THE SMART
SPECIALISATION
STRATEGY SERBIA

2020 - 2027

APPENDIX

SMART
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SERBIA

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).

	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

Table 1. 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.
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).

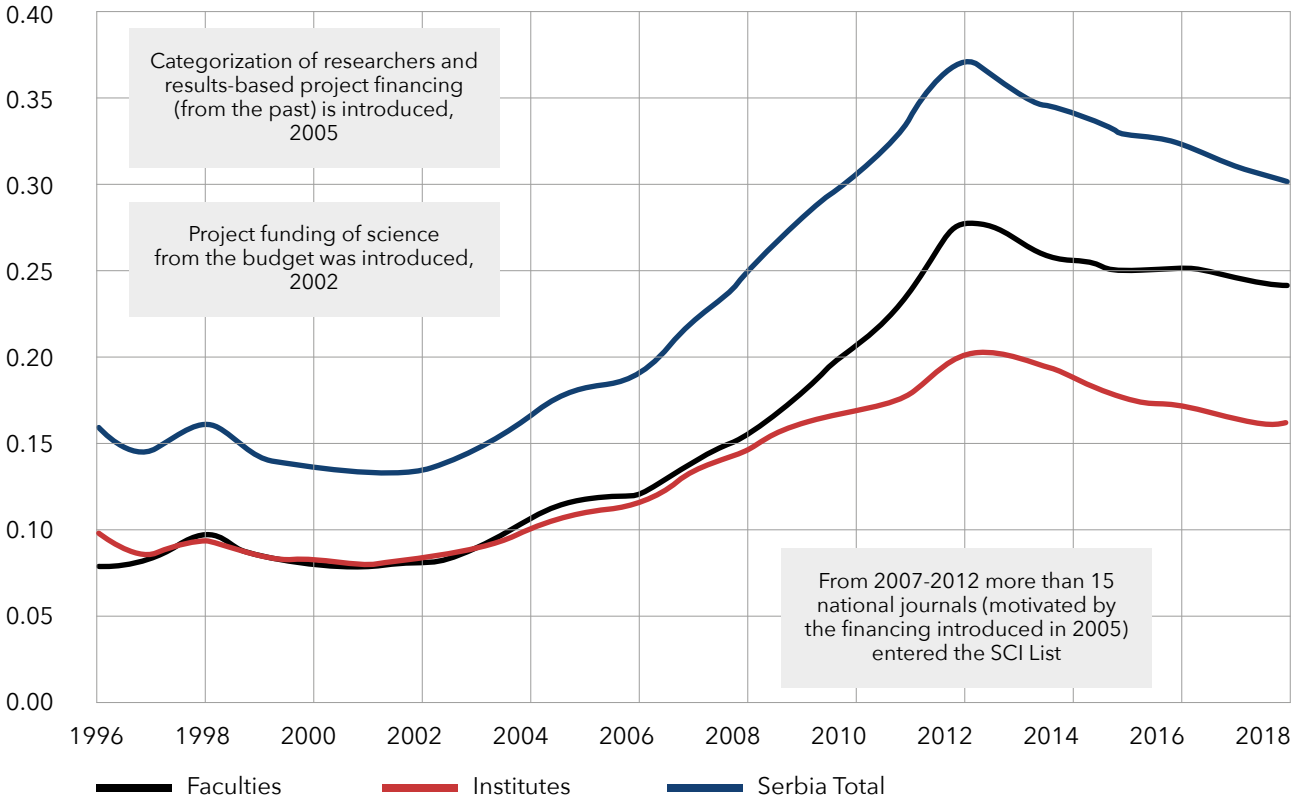
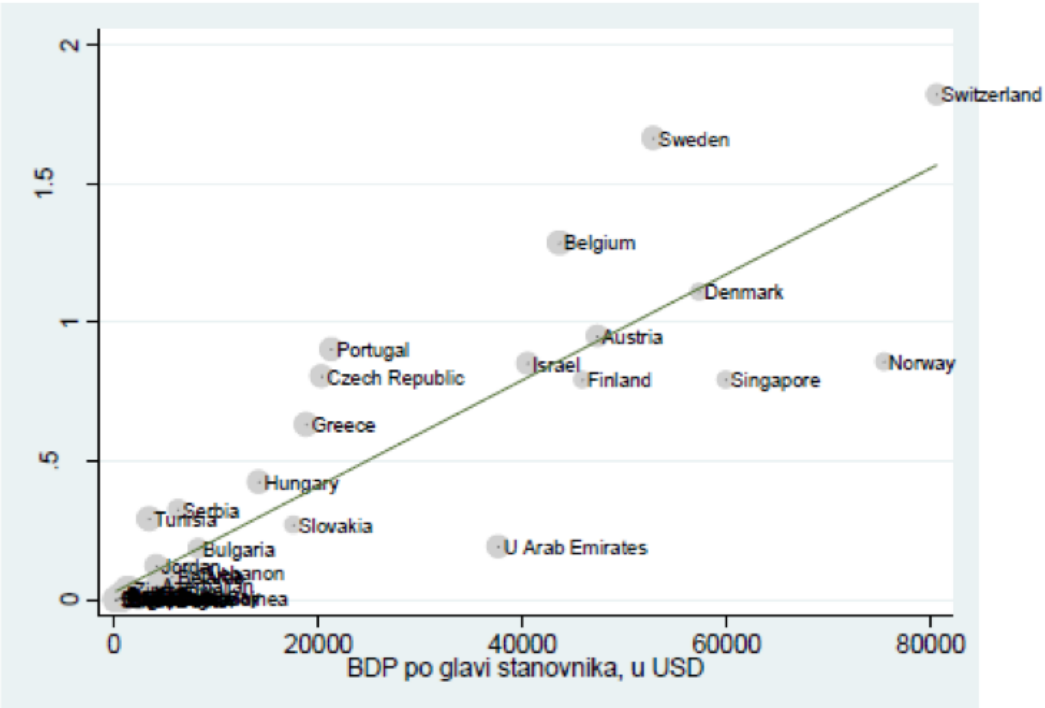


Chart 1. Share of published papers from Serbia in the total number of published papers in the world on the SCI list and crucial events that describe trends
Source: Atanasijević J., Nikolić Z., Jeremić-Zec G., Pavlović O. & Vasiljević D. (2019). "Attaining Higher Productivity in Serbia: Can Higher Education 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.

[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

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).



Graph 2. 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)
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).

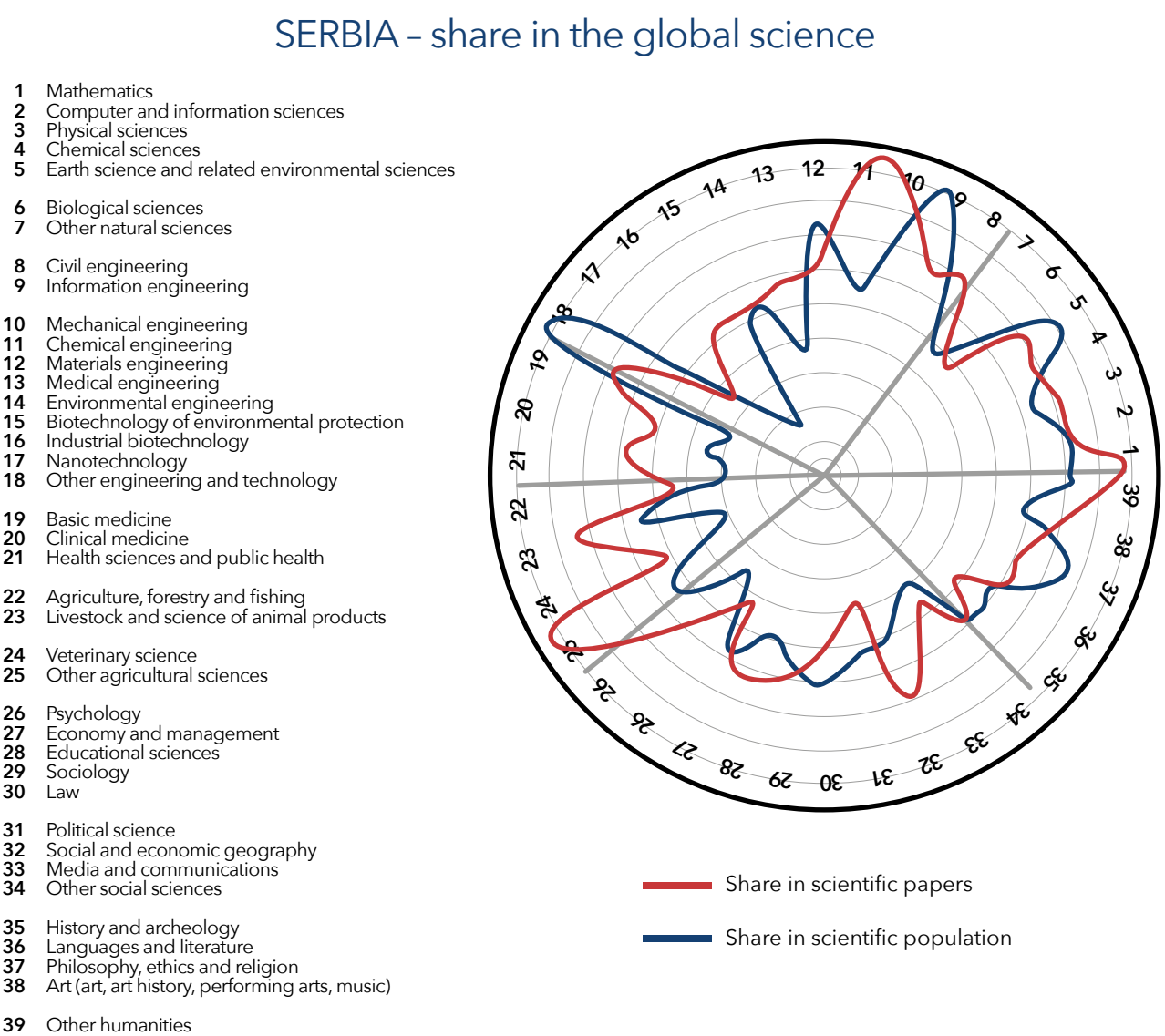


Chart 3. Serbia 2009-2018: Share in the number of papers in the world and in the global population of researchers in 39 scientific areas (OECD Frascati)
Source: Atanasijević J., Nikolić Z., Jeremić-Zec G., Pavlović O. & Vasiljević D. (2019). "Attaining Higher Productivity in Serbia: Can Higher Education 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 or researchers has been halted since 2016 and even a mild decrease has been registered.

	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	–

Table 2. Comparative indicators of expenditures for R&D and the number of researchers in 2018.
Извори: Eurostat Database, https://ec.europa.eu/eurostat/data/database; UNESCO Institute for Statistics, http://data.uis.unesco.org
***Data from 2016**

	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

Table 3. Trends in the total number of researchers (FTE) by sector in 2011-2018
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.

	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%

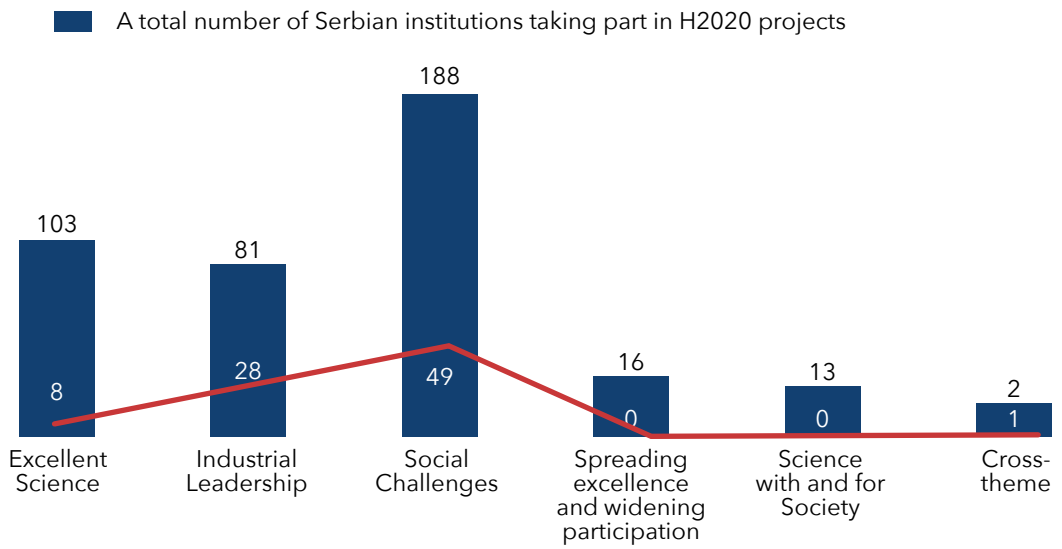
Table 4. Employed researchers by sectors and scientific areas expressed in full time equivalent (FTE) in 2018.
Source: Calculation by the author based on: Republic Statistical Office, Bulletin 648: Scientific research activity in the Republic of Serbia, 2019, Belgrade.

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.

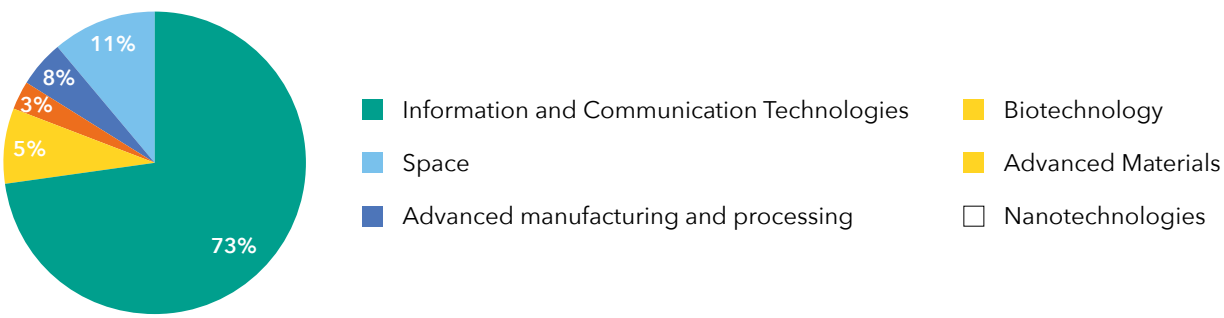
An agreement signed in 2014 by the Government of Serbia and the European Union enabled participation of the Republic of Serbia in the Horizon 2020 program. According to the data from January 2020, 446 institutions from the Republic of Serbia are taking part in the program as part of 311 projects approved 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).



Graph 4. 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 pA totaroject 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 is 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).



Graph 5. 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 EUREKA[56] 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 COST[57] 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 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 (JNIR), an international scientific institution in Dubna, the Russian Federation.

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. In November 2015, Serbia joined the Smart Specialization Strategy Platform, as the first non EU-member state.

[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).

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

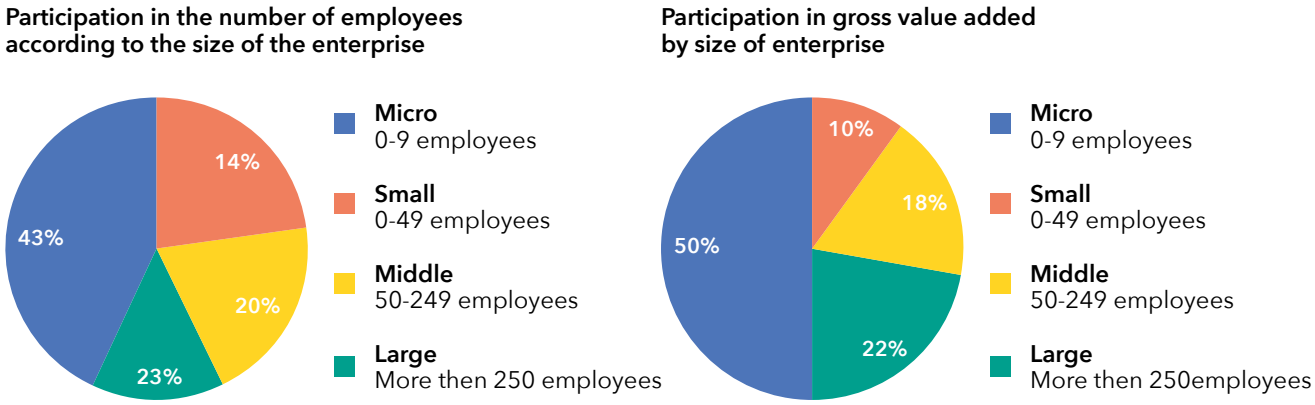
Main characteristics of the business sector in the Republic of Serbia

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).

[58] SORS: Labor Force Survey



Graph 6. Distribution of number of employees and GVA by size of enterprise
Source: SORS

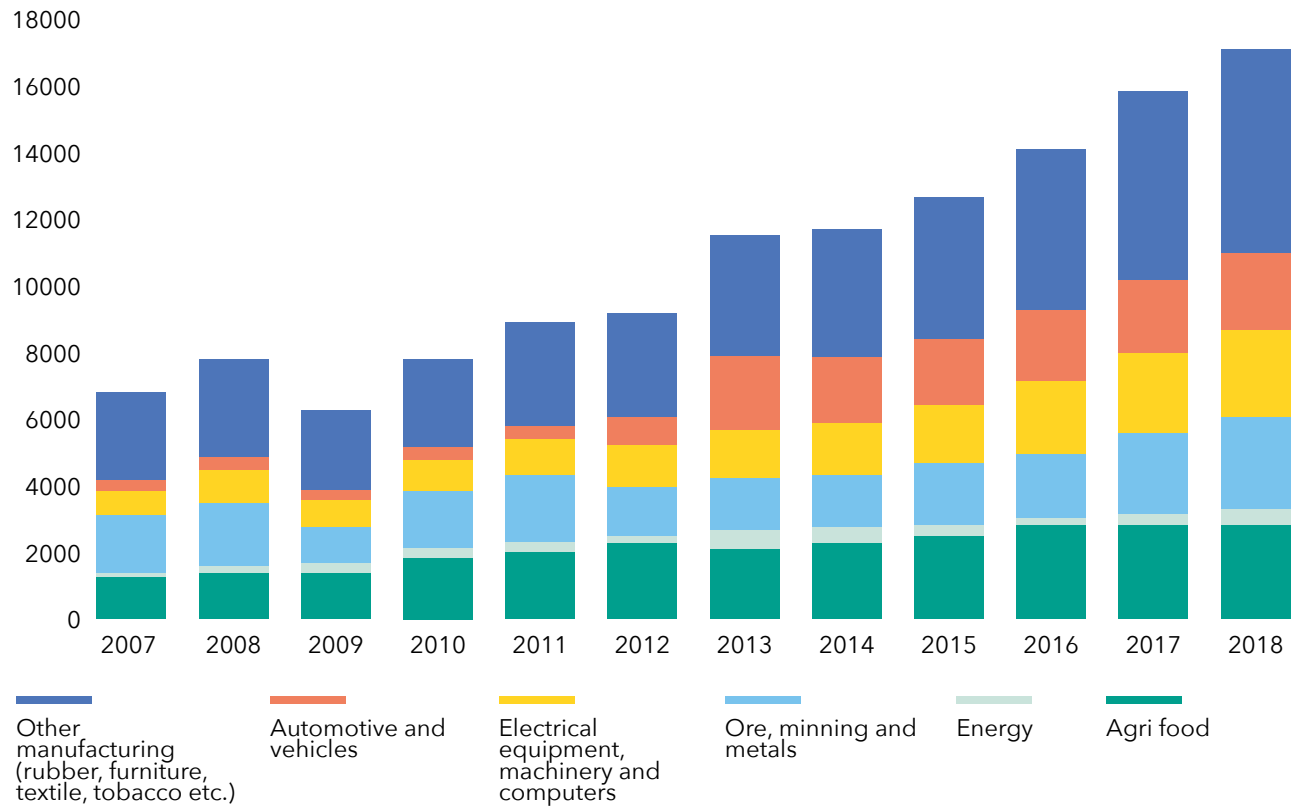
After the global economic crisis of 2008, the structure of the economy has changed significantly - from the pre-crisis model based on imports, final consumption and expansion of services (financial services, real estate, trade) to the post-crisis model based on investments in manufacturing and export 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).

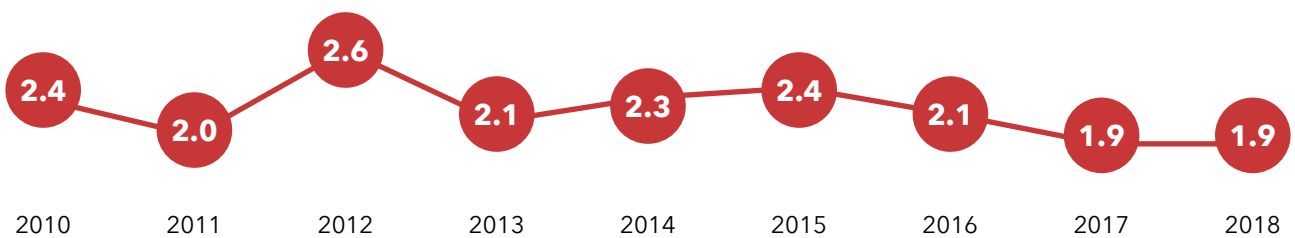
Over **53%** of exports is realized with European Union countries.

The most important foreign trade partners when it comes to exports are: Germany, Italy, Bosnia and Herzegovina, Romania and the Russian Federation.



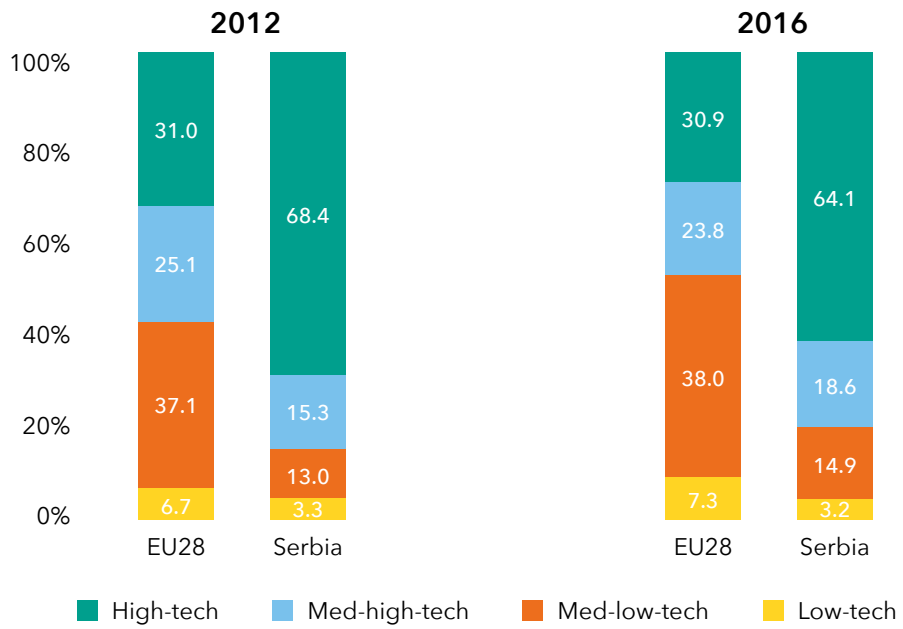
Graph 7. Export structure in manufacturing activities
Source: Data processed by the author based on the SORS data

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)*.



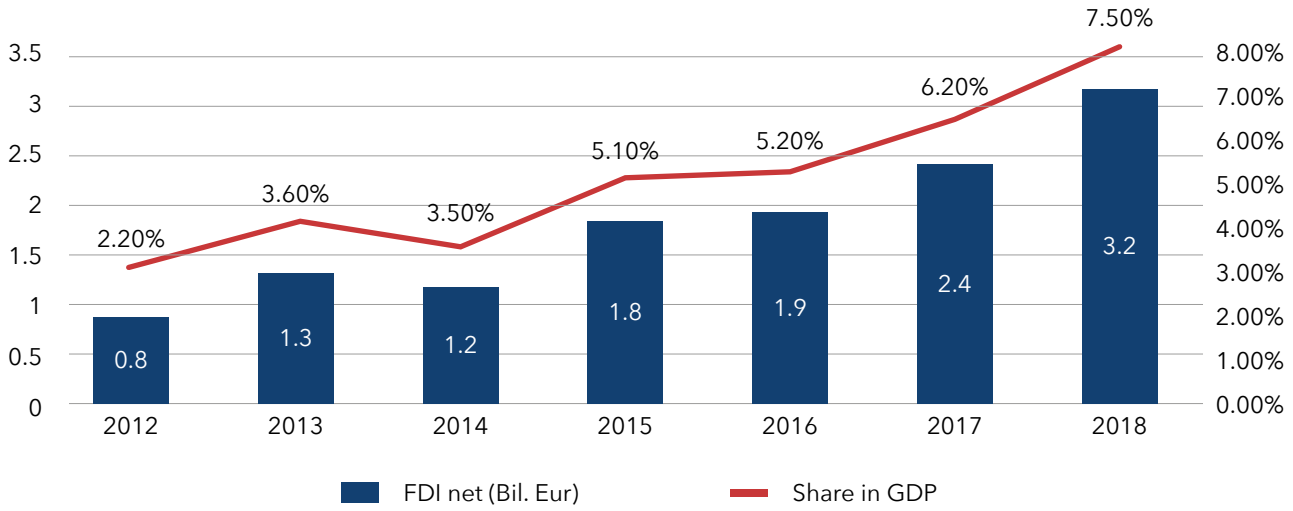
Graph 8. Share of exports of high-tech products in relation to total exports of the Republic of Serbia (%)
Source: Eurostat Database

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).



Graph 9. 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.



Graph 10. 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

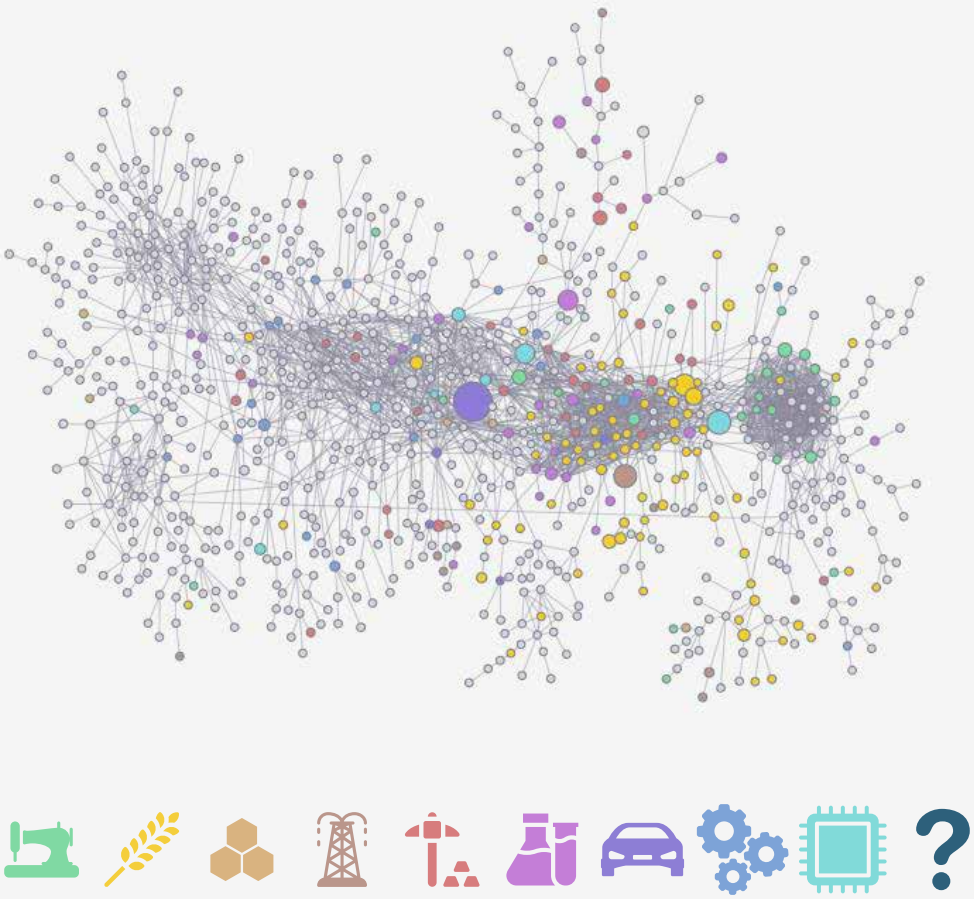
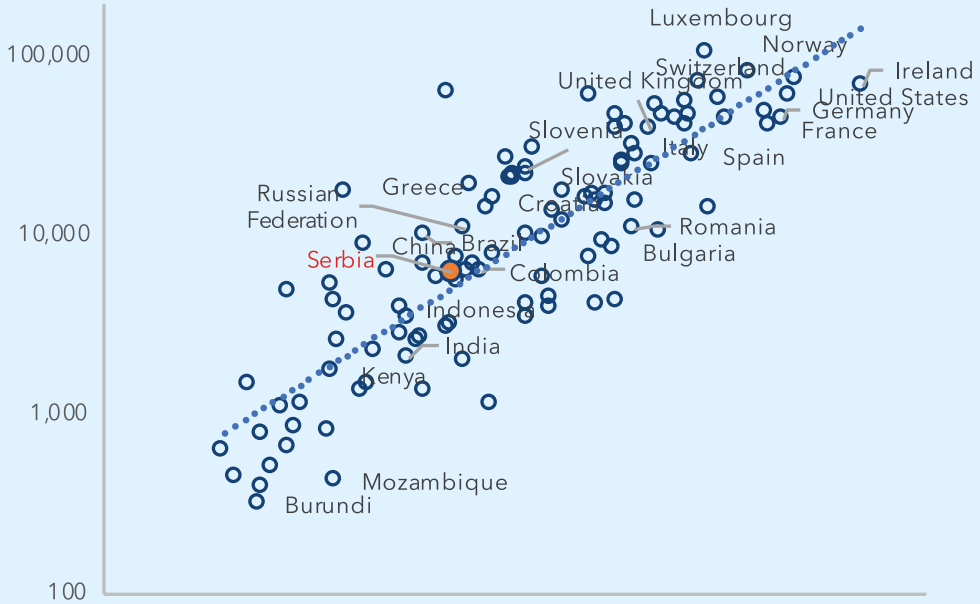


Figure 2. Mapping of Products Exported by Serbia (The Product Space of Serbia 2016)
Source: OECD (2019). Unleashing the Transformation Potential for Growth in the Western Balkans, OECD Publishing, Paris

*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.

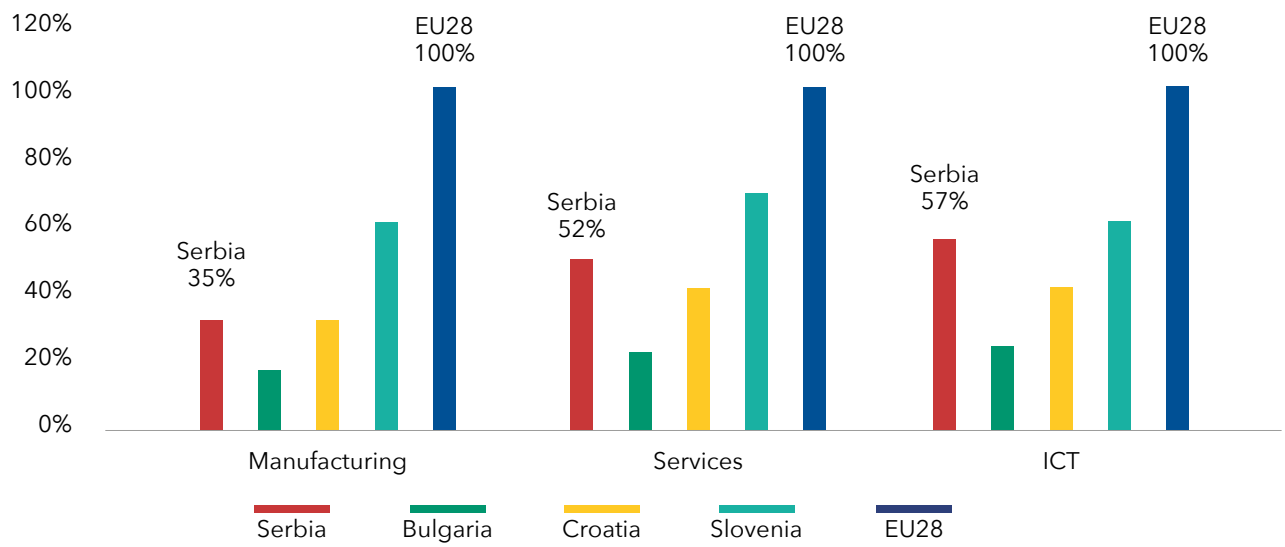
Serbia has relatively low productivity compared to the EU average. The overall productivity of companies in Serbia is growing by 1.1% per year, however, to increase GDP growth by 1 percentage point, the current productivity growth should be doubled (Chart 11). High-growth companies (companies that have 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]

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



Graph 11. Productivity to GDP ratio per capita
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).



Graph 12. 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 list[61]. 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) , 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 filed 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 Index , in 2019, the Republic of Serbia ranks 57th on the list of 126 countries.

[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)

[62] 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)

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 Index[64] 2018.

The Republic of Serbia is a moderate innovator according to the European Innovation Scoreboard 2019[65] 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.

	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)**

[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)

[65] Сумарни индекс иновативности развила је Европска комисија 2001. године. Вредности индекса иновативности објављују се у European Innovation Scoreboard (EIS), при чему се све земље сврставају у четири категорије: иновациони лидери (Inovation Leader), снажни иноватори (Strong Inovator), умерени иноватори (Moderate Inovator) и скромни иноватори (Modest Inovator). Овај индекс обухвата три главна типа индикатора: покретачи (enablers), активности предузећа (firm activities) и аутпути (outputs), који укупно имају осам иновационих димензија које заједно чине 25 индикатора. Покретачи укључују три иновационе димензије: људски ресурси; отвореност и изврсност истраживачких система; финансирање и подршка. Активности предузећа садрже три иновационе димензије: инвестиције предузећа; повезивање и предузетништво; интелектуална својина. Аутпути укључују две иновационе димензије: иноватори и економски ефекти. Република Србија има најслабији скор у димензијама: отвореност и изврсност истраживачких система и финансирање и подршка (https://ec.europa.eu/docsroom/documents/36281).

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)

Table 5. Overview of Serbia's position in relation to countries in the region according to global indices
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 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%).

	2012-2014.	2014-2016.	2016-2018.
Укупно	**40,5**	**41,2**	**50,2**
Пољопривреда, шумарство и рибарство	22,9	41,9	49,3
Рударство	19,3	27,1	41,9
Прерађивачка индустрија	42,7	47,9	58,2
Снабдевање електричном енергијом, гасом и паром	53,2	53,7	21,3
Снабдевање водом и управљање отпадним водама	35,1	31,1	45,0
Грађевинарство	36,2	36,7	42,6
Трговина на велико и мало и поправка моторних возила	40,7	31,0	42,8
Саобраћај и складиштење	31,7	37,3	42,0
Услуге смештаја и исхране	46,2	30,8	44,8
Информисање и комуникације	47,6	40,2	61,3
Финансијске делатности и осигурање	36,3	38,1	32,8
Пословање некретнинама	26,9	8,5	41,6
Стручне, научне, иновационе и техничке делатности	37,5	47,3	48,7
Административне и помоћне услужне делатности	43,4	53,1	40,7

Table 6. Share of innovative business entities by sectors of activity in the period 2012-2018. (%)
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).

	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

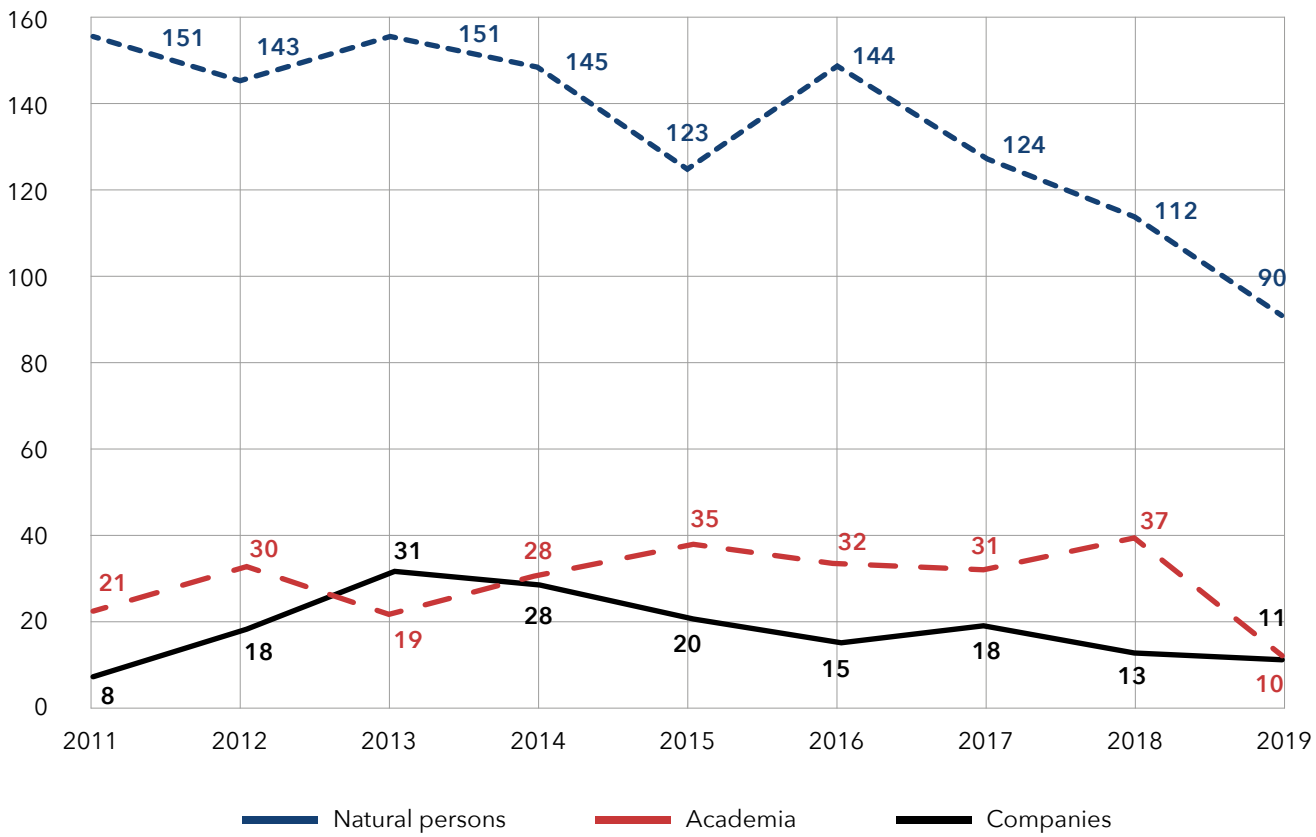
Table 7. Structure of expenditure for innovation activities and revenue structure of innovators
Source: Statistical Office of the Republic of Serbia, Indicators of innovative activities in the Republic of Serbia, author's work

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).

	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

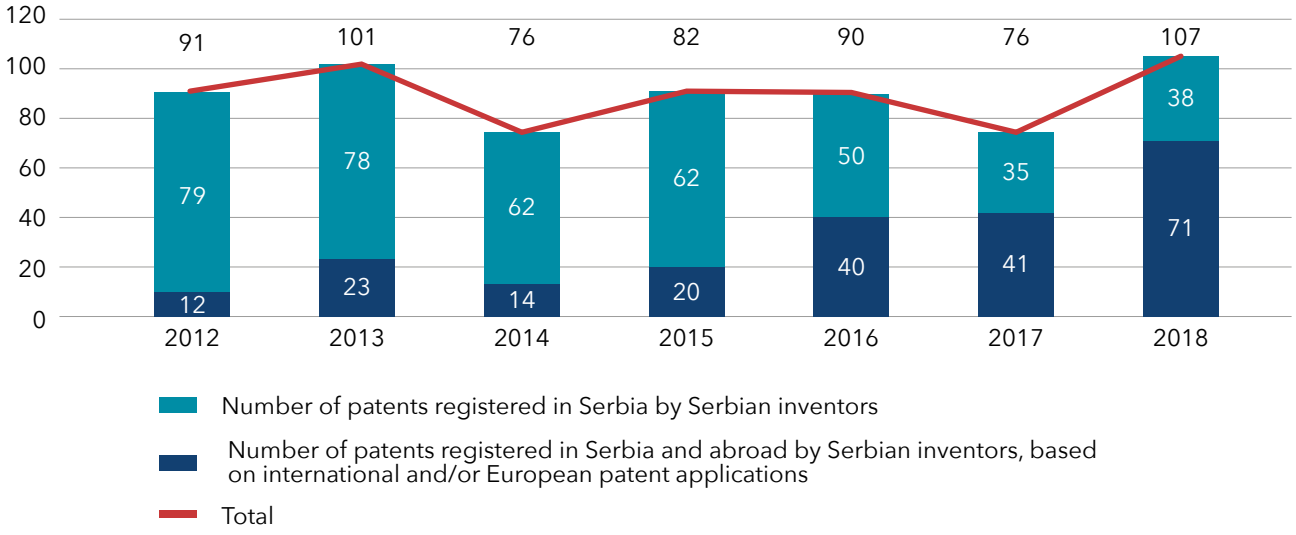
Table 8. Higher education or post-college education employees (%)
Source: SORS (2019), Indicators of Innovative Activities in the Republic of Serbia, 2016–2018, Report No. 172

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).



Graph 13. 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).



Graph 14. 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.

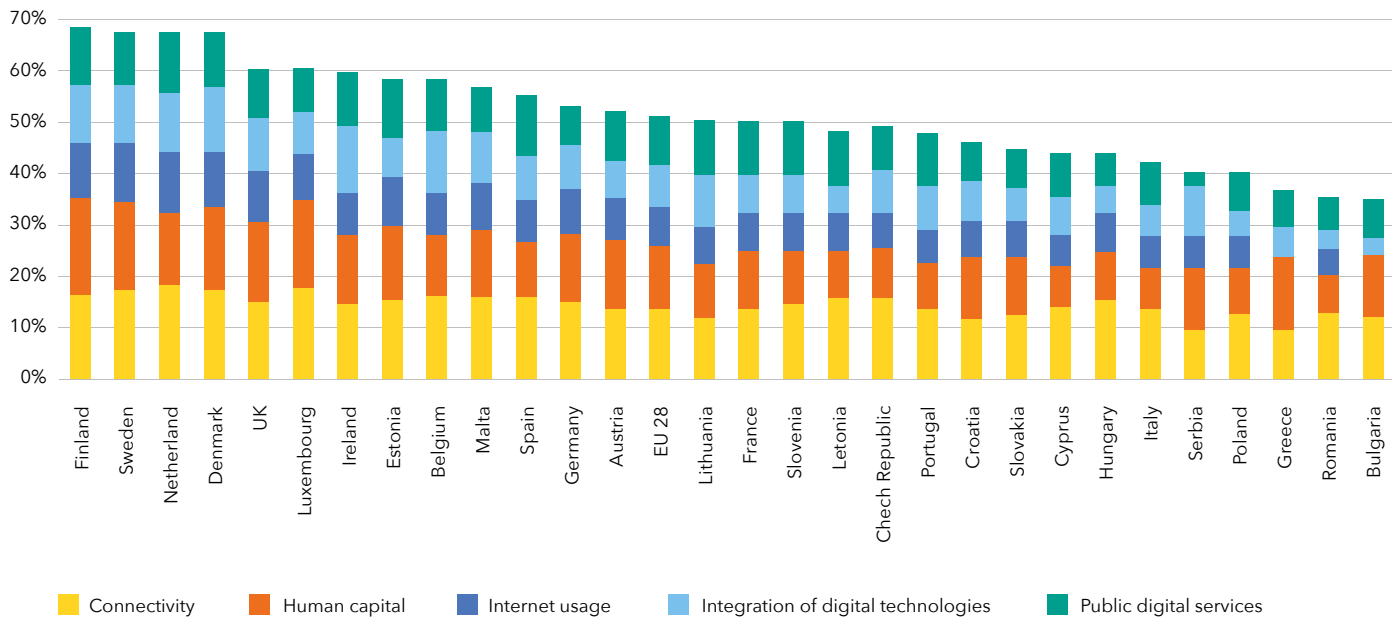
Use of information and communication technologies

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).

[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

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.*



Graph 15. DESI for EU and Serbia for 2018 *
Source: RATEL
*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.

[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.

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).

	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

Table 9. Maximum Internet connection speed in enterprises defined by the contract with an ISP
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).

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).

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).

Owning a Website	2014.	2015.	2016.	2017.	2018.
Use of public administration electronic services	74,0	75,2	80,8	80,4	82,6
Use of mobile internet connection using portable devices (smartphone, laptop, tablet ...)	92,0	94,5	98,6	–	–
Ordering products / services online	–	59,9	69,3	81,9	75,4
Receiving orders online	40,4	41,7	41,0	41,4	41,9
Use of some of the social networks for business purposes	21,2	22,9	23,3	23,8	26,3
Use of cloud service	27,0	28,6	36,1	39,2	39,7
The company employs ICT professionals	3,8	9,2	9,3	9,3	15,5
The company provides any kind of training employees to develop ICT skills	22,6	22,6	22,4	23,0	20,7
	18,9	25,5	27,5	30,2	23,3

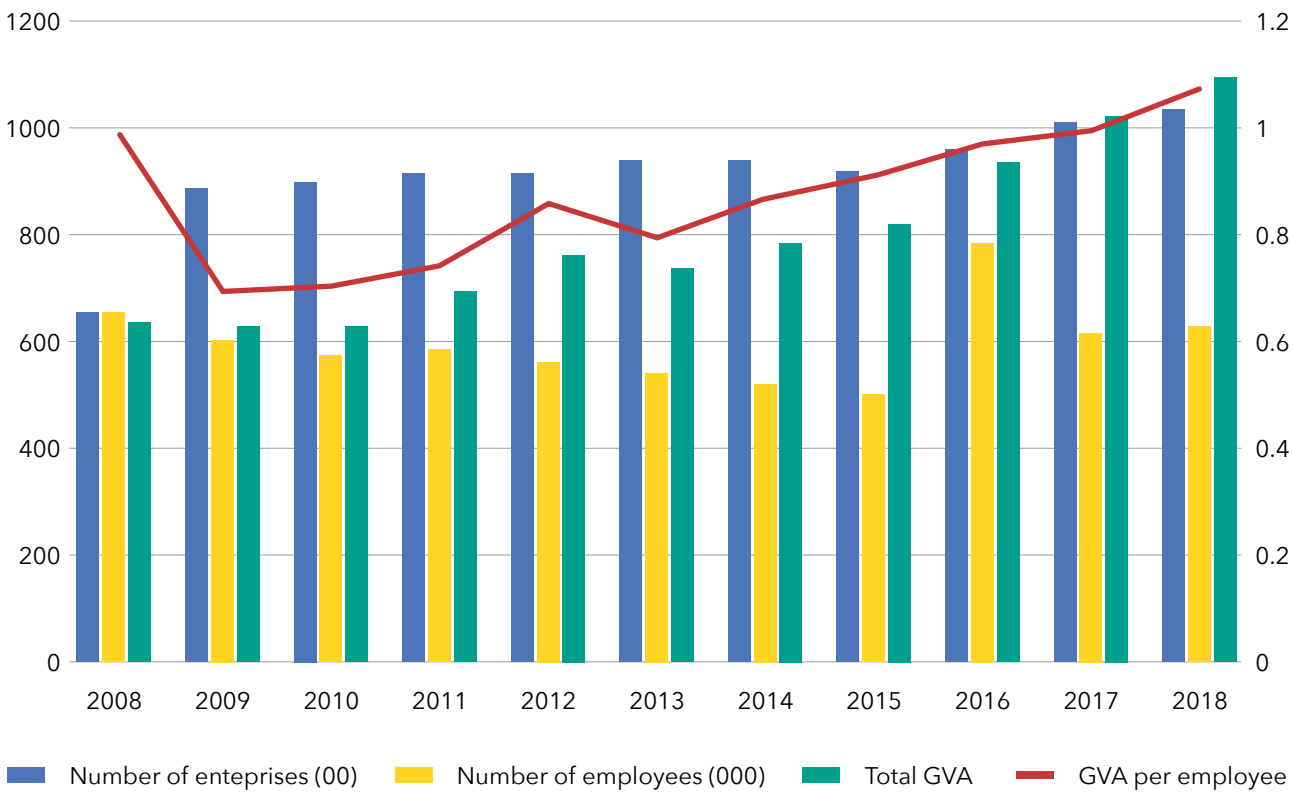
Table 10. Enterprises that responded positively about the use of ICT (%)
Source: SORS, data processed by the author based on the following publications: Use of information and communication technologies in the Republic of Serbia (issues: 2014, 2015, 2016, 2017, 2018).

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.

total	employing	participating with
99,5%	**57%**	**50%**
active enterprises	employees	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).



Graph 16. 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).

	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 quarryng	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

Table 11. Overview of the entrepreneurial sector in Serbia by activities in 2014 and 2018
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

No.	Stakeholder	Sector	Field
13	Zesium mobile	Business	Information and Communication Technologies
14	TotalObserver	Business	Information and Communication Technologies
15	TNation	Business	Information and Communication Technologies
16	Positive	Business	Information and Communication Technologies
17	Runa medija	Business	Information and Communication Technologies
18	ComData	Business	Information and Communication Technologies
19	Fractal Dimension	Business	Information and Communication Technologies
20	Createsi	Business	Information and Communication Technologies
21	Tehnološko partnerstvo	Business	Information and Communication Technologies
22	Veridix	Business	Information and Communication Technologies
23	Implementacija	Business	Information and Communication Technologies
24	Vodena	Business	Information and Communication Technologies
25	Harder Digital Sova	Business	KDTs and New Technologies
26	Visaris	Business	KDTs and New Technologies
27	Quadra graphic	Business	KDTs and New Technologies
28	Typhoon Hill	Business	KDTs and New Technologies
29	Iva 28	Business	KDTs and New Technologies
30	EdePro	Business	KDTs and New Technologies
31	RT-RK	Business	KDTs and New Technologies
32	Ep. belt	Business	KDTs and New Technologies

No.	Stakeholder	Sector	Field
33	Faculty of Technology and Metallurgy, University of Belgrade	Academia	KDTs and New Technologies
34	Enterijer Janković	Business	KDTs and New Technologies
35	Gir	Business	KDTs and New Technologies
36	Paneleven	Business	KDTs and New Technologies
37	Seven Bridges Genomics	Business	KDTs and New Technologies
38	CTT DOO	Business	KDTs and New Technologies
39	Game Credits	Business	KDTs and New Technologies
40	Physics Institute, Centre for Solid State Physics and New Materials	Academia	KDTs and New Technologies
41	Vinča Nuclear Institute, Physics Department	Academia	KDTs and New Technologies
42	NovelIC, elektronika	Business	KDTs and New Technologies
43	HTEC Group ket, elektronika	Business	KDTs and New Technologies
44	Ekofungi ket	Business	KDTs and New Technologies
45	Crater VFX Studio	Business	Creative Industry
46	Fab Lab	CSO	Creative Industry
47	Multikultivator	CSO	Creative Industry
48	DigitalKraft	Business	Creative Industry
49	Vision Team	Business	Creative Industry
50	SGA – Srpska gejming asocijacija	CSO	Creative Industry
51	Faculty of Dramatic Arts, Institute of Theatre, Film, Radio and Television Arts	Academia	Creative Industry
52	Nova Iskra	CSO	Creative Industry

No.	Stakeholder	Sector	Field
53	Red Art Workshop	Business	Creative Industry
54	Spring Onion	Business	Creative Industry
55	FDU	Academia	Creative Industry
56	Naxi Radio	Business	Creative Industry
57	Belgrade Polytechnic	Academia	Creative Industry
58	Kreativni centar	Business	Creative Industry
59	Comex	Business	Creative Industry
60	Tuli štamparija	Business	Creative Industry
61	Papir print	Business	Creative Industry
62	University of the Arts, Faculty of Fine Arts	Academia	Creative Industry
63	University of Belgrade, Faculty of Agriculture	Academia	Production of Food and Beverages
64	University of Belgrade, Faculty of Chemistry, Centre of Excellence for Molecular Food Science	Academia	Production of Food and Beverages
65	University of Novi Sad, Faculty of Agriculture	Academia	Production of Food and Beverages
66	Novi Sad Institute of Food Technology (NS FINS)	Academia	Production of Food and Beverages
67	Institute of Field and Vegetable Crops, NS Seme, Novi Sad	Academia	Production of Food and Beverages
68	University of Niš, Leskovac Faculty of Technology	Academia	Production of Food and Beverages
69	Desing d. o. o.	Business	Production of Food and Beverages
70	Agrounik d. o. o.	Business	Production of Food and Beverages
71	Biofor System d. o. o.	Business	Production of Food and Beverages
72	Drenovac d. o. o.	Business	Production of Food and Beverages

No.	Stakeholder	Sector	Field
73	Global Seed	Business	Production of Food and Beverages
74	Zlatiborac d. o. o.	Business	Production of Food and Beverages
75	ALL NATURAL FOODS d. o. o	Business	Production of Food and Beverages
76	Nelly d. o. o.	Business	Production of Food and Beverages
77	Delta Agrar d. o. o.	Business	Production of Food and Beverages
78	Timomed	Business	Production of Food and Beverages
79	Regionalni voćarski klaster Južne Srbije	Business	Production of Food and Beverages
80	Udruženje Leskovački ajvar	Business	Production of Food and Beverages
81	Žitounija, Žitobačka, Kula	Business	Production of Food and Beverages
82	University of Novi Sad, Faculty of Technology	Academia	Production of Food and Beverages
83	Institute for Science Application in Agriculture, Belgrade	Academia	Production of Food and Beverages
84	Vinarija Aleksić	Business	Production of Food and Beverages
85	Sanum per fructus d. o. o.	Business	Production of Food and Beverages
86	University of Novi Sad, BioSense Institute	Academia	Production of Food and Beverages
87	Plavi Kamen (Amoreti)	Business	Production of Food and Beverages
88	Bilje Borča, Beograd	Business	Production of Food and Beverages
89	Sirogojno Co, Sirogojno	Business	Production of Food and Beverages
90	Faculty of Technology and Metallurgy, University of Belgrade	Academia	Production of Food and Beverages
91	Amiga	Business	Manufacture of Machinery and Electronic Equipment
92	University of Novi Sad, Faculty of Engineering	Academia	Manufacture of Machinery and Electronic Equipment

No.	Stakeholder	Sector	Field
93	Indas	Business	Manufacture of Machinery and Electronic Equipment
94	T & P PLASTIC SRB	Business	Manufacture of Machinery and Electronic Equipment
95	HDD surgery	Business	Manufacture of Machinery and Electronic Equipment
96	Radijator Inženjering	Business	Manufacture of Machinery and Electronic Equipment
97	Kvalitet Niš	Business	Manufacture of Machinery and Electronic Equipment
98	Tim Sistem	Business	Manufacture of Machinery and Electronic Equipment
99	University of Belgrade, Faculty of Mechanical Engineering Innovation Centre	Academia	Manufacture of Machinery and Electronic Equipment
100	Servoteh	Business	Manufacture of Machinery and Electronic Equipment
101	Mont Stubline	Business	Manufacture of Machinery and Electronic Equipment
102	Fabrika Armature	Business	Manufacture of Machinery and Electronic Equipment
103	Kraljevo Faculty of Mechanical and Civil Engineering	Academia	Manufacture of Machinery and Electronic Equipment
104	3D Impuls	Business	Manufacture of Machinery and Electronic Equipment
105	Trefoil Inženjering	Business	Manufacture of Machinery and Electronic Equipment
106	Pomak d. o. o .	Business	Manufacture of Machinery and Electronic Equipment
107	Metalac FAD	Business	Manufacture of Machinery and Electronic Equipment
108	Omni Projekt	Business	Manufacture of Machinery and Electronic Equipment
109	University of Niš, Faculty of Mechanical Engineering	Academia	Manufacture of Machinery and Electronic Equipment
110	NEOMEDICA	Business	Manufacture of Machinery and Electronic Equipment
111	Proxima	Business	Manufacture of Machinery and Electronic Equipment
112	Techno Naiss Group	Business	Manufacture of Machinery and Electronic Equipment

No.	Stakeholder	Sector	Field
113	Lmb Soft	Business	Manufacture of Machinery and Electronic Equipment
114	Ortokon	Business	Manufacture of Machinery and Electronic Equipment
115	Traffix	Business	Manufacture of Machinery and Electronic Equipment
116	Feniks BB	Business	Manufacture of Machinery and Electronic Equipment
117	Alfa Clima	Business	Manufacture of Machinery and Electronic Equipment
118	EM DIP	Business	Manufacture of Machinery and Electronic Equipment
119	Flama	Academia	Manufacture of Machinery and Electronic Equipment
120	Alfa-Plam	Business	Manufacture of Machinery and Electronic Equipment
121	NS Radijatori	Business	Manufacture of Machinery and Electronic Equipment
122	Čip	Business	Manufacture of Machinery and Electronic Equipment
123	Mikoterm	Business	Manufacture of Machinery and Electronic Equipment
124	Ansal Steel	Business	Manufacture of Machinery and Electronic Equipment
125	Nitehnoklima	Business	Manufacture of Machinery and Electronic Equipment
126	Sentronix	Business	Manufacture of Machinery and Electronic Equipment
127	Tagor EMS	Business	Manufacture of Machinery and Electronic Equipment
128	Eurogenyx	Business	Manufacture of Machinery and Electronic Equipment
129	DMV	Academia	Manufacture of Machinery and Electronic Equipment
130	EI PCB	Business	Manufacture of Machinery and Electronic Equipment
131	Netico Solutions	Business	Manufacture of Machinery and Electronic Equipment
132	Nigos Elektronik	Business	Manufacture of Machinery and Electronic Equipment

No.	Stakeholder	Sector	Field
133	Mikkelsen Electronics	Business	Manufacture of Machinery and Electronic Equipment
134	D-Company	Business	Manufacture of Machinery and Electronic Equipment
135	Tim Industriel Steel	Business	Manufacture of Machinery and Electronic Equipment
136	Metalurg	Business	Manufacture of Machinery and Electronic Equipment
137	Dahop utva	Business	Manufacture of Machinery and Electronic Equipment
138	Ming kovačnica	Business	Manufacture of Machinery and Electronic Equipment
139	Gama consulting	Business	Manufacture of Machinery and Electronic Equipment
140	Eko Fungi	Business	Manufacture of Machinery and Electronic Equipment
141	Ministry of Mining and Energy	Government	Environmental Protection and Energy Efficiency
142	University of Belgrade, Faculty of Mechanical Engineering	Academia	Environmental Protection and Energy Efficiency
143	Fabrika hartije Beograd	Business	Environmental Protection and Energy Efficiency
144	ACE Zrenjanin	Business	Environmental Protection and Energy Efficiency
145	Buck	Business	Environmental Protection and Energy Efficiency
146	Keep Light	Business	Environmental Protection and Energy Efficiency
147	FYLTRIS	Business	Environmental Protection and Energy Efficiency
148	Metalac	Business	Environmental Protection and Energy Efficiency
149	Energetika	Business	Environmental Protection and Energy Efficiency
150	Evrotehna	Business	Environmental Protection and Energy Efficiency
151	Interklima	Business	Environmental Protection and Energy Efficiency
152	Korali	Business	Environmental Protection and Energy Efficiency

No.	Stakeholder	Sector	Field
153	Termomont	Business	Environmental Protection and Energy Efficiency
154	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	CSO
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

Ред.бр.	Priority area	Sector
13	Cip	Business
14	RT-RK	Academia
15	Ace-Automatic Control Engineering	CSO
16	ABC proizvod	Business
17	Endava	Academia
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 Entertainement	Business

No.	Priority area	Sector
33	Faculty of Mechanical Engineering, University of Niš	Academia
34	University of Niš	Academia
35	Badin Soft	CSO
36	Shindiri studio	Business
37	Prime Software	Academia
38	NIRI	Government
39	PSR/RCMT	Business
40	Start-up centar Niš	Business
41	Faculty of Sciences and Mathematics, University of Niš	Academia
42	City of 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

No.	Priority area	Sector
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 Enterteinement	Business
69	Faculty of Electrical Engineering, University of Belgrade	Academia
70	Mihajlo Pupin Institute	Academia
71	Innovation Fund	Government

No.	Priority area	Sector
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	Academia
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

No.	Priority area	Sector
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

No.	Priority area	Sector
40	Kvalitet a. d. 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	Business
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

No.	Priority area	Sector
Creative Industries		
1	3Lateral	Business
2	Case 3D	Business
3	Crater VFX Trening centar	Business
4	Digital Asset Tailors	Business

No.	Priority area	Sector
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

No.	Priority area	Sector
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

No.	Priority area	Sector
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 Institut	Business
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

No.	Priority area	Sector
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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APPENDIX 3

Interim Report: From the EDP to the Smart Specialization Strategy

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.

Methodological approac

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

SWOT general and specific	Grouping related SWOTs by priority areas Regrouping incorrectly categorized items (S/W/O/T) Forming a SWOT matrix of items common to all priorities Execution of regulated specific SWOT matrices by priorities
VISION from the Smart and Creative Serbia	Deriving the essence of the vision statement by areas Forming a common vision of smart specialization Deriving common goals and goals specific to priorities
POLICY MIX priority, specific, achievable, continuous	Implementation of the policy mix that: Envisages only specific and achievable measures Focuses on measures aimed at common goals, and highlights key aspects for specific priority goals Provides process continuation and permanent 4S development

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

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.

STRENGTHS

- Strong expert base

WEAKNESSES

- Problem of providing a quality workforce (low awareness, resistance to change, innovation and application of new technologies, underdeveloped "soft" skills)
- Shortcomings of the education system
- 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
- Lack of infrastructure (laboratories, transfer centers, certification bodies of high performance concentrated infrastucture) and lack of suppliers of professional equipment and financial support

OPPORTUNITIES

- Improving the ability to absorb funding from existing sources of funding and opening up new financing opportunities for development

THREATS

- Demographic trends related to the outflow of professional staff
- Characteristics of national culture related to the difficulties in accepting novelties with a pronounced lack of trust in the domestic innovation potential
- Characteristics of socio-political environment, negative phenomena in society, partly inadequate legal framework and inefficient public administration
- Unequal competitive position (lower subsidies compared to developed countries, support for foreign companies, inability to access certain markets, privilieged position of the regional countries that are the EU Member States, poor image of Serbia as a producer)
- Lack of funding and access to funds, as well as lack of adequate financial support

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

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.

F3	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	Number of companies (gaming) High quality, low price, low labor costs, taxes, software, training, intellectual property that attracts investors
CI/SP	Regional concentration (smart packaging) Small, operational, innovative, high-performing, companies with competitive prices
ICT	Agility and completeness of the offer Availability and ability to develop knowledge
MPP	Tradition, flexibility, commitment, openness to innovation and willingness to improvise High quality products at lower prices, great experience

Table 2. Comparative overview of strengths by priority areas

> *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:

1	smart structuring of production capacities and introduction of new production programs
2	smart orientation towards new markets; and smart choice of marketing and sales strategies
3	enhancement of the knowledge base required by smart specialization

F3	**INNOVATION**	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	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

Table 3. Comparative overview of OPPORTUNITIES by priority areas

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.

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

Table 4. Comparative overview of weaknesses by priority areas

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.

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.

F3	CI	ICT	MPP
SERBIA – PRODUCER **OF VALUE ADDED FOOD THROUGH KNOWLEDGE- BASED PARTHERSHIP**	**CREATIVE** INDUSTRIES PROMOTE **INDIVIDUAL AUTHORS' WORK** AND **ADD VALUE TO OTHER SECTORS** OF SERBIAN ECONOMY THUS CONTRIBUTING TO THE **POSITIONING** OF SERBIA AS A HIGH-TECH AND GLOBALLY COMPETITIVE ECONOMY	SERBIA, SOURCE OF **SOPHISTICATED** HIGH-TECH **SOLUTIONS AND SERVICES FOR THE GLOBAL MARKET**	**INDUSTRIAL INNOVATIONS BASED ON EFFICIENT INTERSECTORAL COOPERATION**
VALUE-ADDED FOOD THROUGH PARTHERSHIP BASED ON KNOWLEDGE	**CREATIVITY OF INDIVIDUALS SUPPORTED BY KNOWLEDGE AIMED AT INCREASING COMPETITIVENESS**	**SOPHISTICATED SOFTWARE SOLUTIONS AND SERVICES FOR THE GLOBAL MARKET**	**INDUSTRIAL INNOVATION BASED ON EFFICIENT INTERSECTORAL COOPERATION**
„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:

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

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 stretegy 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 inovation were derived.

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			

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

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.

EDUCATION SYSTEM IN FUNCTION OF INNOVATION AND ENTREPRENEURSHIP			
SWOT – common weakness for all priority areas: Shortcomings of the education system			
Goals by priority areas derived from the EDP			
F3	**CI**	**ICT**	**MPP**
Put education in the function of innovation and technological development in the field of agriculture and food production	Increase institutional and technical capacities of higher education so that they serve professional orientation	Develop the education system in Serbia towards a student-and market-oriented paradigm	Harmonize and adjust curricula of technical universities to meet the requirements of industries in the region
Develop entrepreneurial ecosystem		Develop an ecosystem for supporting entrepreneurship	Improve internal management processes in companies and modernize production processes and technological procedures
Derived common goal			
GOAL 3: Education focused on innovations and entrepreneurship			

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.

PUBLIC SUPPORT SYSTEM			
SWOT – common threat for all priority areas: Characteristics of the socio-political environment, negative phenomena in society, partly inadequate legal framework and low efficiency of the public administration			
Goals by priority areas derived from the EDP			
F3	**CI**	**ICT**	**MPP**
Reduce risks in agriculture and food production through improved public support system and infrastructure development		Optimize legal framework towards creating an environment that supports business activities	
Derive common goal			
GOAL 4: Improved business conditions through optimization and digitization of procedures in the fields of 4S			

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 subsidied 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.

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)			
Goals by priority areas derived from the EDP			
F3	CI	ICT	MPP
			Positioning and creating the image of Serbian industry in the international market
Derive common goal			
GOAL 5: Internationalization of the economy through inclusion into regional and global value chains in the 4S fields			

Table 9. Common goals of the priority areas related to the market position

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).

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

Table 10. Specific goals by priority areas

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.

4S Goal	Planned measures
COMMON GOALS AND MEASURES FOR ALL PRIORITIES	
GOAL 1: Research and development focused on 4S priorities	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	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	3.1. Training for researchers aiming to strengthen cooperation with the business sector 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 environemental 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: Internationaliza-tion of the economy through inclusion into regional and global value chains in the 4S fields	5.1. 5.2.	Establishing interregional partnerships within thematic smart specialization platforms Establishing cooperation with countries in the region as part of the smart specialization

Table 11. Action Plan

SERBIA CREATES INNOVATION

Smart and Creative Republic of Serbia highly competitive in the world and recognized by knowledge-based innovation, partnerships from the domestic eco-system and creativity of individuals in the areas of:

SUSTAINABLE HIGH-TECHNOLOGICAL **FOOD** PRODUCTION WITH HIGH ADDED VALUE FOR **THE FUTURE**

SOPHISTICATED **SOFTWARE SOLUTIONS** FOR THE GLOBAL MARKET

INTERSECTORAL GROUNDED **INDUSTRIAL INNOVATION**

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