ECONOMIC POTENTIAL

INNOVATIVE POTENTIAL

SCIENTIFIC POTENTIAL

Identification: Domain Selection Criteria

NETWORKING

HYBRIDIZATION

SPILLOVER

Domain selection criteria (Cont'd)

Economic potential

Economic potential is defined as a potential of a nation, region, or organization for economic development and growth and creation of surplus value. Typically, discussions about economic potential occur when available resources as preconditions have not yet been tapped and fully developed or exploited, but they may be identified and described. It often refers to economic strength and it is observed through various economic preconditions for achieving positive economic results.

Innovative potential

Innovation may happen only if precondictions for leapfrogging are in place. Innovative potential is a capability to develop new ideas, or something new and improved, and to create added value. Innovations can be defined as substantially improved products, services, or processes that have been commercialized at the market(s).

Scientific potential

Scientific potential is an important part of the innovation paradigm. Therefore, the conceptual, social, and temporal aspects of scientific output and its potential are considered particularly relevant. In numerous cases, the economic and innovative performances of a country depend on the scientific knowledge and its application.

Networking potential

Networking is perceived as a collaboration of two or more sides aimed at jointly driving knowledge and generating innovations. Those sides can come from the same industries or disciplines. There should be cross-disciplinary interaction and matching of complementary resources (financial and technical) and capacities (business support and scientific capabilities) within the network.

Hybridization potential

Hybridization refers to the emergence of new domains. Such a process surpasses traditional cooperation as it involves diffusion of knowledge within economic and/or technological fields, a cross-pollination of knowledge that results in innovation. It involves intersecting domains, as well as proliferation at the periphery of existing domains and cross-pollination of them.

Spillover potential

The spillover effect represents knowledge, technology and solutions transfer between different organizations. Those organizations may belong to the same sector (e.g., companies in the business sector), but the spillover effect can also happen between different sectors, thus benefiting the society as a whole.

Selected indicators

1. Revealed Comparative Advantage (RCA) of export structure benchmarked against the EU
One NACE sector is said to have RCA when the ratio of its exports to the country's total exports exceeds the same ratio for a selected group of benchmark countries.

2. Value added RCA benchmarked against the EU
Value added RCA considers whole domestic production, regardless of whether it is exported or consumed domestically. In addition to exporting sectors, this indicator "reveals" and awards sectors that are engaged in intermediary domestic production.

3. Wage Adjusted Productivity benchmarked against the EU
This indicator shows how cost-effective the production of goods and services is. The indicator is calculated as the ratio of generated value added to labor costs.

4. PPP Adjusted Productivity benchmarked against the region
This indicator reveals how advanced the production of goods and services really is. It takes into account price level differences between countries. It is obtained by adjusting sector productivity for the difference in price level (Purchasing Power Parity, or PPP). Since Serbia is unlikely to be able to compete with advanced European economies at the NACE 2-digit level, this part of the analysis was conducted on the regional level.

5. Export growth rate
Export growth rate was included to introduce export developments into the economic potential analysis. The period from 2015 to 2019 was chosen as the baseline to avoid the impact of the first wave of fiscal consolidation (starting point) and the Covid-19 pandemic (ending point).

Sources: **Statistical Office of the Republic of Serbia, Eurostat**

NACE level
*The Statistical classification of economic activities in the European Community, abbreviated as NACE, is the classification of economic activities in the European Union (EU). NACE classification provides the framework for collecting and presenting a large range of statistical data according to economic activity in the fields of economic statistics (e.g. production, employment and national accounts) and in other statistical domains developed within the European statistical system (ESS). The Statistical Office of the Republic of Serbia has adopted NACE methodology for economic metrics.

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Analysis of commodities – UNComtrade dataset

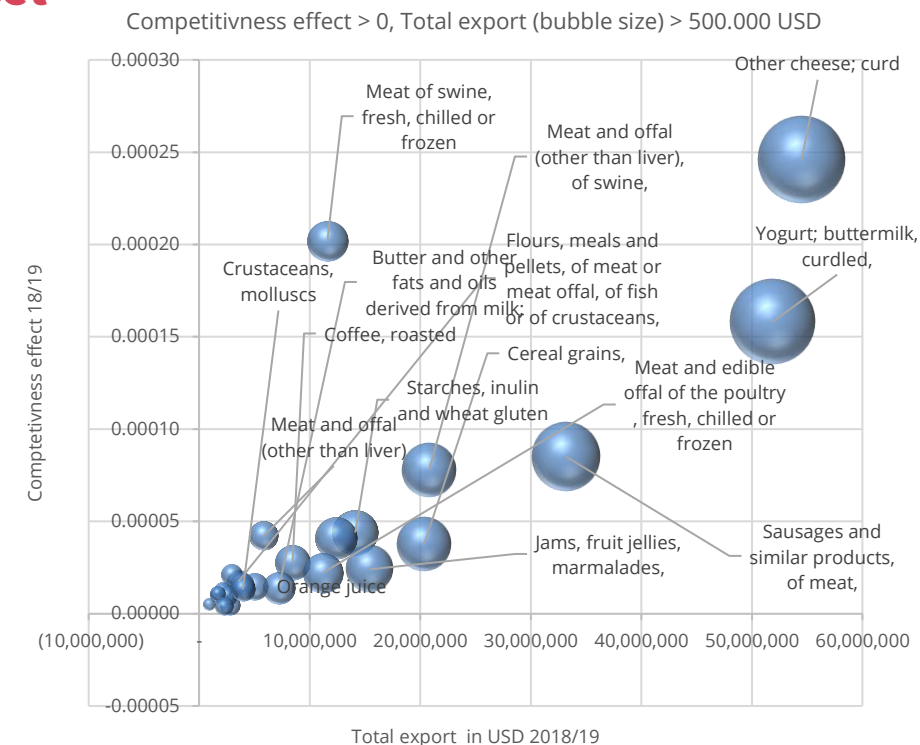### Constant market share (CMS) analysis

The main goal of CMS analysis was to identify the exact products and corresponding economic sectors exhibiting high competitiveness. The data for the analysis were collected on the SITC rev.4 (4-digit disaggregation) level which disaggregates goods exports into 1,027 product groups. Furthermore, to map product groups to corresponding NACE sectors, our team created a correspondence table between NACE rev. 2 economic sectors. This allowed us to **pinpoint products and subsectors within NACE 2-digit disaggregated sectors**.

Findings to date

One sector with pronounced economic potential is **Manufacturing of food products** (NACE C10), which comprises a vast array of producers and products – such as meat processing and preserving, manufacture of vegetable and animal oils and fats, fruit processing, dairy products, production of baked goods, sugar production, and tea and coffee. CMS analysis breaks Manufacture of food products down into 72 different product groups.

Shortcomings in accessing economic potential:
- **NACE classification does not include tech-driven sectors.**
- **CMS analysis of exports is limited to analysis of export of goods, while services are not covered.**

Competitivness effect > 0, Total export (bubble size) > 500.000 USD

Chart labels:
- Other cheese; curd
- Meat of swine, fresh, chilled or frozen
- Meat and offal (other than liver), of swine,
- Yogurt; buttermilk, curdled,
- Crustaceans, molluscs
- Butter and other fats and oils derived from milk;
- Flours, meals and pellets, of meat or meat offal, of fish or of crustaceans,
- Coffee, roasted
- Cereal grains,
- Meat and edible offal of the poultry, fresh, chilled or frozen
- Starches, inulin and wheat gluten
- Meat and offal (other than liver)
- Jams, fruit jellies, marmalades,
- Sausages and similar products, of meat,
- Orange juice

Y-axis: Comptetivness effect 18/19
X-axis values: (10,000,000), 10,000,000, 20,000,000, 30,000,000, 40,000,000, 50,000,000, 60,000,000
Y-axis values: 0.00030, 0.00025, 0.00020, 0.00015, 0.00010, 0.00005, 0.00000, -0.00005

Total export in USD 2018/19

4

Source: **UNComtrade**

Analysis of commodities – UNComtrade dataset

Due to concerns over data comparability, this part of the analysis was conducted entirely at the national level, and was based on Community Innovation Survey (CIS) microdata obtained from the Statistical Office of the Republic of Serbia.

Selected indicators (national analysis):

1. Share of innovative enterprises
This summary indicator is relatively wide, taking into account all enterprises which, during the reporting period, successfully introduced a product or process innovation, engaged in ongoing innovation activities, abandoned innovation activities, completed but not yet introduced an innovation, or engaged in in-house or outsourced R&D.

2. Share of companies with in-house R&D

3. Share of companies having radical innovations

4. Share of companies with patents licensed in or out

5. Share of employees with higher education

6. Share of starups in specific industries

All of the selected indicators are for the most part self-explanatory and correlate positively with the ability of companies and sectors to generate or implement innovations.

*Source:* **Community Innovation Survey, Innovation Fund**

Scientific productivity data were collected from the Web of Science (WoS) database. WoS is an online academic citation index provided by Thomson Reuters. It provides access to multiple databases, cross-disciplinary research, and in-depth exploration of specialized subfields within an academic or scientific discipline. The data were extracted for individual countries: total (all publications) and for the SEE region divided into a total of 251 Web of Science categories.

Selected indicators:

1. **Revealed comparative advantage (RCA)** contrasts the share of a research field in the national economy with the share of a research field in the region.

2. **Absolute Size** measures the total number of published papers

3. **Average annual growth rate (AAGR)** calculates the arithmetic mean of a series of growth rates in number of publications. The AAGR is helpful in determining long-term trends.

In this study, we selected 9 countries that are geographically part of the SEE region and could be interesting for a comparison of scientific productivity:
  1. Albania
  2. Bosnia and Herzegovina
  3. Bulgaria
  4. Croatia
  5. Montenegro
  6. North Macedonia
  7. Romania
  8. Serbia
  9. Slovenia
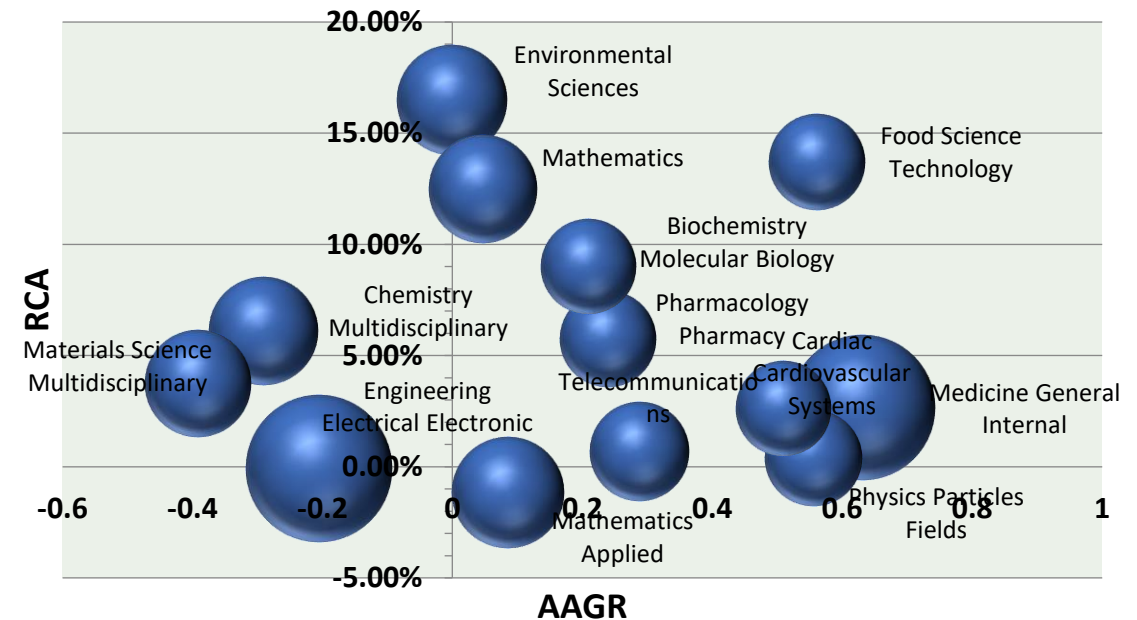
Food Science Technology is the most prominent research area in Serbia. In this area, Serbia records high research productivity and high level of specialization in relation to the SEE region, achieving a high annual growth rate. A significant annual growth rate was also identified in **Environmental Sciences and Mathematics**.

Identification: Networking, hybridization and spillover potentials

Networking potential: indicators

1. Formal cooperation exists within my sector (according to the 5-helix model) and is a stepping stone for innovation

2. Informal cooperation exists within my sector (according to the 5-helix model) and is a stepping stone for innovation

3. Formal cooperation exists between my sector and other ones (according to the 5-helix model) and is a stepping stone for innovation

4. Informal cooperation exists between my sector and other ones (according to the 5-helix model) and is a stepping stone for innovation

5. Trust is important for co-creation

6. Key actors in my sectors promote cooperation and

Hybridization potential: indicators

1. My innovation is the result of various technologies

2. My innovation can be applied in different sectors/domains

3. Startups in Serbia create hybrid innovation

4. Horizon projects from Serbia are multidisciplinary

5. Scientific and research projects in Serbia are multidisciplinary

Spillover potential: indicators

1. Spillover (of knowledge) to other sectors/domains

2. Spillover (of knowledge) through collaboration within and between different actors

3. Spillover (of knowledge) to community /society that has positive economic impact

Source: **Initial insights obtained through interviews with 107 selected actors**

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Serbia's
10 most promising domains

Identification: From NACE sectors to domains

NEW AGE (BIO)TECH SOLUTIONS IN PERSONALIZED MEDICINE

VALUE-ADDED FOOD

HIGH-TECH AGRICULTURE

CLEAN AND GREEN TECH FOR SUSTAINABLE DEVELOPMENT

INDUSTRY 4.0

SMART MOBILITY

NEW GENERATION ELECTRONICS AND OPTICS

SMART LIVING AND WORKING ENVIRONMENTS

GAMING AND VIRTUAL REALITY

ADVANCED BUSINESS SOLUTIONS AND FINTECH

Identifying promising NACE sectors based on economic, innovative and scientific potentials

Narrowing down from the total universe of 88 to 52 NACE sectors

Rank	Code	Sector	Economic & Innovative potential		Economic density			Scientific potential	enabler	Selection
			Economic & Innovative	Total	No Firms	No Emp	Revenues mil EU	Verdict		First step
1	63	Information service activities			341	3,015	226	Not relevant	enabler	
2	14	Manufacture of wearing apparel			897	39,706	866	Low		
3	62	Computer programming, consultancy and related activities			2,714	28,561	1,654	Medium	enabler	
4	72	Scientific research and development			353	6,599	330	Medium	enabler	
5	21	Manufacture of basic pharmaceutical products and pharmaceutical preparations			55	4,731	451	High		
6	51	Air transport			34	1,806	355	Currently unavailable		
7	70	Activities of head offices; management consultancy activities			4,376	25,597	1,000	Low		
8	26	Manufacture of computer, electronic and optical products			805	8,229	647	High		
9	22	Manufacture of rubber and plastic products			1,011	30,323	2,534	Low		
10	10	Manufacture of food products			2,897	95,638	6,559	High		
11	17	Manufacture of paper and paper products			553	8,999	1,020	Low		
12	11	Manufacture of beverages			426	8,497	1,186	High		
13	15	Manufacture of leather and related products			255	15,121	374	Currently unavailable		
14	18	Printing and reproduction of recorded media			805	9,286	412	Not relevant		
15 F		Construction			7,899	83,682	8,002	Currently unavailable		
16	31	Manufacture of furniture			667	18,864	702	Not relevant		
17	28	Manufacture of machinery and equipment n.e.c.			796	15,644	982	Medium		
18	79	Travel agency, tour operator reservation service and related activities			908	5,215	190	Currently unavailable		
19	23	Manufacture of other non-metallic mineral products			582	14,074	999	Not relevant		
20	61	Telecommunications			372	15,442	2,033	Medium		
21	13	Manufacture of textiles			381	12,629	466	Currently unavailable		
22	59	music publishing activities			594	2,371	218	Not relevant		
23	74	Other professional, scientific and technical activities			495	4,782	111	Not relevant		
24	33	Repair and installation of machinery and equipment			314	4,844	230	Not relevant		
25	73	Advertising and market research			1,190	7,502	596	Low		
26	71	Architectural and engineering activities; technical testing and analysis			3,132	27,044	1,127	Low	enabler	
27	27	Manufacture of electrical equipment			464	21,508	1,261	High		
28	78	Employment activities			158	18,779	237	Currently unavailable		
29	50	Water transport			62	1,025	122	Currently unavailable		
30	58	Publishing activities			798	7,114	251	Currently unavailable		
31	32	Other manufacturing			427	7,470	334	Currently unavailable		
32	53	Postal and courier activities			41	18,227	274	Currently unavailable		
33	20	Manufacture of chemicals and chemical products			565	12,529	1,578	Medium		
34	16	Manufacture of wood and of products of wood and cork, except furniture; manu-			1,216	16,481	638	Not relevant		
35	69	Legal and accounting activities			2,228	21,593	638	Currently unavailable		
36	60	Programming and broadcasting activities			397	7,833	272	Currently unavailable		
37	35	Electricity, gas, steam and air conditioning supply			801	38,643	5,300	Currently unavailable		
38	24	Manufacture of basic metals			196	20,051	2,093	Currently unavailable		
39	36	Water collection, treatment and supply			176	18,921	352	Currently unavailable		
40	29	Manufacture of motor vehicles, trailers and semi-trailers			246	49,750	2,162	Currently unavailable		
41	80	Security and investigation activities			402	32,159	397	Currently unavailable		
42	77	Rental and leasing activities			491	2,473	221	Currently unavailable		
43	46	Wholesale trade, except of motor vehicles and motorcycles			20,498	137,794	23,676	Currently unavailable		
44	81	Services to buildings and landscape activities			523	17,492	285	Currently unavailable		
45	25	Manufacture of fabricated metal products, except machinery and equipment			1,974	52,677	2,315	Currently unavailable		
46	75	Veterinary activities			468	4,415	96	Currently unavailable		
47	82	Office administrative, office support and other business support activities			1,031	14,105	379	Currently unavailable		
48	49	Land transport and transport via pipelines			4,300	63,591	3,790	Currently unavailable		
49	93	Sports activities and amusement and recreation activities			512	3,094	87	Currently unavailable		
50	68	Real estate activities			1,533	7,498	353	Currently unavailable		
51	30	Manufacture of other transport equipment			103	2,543	116	Currently unavailable		
52	38	Waste collection, treatment and disposal activities; materials recovery			596	22,223	796	Currently unavailable		

NACE sectors ranked 1 to 52

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Final list of selected NACE sectors based on economic, innovative and scientific potentials

Final list of 24 selected NACE sectors

Rank	Code	Sector	Economic & Innovative	Total	No Firms	No Emp	Revenues mil EU	Verdict
1	63	Information service activities			341	3,015	226	Not relevant
2	14	Manufacture of wearing apparel			897	39,706	866	Low
3	62	Computer programming, consultancy and related activities			2,714	28,561	1,654	Medium
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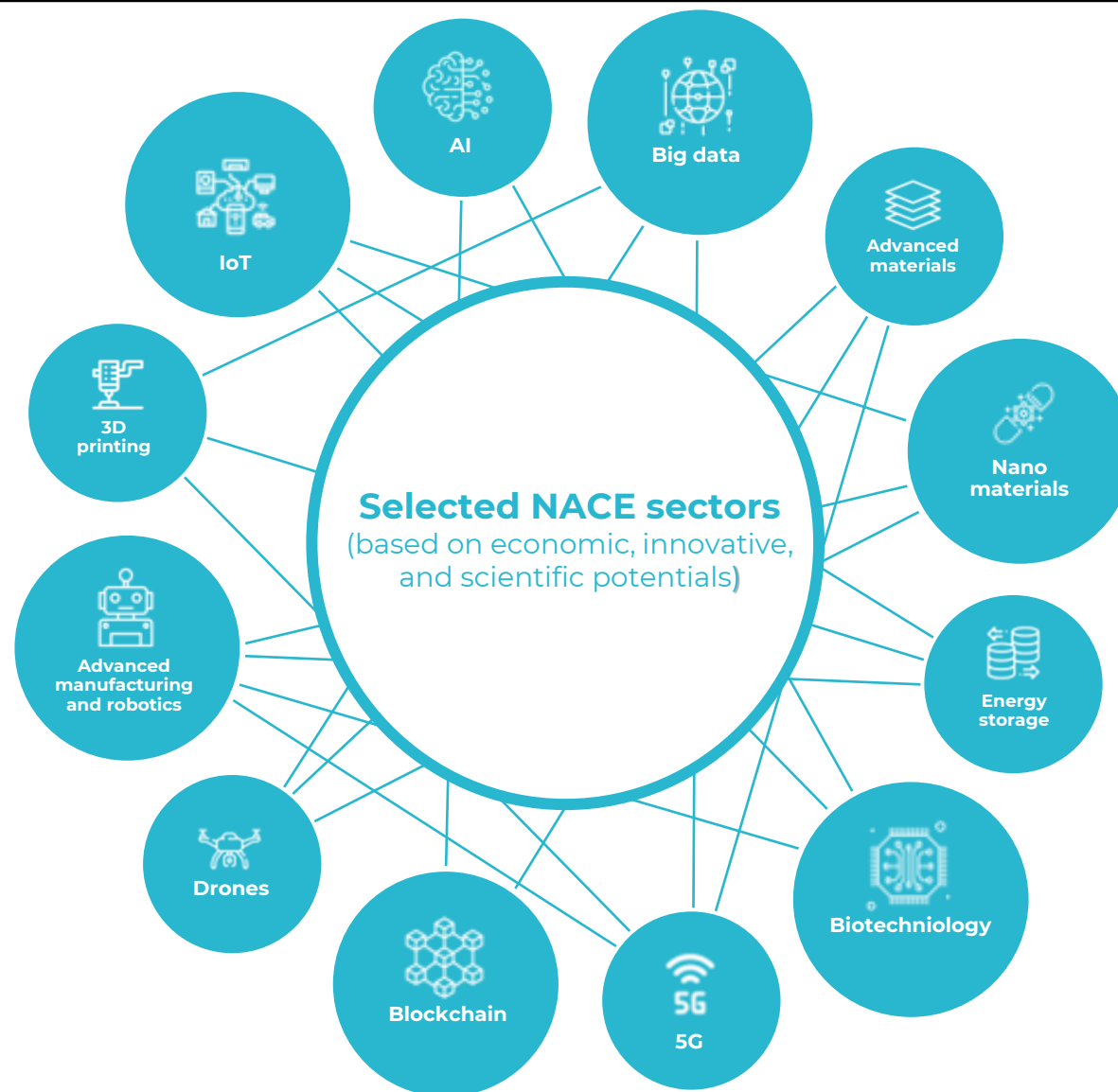# Technologies and how they are identified

Application of transformative technologies was used as a filter.

The technologies were considered from **different perspectives**:

- Scientific (US National Institute of Technology)

- Policy and development (OECD, UNIDO, European Union)

- Market and industry (PwC, McKinsey, Boston Consulting Group)

Selected NACE sectors
(based on economic, innovative, and scientific potentials)

AI
Big data
Advanced materials
Nano materials
Energy storage
Biotechniology
5G
Blockchain
Drones
Advanced manufacturing and robotics
3D printing
IoT

Emerging domains in Serbian economy - combining sectors and technologies

NEW AGE (BIO)TECH SOLUTIONS IN PERSONALIZED MEDICINE

SMART MOBILITY

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CLEAN AND GREEN TECH FOR SUSTAINABLE DEVELOPMENT

GAMING AND VIRTUAL REALITY

INDUSTRY 4.0

ADVANCED BUSINESS SOLUTIONS AND FINTECH

Application of technologies within domains

The spread of transformative technologies within each domain

Technologies

Legend:
- HIGH
- MEDIUM
- LOW

Domains	AI	IoT	Big data	Robotics	3D printing	Biotech	Advanced materials	Blockchain	5G	Energy storage	Drones
New age tech solutions in personalized medicine											
Value-Added Food											
High-tech Agriculture											
Clean and green tech for sustainable development											
Industry 4.0											
Smart mobility											
Electronics and optics											
Smart home and working environment											
Gaming and virtual reality											
Advanced business solutions and fintech											

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Zooming in: the process of identifying Serbia's most innovative companies

Step 1: Assessing innovative performance

A) How often did the company appear in: a) databases of the Innovation Fund, Community Innovation Survey (CIS), Horizon 2020, Eureka, Smart Specialization Strategy and Serbian Development Agency (RAS); **b)** views of sectoral experts; and **c**) interviews with respondents.
Example: a company that appeared in 4 sources had an advantage over a company that appears in 2 sources.

B) How diverse were the sources in which the company appears
Example: if company X appeared only 2 times in the RAS database and firm Y appeared 1 time in the Innovation Fund database and 1 in the RAS database, firm Y will take precedence.

C) Preference was given to appearances in the Innovation Fund, Horizon, and Eureka databases, since these three sources most directly reveal innovative companies. Here we had **two sub-criteria**:
   a. If two companies appeared multiple times, the one that appeared in one of the listed databases was chosen over the one that appeared in other databases. **Example:** if company X appeared in the CIS and RAS databases, and firm Y appeared in the Innovation Fund and CIS databases, firm Y was chosen.
   b. If there was only a single appearance in any source, companies appearing in the Innovation Fund, Horizon, or Eureka database were selected. **Example:** if company X appeared in the RAS database and firm Y appeared in the Innovation Fund database, company Y was chosen.

Step 2: Assessing economic performance

A) **Basic business parameters of selected companies were analyzed by reviewing their financial statements.** The main indicator analyzed was profit. Serbian Business Registers Agency data were used.

B) **In-depth analysis** of all available data on a company's activity (for example company website, news reports, etc.)

Zooming in: the process of identifying Serbia's most innovative companies (Cont'd)

Step 3: Bringing together innovative and economic performance

After creating an initial list of companies and identifying their innovative and economic performance, we brought their innovative and economic performance together.

A) Innovative performance was measured by the frequency with which the company appeared in relevant databases that directly suggest
   innovativeness.

B) Economic performance was measured by the company's profit.

Innovative and economic performance were used to construct a composite indicator of each firm's innovative and economic performance. For that purpose –
   a) we used normalized values of both innovative and economic performance,
   b) and assigned them weights of 0.5 each.

The composite indicator shows the general innovative and economic performance of each company.

Each company was then assigned to one of the 10 selected domains based on its primary economic activity.

LIMITATIONS:
The list of key players given in the Serbia's 10 Most Promising Domains PowerPoint presentation is for illustration only. Our methodology was based on available databases measuring innovative and economic performance. Some companies may have been omitted due to the limited scope of these databases. That said, there exist no other databases that measure innovative performance of Serbian firms. Further steps could include scrutinizing companies that have to date fallen outside the scope of the analysis and exhibit high economic performance.
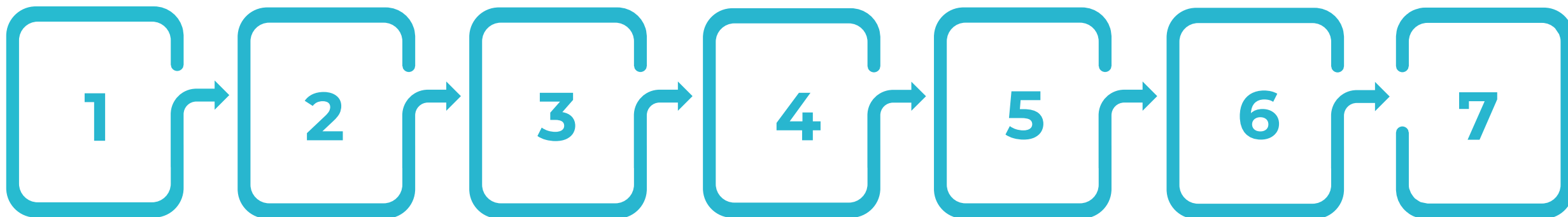
1	2	3	4	5	6	7
Selecting NACE sectors	Identifying economic, and innovative potentials within selected sectors + conducting CMS analysis of products	Analyzing domestic scientific potential and matching it to NACE sectors	Selecting NACE sectors with highest economic, innovative and scientific potentials	Identifying technologies and matching them to NACE sectors with the highest economic, innovative and scientific potential	Defining domains, adding description of each domain role, product space, list of key players, etc.	Next step: Selecting 4 most promising domains based on networking, hybridization and spillover potentials

Criteria

Criteria	Level
Economic potential	National, regional and global
Innovative potential	National
Scientific potential	Regional and national
Networking potential	National
Hybridization potential	National
Spillover potential	National

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