Semantic analysis of RDI achievements in the **priority areas** of the Slovenian Sustainable Smart Specialisation Strategy (S5)

May 6-7th, 2025

I FEEL SLOVENIA

Sofinancira Evropska unija

REPUBLIKA SLOVENIJA
MINISTRSTVO ZA KOHEZIJO IN REGIONALNI RAZVOJ

S5

SIRIS ACADEMIC

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1. Objectives and summary of the methodology

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Objective of the project: To perform **a semantic analysis** of Research, Development and Innovation **(RDI) activities and results** from selected international databases **using artificial intelligence tools,**

- **as a basis for upgrading the development specialisation and RDI ecosystem** of the Republic of Slovenia
- and to **support the process of Entrepreneurial Discovery Process (EDP)**

1. Objectives and summary of the methodology

Increasing expectations and changing priorities for R&I

How to think about priorities, policy instruments and indicators when **expectations and external trends an inputs** on Research and Innovation **keep on expanding and shifting?**

Produced by ChatGPT

1. Objectives and summary of the methodology

But institutions, forms of organisation and skills don't change as quickly

And adapted approach to bridge this gap:

- **Thematic analysis of R&I activities and results as expressed by the R&I actors**
  - AI - Natural Language Processing on granular textual data (titles and abstracts)
- **Analysis of the specialisation of R&I actors, by type of actor, and how they organise**
  - Research, industrial, public admin., others
  - SRIP membership (in 2022)

Produced by ChatGPT

1. Objectives and summary of the methodology

Type of document	Data Source	Number of documents in Slovenia	Number of distinct actors in Slovenia
Scientific publications	OpenAlex	~84,000	~7,400 disambigutaed actors across the data sources
Patents	Patstat	~8,200 application ids, ~4,100 patent families	
Horizon projects	Cordis	~1,600	
ERDF projects	Kohesio	~8,400	
Interreg projects	Interreg	~930	

Period: 2014 - mid 2024. Analytics: 2015-2023

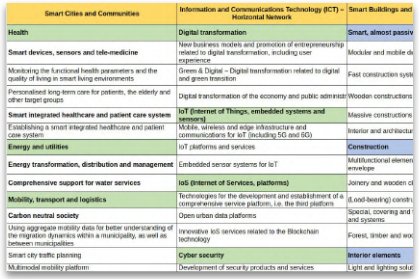
Thematic analysis of R&I activities and results

Top-down: given an area of interest → identify the related R&I activities

- Smart cities and communities
- Sustainable Food Production
- Materials as end products
- ICT
- Smart Buildings and the Wood Chain Home
- Factories of the Future
- Health - Medicine
- Sustainable Mobility
- Sustainable Tourism
- Transition to a Circular Economy

Bottom-up: For a whole ecosystem (region, EU, ...) → identify the most frequent topics in R&I activities

1. Objectives and summary of the methodology



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Carbon neutral society	Open urban data platforms	Special, covering and and systems
Using aggregate mobility data for better understanding of the migration dynamics within a municipality, as well as between municipalities	Innovative IoS services related to the Blockchain technology	Forest, timber and wo
Smart city traffic planning	Cyber security	Interior elements
Multimodal mobility platform	Development of security products and services	Light and lighting solut

"the baseline table"
(S5 Priloga Tabela)

Target analytical taxonomy

S5 - 1st level

Slovenian S5 **Priority Areas**

Smart Cities and Communities ... Factories of the Future

Classification method: **Top-down classifiers for the 10 S5 PAs**

S5 - 2nd level

Automatically identified topics

Smart Cities and Communities - **Topic 1**
Smart Cities and Communities - **Topic 2**
...
(10-20 topics per Priority area)

...

Factories of the Future - **Topic 1**
Factories of the Future - **Topic 2**
...
(10-20 topics per Priority area)

Classification method: **Automatic identification of topics within a S5 PA, via topic modelling**

Tranversal level

Transversal identified topics

Transversal topic 1
Transversal topic 2
...
(50 topics)

Classification method: **Automatic identification of topics via topic modelling**
Added-value: **Bottom-up identification of topics**, independent from the Slovenian S5

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AI-powered classification - Methodology overview

Challenge

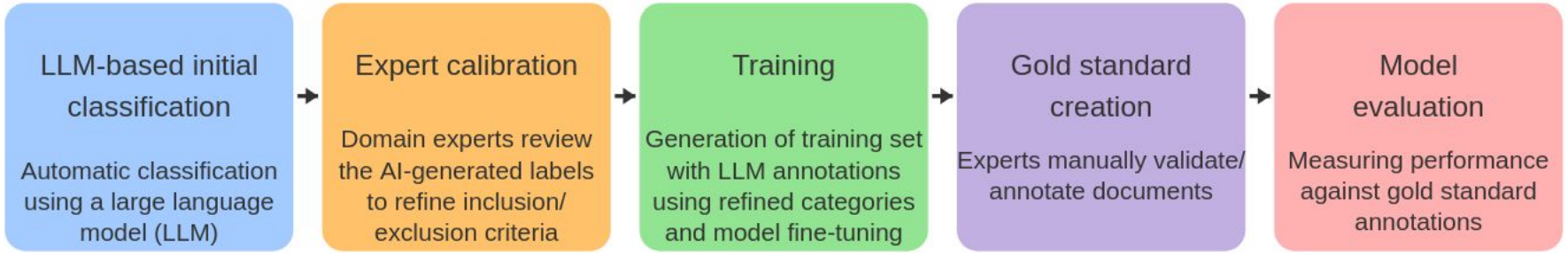
- Classifying 100,000+ documents into 10 Slovenian S5 priority areas require innovative AI-human_ expert collaboration.
- Large amount of training (pre-classified) data is needed for models to learn patterns in the data and make predictions.

Innovative approach

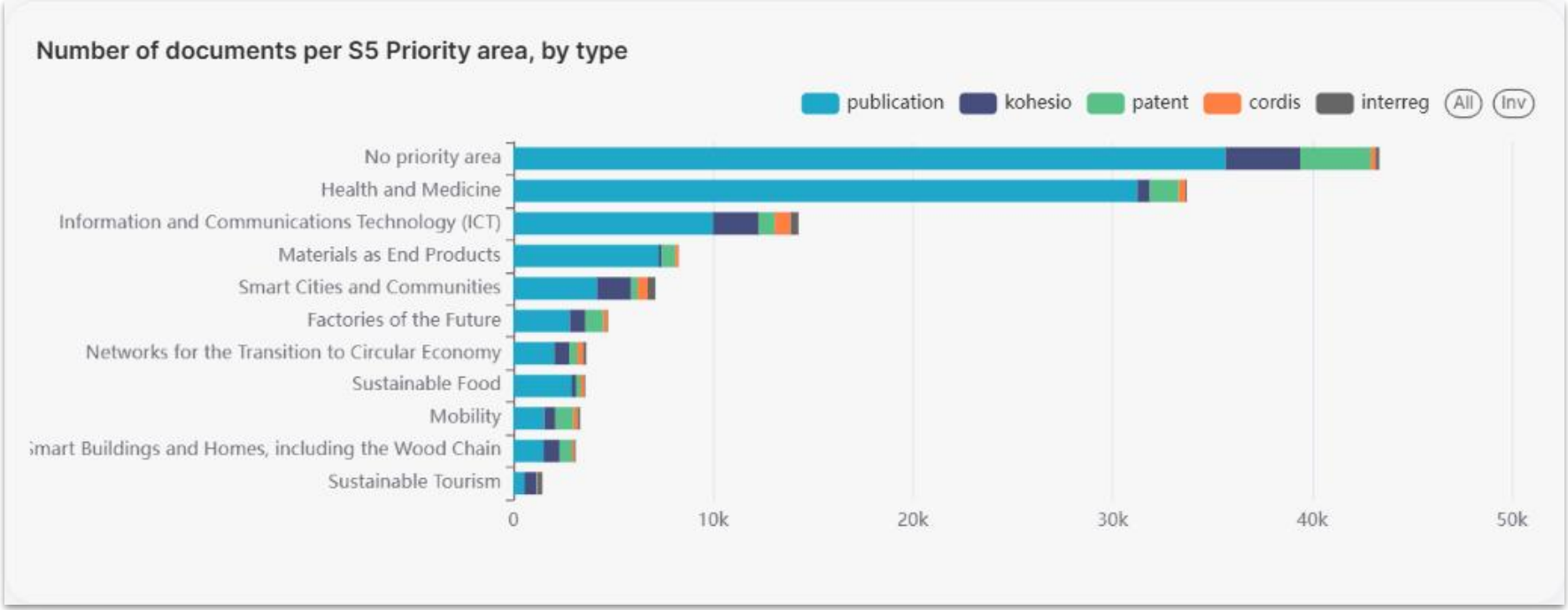
- Combining AI capabilities with **expert annotations** ensure accurate and scalable classification across diverse RDI documents.

Key contribution by six **thematic experts from the Cohesion Ministry's S3 Unit** for Calibration and Evaluation in January and February

Methodology breakdown



Top-down classification of Slovenian RDI documents in the S5 Priority Areas



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Identifying relevant RDI topics automatically via Topic Modeling: How does it work?

Topic Modelling (TM) is a **machine learning technique** that serves to **automatically "discover" the topics from a collection of texts** (in this case, titles and abstracts of scientific publications and R&I projects).

TM allows to go **beyond standard taxonomies** and to **group records from different sources in accordance with a common categorisation**, not defined a priori but specific of the corpus of documents.

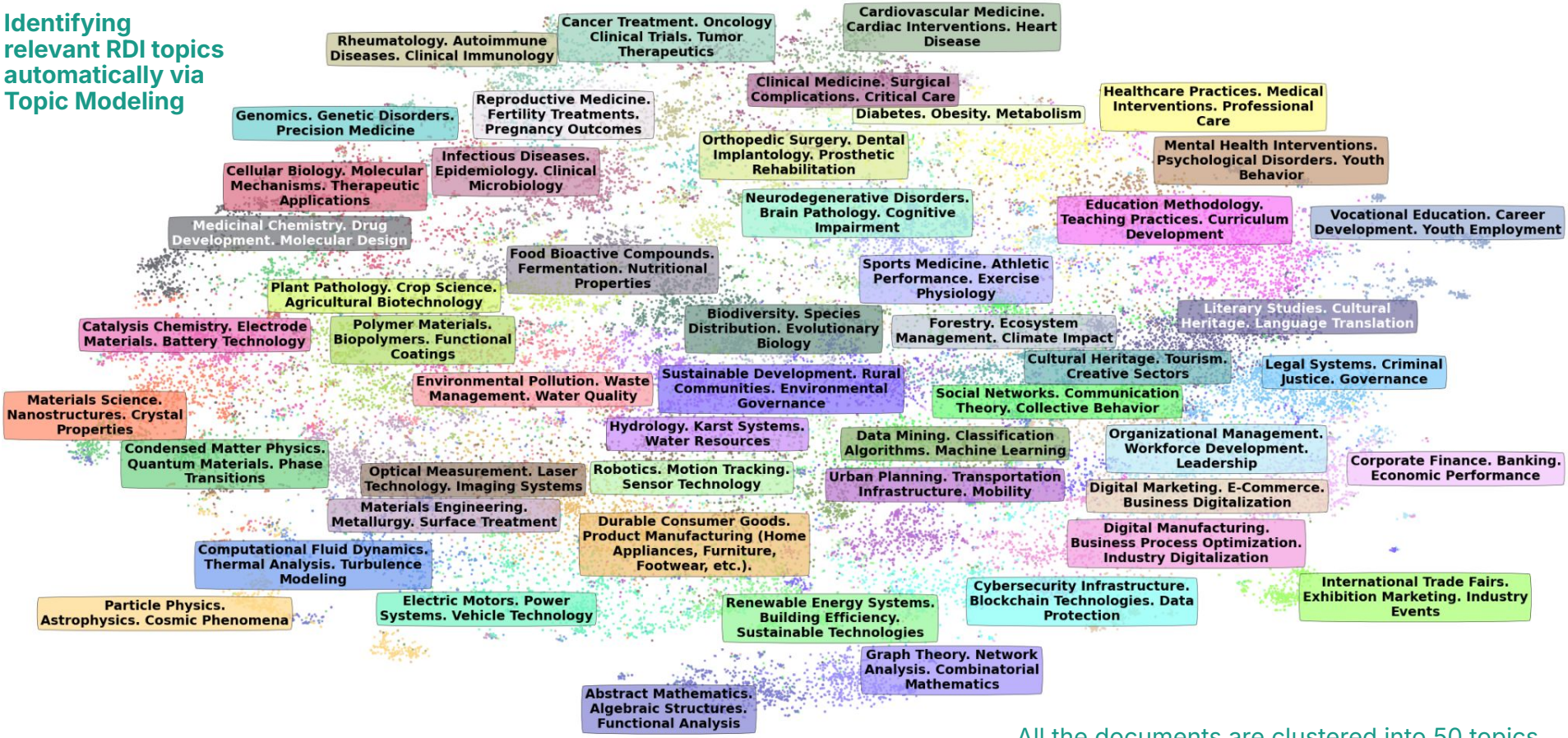
Semantically-similar texts, identified by deep learning models, **are clustered together, forming the topics**.

Advantages:

- **Custom taxonomy to a specific perimeter**
- **Find interdisciplinary topics**
- **Find new topics**
- **Mix data from different sources (e.g. publications + projects + patents)**

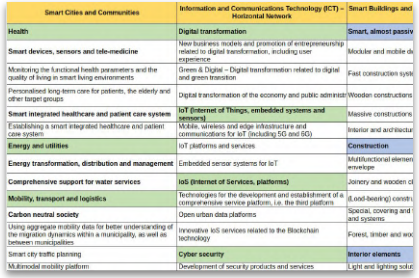
1. Objectives and summary of the methodology

Identifying relevant RDI topics automatically via Topic Modeling



All the documents are clustered into 50 topics, and the topics automatically labeled for human inspection

Period: 2014 - mid 2024



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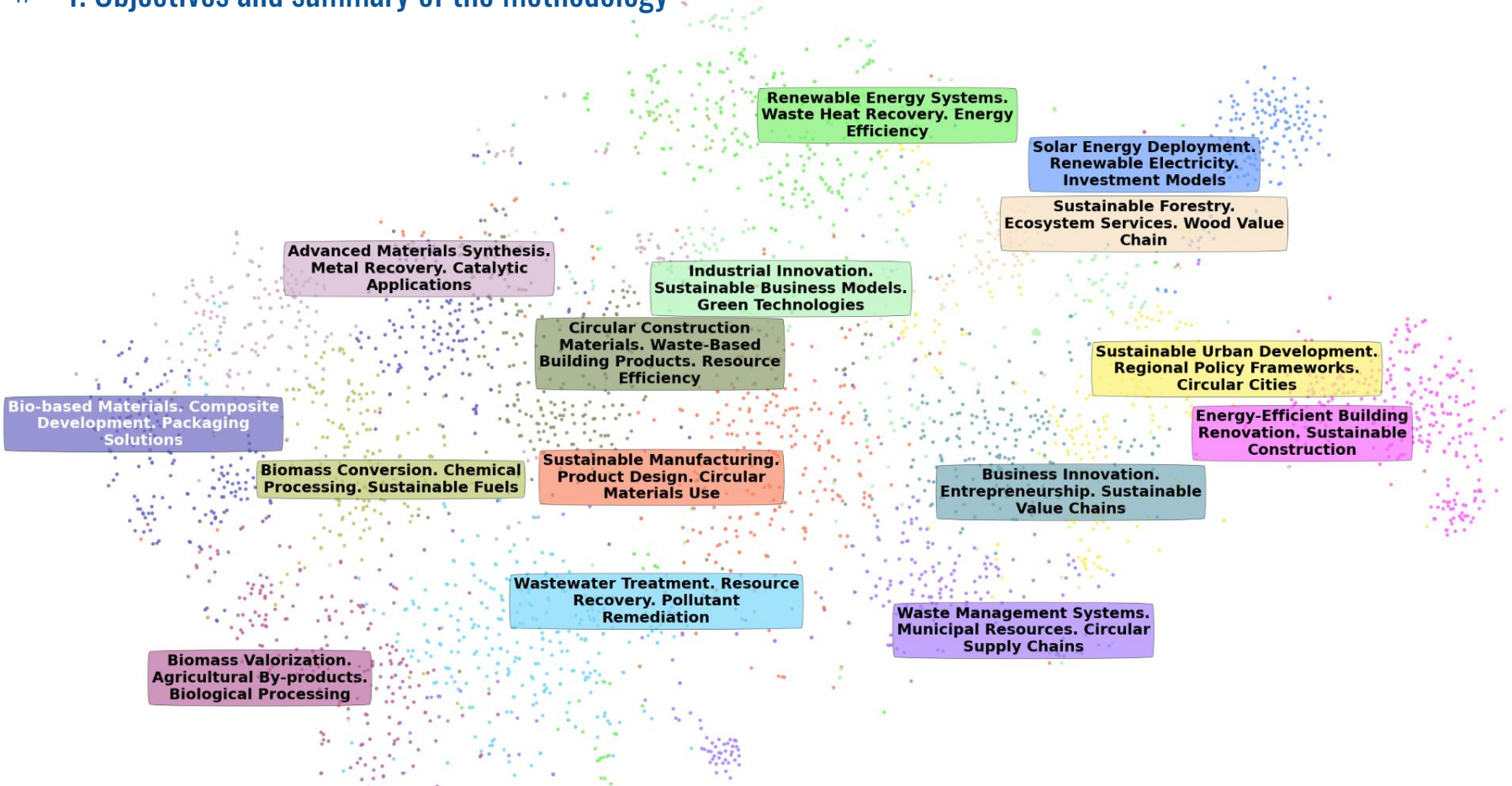
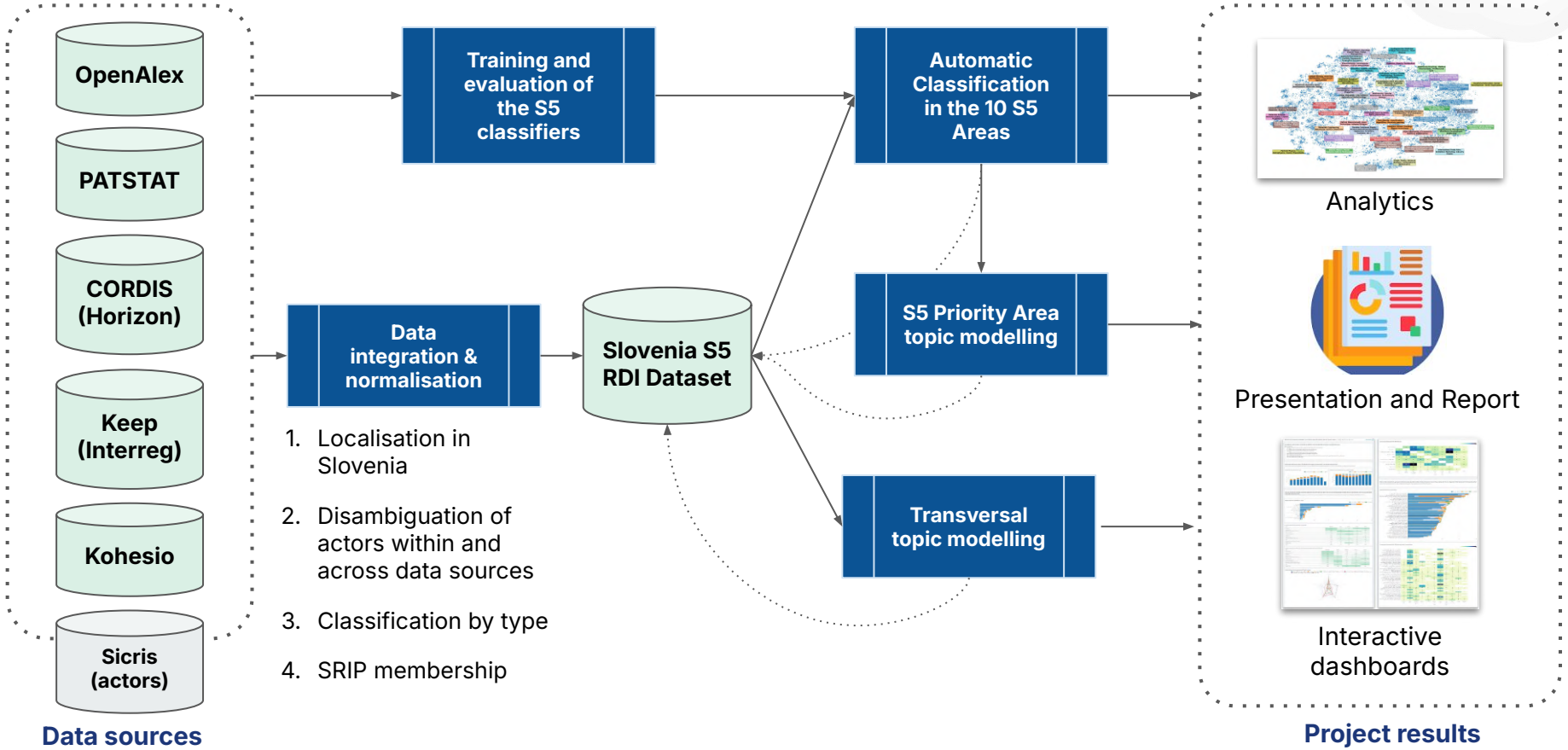


Identifying relevant RDI topics in “Networks for the Transition to Circular Economy”

1. Objectives and summary of the methodology

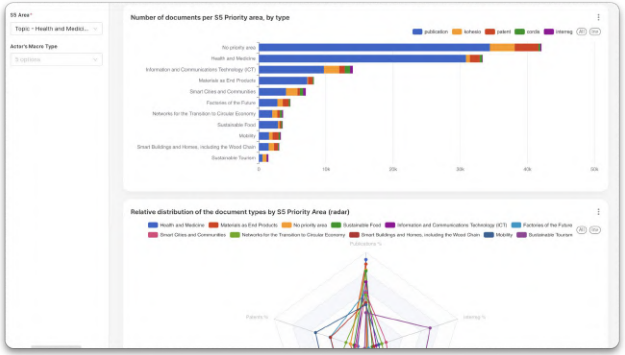
Summary scheme of the full methodology



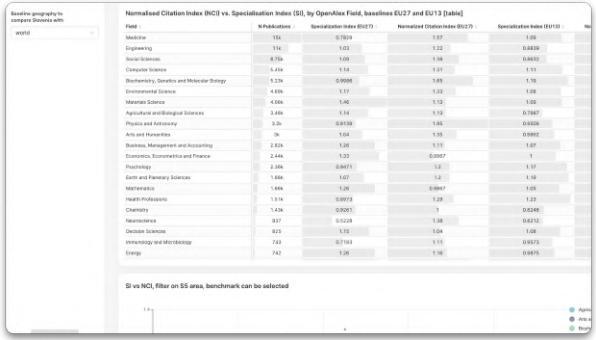
1. Objectives and summary of the methodology

1. Overview of the Slovenian RDI activities in the S5 Priority Areas, their evolution, and their thematic content

2. Focus on individual S5 Priority Areas

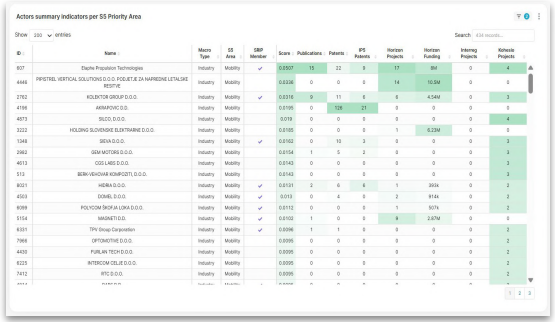


3. RDI International benchmarking in publications and patents, using the original classifications systems of their data sources



4. Indicators on Slovenian R&I actors in the S5 Priority Areas and the SRIPs

5. Indicators on Slovenian R&I actors in the transversal topics



1. Objectives and summary of the methodology

Identifying relevant industrial actors in “Smart Mobility”

Actors summary indicators per S5 Priority Area

Show 200 entries

Search 434 records...

ID	Name	Macro Type	S5 Area	SRIP Member	Score	Publications	Patents	IP5 Patents	Horizon Projects	Horizon Funding	Interreg Projects	Kohesio Projects
607	Elaphe Propulsion Technologies	Industry	Mobility	✔	0.0507	15	22	9	17	8M	0	4
4446	PIPISTREL VERTICAL SOLUTIONS D.O.O. PODJETJE ZA NAPREDNE LETALSKE RESITVE	Industry	Mobility		0.0336	0	0	0	14	10.5M	0	0
2762	KOLEKTOR GROUP D.O.O.	Industry	Mobility	✔	0.0316	9	11	6	6	4.54M	0	3
4196	AKRAPOVIC D.D.	Industry	Mobility		0.0195	0	126	21	0	0	0	0
4873	SILCO, D.O.O.	Industry	Mobility		0.019	0	0	0	0	0	0	4
3222	HOLDING SLOVENSKE ELEKTRARNE D.O.O.	Industry	Mobility		0.0185	0	0	0	1	6.23M	0	0
1348	SIEVA D.O.O.	Industry	Mobility	✔	0.0162	0	10	3	0	0	0	3
2982	GEM MOTORS D.O.O.	Industry	Mobility		0.0154	1	5	2	0	0	0	3
4613	CGS LABS D.O.O.	Industry	Mobility		0.0143	0	0	0	0	0	0	3
513	BERK-VEHOVAR KOMPOZITI, D.O.O.	Industry	Mobility		0.0143	0	0	0	0	0	0	3
8021	HIDRIA D.O.O.	Industry	Mobility	✔	0.0131	2	6	6	1	393k	0	2
4503	DOMEL D.O.O.	Industry	Mobility	✔	0.013	0	4	0	2	914k	0	2
6099	POLYCOM ŠKOFJA LOKA D.O.O.	Industry	Mobility	✔	0.0112	0	0	0	1	507k	0	2
5154	MAGNETI D.D.	Industry	Mobility	✔	0.0102	1	0	0	9	2.87M	0	0
6331	TPV Group Corporation	Industry	Mobility	✔	0.0096	1	1	0	0	0	0	2
7966	OPTOMOTIVE D.O.O.	Industry	Mobility		0.0095	0	0	0	0	0	0	2
4430	FURLAN TECH D.O.O.	Industry	Mobility		0.0095	0	0	0	0	0	0	2
6225	INTERCOM CELJE D.O.O.	Industry	Mobility		0.0095	0	0	0	0	0	0	2
7412	RTC D.O.O.	Industry	Mobility		0.0095	0	0	0	0	0	0	2

1 2 3

2. Analysis of Slovenian RDI activities and results in the S5 Smart Specialisation Priority Areas

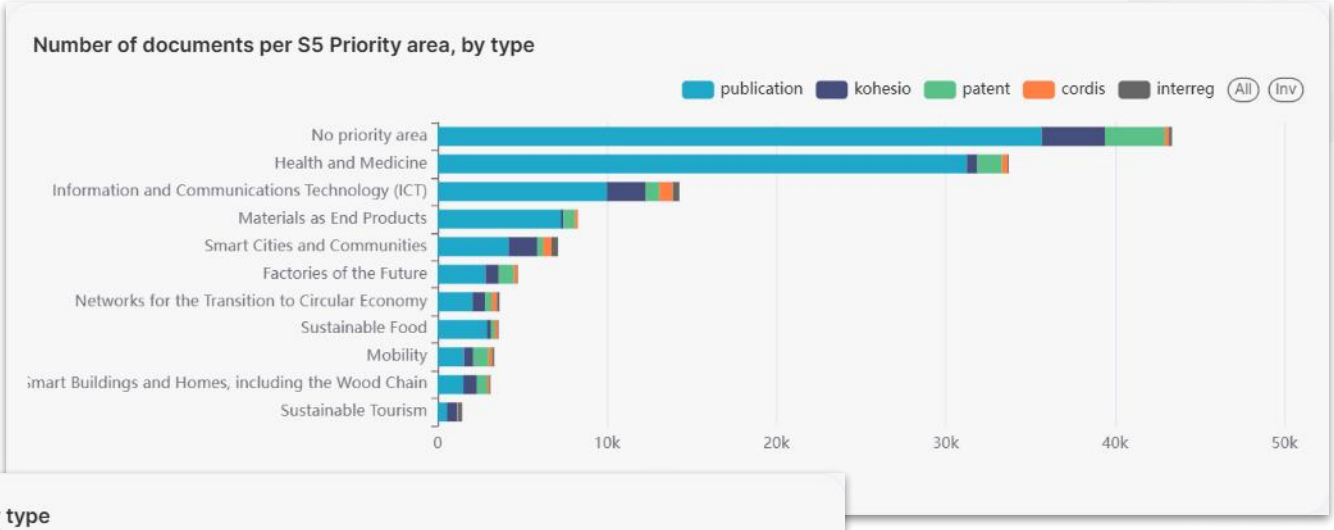
- **Understanding the distribution and evolution of the Slovenian RDI activities in the S5 Priority Areas**
- Comparing Slovenian RDI positioning in the S5 Areas with Europe and selected national benchmarks
- Understanding the overlap between S5 Priority Areas and the distribution of data sources per Area
- Identifying and comparing the RDI presence of research and industrial actors in the S5 Priority Areas
- Identifying relevant RDI topics across the Slovenian RDI ecosystem
- Identifying key Slovenian S&T specialisation areas in an international comparison
- RDI in the S5 Priority Areas: synthetic overview for future evolution

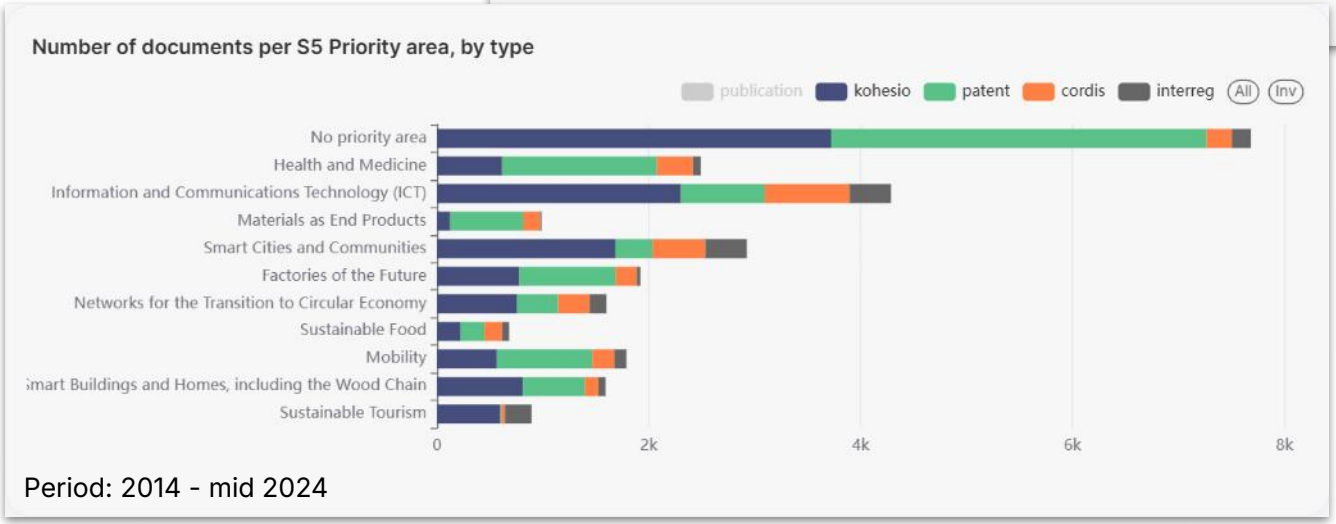
Understanding the distribution and evolution of the Slovenian RDI activities in the S5 PAs

Health and Medicine and **Materials as End Products** are strongly driven by scientific publications

Of the largest S5 Priority areas, **ICT** is the most balanced across the different data sources.

The rest of the S5 Priority areas, except for **Sustainable Tourism**, have similar sizes.





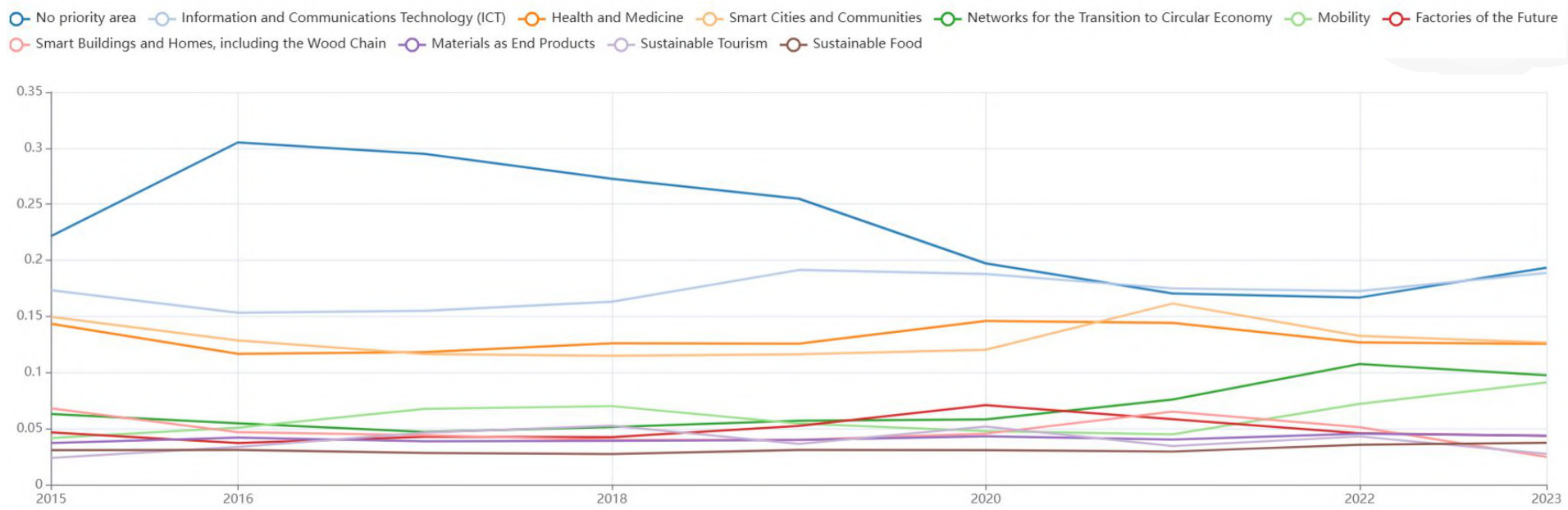
Period: 2014 - mid 2024

When excluding publications, all S5 priority area display an even higher degree of homogeneity, despite relatively lower levels of activity in priority areas Sustainable Food, Sustainable Tourism and Materials as End Products.

It is not easy to decide "where to cut", if a reduction of S5 Priority Areas is expected

Understanding the distribution and evolution of the Slovenian RDI activities in the S5 PAs

Temporal evolution of the concentration of RDI activities per S5 Priority Area (as % of the total, normalised by data source size)



- **No significant trends are identified,** except for
  - a decrease in activities pertaining to no priority area and
  - the **recent relative growth of Circular Economy and Mobility**

Key insights on the volume and trends of RDI activity

- All Priority Area display a significant volume of RDI activity, with a relative **homogeneous decrease in size** (with only Sustainable Tourism having a significantly smaller size), **and in trends.**

There is **no obvious Priority Area to cut** due to very low or decreasing RDI activity.

2. Analysis of Slovenian RDI activities and results in the S5 Smart Specialisation Priority Areas

- Understanding the distribution and evolution of the Slovenian RDI activities in the S5 Priority Areas
- **Comparing Slovenian RDI positioning in the S5 Areas with Europe and selected national benchmarks**
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Comparing Slovenian RDI positioning in the S5 Areas with Europe and benchmarks

To have a clearer view of the positioning of Slovenia inside the international context in terms of S5 areas, we need to perform a benchmarking against relevant countries.

- For **publications** and **patents**, the benchmark is against 4 comparable European countries in terms of size and vocation: Austria (AT, 🇦🇹), Croatia (HR, 🇭🇷), Czechia (CZ, 🇨🇿), and Estonia (EE, 🇪🇪).
- For **Horizon projects**, all the projects in Cordis (around 76k) have been classified, therefore the benchmark baseline is the whole programme.

The benchmarking indicator is the ***specialisation index (S.I.)***, which measures the extent to which the country's documents focus in certain fields compared to another region (here EU27 and EE, AT, HR, CZ, SI), useful to see the distinctive features of a country's specialisation profile.

Formally, it is here computed as:

$$\frac{\%\ \text{of total Slovenian publications in field X}}{\%\ \text{of total EU publications in field X}}$$

Comparing Slovenian RDI positioning in the S5 Areas with Europe and benchmarks

Overview table of benchmarks for publications, patents, and projects

S5 priority area	Publications S.I. (2020-2023) [baseline: EE, AT, HR, CZ, SI]	Patents S.I. (2019-2022) [baseline: EE, AT, HR, CZ, SI]	Horizon project S.I. (2020-2023) [baseline: Europe]	Horizon funding S.I. (2020-2023) [baseline: Europe]
Health and Medicine	1.02	1.44	0.67	0.74
ICT	0.97	0.82	1.64	0.94
Materials as End Products	1.18	0.73	1.20	1.07
Smart Cities and Communities	1.21	1.20	2.13	1.21
Sustainable Food	1.07	1.87	2.00	1.05
Factories of the Future	1.06	0.82	1.59	0.99
Circular Economy	1.30	1.44	2.22	1.51
Mobility	0.83	0.98	2.30	1.25
Smart Buildings and Homes, including the Wood Chain	1.61	1.76	3.31	3.49
Sustainable Tourism	1.63	1.29 (only 2 patents)	2.95	1.28
No priority area	0.98	0.98	0.57	0.87

Comparing Slovenian RDI positioning in the S5 Areas with Europe and benchmarks

S5 priority area	Publication S.I. (2020-2023) [baseline: EE, AT, HR, CZ, SI]	Patent S.I. (2019-2022) [baseline: EE, AT, HR, CZ, SI]	Horizon project S.I. (2020-2023) [baseline: Europe]	Horizon funding S.I. (2020-2023) [baseline: Europe]
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No priority area	0.98	0.98	0.57	0.87

First insights:

- Slovenia is very specialized in patents in *Health and Medicine*, which is the biggest S5 priority area;
- *Smart Buildings and Homes, including the Wood Chain* is the priority area with the most transversal specialisation (publications, patents, and projects);
- Overall, the S5 areas where it is more specialized are:
  - *Sustainable Food*;
  - *Networks for the Transition to Circular Economy*;
  - *Sustainable Tourism*.
- Slovenia is quite specialised in the priority areas, as its S.I.s in *No priority areas* are below 1

Period: 2014 - mid 2024, if not differently specified

2. Analysis of Slovenian RDI activities and results in the S5 Smart Specialisation Priority Areas

- Understanding the distribution and evolution of the Slovenian RDI activities in the S5 Priority Areas
- Comparing Slovenian RDI positioning in the S5 Areas with Europe and selected national benchmarks
- **Understanding the overlap between S5 Priority Areas and the distribution of data sources per Area**
- Identifying and comparing the RDI presence of research and industrial actors in the S5 Priority Areas
- Identifying relevant RDI topics across the Slovenian RDI ecosystem
- Identifying key Slovenian S&T specialisation areas in an international comparison
- RDI in the S5 Priority Areas: synthetic overview for future evolution

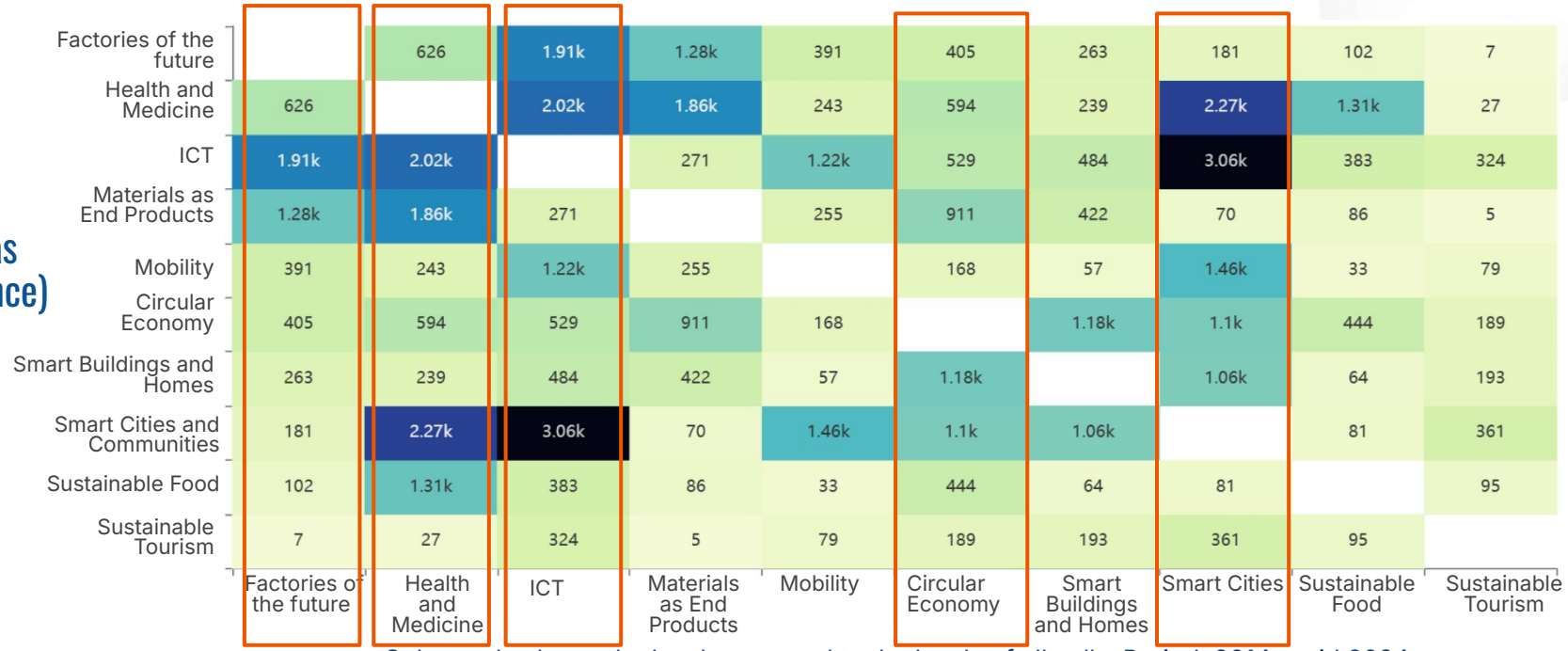
Context and relevance of understanding the overlaps between priority areas

- Understanding the existing overlaps between priority areas is a key element to consider when reviewing the structure of areas
  - It can help decide where merger of priority areas is relevant or not
  - It can help distinguish between highly transversal priority areas and vertical ones
- It is also a key element when designing policy tools that aim at addressing several areas at once, especially for infrastructure policy

Our analysis allows for such analysis by looking at the co-occurrence of classification of a document in several priority areas

Understanding the overlap between S5 Priority Areas and the distribution of data sources per Areas

Documents classified in multiple S5 Priority Areas (co-occurrence)

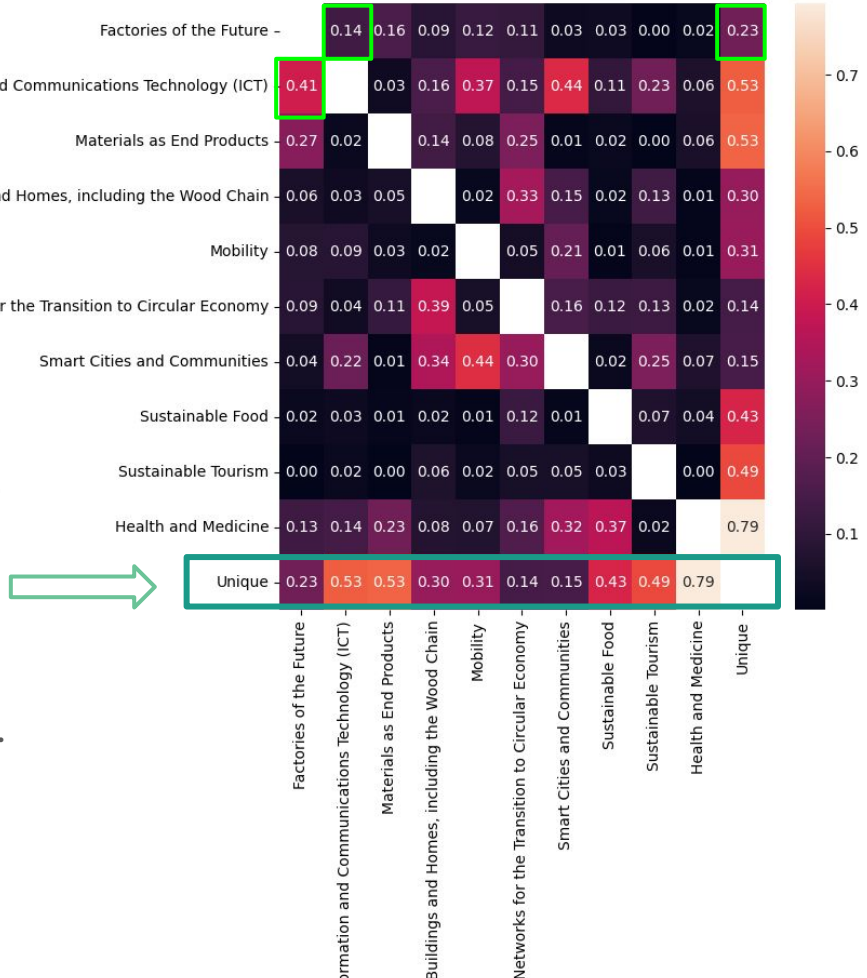


Color scale shows the level compared to the levels of all cells. Period: 2014 - mid 2024.

- **Some S5 Priority Areas are very transversal,** with significant output shared with several Priority Areas : this is the case of **Factories of the Future, Health and Medicine, ICT, Smart Cities and Circular Economy.**
- In contrast, other S5 Priority Areas have low levels of co-occurrence of their scientific output with other Priority Areas, except with the most transversal ones : this is the case of Sustainable Food, Sustainable Tourism, Materials as End Products, Smart Buildings and Homes, and Mobility

Understanding the overlap between S5 Priority Areas and the distribution of data sources per Areas

Documents classified in multiple S5 Priority Areas (Relative co-occurrence)



How to read this graph?

We are looking at documents which have more than one classification, that is, co-occurrence of S5 Priority Areas.

Documents that are only classified in one area can be found in the last row and column as "**Unique**"

41% of documents in FoF are also in ICT, while 14% of ICT documents are also in FoF.

23% of documents in FoF are not classified in any other Priority.

Period: 2014 - mid 2024

Understanding the overlap between S5 Priority Areas and the distribution of data sources per Areas

Factories of the Future presents a high relative overlap overall, notably with ICT (41%), Materials (27%) and Health (13%). Few documents are unique to FoF, **with a low share of unique documents (23%).**

Smart cities presents high contribution to many other areas (Mobility, Smart Buildings, Circular economy, Smart cities, Tourism, etc.), showing its transversality and diversity. **Only 15% of its documents are unique to this priority area.**

Circular economy presents high contribution to many other areas, notably Smart Buildings, showing its transversality. Only 14% of its documents are not classified in any other category, the lowest share.

ICT presents high contribution to many other areas (FoF, Mobility, Smart cities, Tourism, etc.) **while having still a distinctive core (53%)**. As such, it is both a transversal tool, and a distinct discipline/industry in terms of research and technology.

Health and Medicine, overlaps with many other Priorities (notably Smart cities, Food and Materials) also thanks to its large size. At the same time, it **presents the largest share of unique documents, showing its autonomy in most subtopics.**

Period: 2014 - mid 2024

Understanding the overlap between S5 Priority Areas and the distribution of data sources per Areas

Smart Buildings has a relatively strong core (30%), and overlaps mostly with the most transversal topics, notably with Circular Economy (39%), Smart Cities (34%) and ICT (16%).

Materials as End Products presents high contribution to three other areas (FoF, Smart Buildings, Circular economy) **while having still a distinctive core (53%)**

Mobility does not contribute much to the other areas in absolute terms, except for Smart Cities. Conversely, both ICT (37%) and Smart Cities (44%) have high overlap with it, and FoF to a lesser extent (12%)

Sustainable Food overlaps relatively little with the other areas, except for the large co-occurrence with Health and Medicine in nutrition, nutraceuticals and food safety.

Sustainable Tourism overlaps relatively little with the other areas, except for the large co-occurrence with ICT and Smart Buildings.

Period: 2014 - mid 2024

Understanding the overlap between S5 Priority Areas and the distribution of data sources per Areas

Key insight

Mainly transversal Priority-areas

3 of the S5 Priority Areas are very transversal.

They contribute to many other, without having a large unique activity on their own :

- **Factories of the Future**
- **Smart Cities**
- **Circular Economy**

Lower share of uniquely classified documents in the S5 Priority area, higher share of co-occurrence with other areas

"Unique-core" + Transversal Priority areas

3 of the S5 Priority Areas are highly transversal while also having a strong unique activity on their own :

- **Health - Medicine**
- **ICT**
- **Materials as End Products**

Higher share of uniquely classified documents in the S5 Priority area, higher share of co-occurrence with other areas

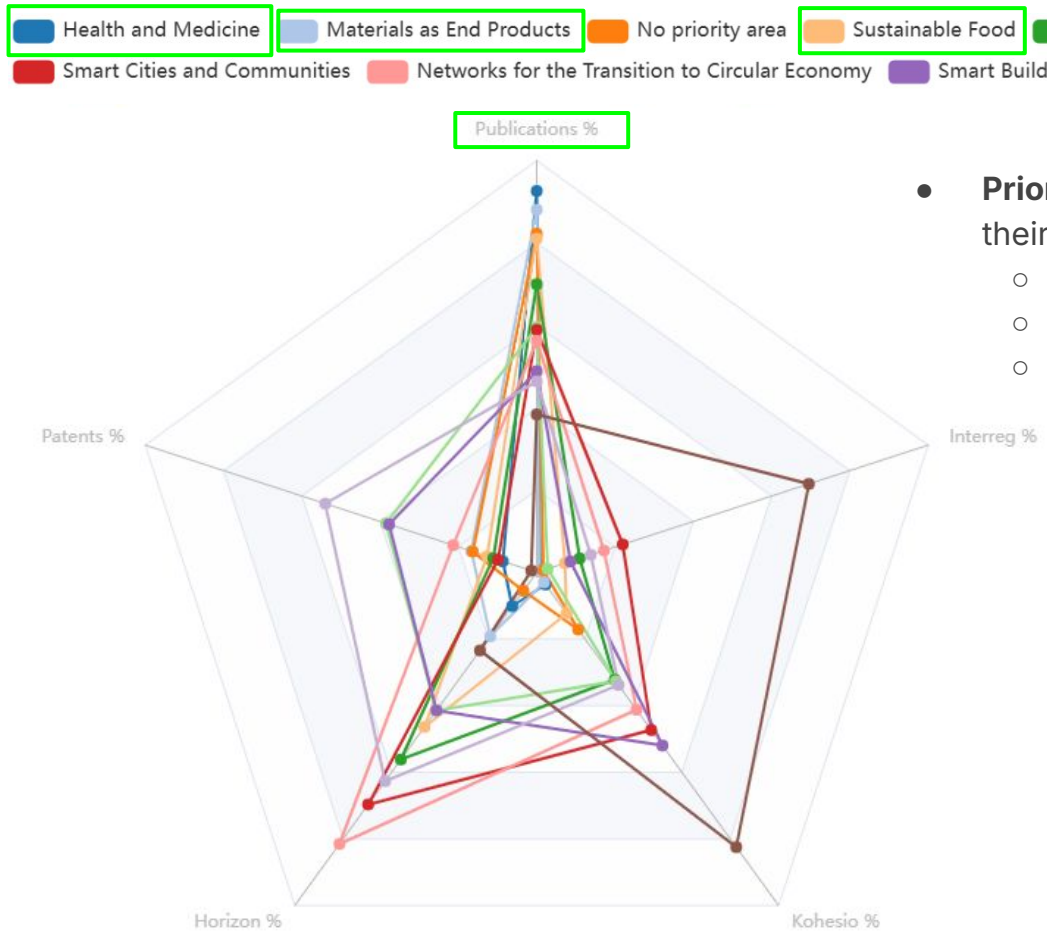
"Unique core" Priority-areas

The 4 remaining priority areas have a much more unique core :

- **Mobility**
- **Sustainable Food**
- **Sustainable Tourism**
- **Smart Buildings**

Higher share of uniquely classified documents in the S5 Priority area, higher share of co-occurrence with other areas

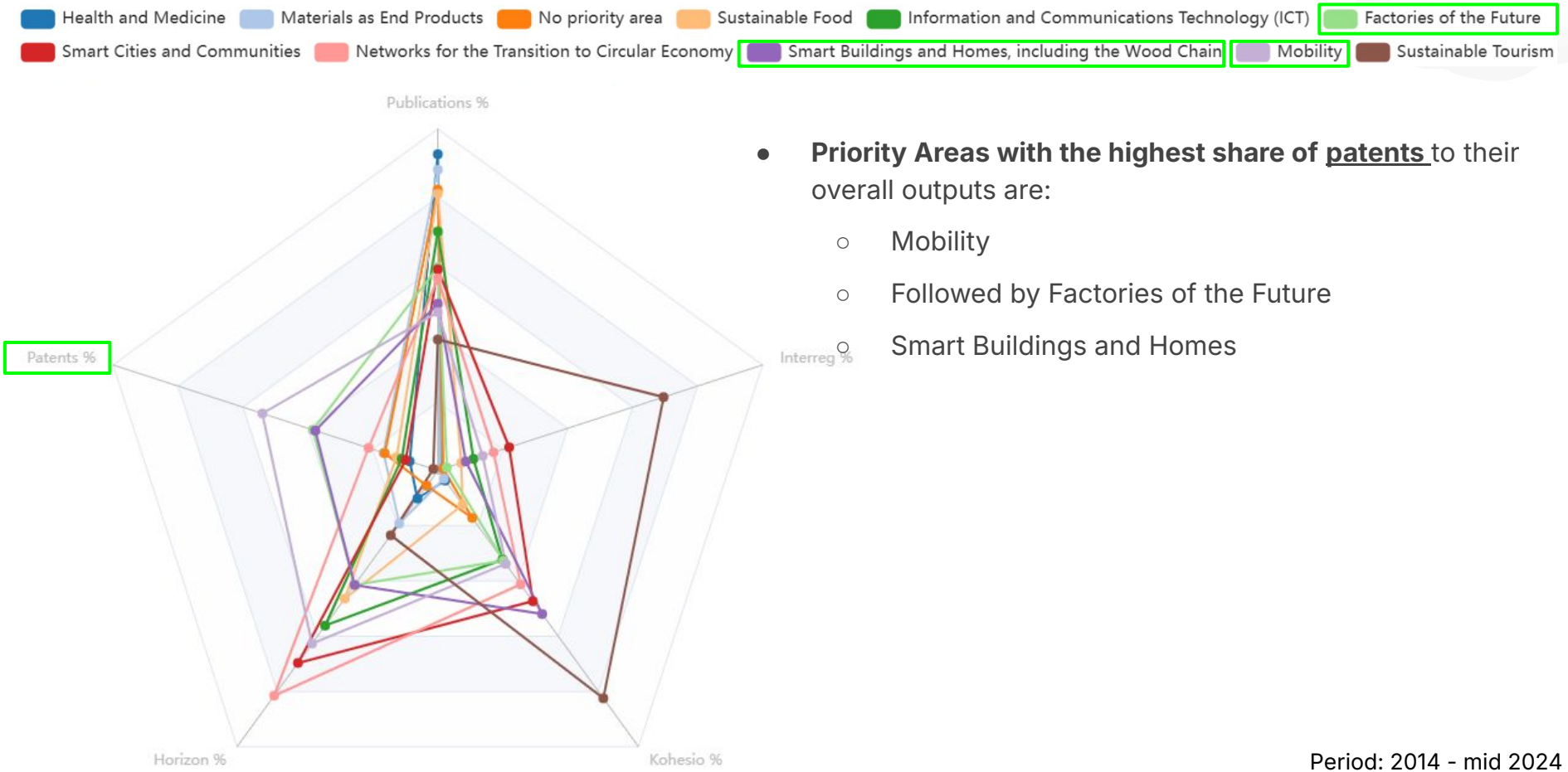
Understanding the overlap between S5 Priority Areas and the distribution of data sources per Areas



- **Priority Areas with the highest share of <u>publications</u>** to their overall output are:
  - Health and Medicine, followed by
  - Materials as End Products and
  - Sustainable Food.

Period: 2014 - mid 2024

Understanding the overlap between S5 Priority Areas and the distribution of data sources per Areas



- **Priority Areas with the highest share of <u>patents</u>** to their overall outputs are:
  - Mobility
  - Followed by Factories of the Future
  - Smart Buildings and Homes

Period: 2014 - mid 2024

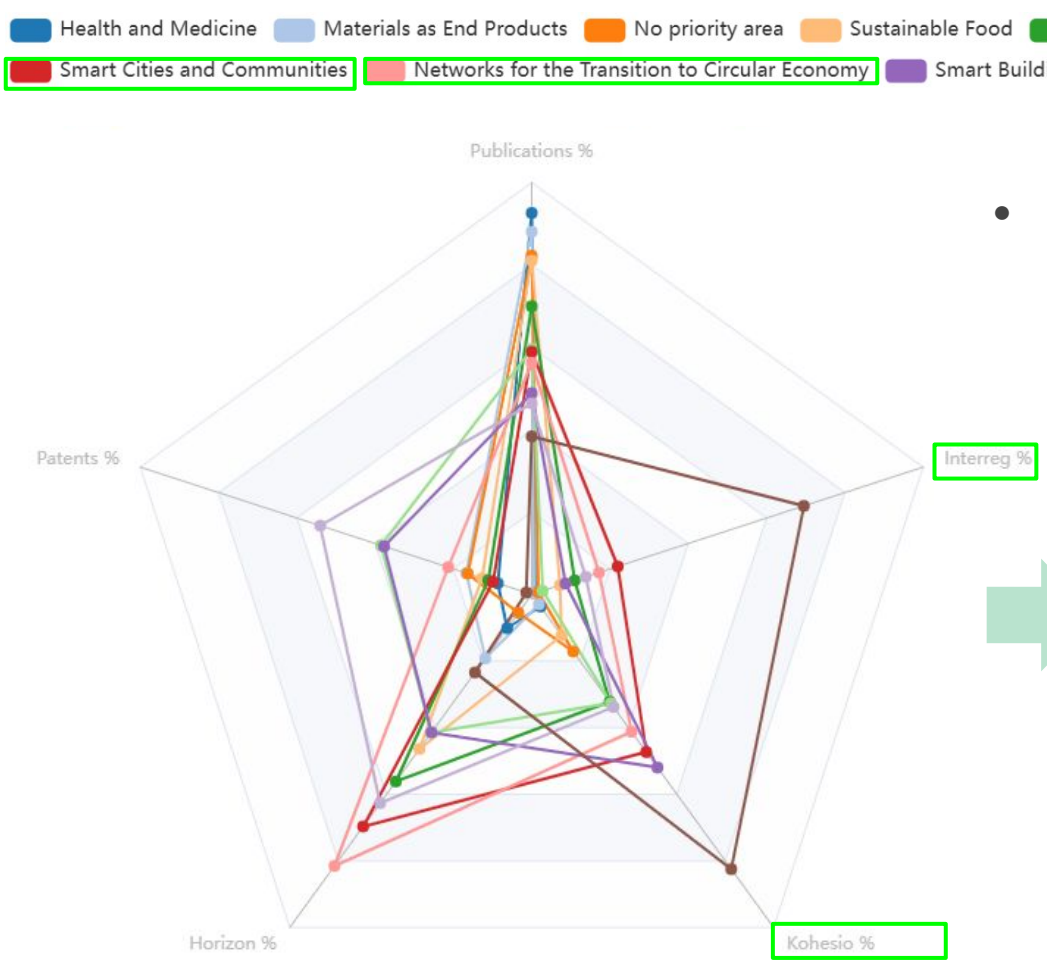
Understanding the overlap between S5 Priority Areas and the distribution of data sources per Areas

- **Priority Areas with the highest share of <u>Horizon projects</u>** to their overall output are
  - Networks for the Transition for the Circular Economy followed by
  - Smart Cities and Communities
  - Mobility
  - ICT
  - Food

Again, this is expected as these priority areas are more closely aligned with the priorities of Horizon 2020 and Horizon Europe (with societal challenges as smart transportation, food security, clean energy and climate action).

Period: 2014 - mid 2024

Understanding the overlap between S5 Priority Areas and the distribution of data sources per Areas



- **Priority Areas with the highest share of <u>Kohesio and Interreg projects</u>** to their overall output are
  - Sustainable Tourism (with a clearly higher share than any other S5 Priority Area)
  - Smart Cities and Communities and Networks for the Transition for the Circular Economy.

This is expected as these are closely aligned with the public-policy priorities of these programs (especially around competitiveness and digitalization of SMEs, transportation and sustainability).

Period: 2014 - mid 2024

Key insights on the nature of the activities of the Priority Areas

Priority Areas with a relatively important basis in publications

- Health and Medicine (also high in total volume)
- Materials as End Products (also high in total volume)
- Sustainable Food* (but with medium total volume)
- ICT* (also high in total volume)

Priority Areas with a relatively important basis in patents

- Mobility
- Factories of the Future
- Smart Buildings and Homes and

Priority Areas with a relatively important basis in Kohesio, Interreg and Horizon

- Sustainable Tourism (with a clearly higher share than any other S5 Priority Area)
- Smart Cities and Communities
- Networks for the Transition for the Circular Economy
- Sustainable Food* (only for Horizon)
- ICT* (only for Horizon)

Items marked with an asterisk appear twice

2. Analysis of Slovenian RDI activities and results in the the S5 Smart Specialisation Priority Areas

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Identifying and comparing the RDI presence of research and industrial actors in the S5 Priority Areas

Objective

To get a clear view of the different nature of the S5 Priority Areas, we need to understand the type of actors contributing to each Priority Area. We are mostly interested in distinguishing the participation of more classific research-focused actors (eg. universities) from businesses.

Approach

To do so, we classify each actor as :

- Academic, including hospital: this category corresponds to the classical research actors
- Industry
- Public and other : all public organisations, excluding research organisations and hospitals
- Unknown, for the remaining actors

Methodological note

The classification of actors is done by processing the SICRIS, CORDIS, Interreg classification into a macro-categories. This step was necessary as these various databases use heterogenous taxonomies.

For each Priority Area, we compare the contribution of each type of actor both to the other S5 Priority Areas and to the rest of the RDI output in Slovenia (“non priority” category), as well as the among and share of “collaborative” publications (co-affiliation) and patents (co-patent application)

Identifying and comparing the RDI presence of research and industrial actors in the S5 Priority Areas

Distribution of different organisations macro-types by S5 area, normalised by size of the data source

S5 Area	Academic and research actors, incl. Hospitals	Industry	Public and Others	Unknown
Health and Medicine	88.4	5.9	3.3	2.3
Materials as End Products	88.2	10.1	0.5	1.3
No priority area	87.8	7.5	2.3	2.5
Sustainable Food	84.8	9.5	3.4	2.2
Information and Communications Technology (ICT)	77.1	14.2	6.1	2.6
Networks for the Transition to Circular Economy	72.9	17.9	5.9	3.3
Factories of the Future	71.7	23.8	1.1	3.3
Smart Cities and Communities	67.9	16.5	11.7	3.9
Smart Buildings and Homes, including the Wood Chain	67.6	23.3	3.6	5.5
Sustainable Tourism	58.4	7.8	26.1	7.6
Mobility	58.1	30.6	6.1	5.3

- **Across all S5 areas, the weight of academic and research actors including hospitals is dominant.**
  - This reflects the dominance of these actors in RDi activities in general in Slovenia (88% of organisations in “no priority” are also academic and research stakeholders)
- **Participation of actors from the industry is highest in priority areas Mobility, Factories of the Future and Smart Buildings.** It is the lowest in Health.
- Participation of public actors in generally low, except in sustainable touris,m and smart cities and communities.

Identifying and comparing the RDI presence of research and industrial actors in the S5 Priority Areas

Key insights : Priority Areas classified depending on their relative coverage of each actor type, **top 4 for each category (from highest to lowest)**

Relatively higher: Academic, including hospital

- Materials as End Products
- Health and Medicine
- Sustainable Food
- ICT

Relatively higher: Industrial

- Mobility*
- Factories of the Future
- Smart Buildings*
- Network for the transition to a Circular Economy

Relatively higher: Public and others

- Sustainable Tourism
- Smart Buildings*
- Mobility*
- Smart Cities

Items marked with an asterisk appear twice

Identifying and comparing the RDI presence of research and industrial actors in the S5 Priority Areas

Number of co-publications between academic and industrial actors, and share of the total per Priority Area

S5 priority area	Academia-Industry collaborations	Total documents	Academia-Industry collaborations (%)
Factories of the Future	320	2,763	11.58%
Networks for the Transition to Circular Economy	180	1,998	9.01%
Mobility	125	1,482	8.43%
Smart Buildings and Homes, including the Wood Chain	120	1,456	8.24%
Materials as End Products	532	7,184	7.41%
Smart Cities and Communities	250	3,852	6.49%
Information and Communications Technology (ICT)	574	9,437	6.08%
Health and Medicine	1,411	30,069	4.69%
Sustainable Food	123	2,820	4.36%
No priority area	851	33,733	2.52%
Sustainable Tourism	12	518	2.32%

There is a relevant amount of Academia-Industry collaborations in scientific publications. Most collaborations concentrate in **Health - Medicine, ICT and Materials**, while **FoF, Circular Economy, Mobility and Smart Buildings** present high relative figures.

Identifying and comparing the RDI presence of research and industrial actors in the S5 Priority Areas

Number of co-patent applications between academic and industrial actors, and share of the total per Priority Area

S5 priority area	Academia-Industry collaborations	Total documents	Academia-Industry collaborations (%)
Materials as End Products	42	470	8.94%
Networks for the Transition to Circular Economy	8	247	3.24%
Sustainable Food	4	156	2.56%
Smart Cities and Communities	5	202	2.48%
Information and Communications Technology (ICT)	8	358	2.23%
Health and Medicine	18	940	1.91%
Smart Buildings and Homes, including the Wood Chain	7	381	1.84%
Factories of the Future	4	514	0.78%
No priority area	14	1,917	0.73%
Mobility	1	491	0.20%
Sustainable Tourism	0	4	0.00%

Collaborations in patenting are much scarcers, with Only Materials and Health - Medicine presenting some such collaborations. **Materials** is a positive outlier, with the **highest amount and the highest intensity**.

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Identifying relevant RDI topics across the Slovenian RDI ecosystem

Smart Cities and Communities	Information and Communications Technology (ICT) – Horizontal Network	Smart Buildings and
Health	Digital transformation	Smart, almost passiv
Smart devices, sensors and tele-medicine	New business models and promotion of entrepreneurship related to digital transformation, including user experience	Modular and mobile d
Monitoring the functional health parameters and the quality of living in smart living environments	Green & Digital – Digital transformation related to digital and green transition	Fast construction syst
Personalised long-term care for patients, the elderly and other target groups	Digital transformation of the economy and public administ	Wooden constructions
Smart integrated healthcare and patient care system	IoT (Internet of Things, embedded systems and sensors)	Massive constructions
Establishing a smart integrated healthcare and patient care system	Mobile, wireless and edge infrastructure and communications for IoT (including 5G and 6G)	Interior and architectur
Energy and utilities	IoT platforms and services	Construction
Energy transformation, distribution and management	Embedded sensor systems for IoT	Multifunctional elemen envelope
Comprehensive support for water services	IoS (Internet of Services, platforms)	Joinery and wooden c
Mobility, transport and logistics	Technologies for the development and establishment of a comprehensive service platform, i.e. the third platform	(Load-bearing) constru
Carbon neutral society	Open urban data platforms	Special, covering and and systems
Using aggregate mobility data for better understanding of the migration dynamics within a municipality, as well as between municipalities	Innovative IoS services related to the Blockchain technology	Forest, timber and wo
Smart city traffic planning	Cyber security	Interior elements
Multimodal mobility platform	Development of security products and services	Light and lighting solut

"the baseline table"
(S5 Priloga Tabela)

Target analytical taxonomy

S5 - 1st level

Slovenian S5 **Priority Areas**

Smart Cities and Communities ... Factories of the Future

Classification method: **Top-down classifiers for the 10 S5 PAs**

S5 - 2nd level

Automatically identified topics

Smart Cities and Communities - **Topic 1**
Smart Cities and Communities - **Topic 2**
...
(10-20 topics per Priority area)

Factories of the Future - **Topic 1**
Factories of the Future - **Topic 2**
...
(10-20 topics per Priority area)

Classification method: **Automatic identification of topics within a S5 PA, via topic modelling**

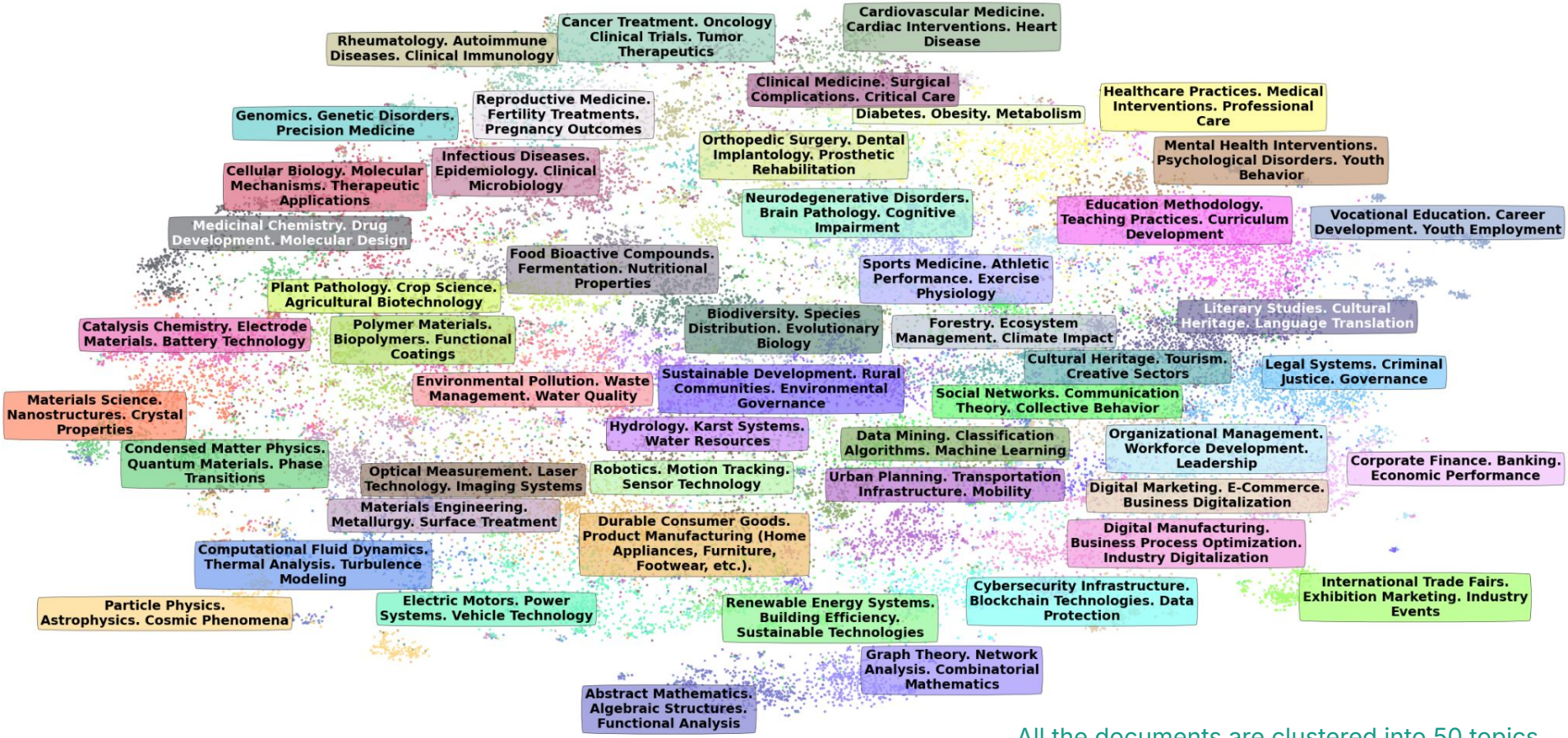
Tranversal level

Transversal identified topics

Transversal topic 1
Transversal topic 2
...
(50 topics)

Classification method: **Automatic identification of topics via topic modelling**
Added-value: **Bottom-up identification of topics**, independent from the Slovenian S5

Identifying relevant RDI topics across the Slovenian RDI ecosystem



All the documents are clustered into 50 topics,
and the topics automatically labeled for human inspection

Period: 2014 - mid 2024

Identifying relevant RDI topics across the Slovenian RDI ecosystem

- **Many of the topics that emerged are clearly aligned with the Current Priority Areas**
  - Eg. Urban Planning, Transportation, Infrastructure, Mobility and Social Networks, Communities, Communication clearly fit into the current Smart Cities and Communities
  - Or Cybersecurity Infrastructure, Blockchain Technologies, Data Protection and Data Mining, Classification Algorithms, Machine Learning fit into the current Priority Area ICT
  - There are emerging topics linked to all Priority Areas, with a particularly high representation to topics linked to Health, Materials and ICT.
- **A couple of topics that emerged do not fit well into the current S5 Priority Areas.** In many cases, this is probably because of projects in all pillars of Kohesio have been considered, even when not relating to R&D.
  - This is the case for emerging topics around education and career such as "Education Methodology, Teaching Practices, Curriculum Development" and competitiveness such as "Corporate Finance, Banking, Economic Performance"
- **Highly theoretical domains are better represented in the transversal Topic Modelling** compared to S5 areas, a logical result as Smart Specialisation aims at bridging research into innovation
- **We do not identify any key relevant topic from this transversal Topic Modelling that is not covered in the current S5 structure**

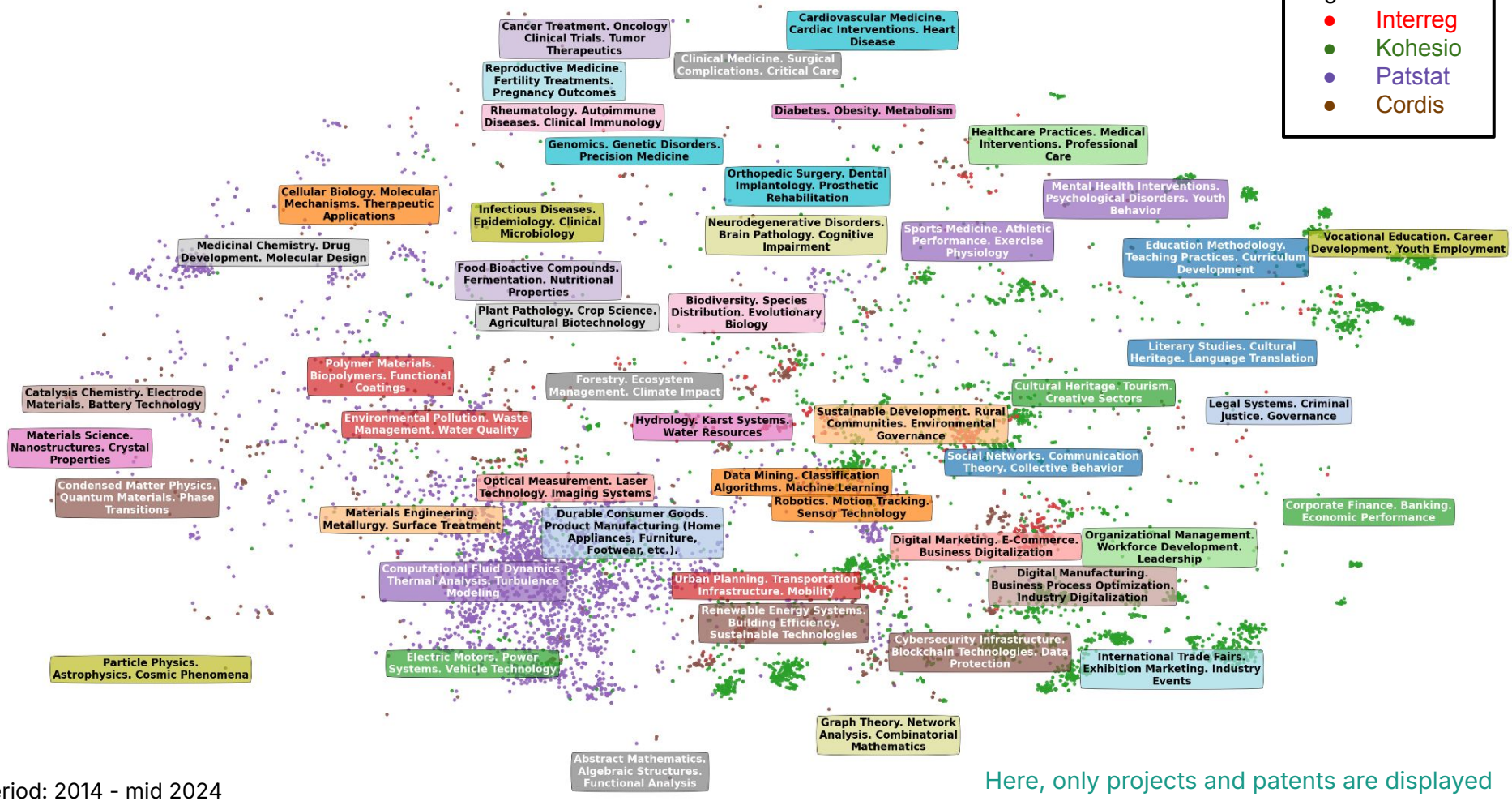
Period: 2014 - mid 2024

Topics emerging from Topic modelling

Cluster 5 - Agrifood + Forestry + Earth sciences + Environmental industries

Topic Labels
Forestry. Ecosystem Management. Climate Impact
Plant Pathology. Crop Science. Agricultural Biotechnology
Biodiversity. Species Distribution. Evolutionary Biology
Environmental Pollution. Waste Management. Water Quality
Food Bioactive Compounds. Fermentation. Nutritional Properties
Hydrology. Karst Systems. Water Resources

Identifying relevant RDI topics across the Slovenian RDI ecosystem



Period: 2014 - mid 2024

Here, only projects and patents are displayed

Identifying relevant RDI topics across the Slovenian RDI ecosystem

Key insights

- Considering the topics emerging from the bottom-up Topic Modelling, we can conclude that
  - all Priority Area are indeed backed by relevant activities emerging as automatically-extracted topics
  - no significant topic is missing in the current Priority Areas
  - Policy oriented, Social science and humanities and more basic research can be also identified, outside of the S5 Priority Areas

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Thematic specialisation in publications

Definitions of indicators for the benchmarking

- **Normalized specialisation Index** : compares the level of citation of articles to the expected level of citation in that field and year, useful to get a contextualised view of the impact of an article, and when aggregated of a country in the field.

  Formally, it is here computed as:

$$\frac{\text{Number of time the publication is cited}}{\text{Expected citation rate (same document type ef. publication, year of publication and subject area)}}$$

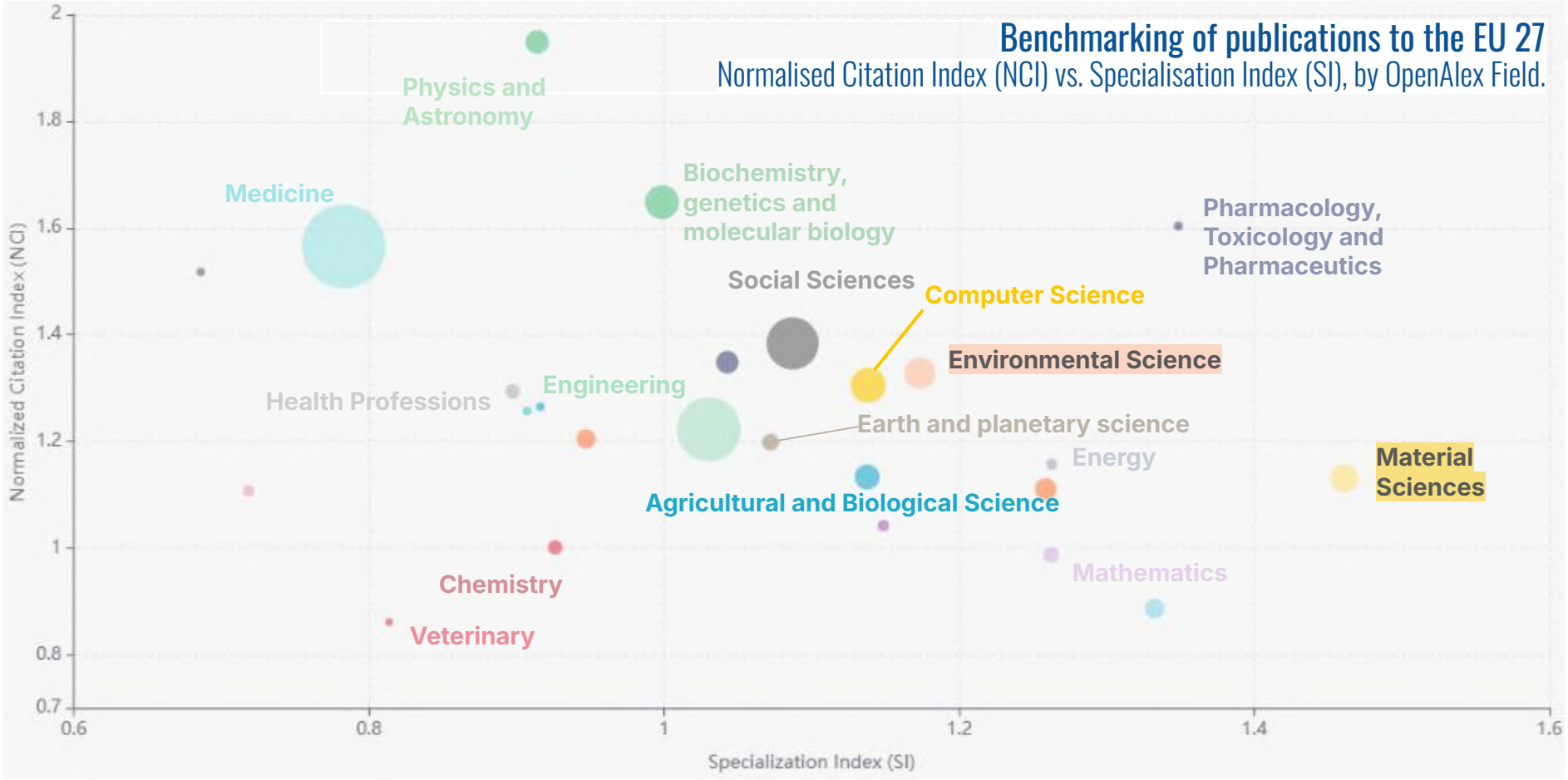
- **Specialisation Index (SI) :** measures the extent to which the country's publications focus in certain fields compared to another region (here EU27 and EU13), useful to see the distinctive features of a country's scientific profile.

  Formally, it is here computed as:

$$\frac{\text{\% of total Slovenian publications in field X}}{\text{\% of total EU publications in field X}}$$

- **Baseline regions :** we use here 2 areas of comparison, the EU 27 and the EU13 (countries that joined the EU after 2004).

Identifying key Slovenian S&T specialisation areas in an international comparison



Identifying key Slovenian S&T specialisation areas in an international comparison
Benchmarking of publications to EU 13

Key difference in the findings when contrasting Slovenia with the EU13 versus the EU27.

- The overall **impact of publications in all fields is higher in Slovenia** (normalized citation index >1 in all fields) compared to EU13
- There are again areas of specialisation of Slovenia compared to these countries, but the levels of specialization are not as strong as compared to EU27
    - This is an expected result : EU 27 countries include bigger countries with a larger critical mass in RDI, leading a much more diverse scientific output than EU13
- EU27 countries include countries which also have a much more developed field of medicine than EU 13 :

    → medicine is therefore a field of under specialisation of Slovenia when compared to the UE 27, but of specialisation when compared to the EU13

Key insights of the EU13 benchmark

- Key fields of strength and specialisation are confirmed : **material science, pharmacology, environmental science, computer science**
- **Biochemistry and medicine**, when compared to EU13, are now not only fields of high impact but also of specialisation

To get a more precise picture of the difference between the EU13 and EU 27 benchmark and the different data points, we can look at the same data in a table format

Identifying key Slovenian S&T specialisation areas in an international comparison

Benchmarking of patents to the EU 27 and EU 13

Specialisation Index (SI), by IPC level 3 classes : top 20 by volume

Title	Slovenia	EU27 Applications	EU13 Applications	SI (vs EU27)	SI (vs EU13)
(A61) MEDICAL OR VETERINARY SCIENCE; HYGIENE	921	435k	23.6k	1.21	1.2
(A47) FURNITURE; DOMESTIC ARTICLES OR APPLIANCES; COFFEE MILLS; SPICE MILLS; SUCTION CLEANERS IN GENERAL	750	76.9k	4.54k	5.59	5.07
(H01) ELECTRIC ELEMENTS	568	223k	7.92k	1.46	2.2
(H02) GENERATION, CONVERSION, OR DISTRIBUTION OF ELECTRIC POWER	497	120k	6.45k	2.38	2.36
(G01) MEASURING; TESTING	450	269k	14.1k	0.96	0.98
(F16) ENGINEERING ELEMENTS OR UNITS; GENERAL MEASURES FOR PRODUCING AND MAINTAINING EFFECTIVE FUNCTIONING OF MACHINES OR INSTALLATIONS; THERMAL INSULATION IN GENERAL	439	179k	7.9k	1.41	1.71
(C07) ORGANIC CHEMISTRY	413	167k	10k	1.42	1.26
(G06) COMPUTING; CALCULATING OR COUNTING	351	235k	14.8k	0.86	0.73
(H04) ELECTRIC COMMUNICATION TECHNIQUE	349	257k	11.9k	0.78	0.9
(C12) BIOCHEMISTRY; BEER; SPIRITS; WINE; VINEGAR; MICROBIOLOGY; ENZYMOLOGY; MUTATION OR GENETIC ENGINEERING	334	93.1k	5.61k	2.06	1.83
(A01) AGRICULTURE; FORESTRY; ANIMAL HUSBANDRY; HUNTING; TRAPPING; FISHING	293	93.7k	5.97k	1.79	1.51
(B01) PHYSICAL OR CHEMICAL PROCESSES OR APPARATUS IN GENERAL	288	95.7k	5.54k	1.72	1.6
(A63) SPORTS; GAMES; AMUSEMENTS	281	22.3k	2.68k	7.23	3.21
(B60) VEHICLES IN GENERAL	242	244k	9.33k	0.57	0.8
(E05) LOCKS; KEYS; WINDOW OR DOOR FITTINGS; SAFES	210	34.2k	1.97k	3.52	3.27
(B66) HOISTING; LIFTING; HAULING	192	24.6k	1.09k	4.47	5.42
(F24) HEATING; RANGES; VENTILATING	175	40.2k	3.69k	2.5	1.46
(H05) ELECTRIC TECHNIQUES NOT OTHERWISE PROVIDED FOR	150	59.2k	2.56k	1.45	1.79
(B65) CONVEYING; PACKING; STORING; HANDLING THIN OR FILAMENTARY MATERIAL	148	118k	5.73k	0.72	0.79
(E04) BUILDING	143	57.6k	6.13k	1.42	0.72

High specialisation in both benchmarks and significant critical mass

Identifying key Slovenian S&T specialisation areas in an international comparison

Benchmarking of patents to the EU 27 and EU 13

Specialisation Index (SI), by IPC level 2 classes :

- Among the areas with the highest volume, highest specialisation to EU27 and EU13 is found in :
  - Lighting and heating ; Separating and mixing ; Personal or domestic articles ; Textiles.
  - Building
  - Agriculture

Specialisation Index (SI), by IPC level 2 classes :

- Among the areas with the highest volume, highest specialisation to EU27 and EU13 is found in :
  - Medical or veterinary science ; organic chemistry ; physician or chemical processes.
  - Furniture and domestic appliances ; sport and games ; hoisting and lifting ; locks and keys.
  - Electric elements ; generation of electric power ; electric techniques.
  - Biochemistry, beer, spirits and microbiology ; agriculture and forestry.

These are very applied categories much closer to the activity of industries.

Formally linking directly patent categories to scientific fields of publications is very complex, and would involved further study.

However, some connections can be made between these results and previous analysis of publication strengths

Science and Technology strengths of Slovenia

A summary

Identifying key Slovenian S&T specialisation areas in an international comparison

Publications	Patents	Summary
○ Material Science ✚ ○ ○ Computer Science ✚ ▲ ○ Mathematics ○	And relevant strength in patents e.g. furniture and appliances ; hoisting and lifting ; textiles.	Key S&T strengths in **advanced materials and manufacturing** and **formal sciences**
○ Pharmacology ▲ ○ ○ Medicine ✚ ▲ ○ Biochemistry and genetics ✚ ▲	And relevant strength in patents e.g. medical science ; physician or chemical processes.	Key S&T strengths in **biomedical research**
○ Environmental Science ✚ ▲ ○ Agricultural and Biological Sciences ✚ ○ Energy ○ ○ Computer Science ✚ ▲	And relevant strength in patents e.g. agriculture, preserving food and disposal of waste.	Key S&T in **green tech, sustainability and environmental science**

Legend

✚ High critical mass (>3 000 publications between 2014 and 2024) ▲ High impact (>1.2 to EU27) ○ Highly specialised (>1.2 to EU27)

2. Analysis of Slovenian RDI activities and results in the S5 Smart Specialisation Priority Areas

- Understanding the distribution and evolution of the Slovenian RDI activities in the S5 Priority Areas
- Comparing Slovenian RDI positioning in the S5 Areas with Europe and selected national benchmarks
- Understanding the overlap between S5 Priority Areas and the distribution of data sources per Area
- Identifying and comparing the RDI presence of research and industrial actors in the S5 Priority Areas
- Identifying relevant RDI topics across the Slovenian RDI ecosystem
- Identifying key Slovenian S&T specialisation areas in an international comparison
- **RDI in the S5 Priority Areas: synthetic overview for future evolution**

RDI in the S5 Priority Areas: synthetic overview for future evolution

To provide a synthetic view of the different indicators, a **Summary table of key indicators per S5 Priority Area has been built**, considering absolute and relative indicators indicators on:

- the **critical mass** of the S5 Priority Area compared to other Priority Areas in publications, patents, Horizon Cohesion, and Interreg Projects
- **relative specialisation index** comparing the share of output in the Priority Area to the share of output in the priority area in the benchmarked countries (Czechia, Austria, Estonia and Croatia) or to EU in the case of
- **temporal evolution: relative growth** against the whole Slovenian RDI activities and results, excluding Cohesion Projects as they are only available until 2020
- the **presence of industrial actors**: looking at the normalised participation of businesses to the overall output
- the **collaboration between academic-scientific actors and industry** (in publications and patents), both in absolute and relative terms

RDI in the S5 Priority Areas: synthetic overview for future evolution

Priority areas	Critical mass of the S5 Priority Area in Slovenia				
	1.1 Top 4 by number publications	1.2 Top 4 by number of patents	1.3 Top 4 by number of Kohesio projects	1.4 Top 4 by number of Horizon projects	1.5 Top 4 by number of Interreg projects
Factories of the Future	☐	☑	☑	☐	☐
Health and Medicine	☑	☑	☐	☑	☐
Information and Communications Technology	☑	☑	☑	☑	☑
Materials as End Products	☑	☐	☐	☐	☐
Mobility	☐	☑	☐	☐	☐
Networks for the Transition to Circular Economy	☐	☐	☐	☑	☑
Smart Buildings and Homes, including the Wood Chain	☐	☐	☑	☐	☐
Smart Cities and Communities	☑	☐	☑	☑	☑
Sustainable Food	☐	☐	☐	☐	☐
Sustainable Tourism	☐	☐	☐	☐	☑

RDI in the S5 Priority Areas: synthetic overview for future evolution

	Relative specialisations against benchmark countries and geographic baselines			Temporal evolution	
Priority areas	**2.1 Average > 1.5 of the SI by Number of Horizon projects and SI of Horizon funding**	**2.3 Top 2 by SI of publications in benchmark against 4 benchmark countries**	**2.4 Top 2 by SI of patents in benchmark against 4 benchmark countries**	**3.1 Has the priority area relatively grown?**	**3.2 Top 4 by growth?**
Factories of the Future	☐	☑	☐	☑	☐
Health and Medicine	☐	☐	☐	☑	☐
Information and Communications Technology	☐	☐	☐	☑	☑
Materials as End Products	☐	☑	☐	☑	☐
Mobility	☑	☐	☐	☑	☐
Networks for the Transition to Circular Economy	☑	☑	☑	☑	☑
Smart Buildings and Homes, including the Wood Chain	☑	☑	☑	☐	☐
Smart Cities and Communities	☑	☑	☐	☑	☑
Sustainable Food	☑	☐	☑	☑	☑
Sustainable Tourism	☑	☑	☐	☑	☐

RDI in the S5 Priority Areas: synthetic overview for future evolution

	Presence of industrial actors	Science-industry collaboration			
Priority areas	**4. Top 4 by activity of industrial actors?**	**5.1 Top 4 by number of co-publications between science and industry**	**5.2 Top 4 by intensity of co-publications between science and industry**	**5.3 Top by number of co-patents between science and industry** (above 10 co-patents)	**5.4 Top by intensity of co-patents between science and industry** (above 5%)
Factories of the Future	☑	☑	☑	☐	☐
Health and Medicine	☐	☑	☐	☑	☐
Information and Communications Technology	☐	☑	☐	☐	☐
Materials as End Products	☐	☑	☐	☑	☑
Mobility	☑	☐	☑	☐	☐
Networks for the Transition to Circular Economy	☑	☐	☑	☐	☐
Smart Buildings and Homes, including the Wood Chain	☑	☐	☑	☐	☐
Smart Cities and Communities	☐	☐	☐	☐	☐
Sustainable Food	☐	☐	☐	☐	☐
Sustainable Tourism	☐	☐	☐	☐	☐

RDI in the S5 Priority Areas: synthetic overview for future evolution

	Critical mass of the S5 Priority Area in Slovenia	Relative specialisations against benchmark countries and geographic baselines	Temporal evolution	Presence of industrial actors	Science-industry collaboration	
Priority areas	**Subtotal**	**Subtotal**	**Subtotal**	**Subtotal**	**Subtotal**	**TOTAL**
Factories of the Future	2	1	1	1	2	7
Health and Medicine	3	0	1	0	2	6
Information and Communications Technology (ICT)	5	0	2	0	1	8
Materials as End Products	1	1	1	0	3	6
Mobility	1	1	1	1	1	5
Networks for the Transition to Circular Economy	2	3	2	1	1	9
Smart Buildings and Homes, including the Wood Chain	1	3	0	1	1	6
Smart Cities and Communities	4	2	2	0	0	8
Sustainable Food	0	2	2	0	0	4
Sustainable Tourism	1	2	1	0	0	4

RDI in the S5 Priority Areas: synthetic overview for future evolution

- **All priorities but Smart Buildings have been growing at a faster pace than the non S5 output** between 2014-2024, showing the overall relevance of S5 areas for Slovenia.
- **Some priority areas have a large critical mass** : ICT, Health and Medicine and Factories of the Future.
  - These are areas with a high degree of transversality, with high co-occurrence with many other areas
  - These are areas that also typically attract funding and are also large in other countries : despite their size, Slovenia does not show any particular specialisation in those areas.
- **Other priority areas are smaller** in terms of total publication, patents and projects, **but are much more of a distinctive feature of Slovenia when compared to other countries** :
  - This is the case for all priority areas, except for Health and ICT (and to some degree Mobility, specialised only in Horizon)
- The more applied priority areas present higher indicators of Cohesion and Interreg projects but less so in terms of publications : sustainable tourism and circular economy
- Priority areas with **the highest relative share of industrial actors** are : **Mobility, Factories of the Future, Smart Buildings, and Network for the transition to Circular Economy.**
- **Science-industry collaboration, more frequent in publications than in patents, concentrates in Materials as end products, Factories of the Future and Health - Medicine**

RDI in the S5 Priority Areas: synthetic overview for future evolution

The following indicators present **a synthesis of the "nature" of each Priority Area**, based on:

- The size, and the intensity, of **overlap (classification co-occurrence) with other priority areas**, to provide an indication about **their uniqueness and transversality**
    - Larger Priority areas can both have a "unique" core, showing relatively little overlap, while co-occurring frequently with other priority areas.

RDI in the S5 Priority Areas: synthetic overview for future evolution

Priority areas	Uniqueness and transversality of the S5 Priority Areas		
	A.1 Does this priority have a unique core?	A.2 Does this priority overlap significantly with other priorities?	Qualitative commentary
Factories of the Future		✅	Transversal
Networks for the Transition to Circular Economy		✅	Transversal
Smart Cities and Communities		✅	Transversal
Health and Medicine	✅	✅	Unique Core + Transversal
Information and Communications Technology (ICT)	✅	✅	Unique Core + Transversal
Materials as End Products	✅	✅	Unique Core + Transversal
Mobility	✅		Unique core
Smart Buildings and Homes, including the Wood Chain	✅		Unique core
Sustainable Food	✅		Unique core
Sustainable Tourism	✅		Unique core

RDI in the S5 Priority Areas: synthetic overview for future evolution

Priority areas	Uniqueness and transversality of the S5 Priority Areas	
	Total score	Uniqueness and transversality of the S5 Priority Areas
Factories of the Future	7	Transversal
Networks for the Transition to Circular Economy	9	Transversal
Smart Cities and Communities	8	Transversal
Health and Medicine	6	Unique Core + Transversal
(ICT) Information and Communications Technology	8	Unique Core + Transversal
Materials as End Products	6	Unique Core + Transversal
Mobility	5	Unique core
Smart Buildings and Homes, including the Wood Chain	6	Unique core
Sustainable Food	4	Unique core
Sustainable Tourism	4	Unique core

Transformation Drivers (digitalisation and sustainability & circularity)

Deep Tech - Science and Technology Foundations

Deep Tech - Science and Technology Foundations

Sectoral Innovation Clusters

Sectoral Innovation Clusters

3. Exploring a new approach for the Slovenian S5 priority-setting and for the Slovenian RDI ecosystem organisation and dynamisation

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- **Context and Rationale : heterogeneity of the current S5 Priority Areas and SRIPs**
- A proposed new approach articulated around:
  - Sectoral Innovation Clusters
  - Deep Tech - Science and Technology Foundations
  - Transformation Drivers
- Policy-mix recommendations for the new approach

Definition of S5 priorities

- Both steps were carried out in close cooperation with the SRIPs
    - **Level 1 priorities (S5 priority areas) stem from high level consultations** (SRIPs, Ministries and Secretary of State) and are informed by previous evaluations and more analytic work (economic, RDI).
    - **Levels 2 (focus areas, value chains and technologies) and 3 (product directions and directions of technology development) are defined through the Entrepreneurial Discovery Process (EDP)** with stronger SRIP influence. They are tasked to design and regularly update their Action Plan.

Current S5 priority areas

1. Factories of the future
2. Health - Medicine
3. Networks for the transition to a circular economy
4. Smart cities and communities
5. Sustainable food processing
6. Smart buildings and home with wood chain
7. Mobility
8. Developing materials as end products
9. ICT
10. Sustainable tourism

Context and rationale - Definition of S5 priorities in Slovenia

- **Consequence of this "bottom-up" approach on the lower granularity definition of the taxonomy**
  - Inconsistent granularity across priority levels
  - Some areas show clear hierarchical structure (e.g., Materials as end products → Steel → Ultra-clean steel alloys)
  - Other areas lack meaningful differentiation between levels (e.g., Factories of the Future → Robotic systems → Innovative robotic applications)

- **Redundant presence of technological specialisations**
  - Same technologies appear across multiple first-level priorities
  - Creates confusion about which vertical domain takes ownership
  - Alternative approach: Separate vertical domains from horizontal enabling technologies

- **Imbalanced Priority Structure**
  - Significant disparity in development detail across priority areas
  - Likely stems from:
    - Varying maturity levels of different SRIPs
    - Heterogeneity of types of actors within SRIP membership
    - Differences in leadership approach (academic vs. industry-led coordination)

- **Some Priorities are purely transversal in nature, without a sectoral nor a technological core, notably Smart cities and Circular economy,** and to a lesser extent, **Smart buildings. These can actually be interpreted as fostering environmental and digital transitions** across different technologies and areas of application

5.1 Context and rationale - Defining relevant R&I priority areas

Different valid approaches can be used to define R&I priority areas for smart specialisation:

- **Relevant economic sectors** (added value, employment, exports, strategic importance, restructuring and upskilling, etc.)
- **Market needs and opportunities** (international innovation and market trends, position in global value chains, disruptive new entrants, changing cost structures, etc.)
- **Distinctives science and Technology foundations**, relevant for many sectors, and **fast-moving deep tech emerging trends**
- **Societal and sustainability transitions,** which anticipate desirable social, economic and environmental transformations and opportunities

The Slovenian S5 has integrated all of the above, within and across S5 Priority Areas.

But different approaches, needs and opportunities require also different policies and different types of cooperation between the actors

Context and rationale - Different rationales for the S5 Priority Areas

The Slovenian S5 has successfully integrated all of the above, within and across S5 Priority Areas.

But different approaches, needs and opportunities require also different policies and different types of organisation between the actors

The diversity of justifications of each priority area should be made explicit to **tailor adapted policy tools and establish the right criteria for success**

The current analysis has focused on the scientific and technological basis of a the S5 Priority areas : while this is a key element, it cannot be used as a standalone justification to redesign the S5 Priorities, disregarding:

- **the economic and industrial basis,**
- **internal and external innovation and societal trends**
- **the reality of the actors and networks in the terrain**

3. Exploring a new approach for the Slovenian S5 priority-setting and for the Slovenian RDI ecosystem organisation and dynamisation

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  - **Transformation Drivers**
- Policy-mix recommendations for the new approach

Accounting for the diverse nature of S5 Priority Areas and SRIPs

- As we have seen, **the nature and RDI activities of the Priority Areas are heterogeneous**
- A new design of Priority Areas should **better account for this diversity**, from its design
- We propose **a restructuring around three types of priorities:**
  - **Innovation in the sectors**
  - **Excellent transversal S&T foundations**
  - **Transformation drivers**

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  - **Innovation in the sectors**
  - **Excellent transversal S&T foundations**
  - **Transformation drivers**

We propose an integrative approach, reviewing both the configuration of the S5 thematic priorities and of the SRIPs, as their definition are highly intertwined.

- The goal is to **preserve the success of the current policies and SRIPs, having created a lasting structure to promote collaboration between public research organizations and businesses.**
- While **adapting it to a clearer framework to facilitate the development of adequate policy tools** to answer the diverse needs of the priority areas.
- And **supporting other types of public-private and private-private forms of association**, such as the Clusters

Proposing a new approach for S5 priority-setting

Transformation Drivers

↳ These are **cross-cutting socio-technological innovations** that enable **broad transformation across multiple sectors** in a desired direction.

Sectoral Innovation Clusters

↳ These are **domain-specific** priorities, focused on supporting innovation in relevant **industries, economic activities or value chain**s.

Deep Tech - Science and Technology Foundations

↳ These are **research-intensive domains** that create fundamental knowledge and capabilities, that **can be applied in several fields.** They require high public investment in equipment and skills, in longer temporal horizons

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R&I policies should support each type of Priority per-se, while maximising the overlap, collaboration and cross-fertilisation between them

Proposing a new approach for S5 priority-setting

Transformation Drivers

- Digitalisation
- Sustainability and Circularity

Sectoral Innovation Clusters

Smart cities is "dissolved" into 2, 4 and 5

- Agrifood
- The built environment
- Mobility
- [Other] Advanced industrial sectors (incl. Machinery, Materials, Defense)
- ICT / Digital, as a sector
- Health industries and healthcare services
- Tourism

Deep Tech - Science and Technology Foundations

- Advanced materials and advanced manufacturing, including robotics and optics/lasers
- Green tech and environmental sciences
- Biomedical research and biotech

Proposal of S5 Priority Area restructuration, based on the semantic analysis, the nature of the priorities and the underlying RDI actors and forms of organisation

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Policy-mix recommendations for the new approach

Transformation Drivers

1. Digitalisation
2. Sustainability and Circularity

In R&I policy, **Transformation Drivers** should:

- Be taken into account in the **evaluation of projects** targeting the Sectorial Clusters and S&T Foundations
- Inform EDP and the **identification of transformative niches** in the Sectoral Clusters. Develop **mission/challenge-oriented innovation** collaborative activities with coalitions of the willing
- Be targeted in higher education, vocational training and LLL (**skills**)
- Be targeted for **entrepreneurship support** and **VC investment** for start-ups and scale-ups (new companies with new business models)
- Be targeted for **public procurement of innovation** and **regulatory sandboxes**

Policy-mix recommendations for the new approach

In R&I policy, **Science and Technology Foundations** should:

- Concentrate **S&T infrastructure investment** and **support S&T talent attraction (early, mid and established), development and retention**
- Be taken into account in the **evaluation of projects** targeting the Sectorial Clusters and the Transition Drivers
- Provide support to **increase competitiveness in Horizon** and other EU and international funding schemes
- Drive **science-push knowledge transfer**, to increase science-industry cooperation as well as **deep tech entrepreneurship**
    - **Be targeted for entrepreneurship support and VC investment for start-ups and scale-ups**
    - Be targeted for **R&D investment attraction** (private and by the EU, such as STEP or ESFRI)
- Support advancements towards **technological sovereignty** and **strategic autonomy**
- Explore the establishment of **wide-ranging framework contracts with academic/research institutions to support and monitor long-term alignment with the S5 priorities,** covering (some of) the elements above

Deep Tech - Science and Technology Foundations

1. Advanced materials and advanced manufacturing, including robotics and optics/lasers
2. Green tech and Environmental sciences
3. Biomedical research and biotech

Policy-mix recommendations for the new approach

In R&I policy, **Sectoral Clusters** should:

- Drive EDP
  - In **transformative niches**, informed by the *Drivers* (*Digitalisation* and *Sustainability and circularity*)
  - in intra and inter-sectoral niches to foster **industry-industry collaboration**
- Drive **market-pull knowledge transfer**, to increase science-industry cooperation
- Foster **internationalisation** (exports and GVCs) and **investment attraction**
- Be targeted for public support to **large R&D investments** (such as IPCEI)
- Be targeted for **public procurement** of **innovation and regulatory sandboxes**

Sectoral Innovation Clusters

1. Agrifood
2. The built environment
3. Mobility
4. [Other] Advanced industrial sectors (incl. Machinery, Materials, Defense)
5. ICT / Digital, as a sector
6. Health industries and healthcare services
7. Tourism

Proposing a new approach for S5 priority-setting

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Thank you very much

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Semantic analysis of RDI achievements in the priority areas of the Slovenian Sustainable Smart Specialisation Strategy (S5)