THE EVALUATION AND IMPLEMENTATION OF A SMART SPECIALIZATION STRATEGY

Mirjana Kranjac and Jakob Salom

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INTRODUCTION

The book aims to define and promote the concept of smart specialisation of a region and why it is essential to have smart specialization strategies (S3) at national and regional levels for the future growth of the European innovation space and the strengthening of the European economy.

The book presents a process of how the smart specialisation strategy of a country or a region is developed and offers a methodological tool that has proved to be suitable for S3 creation in practice. This tool is necessary for state and regional administrations to develop such strategies, and the European Union (EU) demands that each region has it. Having S3 brings additional points during the evaluation of project applications for EU funding.

Additionally, the authors explain the entire process of generating S3 in a selected country, its activities roadmap, and examples of implementation activities.

The significant added value of the book is the recommendations for future activities of the European Commission regarding smart specialization development and implementation in European regions, states, and the whole European Union. The book presents possible enhancements and intensification of the adoption of Smart specialisation principles within the entire European area. It is an excellent example of how to promote European values and how to force, in the best way, states' integration into EU activities and EU society. The readers can find a real-time methodology based on the EU recommendations, which shows the importance of being a member of the European Union. The authors stress the importance of including non-EU countries in the process of preparing them to become EU members more easily.

CHAPTER 1

DEFINITION OF SMART SPECIALIZATION

As most EU countries fully support and work diligently on Smart Specialisation of their regions, it is advisable to start this book with the European Commission's definition of the concept:

> "Conceived within the reformed Cohesion policy of the European Commission, Smart Specialisation is a place-based approach characterised by the identification of strategic areas for intervention based both on the analysis of the strengths and potential of the economy and on an Entrepreneurial Discovery Process (EDP) with wide stakeholder involvement. It is outward-looking and embraces a broad view of innovation, including but certainly not limited to technology-driven approaches, supported by effective monitoring mechanisms" (EC, What is Smart Specialisation).

The Smart Specialization Strategy (S3) is an essential development program that raises the competitiveness of the economy and the progress of the general public. It links the economy, decision-makers, academia, and civil society by connecting research and innovation resources with industrial potential and the strength of a limited number of economic sectors. S3 directs resources to sectors that have the most outstanding innovative and competitive potential. Smart specialization enables more efficient use of potential within the country's economy and a better position in the international value chains of the global economy. With better-identified innovation and science and technology sectors, S3 decreases duplication and fragmentation of efforts and waste of financial resources within European regions. It brings more effective sustainable development of the economy based on their specificities.

In short, the goals of S3 are:

- To use limited natural and human resources rationally,
- To prevent countries and regions from carrying out research and innovation activities in all areas,

- To convince countries and regions to centre their research and innovation activities on ones that will help them accomplish the best outcomes and that will be used in other regions and the entire European Union.

Research and Innovation of the Smart Specialization Strategy (RIS3) are essential in dealing with the economic development of a country or region through focused support for research and innovation (Midtkandal and Sörvik, What is Smart Specialization? 55). What is vital for smart specialization is to have a good overview of necessary developments within a region or nation, identifying where the most significant strategic potential is. It also stresses the importance of developing a control system that will allow multi-stakeholders to set strategic priorities and increase development potential through intelligent policies.

This concept comes from a few complementary sources. A part of it comes from Dominic Foray and the expert group "Knowledge for Growth" within the European Research Area (ERA). The subject that the group of experts analysed is the fact that Europe is less competitive than the USA, especially in its capacity for research and development and in the distribution of new technologies. The analysis shows that research in Europe is too fragmented and that the coordination between stakeholders regarding their investments in research and innovation (R&I) is relatively poor. Namely, most stakeholders invest in similar and modern areas with an "only me" syndrome. The fields such as nano- and biotechnologies and information and communication technologies (ICT) almost dominate investments (EC, Research and Innovation). The expert group recommends a structural change in habits and development in fields that correspond to local strategic potential in each European region. It is necessary to invest in R&I in new sectoral areas or industries, anticipating that regions and countries differ in strength and potential (Foray, David and Hall, Smart specialization - academic idea), (McCann and Ortega-Argilés, Smart specialization - regional growth).

Thus, it is evident that research and development should support things specific to practically oriented applied sciences and other new technologies. Stakeholders of regions must be observant of the strategies in other areas. They should identify niches for themselves, and, therefore, those strategies must, for different regions, be different. However, in some cases, it is advisable to cooperate the policies with other regions and jointly compete thereafter (Boschma, Minondo, and Navarro, Related Variety, 241).

To ensure balanced development across Europe and to reduce disparities between Europe's regions, the European Commission created a cohesion

policy. "Structural funds are the main tool to implement such a policy and, within this process, smart specialization was introduced" (Dow, Treatment of money, 13), (Soete, Chatterjee and Hunt, Research without Frontiers, Chapter 28).

In the 2014-2020 programming period, the Cohesion Fund's average investment in R&I across Europe was close to   €65 billion, about 30% of its total allocations. The main goal of this fund is to promote innovation through the Cohesion Policy programmes for 2014-2020. In the broader sense, the plans in the budget period from 2014 to 2020 were (1) In developed countries and countries in transition, to direct 80% of investments toward renewable energy sources, energy efficiency, and the development of SMEs and R&I competitiveness; and (2) In less developed regions, to direct 50% of investments toward the same fields. In order to receive EU funding for R&I&D (ERDF), a smart specialization strategy (RIS3), which supports such plans, must be developed.

"The ideas on Smart Specialization are in line with the EU 2020 strategy and the strategy should be a response to the current economic crisis" (Dow, Treatment of money, 13), (Soete, Research without Frontiers, Chapter 28). Thus, S3 identifies where the competitive advantages are, what supply and demand problems exist, creates partnerships for innovations that focus on greater cooperation between different societal stakeholders, and equalizes public and private resources and programs. Additionally, smart specialization transposes EU R&D investments, mainly from northern countries to southern regions, to find their strength, develop innovation potential, and use dedicated funds (Carlino, Urban density, 389).

Regional Innovation and Regional Innovation and Technology Transfer Strategies (RIS and RITTS) were the forerunners of S3. While working on them, regions gain accumulated knowledge, which is the basis of Smart Specialization. That has been a successful concept. However, instead of engaging local and regional stakeholders and experts to develop strategies, many regions used external experts to do that, and such a method created problems. With lacking entrepreneurs' participation during the design phase of the first group of strategies, the bottom-up way of thinking was less used, and the regional approach more. This method produces strategies that focus too much on technology and R&D and too little on other innovation areas, such as service innovation. They neglect the need for greater policy integration. (Boschma and Hunt, Related Variety, 289), (Karlsson, Johansson, and Stough, "*Entrepreneurship*").

The European Commission created a valuable and unique tool called the S3 Platform for all Smart Specialisation Strategy development issues and

its application, monitoring, and assessment. The platform is available on the website: (EC, S3Platform). The EC created this tool with the goals to:

- Provide expert materials and great practice models,
- Inform policy-making,
- Support peer-reviews and shared learning,
- Enhance admittance to significant information,
- Train strategy producers.

The tools that are at disposal on the site are the following:

- *Eye@RIS3,*
- *ESIF-Energy,*
- *Regional Benchmarking,*
- *EU Trade,*
- *R&I Regional Viewer,*
- *Digital Innovation Hubs.*

Eye@RIS3

Eye@RIS3 gives a picture of specific innovation sectors across Europe. It empowers public administrators and partners to situate the domains of different regions' interests and discover suited companies for cooperation between regions. The Eye@RIS3 is an online information base of RIS3's most important priority sectors in each European region. It is an instrument for helping methodology advancement. Regions should present/update their contribution to the data set, which will create a good guide of the cycle of the created RIS3.

ESIF-Energy

ESIF-Energy is an interactive instrument to see in Operational Programmes (OPs) of European Structural and Investment Funds (ESIF) which nations and locales intend to put resources into similar energy sectors. The ESIF Energy Monitoring tool is designed to find regions with similar or integrative interests in different energy technologies or areas.

Regional Benchmarking

Benchmarking is the process of learning from the best localities or from those that are under similar conditions. These regions could be called reference regions for the area that is being analysed. When creating an S3 strategy, benchmarking is finding regions with a similar level of advancement in various attributes: social, economic, legislative, scientific, educational, and technological. After such regions are found, it is necessary

to transfer from them the learning methodology and policy together with practical issues. But what are the criteria one ought to consider as a kind of perspective in these selections? The attributes, which benchmarking teams should consider for selecting a reference region to learn from, should be long-term and those that presently "affect the way innovation and economic evolution take place in a region" (EC, S3Platform). These attributes influence how advancement and financial development occur in a region. Besides, there is an online tool that helps in finding relevant regions all over Europe. This tool-finding philosophy was created collectively by "Orkestra" – the Basque Institute of Competitiveness and the S3 Platform.

EU Trade
Competitors' Map
The competitors' map is an interactive and web-based application that offers a picture of goods' flows between regions and shows the competitiveness of each region inside the EU. The application enables insight into the economic position of each locality as the beginning of smart specialisation strategies creation based on place, economy, demographics, and, in general, evidence-based facts.

R&I Regional Viewer
The R&I Regional Viewer is a platform for two types of analysis. It presents information about projects financed by Horizon 2020 through DG R&I and investments given for R&I under the European structural and investment funds (ESIF). All interested can select which of these two data groups to look at the H2020 or ERDF Dashboard. A user of this service, available on the S3 platform, can select any two regions and compare them regarding:

1. data about regional specialization (markers and dissemination of topics),
2. who the recipients of the projects were,
3. data about the projects themselves.

Digital Innovation Hubs
The digital transformation is a basis for the EU to be competitive with other continents and associations. The European Commission assists organizations in making this process faster giving them the possibility to expand using digital transformation. All segments of EU society should be included in the digitalisation process and benefit from it under the Digitising European Industry (DEI) initiative. This is particularly important for SMEs

and the non-tech industry. The EU performs this process by gathering all interested parties dealing with digitalisation to establish Digital Innovation Hubs.

The tool, called The Digital Innovation Hubs, gives a list of innovation hubs that are *set up* in Europe. The list is formed as a catalogue that can be used online. The idea is to enable companies to find competent collaborators to enhance the digitalization of their business processes, services, and products and make their lives easier in a competitive space. On the other hand, the catalogue is a valuable tool for innovation hubs to establish networks, start new cooperations with other hubs, and with bridging organizations and companies to exchange and improve their competencies and achieve their goals.

On S3 Platform web pages, decision-makers and experts, who are involved in regional development activities, can find "The Guide on Research and Innovation Strategies for Smart Specialization" (RIS3). It describes the methodology for creating good smart specialization research and innovation strategy. The steps to follow are:

- Explaining how to analyse the innovation potential,
- Defining the RIS3 process and putting the proper governance (The vision should be created jointly.),
- Prioritizing sectors of the most significant importance,
- Defining a roadmap with detailed further steps of activities together with all stakeholders and, especially, the decision-makers,
- Monitoring, controlling, assessing, and evaluating each milestone.

How should one go through all these steps? The experts working on the creation of such a document should:

- Use experience and all lessons from the past,
- Use knowledge from entrepreneurs and activate it—a procedure named 'entrepreneurial process of discovery' or an 'entrepreneurial discovery process' (EDP),
- Include every region with its role.

The authors consider the EDP procedure the most important one and describe it in detail in the third chapter of this book.

On the S3 Platform, there is an excellent explanation of the concept of Smart Specialisation and why it is 'smart'. In short:

"• Firstly, it links the research and innovation with economic development in novel ways, such as the entrepreneurial discovery process and the setting of priorities by policymakers in close cooperation with local actors.

• Secondly, this process is carried out with an eye on the outside world, forcing regions to be ambitious but realistic about what can be achieved while linking local assets and capabilities to external sources of knowledge and value chains. However, while each regional or national strategy will share standard features, the place-based approach shows us that understanding the local context is crucial to their successful design." (EC, S3Platform)

CHAPTER 2

ANALYSIS OF COUNTRIES' ECONOMIES USING SMART SPECIALIZATION PLATFORM[1]

The Smart Specialisation Platform helps regional and national authorities to prioritise their efforts to create an innovative economy. Established by the European Commission in 2011, it facilitates mutual learning, data gathering, analysis, and networking opportunities for more than 170 EU regions and 18 national governments. The Platform has been instrumental in consolidating, disseminating, and implementing smart specialisation methodology across European regions. It has helped to optimise the definition of innovation strategies based on regional strengths and through an open and participatory process. It is an essential means of improving EU investments in knowledge-based territorial development. Defining the right sectoral priorities is very important. Some regions want to specialize in sectors that are "fashionable" and not in traditional ones where they possess real strength and traditional advantage.

The authors of this book published the paper "Visualization of the smart specialization process using Quantum Geographic Information System (QGIS) tools" (Kranjac, Mirjana et al., Visualization). They explain how to use specific ICT tools and the Entrepreneurial Discovery Process to present defined sectors. These ICT tools cross-cut EDP outcomes with economic, social, political, climatological, and other data. Of course, integration with emerging technologies, defined by visionary scientists and artists, must be included in this process.

The authors used QGIS software to analyse correlations between selected smart specialization sectors for specific regions and some essential and relevant economic facts related to those regions. Such analysis proves whether the choice of every smart specialization sector was correct for a particular country or region. The authors proposed new methods for starting to define smart specialization priorities and how to check final results. They

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[1] For this chapter, the authors used the results and explanations from their research "Visualisation of the smart specialization process using Quantum Geographic Information System (QGIS) tools" (Kranjac et al., Visualization).

recommended an implementation methodology to avoid errors in the decision-making process.

1. Methodology

GIS technology works with georeferenced data and enables its collection, organization, manipulation, analysis, and visualization. It is suitable for finding relationships between entities, creating patterns, finding and following time and space changes and trends. Its use started with public health patterns. Demographics are spatial issues, and GIS enables a lot of visualised discoveries. GIS is an ICT assistance tool in many different sectors of human activity. Some examples are urban planning, ecology, and analysis of transportation problems. GIS is precious for analysing social and human issues, e.g., in law and resource management. It is also helpful for micro and macro analysis of many industrial problems. It includes different techniques: linking databases, georeferencing, research, and visualization.

GIS as a software tool includes many geostatistical techniques for spatial analysis that have extended and improved over the years. It offers a raster analysis and enables analytical methods for businesses. It is often used in 3D analysis, network analytics, space-time dynamics, and techniques specific to various industries.

The authors were using a user-friendly open-source geographic information system, QGIS, previously known as Quantum GIS. QGIS supports numerous vector, raster, and database formats and functionalities and works on all PC and Android platforms. The developers who maintain QGIS and regularly release updates and bug fixes work as volunteers. Developers translated QGIS into 48 languages in 2012, and it is frequently used internationally in academic and professional environments.

2. QGIS for Visualization of Smart Specialization Process

The authors analysed the agricultural sector as a defined priority sector for smart specialization in some countries and compared this choice with actual economic data showing their agricultural sectors' potential. They used QGIS Desktop 2.0 to visualize various financial data on agriculture and food production within EU member countries. They selected the following data:

- Percentage of agricultural exports within total exports,
- The size of the agriculture labour force,
- Percentage of agricultural gross value added within the total GVA.

Figure 2-1 presents countries that defined agriculture and food production as priorities within the smart specialization strategy. Agriculture and food production are the smart specialization priorities in Hungary, Croatia, the Czech Republic, Poland, Lithuania, and Ireland.
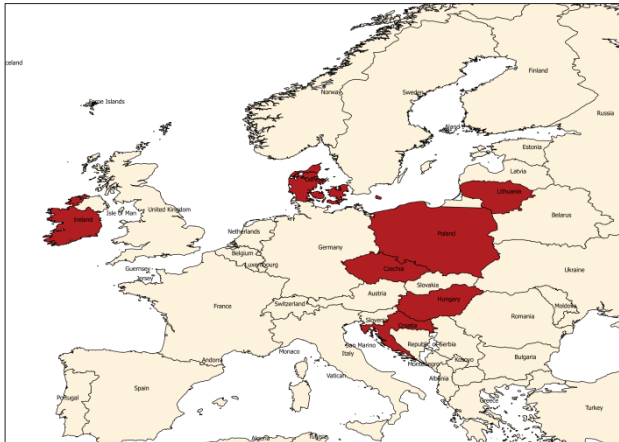
Figure 2-1. Countries that defined agriculture and food production as a smart specialization strategy priority. Source: Authors

The layer in Figure 2-2 presents data on the percentage of agricultural exports within total exports in EU member states in 2019 in a categorized style. Countries with more significant exports are coloured in darker colours. In the layer (Figure 2-3) countries marked with number 1 have agriculture as their focus in their smart specialization strategies. The overlapping of the two layers is depicted in Figure 2-4.

Figure 2-2: Percentage of agricultural exports within total exports in EU member states (2016). Source: Authors

Figure 2-3. The labels 1 and 0 for countries with defined and not defined agriculture as Smart specialisation strategies. Source: Authors

Figure 2-4: Overlapping Figures 2-2 and 2-3. Source: Authors

The numbers from the second QGIS layer (Figure 2-3) are added to the first layer (Figure 2-2) and presented in Figure 2-4. Numbers mean the following:

Number 1: agriculture and food production are smart specialization priorities.

Number 0: agriculture and food production are not smart specialization priorities.

Some countries with weak agricultural exports have put agriculture as a smart priority. On the other hand, countries with significant exports, like Spain and Greece, the Netherlands, Lithuania, and Denmark, did not put agriculture as the focus of their smart specialization. They did not recognize agriculture as a source of innovations.

Countries without any colour do not yet have a smart specialization strategy.

Figure 2-5 shows the portions of agricultural exports within the total exports of EU member countries in a categorized style with inscribed values of percentages of the agricultural exports.
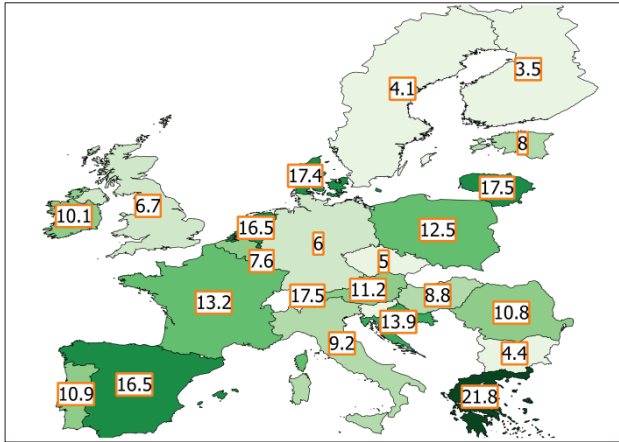
Figure 2-5: Percentage of agricultural exports within the total exports in EU member states (2016). Source: Authors

Figure 2-6 presents the same as Figure 2-5 but with the QGIS canvas with its toolbars. All previous figures are made as QGIS maps and exported with an export resolution of 256 dpi (dots per inch) in the TIFF (Tagged Image File Format) format to store high-quality raster-type graphics.
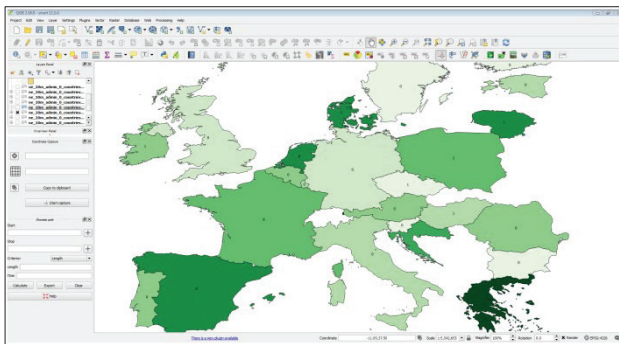
Figure 2-6. Percentage of agricultural exports within total exports in EU member states (2016) with QGIS canvas. Source: Authors

Figure 2-7 presents gross added value (GVA) in agriculture in 2019 for EU countries. The grey colour is getting darker in countries where GVA is higher. Hungary, Greece, and Bulgaria have the highest GVA, and the

lowest GVA is in Italy, followed by Great Britain and Germany. Numbers from the other QGIS layer are added to the previous one and presented the same way as in Figure 2-3.

When the two QGIS layers are overlapped, data on GVA and data on smart specialization priority do not correlate, and they do only in the case of Hungary.
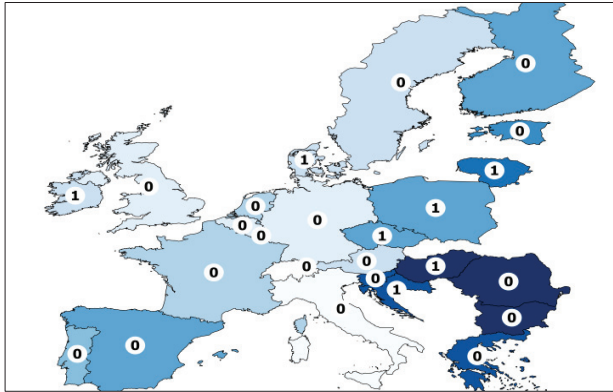
Figure 2-7: Percentage of agricultural GVA in EU member states in 2016 (intensity of grey colour) and agriculture in the focus of smart specialization (ones and zeroes). Source: Authors

Figures 2-8 and 2-9 present another essential factor—employed labour in agriculture and food production. Following the same principle, the grey colour is getting darker where the number of employees increases. Romania has the highest number of employed in agriculture, followed by Greece and Poland.
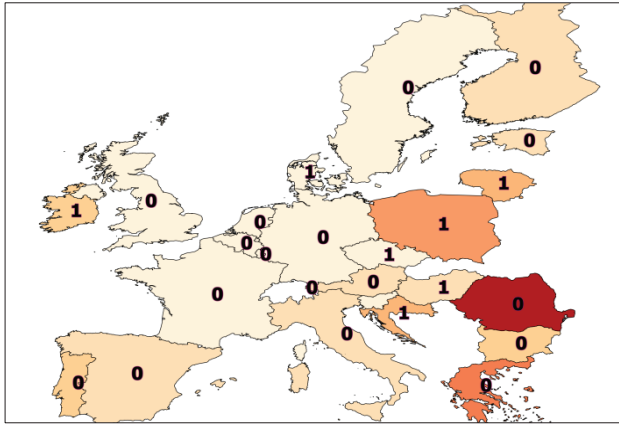
Figure 2-8: Employed labour in agriculture and food production
In EU member states (2016). Source: Authors

Figure 2-9 presents the same data, with the added names of the countries.
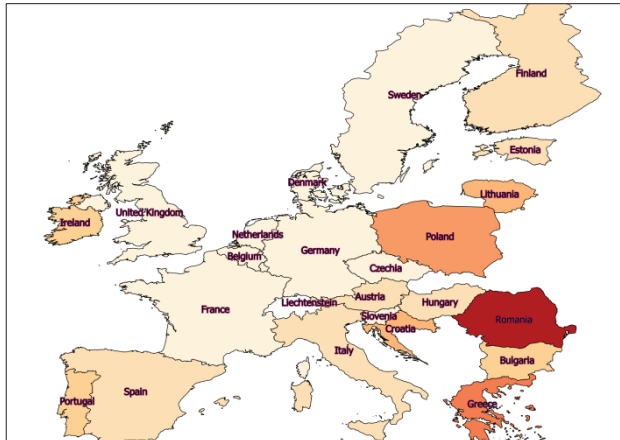
Figure 2-9. Employed labour in agriculture and food production in EU member
states with countries' names (2016). Source: Authors

Figure 2-10 presents data about employed labour in agriculture in 2016
(in millions).
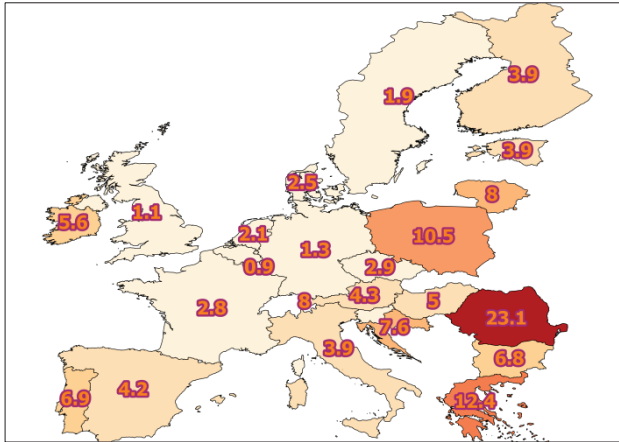
Figure 2-10: Data about employed labour in agriculture (2016).
Source: Authors

Figure 2-11 shows visualized data about GVA. There are GVA values for each country.
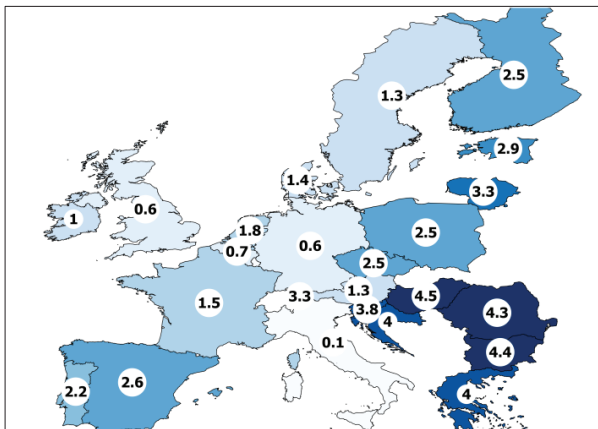
Figure 2-11. Visualized data GVA (shades of grey) with added values
Of GVA for each country (2016). Source: Authors

Figure 2-12, like the previous one, contains visualized data on exports percentages of agricultural products within entire countries' exports (shades of grey) with inscribed values of exports.
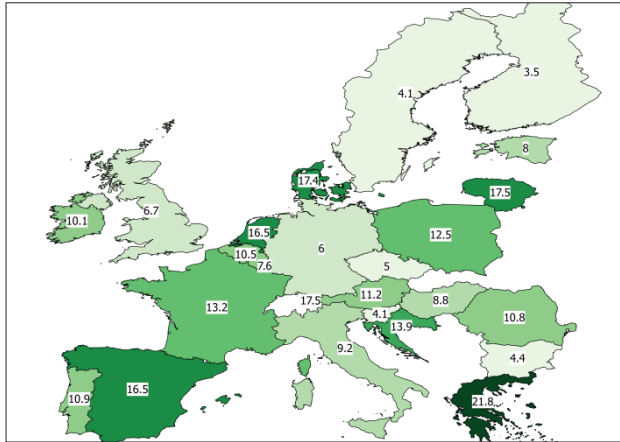
Figure 2-12: Visualized data on exports of agricultural products with a percentage
of agricultural exports within total exports
In EU member states (2016). Source: Authors

3. A new method for the decision-making process of smart specialization

Identification of smart specialization priorities for each region and country is of great significance. The European Union prioritised smart specialisation and adopted a principle to launch all funding directly linked to defined priorities. That means that niches presented within smart specialization strategies will direct all research and development processes. Thus, the process of selecting the right priorities must depend on a complete set of carefully selected data.

Information-communication technology with its tools is a suitable means for analysing data. In this section, the authors presented using software visualization of various data to make the right decisions.

The new method of creating smart specialization focus sectors should consist, first, of going through the whole, already defined and mentioned, EDP process with the inclusion of many stakeholders' groups into activities. Afterwards, an analysis using GIS tools should be performed through the following steps:

- Smart specialization experts should define which data is relevant for selecting smart specialization sectors, regional and national.
- They should present available sources of shown data.

- They define which layers of data should be created and cross-checked.
- GIS experts will create the requested layers and their cross layers.
- Smart specialization experts will analyse all prepared layers and give conclusions.
- Conclusions should be new inputs to a new EDP process.
- This circle should be repeated until the final convergence of outputs of the EDP process and GIS analysis.
- Some other IT tools could be included in this process, too.

Such an approach gives better outputs and impacts and could be repeated regularly to indicate whether correcting the selected specialized areas is necessary.

If a continuous development of the European Union is a goal, it is essential to have the correct sectors/areas defined for the smart specialization of each region. Any mistake in this procedure will cause a slowdown of the EU development process and decrease the EU's ability to compete correctly and successfully with the rest of the world. The authors used QGIS software to visualize data on smart specialization sectors and data on countries' economies. This analysis created using this methodology shows a lack of correlation between chosen/defined smart specialization sectors for specific countries and economic factors related to the same regions.

In this chapter, the authors analysed the sectors of agriculture and food production. They proposed a new method of cross-checking smart specialisation defined areas of agriculture with actual economic data from the regions' agriculture sectors. The authors suggest the same method for any sector of the economy expressed as a focus sector. Such a procedure should be implemented in all regions and countries to avoid errors in the decision-making process.

CHAPTER 3

WHAT IS AN ENTREPRENEURIAL DISCOVERY PROCESS (EDP)?

1. Definition of EDP

Some of the key highlights, which leading researchers and strategy makers managing innovation policies brought up, characterize what EDP is:

- The EDP is a comprehensive and interactive bottom-up process wherein members from various environments (policy, business, academia, NGO, public, etc.) find and deliver information about potential new activities and abilities that arise through exchanging information. At the same time, policymakers survey the results and approaches to encourage the actualization of this potential (Foray, *"Challenges and Opportunities"*).
- Through building connections and partnerships, the EDP is trying to integrate entrepreneurial knowledge that is now distributed and fragmented among many companies, organisations, universities, clients, users, and specialised suppliers, most of them local, but some also located outside the region.
- The EDP comprises the investigation and opening up of new opportunities (technological and market), conceivably rich in various innovations deemed attainable and attractive (Hausmann and Rodrik, Development as Self-Discovery, 603).

2. Why use EDP?

The government does not have all-out knowledge of future sectors' priorities. The recognition of this fact brings the importance of EDP. The decision-makers should not think that they know which potential domains should become leading during smart specialization. Such a process would support the private industry to accept in this way suggested priority sectors (Hausmann and Rodrik, Development as Self-Discovery, 603). But, when

the actual situation is analysed, it is clear that countries and regions do not have broad and deep knowledge with an integrative, holistic insight. Unfortunately, but reasonably, not. The lack of it is the main reason why politics and administration should listen to entrepreneurs, researchers, and citizens when identifying priorities and, only in this, or mainly in this way, facilitate the emergence and growth of new activities.

It is not only the principal-agent problem, but external problems or market failures are also present. They avert knowledgeable choices of the best sectors to invest in and the engagement of well-chosen resources needed for the economic expansion of a region (OECD, "Innovation Driven-Growth"). The main groups of these market failures are:

- **Information failures:** neither the government nor the industry has the correct information on the subject/problem.
- **Coordination failures:** entrepreneurial subjects who are well-positioned to investigate and appreciate new activities often do not have adequate connections to advertising and financing resources, which diminishes their motivation to go into the process. Similarly, finding opportunities can be inhibited since some projects simply need a lot of investment and the starting entrepreneur is unwilling to jump into them.
- **Lack of necessary knowledge** leads to differences between the public and private outcomes of any newly created knowledge. These differences could lead to insufficient investments in innovative projects, even at high competition locations (WIPO, 2009). Sectors with well-selected specialisation, which have an applicable contribution, will bring faster advancement of a region's economy. Nevertheless, the problem that appears is called the "first-mover disadvantage". Namely, the fastest entrepreneur who is the first to discover the carefully selected specialized sector will not use this benefit for a long time. Using business intelligence postulates, his competitors will jump into the same business very soon by using copy-cat actions.
- **Regulatory failures:** it is always the case that the regulatory rules are the barriers and limits to the activities of a private entrepreneur.

3. How can policies enhance EDP?

Which policy to use for the creation of an adequate smart specialisation strategy is an important decision. The core process for it is EDP, and this process should be carefully prepared and performed. The EDP should define

a few research and innovation priorities in RIS3, but not by public intervention. The idea is that the state or EU administration follows the requests of entrepreneurs who should discover what is best for a region to do and where they could generate the most considerable profit.

4. What is the relationship between the EDP and S3 strategies?

"The EDP is a 'conceptual pillar' of Smart Specialisation" (Capello, S3). The same could be said for the New EU Cohesion Policy Reform. This approach to setting the priorities from the bottom upward is crucial to understanding the main feature that makes S3 different from past strategies for innovation. The past strategies mainly promoted the idea that policies/politicians should shape regional systems through priority-setting. In contrast, EDP enables market processes to be central in identifying the best domains for future priorities. What is essential, doing it in this bottom-up non-prescriptive fashion means that no one is entitled to have preferential access to knowledge on which opportunities to choose and which sectors to favour in the future. The fact is that such identification arises only through the mutual interaction between all relevant subjects (Foray and Rainoldi, *"Programmes and implementation"*).

5. Stakeholders

The EDP should involve a lot of different stakeholders within local societies and the government. Three types of actors are in this paper suggested as essential for any EDP:

Entrepreneurial agents:
(Coffano and Foray, Centrality of Entrepreneurial Discovery, 33)
They have the most powerful position in the ED process, having the "entrepreneurial knowledge" - the essential infrastructure for developing RIS3 (Foray et al. 2011). Entrepreneurial agents can be, e.g., firms, higher education institutions, independent innovators, public research institutes. Every actor should possess knowledge, insights, and perspectives from their experiences and position in the market. And all of them can usefully incorporate and combine comprehensive knowledge used as a basis for the RIS3.

Policymakers and the leaders of the S3 strategy who lead the S3 effort:
(Rodriguez-Pose and Callum, Institutions and the EDP, 1)
They have two roles: First, someone must integrate the entrepreneurial knowledge which relevant actors have and second, once this integration procedure has started, the objective shifts to synthesizing and processing that knowledge. Policymakers hold considerable responsibility and should be active in the ED process, but their duty is no longer to consciously "pick-and-choose" stakeholders. Otherwise, in continuing to do so, they would hurt the grassroots, bottom-up nature of the ED process and the RIS3 (Iacobucci, "Marketing Management"). Still, the focus of EDP as a bottom-up, decentralised process of creating information about potential priorities should not limit the scope of policy intervention. However, policy intervention is quite distinct and more detailed than in traditional industrial policy approaches.

The remainder of society:
(Martínez-López and Palazuelos-Martínez, Breaking with the past, 1)
1. EDP additionally requires the dynamic inclusion of the broader society. No actor knows everything, so the more people and legal entities are active in knowledge collection, the more complete the knowledge base is available to policymakers.
2. And what is more important, bigger societal engagement increases local ownership of the process and makes the strategy go deeper. This local ownership is fundamental to the smart specialization strategy in general because it gives a sensation of involvement and strengthening and helps keep the locally-based bottom-up character of EDP.

CHAPTER 4

SMART SPECIALIZATION STRATEGY OF THE VOJVODINA REGION

1. Vojvodina, the basic facts

Figure 4-1. Map of Serbia with Provinces.
Source: https://upload.wikimedia.org

Vojvodina (Figure 4-1) is an autonomous province of the Republic of Serbia. It is generally flat land. Three rivers flow through Vojvodina and all are navigable - the Danube, the Tisa, and the Sava. Since it was a part of the Austro-Hungarian Empire, it has well-designed roads, canals, and railways, built to connect Central and Western Europe with the Balkans and the Middle East.

Vojvodina lies on important crossings of European routes: Corridor X (road and rail), which connects Salzburg, Ljubljana, Zagreb, Beograd, Niš, and Thessaloniki with the branch of corridor X (Xb), Beograd, Novi Sad, Budapest, and the Pan-European Transport Corridor VII (Danube River) with the railway network with the highest density in Europe. Vojvodina has one of the most prominent water knots in Europe. It has 1.400 km of navigable rivers and canals (Danube 358 km, Tisa 164 km, Sava 159 km, Tamiš 53 km, and 673 km of Danube-Tisa-Danube hydro system).

Other essential traffic routes also pass through Vojvodina. There is a highway coming from Central Europe and the Hungarian border. It goes through Novi Sad and Belgrade further to Nis, where it takes two directions: one to the east towards the Bulgarian border and another to the south towards Skopje and Thessaloniki. Another highway in Srem takes the direction westward to the Republic of Croatia and towards Western Europe. On its sides, there is a network of local roads and railway lines.

- Vojvodina covers a surface of 21,506 km2. Its size is half the size of the Netherlands.
- It covers 24,4% of the total surface of the country.
- It has 1.931.809 citizens, 26,87% of the total in Serbia.
- 1,790,565 ha (83.0 %) is agricultural land, of which 76.6 % is cultivable.
- It consists of 9.0 % of infertile land (only), and forests cover 7.6 % of the surface (only). Vojvodina is one of the most deforested regions in Europe.
- So, the province has 0.90 ha of agricultural land per inhabitant.
  - The world average is 0.25 ha per inhabitant.
  - The European average is 0.42 ha/inhabitant.

As far as the effective forms of relief are concerned, the region is divided into seven areas: Srem (16,2% of the province's area), Central Banat (15,1%), North Banat (10,8%), South Banat (19,6%), North Bačka (8,3%), West Bačka (11,3%) and South Bačka (18,7%). The region is crossed by two significant watercourses (the Danube and Tisa). The Danube passes through Serbia at a length of 588 kilometres, mainly in Vojvodina, and

along its whole length, it is navigable. Other rivers are the Tisa and its tributaries (length 168 km in Serbia), Sava (206 km), and Begej (75 km). During the times of Queen Maria Teresia, the Danube-Tisa-Danube Canal was dug with an extensive network of irrigation canals, drainage, and transport between these rivers. Its total length is 939 km, of which 673 km are navigable.

The largest reserves of oil were discovered in Vojvodina, about 97% of total Serbian reserves. Intensive research was conducted in the second half of the last century and found approximately two dozen oil fields with more than 250 deposits. Domestic crude oil is generally of good quality. Paraffin types, mostly, do not contain sulphur and other harmful admixtures in quantities. The processing is done in the two refineries in Pančevo and Novi Sad. Natural gas is generally associated with crude oil reservoirs. The largest Serbian deposits are located on the territory of Vojvodina, where total reserves are about 43 billion m^3. In Vojvodina, there are lignite deposits, and coal reserves are estimated at 525,000,000 million tons. High-quality brown coal can also be found in Vojvodina. Among the metallic minerals/mineral resources, nickel and iron dominate, followed by lead and zinc.

In conclusion, it is evident that in Vojvodina, agricultural land is a comparative advantage.

In the region of AP Vojvodina, eight cities have more than 35,000 inhabitants, 45 municipalities as units of local self-government, 467 settlements, and 52 urban settlements. They are grouped into seven counties (Central Banat, North Banat, South Banat, North Bačka, South Bačka, West Bačka, and Srem), with administrative centres in Kikinda, Novi Sad, Pančevo, Sombor, Sremska Mitrovica, Subotica, and Zrenjanin (Figure 4-2).

The policy of growth poles in Serbia (Geography. Growth Poles Theory) aims to increase economic growth, create jobs, and boost productivity to generate development in small and medium towns and rural areas adjacent to the poles. The state identified several categories of urban centres to contribute to the development of the economy. Twentythree municipalities achieve a development level above the Republic average; of those, twelve are in the region of Vojvodina.
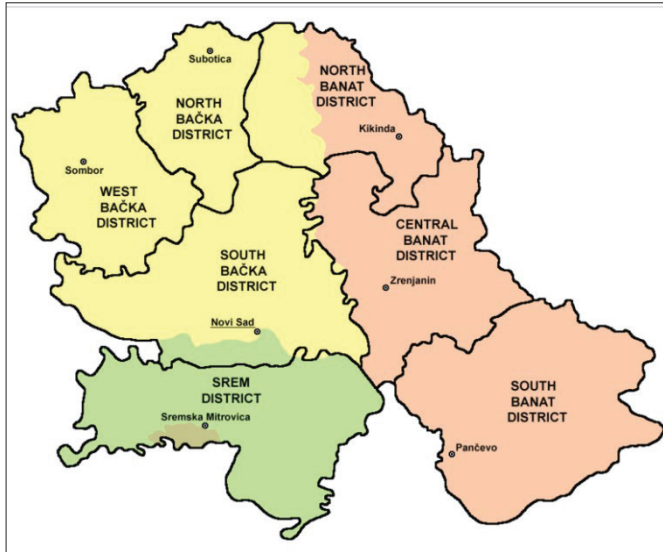
Figure 4-2. The territory of AP Vojvodina.
Source: https://commons.wikimedia.org

There is one public university in Novi Sad and no official number of private universities in AP Vojvodina. The public university is the second-largest in Serbia. It consists of 14 colleges, three institutes, 50,000 undergraduate, graduate, and PhD students, and 5,000 employees. State higher education institutions are Faculty of Philosophy in Novi Sad, Faculty of Agriculture in Novi Sad, Faculty of Law in Novi Sad, Faculty of Technology in Novi Sad, Faculty of Economics in Subotica, Faculty of Technical Sciences in Novi Sad, Faculty of Medicine in Novi Sad, Faculty of Sciences in Novi Sad, Academy of Arts in Novi Sad, Faculty of Civil Engineering in Subotica, Technical Faculty Mihajlo Pupin Zrenjanin, Faculty of Sport and Physical Education in Novi Sad, Faculty of Pedagogy in Sombor, and Teacher Training Faculty in the Hungarian language in Subotica.

2. Business support structures

The business infrastructure is underdeveloped. It is at an early stage of development. The following types of structures are available in the region:

- **Business incubators for SMEs** (e.g., Business Incubator for SMEs in Subotica, Zrenjanin, Kanjiža, Novi Sad, Bački Petrovac, Senta, and Pančevo);
- **Technological Parks** (e.g., Novi Sad, Vršac, and Subotica);
- **Industrial Parks** (e.g., Subotica);
- **Logistic Parks** (e.g., Novi Sad, Subotica-Senta, Apatin-Bogojevo, Bačka Palanka-Vrbas, Inđija-Stara Pazova, Ruma-Pećinci-Šid, and Kikinda-Zrenjanin).

The provincial government of Vojvodina and EU funds financially supported establishing of all these structures. They are all results of this project. These structures are less than five years old and require significant support in developing, sharing knowledge, and increasing awareness of their importance. Their financial power is not enough for their sustainable development. Financial supporters have to build indicators to measure their achievements in the future. At this moment, they are not clear.

In general, service packages provided vary depending on the type of infrastructure and include incubation space rental, exhibition spaces, access to utilities, consulting services, promotional services, etc. Hosted companies can take advantage of the benefits of provided services.

In the region, the provincial government subsidize 30 clusters.

There are also various business support organizations, such as chambers of commerce. There are seven regional chambers of commerce (Novi Sad, Zrenjanin, Pančevo, Kikinda, Sombor, Subotica, and Sremska Mitrovica) and one provincial in Novi Sad.

Five regional development agencies were set up to make development faster and support local communities and SMEs.

Significant industries in Vojvodina are agriculture and agribusiness, the information technology sector, production of parts for the automotive industry, the secondary metal processing industry, business administration, and tourism.

Vojvodina is a region of diversity with 26 nations and six official languages. It was always at the crossroads of battling nations, and many of them left signs of their culture, food, handicrafts, languages, costumes, etc. There are significant diversities among villages depending on the nationality that lives in them. These differences create many attractive locations for ethno-tourism and ecotourism but also places for e-working and team building. The synonym for Vojvodina is good food and relaxing time. It is colourful and, for centuries, protected by the love of its inhabitants. Figure 4-3 presents rural Vojvodina in small pictures.

Figure 4-3. Vojvodina – a few scenes. Source: Authors

3. How was the Smart Specialization Strategy of Vojvodina developed?

The smart specialization program of Vojvodina was developed within the Pre-Accession Program for Cross-Border Cooperation between Hungary and Serbia: IPA CBC Hu-Srb. Szeged Innovation Agency was a partner from Hungary and the Information Centre for Business Standardization and Certification (BSC Centre) partner from Serbia.

Szeged Innovation Agency helped a great deal during the development phase by completely transferring its knowledge about the European methodology for making the Smart Specialization Strategy. It enabled Vojvodina to be the first to make the Smart Specialization Program among the regions outside the European Union (in 2015). Joined teams created a program and not a strategy because the province of Vojvodina does not have the authority to adopt strategic documents. One of the crucial steps in creating the program was conducting a survey involving around 2000 interested entities from Vojvodina. The EC has organised peer review meetings to improve the smart specialization strategies of various regions. In April 2014, Novi Sad was the host of a workshop structured and supported by the European Union. The Smart Specialization Program of

Vojvodina was presented there, assessed, and evaluated together with guests from Germany and Romania.

A Smart Specialization Program aims to differentiate and choose a few priority areas for knowledge-based investment, focusing on the region's strengths and comparative skills. It refers to the area's specialization in research and innovation and can be national or regional (Kranjac, Sikimić, and Vujaković, Cross-border innovation process).

The goal of the smart specialization is to use the limited natural and human resources in the European Union rationally. That means that not all regions should do research and innovation actions in all industries. They should concentrate on the sectors in which they can accomplish the best outcomes that other parts of the European Union may utilize.

All interested entities associated with the innovation process must create and implement RIS3: SMEs, large businesses, colleges, exploration institutions, consulting companies... In addition, RIS3 centres around strategic cross-border and trans-regional connectivity and collaboration for greater critical potential and diversity.

4. Defined priority sectors

The created Smart Specialization Program of AP Vojvodina perceives the specifics of Vojvodina and the benefits for Vojvodina, and they are:

- geographical position,
- climate change,
- human resources,
- culture and tradition.

These specifics and advantages help decide what direction Vojvodina should take in the field of research and development.

Figure 4-4 indicates that Vojvodina was at that moment the only non-EU region that had RIS3.
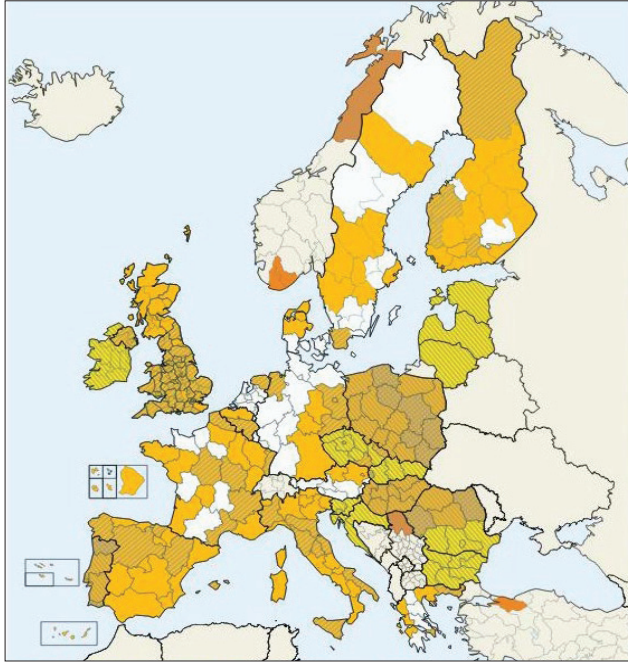
Figure 4-4. The Region of Vojvodina is a part of the European Commission S3
platform (the year 2015).
Source: (EC, Registered regions)

The vision of the future of AP Vojvodina in RIS3 is:

"Vojvodina is initiating and building up a sustainable innovation system that
takes into account the specifics of how a European region connects to
European innovation processes." (Kranjac, Sikimić, and Vujaković,
Program S3 Vojvodina).

RIS3 determines:

- Innovation standards and principles at the essential decision-making
  extent,
- Key economic sectors that have the potential for smart specialization
  (at the level of a region or a nation),
- Processes for accomplishing objectives,
- Procedures for checking, assessment, and revision of the development
  process.

The structure of the program contains the following elements:

- The situation in the field of innovation in Serbia – current status,
- Benchmarking at the international level,
- Database of additional information: literature and statistics,
- Gathering primary information: question sheets,
- Analysis of interested parties,
- Deductions: Strategic structure and preferences.

Three types of organizations took part in the research, and 1292 queries were sent. The following were the three types of organizations:

- Business associations: big organizations, medium-sized, small, and micro-companies,
- Scientific research associations: universities, colleges, and institutes,
- Bridging organizations: provincial administration, local self-government, consulting organizations, chambers of commerce, professional affiliations.

Topics that were analysed together with all the stakeholders were:

- The organizations' overviews,
- Origins of innovation,
- Obstacles to innovation,
- Financial assets for innovation,
- Collaboration during innovation activities,
- Making decisions on innovations.

Three types of surveys were formed, a separate one for each of the three types of organizations with adapted questions. Another survey was conducted relating to cross-border innovation process opportunities between the two regions (Chapter 12).

Each group of surveys consisted of the following groups of questions:

- Primary data about the organisation,
- Sources of innovation,
- Barriers to innovation,
- Financial resources for innovation,
- Cooperation in the area of innovation,
- Decision-making about innovation.

One thousand two hundred ninety-two organisations received the questionnaires. Only 17.34% of them sent responses related to regional cooperation, and 7.89% sent back the cross-border related questionnaire. The possible causes for low numbers are the prolonged isolation and events that took place in the region.

The bridging organisations had the most significant response to the questionnaire (14.5% of the sent questionnaires), and the business entities had the lowest response (8.3% of the questionnaires). To a certain extent, this is understandable because those are primary activities of bridging organisations (or very close to them) and are not of business ones. Industry organisations either consider innovation activities ordinary or burdened by everyday problems, so they have neglected the queries.

Figure 4-5 presents the SWOT analysis of innovation activities in the APV.

Strengths	Weaknesses
- The existence of institutions of high education - Geographic location - Raw material base - Bordering the EU	- The level of innovation in the region is low (according to the OECD indicators of innovation) - Lack of political support - Lack of institutions and organisations that support innovation processes - Lack of a database containing the innovation potential of the region - Serbia is not a member of the EU - Lack of earmarked funding resources - Lack of knowledge of innovation processes - Lack of personnel with needed education - The education process is not oriented toward practical knowledge - A disproportionately small number of highly educated workers who can creatively participate in the innovation process (both technical and technological profiles)

Opportunities	**Threats**
• Geographic and climatic preconditions for economic development	• Lack of innovation funds
• Proximity to the EU, Eurasian Union, North Africa, and the Middle East	• Lack of innovation strategies and appropriate bodies for their implementation and correction
• Establishment of multidisciplinary development teams	• Lack of concrete and visible political support
• Establishment of R&D and certification laboratories	
• The use of EU funds for innovative activities	

Figure 4-5. The SWOT analysis of innovation activities

At the Vojvodina level, the following business areas with the potential for smart specialization have been selected:

❖ Agricultural production and the food industry
  • Organic agricultural production:
    ○ Production of crops,
    ○ Viticulture,
    ○ Fruit growing,
    ○ Livestock production: native species (mangulicas[2], oxen, sheep, donkeys).
  • Functional nutrition,
  • Healing herbs,
  • Phytopharmacology.

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[2] Mangulica is a pig - one of three primitive autochthonous breeds in Serbia.

❖   Information and communication technology
- Information systems,
- Broadband access,
- Services (teleworking, E-Agriculture, E-Medicine, E-Manufacturing, E-Tourism).

These business areas present the specificities of Vojvodina and are applicable to be the "brands" for inviting investments and consideration from the EU and the world.

Also, the accompanying business areas are important:
❖   Metal industry
- Equipment for renewable energy systems,
- The equipment for agriculture (irrigation systems, agricultural machinery),
- Process equipment for the food industry,
- Process equipment for the petrochemical industry,
- Supplies for the automotive industry, railway systems, and shipbuilding.
❖   Tourism
- Spa tourism,
- Health tourism,
- Hunting tourism,
- Ethnic tourism,
- Tourism for older adults,
- Personalized tourism.

Horizontal sectoral priorities that should be incorporated into all sectors are:

❖   Ecology and environmental protection
- Waste-water management,
- Recycling,
- Decreasing harmful gas emissions.
❖   Energy efficiency.
❖   Renewable energy sources
- Geothermal resources,
- Biomass/biogas,
- Biodiesel,
- Mini hydropower,

- Wind turbines,
- Solar energy.

The Priority roadmap to reach the business areas in focus has been defined as:

1. Creating competencies and abilities for the innovation process as an input for generations that will come,
2. Supporting companies to start to be and to stay innovative,
3. Technical support.

Within priority 1: "Developing innovation competencies for future generations," the following measures have been suggested:

Measure 1.1: Raising awareness of the significance of innovation in similar business areas

For this purpose, the following types of projects are priority:

- Preparing a system that will increase awareness of innovation (encompassing education, training, info days, discussions, media support, etc.),
- Creating training courses for trainers for innovativeness in priority sectors,
- Developing solid relations between educators and enterprises in the fields with regional smart specialization potential. The goal is to harmonize education supply with education needs, especially in new technologies in smart specialization sectors.
- Developing a transnational knowledge transfer in smart specialization sectors,
- Developing a long-life learning system for smart specialization sectors.

Measure 1.2: Creating collaboration between the economic and educational systems

A new way of thinking prioritising the importance of industrial production should be developed from childhood. This measure proposes developing functional knowledge based on close cooperation between educational institutions and companies:

- Active practical work at companies,
- Laboratories in educational institutions,
- Internships in smart companies at a transnational level,

- Master and doctoral studies in line with smart specialization sectors.

Measure 1.3: Creating more space for creative sectors in industrial production and, thus, increasing their role.
For this purpose, the following types of projects are a priority:

- Joint clusters,
- Business parks.

Within priority 2: "Supporting companies to start to be and to stay innovative in the region of Vojvodina," the following measures have been suggested:

Measure 2.1: Supporting the turning of innovative ideas into business ones.
For this purpose, the following project idea is a priority:
Creating a system to gather innovation potential from employers for company functioning:

- Establishing new business support structures and encouraging existing ones to attract new companies (for example, business incubators, business hubs, technological parks, etc.),
- Developing "shared resources" initiatives,
- Developing consultancy activities for start-ups and spin-offs to go from an idea to the first production line.

Measure 2.2: Using monetary instruments to empower the foundation and development of new innovative companies in the region.
For this purpose, the following types of projects will be a priority:

- Self-investments into innovative projects within the company,
- Developing business angels' networks,
- Attracting new risk capital funds to the region,
- Creating microcredit schemes for new business ideas.

Under Priority 3: "Technical Support", this measure has been suggested:
Measure 3.1: Creating the RIS3 system's implementation, checking, and assessment. The BSC Centre is supposed to lead the implementation of tasks emerging from RIS3 and check their execution. It should develop into a Centre for Standardization, Certification, and Innovation.

For this purpose, the following projects will be a priority:

- Creating a regional consortium for smart specialization at the level of the Vojvodina Region,
- Generating innovation indicators specific to the region but according to the Oslo Manual (OECD, "Oslo Manual") and ways to measure them,
- Develop monitoring studies to analyse the implementation results obtained by S3 in the region.

5. Methodology for monitoring Smart Specialization Strategy

Designated teams will do the necessary activities for monitoring the implementation of the Smart Specialization Strategy each year. They will do it according to the following **schedule of activities** and by using the following indicators**:**

- *Context indicators:* the values of indicators will be obtained from secondary sources—statistical data from the National Institute for Statistics.
- *Output and result indicators:* the values of indicators will be taken from Annual Implementation Reports of Operational Programs related to the period 2014-2020, elaborated by the BSC Centre, which will be proposed to be financed by Operational Programs.

Proposals for the measures
The development of an innovative society has to be based on a system of indicators. Indicators must be transparent, objective, accurate, archivable, measurable, and specific for the region. They should give indications for corrective measures and improvement of the innovation process.

The Statistical Institute of the Republic of Serbia is the reference centre for statistical data and will collect and present innovation indicators selected to suit Serbia in the vest way.

The Future Innovation centre of AP Vojvodina, with a leading role in the implementation process of RIS, should analyse a specific set of innovation indicators for the hub group of organizations in Vojvodina. This analysis will proof check the activities of innovation processes in Vojvodina and the achievements of the RIS during the realization of the Action plan of the Regional Innovation Strategy.

Functional knowledge has to be measured using the PISA tests, which should be a mandatory part of the education process, permanently processed.

Outputs and results:

The success of the RIS of APV (Autonomous Province of Vojvodina) will be confirmed using the mentioned indicators and their improvements in time. The effects will be:

- Increase in production,
- Growth of employment and the number of companies,
- Growth of exports and a decrease in imports,
- Increase in BDP,
- Increase in population standards.

6. Institutional framework for creating innovation activity conditions in the Autonomous Province of Vojvodina

Questionnaires and the innovation results show that the innovation activities of the APV region are small and that practical processes of innovation do not exist. One might have foreseen such consequences since the OECD innovation indicators for the region of the APV are at a deficient level. Efforts of all relevant actors in the province are needed to support these processes. These activities should lead to the establishment of bodies for planning and implementing innovation strategies. The creation of this Regional Innovation Strategy is an essential contribution to paving the way for the activities in this area.

Figure 4-6 presents the general fields of activities that should be specially insisted upon when creating the RIS for the APV. Each of these elements must be carefully considered, and corrective actions should be taken to improve them.

IDEA GENERATING
- To increase investments in the development of ideas
- To have better knowledge of consumers
- Innovation guidelines from management
-To develop new innovation resources
- To stimulate innovation acctivities
- To use external R&D resources

INNOVATION PROCESS BEING DEFINED
- Going through all the stages of an innovation process must be consistent, disciplined and without arbitrariness and improvisation
- Each innovation process is managed as any project

HUMAN RESOURCE QUALITY
- A need for a high number of quality scientific research and engineering personnel
- Quality trained, stimulated and disciplined working force
- Human resource must have functional, applicable knowledge
- Human resource must undergo a process of continuing education

CREATING FAVOURABLE ENVIRONMENT
-R&D and innovations are a concern of the entire society, but not of individuals or groups
- Creation of industrial infrastructure
- Stimulus to innovation processes, protection of intellctual property, tax incentives, favourable legal regulations...
- Verification of new product or service at the market

AVAILIBILITY OF INNOVATION RESULTS
- Results of innovation processes must be easily available
- R&D institutions must analyse and identify companies that need innovation support
- To educate companies how to exploit innovation

CONTINUITY OF INNOVATION PROCESSES
- The state must support long innovation processes because they may not generate direct added value
- There should be an appropriate banking infrastructure
- The very state must initiate complex R&D activities which many innovation resuts stem from

THE QUALITY OF EDUCATION
- There is a direct link between quality of education and competitiveness of industry
- Plans and programmes, the number of enrolled students must be in accordance with long-term plan of industry development, and the state is the only one that makes decision concerning it
- The education institutions must be capable to provide hands-on training

STATE INVOLVEMENT
- Continuity of development policy regardless of political mandate
- A strong link between education, science and industry
- To initiate R&D activities through state institutions and public eneterprices

MANAGING INNOVATION PROCESSES
- Development of innovation processes must be strategic decision of the management
- The management must provide all the preconditions for a successful management of an innovation process
- An innovation process must not be an employees' casual activity
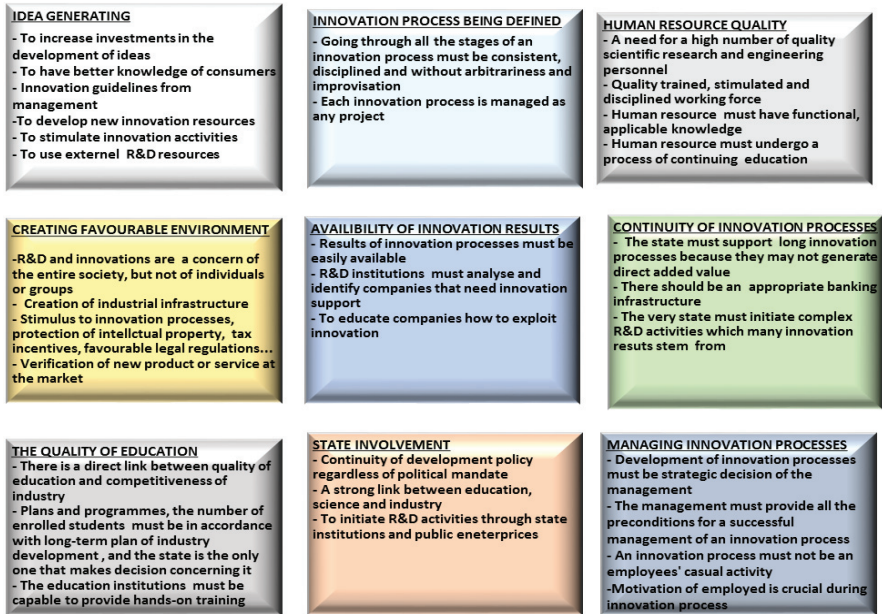-Motivation of employed is crucial during innovation process

Figure 4-6: General fields of activities in the APV RIS.
Source (Kranjac, Sikimić, and Vujaković, Program S3 Vojvodina)

The innovation strategy of Vojvodina itself must be harmonised with the individual innovation strategies of the neighbouring regions and with the EU innovation strategies and strategic documents of the Republic of Serbia and Vojvodina. The following steps should be undertaken:

- To collect data on innovation offers and needs of the region,
- To analyse the complementarity of supply and demand,
- To identify overlaps,
- To identify deficiencies,
- To unify innovation efforts and processes,
- To create an innovation system in terms of Open Innovation,
- To support the creation of innovation centres as bridges between basic skills and knowledge and the economy,
- To facilitate political support and provide information on the importance of innovation,
- To continuously measure innovation indicators according to the OECD methodology (Oslo Manual). All the EU member states are

members of the OECD. For Serbia, it is imperative to become a member of the OECD, or, at least, to systematically and continuously implement OECD activities.
- To create conditions for a better understanding of Vojvodina's innovation potential and the potential of partner countries,
- To create mechanisms that inform others about the innovation potential of the APV region.

Additionally, the following should be done:

1. Develop awareness and culture in an innovative society through overall and real political support in the following way:
   - To create legal and other preconditions for verifying innovation process results and projects in the market,
   - To develop common development platforms and to link them to one another,
   - To create the same legal preconditions for exploiting innovative potential under the same conditions for both the public and private sectors.
2. Survey the current state of the APV:
   - To create and maintain databases containing innovation resources of the region:
     - Innovation companies,
     - Innovation and technological services,
     - Unused innovation potential,
     - Scientific and research organisations,
     - Bridging organisations in innovation activities,
     - Patents, small patents, marks, trademarks, industrial designs,
     - Innovation projects in the region and the surroundings,
     - Researchers and scientists, their achievements and results, and, in particular, young researchers,
     - Clusters and other organisations, micro, small, and medium enterprises, technology parks, business incubators, etc.,
     - Innovation activities funds.
3. Activate the innovation process in the following way:
   - To establish centres to promote innovation systems and to make them work,
   - To activate domestic and cross-border clusters, and in particular to emphasize cluster-based knowledge,

- To conduct constant familiarisation with the possibilities and ways of functioning of organisations that support the innovation process,
- To constantly popularise the innovation process by informing the public through the organisation of gatherings:
  - o Innovation day/week,
  - o Innovation fairs,
  - o Creation of an internet presentation of the region,
  - o Webinars,
  - o Printing of publications, brochures, posters, billboards,
  - o Issuing magazines,
  - o Competitions,
  - o Professional conferences.
- To modernise and interconnect R&D organisations in the APV and region,
- To modernise and interconnect educational organisations in the APV and region,
- To create a joint plan for continuing education and certification,
- To create a unique system for certifying experts and creating and maintaining an individual's creative and innovative potential,
- To establish conditions for the unhindered mobility of highly educated professionals,
- To intensify applied research and to connect science and industry,
- To develop a system for assessing the commercial potential and for financing innovation and R&D projects.
4. To provide permanent and secure funding for innovation processes in the following way:
- To organise sectoral funds for financing:
  - o Short-term projects,
  - o Long-term projects (common state funds).
- To establish funds for high-risk projects,
- To set exchange of innovative projects and ideas,
- To have constant and sufficient funds supply from:
  - o Budget,
  - o Public sector,
  - o Games of chance,
  - o Socially responsible enterprises,
  - o Donations by individuals, enterprises, and non-government sectors.
- To create sector funds and support organisations that would collaborate on multidisciplinary projects,

- To create organisations that will commercialise innovation potential,
- To establish spin-off enterprises,
- To create preconditions for reducing knowledge drain via outsourcing,
- To attract and absorb knowledge from the region.

5. To create prerequisites for paving the way to an innovative society (an economy based on knowledge) in the following way:
   - To develop education programmes and strategies for:
     - Preschool,
     - Elementary school,
     - Secondary school,
     - High education,
     - Specialist studies,
     - PhD and post-PhD studies.
   - To enable universities and colleges to publish theses and dissertations directly related to the innovation process in the region,
   - To introduce modern methodologies to increase and measure creative and innovative resource potential (TRIZ, PISA…),
   - To form distributive education institutions throughout the region to make knowledge available to all and decrease expenses,
   - To network state and private educational institutions,
   - To integrate faculty experts into multidisciplinary teams,
   - To introduce a system for evaluating and rewarding innovation results,
   - To connect sources of knowledge and skills in a unique science education unit with the possibility to differentiate them,
   - To increase the number of people with high education and to create preconditions for growing students' standards,
   - To exchange students with other regions in Serbia and abroad and create conditions to attract them,
   - To increase the standard and quality of life of highly educated professionals, to organise their exchange,
   - To create a unified system for managing a career:
     - To monitor affinities and preferences from one's birth,
     - To guide the development of highly educated professionals in a stimulating way,
     - To navigate toward applied science and skills,
     - To identify leaders.

- To create prerequisites for positive business migration, capital, and human resources, which would make the APV area attractive for experts with high education from the EU regions and other regions of the world and the arrival of investment capital.
6. To equalize the innovation development of the region.
   - To form distribution centres for promotion and operation of the innovation system, to facilitate the availability of innovation resources which must be the same at all points in the region.
7. To have constant control, measurement, and correction of innovation processes in the APV in the following way:
   - To perform continuous control over the execution of the innovation strategy,
   - To perform constant corrections, adjustments, and improvements (through public discussions, practical validity testing, and the creation of a joint test market) and to change the innovation strategy of the APV,
   - To introduce innovation measurement indicators according to the EU standards,
   - To include the public sector in innovation processes (including the sector that deals with social issues and the sector that deals with the health protection of the population).

7. A Roadmap for the future[3] (EC, RIS3 Peer Review)

To generate a roadmap for future activities in the frame of the smart specialization of Vojvodina and get an overview of the achievements of the first draft of the Strategy, European Commission proposed organising a peer review workshop in Novi Sad.

Figure 4-7 depicts economic changes European Commission foresees for regions that adopted regional smart specialisation strategy.

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[3] This sub-section 7. was taken from the document "RIS3 Peer Review Report Vojvodina" written by the Authors. (EC, RIS3 Peer Review)
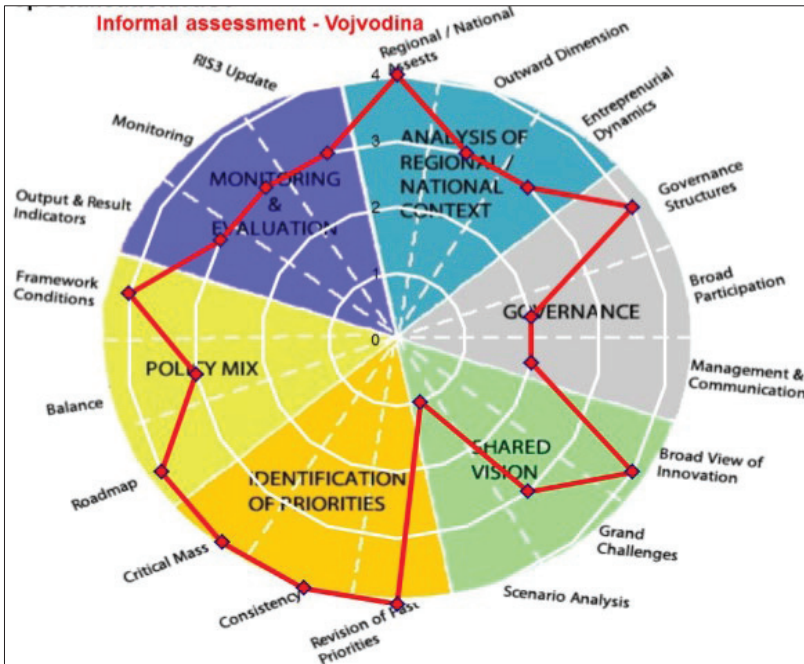
Figure 4-7. Driving economic change through smart specialisation/RIS3. Source: (EC, RIS3 Peer Review).

About S3 workshops.

An average S3 peer review workshop runs over two full days and includes peer review of four regions. Individual peer review sessions focus on one region and last around two hours, and peer review workshops are generally organised around four individual peer review sessions focusing on four regions. A presentation of each region's current work on RIS3 is usually followed by a Q&A session and several simultaneous discussions of specific issue areas highlighted during presentations. Particular issues are then discussed at individual tables in three iterations, which ensure that participants can: (1) work together to understand the actual problem behind each issue; (2) propose solutions to these problems by discussing what worked well (good practices) and what did not work; and (3) learn together how to deal with new policy issues in new contexts.

Structure.

The S3 peer-review process generally includes three phases: preparation, workshop discussions, and the post-workshop follow-up. Before their workshop, each region under review should prepare two documents describing the region's socio-economic and political background and its research and Smart Specialisation Platform innovation system.

These documents outline pre-selected priorities and specific questions to guide and focus further discussions. Each reviewed region carries out a comprehensive self-assessment of its current work on RIS3, which should cover nine principal areas: stakeholder engagement, analytical work behind RIS3, a shared vision, priorities, an action plan, a policy mix, the outward-looking dimension, synergies between policies and funding sources, and convergence and monitoring system. The assessment exercise allows regional authorities to examine their region's smart specialisation strategy from a perspective of an external expert.

Structured Feedback.

A final session follows peer-review sessions. All participants (experts, representatives of the regions under review, and peers) summarise the results of four peer-review sessions and discuss individual and mutually learnt lessons. The regions under study have an opportunity to respond to any feedback collected throughout the workshop. Then they share with peers their new assignments and any short- to mid-term plans to implement these lessons. During the seminar, the S3 Platform team members collect relevant information and data covering different elements of each region's peer review exercise. To ensure regions under review receive adequate feedback from their peers, the S3 Platform employs a newly developed approach to analysing outcomes associated with individual peer review sessions. This data triangulation is based on dedicated evaluation forms completed by three groups of participants: regions under review, their critical buddies, and experts. Based on the feedback from three groups of participants (see Table 1), the S3 Platform team develops summary/feedback reports.

Regions under review:

Following its peer review session (presentation and discussions), each region under review completes a short evaluation form to take the results of discussions in their session to a level up. Representatives should list three specific actions that they could do to improve their RIS3 further. Regions are then asked to indicate which steps they are likely to follow to implement learned lessons and related conclusions.

Experts:
Several experts attend each session and provide comments to regions under review using a dedicated evaluation form which they fill in based on the information provided before/during the workshop. Experts are also encouraged to offer suggestions to regions under peer review and share any relevant good practices.

The analysis of the regional context and potential for innovation
Up to this point of the workshop, the regional assets have been analysed, but the entrepreneurial environment dynamics have not been sufficiently addressed, especially the entrepreneurial discovery process. For instance, the numerous university spin-offs or the cooperation with multinational companies have not been mentioned. Also, the indicated clusters should be analysed in greater detail in terms of their contribution to the prioritised areas. Two other elements missing or not depicted more prominently are solid academic research and the potential for social innovation in a multi-cultural context. On the other side, the region's business infrastructure is very recent, and the limited financial sources could threaten sustainable development. The strengths and opportunities could be defined more precisely in the SWOT analysis. It is not true that "practical innovation processes do not exist", as evidenced by the spin-off examples (Schneider DMS). Given the challenging framework conditions and the low GDP, the innovation performance is relatively good. It is recommended to rethink the entrepreneurial discovery process much more profoundly to identify the opportunities, needs, and bottlenecks of developing and supporting entrepreneurial activities. More substantial involvement of motivated and relevant stakeholders (UNS, companies, etc.) is crucial to achieving all that.

Setting up a governance structure
Who should be the 'owner' or supervisor, and implementing the governmental body of RIS3 is a permanent and pertinent question. The question of ownership is closely related to the financing of RIS3 implementation. IPAII-Funds, national and regional state funding and private funds will be necessary to implement the innovation strategy. That is why not only the government of the APV but the central Serbian government should be involved during RIS3 implementation, too. To successfully implement the RIS3, a Steering Committee could be established consisting of relevant stakeholders (representatives of central and regional governments, implementing agencies, UNS, industry representatives, financing organisations and investors). For that, it is also essential to clearly distribute responsibilities between the concerned

Secretariats of the APV government (Science & Technological Development, Agriculture, Economy, Inter-regional Cooperation, Energy).

Shared vision about the region´s future

The presented vision is generally sound but rather generic. It should be based more on the regional development potentials and strengths. Also, it should lead to the structural change of the regional economy towards sustainable growth based on an increased innovation capability of manufacturing and emerging knowledge-intensive sectors. That would support socio-economic transformation, catching up with developed regions, job creation, and better living conditions under the main umbrella topic "sustainable innovation".
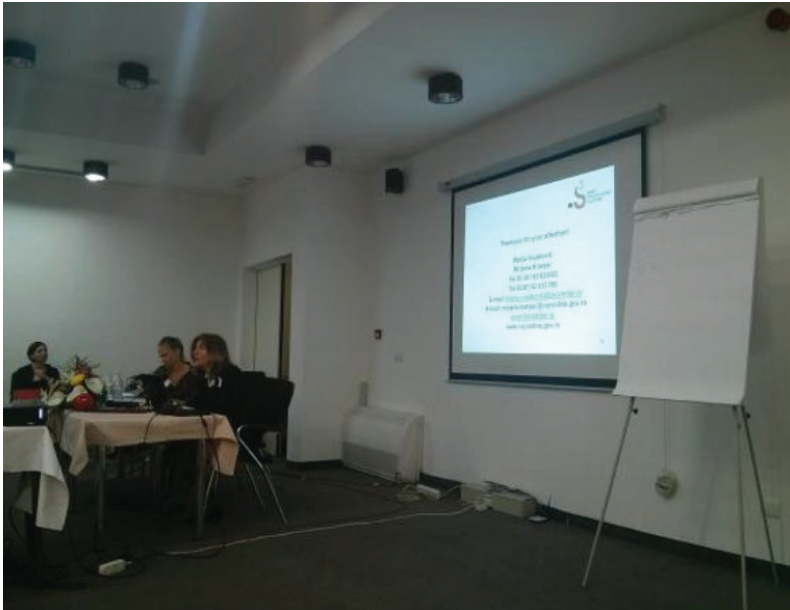

Figure 4-8. Peer review of the workshop in Novi Sad. Source: Authors

Selection of a limited number of priorities for regional development

The proposed five sectors might be too broad since probably not each of them has the critical mass needed in a region with a population of two million. Based on the strengths indicated by the UNS ICT spin-offs (Schneider DMS) and the excellent conditions for agriculture in Vojvodina, one viable option is to emphasise and prioritise these two sectors:

agriculture and food production & ICT. That does not mean that other mentioned sectors are insignificant. It just means that these two sectors have the best potential for smart specialisation since they constitute the unique characteristics of Vojvodina. That is why they are suitable to serve as 'brands' to attract investments and attention EU-wide and globally.

Establishing a suitable policy mix

The defined horizontal measures seem, in general, appropriate. Strategic goals should be determined based on a more concrete vision and revised priorities. The proposed policies and measures and following action plans are the main implementing instrument of the RIS3 and its vision and strategic goals. The proposed regional action plan should reflect these strategic goals. The measure "Implementing financial instruments to support creation and development of innovative companies in the region" seems to be the most relevant one.

Monitoring and evaluation mechanism

The monitoring of the RIS3 implementation should be done by the regional and possibly central government, by providers of financial resources for its implementation, and by appointed organisations, e.g. by the BSC Centre. The presented monitoring and evaluation indicators are a good starting point and should be fine-tuned according to the experience during the implementation of RIS3.

8. S3 of Vojvodina as an official document

Research and Innovation Smart Specialization Program of the Autonomous Province of Vojvodina for 2015-2020 was adopted in May 2015 by the Assembly of AP Vojvodina and is accepted as "de facto" the Smart Specialization Program of Vojvodina.

For its successful implementation, it was essential to take the following steps:

- Formalize the status of the BSC Centre,
- Establish the Provincial Council for implementing the RIS3,
- Develop and embrace a RIS3 Activity Plan with a checking and correction framework,
- Establish a system of checking and informing all interested parties through yearly reports and the innovation portal,
- Maintain the steady inclusion and agreement of all parties interested in innovation actions,

- Make RIS3 an essential part of all future key documents of AP Vojvodina,
- Involve AP Vojvodina in international innovation actions by establishing joint cross-border and international RIS3 programs within the European Union, mainly in the region of the Macro-Regional Danube Strategy[4],
- Start and help in the development of RIS3 of the Republic of Serbia.

Unfortunately, the government of Vojvodina did not recognize the importance of the RIS3 program. It did not organize activities to upgrade it and adopt it for the next period of 2020-2025, which will cause a lack of points during the assessment of the EU funded project applications and less financial resources for the implementation of the projects.

9. Implementation of S3 in Vojvodina

When discussing the implementation or results defined in S3 of Vojvodina, it should be clear that all that was done was without any link to this document. Nobody informed the public about the S3 paper and its roadmap for the future.

The activities described below align with the S3 document and support its resolutions but have happened simply by chance. Nevertheless, such a fact proves the value of that document.

The authors want to repeat that Vojvodina was **the first non-EU region that developed S3.**

a. The main achievements of S3

As the basis of the smart specialization process within one region, fostering innovation should start even at preschool age. Doing that will enable individuals to raise awareness about entrepreneurship and establish new companies, especially SMEs. Additionally, the state should create career development centres, financially support them, and assist in selecting the right leaders and leading experts.

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[4] It is the largest and most diverse macro-regional strategy involving 14 countries: nine EU Member States (Austria, Bulgaria, Croatia, Czech Republic, parts of Germany, Hungary, Romania, Slovakia, and Slovenia), three Accession Countries (Bosnia and Herzegovina, Montenegro, and Serbia), and two neighbouring countries (Moldova, and Ukraine).

Vojvodina region already has the following resources to fulfil the requirements of S3:

- The university with over 50,000 students and 5,000 employees, e.g., FTN, Novi Sad (Figure 4-9.),
- Around 400 study programs,
- Five business incubators,
- Over 30 sectoral clusters,
- Start IT (Start-up incubator for IT companies),
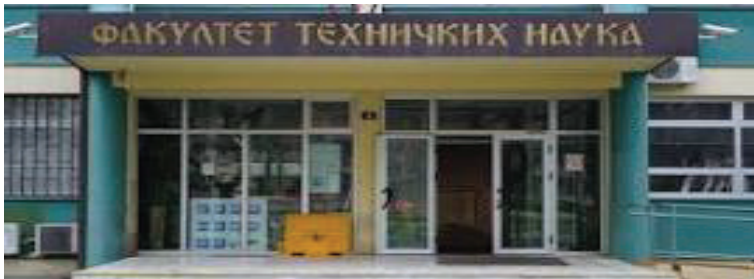- Science and Technology Park (just finished) (Figure 4-10.).

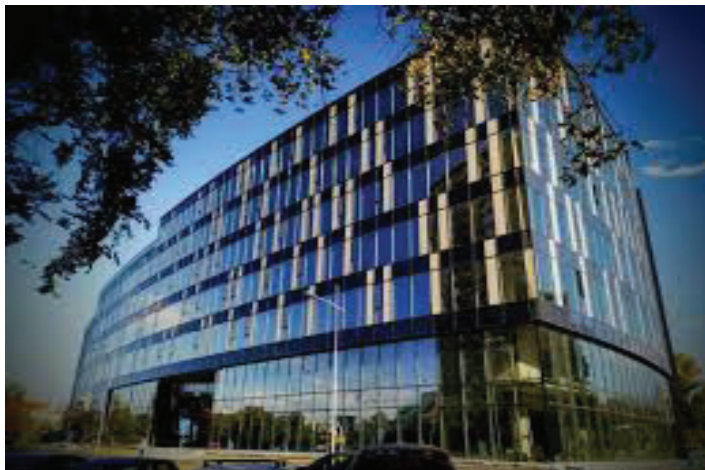Figure 4-9: Faculty of technical sciences, Novi Sad. Source: Authors

Figure 4-10. Science and Technology Park in Novi Sad. Source: Authors

The University of Novi Sad has over 130 successful spin-off companies, an excellent example of the crucial links between science and companies.

- **Schneider Electric DMS NS d.o.o.**

One of the spin-offs of the Faculty of Technical Sciences (FTN) from Novi Sad is the well-known company, Schneider Electric DMS NS Ltd. This company, which is very important for Novi Sad IT sector, employs more than 1000 researchers, primarily engineers It (previously known as DMS d.o.o Novi Sad) was sold to Schneider Electric after its first stage of development as a spin-off of the FTN. This company has over one billion users in most countries globally in the domain of smart energy management. Schneider Electric DMS is a remarkably innovative company for Smart GRID solutions. It is dedicated to enhancing its primary products, "Advanced Distribution Management System, a modern and comprehensive solution for power network management" and "Advanced Gas Management System, an integrated operational platform for natural gas networks" (Schneider), two worldwide applications for carrying out all specialized tasks in the distribution of electricity and gas in a proficient way suited for modern industry requirements.

- **3Lateral**

3Lateral is a company set up in Novi Sad which has recently developed a new technology for face recognition. This technology is proclaimed as the best in the world. The American company Epic Games bought 3Lateral in 2019. The Epic Games has been making the best game-engine technology for over 25 years.

3Lateral's website says:

> "3Lateral is currently employed to define the visual style and design of 30 primary characters in feature-length animation movies. We are able to communicate design through traditional and digital media. 3Lateral is the leading developer of 'digital humans' technology and creative content. It has joined with Epic in an acquisition that will bring significantly increased investment in the 3Lateral team's efforts. The Serbia-based group will continue supporting game industry, film, and television partners while working to advance state of the art in Unreal Engine's support for virtual humans and creatures**.**" (3lateral).

- **BioSense institute**

The Assembly of the Autonomous Province of Vojvodina established in April 2015 the BioSense Institute - Institute for research and development of information technology in biosystems. In the past, as is the case now, it participated in many internationally funded project programs as an excellent

example of how a company should use them. Within the H2020 Teaming ANTARES project, in competition with almost 200 European research centres, the BioSense Centre has been selected as one of 30 potential European Centres of Excellence.

BioSense mission and vision:

"The mission of BioSense is to lead multidisciplinary, game-changing, and needs-driven research to ensure safe and adequate food for the growing world population, with a minimal environmental footprint. BioSense exists to generate, apply, and disseminate research findings through a global ecosystem of forward-looking stakeholders and build capacity in the field by empowering the next generation of technology-enabled professionals in the agri-food sector.

The vision of BioSense is to be a European leader in research in ICT for agri-food and related biosystems. BioSense strives to create prosperity and sustainability for a broad ecosystem that includes academia, government, industry, the farming community, and civil society." (BioSense)

The following are a few of the EU-funded programs in which BioSense took part:

- Horizon 2020,
- FP7 (European Commission Seventh Framework Program),
- EUREKA,
- COST,
- IPA Projects (Cross-border Co-operation Program).

At this moment, BioSense is an applicant or a partner in 21 Horizon projects. Table 4-1 presents a few of them.

Table 4-1 A few of BioSense Horizon 2020 projects

H2020 program projects
SmartAgriHubs H2020 DT-RUR-12-2018
Protein (PeRsOnalized nutriTion for hEalthy livINg) H2020 DT-SFS-14-2018
CYBELE H2020 ICT-11a-2018-2020
ENVRI-FAIR (Environmental Research Infrastructures building Fair services Accessible for society Innovation and Research) H2020 INFRAEOSC-04-2018

DRAGON (Data-Driven Precision Agriculture Services and Skill Acquisition) H2020-WIDESPREAD-05-2017-Twinning
NOCTURNO Non-Conventional Wave Propagation for Future Sensing and Actuating Technologies H2020-RISE-2017
CISTEM – Heart On chip based on induced pluripotent Stem cell Technology for personalized Medicine H2020-MSCA-RISE-2017
NEFERTITI Networking European Farms to Enhance Cross Fertilisation and Innovation Uptake through Demonstration H202-RUR-2017-1
DIATOMIC Digital Innovation Hubs boosting the European Microelectronics Industry H202-ICT-2016-2

S3 related activities in Vojvodina

The Creative industries cluster of Vojvodina has been organizing a competition called Serbia Start-Up (Figure 4-11.) aimed at developing all industries, developing business skills, and creating creative entrepreneurship in Serbia. The result of activities at this event is participation in the international competitions of selected best innovative industrial companies. The crucial criteria for evaluating business ideas are:

- creativity,
- team spirit,
- market potential.

Figure 4-11. The winners of the Serbia Start Up were participants at the
international Creative Business Cup.
Source: Creative industries cluster of Vojvodina. (Fair source)

- **A Little IT Academy**

The Vojvodina ICT Cluster, the leading organization in information
technologies in Serbia, organises public programming classes with
substantial experience in designing special courses for young people, called
Small IT Academy (Figure 4-12.). A known fact is that children, like
sponges, absorb computer knowledge and are capable of much more than
their parents think.

That is why Vojvodina IT Cluster decided to launch a Small IT
Academy. After the excellent results of the summer school, it continues with
the activities during the school year, and it offers:

SCRATCH - Learn to program by making Scratch games.
During the junior course, participants learn basic concepts in the domain
of programming through practical examples. In addition to the fundamental
theories of Scratch needed to understand the tasks, pupils also learn the
basics of computer operation, computer logic, computer graphics, and
animation. (Milutinovic, Veljko. "The best method")

APPINVENTOR - Learn to program by making mobile applications.
Throughout this course, participants learn how to create mobile
applications. In addition to the practical knowledge, which gets a lot of
attention, participants learn about the basics of phone operation, its parts,
the architecture of the Android OS, GPS systems, and the history of
technology development.

WP WEB - Learn how the internet works and create their first websites
using WordPress.
This course aims to teach the basics of how the Internet works, its
origins, and the protocols it needs to function. In addition to the basic
theoretical knowledge, participants learn how to create their websites and
make them accessible to everyone. The duration of the course is 15 weeks.

Mala IT Akademija

Vojvođanski IKT klaster je, kao vodeća organizacija u oblasti informacionih tehnologija u Srbiji, u poslednje dve godine organizovao javne časove programiranja i to iskustvo nam je bilo dragoceno u koncipiranju **Male Akademije**. Videli smo iz prve ruke da deca kao sunđeri upijaju računarsko znanje i da su sposobna za mnogo više nego što mi mislimo.

Zato smo odlučili da lansiramo našu **Malu IT Akademiju**. Nakon sjajnih ostvarenih rezultata letnje škole, nastavljamo sa aktivnostima i tokom školske godine, a u ponudi imamo:

> **SCRATCH – Naučite da programirate praveći Scratch igrice**
Deca svakodnevno igraju igrice, a jedan od najboljih načina da im se približi programiranje jeste upravo kroz **razvoj igrica**. Tokom **junior** kursa polaznici će kroz praktične primere naučiti osnovne pojmove iz domena programiranja. Pored osnovnih teorija o Scratch-u potrebnih za razumevanje zadataka, polaznici će učiti i o osnovama funkcionisanja računara, računarske logike, računarske grafike i animacije. Za one koji su savladali osnove, imamo i **senior** kurs tokom kojeg će polaznici proširiti svoje znanje i savladati komplikovanije programerske zahvate. Trajanje svakog kursa je **15 nedelja** (po**dva dvočasa nedeljno**). Svaki kurs je podeljen u 3 celine od 5 nedelja. Posle svake celine polaznici će biti testirani, kroz pismene testove i praktične projekte, kako bi se osigurao **konstantan napredak i postepeno usvajanje znanja**.

> **APPINVENTOR – Naučite da programirate praveći mobilne aplikacije**
Na svetu postoji više mobilnih telefona nego ljudi. Nijedna tehnologija nije imala toliki uticaj kao mobilni telefoni. Mobilne aplikacije **uzimaju primat nad računarima** u obavljanju svakodnevne komunikacije i pristupu informacijama. Kroz ovaj kurs polaznici će naučiti **kako da naprave mobilne aplikacije**. Pored praktičnih znanja, kojima se posvećuje dosta pažnje,

Figure 4-12. Little IT Academy. (Fair source)

- **Danube Business Forum**

Each year, a media agency, Mediainvent, together with the government of Vojvodina, organizes the Danube business forum. This event consists of different panels to support the Danube Region Strategy (Figure 4-13.) of the EU.

The Danube Region Strategy addresses a broad scope of topics divided into four pillars and twelve priority areas. Selected two countries out of the fourteen from the Macro-Regional Danube Strategy, so-called Priority area coordinators, govern each priority area. The area covered by the EU Strategy for the Danube Region stretches from the Black Forest (Germany) to the Black Sea (Romania-Ukraine-Moldova). It is home to 115 million inhabitants in 14 countries.

The Macro-Regional Danube Strategy has become a new opportunity for further improving cooperation and strengthening the region's prosperity. Consequently, the Danube Business Forum has grown into a permanent and sustainable event, promoting Vojvodina as the most promising Serbian region and the Republic of Serbia as a desirable destination for foreign investments.

The European Commission accepted the Novi Sad Danube Business Forum as a new model of communication. As a respectable one, it was praised by the Institute of European Regions from Salzburg and the Council of European Cities and Regions from Ulm. It brings representatives from businesses, media, diplomacy, politics, and students to sit together and write all panels' conclusions at the final round table. Additionally, they give recommendations for sustainable development of the Danube region to the state administration, the University of Novi Sad, the Danube Strategy team, and the European Commission. The following are some standard topics at the Forum:

- Danube Strategy - from idea to realization,
- Diplomacy in the service of economic connection and development of the Danube region,
- Danube - Energy backbone of Europe, Entrepreneurship - the source and basis of prosperity,
- Business and prosperity,
- The media and their impact on building awareness of the importance of connecting people, ideas, and markets,
- Danube Strategy and Youth,
- New technologies, new opportunities, and jobs of the future,
- Municipalities, cities and regions;
- Danube Agriculture.

Figure 4-13. Logo of the Danube business forum. (Fair source)

- **When I grow up, I will have my own company!**

With an idea that people should develop entrepreneurial souls during childhood, performances and workshops for pre-school children are organized to enforce their will to become entrepreneurs (Figure 4-14.).

A special issue of the children's journal "Maštalica" ("Dreamer") was published about entrepreneurship to drive their imagination about future jobs.

Figure 4-14. Workshops for children. Source: Authors

- **BSc, Master, and PhD diplomas**

As an excellent example of cooperation between universities (science) and companies, significant efforts have been made in recent years to have bachelor, master, and PhD theses created according to companies' demands.

As an example (Figure 4-15.), at ATB Sever Subotica, at a ceremony, seven PhD theses were presented in the production hall at the same time. The company problems were solved, students received practical experience, and all got employed at this company.

Figure 4-15. Presenting of PhD theses in a working environment.
Source: Authors

- **The day of engineering jobs**

This event aims to attract high school students to study at engineering faculties (colleges). High school pupils are taken to engineering faculties to visit labs and talk with professors. Unique films are made, which picture engineers at their workplaces doing everyday tasks supplemented by experts' explanations of their daily duties, goals, results, problems, etc. (Figure 4-16.).

Figure 4-16. Program for the Day of Engineering Jobs. Source: Authors

- **Competition for co-financing facilities for the application of new technologies in Vojvodina**

To foster its strategic orientation of implementing a more dynamic economic development and launching new production capacities based on new technologies, the Provincial Government co-finances the application of new technologies (up to 49% of the investment value). The total amount assigned for these purposes is 1.000.000 EUR per year.

- **Best Technological Innovation Award**

Best Technological Innovation Award is a national competition in Serbia to promote and financially support new innovative ideas. This competition inspires innovative people to present their ideas and realise them, and it helps commercialise practical, creative products (Figure 4-17.). All competitors go through preparation courses where they learn how to develop a business plan, prepare and do marketing campaigns, and present their ideas to investors in the best way (pitching).

Figure 4-17. Competition for the Best Technological Innovation. Source: Ministry of Education, Science, and Technological Development (Fair source)

- **Popularization of science - Science festival**

The Science festival enables the presentation of research results. Its goal is to attract young people and to persuade them to enrol on scientific faculties. The festival is a place to promote famous scientists but also not well-known or not-known researchers. It encourages interest in science with a simple demonstration of just how much it is interesting, inspiring, and, above all, fun. Its slogan is: "Everything is possible. The impossible just takes a bit longer." (Figure 4-18.)

Figure 4-18. The programme of the Science Festival.
Source: Authors

- **Researchers' night**

Researchers' night aims to popularize research among the young population. The presentation of research results is in ten Serbian towns and cities (Figure 4-19.). Many young researchers present their ways of working and research results throughout the night, which makes the event very special.

Figure 4-19. Researchers' night. (Fair source)

- **Tesla Fest**

Tesla Fest is a festival for the presentation of innovative products and services. (Figure 4-20.) It is devoted to the work of the famous Serbian researcher Nikola Tesla and should promote science. This event aims to provoke young people to follow the life of Nikola Tesla. At the event, the broad public has a chance to see many experiments that Tesla performed.

Figure 4-20. Teslafest. (Fair source)

b. What is needed in Vojvodina to force the implementation of S3?

At the Etran conference in Kladovo, Serbia, which took place in 2017, under the special session 3 - "Funding for productive and effective R&D: Smart specializations in Serbia", the authors of this book stated that the following necessary measures were needed in Vojvodina to help and force implementation of S3:

- Measures to **support beginners** to start a business – Start-Up,
- Measures to support the development of successful entrepreneurial companies, SMEs, and entrepreneurial activities (**next phase of companies' life cycle)-accelerators,**
- **Innovation vouchers** for joint development of innovative products or services with scientific research institutions and mentoring,
- Measures to support the establishment and development of **accredited laboratories,**
- Measures to support the development of **clusters,**

- Measures to support **start-up incubators** (Figure 4-21.),
- Measures to support professional practice in companies-**student and pupil vouchers,**
- Measures to **develop faculties, universities, and to set up open labs.** (Figures 4-22. and 4-23.) (Kranjac, Mirjana. Sustainable development)

Figure 4-21: SPENS (Sport and Business Centre in Novi Sad)
As a possible home for an IT start-up incubator. Source: Authors

Figure 4-22. Open lab 1. Source: Authors

Figure 4-23: Open lab 2. Source: Authors

The involvement of the European Institute of Innovation and Technology (EIT) (Figure 4-24.) would be of great importance for implementing S3 in Vojvodina. It is an EU body created by the European Union in 2008 to foster Europe's innovative capacity. The EIT is an integral part of the EU's Framework Program Horizon 2020 for Research and Innovation (EIT, EIT at a glance). It is a competitor to the Joint Research Centre (JRC), which was set up to intensify the activities of JRC, bring better results, and make European innovation and research space more efficient.

Figure 4-24. Presentation of EIT at the University of Novi Sad.
Source: Authors

CHAPTER 5

SMART SPECIALIZATION STRATEGY OF THE REPUBLIC OF SERBIA – S4

1. The process of the S4 generation[5]

The S4 development process was officially started in late 2016 by the Ministry of Education, Science and Technological Development of the Republic of Serbia (MoESTD) and the Republican Secretariat for Public Policy. After a progression of meetings, a political agreement was reached, and it was decided, at the country level, to start a procedure toward drafting this strategy. After establishing contacts and correspondence lines with the Directorate General Joint Research Centre (DG JRC), Serbia became the first country outside the European Union to enter the Platform of Regions and States to work on the Smart Specialization Strategy. An inter-ministerial Working Body for creating the strategy was formed, with members from the Ministry of Education, Science and Technological Development, the Ministry of Economy, the Ministry of Finance, the Ministry of Labour, Employment, Veterans' and Social Affairs, the Ministry of Trade, Tourism and Telecommunications, the Ministry of Agriculture, Forestry and Water Management and Environmental Protection, Ministry of Culture and Information, Republic Secretariat for Public Policies, Provincial Secretariat for Economy and Tourism of AP Vojvodina, Serbian Chamber of Commerce and Serbian Academy of Sciences and Arts - SANU (Gov-RS. „S4 Decision").

This Working Body created a sub-unit - the Operations and Analytical Team Working Group and its subunits. After receiving instructions from JRC, all of them accepted and followed JRC's methodological framework during the strategy drafting period. Figure 5-1 presents the process of generation of S4. The following slides in this chapter and Table 5-1 have been adopted from the Strategic Smart Specialization in The Republic of

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[5] The source for the information and data presented in this chapter is the free-source document (MPNTR, „S3RS").

Serbia from 2020 to 2027 created by the Ministry of Education, Science, and Technological Development (MoESTD, „S3RS").
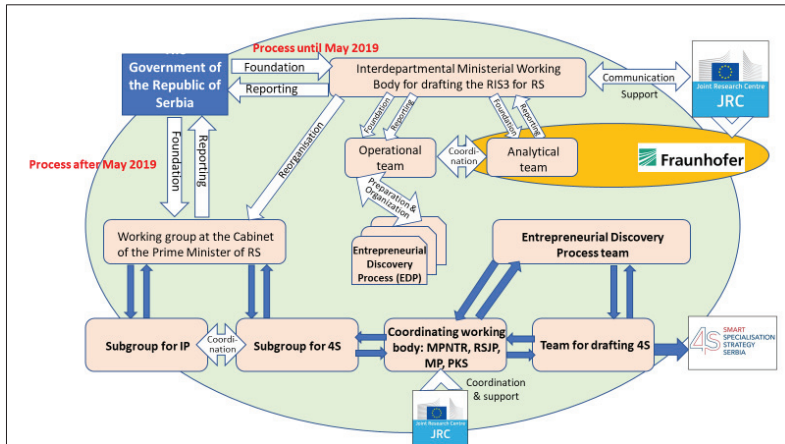

Figure 5-1. The process of generation of S4.
Adopted from (MoESTD, „S3RS")

a. During the following year, in 2017, a definite quantitative examination was conducted to estimate the potential for innovation and research in the Republic of Serbia and its financial capabilities to support them. All this was done in collaboration with the applicable institutions: the Statistical Office, the Institute for Intellectual Property Protection, the Republican Secretariat for Public Policy (RSJP)[6], the Ministry of Education, Science and Technological Development, the Ministry of Economy, the Economic Chamber of Serbia, the University of Belgrade, and the German Fraunhofer Institute.

b. The quantitative examination identified some areas of potential, which were analysed in December 2017 at an ICT Innovation camp (software engineering).

c. In 2018, after a progression of meetings with significant stakeholders, a qualitative analysis was conducted, indicating potential sectors with

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[6] The RSJP is a special organization of the Government of the Republic of Serbia that provides expert support to the government and state administration bodies in the process of planning, developing, adopting and coordinating public policies and implementing regulatory reform.

competitive advantages. During the writing of that document, the MoESTD coordinated a great deal with other public institutions and non-governmental and private companies. It had the help of specialists from the World Bank's Competitiveness and Employment Project and specialists provided by the European Commission's JRC.

d. The entrepreneurial discovery process lasted from March 2019 until June 2019. In that period, there were 17 workshops, and the Ministry of Economy began preparing the Industrial Strategy. The Government of the Republic of Serbia wanted to enable harmonization between the contents of industrial and S4 strategies and to abide by the EC Recommendation that it gave in the Annual Progress Report for 2018 proposing the use of the Strategies for Smart Specialization for the elaboration of the Industrial Strategy. The Government of the Republic of Serbia created a Working Group for drafting the Industrial Policy Strategy of the Republic of Serbia from 2021 to 2030. The group had a task to develop a research and innovation strategy for Smart Specializations in the Republic of Serbia. Moreover, teams cooperation meetings that were creating these two strategies were organized with the support of this Working Group.

A new structure was formed to carry out the EDP process and follow the new requirements, consisting of the Coordination Body and the EDP team. The Coordination Body composed of delegates of the Ministry of Education, Science and Technological Development, the Republic Secretariat for Public Policy, the Ministry of Economy, the Serbian Chamber of Commerce, and the Expert Team on the project "Improving Competitiveness and Employment", had tasks in the process to coordinate, manage, and approve decisions. The wider EDP team comprising an S4 writing procedure organizer, the leading EDP usage consultant, an analytical consultant, an area organizer, and coordinators was responsible for practical actions, arranging and coordinating workshops, and suggesting strategic choices related to the EDP. The Entrepreneurial Discovery Process team worked with the support of the Coordination Body.

e. The government formed a special team for writing the strategy in 2019. It consisted of the S4 writing process coordinator, the head of the Coordination Body, the team leader for expert support for the project "Improving Competitiveness and Jobs", an analytical counsellor, a counsellor to the process coordinator, and two areas coordinators. The Strategy Writing Team wrote the first version of the S4 in September 2019. During the composition of the current

strategy, the Team put a particular accent on defining a package of measures dependent on the outcomes and suggestions from the EDP process. Given the intricacy of the public authority organizations and the scope of subjects covered by the proposals, extra counsellors were assigned from divisions outside the MoESTD, responsible for specific components of the package of measures. Specifically, there was a requirement for close collaboration in getting the measures ready. In addition, in the elaboration of EDP suggestions and execution of the measures, close cooperation was necessary with the Ministry of Agriculture, Forestry, and Water Management, since the significance of the Food for the Future priorities under S4 is very high. With this in mind, the government chose to set up a limited group comprising delegates from the Coordination Body and the Ministry of Agriculture, Forestry, and Water Management, which would determine the rules for execution of this measure and the indicators for its auditing.

f. The S4 Coordination Body will continue to exist after the government enacts the S4 and will be liable for planning and checking the execution. The MoESTD, as the body responsible for strategy implementation, will be in charge of the assessment of its execution.

g. The public discussion, which included quite a few targeted meetings and workshops of all delegates of the quadruple helix[7], brought about the list of priority thematic areas for research, development, and innovation, all founded upon the strengths and potential of Serbia's regions. Given that EDP should be a never-ending process, one of the adopted requirements of the strategy was the perpetuation of EDP activities. That meant that workshops and focused discussions with representatives of industry, academia, governmental institutions, and civil society should be organized regularly to gather data to be used as input for calls for proposals for financing innovative projects in thematic priority areas. Figure 5-2 presents the organizational view of the bodies in charge of making the S4.

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[7] Key local actors from government, research and scientific institutions, companies, and citizens (NGO), which engage in bottom-up collaborative processes in innovation policy and challenge the traditional top-down policymaking process.
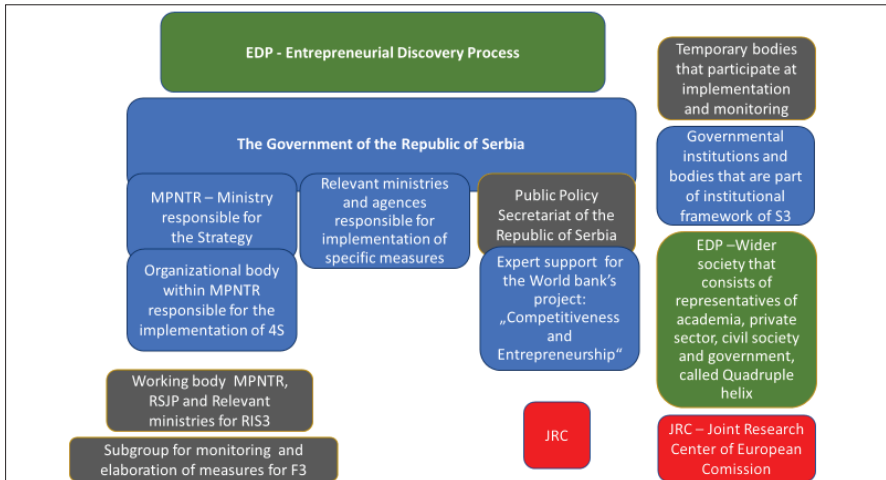
Figure 5-2. The bodies in charge of making the S4.
Adopted from (MoESTD, „S3RS")

2. Managing the S4 strategy implementation process

As the bearer of the strategy, the Ministry of Education, Science, and Technological Development was the responsible institution and the primary body responsible for checking and executing the S4. Its support will a particular group inside the Ministry itself. This group will be responsible for the everyday implementation of the strategy and for gathering related data from the relevant ministries and agencies involved in executing all assignments and actions. The country's Planning System Law assigns ministries to create and send yearly reports to the government; thus, the MoESTD will be responsible for sending data on the outcomes of the execution of the Action Plan. It will also report on the strategy execution outcomes toward the end of the three-year time frame. S4 is a continual development strategy, and it is impossible to dependably estimate significant effects toward the start of the execution of the measures. That is why it is important to let some time pass before assessing the impacts of the measures and actions.

The RSJP, as the working body of the Ministry of Education, Science and Technological Development, and the delegates of all ministries related to RIS3, will be responsible for planning and observing the strategy. This group will be active continuously during the execution of the strategy and will monitor and evaluate its implementation. It will continue to have the

same structure and guarantee that the process stays on a good path and is managed well and that all significant stakeholders are included. Additionally, another working group, only for the priority area F3 (Food for the Future), will be established inside this group. This working group will incorporate specialists of the EDP process in the F3 area and some delegates from the Ministry of Agriculture, Forestry, and Water Management. Both groups will get monitoring checklists, examine all pertinent data with the members of the EDP, form assignments for the S4 team, and help with carrying out the strategy on a case-by-case basis.

Since full transparency of the process is crucial, the strategy sets out a measure that will help keep monitoring and evaluation open and immune to political pressure as a continuation of the EDP process. To avoid possible gaps, biases, and asymmetric information and to keep in touch with the implementation, representatives of the EDP process will also be involved in discussions during the implementation of the strategy. Their job will be to help interpret the data, cover the missing points, and make otherwise inaccessible "real-world" information available to achieve a more informed and transparent decision-making process.

During the implementation of the strategy, the MoESTD will have the technical support of the RSJP. Likewise, during the first year of the strategy, the Competitiveness and Employment project of the World Bank will help the MoESTD.
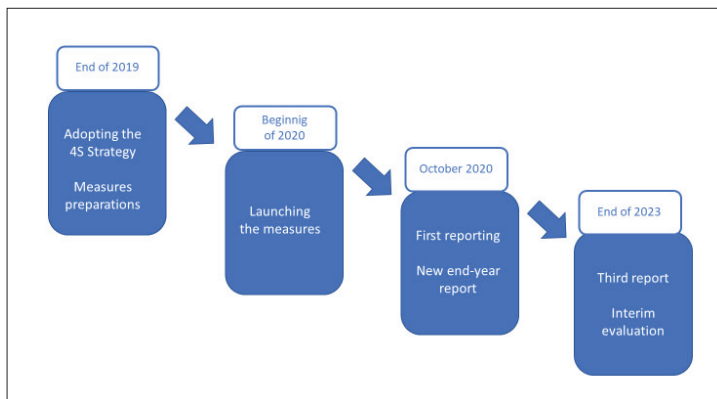

Figure 5-3. Strategy monitoring flow.
Adopted from (MoESTD, „S3RS")

The last control mechanism will be the evaluations by the JRC, which it will do as needed (Figure 5-3).

CHAPTER 6

SURVEY AND ANALYSIS FOR S4

The first activity to distinguish possible priority areas of the Smart Specialization Strategy of the Republic of Serbia was an experimental examination that made the proper selection of them. The selected priority areas were the first pool and a starting point for organizing a focused dialogue (entrepreneurial discovery process) with all involved in the Quadruple helix. The concluding choice of priorities was the outcome of a point-by-point quantitative investigation into the economic, innovation, and research potential of the Republic of Serbia.[8]

The qualitative examination went after the quantitative one. It contained more than 140 interviews with primary delegates from business, research, and government sectors. The EDP incorporated workshops with all representative parties, especially targeting the business sector (Figure 6-1). The procedure for choosing priority zones abided by the European Commission's Joint Research Centre (JRC, S3 Platform) framework.
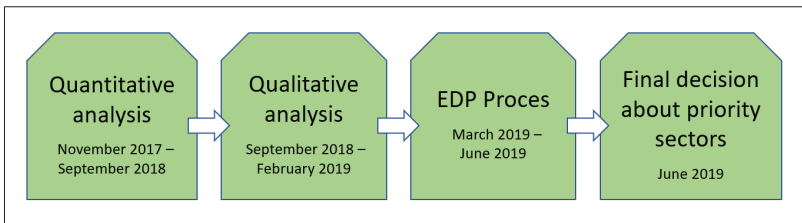

Figure 6-1. The process of identifying potential priority areas.
Adopted from (MoESTD, „S3RS")

1. Quantitative analysis

The quantitative analysis included these actions:

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[8] The source for the information and data presented in this chapter is the free-source document (MoESTD, „S3RS").

- The economic, innovation, and scientific potential of Serbian regions,
- Mapping the creative and innovative potential of the economy.

The mapping was completed at the end of 2017 by the Serbian analytical team (from key institutions involved from the outset in the strategy preparation and the development process) with the help of specialists from the Fraunhofer ISI Institute (Karlsruhe, Germany) and the Joint Research Centre of the European Commission. It included analysis pointed toward enhancing the previous examinations with new markers solely connected to development programs and stressing innovative Serbian potential, which the past reports did not contain.

2. Potential of the Serbian region through the process of mapping economic, innovation, and scientific potential.

The technique for the planning was to compare what advantages a specified region has relative to the rest of the country utilizing these markers:

- economy (employment, exports, qualified workforce),
- innovation (start-ups, innovative companies, patents),
- science (institutes and scientists with good references).

Potential priority areas' final selection contains three criteria:

1. *The value of the Learnability Quotient (LQ) index.*
    The workplace is constantly changing, just as technology is. The Learnability Quotient reflects "The desire and ability to quickly grow and adapt one's skill set to remain employable throughout the working life." (LQ. "Learnability Quotient"). The LQ index value should be higher than 1.5. As per this rule, the selected sector for the selected region must have at least a 50% higher LQ index than it has at the national level.
2. *Total size.*
    The size matters, as usual. If the importance of the selected sector is 50% higher for the local economy, but it employs a small portion of the workforce, it can not be taken into account. So, size is, obviously, a necessary criterion.
3. *Growth.*
    Growth carries relevant information when selecting potential sectors, but it has not been used as a prerequisite for qualifying to

avoid it as a limiting restriction. This rule addresses whether the sector is developing or is just a tradition of prior years. If it is not growing, it would require some significant investments to reach the present technology levels of the developed countries.

Belgrade region

The Belgrade region is the most powerful economic and university centre in the Republic of Serbia. Services as a branch of the economy are dominant in the Belgrade region and have been increasing in recent decades. The region has also shown substantial economic potential in ICT, research and development, creative industries, and developing potential in a few producer industries (e.g., beverage industries, etc.).

The Belgrade region has a population of 1.66 million (2011 census) and covers 3,234 km2. The region contributes to the total value added of the Republic of Serbia by 54.1% (2018) and to Serbia's total exports by 27.2% (2019). The unemployment rate in Belgrade has fallen in the last five years and stood at 13.3% in 2019. Belgrade has the highest average wage per employee of all Serbian regions (net RSD 66,925 in June 2019). As mentioned, a large portion of the workforce is in services and, so, in this region, services earn 80.6% of total GVA. A significant number of highly educated people live in Belgrade, and the ICT sector employs a large percentage of them. Also, the workforce engaged in different service sectors, like public administration, education, finance, and scientific services, has more than 60% of university graduates. Belgrade is the capital of Serbia, and its employees have the highest average qualification in Serbia. The expected consequence of this is its high scientific potential.

Vojvodina region

The Vojvodina region is partly industrial and partly agricultural. It is comparatively in a better position than other regions in Serbia because it already manufactures vehicle parts, has petrochemical and plastic material production, and high level of agribusiness. Novi Sad, the capital of Vojvodina province, has a high standard of scientific and other research. It and a few other bigger Vojvodina towns have a very high potential in the ICT field. Vojvodina has a population of 1.93 million (2011 census) and covers an area of 21,614 km2. The region contributes to the total value added of the Republic of Serbia with 24.63% (2018) and total national exports with 33.8%. The current unemployment rate is 12.2% (2019). The average monthly net salary in June 2019 was RSD 50,615 per employee (430€).

Like Belgrade, Vojvodina has a high percentage of university graduates in the information technology sector, scientific and technical activities, the financial sector, public administration, and education. Of all university-educated people in Vojvodina, 60%. are employed in these sectors**.** The advantage of Vojvodina is its proximity to Belgrade. Unlike Belgrade, the number of people in professional education for engineering, manufacturing, and construction is higher than the national average (31%/30%). At the same time, it is lower than the average percentage in Serbia, in business, administration, and law and legislation (13%/15%).

Šumadija and Western Serbia
The region of Šumadija and Western Serbia (WS) is a region portrayed principally by agribusiness. With the appearance of the Fiat organization from Italy, this region started to grow in the automotive sector, in which it now has a significant legacy. The region has an articulated scientific base in mechanical engineering, pharmaceutical production, and general machinery production. The WS region has a population of 2.03 million (2011 census), and it covers an area of 26,493 km2. Thus, it is the largest region both in the number of inhabitants and in the size of its surface. The region contributes to the GVA of the Republic of Serbia by 13.19% (2018). The size of WS's exports reaches 21.9% of Serbia's exports. The unemployment rate was 13.6% (2019). The average monthly net salary in June 2019 was RSD 45,585 per employee (387€). The percentage of employees with higher education differs from the national average in most activities. For example, in the IT sector, which, by definition, requires higher educated workers, the share is only 32%, one-half of the percentage in Belgrade or Vojvodina. Another example is agriculture, where more than 55% of workers have lower than average education (Vojvodina 39%). One positive thing is that the number of people taking expert education training courses is above the national average in three industries: engineering, manufacturing, and construction (32%/30%).

Southern and Eastern Serbia
The Southern and Eastern Serbia region (SES) is the poorest, with the lowest salaries and the highest number of jobless people. The SES region is strong in agriculture, textiles, and rubber industries, and there is good scientific knowledge in electrical engineering.

This region has 1.56 million inhabitants (2011 census). Its area is 26,248 km2. Its GVA is 8.07% of Serbia's (2018), but its exports are 16.9% of Serbia's. The jobless rate is 15.2% (2019). The average monthly net income in June 2019 was RSD 46,974 (399€). The number of higher-educated

employees in this region is below the national average in financial services, science, IT and technical activities, public administration, and education. The number of students in vocational education and training is close to the average in Serbia. It is a bit higher in agribusiness, forestry, fisheries, veterinary science, and natural sciences.

The results of the quantitative examination in the SES region indicated that in this region, employment and GVA do not agree—comparing their percentages with the total of Serbia shows that the employment has a substantially higher number than GVA. That is a consequence of the fact that agriculture is vital in determining employment and salaries in Serbia, but its weight in the national GVA is relatively small. (Table 6-1.)

Table 6-1. Potential priority domains in Serbia

Belgrade	Šumadija and Western Serbia	Vojvodina	Southern and Eastern Serbia
Existing core: Computer Programming and ICT • R&D and Technical Consultancy • Creative Economy • Monetary Intermediation	*Existing core:* Agri-/Horti-/Silvicultural economy (including processing industries) • Automotive • Textile Industry • Plastics Industry, Metal Industry	*Existing core:* Automotive suppliers • Agricultural Economy (including processing industry) • Petrochemical industry • Plastics Industry	*Existing core:* Agri-/Horticultural economy (including processing industries) • Textile Industry • Rubber Industry • (Electrical engineering)

Potential emerging: Beverages, Pharmaceuticals, Electrical Components, Transport Equipment	Potential emerging: Special-purpose machinery	Potential emerging: Agricultural Machinery, Measurement Instruments	Potential emerging: Food products, Medical, and Dental products
Science base: various	Science base: Mechanical engineering, Pharmacy	Science base: Computer Science, Telecommunications	Science base: Electrical engineering

The additional conclusion of the quantitative analysis is that an economy of a country such as Serbia, which is still heavily dependent on agriculture and low-tech industries, should consider traditional sectors in RIS3strategy. It should not be "smart" in implementing the Smart Strategy by specialising in high-tech sectors only. Information on human resources in Serbia indicates that there is a substantial proportion of the population with secondary education all over the country. Still, most of the university graduates live in Belgrade and Vojvodina since most universities are in Belgrade and Novi Sad. Also, the standard of living in northern regions is much higher than in others.

From the above mentioned, it is clear that the living standards and current economic development vary significantly in different parts of Serbia, which substantially influences the innovation and science capabilities of the regions. The strategy should define regional specializations and priority areas with equal coordination of all the regions and must be carefully monitored at the national level.

Given the present status of the country's economy with high differences and its small volume and importance on the European scale, it is necessary to consider the comparative advantages at the national level relative to the EU regions.

3. How to map the innovation and creative potential of the country's economy

Additionally to information and pointers from formal statistics, this analysis takes into account remaining accessible data related to innovations in Serbia:

- The projects of the Innovation Fund and the European Bank for Reconstruction and Development,
- Successful new businesses (some of them are start-ups),
- Business clusters,
- Incubators, etc.

These extra analyses again confirmed the more significant part of the discoveries from the investigations and studies presented before. They likewise validated the conclusion that the comparative advantages should be dealt with at the national level in addition to the regional one. In the same manner, the investigations showed that business areas, the so-called horizontal priorities in all sectors, such as energy efficiency, KET (key enabling technologies), and safeguarding the environment, should be covered. Finally, they stressed the need to consider potential priorities, which are indicated only by official statistics, but after the qualitative analysis.

Given the relative numbers of recent sector applications to the EU Innovation Fund, Serbia's most significant innovation potential lies in ICT, primarily in software application development. Then, there is food and agriculture, followed by mechanical design and mechanical engineering and energy proficiency.

4. Qualitative analysis

Conducting a qualitative analysis was necessary to overcome the limitations of existing classifications of industry and science and discover natural priority areas and the value chains they represent. The main reason for the execution of the qualitative examination is to do a good job of selecting preliminary priority domains to use in the next phase of the smart specialization general schedule – the Entrepreneurial Discovery Procedure.

Mapping economic, scientific, and innovation potential at the regional level and additional analysis, i.e., mapping the innovation and creative potential of the economy at the national level, presented above, brought significant outcomes. The Working group reviewed all findings and results for developing a smart specialization strategy. They narrowed the group of priorities and decided to further explore the following six areas through targeted interviews with business and research sectors. The goal was to gain additional information on the potentials of the Republic of Serbia and to make the final selection of priorities for the entrepreneurial discovery process:

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

Additional interviews helped reach more information on the country's potential and make the final selection of priorities for entrepreneurial discovery.

The qualitative examination interviews were looking for responses to these topics:

1. *Who are* the leading players and stakeholders in preliminary priority areas?
2. *What are* the strongest sub-specializations in the area?
3. *Where is*, in the value chain, the most significant value created globally, and what is the position of Serbian actors in global value chains?

In addition to answering the previous questions, additional objectives of the analysis relate to the following:

1. Gathering essential information for developing a good EDP process tailored to the needs and capabilities of the representatives.
2. Identifying "process ambassadors" in each priority area who would represent the economic, scientific, and civil sectors. They could readily appreciate the usefulness of EDP and be influential enough to enable full participation of other relevant stakeholders and ready to contribute to the whole process quality through frequent opinions and recommendations.

The Qualitative Analysis Report is the meaningful result of looking for potential priorities continually within the Smart Specialization Strategy.

From September 2018 to February 2019, 155 interviews were conducted with relevant stakeholders from the business, research, and government sectors to obtain additional information on the six pre-identified priority areas during the quantitative analysis. Besides the vertical ones, which are the main focus sectors, horizontal priorities ought to be included. As stated before, they impact all sectors, and their influence refers to the diffusion of novel technologies and organisational and social innovation. After the

systematization of information gathered in the interviews done within this
quantitative examination, the first proposal identified the following names
of areas and sub-areas (recognized as the crucial followers and influencers
of the main sectors):
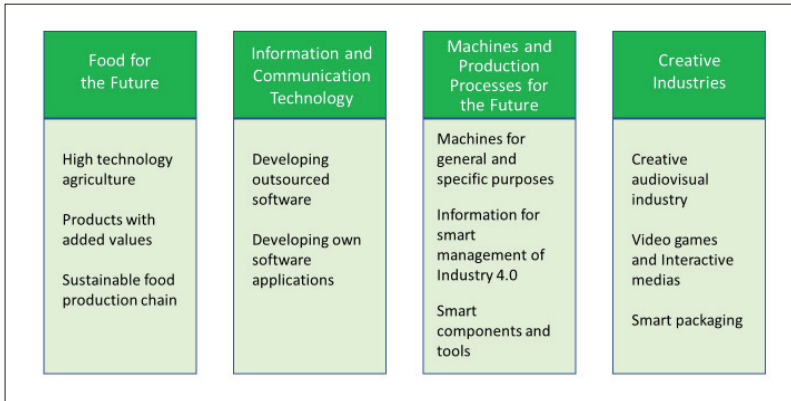
Figure 6-2. Products for the future.
Adopted from (MoESTD, „S3RS")

The vertical priority areas presented in Figure 6-2 are:

1. Information and communication technologies:
   - Big data and business analytics,
   - Cloud computing,
   - The Internet of Things,
   - Software development,
   - Embedded systems.
2. Food for the future:
   - High-tech agriculture,
   - Food with added value,
   - Sustainable agriculture and food production.
3. Creative industries:
   - Creative Digital Audio-visual Production:
   - The video game industry,
   - Smart and active packaging.
4. Machines and production processes of the future:
   - Devices for specific purposes,
   - Information in the service of smart management-industry 4.0,

- Premium toolboxes and parts for auto, rail, and aviation enterprises,
- Eco-friendly and sustainable fuel ignition plants,
- Smart environmental solutions.

Horizontal (supporting) areas are:

1. Energy-efficient and Eco-smart solutions:
   - Eco-smart energy sources.
2. Key enabling technologies (KET) and growing technologies:
   - Photonics,
   - Advanced materials,
   - Advanced manufacturing technologies and electronics,
   - Biotechnology,
   - Blockchain technologies,
   - Autonomous driving, aeronautical systems, and engineering.

5. The Entrepreneurial Discovery Process (EDP)

The Entrepreneurial Discovery Process is an interactive process based on targeted dialogue that brings together different actors to identify priority areas of smart specialization and develop an appropriate mix of policies for their implementation. From March to May 2019, there were 17 workshops aimed to identify future priorities and confirm them. Over 200 participants from different target groups were there, divided into three thematic units.

The goal of the first thematic workshops was to recognize critical challenges in potential priority sectors and make a final SWOT matrix taking into account fundamental forces, shortcomings, and opportunities in all sectors chosen for analysis.

The goal of the second group (VISION), based on the results from the first one, was to verify the priorities by defining visions and goals of priority areas and what needs to be attained in the next three to five years.

The third round of workshops (POLICY MIX) aim to specify measures and actions for reaching the identified goals.

Figure 6-3 shows the process of organizing workshops to identify final priority areas.
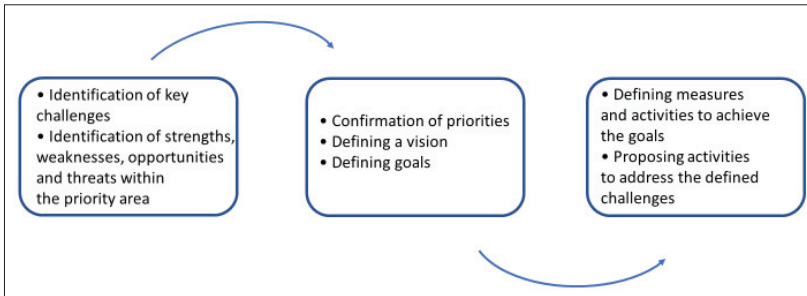
Figure 6-3. The process of organizing EDP workshops in Serbia.
Adopted from (MoESTD, „S3RS")

More than half of the participants in the EDP workshops were representatives of the business sector, which is an essential indicator of the success of the workshops. In addition to the business sector, participants from scientific, research, and the public and civil sectors attended the EDP workshops. Figure 6-4 shows the structure of participants.
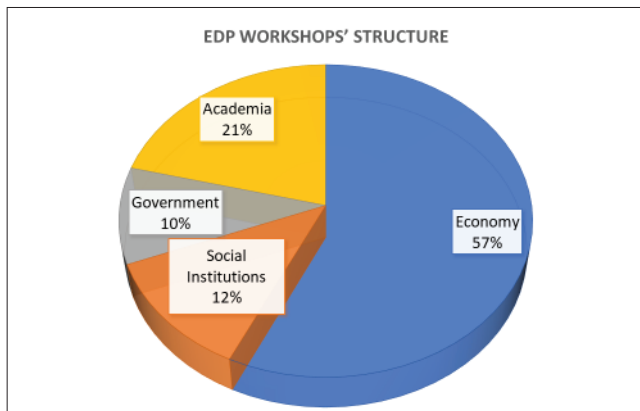
Figure 6-4. Structure of participation in EDP workshops.
Adopted from (MoESTD, „S3RS")

The main results of the EDP workshops were: confirmed priority areas, vision, goals, and measures to address potential challenges. Workshops took place in Serbia's more important centres: Belgrade, Novi Sad, Niš, Kragujevac, Kraljevo, and Gornji Milanovac. Coordinators for priority areas led the workshops, and 30 to 50 participants took part in each one.

Participants were obliged to make final workshops' decisions unanimously. The main goals were:

- Identifying key challenges,
- Identifying strengths, weaknesses, chances, and threats within priority areas identified by SWOT analysis.

SWOT analysis was the basis for:

- Confirmation of priorities,
- Defining the vision,
- Defining goals,
- Identified VISION was a roadmap for:
  o Defining measures and activities for achieving goals,
  o Proposing activities for solving defined challenges.

6. How to make the final decision on priority sectors

The final priority areas of the Smart Specialization Strategy of the Republic of Serbia are the following:

(1) Food for the future,
(2) Information and communication technologies,
(3) Machinery and manufacturing processes of the future,
(4) Creative industries.

These decisions are the consequence of introduced analyses, both quantitative and qualitative, and the performed entrepreneurial discovery process. Or, to underline, they are the result of correctly applied EC methodology for S3 development. Figure 6-5 presents the selected priority sectors.
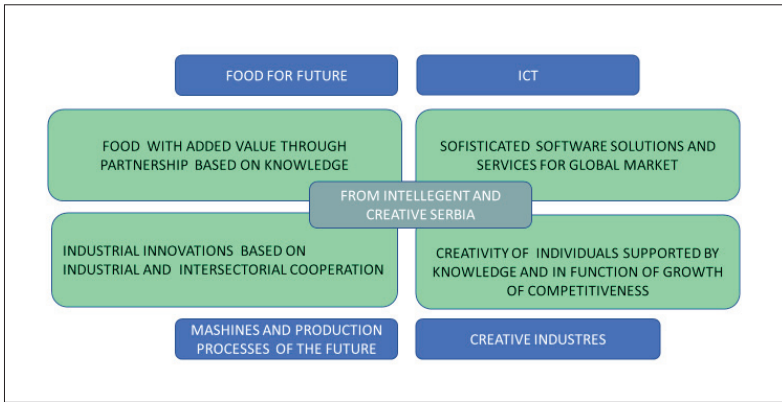
Figure 6-5. Selected priority sectors of S4.
Adopted from (MoESTD, „S3RS")

By using EC methodology and going through all the recommended steps of S4 creation, Serbia wanted to achieve its stated vision:

"Serbia creates innovations: The smart and creative Republic of Serbia is highly competitive in the world and is recognized for innovations based on knowledge, partnerships from the domestic ecosystem, and creativity of individuals in the areas of:
- Sustainable high-tech food production with high added value for the future
- Sophisticated software solutions for the global market and cross-sectoral industrial innovations." (Gov-RS. "S3 Serbia").

The general and specific objectives of the smart specialization strategy take into account the results of the implemented EDP, and their definition entirely derives from the results of the EDP workshops.

The general and specific objectives are presented in Figure 6-6.

Figure 6-6. The general and specific objectives of S4.
Adopted from (MoESTD, „S3RS")

CHAPTER 7

INFORMATION AND COMMUNICATION TECHNOLOGIES IN SMART SPECIALIZATION OF SERBIA
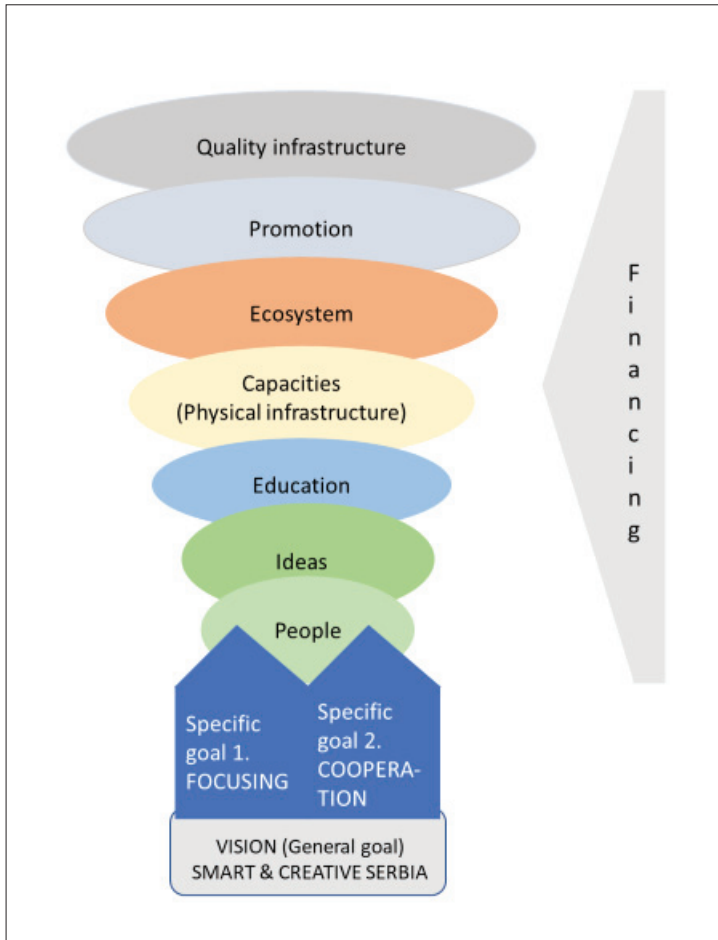
The Information and Communication Technologies Sector has been the most dynamic sector in Serbia in the last ten years. It is the second important for the smart specialization of Serbia and Vojvodina, too. The segments of ICT that should be part of ICT research and innovation, as described above, are:

- Big data,
- Business analytics,
- Cloud computing,
- The Internet of Things,
- Software development,
- Embedded Systems.

The comparative analysis of employment in different economic sectors showed that Serbian ICT had the most significant employment growth from 2010 to 2015 compared to other Danube region countries (Kleibrink, Radovanovic, Kroll et al., *The Potential of ICT in Serbia*). In 2013-2018, total revenue rose 2.9 times, making an average yearly gain of 23%. According to data from 2019, 2,349 IT companies were registered with 28,543 employees, representing 1.8% of the total Serbian market labour force. The profitability index of the ICT sector per worker is six times bigger than the average reported for the country's economy. The annual growth of 6% resulted in the IT market's revenue increase of €578 million in 2019 (IT services 42.1%, software 18.1%, and hardware 39.9%) (Matijević and Šolaja, "ICT at a Glance"). Due to increased demand for the workforce, the number of employees in this sector is growing significantly.

Almost 200 new ICT companies are registered every year. Most start-ups deal with software developments and orient themselves towards more

extensive and more affluent IT markets abroad. This tendency is vital for the private sector, and the private sector leads the ICT industry. In Serbia, there is no even distribution of human capacities among the regions. That is also the case for the availability of IT human resources and financial tools. The most important and most influential businesses are in the three biggest cities: Belgrade, Novi Sad, and Ni. Approximately 2/3 of all employees in the ICT sector (and in programming separately) work for companies registered in Belgrade. There are seats in Novi Sad companies for as much as a quarter of all developers in Serbia (Verbić, Digital Economy in Serbia in 2017). The most significant net assets, over €379.7 million, belong to companies that are software exporters. Their assets form almost 57% of the total net assets of the IT industry. The next are IT services (25%). In the period between 2013 and 2018, the capital of the SW industry increased by 80%. The prognosis predicts growth of more than €200 million in capital over the next three years. The Internet has significantly improved in the past few years in Serbia. However, broadband access to the Internet network in Serbia is still far from the standard quality in EU countries. Since most ICT businesses are in metropolitan areas where the quality of the ICT framework (infrastructure) is sufficiently better, the weaknesses of the ICT framework do not present a big problem for the development of this industry (Matijević and Šolaja, "ICT at a Glance").

The rapid development in this business area is a solid signal of present and future potential. The SME segment of the IT industry in Serbia has excellent prospects, but still, investments are vital for its further development.

The most important advantage of the Serbian ICT sector is the solid knowledge and innovativeness of its workers. That is why Serbian ICT businesses can provide top-notch solutions and all services - from software development to systems, to hardware and general support.

The competitiveness of the sector in the global market is formed based on lower costs and the quality of human resources. The domestic ICT industry is very dependent on foreign ICT companies, their intellectual property, and their investments. Outsourcing as a predominant business model characterizes the ICT sector in Serbia. Namely, out of 200 ICT businesses that mainly export their products and services, according to newly published revenues, 138 are doing outsourcing (employing 82% of the workforce and completing 69% of the exports). The remaining 62 businesses are mainly solutions exporters. (Matijević, "*IT in Serbia in 2017-2018*"). In terms of ownership, among 200 of the largest IT exporters, 88 were founded by foreign individuals and companies. They employ 58% of the workforce, generate 54% of total export revenues, and almost exclusively do

outsourcing. Even though the legal status of freelancers has not been resolved, an estimate is that several tens of thousands of them work in Serbia.

The outflow of highly qualified IT professionals is one of the biggest threats to this sector's future growth and development. In addition to the interstate, there is a significant "brain drain" within the country because companies and employees are primarily in three cities: Belgrade, Novi Sad, and Niš. The supply of IT experts in Serbia is currently much lower than the demand (Ognjenović, Kosovka and Vladimir Vasić, *"ICT Skills Need Analysis"*). Serbia has little demand for domestic IT products and services, both from the private and public sectors. The absence of investment in infrastructure and HR arises from the lack of interest in the products in the home market (Verbić, Digital Economy in Serbia in 2017). Investments in ICT infrastructure and human resources are 2-3 times lower than the EU average. The growing interest of young people in IT and similar sectors and a solid entrepreneurial spirit reflect positively on Serbia's reputation. The estimate is that the annual growth of the ICT sector in the next period will average 20%. During the EDP workshops, IT companies' representatives pointed out a great opportunity for innovation and progress in cross-sectoral cooperation. Public-private partnerships between faculties, companies and state administration focus on specializing in highly profitable services and opening access to public data.

Numerous studies show that Serbia has a significant untapped potential among highly educated staff in the "STEM" area, i.e., sciences, technology, engineering, and mathematics (World Economic Forum, *"Readiness for the Future"*). There are more and more initiatives for informal education in this area. The orientation of the state administration towards digitalization represents an excellent opportunity for the ICT sector in Serbia. It is clear that Serbia needs more concentrated IT development, but that relies on big state public tenders or significant business investments, which are difficult to find.

The entrepreneurial discovery processes and empirical research show that the business model of ICT companies in Serbia is mainly outsourcing. Priorities declared as the most important within the Smart Specialization Strategy in the ICT sector are:

- Software development,
- Development of own solutions.

Software development:
Custom Software Development (CSD) means that IT specialists create applications for a specific user or group of users in a company or

organization. Unlike on-the-shelf software applications that try to satisfy many companies and customers without code changes(allowing just the parametrisation proper for each client), CSD software meets precise customer needs.

Development of own solutions:
Serbian companies in the CSD field mainly come from the outsourcing IT industry, and from there, they have moved into CSD by specializing in a niche market or for a single client. There are many companies in this part of the ICT industry, and they generate a substantial part of the software exports from Serbia. The underlying concept of CSD determines the positions of those companies in the Serbian ICT market – namely, the sales of their solutions to end-users increase their values (and revenues). Not many Serbian ICT companies are ready to develop their own solutions. Creating new and better than existing technology solutions within different industry sectors is the business model of these companies. Those new technology solutions are in the fields of software, services, and embedded systems. There is a vast potential in these fields due to the growing number of technology start-ups and companies coming from CSD. Support for this sector will create conditions for strengthening the domestic market what will directly prop the development of other sectors in Serbia.

CHAPTER 8

SERBIAN ICT SECTOR

After presenting the result that ICT should be the focus of research and innovation development in Serbia, the authors of this book will clarify why this sector is vital in the vision of the Serbian future.

1. Introduction

Information and Communication Technologies (ICT) undoubtedly brought the most effective innovative changes in recent years. ICT is the name of many products and service technologies, and they encompass computer hardware, software, services, and many telecommunication functions. ICT strongly impacts international and socioeconomic development areas and, nowadays, more and more, human rights. The essential speculation behind this approach is that information and communication further the advancement of society (through income improvement, health, education, security and safety, wellbeing, or some other human benefits).

Numerous studies and organisations define the ICT sector differently. The OECD defines it as "a combination of manufacturing and service industries, whose products electronically capture, transmit, or display data and information". In addition, there is the Fraunhofer definition: "The production (goods and services) of a candidate ICT industry must primarily be intended to fulfil or enable the function of information processing and communication by electronic means, including transmission and display." (Fraunhofer, Defining ICT-related professional profiles). Information and Communication Technologies, of course, cover the manufacturing of electronic components, too.

By this definition, two groups form the ICT sector: telecommunications (electronic communications) and information technologies (IT). While telecommunications could not be easily divided into clearly delimited subsets, IT can be divided into three sets - hardware, software, and services.

2. Potential of the ICT sector of Serbia

"You journalists should pay more attention to what is going on. Everyone is writing about the Serbian export of raspberries as a huge national success, and nobody knows that we export more software than raspberries. In early 2011, one journalist at the Danube IT Conference in Novi Sad told this sentence. The very next day, this big headline appeared: 'SERBIA EXPORTS MORE SOFTWARE THAN RASPBERRIES!' and raspberries have been fused with software topics in the media ever since. " (Matijević and Šolaja, "ICT at a Glance")

For more than a decade, it has been a fact that the Serbian IT industry increases its income by more than 10% every year, and, for the first time, in 2017, the Serbian export of IT services surpassed the export of maize. That was a big surprise to the whole Serbian economy, despite being more than expected by the IT businesses. It is interesting how different audiences accepted that fact.

For younger generations, this just confirmed what they thought of new technologies. It also increased their interest in IT and invited them to study IT and related studies in much greater numbers. Soon there were more start-ups and developers' communities, more meetings and conferences. By attending them, young developers exchanged their knowledge and experience what helped them improve the industry's products.

For conventional organizations, it was a warning. To small and medium companies—the significant contributors to gross domestic product, state taxes, and workforce demand, it represented a challenge.

Now, it is clear that entrepreneurs, who firmly and willingly got on board of digitization and took advantage of automation, online businesses, and worldwide advertising opportunities, are not just surviving; they are becoming the engine of economic progress.

As far as the IT investments per capita are concerned, they stand at €83 (1.4% of gross domestic product per capita)– one-tenth of the EU average of €800. That per capita investment is a significant indicator of the general usage of standards and new technologies in any state. It shows that Serbia must do substantially more to push financial and other improvements forward. For the time being, IT investments remained at the same level, under 2% of gross domestic product, which is totally unsatisfactory. The only way for Serbia to get an opportunity to speed up its development is if the IT investments surpass 3% of GDP by 2025. This means that the current investment of €86 per capita must expand to €150.

That is a big test for the public authorities, but additionally, a chance. Current actions show that the authorities are not ready to react to this challenge and utilize that chance.

Serbia has a young Prime Minister, proficient and dealing with information technology throughout her profession – and she showed a significant commitment to IT-related subjects in her inauguration speech. The new inter-ministerial body—the Ministerial Council for IT and Innovative Entrepreneurship—distributed the Plan of Priority Objectives and Activities of all State Administration Bodies and Government Services for IT Sector Improvement in Serbia for 2018 (Vojvodina ICT Cluster, Plan of Priority Activities). The Science and Technology Park in Belgrade has begun to work, while a couple of others are being built in different urban communities. Nonetheless, the impression is that one well-thought-of vision for the IT sector's overall socio-economic development is for now absent. Additionally, firm decisions that clearly define future activities and outcomes are still missing (Vojvodina ICT Cluster, Plan of Priority Activities).

For a majority of IT organizations, this constant growth implied expansion and corporatization. The prevailing pattern was to move away from outsourcing. The reason for this pattern comes from the continual absence of IT professionals in the work market. That gradually drives the pay rates up, moving organizations from lower-paying arrangements toward specialization and niche markets/customers to keep up their capacity to manage IT professionals' costs and remain profitable.

About 2,000 IT new companies were established in 2017, demonstrating higher enthusiasm and courage to dive into a business venture – even though there is a very weak eco-framework of assistance for businesses in the country. Large numbers of domestic IT organizations joined the trend and boosted this pattern, either by spinning off new organizations or putting resources into new companies or startups. Greater visibility of the IT business, the ascent of profits that IT organizations redirect into new companies, and notable examples of success stories essentially added to this trend.

The Vojvodina ICT Cluster is in its 10th year of activity. It has intensively carried IT to different areas in recent years and showed how IT could change organizations. It utilized EU programs to help link IT and agribusiness in two projects: FRACTALS (Cordis, Future Internet Enabled Agricultural Applications) and KATANA (Katana).

There are some open doors for takeover, merger, and B2B collaboration for foreign investors and IT organisations coming to Serbia. Outsourcing to Serbia has been widespread throughout recent years; domestic organizations

grew and became more experienced and utilized possibilities to broaden this collaboration into JVs, joint research, and mergers. Numerous Serbian organizations took these opportunities to corporatize and gain from existing partnerships, carrying them to a higher level.

Thus, the objective of Serbia to be an excellent location for the development of sophisticated software and the centre of regional IT is still in the core interest. Vojvodina ICT Cluster keeps on uniting with different partners. In 2018, the current key organization of Serbian IT Clusters extended to six clusters: Vojvodina ICT Cluster (Vojvodina ICT Cluster, six clusters), ICT Network, NiCAT (NiCAT, ICT Network), ICT Cluster of Central Serbia (CS, ICT Cluster of Central Serbia), Subotica IT Cluster (Subotica IT Cluster), and Zrenjanin ICT Cluster (Zrenjanin IT Cluster). The Serbian IT clusters have gotten more dynamic on the international stage as well, and in 2017 they led the Balkan&Black Sea ICT Cluster Network (WBC-RTI.info).

In short, the description of the IT market in Serbia is the colossal development potential on a small basis. The governmental beginning of negotiations in the EU accession process has, without a doubt, primary importance for Serbia. Still, it is considerably more essential to satisfy all requests within 35 negotiation chapters.

The world economic crisis caused delays to many IT projects but, at the same time, created an extraordinary potential in this sector. The economy of Serbia is now growing, many obstacles have been removed, and the present situation is at the stage that allows fast development with good results. With Serbia's current economic improvement and after eliminating existing boundaries, its potential will be realised.

CHAPTER 9

ICT BUSINESS OF SERBIA

This chapter provides an overview of the current business environment in Serbia and the legislative framework of Serbia – in general, and IT-related.

The analysis contains six thematic areas: Serbia in general, Description of business conditions in Serbia, the ICT environment of Serbia, the Technological gap in Serbia, Opportunities and threats for Serbian ICT, and Administration incentives for ICT.

1. Serbia in general

The basic facts about Serbia in 2019 are:

Population (millions): 7.0.
Capital: Belgrade.
Territory area: 88,499 km^2.
GDP (EUR billions): 42.9 (per capita: $6,114).
73.1% of households have personal computers.
72.9% of households have Internet access.
93.7% of households have mobile phones.
120 Mobile telephone subscriptions/100 inhabitants.
34.8 Fixed telephone lines/100 inhabitants; 99.9% digitalized network.
Percentage of GDP spent on R&D: less than 1.0%.
Percentage of GDP spent on education: 3.6%.
Source: Statistical Office of the Republic of Serbia

2. Description of business conditions in Serbia

Serbia is a developing country that has been in a transition process since 2001 when democratic changes happened. That has had a significant impact on its economy, which has passed through years of advancement and years of stagnation. Despite all that was happening in Serbia, the annual growth rate of BDP from 2015 to 2019 was about 4% on average. The share of individual sectors is very different. Serbia is primarily agricultural land, but

this sector participates with only 6% of the total GDP. The services sector provides about 68% and industry about 26% of GDP (http://publikacije. stat.gov.rs/G2018/PdfE/G20181271.pdf).

The economy in Serbia shows lower figures than in comparable EU countries. A report by the World Bank that evaluates the economic situation in Serbia shows that even a high annual gross domestic product increment for a longer time will not be sufficient to return Serbia's economy to its past levels. Gross domestic product in Serbia is supposed to increase between 4% and 6% during 2020-2025. The IT market is much more dynamic and increases typically a few times quicker than the gross domestic product.

In 2017, Serbia reached the BB level of (Standard and Poor's) credit rating that it had had in 2012. In 2020, it was at the level of BB+/stable with the action: rating affirmed (RS, Long-term credit rating).

When analysing the public debt of Serbia during the period 2000 to 2008, compared to its gross domestic product, it was decreased by 40%. Then, it began expanding again as the public authorities battled the impact of the overall 2008 monetary crisis. The public debt remained at 53.8% of the gross domestic product in 2018 (Dept statistics – December 2018, Ministry of finance RS).

As indicated by the European Commission, regarding economic standards, Serbia is only fairly prepared to build up a functioning market economy

The government succeeded in advancing some policy problems. It reduced the budget deficit to 8% of GDP. Serbia managed to restructure public companies, but not the big organizations whose owner is the state. That is supposed to be completed soon. The economic reforms brought more stability to the economy of the country. Regarding the high level of Serbian debt, the government is still under fiscal consolidation.

The unemployment rate remained high in 2020 (9%), particularly among young people.

To improve the existing situation, economic development policies in Serbia focus on Foreign Direct Investments (FDI). These investments coming from the external world reached the sum of €19.2 billion during the period 2010-2018. The highest FDI was in 2018 with €3.5 billion (all the data are from the National Bank of Serbia).

In two years, 2015 and 2016, the average value of investments did not surpass two billion euros per year. The decreasing plans of investors were not linked just to Serbia but to the whole Western Balkan region. The principal reasons were the prolonged process of joining the EU and the worldwide financial crisis. The key explanations behind not having more FDI in Serbia, among others, are connected to bureaucratic and inadequately

transformed public administration and a significant level of corruption. Serbia is still waiting for a better defined FDI strategy needed to avoid problems in the future. One critically bad example was financial assistance to a company Continental to Novi Sad, to start its research and development activities. Regardless of the arrangement changes in 2017 that prohibited subsidies to IT organizations, this company got €9.5 million. It happened despite IT groups and specialists complaining that financial aid in areas with an essentially zero joblessness rate is placing subsidy beneficiaries in a superior market position. That caused severe disturbances in the workforce in Novi Sad. And what is worse, the higher salaries at Continental provoked professors from the University of Novi Sad to leave teaching and move to Continental. The damage from such a process is immeasurable (Matijević and Šolaja, "ICT at a Glance").

Total investments show that Serbia is not among important destinations for venture capital as the FDI stays low with or without the administration motivating incentives.

For instance, one of the attempts to decrease the current financial crisis' negative effect were the measures to lure foreign organizations to set up their business in Serbia. Even though it has one of the lowest corporate tax rates in Europe, the Serbian government was giving incentives of €10,000 per newly employed worker. Despite great expectations and desires, these measures have never created too beneficial outcomes. That is why the government mostly gave up giving subsidies for new workplaces and returned the corporate tax rate to 15%.

In the current geopolitical state of Europe, it is too optimistic to expect FDI to grow in Serbia. Nonetheless, Serbia could have other sources of income. For example, an estimate is that, between 2010 and 2016, payments from Serbs living in foreign countries were twice the amount of foreign direct investments. In other words, the government should motivate the placement of diaspora money into the Serbian economy because this could be a potential method to make up for the missing FDI.

Governmental assistance to companies in the IT sector is meaningless since it is without unemployed workers, and such an incentive causes unfair competition between companies. That attitude of the IT sector negotiators resulted in the cessation of giving subsidies to the IT sector in 2017.

3. The ICT environment of Serbia

The information and communication technology, infrastructure, and services in Serbia are underdeveloped, bringing hurdles to its international competitiveness, as the World Economic Forum (WEF) reported.

When discussing the technological readiness index, Serbia is in 75th place out of 139 states that are rated. After Serbia, toward the end of the list, there are Albania (84th) and Bosnia and Herzegovina (94th). The other ex-Yugoslavian countries are in better positions. Croatia is ranked 54th, Montenegro 51st and Macedonia is in a much better situation, positioned as 46th.

The analysis of this position brings up specific issues: why is Serbia ranked so low, and what are the key variables influencing such lousy positioning? Serbia is in a noticeably better position when quantitative pointers are compared (similar statistics that exist for every one of the analysed nations) in contrast to subjective markers (assessments and perspectives that WEF gathers through overviews by local offices).

In practically all inquiries, respondents from Serbia express recognizable criticism and point to a lack of technological preparation, in contrast with most of their colleagues around the globe.

Due to so collected subjective (qualitative) markers (indicators), Serbia is at 116th place. That is a much worse rating than the 56th place that it gained when considering only statistical (quantitative) data (indicators). The qualitative assessment is calculated based on consumers' answers, and they are reflections of the mentalities of the Serbian people. The rating of 75, in the middle of the two indicators described above, indicates that the methodology used for countries' positioning has limits. The proof for this is the state of Serbia today. What is even more tricky is that only the data from the quantitative analysis is routinely presented together with reports containing reviews of respondents' perspectives and assessments. Such discrepancies between qualitative and quantitative markers indicate the criticism of the respondents, which is by no means negative since they want the situation to be improved, but, as noticed, they could lead to the wrong conclusions.

4. The Technological gap in Serbia

Serbia sits in the middle of the world's technology map. That would be the briefest description, yet it is crucial to glance at the more comprehensive picture. The US and Japan are the drivers of technology development. Some EU members are followers of a small group of nations from the remainder of the world. The well-known Pareto rule could be used on this subject— 20% of countries invest 80% of the total invested capital into new technologies. We live in a very typical time of globalization based on the use of IC technologies. The digital gap is becoming more and more important and could become the basis for countries' rating for their further

development and reaching global economic goals. For Serbia, challenges toward decreasing the digital gap could lead to lagging behind other EU countries even more. The digital gap will probably cause an increase of other gaps: in the economy, education, health, agriculture, etc. It is also a source of the social gap, a divide between both people and their possibilities and opportunities. The government must lay foundations to diminish this gap and enable faster development of Serbia, similar to other countries.

5. Opportunities and treats for Serbian ICT

Creative people are welcomed to the ICT sector of Serbia. These are people with innovative ideas and the confidence to start their businesses as entrepreneurs. On the other hand, people working in the administration are not flexible and not ready for changes. There is no motivating workforce among decision-making employees. Additionally, due to a high level of nepotism and corruption, they have a lack of knowledge.

The restructuring will be an impossible mission as long as public authorities avoid the chances for modernization and advancement of new technologies. In this way, Serbia stays a country with possibilities, while financial capital and important ICT organizations focus on other, more developed nations and their opportunities.

The progress of the ICT sector demands individuals with smart ideas. Such individuals are generally working in private companies and not in the administration which does not hire them. A course of fast development will remain an incredible mission as long as public authorities reject modernization that brings innovations. Thus, Serbia remains a nation perceived to have potential. Significant foreign companies and associations keep up their focus on considerably more advanced countries.

For the Serbian ICT sector, FDIs are considered more of a danger than an advantage because of the limited workforce available in the market. In particular, businesses coming from abroad to Serbia will try to woo ICT specialists using more significant financial and other compensation, frequently making national organizations not competitive. The IT market in Serbia is not stable and is not convenient for external companies that plan to have their branches in Serbia. As in other countries, the best way for foreign companies to enter the Serbian market is by setting up joint R&D centres, joint ventures, and any other business-to-business combination (B2B) (Matijević and Šolaja, "ICT at a Glance").

The low level of the IT infrastructure of Serbia has changed a lot during the last few years, but Serbia is still behind in building a national broadband infrastructure of high quality. Broadband internet access is faster and has a

larger data throughput, but still not at the level of member states. However, as has been mentioned previously, the ICT framework's development level does not significantly obstruct ICT businesses in Serbia since, most ICT organizations have offices in urban territories, where the ICT infrastructure is up to elevated expectations that permit undisturbed IT business.

Building a publicly-owned fibre-optic network that is promptly accessible to companies and residents would significantly impact the overall social development. It would bring a significant change by moving the business competition from the physical network (infrastructure) layer to the services sector. One powerful possible resource to finance such a change—EU-funded programs and projects—are insufficiently used in Serbia. Utilizing EU-financed resources to set up cross-border collaboration is the best tool for such undertakings. Such a big step would significantly impact the economy of the country (Matijević and Šolaja, "ICT Initially"). These changes should facilitate getting building licenses and including local communities in the process. Broadband networks should be designed and constructed as a public utility, readily available to everybody, to urban and rural residents.

Established in 2017, the Science&Technology park in Belgrade was of tremendous importance to the development of ICT in Serbia. It is excellently functioning together with two new ones, in Novi Sad and Niš.

A new public-private partnership model (PPP) is a unique possibility to construct more IT-supporting structures, as IT start-up incubators and business parks. However, these activities fail to receive attention from any level of the government (Vojvodina ICT Cluster, BRAINS Centre).

It seems that only foreign partners' requests are the basis for the standardization of the Serbian IT organizations. Standardization prerequisites are typically tuned to the nature of IT exported services. For instance, the embedded industry in charge of innovative medical appliances products requires standards linked to that industry.

6. Administration incentives for ICT

Not long ago, Serbia started creating a few crucial institutions for supporting the development of ICT. Those were the Ministry of Telecommunication and Information Society (Motifs), the Republic Agency for Telecommunication (RATEL), and the National Council for Science and Technological Development (NC). In 2005, they started to work, and these administrative bodies were the starting point of the national ICT R&D policy framework. At the same time, Serbia transformed the National Information

Technology and Internet Agency (NITIA) and the Ministry of Science and Technical Development (MoESTD).

The instability of the Serbian political system resulted in the delayed progress of ICT R&D, in contrast with its incredible potential. The potential reasons may lie in regular changes in the Legislature and the government without relevant ideas. The fact is that during sixteen years, from 2005 to 2021, Serbia had nine different ministers of science.

MoESTD was abolished in 2011 what caused research and development jurisdiction to go down the ladder in the government. The government decided to optimize the functioning of two ministries: the Ministry of Telecommunication and Information Society (MoTIS) and MoESTD. It transferred the responsibilities of the MoTIS to the newly established Digital Agenda within the Ministry of Culture, Media, and Information Society. The government assigned most of the MoESTD's tasks and responsibilities to the Ministry of Education and Science. The office of NITIA ceased to exist. The new situation was not suitable for ICT. The government did not find it necessary that there should be a separate central body devoted to ICT, which resulted in its slow development. It was still not in the governmental focus of actions.

The changes continued. After elections in 2014, the ICT jurisdictions were split among three ministries:

- the Ministry of Education, Science, and Technological Development (R&D component);
- the Ministry of Trade, Tourism, and Telecommunications (ICT component at the level of Assistant Minister for Information Society);
- the Ministry of Public Administration and Local Self-Government, (Digital Agenda, which was accountable for the IT business and development of strategic software).

After changing the Digital Agenda into the Directorate for e-Government, this department was abolished in 2014. Serbia created a Strategy for developing digital skills for the 2020-2024 period, but no main ministry is yet assigned for ICT. That is a serious barrier to giving ICT the importance it deserves.

Chapter 10

Assessment of the Serbian ICT Sector

1. IT market and present industry conditions

IT market-What is there to be bought?

The Serbian IT market produced hardware, software, and services for a total value of €578 million in 2019, which gives a yearly growth of 7.3% for 2015-2019. Nevertheless, the results of these three most important market sections all missed this average. The section with the most considerable revenues, PC Delivery, remained down by nearly 2%. Then again, the strong market development of the IT Services and Package Software section had yearly growth higher than 10%. Market growth is generally forecasted based on the value of the current business infrastructure, estimated at more than €1 billion.

IT Industry-Who is selling?

It is impossible to sum up the outcomes of the IT industry utilizing statistical data available in small quantities. By and large, the IT industry is progressing faster than the IT market itself. However, there are significant differences between companies in this respect – from disappointments to amazingly fruitful ones. Numerous discrepancies from these average growth numbers are signs and characteristics of a weakened market. The Serbian IT market has not been moving uphill during and after the global crisis. Still, there were 2,349 operating companies in Serbia in 2019, and their number of labourers increased by 10% compared to 2018. They employed 1.4% of all employees in companies and state institutions in the country, totalling 21,514 employees. The process of taking new employees happened primarily because of the work expansions in mostly export-centred IT organizations.

Further solid development from the low starting point will add to the expanding significance of the IT area as the best one in the Serbian economy.

The Serbian IT market has depended principally on entrepreneurship and individuals' energy and activities, resulting in many efficient IT

organizations. The market considers the following companies to be the best: DMS, ASSECO, and SAGA. Their significance and capabilities were acknowledged by external investors, as they now have proprietorship from countries outside of Serbia.

As far as quality is concerned, the IT development in Serbia based on domestic companies and the domestic know-how has shown outstanding results. Still, it is much slower when one compares it to an environment where foreign companies have top-level knowledge and experience. It is undeniable that Serbia needs more serious IT development. However, this development dominantly relies first on big public tenders by the country's authorities, then on capital coming from the business area, and finally on the presence of worldwide IT merchants.

Because of the high effect of the government's tenders, the following paragraphs deal with the state's explicit/unexplicit impact and its growing impact on ICT in Serbia.

2. Possibilities and roadmap: New IT objectives for the time frame 2020-2023

The Serbian IT market has enormous development potential. The one billion market value figure gives exactly €150 per capita—the desirable minimal amount of IT investments**.**

The official beginning of talks in the EU accession process, without a doubt, impacted Serbia. Yet, it is considerably more noteworthy to satisfy the guidelines from the 35 accession chapters than to enter the EU. It is interesting to note that IT is diffused throughout the economy. It is impossible to envision an advanced society without IT upholding it in education, medicine, the public, and other sectors. Comparably, IT is also associated with a few government strategies: science and research, e-correspondence, economic growth, and, by definition, the information society.

For every one of these reasons, the government's impact on IT market development in Serbia will be of great significance, raising the requirements of all involved to improve their approaches in following it. The authors' suggestion was to set a new and significant estimate for the Serbian IT market in 2021, to the value of €1 billion. Even though this estimate seemed excessively high, it turned out to be the correct one. Now, in 2021, despite all the barriers brought by the Covid 19 virus pandemic, the authors have an optimistic vision that Serbian IT exports could reach €2 billion in 2022. For sure, the IT sector will continue to develop and attract new young entrepreneurs and employees, thus leading Serbia in technological progress. If

the government decides to support the IT sector with clear and intelligent measures, it could surpass the two billion euros in exports. What is sure is that the significant psychological threshold set at €1 billion and held as a national challenge has been reached.

On the other hand, when the last EU10 nations entered the EU (in 2004), such a value represented how much venture investments per capita entered their IT markets. For example, it is necessary to have a total of €150 per capita IT investments for seven million inhabitants in Serbia to reach the €1 billion market. Past investigations have additionally affirmed that the value of IT ventures per capita is a valid indicator of how fast countries are getting close to EU standards.

Further intensive development from this still low starting level will add to the growing significance of the IT area as the best one in the Serbian economy.

In this way, by putting €150 for each capita as the underlying objective, Serbia would be more ready to arrive at the level where advancement is faster.

At the same time, Serbia will move up to the higher category among countries in the region. Likewise, Serbia would climb to the higher class of surrounding EU states.

Another essential thing for accomplishing this objective of €150 IT investments per capita is the yearly increase in the gross domestic product of over 4%. Only then will Serbia get an opportunity to reach the projected value by 2025 and carry the country to the lower limit of the required EU standards.

So, it is evident that IT must be one of the first things on the government's priority list.

3. Government Initiatives and influence on the IT market and IT sector

Only a few years ago, the Serbian government started to pay attention to the development of the IT sector, and much has happened since then.

What Serbia is still missing is a single place in the state administration that will comprise and converge IT topics at the level of the central government.

In 2016, the Ministerial Council for Innovative Entrepreneurship and IT was set up, which was an obvious sign that the government planned to pay more attention to the IT area in the future. A ministerial council is not a ministry, but it is still a move forward. Everybody was talking about IT, but very few assets backed up this body. Consequently, that restrained its

activities. In October 2016, the government adopted the Strategy for Development of the IT industry 2017–2020, a document that covered practically the entirety of the issues raised by IT providers and users.

Nevertheless, everybody had to be patient for almost a year until the necessary Activity Plan for "Implementation of the Strategy for Development of the IT Industry 2017 – 2020" was finally delivered. But, alas, it turned out to be a disappointing document. A portion of the significant issues was left out with a note that additional analyses were forecast. There was no clear list of planned activities in this Activity Plan for most of the necessary steps from the strategy (Vojvodina ICT Cluster, Strategy of IT Industry).

In June 2017, Ms Ana Brnabić, then the Minister for State Administration and Local Self-Government, received the mandate to form a new government. An essential part of her inauguration speech was related to information technology, and soon IT became a topic that everybody in the Serbian economy and public life was talking about (Government – President). Consequently, from then on, the Serbian government has been focusing on developing the IT sector.

Toward the end of 2017, the Ministerial Council for Innovative Entrepreneurship and IT distributed its Plan of Priority Goals and Activities of all governmental bodies and services to progress the IT area in Serbia in 2018. This document contains tasks partitioned into four categories: development of IT skills, building innovation infrastructure, the legal framework for investors, and competitive market. This document is, by all accounts, well organized. However, it has similar logic to the Activity Plan referenced previously and, thus, similar deficiencies.

While it analyses IT abilities to improve, it does not mention one of the principal hurdles to getting more IT graduates out of Serbian colleges – the absence of top-quality educators. This document repeats some old activities that ought to be pushed forward more forcefully regarding infrastructure for innovation and how to establish it. For example, building Science and Technology parks is the most important of the necessary actions.

It likewise records some novel actions, including the secretive "New buildings for the education of IT engineers", with no subtitles at all, as to how the development of such structures could take care of the issue of lacking IT engineers.

Several PPP activities are geared toward building innovation infrastructure in collaboration with organizations and IT experts—for example, the BRAINS Centre (Vojvodina ICT Cluster, BRAINS Centre) in Novi Sad.

Unfortunately, like many other good ideas, this one did not reach the execution phase, and it simply remained as an additional one on the list of unfulfilled promises.

The Legal Framework for Investors still lacks guidelines, e.g., venture capital and crowdfunding, necessary for supporting startups.

Another improvement to the competitive market could be support for e-businesses, such as tax incentives, to increase the number of companies, including online versions of their businesses.

The government did an excellent job in promoting *two crucial strategies:*

(1) Smart Specialization Strategy Serbia - 4S (RIS3) that should have been adopted in 2019, and it was, with a delay, in February 2020; and
(2) The Industrial Policy Strategy of the Republic of Serbia from 2021 to 2030, which was distributed in March 2020.

The public is still waiting to get clear and detailed action plans for these strategies. Of course, financial and other resource plans must follow the action plans, and additionally, they should contain the responsibilities of all the stakeholders and the dynamics of all the actions. Also, the government did another thing—created and distributed the following strategic documents related to ICT:

• Strategy for Development of Next Generation Networks until 2023
• Strategy for Artificial Intelligence 2020-2025
• Strategy for the Fight Against High-Tech Crime 2019-2023

The government's vague turning of words into actions still makes one wonder whether its current interest in ICT is there because it is puzzled by the enormous headway this sector is making or whether there is some well-thought-out intent.

In their public appearances, high government authorities repeatedly show their relatively common knowledge or understanding of the IT business, of its systems and plans of action, of its requirements and issues. For the time being, people in Serbia hear many good intentions, but it's high time for some actions, too. Maybe, just maybe, 2022 might be a tipping point.

CHAPTER 11

ICT MARKET – STATISTICAL OVERVIEW

1. IT market value and structure

This chapter gives essential data for informing the readers about the Serbian ICT sector, such as:

- Market value and structure,
- Important geographical market distribution,
- IT ventures and spending in Serbia,
- Utilization of IT by individuals/families and organizations in Serbia.

When estimated by the income per capita, the Serbian ICT market is much more developed than the indicators of information technology usage show. The principal explanations behind this are:

- Customers generally centre around essential ICT solutions and low-end specifications,
- Customers use non-brand arrangements more often than brand ones,
- Low-cost ICT arrangements are the goal,
- The cost of local IT services and programming is 50% lower than what is usual in the EU for similar expertise,
- The substitution cycle is far longer than in EU countries (rather than 3-4 years, ICT equipment is used for 6-7 years or even longer).

The domestic IT market[9] in 2019 has an estimated value of €578 million, with an annual growth of 7.3%, as presented in Figure 11-1. It is expected that equipment purchases will stay at the 2019 level, and the market value of IT services and software will probably increase and reach a two-digit growth rate. There are early indicators of faster development of the IT

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[9] The following data and slides have been taken from a free source: Matijević and Šolaja, "ICT At a Glance" – (ICT at a Glance.)

market in Serbia. Interestingly, following ten years of stagnation, 2018 was when the market for the IT sector in Serbia went over the milestone of half a billion euros.
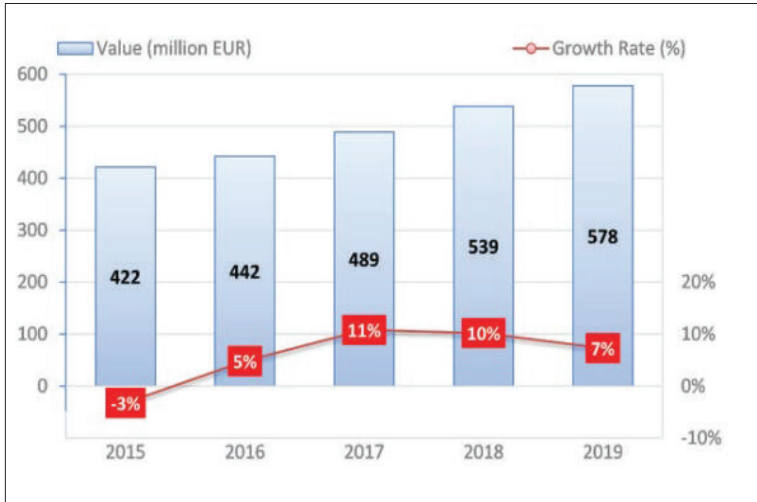

Figure 11-1. Serbian IT Market and Growth Rates
For 2015-2019. Source: ICT at a Glance

a. IT market structure

The following are the key observations from the figures below relating to 2017:

- IT market structure is such that IT hardware has a dominant share of 44,8%. It is followed by the IT Services segment with a share of 37.1%. The software makes up the remaining 18.1% of the IT market. (Figure 11-2.) According to European standards, such a market structure clearly shows that this market has not matured yet.
- IT hardware still drives the development of the IT market in Serbia. However, hardware companies have minimal profit margins, making their total profit consequently very low. The software sector has the highest net profit, more than one-half of the entire IT industry net profit. (Figure 11-2).
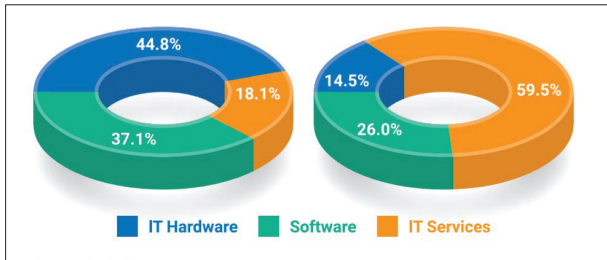
Figure 11-2. Serbian IT Market Structure vs Profit in the IT Sector
In 2019. Source: ICT at a Glance

b. IT services structure

It is expected that the hardware installation and support market will have stable demand in the next few years. Still, its participation in the total services market will probably continue to decline.

The IT services market amounted to €243.1 million in 2019. This market is expected to have a high growth rate in the future. Outsourcing is the most significant part of it, and it has a 30% annual growth rate. Figure 11-3 depicts the structure of IT services in Serbia in 2019 and the Compound Annual Growth Rate (CAGR) for five years.

Serbia expects an increase in both the number and strength of international vendors operating in the region. This increase will have significant implications:

- As the growing demand for new services requires more complex expert solutions, local service firms will have to create strategic partnerships with renowned product vendors or international service companies to meet customer needs.
- A valuable tool for international vendors' entry into the Serbian IT market will be the purchasing of local companies. Most of these companies have highly skilled employees. Such acquisitions have already been seen in other countries in the CEE region and in Serbia too.
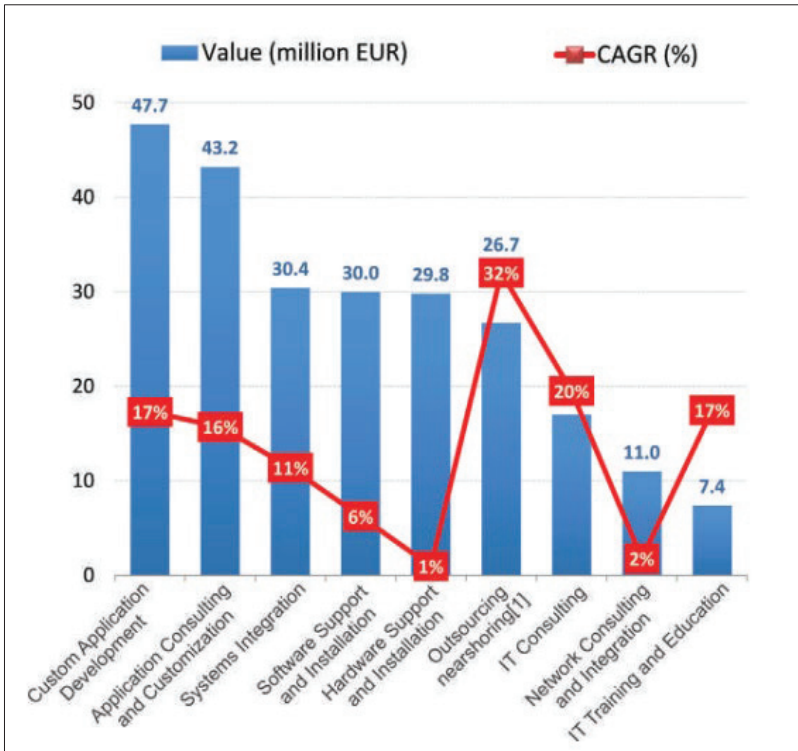
Figure 11-3. Structure of IT services in Serbia in 2019 and CAGR (5-year period).
Source: ICT at a Glance

The market for IT services only doubled during the time frame of 2008-2018. That means that it was increasing at a yearly rate of 6.5%, which is relatively slow and points to the state of the Serbian economy. This low annual change primarily stems from the low prices that IT service providers charge for their activities and the government's lack of interest in IT. In Serbia, prices for IT services are very low, and they are mostly 50% lower than the cost of the same services in more developed EU member states.

The significant clients of IT services in Serbia in the future are probably going to be: financial institutions, state administration, production facilities, and electronic communications. Serbia is trying to balance its economy and politics, which will expand its capabilities for FDI. The first recipients of FDI investments are the previously named four areas and, as has earlier

happened in other developing states, FDI will encourage Information Technology usage.

Many end-user companies have their internal IT departments, and they do not outsource IT services, so they are not included in the market analyses.

It is forecast that globally significant merchants will open their businesses in Serbia. That will have huge impacts:

- For the next generation of services and software applications, Serbia needs complex solutions and the right experts. Local service firms will have to create strategic partnerships with organizations that have successfully demonstrated their products worldwide and address client issues adequately.
- As already stated, the best way for worldwide sellers to enter the IT market of Serbia will be to acquire local organizations. The majority of these organizations have exceptionally talented workers.

c. Application software structure

The application software market increased from €38.1 to €57.2 million from 2015 to 2019, an average annual increase of 8.5%. The business applications part of the market (Enterprise resource planning - ERP, Supply chain management, and Accounting) decreased slightly but still makes up the most significant part of 47.5%.

One-third of the market belongs to collaborative applications (Document management, Content management system, Customer relationship management, Business intelligence, Portal, and Web) (Figure 11-4). The specialized software for accounting and ERP is dominantly used in production facilities, and custom software applications are primarily created for SMEs seeking specialized software solutions. Figure 11-5 depicts the structure of the application software market in Serbia in 2019.

Expanding interest in specialized and ready-made software solutions will drive the development of this market in the years 2021-2025.
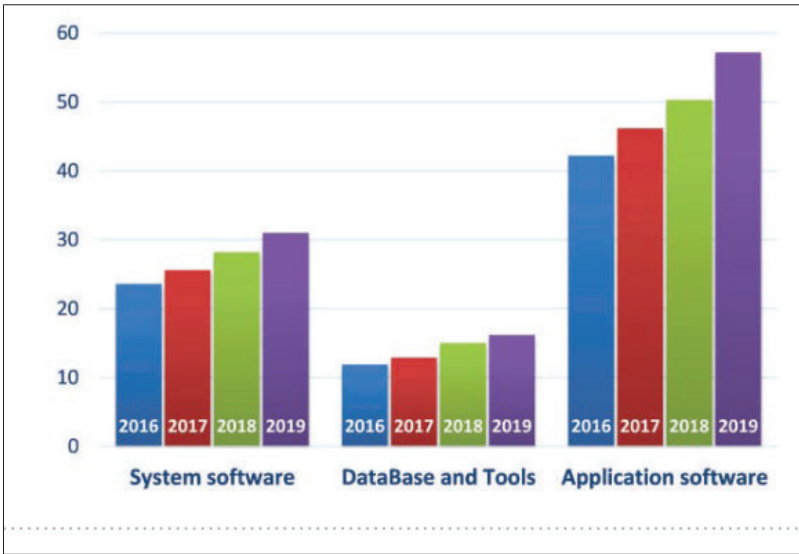
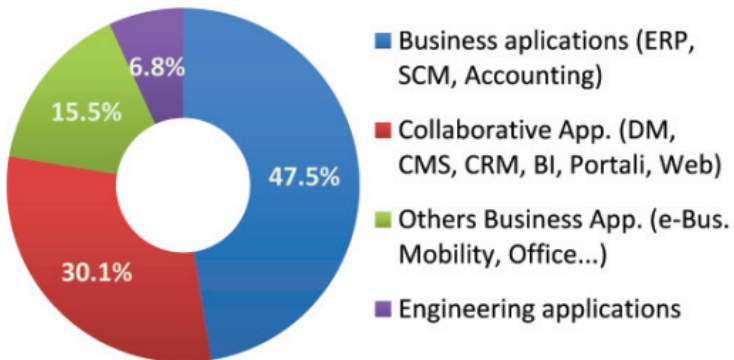Figure 11-4. Software Market in Serbia 2016-2019.
Source: ICT at a Glance

Figure 11-5. Structure of the Application Software Market
In Serbia, 2019. Source: ICT at a Glance

CHAPTER 12

CROSS-BORDER SMART SPECIALIZATION, ROADMAP TOWARDS THE FUTURE[10]

Smart specialization, which goes beyond borders, concentrates knowledge of more than one region within one sector to deliver real novelties, practically forming a new level of technology. This concept belongs to the idea of knowledge-based development, but this time enriched by adding multinational teams to the research and innovation idea. Exchanging ideas, travelling to other regions, and staying with researchers from other areas generate new ideas and encourage teams to realize them. Such a multinational and multicultural approach is stimulating and motivating and brings unique qualities from different views of problems and solutions. EU programs and EU funds contribute by offering to finance the implementation of new ideas.

The problems that the work on cross-border smart specialization faces are:

- Defining the methodology for the elaboration of cross-border smart specialization,
- Filling the gap between regional and transnational smart specialization planning processes.

The identification methodology can be supported by:

- Looking into relationships between smart specialization related activities in the neighbouring regions,
- Finding common elements of regional and cross-border innovation processes and including them in planning activities.

The authors raised the following hypotheses:

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[10] For this chapter, the authors used the results and explanations from their paper "Cross border protection of the clusters' intellectual property in the agricultural sector" (Kranjac, Sikimić, and Vujaković, Cross-border innovation process).

- Hypothesis 1: There is a significant correlation between obstacles and opportunities along the development path of smart specialization within cross-border regions.
- Hypothesis 2: The same methodology used for regional smart specialization should be used in creating cross-border strategies.

The EU is forcing the development of RIS3 throughout its territory. By the end of 2020, 215 EU regions in 24 countries and 19 non-EU regions and nine non-EU countries have registered for the S3 Platform, and the community is continuously growing. The Smart Specialization Platform provides professional advice to EU countries and regions on designing and implementing their research and innovation strategies for smart specialization. Having such a regional strategy is a needed condition for applying for any significant funding. One such example is the Teaming program (Biosense, Novi Sad, Antares project). In addition, RIS3 must cover cross-border regions with the same or similar potential, giving them the ability to cooperate and reach critical potential for growth. It is necessary to keep in mind that regional fragmentation within European territory results mainly in small regions that, even if they have potential, cannot offer a real breakthrough, visible to the whole of Europe or even broader.

The dilemma is, as always, between two directions; centralization of regions or cooperation among them, or, actually, between:

- smart specialization within only one region
  and
- cooperation among regions with the same or similar focus sectors to create a bigger, more competitive „smart specialized" space.

When discussing innovations and their transnational effects, authors identify interconnections and complementarities between the studied regional units in some studies. These interconnections and complementarities can be seen in better use of resources, which creates added value to national competitiveness. In this way, the authors contribute to understanding and describing governments' role in increasing the overall innovation level through various activities that push competitiveness growth within national economies.

Other authors explain that countries may have a common interest in building intensive cooperation within a specific sector. They are even ready to use the same research infrastructure or testing platforms to encourage cross-border knowledge transfer. The authors suggest strategies based on

the development of global clusters. Initially, the clusters would be oriented towards cross-border cooperation between regions with a substantial benefit for the covered area. Later, they would start to act as transnational clusters.

Regional competitiveness is closely tied to regional economic growth and the level of economic development. Some empirical studies are looking for information on the World Competitiveness Index of the region. The authors consider that regional competitiveness explains the differences in the level of economic development of the region and directions for future regional economic growth. They conclude that regional competitiveness emphasizes innovation, knowledge, and entrepreneurship as crucial points of regional and cross-border economic differentiation.

Most of the breakthrough innovation processes cannot succeed within regional isolation but require extensive regional alignment. In essence, they need complementary innovation systems that will attract participants in the innovation processes.

Some articles examine innovation systems in particular sectors. Researchers examine the innovation system in the agricultural sector and show how components of an agricultural innovation system are dependent on the use of modern technology tools. Their analysis is based on data from 85 low-and middle-income countries in the period 2004–2011. The technological class where a country belongs enabled the authors to compare innovation efficiency between countries. They incorporate new components of the agricultural innovation system framework (like mobile phone subscriptions, the number of scientific and technical journals published, etc.) as indicators that show the efficiency of knowledge transfer. These measures also describe the efficiency of research and knowledge transfer, essential development factors in agricultural production and a sound basis for improving the multinational agriculture innovation system.

To put their strategy into action and enable its theoretical and practical existence, the strategy makers must have a clear vision of how to implement it. Strategy formulation and strategy implementation are closely interdependent on local, regional, national, and transnational levels.

Regional innovation systems and intra-regional cooperation are focusing on firms' innovation performance. The analyses of data related to co-application and co-invention of patents for regional labour markets show that cooperation intensity and regions' innovation efficiency are negatively correlated. Such correlation happens in two cases: (1) when inter-regional cooperation is missing and (2) when inter-regional cooperation is extensive. But, on the contrary, when cooperation in innovation is medium-intensive, it has positive effects.

A comparison of R&D efficiency across 24 nations finds that human resources, patents, scientific journal articles, royalties, and licensing fees are linked to the R&D efficiency. IP rights protection, technological cooperation, and knowledge transfer between business sectors and regions (with the strong encouragement of the government sector related to R&D activities) foster national and multinational R&D effects.

Innovations based on the knowledge that a region could adopt rely on its capacity to attract, collect, and assimilate it from a wider area and transform it into innovations. Different interactions among actors (individuals, firms, and institutions) also cause unintended transmission of knowledge and its spill-over. The main feature of knowledge-intensive business services (KIBS) is to adapt and disseminate tacit knowledge. Although a variety of recent studies have contributed to the understanding of tacit knowledge's diffuser role in KIBS, there has been little investigation into the spatial effects related to the presence of KIBS. That sheds some light on both the geographical and technological distance in the knowledge diffusion process to show how high-technologies account for a significant part of the regional innovation process. This analysis' two significant findings indicate the following: (1) inter-regional knowledge flows are crucial elements for explaining regional innovation performance, and (2) technological proximity is far less critical than geographical proximity. Regions with a higher specialization in high-tech services (HTS), or ones proximate to regions with a higher presence of HTS, tend to innovate more, mainly because HTS can improve their capacity to transform knowledge into innovation.

State administration has an essential role in enabling leverage of innovation either by creating conditions that will allow innovation or by encouraging the private sector to invest in the creation and adaptation of innovation, always by inclusion into a broader regional innovation. Good examples are the neighbouring regions of Hungary and Serbia.

1. Research methodology

The input for explaining cross-border smart specialization is a project funded by the EU Instrument for Pre-assession Assistance (IPA) cross-border program Hungary-Serbia. The project is the result of the cooperation between two partners: The Regional innovation agency of the region Southern Great Plain Association from Szeged (Hungary) and the Information Centre for Business Standardization and Certification - BSC from the Vojvodina region (Serbia). The project is based on the need to perform aligned strategic innovation planning in cross-border areas to

optimize the use of resources. The experts of two organizations were involved in the projects' activities and scientific analysis and conclusions.

The authors (Kranjac, Sikimić, and Vujaković, Cross-border innovation process) presented a study of the current innovation standing of the region. They compared it with the innovation standing of neighbouring competitive regions. Moreover, the goal was to identify the correlation and verify whether cross-border innovation strategies may use the same design methodology as regional/national strategies.

The following activities were performed throughout the research:

- Examining the current state of the innovation system in the region and comparing it with the state in the neighbouring areas,
- Finding a correlation between key points of the innovation process in two regions by using the following statistical techniques: descriptive statistics and graphics, Pearson correlation coefficient (for exploring and confirming the proposed hypothesis), synthesis, and deduction,
- Verifying the phenomenon of the same methodology for developing regional and cross-border RIS3 strategies and based on the results achieved, the authors tested the following hypotheses:
  Hypothesis 1: The correlation between obstacles and opportunities during the development of smart specialization within cross-border regions is significant.
  Hypothesis 2: The same methodology as for regional smart specialization should be used to create cross-border strategies.

The pilot project was conducted in the neighbouring regions of two countries, Hungary and Serbia. The activities realized during the project were:

- Design of a joint database of innovative actors (organizations),
- Creation of a cross-border questionnaire that was used for organizations from both countries,
- Primary data collection: Examination based on 200 responses from innovative entities (100 from Hungary and 100 from Serbia),
- Statistical analysis of the answers and drawing of the appropriate conclusions.

The target group of the research consisted of all stakeholders participating in the innovation process (big companies, SMEs, entrepreneurs, universities, research institutions, and consulting companies) and those who have a

remarkable role in raising the competitiveness of the region. Generally, all those who produce and use innovations, from researchers to consumers-end users, are subjects of the examination.

The authors divided examinees into three groups of organizations, which have specific tasks within the innovation process. These three groups were:

- economic organizations: large companies, medium-sized, small and micro-enterprises, entrepreneurs, and clusters,
- scientific research organizations: universities, faculties, and institutes,
- bridging organizations: provincial government, local government, consulting organizations, chambers of commerce, and professional associations.

The questionnaire related to cross-border innovation relationships consisted of five groups of questions:

- Sources of innovation,
- Obstacles to innovation,
- Financing of innovation,
- Collaboration in innovation,
- Innovation decision-making.

The focus of the investigation was to capture the parallel behaviour of two regions concerning the same innovation problems. That was performed by calculating the Pearson correlation coefficient for the answers to questions related to the basic facts about innovation processes in both regions.

2. Empirical data and analysis

When the project was conducted, a smart specialization strategy for research and innovation (RIS3) did not exist in the Vojvodina (VO) region. In contrast, the first innovation strategy for the Southern Great Plain (SGP) had been created (Kranjac, Sikimić, and Vujaković, Program S3 Vojvodina). Thus, the result of this project was RIS3 for the Vojvodina region and Cross-border RIS3 for both regions. They were created by using the same methodology used for the regional Hungarian RIS3. That was a result of the proven fact that the same methods should be used.

When comparing the focus sectors of both regions, it came out that both regions highlighted the same sectors for smart specialization in research and innovation: agriculture and agribusiness.

The authors presented a review of selected results. They compared behaviours regarding innovation and research activities in the South Great Plain region (SGP) in Hungary and Vojvodina (Vo) in Serbia.

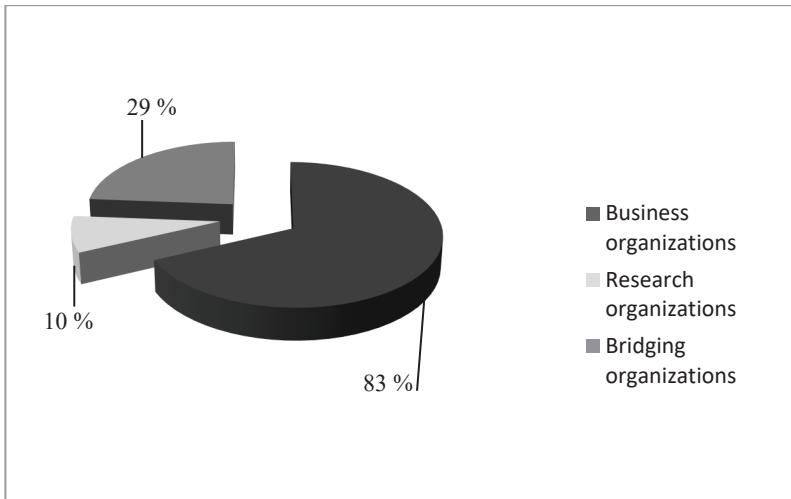Figure 12-1 shows the structure of the organizations from both countries that were included in the research.

Figure 12-1. Distribution of researched organizations

Business organizations were the most active in giving answers, as was expected. Research organizations showed the minimum interest in the subject of research, indicating their passivity towards trans-national linkage.

a. Sources of innovation

The answers about research and development activities in organizations are shown in Figure 12-2. It proves that in both countries, the R&D processes are of very similar intensity. Almost the same number of companies answered that they had R&D activities, about 60%.
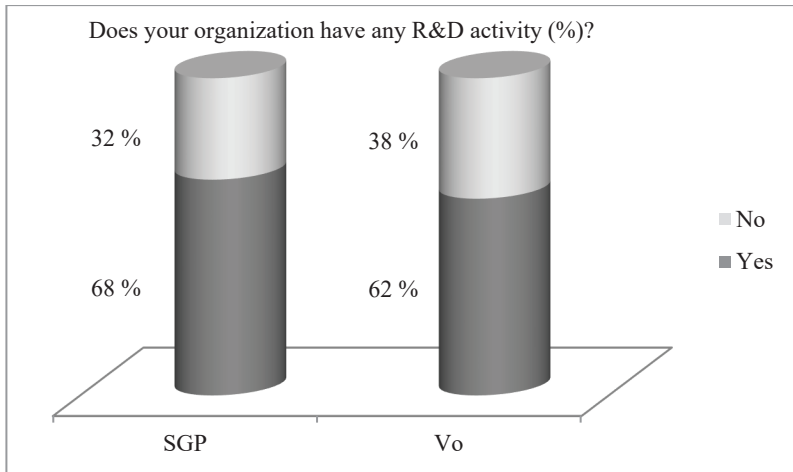
Figure 12-2. Research and development activities of respondents in both regions

Despite the regions' proximity and common characteristics, the examinees considered that the neighbouring market was not attractive enough to place their developed products there (Figure 12-3). Namely, a considerable Hungarian minority lives in the Vojvodina region, so some aspects of cultural and traditional similarity are present. The Stabilisation and Association Agreement exists and supports cooperation between the two regions. The current situation across the regions might cause these answers. There is a lack of mutual knowledge and a flow of information among the regions and there are no policies that would foster innovation exchange from both sides. Because of past political instability, Hungarians still have a lack of trust in the Serbian market.
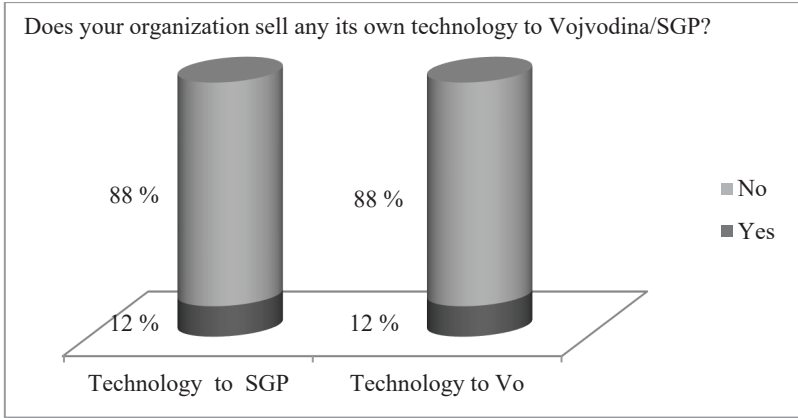
Figure 12-3. State of cross-border technology exchange

One of the questions was: "Do you know an organization in SGP/Vojvodina that can help to solve the technological problems of your organization?" The answers showed that the attitude towards cooperation in innovation actions in both countries is significant. Over 75% of examinees answered that they know an organization in another region that could be a partner in solving their technological problems, as presented in Figure 12-4.

Organizations are aware that they could multiply innovation results through cross-border cooperation.
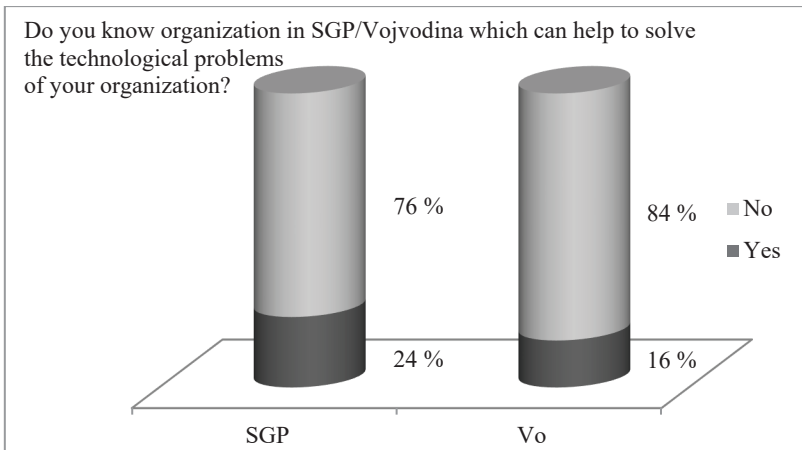

Figure 12-4. Attitude towards cooperation in innovation

b. Cooperation in innovation

When discussing already established cooperation in the area of the innovation process, the fact is that the percentage of companies that have already reached collaboration (in the last two years) is low, and it is below 20% (Figure 12-5). Some cross-border relations have already started, and others should follow their good practices.
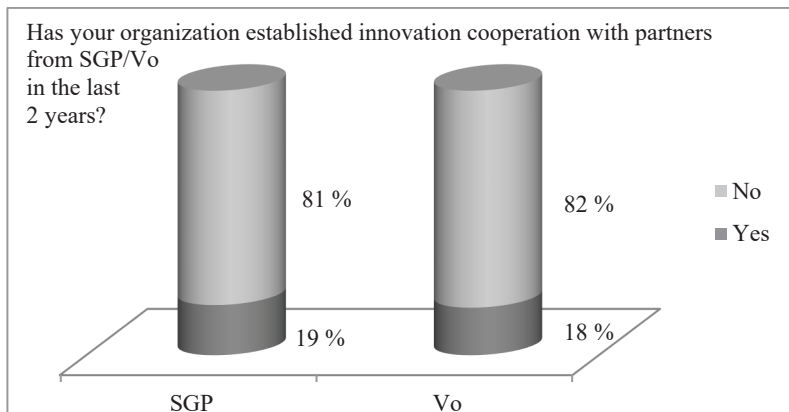
Has your organization established innovation cooperation with partners from SGP/Vo
in the last
2 years?

81 %   82 %   ■ No
                        ■ Yes

19 %   18 %

SGP   Vo

Figure 12-5. State of the cross-border innovation process

c. Obstacles to innovation

Table 12-1 presents the main obstructive factors for cross-border innovation activities. Mutual information is essential, but it is vague or missing. Financial resources to support innovation activities would have a substantial impact on engaging actors in innovative cross-border processes. The most significant difference between the two sides of the border is the perception of trust in foreign partners. Serbian partners have a lower level of distrust (4%) than Hungarian ones (10.5%). Differences in languages and the gap in cooperation skills and workers' qualifications are less important factors in this context.

Table 12-1. The main obstructive factors of the cross-border innovation process

What are the main obstructive factors in cross-border innovation activity?	The ratio of respondents in Serbia%	The ratio of respondents in Hungary %
Lack of information	23	18
Not enough capital	20	16
Lack of adequate support	17	14
Lack of trust	4	10
Lack of communication between partners	11	11
Lack of language skills	9	9
High level of market risk	6	9
Lack of cooperation skill	7	8
Lack of qualified labour	3	3

The value of the Pearson correlation coefficient, R, is 0.942 for the answers from two countries regarding the inhibiting factors for cross-border cooperation in the innovation process. That shows a strong positive correlation, which means that high scores of the X variable go along with high values of the Y variable (and vice versa). The value of R2, the coefficient of determination, is 0.887 - both regions have very similar problems.

d. Financing innovation

The respondents said that resources for financing should primarily come from:

- EU funds (about 90% of them clicked "yes" on this option to the question "How cross-border processes ought to be financed?");
- Public resources (about 48% of respondents support the financing from public resources);
- Own internal sources (28% of respondents agree that their internal resources should be an important funding source).

The conclusion is that organizations from both countries are mostly waiting for the external stimulus. They do not think that they should use their internal financial inputs to move forward with innovations. That shows that they do not find innovation powerful enough to drive the sustainable development of an organization (Figure 12-6). The percentage of answers

in both regions is very similar, and the value of R is 0.994, which is again a strong positive correlation between responses in the two countries. The value of R2 is 0.989.
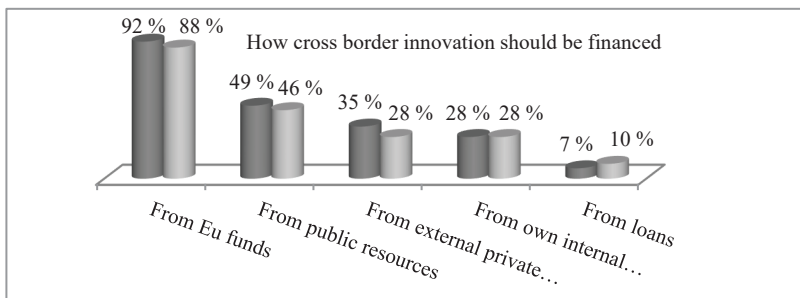

Figure 12-6. Sources for financing innovation which Hungarian and Serbian enterprises prefer

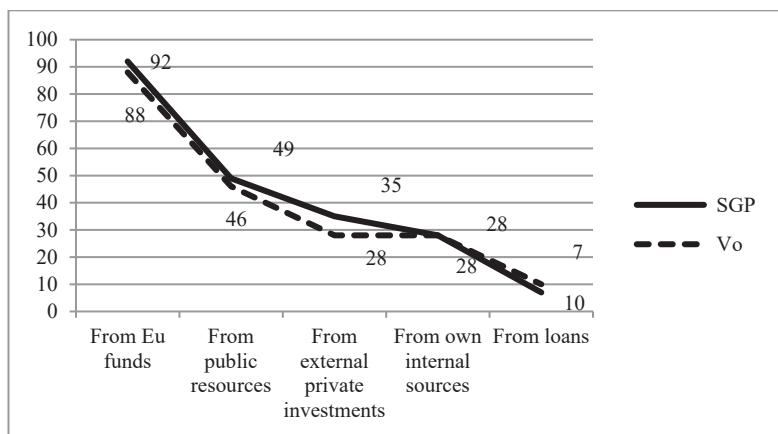Figure 12-7 graphically presents the percentages of similarity of answers among innovation actors of both regions.

Figure 12-7. Preferred financial sources for innovation according to the answers of Hungarian and Serbian enterprises, trend

e. Decision-making in innovation

Figure 12-8 illustrates a graphical representation of the answers to questions about what conditions organizations find essential to enter into a new cross-border innovation process. The graphics follow the percentage of these answers.
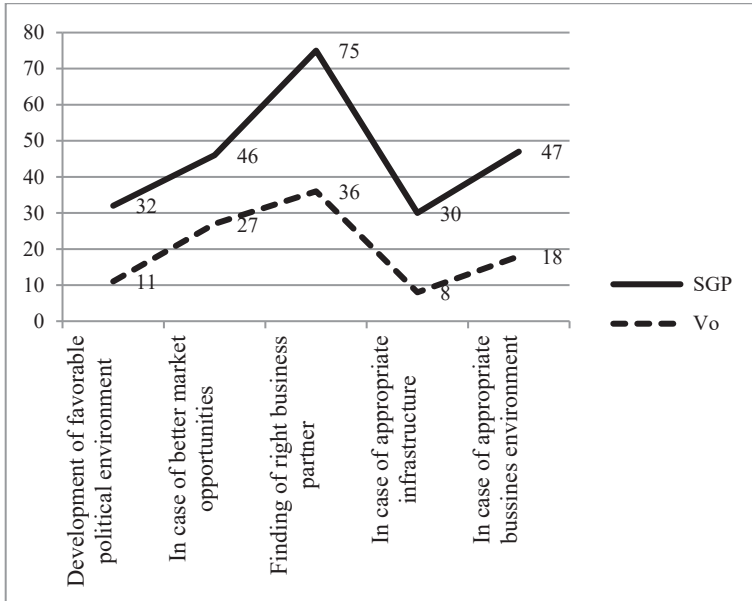

Figure 12-8. Motivation for starting new cross-border innovation cooperation.
Source: Authors

Both sides consider finding the right partner the most important thing, and it shows the need for assistance in this field. The activities of bridging organizations are missing. Appropriate institutions (chambers of commerce) should initiate meetings with potential partners to establish the required cooperation (business to business forums, cross-border exhibitions, fairs, etc.). Respondents from SGP expressed the importance of a good business environment, better market opportunities, and legal incentives. These incentives encompass encouraging tax policies and simplification and acceleration of cross-border administration processes. Partners from Vojvodina are more looking to find the right partner and get a chance to expand into the foreign market. The calculation of the Pearson correlation

coefficient for the data from Figure 12-8 is R = 0.9383. That is a strong positive correlation. The value of R2, the coefficient of determination, is 0.8804. This value considers the significant positive dependence of the answers from both regions, related to the conditions that encourage cross-border innovation.

The general conclusion from comparing these results is a significant lack of information regarding the possibilities for cooperation among partners. The lack of information is the most important problem for future joint work in the innovation field. That means that political support for the innovation process is required. Financial support is an essential accelerating activity. The Hungarian side expresses insufficient trust towards the other side. The reason could be that they do not recognize the situation in the neighbouring country. Information crosses the borders slowly.

The strong positive correlation between groups of answers about obstacles and opportunities in developing a smart specialization in cross-border regions is significant. It can be concluded that cooperation is necessary within each of the nominated focus specialization sectors and that it must be defined in the framework of a smart specialization strategy.

3. SWOT analysis of cross-border innovation activities

Table 12-2 presents the SWOT analysis arising from the results of the performed research. It presents factors that ought to be taken into account by laying out innovation development across the borders.

Table 12-2. SWOT analysis of cross-border innovation activities. Source: (Vujaković, Marija and Mirjana Kranjac. "Vojvodina in Europe")

Strengths	Weaknesses
• Geographical connections, similarity in climate and topography of the region • Strong cultural and historical connections • The necessity to use the innovation process for regional development • The appearance of start-ups with high growth potential	• The innovation level of both regions is deficient (according to OECD) • Lack of cross-border institutions which support innovation • Lack of a database including the innovation potential of both regions

	• Lack of mutual contacts among innovation process partners • The Republic of Serbia is not a member of the EU • Lack of services that support cross-border innovation projects • Lack of financial models
• Overlap of innovation and research areas and those areas where they complement one another • Presence of qualified researchers in both regions	
Opportunities • Strengthening of the R&D and innovation (R&D&I) friendly atmosphere in the economic and regulatory environment • Geographic and climate preconditions for developing economies rely on each other • Partial compatibility of economies with possibilities to organize cross-border clusters • Formation of joint multidisciplinary development teams • Establishment of joint R&D and certification laboratories • Creation of joint instruments for practical cross-border incubation (e.g., tech shop, open lab, etc.)	*Threats* • Lack of cross-border innovation funds • Absence of joint research and innovation strategy and failure to establish joint bodies for its implementation and correction • Concrete and visible political support • Competitiveness among regions, rather than cooperation • Low level of the R&D&I demand • Overlap and complementary research areas • There is not a sufficient number of qualified researchers in both regions

4. Actors in the cross-border innovation process

Actors in the cross-border smart specialization (CBS3) in research and innovation have a crucial role in leading the smart specialization process to visible results. They should:

- participate in the entrepreneurial discovery process,
- contribute to the development and implementation of CBS3 strategies,

- provide advice on matching cross-border development needs with R&I demand,
- support the development of cross-border industries,
- help the spread of technologies across borders,
- support cross-border networking of clusters,
- provide a cross-border innovation ecosystem,
- bolster and shape the cross-border quadruple helix consisting of companies, scientific organizations, state administrations, and civil society organizations.

A cross-border smart specialization committee should be established to lead the process and have an internal and external or outward-looking dimension to cross-border smart specialization strategies.

CBS3 should use some policy instruments which will enable cooperation in creating:

- Joint education programs,
- Joint research programs,
- Cooperative building of research infrastructure,
- Collaborative schemes to support R&D activities in companies,
- Cross-border technology transfer bridges,
- Joint innovation support services,
- Common database for innovation offers and demand, experts, patents, equipment,
- Joint finance sources,
- Cross-border cluster policy,
- Cross-border innovation labs,
- Cross-border industrial, business, and technology parks,
- Joint and multiplied public procurement,
- Cross-border innovation policies.

Higher education institutions (HEIs) as leaders of the process

The pushing role in the design and implementation of the cross-border smart specialization process is played by university institutions. They have to span their activities over the borders and strengthen their knowledge capacity in this way. With its programs and funds, the European Union has to enable the mobility of professors and students. Joint study programs are welcome. Universities must have dynamic approaches and use various tools to connect the three elements of the "Cross-border knowledge triangle" (collaborative research, joint education, and gaining innovation).

State and regional policies are a powerful support

Political bodies have to understand and develop a cross-border smart specialization. That should be a joint decision of the governments of the two regions, which must establish a joint innovation steering committee that will lead the process together with all stakeholders. To encourage Decision-making processes, experts must promote the cross-border innovation process, raise awareness about its importance, activate stakeholders in both regions, and make the process outcomes visible. They should develop a monitoring system with defined measurable indicators, which will enable them to follow the progress of the process. Each milestone should be a point of discussion and bring possibilities for improvements.

New role for Science Parks in cross-border smart specialization

Science Parks should have the particular international task of creating cross-border networks of experts, companies, support institutions, and clusters in both regions. In that way, they will link their strength and create synergy between regions. Competent international managers are required to develop a good ecosystem that will foster cross-border innovations and attract experts from the wider area to join a science park. They should work to raise the level of trust of all involved in the process, especially private investors. Their task is to find new ways to finance the innovation process through innovation shares, innovation bonds, etc. When all favourable conditions are met, science parks will have the potential to play an essential transformative role in line with the goals of smart specialization strategies. It is not easy to continuously monitor science parks' results. Sometimes, they make internal and external connections generated by the innovation actors' from the park and create intangible added value.

Small and medium enterprises – generators of innovations

The innovativeness of SMEs is crucial for the competitiveness of the European Union, especially in transition countries where victims of privatization are pushed to start their businesses. Their sustainable development and even existence in the market are highly dependent on their ability to be innovative and bring something slightly different to the market. R&D&I activities are inevitable. SMEs should build their networks through clusters and must be cross-border connected to join capacities.

The role of the EU – S3 platform

"The S3 platform assists EU countries and regions in developing, implementing, and reviewing their Research and Innovation Strategies for Smart Specialization (RIS3)" (Kranjac, Sikimić, and Vujaković, Cross-border innovation process). Established in 2011 following the Communication "Regional Policy contributing to Smart Growth in Europe 2020", the S3 Platform is intended for policymakers to provide information about smart specialization and all processes related to it. It brings methodologies, expertise, and advice. It provokes debates and offers dynamic surroundings for all involved in the smart specialization concept. That is a new approach that is much more than a routine web portal and it presents an online tool. It brings theoretical background, practical results, connections to other EU documents, activities, and peer review outcomes from workshops realized in line with the EU procedures. Workshops are devoted to different topics and involve a few countries as presenters of their RIS3 and the public from various EU and non-EU countries. They are all actively engaged in debates and in answering carefully created questions. All events serve to analyse the documents inside-out and shape them with the implementation of all responses. They slightly tune the documents.

The S3 Platform registration is open to regional and national administrations of the EU, candidates, and neighbouring countries. The Institute for Prospective Technological Studies (IPTS) in Seville, a part of the European Commission's Joint Research Centre, hosts and organises this registration process.

The S3 Platform, with its expert team, is forcing cross-border and transnational innovation actions by being educators, activities initiators, active participants, followers of the process, and the ones involved in them.

- *Methodological guidance*

It contributes to the scientific development of smart specialization theoretical concepts and the methodology for their application.

- *Peer review*

That is a personalized approach to each regional or cross-border RIS3 done through specialized workshops. The results of the workshops are critics, comments, and recommendations from other regions based on the realistic RIS3 document. They enable mutual learning in real-time through discussion and shared work.

- *Academic research and analysis*

The S3 Platform is a part of the Joint Research Centre (JRC) which gives scientific and technical support to the European Commission. Smart

specialization is an example of academic expertise which is possible within
EU activities.

- *Events*

The Platform organizes two main types of events: Outreach seminars in
different European locations explaining and promoting the concept of smart
specialization to all interested regions and institutions. Workshops for
registered regions address specific aspects of concern to local policymakers.
In addition, the Platform can support the Member States in organizing
national events on Smart Specialization.

- *Transnational learning area*

The S3 Platform brings transnational learning tools shifting from
general assessments to more targeted ones on specific themes, concerning:
(1) specific sectors, (2) stakeholders, (3) similar regions, (4) specific level
of development, (5) standard features of regions, (6), specific policy tools,
and (7) identical or similar RIS3 priorities of regions and countries, etc.

- *EYE@RIS3*

Generating smart specialisation strategies is a long-lasting process that
involves many stakeholders and has a bottom-up approach. It stimulates
knowledge-driven development. The S3 platform contains an online
database named EYE@RIS3 to assist in strategic development. It is a
realistic map of the RIS3 implementation process, which consists of
regions' focus sectors. It enables one to see the whole map and to find places
with regional and cross-border positioning. It allows finding all the focus
sectors and setting up other cooperations.

- *EU grants for RIS3*

The creation and implementation of RIS3 and cross-border innovation
systems have been supported by funding from the European funds. Some of
these grants have already started within the Horizon 2020 program.

5. Results and discussion

Authors are also performing an educational role about the process of smart
specialization, which is one of the priorities important for the economic
prosperity of the European Union. Besides the concept of regional smart
specialization, they introduced the concept of smart specialization within
cross-border cooperation where adjacent regions have the same or
complementary target sectors for research and innovation. The authors
defined the methodology that should be used to generate cross-border smart
specialization, which provides the basis for developing needed strategic
documents and implementing the entire concept. The introduced concept is
essential and should integrate the European area of research and innovation

and record available resources within the EU while allowing their more efficient use. In this way, the European Union will be able to:

- Include many more actors in the process of research and innovation,
- Enable easier and faster transformation of ideas into products and services,
- Promote a more dynamic innovation space,
- Enable multicultural and multidisciplinary EU space,
- Include underdeveloped and developing countries and non-European countries in the process of innovation and exploit their distinct creativity, permitting them to enter the European space and even pull up the European development.

The Commission itself, through the Joint Development Centre (JRC), for the first time, is actively involved in the innovation processes based on the bottom-up principle. By organizing the S3 platform and activities, such as peer review workshops, those who work for the European Commission become part of the team that acts in actual circumstances on the ground. In this way, there is better information from the field about the problems and successes, the EC can perform better concrete actions, and strategic documents can be efficiently generated.

Thus, for the first time, the bureaucracy hired by the Commission is actively working on promoting and realizing a defined concept in the EU countries. The bureaucracy also includes active non-European regions and countries in the process, which should be a model for far more efficient use of EU bureaucratic mechanisms.

6. Remarks on Cross-border S3

The correlation between obstacles and advantages along the development of smart specialization in cross-border regions is significant. The respondents mentioned the same factors inhibiting and forcing innovative processes and projects in regional and cross-border contexts. The strong correlation between answers from organizations in both regions confirms Hypothesis 1 (The correlation between obstacles and opportunities during the development of smart specialization within cross-border regions is significant.), which fits the findings from similar studies referring to cross-border regional innovation strategies. The significant correlation between the received answers in both regions confirms that the same methodology used in a regional smart specialization should be used to create a cross-border strategy. This fact indicates that the dimensions of cross-border

strategic planning are, as a matter of fact, identical with those used throughout regional strategic planning within one region. The explanation behind this can be found in the analogy of the processes.

Since the innovative capabilities and potentials of the South Great Plain region (Hungary) and the Vojvodina region (Serbia) are relatively similar, the innovative attitudes of the Hungarian and Serbian innovation subjects can not be very different, either. The survey results have verified the phenomenon that innovation flows freely across state borders and confirmed Hypothesis 2 that the methodology for cross-border smart specialization planning is, in fact, very similar to that of the regional strategic planning within one region. This similarity shows that state borders are not barriers to the innovation process and that cross-border smart specialization is even a required process that enables reaching the critical potential needed to kick out visible innovative products or services.

There is a need to integrate capacities for smart specialization to increase competitiveness potential. Cross-border smart specialization applies only to regions that have the same or complementary innovation sectors in focus. The problem which will appear is the lack of a joint European mentality that was supposed to dismiss competitiveness between European regions. The sense of belonging to the EU should be developed to bolster stronger partnerships. Ideas of borders as the limitations of the past should be overcome. Such a change of mentality would bring a completely new platform of possibilities and outcomes. That approach can fortify the establishment of innovation alliances between different regions of the same or complementary target innovation sectors creating a genuine European breakthrough in the economic sense.

The economic policy of research and innovation convergence should be governed by one strong European political body with strong ambitions to achieve great success. That convergence could help to recommend more economic efforts and form viable economic policies, among others, to reduce the gap between recent members of the EU, future members of the EU, and foundation members. The need for the existence of regional political experts' bodies has been identified. They should govern the creation of a transnational research and innovation system using the European research and innovation policy budget as a straightforward tool. Besides, they must shape action plans for future activities with defined indicators for monitoring outcomes. Political bodies should play a key role in stimulating the process of innovation and in connecting countries to reach the critical potential of all resources, including knowledge, as the most crucial resource.

CHAPTER 13

SUGGESTIONS FOR EC SUPPORT TO S3

What could be the activities of the European Commission regarding smart specialization of European regions, states, and the whole European Union in the future? The current situation in regions and states that have adopted smart specialization strategies shows that the assistance of the EC during the development of smart specialization strategies is vital. It moves, it provokes, it engages. But this is not sufficient. EC should continue to permanently follow the outcomes, results, and impacts of the tasks that are the focus of the strategies. It should compare achieved results with foreseen results from activities put in the focus of the S3 roadmap and monitor indicators of all active strategies.

How to do it?
A very active approach must be developed. The approach could be designed through the S3 Expert's Development Process, which could be denominated with the shorthand "S3ExDP". Groups of experts from monitoring teams or advisory teams for the implementation of national and regional S3 strategies should have their joint board. This European S3 board ought to create a plan for monitoring and supporting all regions and countries across Europe. That should be done for EU members and non-EU members who have created S3 strategies and are competing to become members of the EU (like Serbia and Vojvodina). The monitoring plan should be designed through the S3 experts' development process together with the financial plan, training, and expertise support.

What could be the essential pillars of such a monitoring plan?
An overall indicator of S3 success should be created, and it should consist of a list of sub-indicators developed by S3 experts during the S3ExDP process. Regarding these indicators, a rating success list can be created in which the achievement of every region and state would be visible.
Once a year, a big conference should be organised where the overall results of S3 regions and countries will be presented and discussed. It would include the achievements of everyone over the previous year. The materials

from this conference would be educational and training materials and should be distributed to all interested parties.

> *The EC could organize many activities of support. What activities?*
> - The European Union should have a specialized financial fund to support projects that contribute to the activities of S3 strategies. The kind of activities that should be supported will depend on the regions and sectors in focus and the region's development state, and all will be clearly defined through the S3ExDP.
> - The EC must enforce establishing S3 business incubators for companies and stakeholders of the sectors in focus. These incubators should be within national borders, but also cross-border and international. The same applies to smart specialization clusters, start-up incubators, and accelerators.
> - Smart specialization fairs. Such fairs would gather innovative products, services, business models and processes, marketing campaigns, value chains, distribution channels, logistics solutions, financial models, research and development processes, and results. All these would relate to one or a few smart specialization focus sectors. Fairs could be national, cross-border, or international. Within fair activities, there can be competitions and award ceremonies for those with the best results.

Research niches in smart specialization sectors should be intensified. Universities, faculties, and research institutes from each focus sector should connect to perform investigations together. State borders must not be barriers to joint work. That will be a way to improve similar sectors on both sides and raise them to a higher level of functioning with better innovative results.

The reform of middle and high-level school education is of the most significant importance. High schools, graduate-level studies, and postgraduate levels must follow the requests of smart specialization with its vertical and horizontal principles. Smart specialization cannot achieve its goals without a good education. That means that the whole education system should be changed, become more oriented towards practical work, testing, and experiments, and be tightly connected to production systems. It should generate professions of the future, professions that should add value to the smart specialization areas. Enrolment quotas at schools, faculties, and doctoral studies should follow the goals of smart specialization strategies. That will consequently lead to higher employment of graduate and

postgraduate students. Companies should be actively involved as stakeholders in schools and faculties' management bodies.

Also, testing labs should get more attention. Development of new products and services is not possible without good and up-to-date testing equipment. The start of any development, prototyping, and the first assembly lines is tightly connected with adopting European and international standards and requires all tests to be done in labs. International labs would enormously reduce the costs and offer many more possibilities than labs belonging to a single country or even to a single region. In addition, labs are places where students can be trained and can try and evaluate their ideas.

What about the wider public, citizens?

The whole society must be a part of the smart specialization process. Incubators should be open to anybody who would like to produce anything, improve any product, or learn to work on any machine. Training should be organized at appropriate places to increase knowledge of everyone: housewives, retired people, kids, etc. Everybody can contribute to a smart, specialized society.

What about the youngest and the oldest members of a smart, specialized society?

Children must learn to be creative, to be innovative. Even during their young childhood, during their stay in kindergartens, they should be provoked to create and make and develop skills to build things of metal, plastic, wood, and soil. Making, creating, and designing through play will enable them to make new products when they grow up.

It is a similar case with older people. Many of them are still in condition to work and would like to work, and it is also good to involve them in work to keep them healthy. An outstanding possibility is to connect young and older adults and make both groups happy and satisfied. The transfer of knowledge, experience, creativity, and skills from old to young and vice versa is a valuable process in developing a smart and visionary society.

The bottom line is: all these activities must have international significance. The European commission could organize and finance the travel and exchange of groups of people, experts, of kids. They could make new contributions to new environments. And they, of course, could offer much stronger effects if they worked in multinational teams. The differences in mentalities, habits, and customs between, for example, citizens from Scandinavia, Sweden, Finland, and from the Mediterranean coast countries like Italy and Spain, or people from Holland and Romania or Serbia, will give a new quality. That will reflect the multinationalism of

the European Union and Europe and put this continent in a much better
perspective.

CONCLUSION

The essential tips towards EU efforts in the field of smart specialization:

- The European Union's decision to compare its vision, mission, general and specific goals, together with results, with the United States is an excellent way to boost its economy. The European commission's attitude to directing its efforts towards innovativeness, research, and development as tools to save the European economy and make it more competitive is worth supporting. That is a good approach and should become a practice.
- Also, creating a methodology at the EU level on how to lead the process of creation of the S3 strategy is an excellent step forward. It gives a framework for all countries to do it the same way and provides a basis for quickly comparing the creation and implementation processes of S3 and their outcomes.
- For the first time, EC has set up a platform (EC, S3Platform). This platform is a treasury of data, information, texts, books, and results.

The peer-reviews are new tools that are valuable and that the Vojvodina region passed through while creating its S3. This process of connecting regions and nations and enabling mutual discussions, criticism, exchanging opinions and ideas, and learning is a new method used during the creation and implementation of S3. It is of great importance due to its role in avoiding making the same or similar mistakes among regions and makes it possible for regions to meet one another and learn from one another.

The Smart Specialization Strategy of Serbia has just been adopted. Its writing was a creative process that included many stakeholders, and it is evident that such a process is needed by Serbian society. Stakeholders gathered and had the opportunity to exchange their opinions, attitudes, needs, and demands. That was a rare occasion for Serbia. The country was pretty late in making national S3, five years after Vojvodina had made its strategy. Additionally, the experience from Vojvodina was barely used for the development of the Serbian S3.

It is clear that, even without such a long creation process, it is apparent that agriculture, food production, and the information technology sectors

should be the main directions of innovation in Serbia. Precisely that is stated in the results of S4.

Nevertheless, the process of preparing S4 through all the steps presented in this book was inevitable.

Why? Because these steps involving many stakeholders are necessary to make a sound base for implementing S4. The niches that were defined will be the starting points for R&D&I of Serbia towards stabilising and strengthening the Serbian economy. The links between the academy, companies, civil society and the state administration should clarify and define actual products and services and put them on the right shelves for the future. Also, it should activate innovative approaches and increase employment in new sectoral fields.

Coming back to the case of the Vojvodina region, it must be underlined that the current situation is not optimistic. The result is that the goals of smart specialization have not been reached. The most important political and expert bodies that should have led implementation activities were not established, and S3 of Vojvodina was not used in the terms it should have been. The most important part of the whole system, the decision-makers—the politicians, did not accept S3 as a vital program towards improving the regional economy. They have not understood its meaning and potential. The only thing S3 of the Vojvodina region contributed to was that organizations applying for EU funds with their project ideas received more points during rating processes and were more competitive in gaining financial support. The best example of this is the BioSense Institute, which has received financial resources from the EC through more than 30 Horizon 2020 projects.

The S3 of Vojvodina is not a valid document anymore, it lasted only until 2020. The government of Vojvodina has not put in its plan to update it for the coming five-year period.

And to conclude, the smart specialization strategy of Serbia is a very important document whose implementation should be led by a qualified body with experts and politicians included in it. Furthermore, S4 must have permanent monitoring of all activities and results, with accompanying programs created and supported financially and expertly by the national and regional governments.

It should be updated when needed, always with an attractive action plan. Such a document needs permanent promotion that ensures its visibility and creates a feeling that it is owned by the process owners—by as many stakeholders as possible. Also, the fact that the process was led by a European team of experts from the Joint Research Institute increased the importance of the document and the process itself. The inclusion of JRC

influenced many stakeholders to want to participate, acquire new knowledge, or just be part of the process.

Such an approach is an excellent example of how to promote European values and support, in the best way, Serbian integration into EU activities. That is a real-time methodology, which shows the importance of being a member state of the European Union.

In the last chapter, the authors gave suggestions to the European Commission on enhancing and intensifying the adoption of Smart specialisation principles within the whole European area. It is imperative to include non-EU countries in the process to become members of the EU more easily.

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ABBREVIATIONS

APV - Autonomous Province of Vojvodina

BSC Centre - Information Centre for Business Standardization and Certification

CAGR - Compound Annual Growth Rate

CSD - Custom Software Development

DG JRC - Directorate General Joint Research Centre

EDP - Entrepreneurial Discovery Process

EIT - European Institute of Innovation and Technology

F3 - Priority area: Food for Future

FDI - Foreign Direct Investments

ICT - Information and Communication Technology

KET - Key Enabling Technologies

MoESTD - Ministry of Education, Science and Technological Development of the Republic of Serbia

MoTIS - Ministry of Telecommunication and Information Society

Quadruple helix - Key local actors from government, research and scientific institutions, companies, and citizens, which engage in bottom-up collaborative processes in innovation policy and challenge the traditional top-down policymaking process

PPP - Public-Private Partnership

RIS - Regional Innovation Strategy

RIS3 - Research and Innovation Strategies for Smart Specialisation

RITTS - Regional Innovation and Technology Transfer Strategies

RSJP - Republican Secretariat for Public Policy

S3 - Smart Specialization Strategy

S4 - Smart Specialization Strategy of Serbia

SANU - Serbian Academy of Sciences and Arts

SGP - South Great Plain region in Hungary

SME - Small and Medium Enterprises

STEM area - Connected areas of study: Science, Technology, Engineering, and Mathematics

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