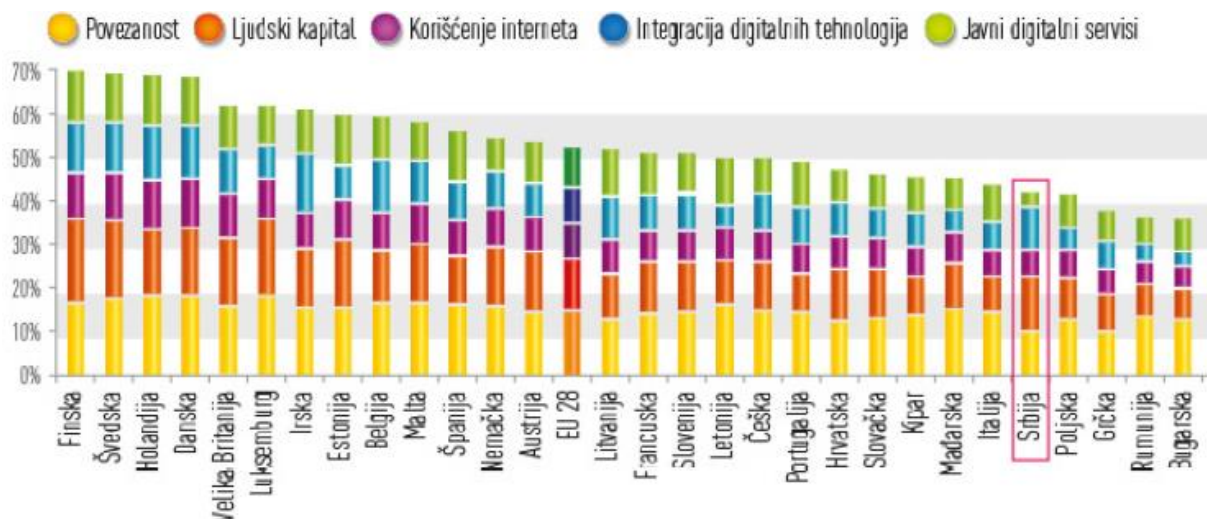
Due to the low patent activity in the Republic of Serbia and due to the mentioned shortcomings of patents as an innovation indicator, patents represent only indirect indicator of innovative activities and do not provide a clear picture of the innovation potential of the economy.

Use of information and communication technologies

In Serbia, at the end of 2018, the number of fixed broadband users per 100 inhabitants was 22.0, well below the EU average of 34.7 users per 100 inhabitants. On the other hand, the number of broadband internet users is increasing and there is a trend of increasing internet speed. Mobile phones are the most commonly used internet access, resulting in a 10.7% increase in mobile Internet users compared to 2017. The increase in the number of users also led to an increase in the volume of Internet traffic, which doubled compared to 2017. Looking at the internet speed, at EU level, 27% of users used Internet packages with speeds from 30 Mbps to 100 Mbps, while 26% of users had access to speeds of 100 Mbps and above. In Serbia, 42% of users accessed the Internet at speeds of 30 Mbps to 100 Mbps, while only 1.5% of users had access to speeds of 100 Mbps.⁶⁶ (RATEL, 2019).

According to the Digital Economy and Society Index (DESI)⁶⁷, Serbia ranks 25th in the list of European countries. This result places Serbia in a cluster of relatively low performing countries (Chart 15). The main reason for this position of Serbia is the low percentage of fixed broadband access, the low level of online transactions, which mostly relate to ordering products via the Internet, which speaks in favor of distrust in online payment security in Serbia. On the other hand, Serbia is above the European average in human capital related to digital skills needed for active participation in the digital society as well as for the use of digital products and services.

Chart 17. DESI for EU and Serbia for 2018 *



Source: RATEL

⁶⁶ RATEL (2019). Overview of the Telecommunications and Postal Services Market in the Republic of Serbia in 2018, Regulatory Agency for Electronic Communications and Postal Services - RATEL, Belgrade, 2019

⁶⁷ The Digital Economy and Society Index (DESI) is a complex index that summarizes relevant digital performance indicators and tracks the development of EU countries in digital competitiveness. The index provides insight into the country's overall performance and makes it easy to identify areas where performance could improve. The Digital Economy Index comprises five categories: Connectivity, Human Capital, Internet Usage, Integration of Digital Technologies and Digital Public Services.

*Values for Serbia and EU countries are not fully comparable as the review of European countries is in line with the new methodology published in June 2019, which contains a large number of indicators, most of which are added in the categories Internet Usage and Human Capital.

The business sector in Serbia has made significant advances in the use of information technologies in its day-to-day business, which is an important step towards modern business that involves digitalization and growth of internal capacities in the field of application of the latest technologies. Significant progress in the percentage of use of information technologies has been accompanied by an increase in the quality of broadband internet connection, which is still unsatisfactory in rural areas, but with noticeable progress in the last 5 years. According to a survey by the Statistical Office of the Republic of Serbia, the presence of computers and computer networks in Serbian enterprises has reached almost full coverage. During 2018, in the Republic of Serbia, 99.8% of enterprises had internet connection and 98.8% of enterprises had broadband internet connection. The speed of internet connection used by the business sector in everyday business has significantly increased. In 2018, over 82% of businesses had an internet connection of more than 10 Mbit/s, which is a significant increase compared to 2014 when just over 40% of businesses used the stated connection speed (Table 9).

Progress is present in most segments, however e-commerce is still largely underdeveloped, although there has been a slight improvement in this segment of business. (Table 10).

Table 18. Maximum Internet connection speed in enterprises defined by the contract with an ISP

	2014	2015	2016	2017	2018
Under 2 Mbit/s	10.2	3.4	2.1	1.2	0.5
At least 2 but under 10 Mbit/s	48.8	50.5	34.7	22.0	16.7
At least 10 but under 30 Mbit/s	28.5	32.0	42.2	42.4	49.8
At least 30 but under 100 Mbit/s	7.7	9.5	17.1	29.1	25.8
At least 100 Mbit/s	4.8	4.6	4.0	5.3	7.1

Source: SORS, data processed by the author based on the publications: Use of information and communication technologies in the Republic of Serbia (issues: 2014, 2015, 2016, 2017, 2018).

Table 19. Enterprises that responded positively about the use of ICT (%)

	2014	2015	2016	2017	2018
Owning a Website	74.0	75.2	80.8	80.4	82.6
Use of public administration electronic services	92.0	94.5	98.6	-	-
Use of mobile internet connection using portable devices (smartphone, laptop, tablet ...)	-	59.9	69.3	81.9	75.4
Ordering products / services online	40.4	41.7	41.0	41.4	41.9
Receiving orders online	21.2	22.9	23.3	23.8	26.3
Use of some of the social networks for business purposes	27.0	28.6	36.1	39.2	39.7
Use of cloud service	3.8	9.2	9.3	9.3	15.5
The company employs ICT professionals	22.6	22.6	22.4	23.0	20.7
The company provides any kind of training employees to develop ICT skills	18.9	25.5	27.5	30.2	23.3

Source: SORS, data processed by the author based on the following publications: Use of information and communication technologies in the Republic of Serbia (issues: 2014, 2015, 2016, 2017, 2018).

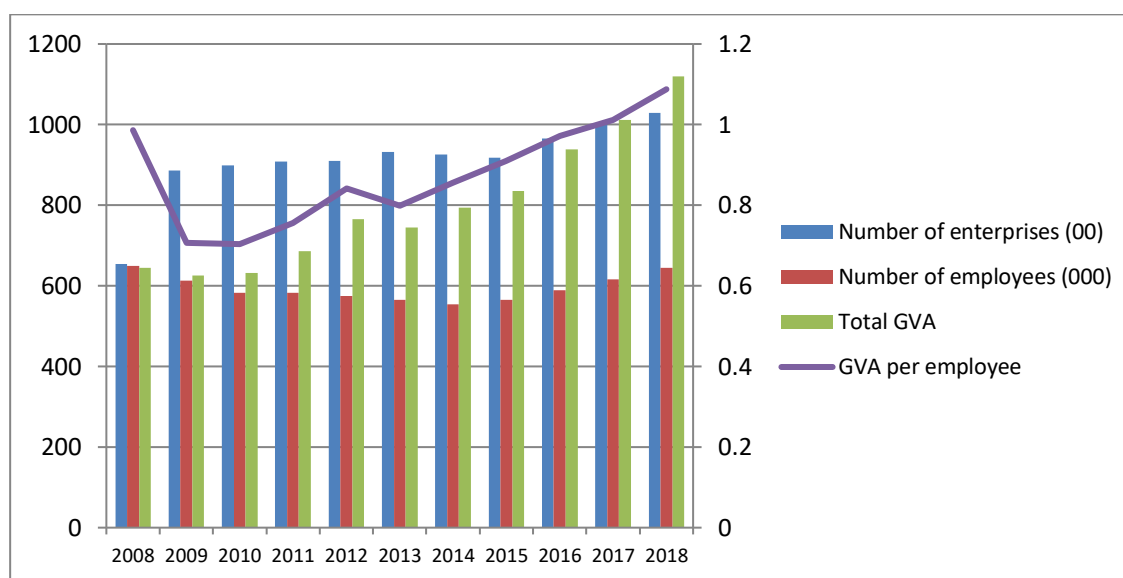
Social networks are increasingly present in the business operations. This is supported by the results of the research showing that in 2018, 39.7% of enterprises used some of the social networks for the needs of their business operations, which represents a significant increase compared to 2014 when this percentage was 27%. Cloud services were used by 15.5% of companies in 2018, which present the significant improvement over 2014 when less than 4% of companies used cloud services.

Less than 23% of enterprises have hired ICT professionals, but there is an increase in the number of companies providing training for employees to develop ICT skills (Table 10).

Sector of micro-small and medium-sized enterprises and entrepreneurs in the Republic of Serbia

The micro, small and medium-sized enterprises (MSMEs) sector is an important segment of the Serbian economy, accounting for 99.5% of the total active enterprises, employing 57% of employees and participating with 50% in the GVA of Serbia. The global economic crisis has affected the MSME sector during the recessionary period after 2008. Positive recovery trends are particularly evident after 2014, when employment is rising and there is a continuous increase in GVA. Despite the pronounced recovery indicators of this sector, the level of GVA per employee in 2008 was reached only in 2017 with an upward trend in 2018 (Chart 16).

Chart 18. MSME Sector – Number of Companies, Employees and GVA 2008-2018



Source: Processing of the author on the basis of SORS: Enterprises in the Republic of Serbia, (2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018)

The largest number of MSMEs is concentrated in three sectors: Trade (32.7%), Manufacturing (16.9%) and Professional, scientific and technical activities (12.6%). Manufacturing and Trade sectors dominate the observed performance of MSMEs: they employ more than 52.7% of employees, generate 49.3% of GVA, account for 85% of exports and 90% of imports (SORS).

In general, MSMEs in the manufacturing industry is characterized by unfavorable technological structure and low competitiveness of domestic industry. The manufacturing industry is dominated by products of low technological complexity that create products of low added value, low differentiation and weak competitive positions in the market. The dominant areas are: food production, apparel production and processing of wood and wood products.

The entrepreneurial sector in the Republic of Serbia is characterized by fragmentation, high frequency of shutting down and establishment of new entrepreneurial initiatives, instability in the basic business and employment activity, etc. In the last 5 years, there has been a significant increase in the number of entrepreneurs and the number of employees in Serbia. In the period from 2014 to 2018, total gross value added per employee increased by 18%. Observed by sectors, the highest

growth in the number of entrepreneurs (164.34%) and the number of employees (190.62%) was recorded in the Information and Communication sector, as well as a significant increase in GVA per employee (16.72%). Other sectors also achieved a significant increase in GVA per employee, ranging from 4% to 24% in the observed period (Table 11).

Table 20. Overview of the entrepreneurial sector in Serbia by activities in 2014 and 2018

	Number of entrepreneurs		Number of employees		GVA (mil. RSD)		GVA per employee (mil. RSD)	
	2014	2018	2014	2018	2014	2018	2014	2018
Total	231.616	272.969	207.748	271.721	236.081	367.317	1,14	1,35
Agriculture, forestry and fishing	2.405	2.805	1.183	1.751	1.693	2.670	1.43	1.52
Mining and quarrying	142	179	180	346	166	332	0.92	0.96
Manufacturing industry	34.536	40.620	49.777	67.699	43.193	67.901	0.87	1.00
Construction	16.429	19.844	9.755	13.576	15.702	24.531	1.61	1.81
Wholesale and retail trade, repair of motor vehicles and motorcycles	64.126	63.969	76.050	87.347	66.022	88.392	0.87	1.01
Transportation and storage	28.199	31.178	5.058	6.569	21.400	30.189	4.23	4.60
Accommodation and food service activities	20.765	23.882	27.120	36.341	21.318	33.317	0.79	0.92
IT and other information services	4.650	12.292	1.300	3.778	4.283	14.492	3.29	3.84
Financial and insurance activities	1.739	1.779	2.229	2.665	1.982	2.748	0.89	1.03
Real estate activities	882	1.072	390	532	547	853	1.40	1.60
Professional, scientific, and technical activities	27.002	35.055	12.041	17.609	28.118	46.993	2.34	2.67
Administrative and support service activities	4.869	7.453	3.266	5.437	4.698	9.371	1.44	1.72
Education	1.114	2.004	591	1.188	1.204	2.821	2.04	2.37
Health and social care	4.398	5.748	5.081	7.662	7.305	12.858	1.44	1.68
Arts, entertainment, recreation	1.727	2.806	542	899	1.306	2.744	2.41	3.05
Other services	18.185	21.574	11.151	15.335	16.162	25.221	1.45	1.64

Source: Statistical Office of the Republic of Serbia: Entrepreneurs in the Republic of Serbia, 2018, working document; Entrepreneurs in the Republic of Serbia, 2014, working document

The overall conclusion is that MSMEs and the entrepreneurial sector are an important segment of the overall economy and have a significant impact on employment and GVA growth. Further growth and development of this sector is one of the important goals of the Smart Specialization Strategy in the Republic of Serbia.

APPENDIX 2

List of stakeholders interviewed for qualitative analysis

No.	Stakeholder	Sector	Field
1	Nordeus	Business	Information and Communication Technologies
2	Eipix	Business	Information and Communication Technologies
3	3Lateral	Business	Information and Communication Technologies
4	TIAC	Business	Information and Communication Technologies
5	Intens	Business	Information and Communication Technologies
6	DevoTeam	Business	Information and Communication Technologies
7	Levi9 IT Services	Business	Information and Communication Technologies
8	Vega IT Sourcing	Business	Information and Communication Technologies
9	EXLRT	Business	Information and Communication Technologies
10	Prozone	Business	Information and Communication Technologies
11	M&I Systems, Co	Business	Information and Communication Technologies
12	Prokomsoft	Business	Information and Communication Technologies
13	Zesium mobile	Business	Information and Communication Technologies
14	TotalObserver	Business	Information and Communication Technologies
15	TNation	Business	Information and Communication Technologies
17	Positive	Business	Information and Communication Technologies
18	Runa medija	Business	Information and Communication Technologies
19	ComData	Business	Information and Communication Technologies
20	Fractal Dimension	Business	Information and Communication Technologies
21	Createsi	Business	Information and Communication Technologies
22	Tehnološko partnerstvo	Business	Information and Communication Technologies
23	Veridix	Business	Information and Communication Technologies
24	Implementacija	Business	Information and Communication Technologies
25	Vodena	Business	Information and Communication Technologies
26	Harder Digital Sova	Business	KDTs and New Technologies
27	Visaris	Business	KDTs and New Technologies
28	Quadra graphic	Business	KDTs and New Technologies
29	Typhoon Hill	Business	KDTs and New Technologies
30	Iva 28	Business	KDTs and New Technologies
31	EdePro	Business	KDTs and New Technologies
32	RT-RK	Business	KDTs and New Technologies
33	Ep.belt	Business	KDTs and New Technologies
34	Faculty of Technology and Metallurgy, University of Belgrade	Academia	KDTs and New Technologies
35	Enterijer Janković	Business	KDTs and New Technologies
36	Gir	Business	KDTs and New Technologies
37	Paneleven	Business	KDTs and New Technologies
38	Seven Bridges Genomics	Business	KDTs and New Technologies
39	CTT DOO	Business	KDTs and New Technologies
40	Game Credits	Business	KDTs and New Technologies

41	Physics Institute, Centre for Solid State Physics and New Materials	Academia	KDTs and New Technologies
42	Vinča Nuclear Institute, Physics Department	Academia	KDTs and New Technologies
43	NovelIC, elektronika	Business	KDTs and New Technologies
44	HTEC Group ket, elektronika	Business	KDTs and New Technologies
45	Ekofungi ket	Business	KDTs and New Technologies
46	Crater VFX Studio	Business	Creative Industry
47	Fab Lab	CSO	Creative Industry
48	Multikultivator	CSO	Creative Industry
49	DigitalKraft	Business	Creative Industry
50	Vision Team	Business	Creative Industry
51	SGA - Srpska Gejming Asocijacija	CSO	Creative Industry
52	Faculty of Dramatic Arts, Institute of Theatre, Film, Radio and Television Arts	Academia	Creative Industry
53	Nova Iskra	CSO	Creative Industry
54	Red Art Workshop	Business	Creative Industry
55	Spring Onion	Business	Creative Industry
56	FDU	Academia	Creative Industry
57	Naxi Radio	Business	Creative Industry
58	Belgrade Polytechnic	Academia	Creative Industry
59	Kreativni centar	Business	Creative Industry
60	Comex	Business	Creative Industry
61	Tuli štamparija	Business	Creative Industry
62	Papir print	Business	Creative Industry
63	University of the Arts, Faculty of Fine Arts	Academia	Creative Industry
64	University of Belgrade, Faculty of Agriculture	Academia	Production of Food and Beverages
65	University of Belgrade, Faculty of Chemistry, Centre of Excellence for Molecular Food Science	Academia	Production of Food and Beverages
66	University of Novi Sad, Faculty of Agriculture	Academia	Production of Food and Beverages
67	Novi Sad Institute of Food Technology (NS FINS)	Academia	Production of Food and Beverages
68	Institute of Field and Vegetable Crops, NS Seme, Novi Sad	Academia	Production of Food and Beverages
69	University of Niš, Leskovac Faculty of Technology	Academia	Production of Food and Beverages
70	Desing d.o.o.	Business	Production of Food and Beverages
71	Agrounik d.o.o.	Business	Production of Food and Beverages
72	Biofor System d.o.o.	Business	Production of Food and Beverages

73	Drenovac d.o.o.	Business	Production of Food and Beverages
74	Global Seed	Business	Production of Food and Beverages
75	Zlatiborac d.o.o.	Business	Production of Food and Beverages
76	ALL NATURAL FOODS d.o.o	Business	Production of Food and Beverages
77	Nelly d.o.o.	Business	Production of Food and Beverages
78	Delta Agrar d.o.o .	Business	Production of Food and Beverages
79	Timomed	Business	Production of Food and Beverages
80	Regionalni voćarski klaster Južne Srbije	Business	Production of Food and Beverages
81	Udruženje Leskovački ajvar	Business	Production of Food and Beverages
82	Žitounija, Žitobačka, Kula	Business	Production of Food and Beverages
83	University of Novi Sad, Faculty of Technology	Academia	Production of Food and Beverages
84	Institute for Science Application in Agriculture, Belgrade	Academia	Production of Food and Beverages
85	Vinarija Aleksić	Business	Production of Food and Beverages
86	Sanum per fructus doo	Business	Production of Food and Beverages
87	University of Novi Sad, BioSense Institute	Academia	Production of Food and Beverages
88	Plavi Kamen (Amoreti)	Business	Production of Food and Beverages
89	Bilje Borča, Beograd	Business	Production of Food and Beverages
90	Sirogojno Co, Sirogojno	Business	Production of Food and Beverages
91	Faculty of Technology and Metallurgy, University of Belgrade	Academia	Production of Food and Beverages
92	Amiga	Business	Manufacture of Machinery and Electronic Equipment
93	University of Novi Sad, Faculty of Engineering	Academia	Manufacture of Machinery and Electronic Equipment
94	Indas	Business	Manufacture of Machinery and Electronic Equipment
95	T&P PLASTIC SRB	Business	Manufacture of Machinery and Electronic Equipment
96	HDD surgery	Business	Manufacture of Machinery and Electronic Equipment
97	Radijator Inženjering	Business	Manufacture of Machinery and Electronic Equipment
98	Kvalitet Niš	Business	Manufacture of Machinery and Electronic Equipment
99	Tim Sistem	Business	Manufacture of Machinery and Electronic Equipment
100	University of Belgrade, Faculty of Mechanical Engineering Innovation Centre	Academia	Manufacture of Machinery and Electronic Equipment
101	Servoteh	Business	Manufacture of Machinery and Electronic Equipment
102	Mont Stubline	Business	Manufacture of Machinery and Electronic Equipment
103	Fabrika Armature	Business	Manufacture of Machinery and Electronic Equipment
104	Kraljevo Faculty of Mechanical and Civil Engineering	Academia	Manufacture of Machinery and Electronic Equipment
105	3D Impuls	Business	Manufacture of Machinery and Electronic Equipment
106	Trefoil Inženjering	Business	Manufacture of Machinery and Electronic Equipment
107	Pomak d.o.o.	Business	Manufacture of Machinery and Electronic Equipment

108	Metalac FAD	Business	Manufacture of Machinery and Electronic Equipment
109	Omni Projekt	Business	Manufacture of Machinery and Electronic Equipment
110	University of Niš, Faculty of Mechanical Engineering	Academia	Manufacture of Machinery and Electronic Equipment
111	NEOMEDICA	Business	Manufacture of Machinery and Electronic Equipment
112	Proxima	Business	Manufacture of Machinery and Electronic Equipment
113	Techno Naiss Group	Business	Manufacture of Machinery and Electronic Equipment
114	Lmb Soft	Business	Manufacture of Machinery and Electronic Equipment
115	Ortokon	Business	Manufacture of Machinery and Electronic Equipment
116	Traffix	Business	Manufacture of Machinery and Electronic Equipment
117	Feniks BB	Business	Manufacture of Machinery and Electronic Equipment
118	Alfa Clima	Business	Manufacture of Machinery and Electronic Equipment
119	EM DIP	Business	Manufacture of Machinery and Electronic Equipment
120	Flama	Business	Manufacture of Machinery and Electronic Equipment
121	Alfa-Plam	Business	Manufacture of Machinery and Electronic Equipment
122	NS Radijatori	Business	Manufacture of Machinery and Electronic Equipment
123	Čip	Business	Manufacture of Machinery and Electronic Equipment
124	Mikoterm	Business	Manufacture of Machinery and Electronic Equipment
125	Ansal Steel	Business	Manufacture of Machinery and Electronic Equipment
126	Nitehnoklima	Business	Manufacture of Machinery and Electronic Equipment
127	Sentronix	Business	Manufacture of Machinery and Electronic Equipment
128	Tagor EMS	Business	Manufacture of Machinery and Electronic Equipment
129	Eurogenyx	Business	Manufacture of Machinery and Electronic Equipment
130	DMV	Business	Manufacture of Machinery and Electronic Equipment
131	EI PCB	Business	Manufacture of Machinery and Electronic Equipment
132	Netico Solutions	Business	Manufacture of Machinery and Electronic Equipment
133	Nigos Elektronik	Business	Manufacture of Machinery and Electronic Equipment
134	Mikkelsen Electronics	Business	Manufacture of Machinery and Electronic Equipment
135	D-Company	Business	Manufacture of Machinery and Electronic Equipment
136	Tim Industriel Steel	Business	Manufacture of Machinery and Electronic Equipment
137	Metalurg	Business	Manufacture of Machinery and Electronic Equipment
138	Dahop utva	Business	Manufacture of Machinery and Electronic Equipment
139	Ming kovačnica	Business	Manufacture of Machinery and Electronic Equipment
140	Gama consulting	Business	Manufacture of Machinery and Electronic Equipment
141	Eko Fungi	Business	Manufacture of Machinery and Electronic Equipment
142	Ministry of Mining and Energy	Business	Environmental Protection and Energy Efficiency
143	University of Belgrade, Faculty of Mechanical Engineering	Academia	Environmental Protection and Energy Efficiency
144	Fabrika hartije Beograd	Business	Environmental Protection and Energy Efficiency
145	ACE Zrenjanin	Business	Environmental Protection and Energy Efficiency
146	Buck	Business	Environmental Protection and Energy Efficiency
147	Keep Light	Business	Environmental Protection and Energy Efficiency
148	FYLTRIS	Business	Environmental Protection and Energy Efficiency
149	Metalac	Business	Environmental Protection and Energy Efficiency

150	Energetika	Business	Environmental Protection and Energy Efficiency
151	Evrotehna	Business	Environmental Protection and Energy Efficiency
152	Interklima	Business	Environmental Protection and Energy Efficiency
153	Korali	Business	Environmental Protection and Energy Efficiency
154	Termomont	Business	Environmental Protection and Energy Efficiency
155	Milanović Tretman Voda	Business	Environmental Protection and Energy Efficiency

List of stakeholders participating in EDP workshops

No.	Priority area	Sector
Information and Communication Technologies		
1	IKT Klaser Centralne Srbije	Business
2	Greensoft	Business
3	Inicijativa Digitalna Srbija	Business
4	Mineco	Business
5	University of Novi Sad	Academia
6	Seven Bridges Genomics	Business
7	IT Klaster Subotica	Business
8	ConcordSoft	Business
9	Termovent	Business
10	University of Novi Sad, Faculty of Sciences and Mathematics	Academia
11	City.AI	Business
12	Createsi	Business
13	Cip	Business
14	RT-RK	Academia
15	Ace-Automatic Control Engineering	Business
16	ABC Proizvod	Business
17	Endava	Business
18	Vojvodina Provincial Secretariat for Business and Tourism	Government
19	Prozone	Business
20	ComData	Business
21	Zesium mobile	Business
22	Positive	Business
23	M&I systems co	Business
24	Klaster IKT mreža	Business
25	University of Kragujevac	Academia
26	Vojvodina Development Agency	Government
27	Autonomous Province of Vojvodina	Government
28	Vojvođanski IKT klaster	Business
29	Levi 9	Business
30	Ministry of Education, Science and Technological Development	Government
31	Biofor systems	Business
32	Eipix Entertainment	Business
33	Faculty of Mechanical Engineering, University of Niš	Academia

34	University of Niš	Academia
35	Badin Soft	Business
36	Shindiri studio	Business
37	Prime Software	Business
38	NIRI	Business
39	PSR/RCMT	Business
40	Start-up centar Niš	Business
41	Faculty of Sciences and Mathematics, University of Niš	Academia
42	Grad Niš	Government
43	Office of Local Economic Development	Government
44	Southern Serbia Regional Development Agency	Government
45	NICAT	Business
46	City of Kragujevac	Government
47	SCTM	Government
48	Biznis inovacioni centar Kragujevac	Business
49	MSP konsalting Kraljevo	Business
50	Seavus	Business
51	Prototype solutions	Business
52	NTP Čačak	Government
53	Vodena	Business
54	Faculty of Sciences and Mathematics, University of Kragujevac	Academia
55	4IT Singleton Solutions	Business
56	Faculty of Technical Sciences, Čačak	Academia
57	Razvojni biznis centar Kragujevac	Business
58	BIOIRC	Academia
59	Steindeis Advanced Risk Technologies Institute	Business
60	National Public Policy Secretariat	Government
61	Peterhof Consulting	Business
62	Inbox IT Solutions	Business
63	Smart Research	Business
64	NTP Beograd	Government
65	Digital Worx	Business
66	Complus Visual Communications	Business
67	Alkemy Play	Business
68	New Look Entertainment	Business
69	Faculty of Electrical Engineering, University of Belgrade	Academia
70	Mihajlo Pupin Institute	Academia
71	Innovation Fund	Government
Future Machines and Manufacturing Systems		
1	University of Niš, Faculty of Mechanical Engineering	Academia
2	Kraljevo Faculty of Mechanical and Civil Engineering	Academia
3	Korali	Business
4	Radijator Inženjering	Business
5	Amiga	Business
6	Odžačar - Kotloremont	Business

7	Perfom Požega	Business
8	D-Company	Business
9	3D Impuls	Business
10	T&P Plastic	Business
11	Armature Aleksandrovac	Business
12	Sigma Komerc	Business
13	Unipromet	Business
14	Techno Naiss Group	Business
15	Indas	Business
16	Serbian Chamber of Commerce and Industry	Government
17	Elit Inox Čačak	Business
18	Energoglobal	Business
19	Metalac Gornji Milanovac	Business
20	Buck	Business
21	University of Belgrade, Faculty of Mechanical Engineering	Academia
22	Proxima	Business
23	Vojvodina Metal Klaster	Business
24	Banim Reklame	Business
25	Pomak Kraljevo	Business
26	Eurotehna	Business
27	IQ patent	Business
28	Grindex	Business
29	Stax Technologies	Business
30	BankPro	Business
31	Ministry of Education, Science and Technological Development	Government
32	LMB Soft	Business
33	Iva 28	Business
34	Ming Kovačnica	Business
35	Minel General Electric	Business
36	ABC Proizvod	Business
37	Konelek	Business
38	Omniprojekt	Business
39	Tim Sistem	Business
40	Kvalitet AD Niš	Business
41	Traffix Niš	Business
42	PPT Armature	Business
43	Kraljevo Regional Chamber of Commerce and Industry	Government
44	Magnohrom	Business
45	Harder Digital Sova	Business
46	ARRA Leskovac	Government
47	GIZ GmbH	Business
48	Kopernikus	Business
49	Flamma Systems	Business
50	Kragujevac Faculty of Engineering	Academia
51	Niš Regional Chamber of Commerce and Industry	Government

52	Meter & Control	Business
Creative Industries		
1	3Lateral	Business
2	Case 3D	Business
3	Crater VFX Trening centar	Business
4	Digital Asset Tailors	Business
5	Digital Mind	Business
6	DigitalKraft	Business
7	Dreamdust	Business
8	Fried	Business
9	Mosquito ADV	Business
10	Open Studio	Business
11	SpringOnion	Business
12	Take One	Business
13	VRHabitat	Business
14	Zero Gravity	Business
15	Centre for the Promotion of Science	Government
16	Srpska gejming asocijacija	Business
17	VFX Serba	Business
18	Srpska filmska asocijacija	Business
19	Novi Sad Academy of the Arts	Academia
20	University of the Arts Belgrade, Faculty of Dramatic Arts	Academia
21	University of the Arts Belgrade, Faculty of Visual Arts	Academia
22	Visual and Applied Arts College, Belgrade	Academia
23	Tuli štamparija Vršac	Business
24	Polyhedra	Business
25	Papir Print	Business
26	Vizartis	Business
27	Belgrade Polytechnic	Academia
28	Comex Šabac	Business
29	Metropolitan Univerzitet	Business
30	Mad Head games	Business
31	Ministry of Education, Science and Technological Development	Government
32	University of Belgrade, Faculty of Technology and Metallurgy	Academia
33	Foka	Business
34	Tipoplastika	Business
35	Tetrapak	Business
36	Gornji Milanovac Municipal Administration	Government
37	Coba & Associates	Business
38	National Public Policy Secretariat	Government
39	VRlabs	Business
40	Čačak Engineering College	Academia
Food for Future		
1	Novi Sad Scientific Institute of Food Technology	Academia
2	University of Novi Sad, Faculty of Agriculture	Academia

3	Pulcap	Business
4	Grund	Business
5	Delta Holding	Business
6	Institute of Field and Vegetable Crops	Academia
7	Biofor System	Business
8	Invetlab	Business
9	Vinarija Temet	Business
10	Institute for Science Application in Agriculture	Academia
11	Serbian Chamber of Commerce and Industry	Government
12	BioSense Institute	Academia
13	Ministry of Education, Science and Technological Development	Government
14	Uljara Pan-Union	Business
15	Business Standardisation and Certification Centre (BSC)	Government
16	University of Belgrade, Faculty of Technology and Metallurgy	Academia
17	CAM-Engineering	Business
18	Patent co	Business
19	Global seed	Business
20	University of Belgrade, Faculty of Agriculture	Academia
21	Desing	Business
22	University of Belgrade, Faculty of Chemistry	Academia
23	Bilje Borča	Business
24	Carnomed	Business
25	Agrounik	Business
26	Golden Oil	Business
27	The Truffles Co	Business
28	Phytonet	Business
29	Sanum per Fructus	Business
30	Superior	Business
31	Institute of Molecular Genetics and Genetic Engineering	Academia
32	University of Belgrade, Faculty of Biology	Academia
33	Vojvodina Provincial Secretariat for Business and Tourism	Government
34	Ministry of Agriculture, Forestry and Water Management	Government
35	Autonomous Province of Vojvodina	Government
36	National Public Policy Secretariat	Government

APPENDIX 3

Interim Report: From the EDP to the Smart Specialization Strategy

1. Background Information

Authors:	
Date:	

2. Abbreviations

EDP	Entrepreneurial discovery process
SWOT	Analysis of strengths, weaknesses, opportunities and threats
F3	Priority Area Food for Future
ICT	Priority Area Information and Communication Technology
CI	Priority Area Creative Industry
MPP	Priority Area Future Machines and Manufacturing Processes
SP	Sub-area Smart packaging
AV	Sub-area Audio-visual production
GAMING	Sub-area Gaming

Introductory remarks

The process of developing the Smart Specialization Strategy was carried out according to the dynamics show in Figure 1:

Figure 1 – Dynamics of Smart Specialization Strategy development



During the entrepreneurial discovery process, three thematic workshops were implemented for four identified priority areas, some of which were conducted at multiple locations with different stakeholders. The result of each thematic workshop was an Interim Report in which the coordinators of each priority area presented in detail information derived from the workshops.

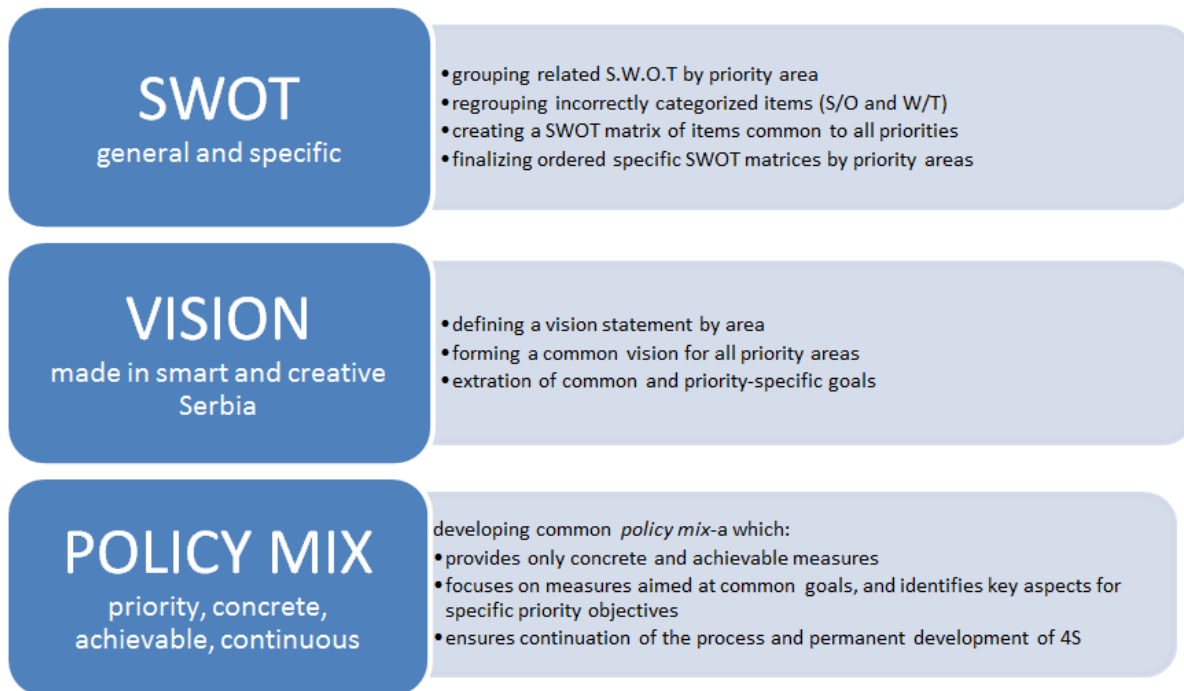
During the EDP, these reports were partly refined by the coordinators in order to clearly highlight the substance of the information received from the workshop participants, and at the end of the entrepreneurial discovery process, summary reports were prepared for all priority areas.

This interim report was designed to summarize and arrange the information from individual and consolidated EDP reports that created a large amount of relatively unordered information, among which, there was a significant overlap of information that was only presented in different ways by the participants of the workshops and coordinators.

3. Methodological approach

The process of developing the Interim Report covered the key steps shown in Figure 2.

Figure 2 – Overview of the steps in forming the Interim Report

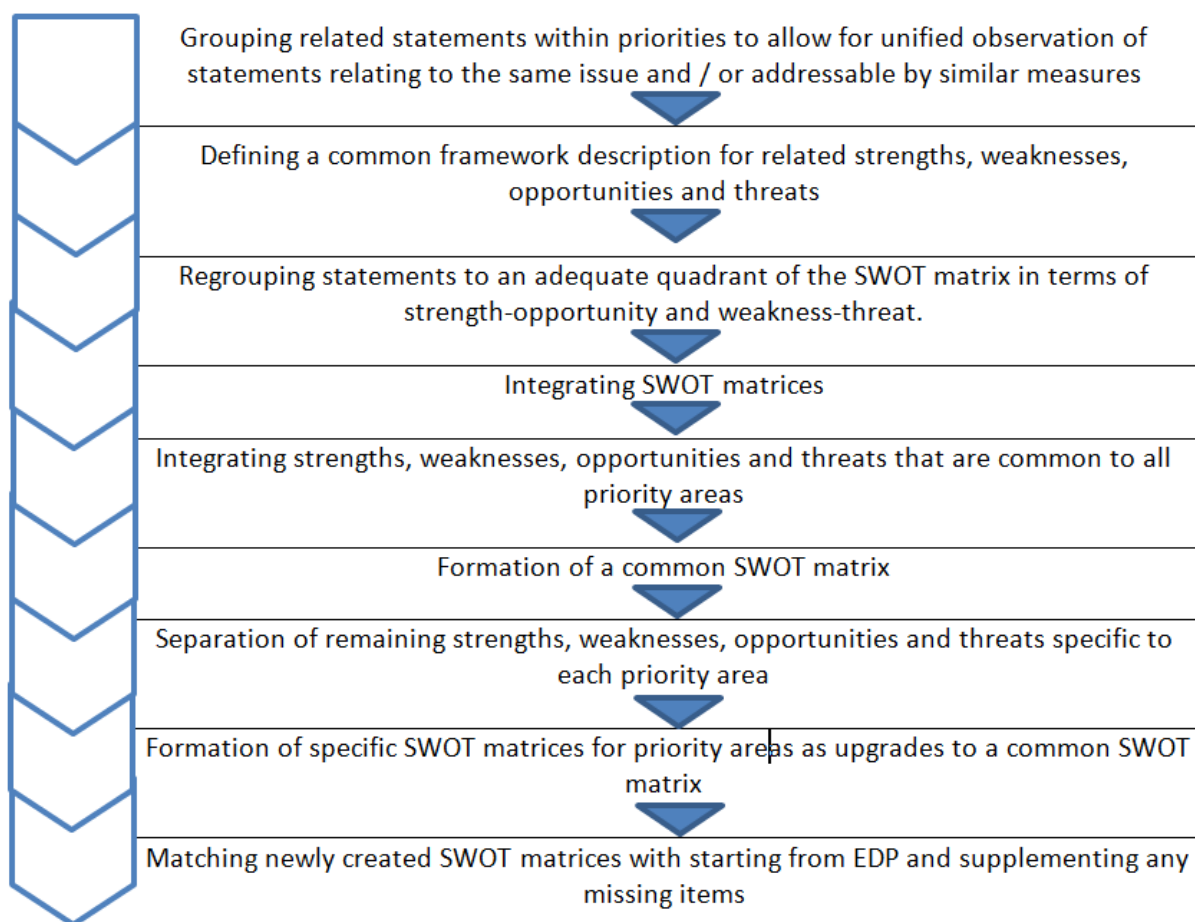


4. SWOT analysis – general and specific

Putting together and processing individual SWOT matrices resulting from the EDP workshops by priority area were performed in a way that ensured maximum details presented during the workshops as well as the implementation of key common and specific determinants of the SWOT. The steps of putting together and processing SWOT matrices are presented in Figure 3.

In the consolidated SWOT matrix, similar statements were grouped for all four priority areas and classified under a common framework. In the resulting table, the regrouped statements are positioned under an adequate quadrant of the SWOT matrix in terms of strength-opportunity and weakness-threat. From this table, observations were made regarding the extent to which the statements given under the same framework are related and common to all priority areas, or specific depending on the priority area observed. These observations provided further guidance for retrieving strengths, weaknesses, opportunities and threats that are related and common to all priority areas into a common SWOT matrix, or to retain specific comments in a specific SWOT matrix for a priority area.

Figure 3 – Putting together, grouping, systematization and processing of individual SWOT matrices



The next step provides a common SWOT matrix which is the result of the general situation in Serbian society and economy (Table 1), as well as specific SWOT matrices (Tables 2-5) which are further compared to the initial SWOT matrices obtained through the EDP, and supplemented as needed. These SWOT matrices, shown below, were used in the development of the strategy document.

Table 1 – General matrix of common strengths, weaknesses, opportunities and threats for all priority areas

STRENGTHS	WEAKNESSES
Strong expert base	<p>Problem of providing a quality workforce (low awareness, resistance to change, innovation and application of new technologies, underdeveloped “soft” skills)</p> <p>Shortcomings of the education system</p> <p>Insufficient transfer of knowledge and innnovation including cooperation between academia and economy, but also knowledge sharing between companies and within companies, insufficient cross-sectoral integration, disconnected value chains</p> <p>Lack of infrastructure (laboratories, transfer centers, certification bodies of high performance concentrated infrastucture) and lack of suppliers of professional equipment and financial support</p>
OPPORTUNITIES	THREATS

<p>Improving the ability to absorb funding from existing sources of funding and opening up new financing opportunities for development</p>	<p>Demographic trends related to the outflow of professional staff</p> <p>Characteristics of national culture related to the difficulties in accepting novelties with a pronounced lack of trust in the domestic innovation potential</p> <p>Characteristics of socio-political environment, negative phenomena in society, partly inadequate legal framework and inefficient public administration</p> <p>Unequal competitive position (lower subsidies compared to developed countries, support for foreign companies, inability to access certain markets, privileged position of the regional countries that are the EU Member States, poor image of Serbia as a producer)</p> <p>Lack of funding and access to funds, as well as lack of adequate financial support</p>
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Several very important conclusions can be drawn from the SWOT matrices thus formed. A common strength for all four priority areas is a strong expert base, that is, highly skilled people. Contrary to only one common strength, the weaknesses of the four groups are characteristic of all priority areas, which indicates that they relate to Serbian society and the economy as a whole. Three groups of weaknesses also relate to human resources, ranging from problems in the structure and number of available workforce, to the education system that profiles future generations in a way that doesn't allow them to cope with development challenges, to a widespread unwillingness to cooperate. Although the shortcomings of the education system could also be seen as a threat, given the inextricable link between higher education and research and innovation, this aspect is classified as a weakness – that is, internal problems. The fourth group of common weaknesses is related to the missing infrastructure related to research, innovation, creative work, control and product certification.

The situation is similar when it comes to the relationship between opportunities and threats. For all priority areas, only one common opportunity was presented, which relates to improving the capabilities and opportunities to fund development process. On the other hand, there are as many as five groups of threats that can threaten development, regardless of which priority area is involved: unfavorable demographic trends, unsupportive national culture, perception of innovation, socio-economic environment and legislative framework, unequal competitive position and lack of sufficient financial resources. Specific SWOT matrices by priority areas (Tables 2-5) indicate that there are very few threats related to particular priority areas, i.e. that specific threats are almost never identified.

According to these observations, measures aimed at eliminating the risks posed by existing threats and eliminating identified weaknesses should be defined as common to all priority areas and prioritized in the first phase of implementation of the smart specialization strategy aimed at eliminating weaknesses and preventing the risks posed by threats continuing to focus on smart specialization priorities could jeopardize or slow the growth and achievement of future goals.

Specific SWOT matrices by priority areas are the basis for analyzing the specificity of the situation by priority areas.

In terms of strengths (Table 2) in three priority areas (ICT, CI and MPP), the main strength of each priority area are the companies that have developed successful businesses in these domains, and the favorable price/quality ratio of products and services. In the priority area Food for Future, the database

of successful companies is underdeveloped, and the strengths are based on natural resources, tradition, production specifics with identified successful examples from practice and collaboration with science that highlight the potential of this area.

Table 2 – Comparative overview of strengths by priority areas

F3	<ul style="list-style-type: none"> - Examples of successful companies based on collaboration and innovation as confirmation and example of successful growth and development - Natural resources and environment, tradition, biodiversity, authenticity, non GMO - Developed agricultural production/raw material base - Successful examples of diversification and cross-sectoral innovation
CI/AV&GAMING	<ul style="list-style-type: none"> - Number of companies (gaming) - High quality, low price, low labor costs, taxes, software, training, intellectual property that attracts investors
CI/SP	<ul style="list-style-type: none"> - Regional concentration (smart packaging) - Small, operational, innovative, high-performing, companies with competitive prices
ICT	<ul style="list-style-type: none"> - Agility and completeness of the offer - Availability and ability to develop knowledge
MPP	<ul style="list-style-type: none"> - Tradition, flexibility, commitment, openness to innovation and willingness to improvise - High quality products at lower prices, great experience

The identified strengths of companies and academia should be the basis for measures aimed at optimization of their use and their direction towards using the advantages of opportunities that will drive development toward the pursuit of smart specialization goals.

For each of the priority areas, the opportunities that can be used to initiate development (Table 3) are highly specific, but generally in all priority areas three parallel directions of development are pointed out in the direction of smart specialization: (a) smart structuring of production capacities and introduction of new production programs, (b) smart orientation towards new markets; and smart choice of marketing and sales strategies, (c) enhancement of the knowledge base required by smart specialization.

Table 3 – Comparative overview of OPPORTUNITIES by priority areas

F3	INNOVATION	<ul style="list-style-type: none"> - Transition from extensive to labor intensive agriculture - Creating and manufacturing a wide range of innovative value-added food products, improving sustainability through waste reduction and utilization, development of products that are used in agriculture and food production - Harnessing the potential of traditional and indigenous products - Great ability to absorb solutions from other fields and apply the results of research work
	MARKET	<ul style="list-style-type: none"> - Market niches, placement through tourist offer, new types of sales and promotions - Markets with preferential agreements, markets with a large number of users

	KNOWLEDGE	- Improving the work and use of the existing network of expert advisory services
CI/AV& GAMING	INNOVATION	- Pooling the capacities of existing small entities - Many new start-ups - Arrival of large companies involved in development
	MARKET	- Global market with increasing demand - Regional market with a similar cultural pattern - Markets with favorable trade and tax relations
	KNOWLEDGE	- Rounding up all the necessary knowledge - Knowledge from diaspora
CI/SP	INNOVATION	- Use of new packaging materials - Product standardization
	MARKET	- Expanding the placement through existing clients
	KNOWLEDGE	-
ICT	INNOVATION	- Development of ICT solutions for other priority areas, horizontal and public administration - Collaboration between companies and professionals from other sectors to obtain larger contracts, develop more complex products and enhance knowledge - Offer specialization for targeted market niches, clients and technologies - Development of own software solutions
	MARKET	- Global market with increasing demand, - Development of the domestic market - Digitization of public administration - Markets of developing countries
	KNOWLEDGE	- Increasing quotas for ICT studies - Dual education - Participation of the economy in the educational process and creation of curricula - Modernization of the educational process - Fundamental knowledge - Entrepreneurship - Informal education
MPP	INNOVATION	- Clustering with the cooperation of all stakeholders - Inventors, integrated products, Industry 4.0, intellectual property creation and capitalization - Products with competitive prices
	MARKET	- Markets with favorable trade and tax relations - Proximity of the European market - Growing demand
	KNOWLEDGE	- Number of faculties - Dual education - Informal education

In addition to the identified weaknesses common to all areas, each of the priority areas is also characterized by highly specific weaknesses, which overlap slightly. For all priority areas, specific weaknesses are complex and cannot be addressed in the short term and with a limited set of measures, but they must be subject to long-term consideration and careful strategic planning not only through smart specialization strategy, but through a number of other strategic documents.

Table 4 – Comparative overview of weaknesses by priority areas

F3	- Fragmented agricultural holdings, inadequate structure and absence of production re-ionization, underdeveloped infrastructure for irrigation, drainage, transport, low level of finalization, large number of small processors that are not involved in cooperation, outdated technologies and equipment
CI/AV&GAMING	- Small companies that do not have the ability to purchase high performance equipment
CI/SP	- Absence of brand
ICT	- Number of available workers - Outsourcing as the dominant business model - Lack of information on the ICT sector
MPP	- Outdated equipment, low productivity, insufficient digitization, insufficiently skilled management, lack of business and marketing strategy

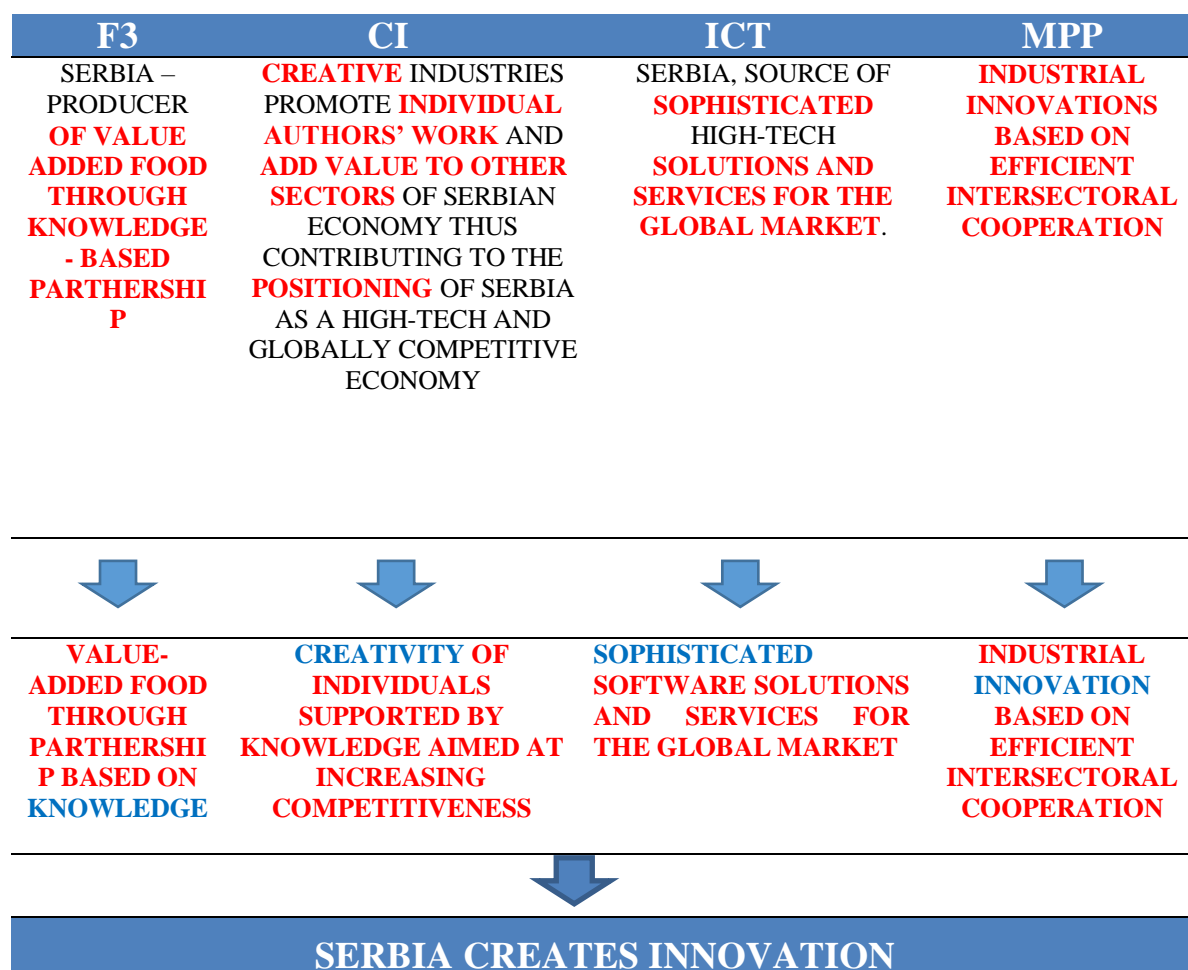
As already mentioned, regardless of the priority area, the threats summarized through the SWOT analysis are common and should be addressed in this regard by measures common to all priority areas. The only exception is climate change, which has been identified as a threat in the priority area of Food for Future, but given the complexity of this global threat, it may not be seen as the focus of smart specialization strategy.

5. Shared vision

As part of the *VISION* workshop in the entrepreneurial discovery process, for each of the priority areas, the stakeholders adopted a statement defining the vision of the priority area in terms of smart specialization. In order to come up with the final version of 4S, statements derived from the EDP have been summarized as shown in Table 5 and combined under the slogan that should identified products from Serbia, in the future, that are created as a result of smart specialization.

“SERBIA CREATES INNOVATION”

Table 5 – The process of generating a common vision derived from the specific visions of priority areas



Based on these visions arising from the EDP, the final vision of the Smart Specialization Strategy of Serbia was defined:

Serbia Creates Innovations - Smart and creative Republic of Serbia, highly competitive in the world, recognized by its knowledge-based innovations, partnerships from domestic ecosystem and creativity of individuals in areas of:

- Sustainable high-technology production of high value-added food for the future
- Sophisticated software solutions for global market and
- Intersectoral-based industrial innovations.

6. Common and specific goals by priorities

Within the POLICY MIX workshop conducted in the entrepreneurial discovery process, the goals of smart specialization were defined for each priority areas. These goals defined in the priority areas overlap, they focus on the same aspects of socio-economic development that need to be addressed in order to contribute to smart specialization. Issues for which the goals are defined within the EDP workshops of all or most of the priority areas are:

- Research and innovation

- Education system
- Entrepreneurial ecosystem
- Public support system
- Market position and value

For each of the abovementioned aspects, the goals by priority areas are observed and summarized in the SMART goals of the smart specialization strategy that are common to all priority areas.

Research and innovation

When it comes to the research and innovation, as shown in Table 6, similar goals have been defined for all four priority areas. Essentially, in all priority areas, the goals are aimed at creating the conditions to harness research potential as an identified strength in all priority areas in order to seize the development opportunities and its funding.

As part of the **SWOT** analysis, in all priority areas, a strong expert base is registered as one of the strengths, insufficient connection of actors in the research and innovation system as one of the weaknesses, and increasing the ability to absorb existing ones and provide additional resources to support the innovation system as one of the opportunities.

Based on the above mentioned observations, as shown in Table 6, two common goals related to research and innovation were derived.

Table 6 – Common goals of priority areas for research and innovation

RESEARCH AND INNOVATION			
SWOT– common strength to all priority areas: Strong staff/expert base			
SWOT– common weaknesses for all priority areas: Insufficient transfer of knowledge and innovation including collaboration between academia and economy, but also knowledge sharing between companies and within companies, low cross-sectoral integration, disconnected value chain			
SWOT– common opportunity for all priority areas: Improving the ability to absorb funding from existing funding sources and opening up new opportunities for development financing			
Goals by priority areas derived from the EDP			
F3	CI	ICT	MPP
↓	↓	↓	↓
Put research into the function of innovation and technological development in the field of agriculture and food production	Creative industry clusters with high performance infrastructure and smart packaging labs	Enhance institutional and technical capacities of higher education in the function of cooperation with business entities	Empower R&D through inter-sectoral collaboration of industry and research institutions
Derived common goals			
↓			
GOAL 1: Research and development focused on 4S priorities			

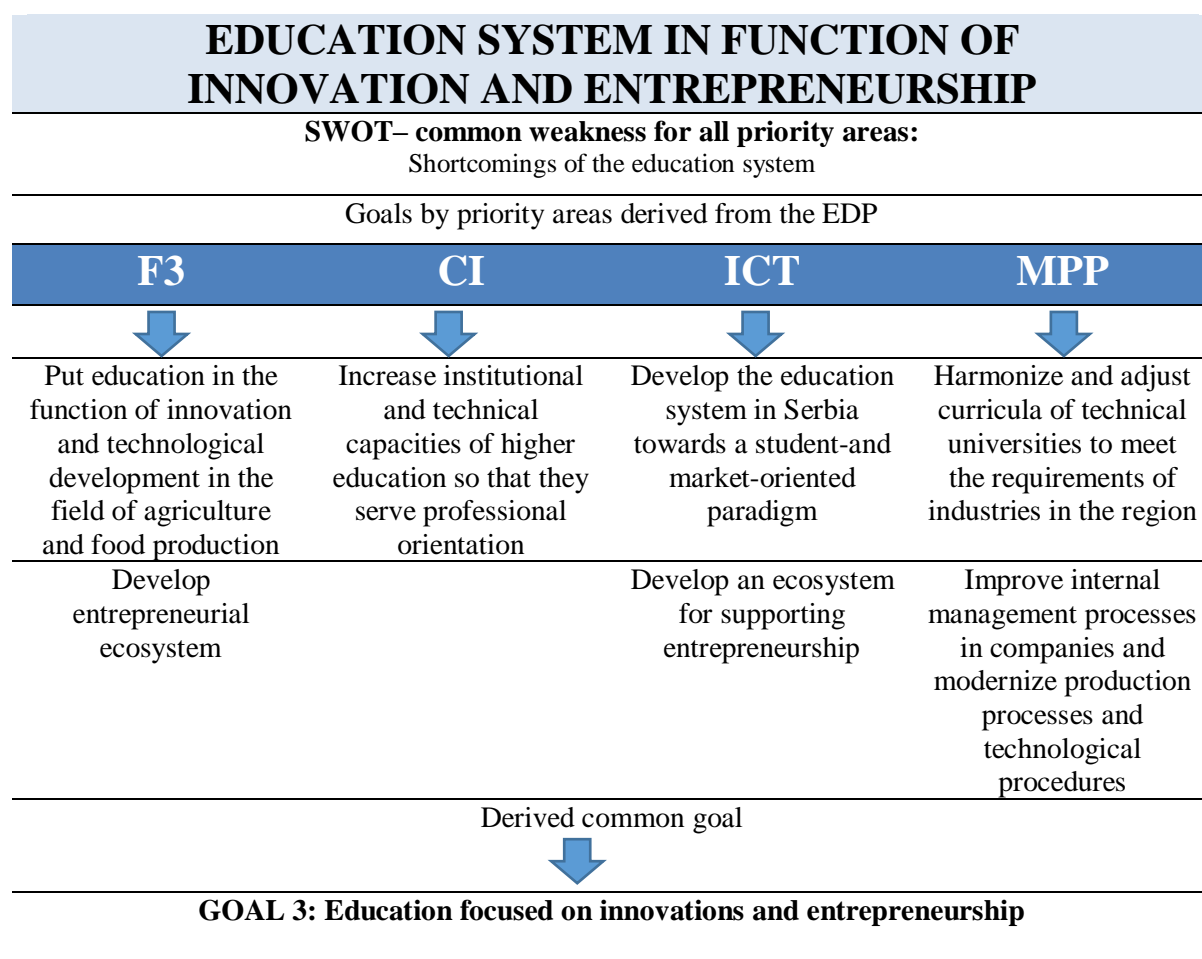
GOAL 2: Economic growth supported through R&D and collaboration among the quadruple helix participants

Education and the entrepreneurial ecosystem

In all four priority areas, goals related to the needs of overcoming weaknesses of the education system that can pose a significant threat to the implementation of smart specialization strategy, were also derived from the EDP, with particular focus on the role of the education process in creating entrepreneurial ecosystem.

Various gaps in the education system were also reported as a weakness within the SWOT analysis in all four priority areas. Based on these observations, a third common goal was formulated, as shown in Table 7.

Table 7 – Common goals of priority areas related to the education system



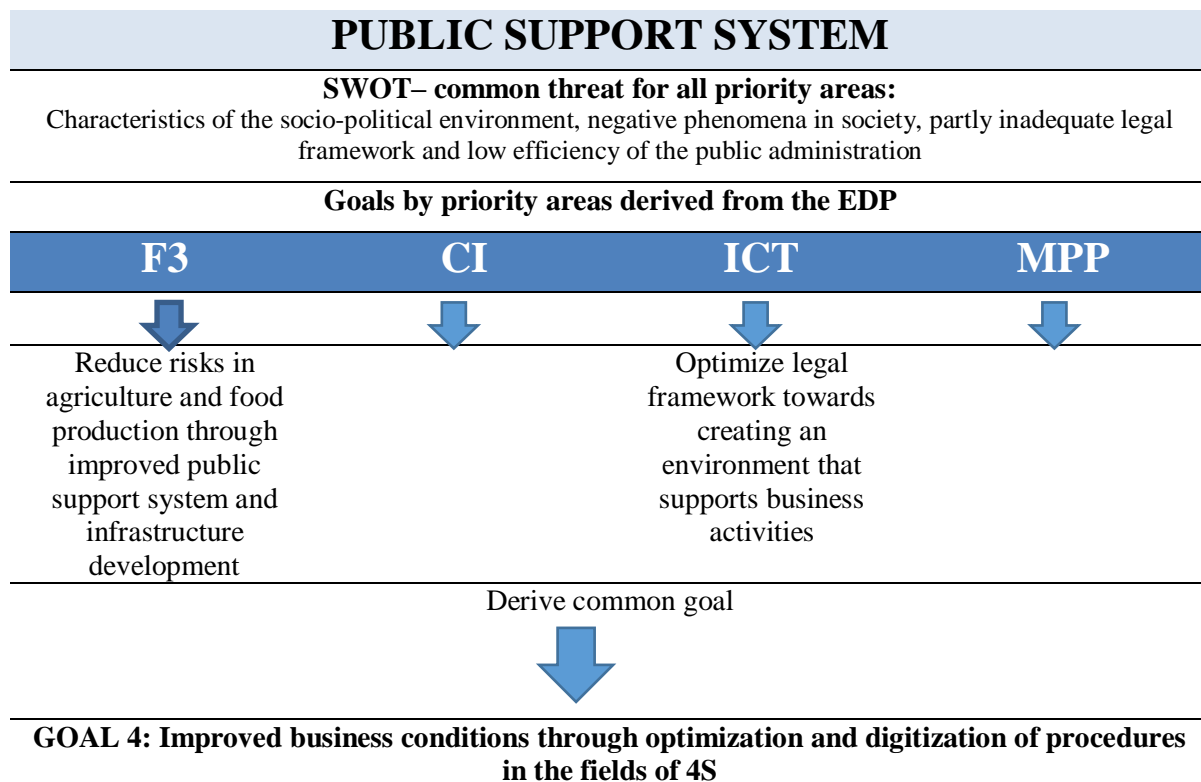
Public support system

During the EDP workshops, participants have repeatedly stated that a significant threat to rapid growth and development in the priority areas, as well as in society and economy as a whole, are the characteristics of the socio-political environment that is burdened by inadequate legal framework and inefficient public administration.

In two priority areas, Food for Future and Information and Communication Technologies, the need to improve the public support system and legislation has been expressed and explicitly defined as part of the POLICY MIX workshop.

Based on these observations, the fourth common goal was derived as shown in Table 8.

Table 8 – Common goals of priority areas related to legislative improvements and functioning of the public support system



Market position

Among the participants of the EDP workshops in all priority areas a common threat was registered regarding the position of Serbian manufacturers in the international market. Workshop participants highlighted this threat through various aspects of experiencing unequal competitive position in relation to entities operating in different conditions compared to Serbia. In agriculture, these are lower subsidized compared to developed countries, in the machine industry – support to foreign companies and inability to access certain markets, and generally there is a perception of the privileged position of the EU Member States and the lack of good image of Serbia as a producer.

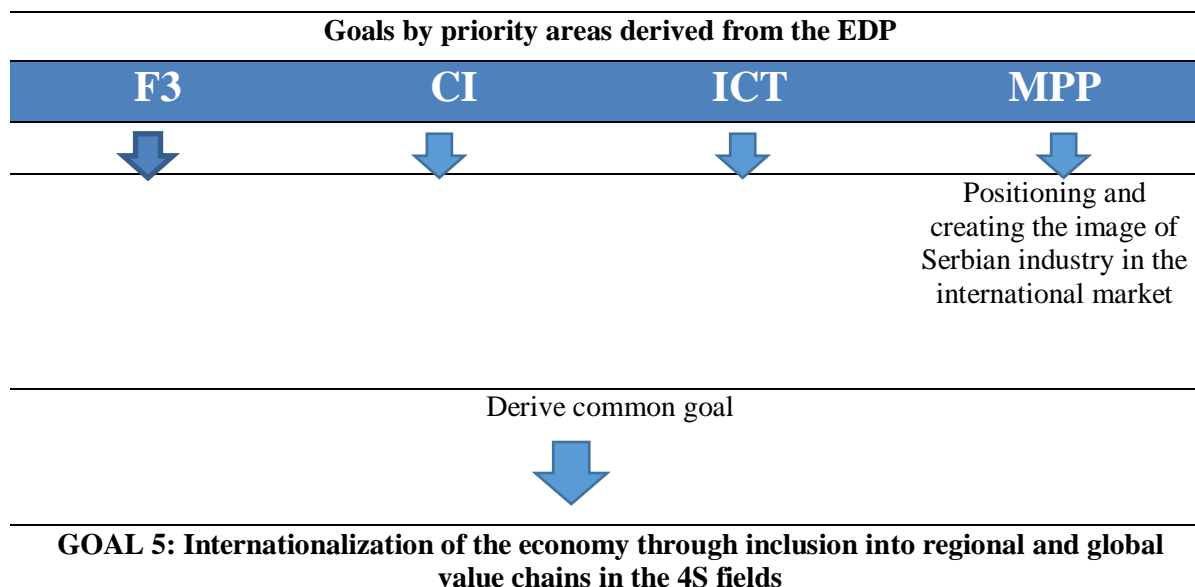
Based on this observations, although the goal related to the positioning of Serbia in the global market is expressed only in the field of Future machines and manufacturing processes, the fifth common goal was derived, as shown in Table 9.

Табела 9 – Common goals of the priority areas related to the market position

MARKET POSITION

SWOT – common threat for all priority areas:

Unfair competitive position (lower subsidies compared to developed countries, support for foreign companies, inability to access certain markets, privileged position of the EU Member States, poor image of Serbia as a producer)



Common goals of all priority areas

Based on the above mentioned considerations, five general goals have been defined that are common to all priority areas:

1. **Research and development focused on 4S priorities**
2. **Supported economic growth through R&D and collaboration among the participants in the quadruple helix**
3. **Education focused on innovation and entrepreneurship**
4. **Improved business conditions through optimization and digitization of procedures in the 4S fields**
5. **Internationalization of the economy through inclusion into regional and global value chains in the 4S fields**

Specific goals by priority areas

Having integrated all the related goals derived from the EDP process, one defined goal remained within each priority area that stems from the specific characteristics of the priority area itself (Table 10).

Table 10 – Specific goals by priority areas

SPECIFIC GOALS			
F3	CI	ICT	MPP
Increase the output from the food production chain	Strategic orientation towards intellectual property creation	Support to the development of domestic ICT market	Improving the quality and competitiveness through incentives for implementation of international standards for products and processes

7. Defining the package of measures

For the common goals of the Smart Specialization Strategy for all priority areas, an Action Plan was defined in order to achieve them with a package of measures (Table 11). The basic criterion for defining the measures was that they could be realistically implemented within the foreseen deadline, and availability of funds for their implementation.

Table 11- Action Plan

4S Goal	Planned measures
COMMON GOALS AND MEASURES FOR ALL PRIORITIES	
GOAL 1: 1. Research and development focused on 4S priorities	<ul style="list-style-type: none"> 1.1 Competitive calls from the Science Fund focused on 4S (Food for Future, Smart machines and processes, ICT, Creative industry) – Development Program 1.2 The call for artificial intelligence 1.3 Development of criteria within the regulations governing the allocation of institutional funding for R&D in a way that fosters relevance (4S) and excellence in the fields of 4S 1.4 Support program for experimental and innovative projects combining art, science and advanced technologies
GOAL 2: Supported economic growth through R&D and collaboration among quadruple helix participants	<ul style="list-style-type: none"> 2.1 IF's Voucher Program in the fields of 4S 2.2 Collaborative program of science and business in the fields of 4S 2.3 Program of funding for development of innovative projects of companies in the fields of 4S 2.4 Accelerator and sub-program for start-ups in the fields of 4S 2.5 Proof of concept, a program for researchers from research organizations 2.6 Minin Grants Program – intended for private companies developing technological innovation 2.7 Incentives for research and development within the agricultural and food industries 2.8 Pilot project linking fast growing food companies with creative industries and ICT 2.9 Competitive call to further stimulate research contracts in the fields of 4S between scientific and research organizations and reserach users 2.10 Developing a procurement system focused on procurement of innovative solutions with piloting in 4S (pilot) 2.11 Creative Hub Lozionica 2.12 Creative Embassy in London 2.13 Public register/map of scientific infrastructure 2.14 Continuation of the Entrepreneurial discovery process
GOAL 3: Education focused on innovation and entrepreneurship	<ul style="list-style-type: none"> 3.1 Training for researchers aiming to strengthen cooperation with the business sector 2.11 Involvement of practitioners in the educational process – pilot in 4S 3.2 Introducing entrepreneurial skills in the curricula in faculties and academies in the fields of 4S 3.3 Involvement of practitioners/industry professionals in the education process 3.4 Student competition to promote student innovation, entrepreneurial spirit and environmental awareness

3.5 Amendments to the rulebook on evaluation on the procedure, method of evaluation and quantitative presentation of researchers' scientific results

3.6 Master program for connecting arts and information technologies

GOAL 4: Improved business conditions through optimization and digitization of procedures in the fields of 4S

4.1 Analysis and simplification of all administrative procedures as required by the 4S

**GOAL 5:
Internationalization of the economy through inclusion into regional and global value chains in the 4S fields**

5.1 Establishing interregional partnerships within thematic smart specialization platforms

5.2 Establishing cooperation with countries in the region as part of the smart specialization