**Smart strategies for the transition in coal intensive regions**

**Project No: 836819**

TRACER
TRANSITION IN COAL INTENSIVE REGIONS

# *Roadmap for Upper Silesia*

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Authors: Marcin Chodak, UAK, Poland
Justyna Likus-Cieślik, UAK, Poland
Marcin Pietrzykowski, UAK, Poland
Bartłomiej Woś, UAK, Poland
Marek Pająk, UAK, Poland

Editors: Charalampos Malamatenios, Centre for Renewable Energy Sources and Saving, Greece
Rita Mergner, WIP Renewable Energy, Germany
Rainer Janssen, WIP Renewable Energy, Germany

Contact: University of Agriculture in Krakow, Poland
Marcin Pietrzykowski,
m.pietrzykowski@ur.krakow.pl
www.ur.krakow.pl

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# 1 Introduction

A roadmap for implementing the research and innovation (R&I) strategy for Upper Silesia (Poland) and the roadmap for reskilling and retraining needs of the local workforce has been prepared based on official strategic documents that describe the development of the Silesian Voivodship up to the year 2030. Two relevant documents have been approved by the local authorities. The first one, the *Strategia Rozwoju Województza Śląskiego "Śląskie 2030" – Zielone Śląskie* (*Development Strategy for the Silesian Voivodship "Silesia 2030" – Green Silesia*) [1], hereafter referred to as *Silesia 2030*, is the official strategic plan for the general development of the Silesian Voivodship, in which all aspects of development in Silesia are described up to 2030, and is an update of the *Development Strategy for the Silesian Voivodship "Silesia 2020+"*, adopted by the Silesian Voivodship Assembly on 1 July, 2013.

The new plan constitutes the fifth edition of this key document, which defines the objectives for regional development and the instruments for their implementation with an achievement goal of 2030. The aim of updating the strategy was to verify the forecasts and national, European and global trends shaping the development processes in the region. The growing importance of ecology, demographic trends and an ageing society, as well as the fourth industrial revolution – including the several changes that will accompany that – was identified as the key trend for the coming years.

Based on the outlined vision for development, four strategic objectives were identified, for which operational objectives were formulated, looking towards 2030. The four strategic objectives for the Silesian Voivodship are:

1) to be a region of responsible economic transformation;

2) to be a resident-friendly region;

3) to be a region with a high-quality environment with open space; and

4) to be an efficiently managed region [1].

The second document is the *Regional Innovation Strategy of Silesia 2030* (hereafter referred as *RIS Silesia 2030*) [2], in which the issues of innovation development in the Silesian region are described. The *RIS Silesia 2030* is related to *Silesia 2030* through its contribution to the implementation of the vision, and provides that "*the Silesian Voivodship in 2030 will be a modern European region with a competitive economy resulting from responsible transformation, providing opportunities for development to its inhabitants and offering a high quality of life in a clean environment*", referring to the strategic objective "*The Silesian Voivodship as a region of responsible economic transformation*" [2].

The *RIS Silesia 2030* includes several smart specialisations for the Silesian Voivodship that were identified on the basis of a forward planning process carried out under the title *Priority technologies for the sustainable development of the Silesian Voivodship*. These include energy, medicine, information and communications technologies, the green economy and emerging industries. Within each smart specialisation sector, several technology groups were designed to provide strong support. For smart specialisation in energy, the priority technologies include highly efficient energy technologies that limit the emission of greenhouse gases and other pollutants into the environment, combined generation (cogeneration / polygeneration), technologies for fuel-cell production, the generation of energy and improvements in the efficiency of obtaining energy from renewable sources, prosumer energetics, technologies for smart grids and their interconnection, energy-storage technologies, and smart and energy-saving constructions.

To enable smart specialisation in a green economy, the priority technologies include biotechnologies for environmental protection, construction technologies, technologies for environmental protection and reclamation, energy (including biogeochemical engineering),

technologies for ecological, safe and effective waste management, technologies for processing (purifying and separating) water and the collection and treatment of wastewater, technologies limiting the emission of pollutants into the atmosphere, technologies supporting environmental management, and environmental technologies associated with various industries [2].

# 2 Strategic approach to the development of the roadmap

Work on the *RIS Silesia 2030* was performed giving consideration to the strategic process carried out in the region, including the development of *Silesia 2030* and a package of related documents. The vision for the development of the Silesian Voivodship was the focal point for both the diagnostic and the recommendation parts of the *RIS Silesia 2030*. This was defined in the following way in the *Silesia 2030* document: Green Silesia (the Silesian Voivodship) will be a modern European region with a competitive economy that will result from responsible transformation, providing opportunities for development to its inhabitants and offering a high quality of life in a clean environment. The expected qualities of the region indicated in the vision are expected to be achieved through implementation of the *RIS Silesia 2030*, among others.

The most important experiences gained from previous editions of the RIS have indicated that each regional initiative – presented as flagship projects – must ultimately have its own creators who take on the responsibility for organising and coordinating the processes associated with its implementation. It was also shown that, if public financial instruments are primarily aimed at supporting individual companies, rather than multi-stage projects prepared by consortia, it will be difficult to achieve tangible synergies and visible effects within the framework of smart specialties on a scale greater than that of individual entities. This rationale determined the provisions of this edition of the RSI, the guiding principle of which was the smart transformation of the region, realised on the foundations of a regional innovation ecosystem [2].

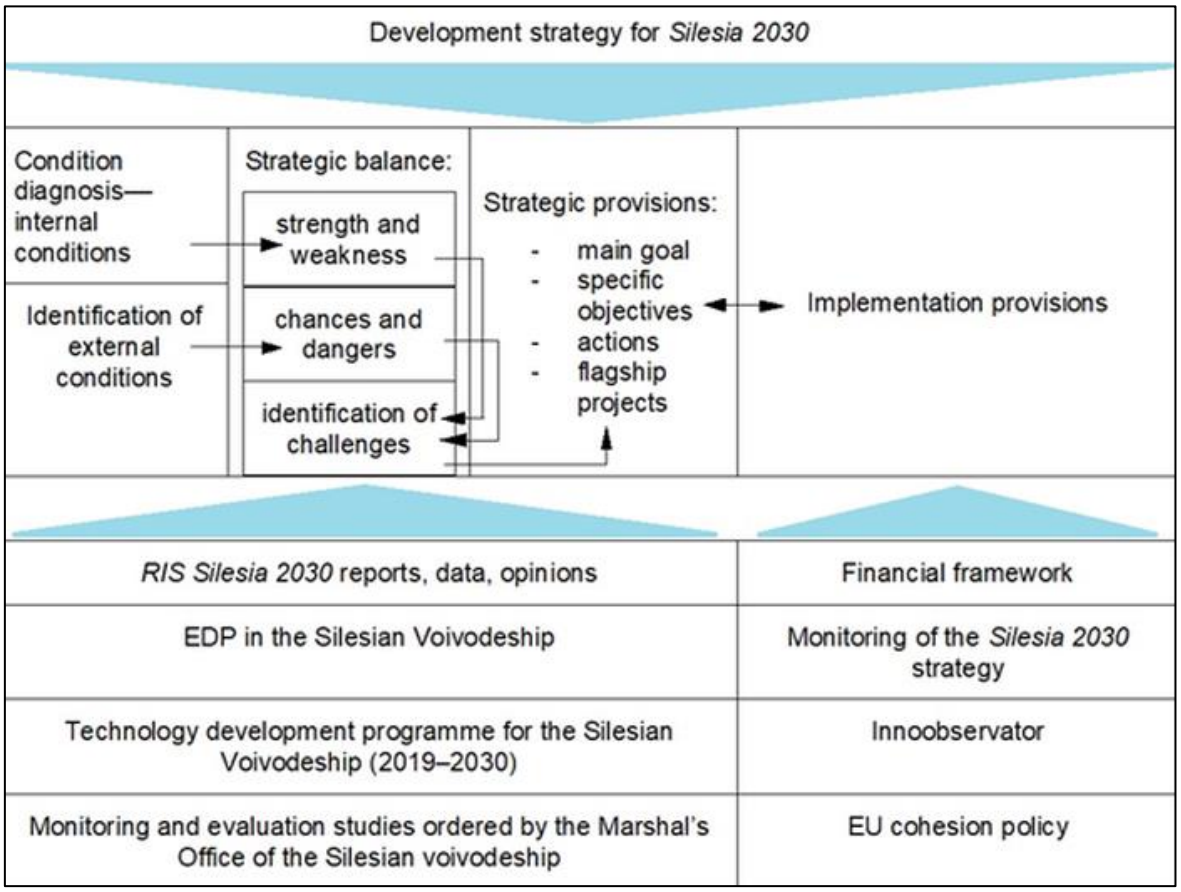


**Figure 1: Preparation scheme underpinning the RIS *Silesia 2030* [2]**

Figure 1 shows the stages involved in preparing the strategy for innovation development in Silesia. The diagnosis and description of the external conditions for innovative development were based on statistical data, information from monitoring and evaluation reports and other research works ordered by the Marshal's Office of the Silesian Voivodship, findings from the Technology Development Programme, information from reports prepared by RSI Observatories (a network of regional specialist observatories [SOs]), findings resulting from an entrepreneurial discovery process (EDP) carried out in the region, and expert knowledge concerning industrial and economic issues.

The results of the strategic balance constitute the element combining the analytical part of the strategic document with the recommendation part. The balance sheet (see Figure 1) consisted of formulating strengths, weaknesses, opportunities and threats (SWOT) factors and their analysis, aimed at identifying strategic challenges. As a result, the main aim of the RIS, together with the specific objectives of the RIS activities and flagship projects, were agreed, which were all discussed, both internally and during working meetings, with representatives of various ministries and the European Commission [2].

The implementation provisions were strategic provisions defined on the basis of framework decisions concerning financing pro-innovative policy for the region, assumptions about the monitoring system for strategic documents conducted by the local authorities of the Silesian Voivodship, and previous experience in monitoring the implementation of past RISs. Given that the implementation of this RIS would be strongly conditioned by the use of EU funding, at the stage of defining the strategic and implementation provisions, the requirements resulting from the projected shape of the EU cohesion policy for 2021–2027 were taken into account [2].

The diagnosis of the state involves a description of the most important internal conditions that determine the innovative development of the Silesian Voivodship. The conclusions drawn from the diagnosis included the strengths and weaknesses of the region. The list of opportunities and threats is a compilation of conclusions derived from a process of identifying the most important external conditions. The criterion used for assessing whether the internal phenomena should be qualified as strengths or weaknesses, and the external phenomena as opportunities or threats, was expert verification.

The SWOT analysis was followed by an examination of the interactions between the strengths and weaknesses and the opportunities and threats, and thematic grouping, and then four strategic challenges to innovation policy in the Silesian Voivodship dedicated to the smart transformation of the region, realised on the foundations of the regional innovation ecosystem, have been identified. These are:

- Challenge I – improving the level of innovativeness of the region's economy compared to Europe;
- Challenge II – digital transformation of the economy and society, minimising the risk of digital exclusion;
- Challenge III – reducing the atomisation of the economic structure under the growing pressure of international competition, and the legal requirements for the operation of small businesses; and
- Challenge IV – increasing the integration of the innovation ecosystem, supporting competence development in the Silesian economy.

The identified challenges were confronted with available assumptions regarding the support for innovation expected for 2021–2027 from the EU, and at national and regional levels [2].

## *2.1 Prioritization of R&I activities for the selected energy technologies*

The R&I activities in the region have been based on smart specialisations that were elaborated in 2013–2019 within the framework of two projects, namely the *Network of Regional Specialist*

*Observatories* and the *Network of Regional Specialised Observatories in the Entrepreneurial Discovery Process* [1].

The *Network of Regional Specialist Observatories* project was implemented in 2013–2015 within the framework of the Human Capital Operational Programme in the Silesian Voivodship, and was co-financed by the European Social Fund. The project leader was the Marshal's Office of the Silesian Voivodship and the partners were the Central Mining Institute in Katowice, the Science and Technology Technopark in Gliwice, and a consortium comprising Górnośląska Agencja Przedsiębiorczości i Rozwoju Sp. z o.o., the Instytut Techniki i Aparatury Medycznej in Zabrze, the Fundacja Rozwoju Kardiochirurgii im. Zbigniew Religi and the Park Naukowo-Technologiczny Euro-Centrum in Katowice [2].

The main aim of the project was to develop the technological and innovative potential of the region by building a competitive advantage for the Voivodship realised by programming economic changes into the workings of representatives of local government units based on the results of the project. The following tasks, among others, were carried out as part of the project:

- an analysis of the Voivodship's potential in selected technological specialisations in line with the specialisations of the *Network of Regional Specialist Observatories* project;
- audits of the available technology and innovation, aimed at creating a policy of enterprise development and adaptability; and
- a benchmarking of the endogenous potential of cities/municipalities, indicating, for example, the potential for investment in a given area, and the possibility of cooperating with local businesses or research institutions, in terms of adapting to the changes taking place in the economy.

The *Network of Regional Specialised Observatories in the Entrepreneurial Discovery Process* project was implemented in 2017–2019. The leader of the project was the Marshal's Office of the Silesian Voivodship. This project was a continuation of the EDP initiated under the previously implemented *Network of Regional Specialist Observatories* project, and was based on the identification of growth sectors in the economy that could change or complement the regional smart specialisations (medicine, energy, and information and communication technologies [ICT]) indicated in the RIS for the Silesian Voivodship for 2013–2020. The main objective of the project was to support and improve the management of the region's development in terms of regional scientific and technological potential, and to increase the number of SOs in line with the technological areas indicated in the Technology Development Programme and research and development (R&D) entities and businesses.

Moreover, the aim of the project was to disseminate effective business models to enterprises, circulate specialised reports developed by technology observatories on available technologies, and present opportunities for R&D cooperation. The action, in terms of the professionalisation of services, was focused on animating cooperation between actors in the innovation ecosystem through, among other things, analysing technology and innovation needs in enterprises and in the R&D sector, applying business models and instruments for technology transfer and commercialisation to R&D activities in enterprises, identifying business opportunities for enterprises, and preparing to join cooperative networks. The project was mainly directed at enterprises in order to increase their knowledge of technologies and the market trends so as to increase their competitiveness and innovation at both the regional and national levels [2].

The project included an update of the Technology Development Programme for the Silesian Voivodship and the Technology Development Programme Implementation Model. An analysis was made of the Voivodship's potential in selected technological specialisations, as represented in the *Network of Regional Specialist Observatories* project. Recommendations on key technological areas were prepared as a basis for creating an action plan for particular areas, changes were introduced into the regional system of financing innovations, directed at

entrepreneurs, and an analysis of the technological and innovative needs of enterprises was made, directed at creating a development policy [2].

**Identification of smart specialisations**

Based on the EDP and analyses carried out, as described above, the following smart specialisations were proposed for the Silesian Voivodship:

- energy;
- medicine;
- ICTs;
- the green economy; and
- emerging industries.

Two of them – energy and the green economy – are closely related to the transition of coal intensive regions.

**Smart specialisation – Energy**

The innovation policy strategy for the Silesian Voivodship, and the implementation provisions for smart specialisations in the region, characterised the energy industry as:

- an important economic sector for the region and the national economy;
- an area that, due to the existing infrastructure (production, transmission and consumption of energy), high population density and location of industry in the region, made the Silesian Voivodship an excellent base for the testing and full-scale implementation of innovative solutions;
- generating a suction effect, not only in terms of technologies for the energy sector, but also in terms of modern solutions for environmental protection, information technology (IT) and automation, or machine industries;
- an area in which the use of renewable energy sources in professional and industrial power engineering, as well as in business and residential prosumer groups, was becoming increasingly important; and
- in a broad sense, the first and most important area for the creation, testing and application of smart-grid technologies for the distribution of utilities, the experience from which could be transferred to solutions for other smart markets.

The attributes of the energy smart specialisation included:

- its strategic importance to the economy of the region and the country;
- the excellent facilities for testing and implementing innovative solutions;
- the potential to create model solutions for smart markets;
- the specific natural resources in the region;
- the generation of a suction effect on technologies from other industries; and
- its environmental friendliness and low emissions.

**Smart specialisation – The green economy**

Green economy is a priority area for the Silesia Voivodship, because of the greatest potential to be exploited in the economy, which includes activities supporting economic growth and development, ensuring constant availability of natural capital and ecosystem services (green growth). Green economy includes environmental, economic & social policies and innovations

which ensure society's efficient use of resources in production and consumption processes (green economy).

A green economy means managing resources, using economic instruments that favour environmental protection, lending support to innovative projects, conducting more effective water and waste management policies, and making efforts to develop sustainable consumption and production. The key areas for the green economy included:

- renewable energy; clean technologies;
- energy-efficient construction;
- public transport;
- waste management and recycling;
- the sustainable use of land, water and forests;
- ecotourism.

Due to the fact that the energy industry (including renewable energy) is one of the smart specialisations, it was decided that the green economy in the Silesian Voivodship would include: green products and services, green investments, green economic sectors, green public procurement, green jobs, and the corresponding technological areas [2].

In summarising the analysis of data on the research and innovation (R&I) strategy in the field of energy for Upper Silesia, it can be concluded that, in the period 2021–2030, the demand for solutions supporting energy efficiency in industry, energy-efficient construction, energy generation from renewable sources and integration of electric transport infrastructure with building infrastructure will continue. This will contribute to the development of new technologies and their implementation by IT companies, manufacturers of RES equipment and systems, service providers for the utility power industry, and companies in the construction sector. At this stage, no official vision or development strategy has been prepared for the Silesian Province for the year 2050 [3].

## *2.2 Prioritisation of local workforce reskilling/retraining needs*

The problems associated with retraining the workforce were not included in any detail in the *Innovation Development Strategy* of the Silesian Voivodship. Indications for the need for retraining probably resulted from the SWOT analysis and a diagnosis of the internal conditions of the region. At present, there is no need to create special programmes for retraining people employed in the mining industry in order to prevent unemployment. Rather, the threat seems to be the lack of workers and a concomitant increase in the number of economically inactive people. The ageing population and decreasing number of people of working age means that, in the next decade, several hundred thousand people will disappear from the labour market and will not be replaced by young workers.

These shortages might be partly filled by foreigners and partly by automation and the digitisation of various processes. The lack of manpower, as well as high wage expectations, may force some companies to close their operations, resulting in an increase in the number of low-skilled unemployed, despite the growing demand for skilled workers [4].

The impact of the coal phase-out on the labour market has been studied in a publication by the Institute of Structural Research entitled: *The coal phase-out and the labour market transition pathways: The case of Poland* [5]. This work presented the labour market dimension of the coal phase-out in Poland from 1990 to 2050, and highlighted that the labour market conditions for the coal phase-out have improved since the late 2000s. In the 1990s and 2000s, labour prospects for workers who lost their coal-mining jobs were weak, especially among people with relatively low educational attainment. However, since the late 2000s, labour market

conditions have improved as other industrial sectors have rebounded, with the overall growth in the labour supply having slowed due to demographic changes, and educational upgrading having improved the supply of skilled labour. As a result, the labour market outlook for the future coal-mining phase-out is much better now than it was in the past. Furthermore, the regions that were dependent on coal in the 1990s have already transformed their labour market structures, and have been less reliant on coal-mining since the mid-2000s [5].

Some of the miners currently employed who will leave the mining sector before reaching retirement age will be able to find work in the industrial processing, transport or construction sectors. Based on the analysis of the available instruments, it was indicated that the use of, inter alia, temporary wage subsidies and job priority guarantees can facilitate the transition of workers from mining to other sectors [6].

Despite this improved situation in the labour market, certain measures are necessary because the phase-out of coal may lead to the loss of ~14,000 jobs. According to recommendations given by the authors from the Institute of Structural Research, a recruitment freeze should be implemented in the Polish hard coal-mining sector in order to decrease the number of miners requiring support over the next few years. Vocational schools providing mining-related education should focus on training these people for the jobs that will be required (e.g. electricians, machine operators, construction workers) rather than miners [5].

Policy instruments should be adjusted to meet the needs of older and younger miners. The older miners could be offered new jobs in coking coal mines or early-retirement benefits, while active labour market policies (e.g. retraining or providing funds for setting up and running new businesses) should be prioritised for the younger ones. Reskilling programmes are crucial for miners who are young enough to remain in the labour market, but who need new skills to be able to work in sectors other than mining. Due to the anticipated shortage of workers in the engineering and technical supervision staff after 2030, intersectoral upskilling seems to be crucial. This process should be managed by mining companies that should include these employees in their decarbonisation strategies because engineering and technical supervision workers are essential to the process of closing down mines [5].

## *2.3 Barrier analysis*

The Silesian Voivodship is one of the moderately innovative regions in Europe. The most important barriers to innovativeness are considered to be: low public expenditure on innovative activities, high requirements concerning one's own contribution to programmes supporting innovativeness, low motivation for the commercialisation of research on the part of the scientific and research sector, internal administrative burdens connected with project management, low salaries in research projects for employees of the scientific and research sector, and unsatisfactory innovative results from companies in the Silesian Voivodship, limiting the possibilities for the commercialisation of R&D works. The outlays on R&D are often spent on purchasing software, or on standard solutions or repetitive works commissioned to scientific entities. Rarely R&D works do concern the development of completely new products or business processes. On the other hand, small and medium-sized enterprises (SMEs) that implement innovations have insufficient access to venture capital and support instruments [2].

Despite a number of initiatives carried out in the Silesian Voivodship, cooperation between enterprises introducing innovations and the market is insufficient. This is due to the following reasons:

- a lack of knowledge among enterprises about the competencies (through the prism of people, research equipment, knowledge and experience) available in universities and research institutes;
- a lack of interest from enterprises in using the results of R&D works from universities and research institutes (difficulty in finding an appropriate customer);

- the limited potential for the commercialisation of the results of R&D works in the form of spin-off companies by universities and research institutes (due to imprecise legal regulations and difficult access to capital);
- the low social competence of scientists (in terms of having dialogues with representatives from enterprises and commercial negotiations), which is a barrier to establishing new relationships and their consolidation;
- a difficulty in balancing the interests of companies (obtaining results that can be implemented and that generate financial value) with the interests of scientific entities (obtaining a scientific breakthrough, development of technology) in joint projects co-financed by public funds;
- the difficulty of companies to identify the right problem for them that should be the subject of R&D work, which creates frustration during the execution of orders (on the part of scientists) and the stage of acceptance of the work (on the part of the company); and
- the relatively long time taken to process requests, offers and contracts in universities, as well as the non-competitive offers made by universities (adding a number of surcharges to the price) [2].

The essence of the regional smart green-economy specialisation was, in this context, to generate and implement innovative, low-carbon, resource-efficient and inclusive solutions for the development of the region's economy, while achieving the environmental objectives set out in strategic documents, and making real improvements in the state of the environment and living conditions in the Silesian Voivodship. The green economy is closely related to the specialisation "energy" in the context of renewable energy sources [2].

Due to a high degree of urbanisation and industrialisation, as well as a high population density, the Silesian Voivodship covers regions with great anthropo-pressure. Intensive industrial development has contributed to a significant degradation of the environment. The most frequent problems include chemical pollution of the soils, surface deformation, excessive concentrations of dust and gas pollutants in the air, the poor condition of surface waters resulting from disorganised water and sewage management in communities, and the discharge of salty mine water into surface waters, exceeding permissible noise levels, and insufficient activities to restore post-industrial and degraded areas to make them economically useful.

Green innovations are a response to legislative requirements and changing awareness among end-consumers. However, companies rarely take steps on their own to develop green products or business process innovations unless there is certainty that the customer will want such a solution and be willing to pay more for it. Also, public procurement, where technology neutrality must be ensured, can rarely allow the selection of more expensive green innovations that have not yet been fully proven on a larger scale [2].

# 3 Recommendations for measures

The overall aim of the strategy behind the vision for a future Silesia was formulated in the *Silesia 2030* document [2]. The vision stated that the Silesian Voivodship would become a modern European region with a competitive economy resulting from a responsible transformation, providing its inhabitants with development opportunities and offering a high quality of life in a clean environment, with the strategic aim to economically transform the Silesian Voivodship.

The major goal of the regional innovation strategy (RIS) was nicknamed "Smart Silesia", and it was described as an innovative and intelligent economic transformation to provide a competitive advantage for the region in the international arena. In order to achieve the major goal, specific objectives were set to support the strategy. To achieve each of the specific

objectives described above, appropriate actions were outlined. In order to implement the planned actions, the strategy required the implementation of so-called flagship projects (Table 1). The strategic objectives, actions and flagship projects are presented in the following sections.

**Table 1: Action plan for achieving the goals of the *Silesia 2030* RIS Strategy [2]**

| | | | | |
|---|---|---|---|---|
| Vision for regional development | "Zielone Śląskie" – the Silesian Voivodship will be a modern European region with a competitive economy, the result of a responsible transformation, providing development opportunities for its inhabitants and offering a high quality of life in a clean environment | | | |
| Strategic goal for the region | The Silesian Voivodship as a region of responsible economic transformation | | | |
| Main goal of the RIS | Smart Silesia – an innovative and intelligent economic transformation ensuring the competitive advantage of the region in the international arena | | | |
| Detailed RIS goals | *G1*<br>Increase the ability of entities in the regional innovation ecosystem to generate and implement innovations and modern technological solutions | *G2*<br>Ensure an inclusive digital transformation in the region's economy and society | *G3*<br>Support the competitiveness and effective transformation of the entities in the regional innovation ecosystem towards national and international champions | *G4*<br>Develop the competencies of employees and entities in the regional innovation ecosystem for smart specialisation, digital transformation and innovative entrepreneurship |
| Actions | *A1.1*<br>Dynamize the development processes in smart specialisations<br>*A1.2*<br>Implement innovations in enterprises<br>*A1.3*<br>Strengthen the research infrastructure for the regional science–business partnership | *A2.1*<br>Support the comprehensive digital transformation of SMEs<br>*A2.2*<br>Create intelligent products and services in the public sector, meet social challenges | *A3.1*<br>Comprehensively support start-ups<br>*A3.2*<br>Activate cluster environments<br>*A3.3*<br>Support the transformation and internationalisation of the entities in the regional innovation ecosystem | *A4.1*<br>Develop employees' competencies for the competitiveness of the regional economy<br>*A4.2*<br>Strengthen the regional innovation ecosystem<br>*A4.3*<br>Internationalise the entities in the regional innovation ecosystem |

## *3.1 Major axes needed to accomplish the objectives of the R&I strategy*

As it is shown in Table 1, after performing a strategic balance and SWOT analysis for the Silesian Voivodship, four specific objectives were set:

- G1 - Increase the capacity of regional innovation ecosystem actors to generate and implement innovations and modern technological solutions;

- G2 - Ensure inclusive digital transformation in the region's economy and society;
- G3 - Support the competitiveness and successful transformation of regional innovation ecosystem actors into national and international champions; and
- G4 - Develop competencies of employees and actors of the regional innovation ecosystem for smart specialisations, digital transformation and innovative entrepreneurship,

Each of the objectives listed above corresponds to one of the challenges defined by the SWOT analysis. Objective G1 responds to the challenge "*Improving the level of innovation of the region's economy compared to Europe*". Objective G2 meets the challenge "*Digital transformation in economy and society minimising the risk of digital exclusion*". Objective G3 responds to the challenge "*To reduce the atomisation of the economic structure in conditions of growing pressure from international competition and legal requirements on the functioning of small companies*", while Objective G4 deals with the challenge "*To increase the integration of the innovation ecosystem supporting the development of competencies in the economy of the Silesian Voivodship*" [2].

To achieve each of these objectives, appropriate actions were provided. The actions for Objective G1 included supporting development processes in smart specialisations (A1.1), implementing innovation in enterprises (A1.2) and strengthening research infrastructure for regional partnerships between science and business (A1.3). Objective G2 will be achieved through supporting an end-to-end digital transformation of SMEs (A2.1) and creating smart public-sector products and services to address societal challenges (A2.2), while Objective G3 provides for comprehensive support for start-ups (A3.1), the activation of cluster environments (A3.2) and support for the transformation and internationalisation of regional innovation ecosystem entities (A3.3). Finally, the actions for achieving the specific goal of Objective G4 will involve developing employees' competencies for the competitiveness of the regional economy (A4.1), strengthening the regional innovation ecosystem (A4.2) and strengthening competencies for the internationalisation of regional innovation ecosystem entities (A4.3) [2].

In order to implement the planned actions, a strategy of implementing flagship projects was foreseen, including:

- Eco-innovations in the region;
- Silesian science and technology parks;
- Silesia – the top Polish technologies for medicine;
- A map of key regional research infrastructure;
- Testing social and technological innovations;
- Regional innovation vouchers;
- Digital solutions for public services;
- Digital innovation hubs (DIHs);
- A platform of Silesian start-ups;
- The incubation of technology companies 3.0;
- A network of regional SOs;
- A programme for improving and changing professional qualifications to fit the needs of green energy; and
- A Laboratory for New Technologies in Żory.

Each of the planned flagship projects addresses one or more specific objectives, and some of them include R&I for the energy transition or development of a green economy.

Poland's energy policy until 2040 (PEP2040) sets the framework for the energy transformation in Poland. It contains strategic decisions in the selection of technologies for building a low-emission energy system [7]. PEP2040 is one of nine integrated sector strategies resulting from the Strategy for Responsible Development. PEP2040 is consistent with the National Energy

and Climate Plan for 2021-2030. PEP2040 describes the state and conditions of the energy sector. Then, three pillars of PEP2040 were identified (1st Just transition; 2nd zero-emission energy system; 3rd good air quality), on which the eight specific objectives of PEP2040 were based, along with the activities necessary for their implementation, and strategic projects [7]:

1. Optimal use of own energy resources
   - STRATEGIC PROJECT 1. Transformation of coal regions;
2. Development of the manufacturing infrastructure and mains electricity
   - STRATEGIC PROJECT 2A. Capacity market,
   - STRATEGIC PROJECT 2B. Implementation of smart power grids;
3. Diversification of supplies and expansion of the network infrastructure of natural gas, crude oil and liquid fuels
   - STRATEGIC PROJECT 3A. Construction of the Baltic Pipe
   - STRATEGIC PROJECT 3B. Construction of the second line of the Pomorskie pipeline;
4. Development of energy markets
   - STRATEGIC PROJECT 4A. Implementation of the Action Plan (to increase cross-border electricity transmission capacity)
   - STRATEGIC PROJECT 4B. Gas hub,
   - STRATEGIC PROJECT 4C. Development of electromobility;
5. Implementation of nuclear energy
   - STRATEGIC PROJECT 5. Polish nuclear power program;
6. Development of renewable energy sources
   - STRATEGIC PROJECT 6. Maritime implementation wind energy;
7. Development of heating and cogeneration
   - STRATEGIC PROJECT 7. Development of system heating;
8. Improving energy efficiency
   - STRATEGIC PROJECT 8. Promoting the improvement of energy efficiency

## *3.2 Major axes needed to fulfil the need for workforce retraining*

The current RIS does not highlight specific objectives (or axes) for workforce retraining. The need for workforce (re-)education/training is included in the specific objectives above, and in the measures and flagship projects described in the following sections.

Research made by the Institute for Structural Research (IBS) shows that in the scenario of implementing an ambitious climate policy in 2015–2040, the number of miners will decrease by approximately 50,000. However, most of them will naturally retire from the sector. Those miners whose mines will close before they reach retirement age have a good chance of finding work in the industrial processing, transport and construction sectors. Each of these industries is characterized by a structure of education and age of employees similar to mining. They are also all relatively large, so the number of jobs they can offer will be significant [6].

In Silesia education of workforce rather than reskilling is required to achieve the goals stated in the development strategy. Education, in particular vocational training, directly affects the preparation of young people for demands of the labor market. The cooperation of educational institutions with employers and the continuous process of monitoring the demand for new professions is important in this respect. The development of innovation and technology requires an efficient higher education system in terms of the proposed courses of study, as well as improving the quality of the base and infrastructure of universities. In order to fulfil the educational needs of the region, the existing strategy includes a flagship Programme for improving and changing the professional qualifications to service the needs of green energy

that meets the specific goal G1 (“Develop competencies of employees and actors of the regional innovation ecosystem for smart specialisations, digital transformation and innovative entrepreneurship”). Its objectives are to provide human resources for a sector with high growth potential and to retrain workers leaving the fuel and energy sectors.

### *3.3 Measures proposed under each of the main axes to overcome barriers*

In order to increase the capacity of regional innovation ecosystem actors to generate and implement innovations and modern technological solutions (Objective G1), three actions were foreseen. The first involved supporting development processes in smart specialisations (A1.1). This action will be a continuation of measures taken to strengthen the innovative potential of entities in smart specialisations in previous years in order to move from supporting investments in R&I infrastructure towards the implementation of R&D projects.

On the one hand, the support for individual projects will contribute to strengthening the competitiveness of Silesian companies in the international arena, while, on the other hand, dedicated activities related to EDPs will be translated into specific research agendas, which will allow joint support initiatives to be launched in line with the Voivodship’s self-governing National Centre for Research and Development. It was assumed that regional consortia in smart specialisations, as a result of joint activities undertaken, would be perceived by international organisations as appropriate partners for the implementation of European research agendas [2].

The second action is the implementation of innovation in enterprises (A1.2). SMEs struggle with the transition from research projects that create new technological solutions to the introduction of innovative products and services in the market. Bearing in mind the increasingly demanding legal and market regulations, and the specificity of innovative projects, as well as the role of intellectual property in securing a position in the international arena, it is necessary to provide support for:

- development and implementation projects,
- development of R&D infrastructures for enterprises,
- securing of intellectual property
- obtaining of necessary certifications.

Enterprises going through this process will benefit from the support related to a scaling-up of the implementation of innovative products, through which they will have the opportunity to expand their technical infrastructure, hire specialists, expand the scope of intellectual property protection, and obtain the necessary certification in selected international markets. The role of large enterprises, which can include solutions from regional SMEs in their own innovation processes in the value chains, is significant. Therefore, the possibility of supporting large enterprises in the field of R&D, and the implementation of innovative solutions, including those provided by SMEs, is assumed [2].

The third action for achieving Objective G1 was strengthening the research infrastructure for regional partnership between science and business (A1.3). In recent years, universities and R&D units have undergone significant transformation processes. Also, business institutions, such as technology parks, incubators and clusters, have strengthened their role as integrators of innovation services. Thus, areas requiring further support for the development of research infrastructure have been highlighted. The support activities will be launched to improve the offer of cooperation between business institutions, universities and R&D units with enterprises in the region and beyond. In addition, the modernisation of infrastructure, and related activities aimed at increasing competencies in the commercialisation of research results and cooperation with enterprises, will help entities from the R&D sector to strengthen their activities within international consortia and R&D projects [2].

Two actions are necessary for ensuring inclusive digital transformation in the region's economy and society (Objective G2). The first relies on supporting an end-to-end digital transformation of SMEs (A2.1). In an effort to intensify the uptake of ICTs by SMEs, all aspects of digitalisation (e.g. Internet of Things platforms, mobile devices and applications, advanced human–machine interactions, augmented and virtual reality, big-data management systems and blockchains) must be taken into account. This will help to convince companies to digitally transform, regardless of the scale, type of activity or level of technological advancement. Support for investments in ICTs will be preceded by information, training and advisory activities, including in regional and thematic DIHs. Due to the different needs of service companies and typically industrial companies, it is assumed that the instruments of support for ICT investments for enterprises in the scope of the implementation of digital technologies will differ. At the same time, measures to make companies and the public sector aware of cyber security issues, and investment support related to securing network infrastructure, technical infrastructure, smart devices and data, should be of key importance.

The second action involves creating smart public-sector products and services that address societal challenges (A2.2). Through this action, by integrating data collection, processing and utilisation activities, as well as by implementing smart solutions in the areas of transport, education, health, culture, media and environmental management, the public sector will improve the quality of its services and increase the efficiency and effectiveness of its operations. For some problems, there are already solutions that can be brought on the market. However, other problem areas require a specific approach, including R&D works on the part of enterprises, in order to develop dedicated solutions and demonstrate activities on a smaller scale on the part of public entities, before their implementation on a larger scale.

Therefore, building consortia of enterprises and cities will be promoted in the context of smart-cities projects, in which R&D and demonstration activities by those enterprises and investment projects in the cities will be implemented. In the first place, these may involve intelligent devices, artificial intelligence and methods for analysing large collections of data, addressing the problems and challenges faced by various social groups (e.g. the elderly and those with dysfunctions) or helping to build awareness on environmental impacts and solve selected environmental problems. Investment support aimed at development and testing in specific environments of digital innovations for society, including innovations based on the prosumer approach, could contribute to solving problems that the public sector or local non-governmental organisations do not currently deal with.

The 3rd specific objective (G3) will be achieved through three specific actions, the first being comprehensive support for start-ups (A3.1). Ensuring a smooth transition from the conceptual phase to business operations requires a strengthening of the providers of seed-stage financing and subsequent investment rounds, both from public–private and private (only) sources. The provision of venture capital assumes funding for existing and new funds that will guarantee the funding of single investments. These funds should develop partnership relations with the animators of start-up environments and, together, they could come up with the most interesting ideas in a pre-incubation phase. An important role will be played by science and technology parks, incubators, business accelerators and special-purpose vehicles and their networks, which comprehensively provide young companies with access to infrastructure, knowledge, capital, and scientific-research and business contacts within their ecosystems. In addition, given the important role of medium and large enterprises in the regional economy, it is important to involve these companies in scale-up projects that will ensure implementation of innovative solutions from start-ups around the region on a larger scale [2].

The activation of cluster environments (A3.2) is another action required to achieve Objective G3. Animating cluster initiatives will involve a lot of commitment and require consistency and persistence. In order for more business communities to take advantage of industry or value-chain synergies, the region will support the development of seed-stage (years 1–3) cluster initiatives with themes related to smart specialisation. Existing cluster initiatives with several

years of experience might, in turn, benefit from support for the implementation of a new service [2].

The third action to achieve Objective G3 is the provision of support for the transformation and internationalisation of regional innovation ecosystem entities (A3.3). Changing conditions and new opportunities appearing on the horizon require constant adjustments from companies, including changes in business models and increased scales of activity. In these activities, SMEs in the region will be supported by a system of vouchers for services implemented by business-support institutions, as well as by repayable financial instruments and guarantees and guarantee schemes. Regional product brands and regional specialisation products will also be supported in the field of export promotion or by building a presence in international supply chains. Business support institutions, whose regional networks will be strengthened in terms of infrastructure and resources, will become the backbone of the transformation of SMEs. Support will also be provided for the preparation of investment areas, giving space for development to companies from the region, but also to external investors, including the Silesian Voivodship. Support for higher education and science entities in the transformation processes will contribute to strengthening their position in the area of innovation diffusion (e.g. the commercialisation of R&D outputs) and to intensifying their activities in the international arena [2].

Objective G4 will be achieved through three actions. The first relies on the development of employees' competences for the competitiveness of the regional economy (A4.1). Experiences gained so far indicate the relevance of raising the competencies of employees working in the regional economy and increasing the adaptability of both employees and the companies in which they work. Advanced competencies in cyber security and the data economy are key. Actions undertaken in this area will be complemented by direct support for business-support institutions and the managers of cluster initiatives, in response to a need for the further professionalisation of their activities. Training and advisory activities for the development of competencies and improvement of scientific staff in higher education and science, both in their areas of specialisation and in terms of research infrastructure management or the commercialisation of the results of R&D work and their cooperation with business, are of great importance for strengthening links within smart specialisations.

The second action for Objective G4 is the strengthening of the regional innovation ecosystem (A4.2), through which Silesian Voivodship will continue the initiatives of the regional innovation ecosystem via further activities of the *Network of Regional Specialised Observatories* and dissemination of the idea of regional DIHs. In the first case, support will be directed to networking between enterprises and scientific units for smart specialisations. In the second case, support will be provided for operating costs and information, training and advisory activities that address SMEs within the framework of hub activities. There will also be an investment component for demonstrators. The activities of both types of entities will ensure the continuity of EDP, networking and brokerage activities within smart specialisations in the region [2].

The third action to achieve the goals of Objective G4 will involve strengthening competencies for the internationalisation of regional innovation ecosystem entities (A4.3). In the region, building openness to new technological and market trends will be promoted by supporting a preparatory process for the participation of SMEs, business environment institutions and higher education and science entities in international programmes for the development of innovation. In particular, training and advisory activities will be supported in the development of qualifications for scientific and research teams, including in the context of strengthening their competencies towards the diffusion of innovation in areas related to smart specialisation [2].

The actions described in the strategic provisions of the RIS will enable the realisation of flagship projects. Each of these projects will respond to one or several of the objectives described in the RIS and will play a role in *Silesia 2030*. In total, there will be 13 flagship

projects. These are presented in Table 2, along with the specific objectives they are responding to, their role in the RIS, their extent and expected outcome [2].

**Table 2: Flagship projects servicing *Silesia 2030* [2]**

| **Name** | **Eco-innovations in the region** |
|---|---|
| Response to specific objective | G1, G3 |
| Role in the *Silesia 2030* strategy | Part of the project *Innovative Silesia, the Highway of the Companies of the Future* with the scope of:<br>- Supporting the development and cooperation of companies operating in areas of smart specialisation<br>- Supporting companies in the field of export activity |
| Extent | - Regional research agendas for the green economy<br>- Specialised support services for the implementation of eco-innovations in companies – the green transformation of enterprises<br>- Promotion of developed solutions in international markets<br>- Financial support—the Silesian Fund for Eco-innovation Development<br>- Specialised support services for the market introduction of eco-innovations |
| Expected outcome | - Generation and implementation of green technological and non-technological innovations<br>- Recognition of entities from the region in the international arena<br>- Increase in the level of diversification of the region's economy |
| **Name** | **Silesian science and technology parks** |
| Response to specific objective | G1, G3, G4 |
| Role in *Silesia 2030* strategy | Part of the project *Innovative Silesia, the Highway of the Companies of the Future* with the scope of:<br>- Investing in highly specialised, integrated industrial and research centres (technology parks in the area of smart specialisation – regional networks, universities and research centres in higher education institutions, R&D centres, scientific and research units, and research institutes)<br>- Supporting the development and cooperation of companies operating in the area of smart specialisation<br>- Developing and comprehensive supporting the patenting and implementation process |
| Extent | - Support leadership between science and technology parks to aggregate and underpin companies with high technological potential<br>- Strengthen the technological resources around smart specialisations<br>- Implement scale-up projects<br>- Promote the region as a strong support centre for technological innovation |

| | |
|---|---|
| Expected outcome | - Development of technology companies based on dedicated technology infrastructure<br>- Effectively attract young technology companies from outside the region and country |
| **Name** | **Silesia the top Polish technologies for medicine** |
| Response to specific objective | G1, G3 |
| Role in *Silesia 2030* strategy | Part of the undertaking *Innovative Silesia, the Highway of the Companies of the Future* with the scope of:<br>- Investing in highly specialised, integrated industrial and research centres (technology parks in the area of smart specialisations—regional networks, universities and research centres in higher education institutions, R&D centres, scientific and research units, and research institutes)<br>- Supporting the development of, and cooperation between, companies operating in the areas of intelligent specialisation<br>- Supporting companies in the area of export activity |
| Extent | - Regional research and implementation agenda for medical technology<br>- A platform for industrial collaboration focused on building international partnerships in technologies for medicine<br>- Demonstration of activities and exhibition spaces to support the development and dissemination of technologies for medicine<br>- Building entrepreneurial competencies and an interdisciplinary approach to creating medical devices<br>- Supporting the use of artificial intelligence, machine learning and service robotics in the development of technologies for medicine<br>- Promoting the region as a location for the development and provision of modern medical services<br>- Investing in research infrastructure in companies |
| Expected outcome | Growth of companies developing current global state-of-the-art technologies and products for medicine |
| **Name** | **Map of regional key research infrastructure** |
| Response to specific objective | G1 |
| Role in *Silesia 2030* strategy | Part of the undertaking *Innovative Silesia, the Highway of the Companies of the Future* with the scope of:<br>- Investing in highly specialised, integrated industrial and research centres (technology parks in the area of smart specialisations—regional networks, universities and research centres in higher education institutions, R&D centres, scientific and research units, and research institutes) |
| Extent | - Inventorying and mapping of regional key research infrastructure assets<br>- Create a dedicated fund for the maintenance of regional key research infrastructure |

| | |
|---|---|
| | - Create a new research infrastructure—European Centre for Cancer Immunotherapy |
| Expected outcome | Access to highly specialised research centres in areas of smart specialisation |
| **Name** | **Testing of social and technological innovations** |
| Response to specific objective | G1 |
| Role in *Silesia 2030* strategy | Part of the undertaking *Innovative Silesia, the Highway of the Companies of the Future* with the scope of:<br>- Investing in highly specialised, integrated industrial and research centres (technology parks in the area of smart specialisations—regional networks, universities and research centres in higher education institutions, R&D centres, scientific and research units, and research institutes)<br>- Supporting the development and cooperation of companies operating in areas of smart specialisation |
| Extent | - Animating and financing pilots and technology demonstrators for the development of smart city districts and advanced public services<br>- Implementing living laboratories through consortia of SMEs, scientific institutions and business-support institutions |
| Expected outcome | Improve and accelerate processes of new product and service development |
| **Name** | **Regional innovation vouchers** |
| Response to specific objective | G1 |
| Role in *Silesia 2030* strategy | Part of the undertaking *Innovative Silesia, the Highway of the Companies of the Future* with the scope of:<br>- Developing financial and organisational instruments to create and support companies implementing new technologies and high-risk companies |
| Extent | - Financing of pro-innovative services ordered by SMEs in connection with the implementation of incremental innovations or preparation to move to more advanced technological changes<br>- Financing of services in the scope of R&D works comprising the development of a new or significantly improved product (product, service) or process |
| Expected outcome | Increase the competitive advantage of businesses |
| **Name** | **Digital solutions for public services** |
| Response to specific objective | G2 |
| Role in *Silesia 2030* strategy | Part of the undertaking *Innovative Silesia, the Highway of the Companies of the Future* with the scope of: |

| | |
|---|---|
| | - Supporting the development and cooperation of companies operating in areas of smart specialisation |
| Extent | Support the creation of regional digital public products and services for the development of green energy, a circular economy, water supply and wastewater treatment, environmental restoration and economic transformation |
| Expected outcome | Develop innovation in public services |
| **Name** | **DIHs** |
| Response to specific objective | G2 |
| Role in *Silesia 2030* strategy | Part of the undertaking *Innovative Silesia, the Highway of the Companies of the Future* with the scope of:<br>- Supporting and developing the activities of DIHs, operating within a one-stop-shop model<br>- Supporting companies in their export activity<br>- Developing and comprehensively supporting the patenting process and implementations |
| Extent | - Consultancy and one-stop-shop services for industrial enterprises in digital transformation processes in the fields of automation and robotics, including artificial intelligence, cyber security, smart materials and incremental technologies<br>- Consulting and one-stop-shop services for application of the Internet of Things in society, including smart-cities development programmes<br>- Consulting services for introducing optimisation or innovation in the existing way of manufacturing products, or providing services, as well as manufacturing new products or providing new services, based on state-of-the-art digital technologies |
| Expected outcome | - Increase the level of adoption of digital technologies in industry and services<br>- Increase the level of uptake of business and municipal process digitisation solutions |
| **Name** | **Platform of Silesian start-ups** |
| Response to specific objective | G3 |
| Role in *Silesia 2030* strategy | Part of the undertaking *Innovative Silesia, the Highway of the Firms of the Future* with the scope of:<br>- Developing financial and organisational instruments for the creation and support of companies implementing new technologies and high-risk companies |
| Extent | - Promoting innovative entrepreneurship and accelerating technological ideas through business consulting, building relationships with partners, suppliers and potential customers, and preparing for capital investment processes<br>- Financially supporting a PoC phase<br>- Capital investment in seed phases and the first investment round |

| | |
|---|---|
| Expected outcome | - Increase the number of innovative ideas realised by start-ups<br>- Increase the survival rate of young technology companies |
| **Name** | **Incubation of technology companies 3.0** |
| Response to specific objective | G3 |
| Role in *Silesia 2030* strategy | Part of the undertaking *Innovative Silesia, the Highway of the Companies of the Future* with the scope of:<br>- Supporting the development and cooperation of companies operating in areas of smart specialisation |
| Extent | - Creating incubation programmes, according to the incubation 3.0 process and accelerating programmes for technology companies, along with providing financing up to the level of the first sale<br>- Strengthening business support institutions offered to start-ups and growing companies |
| Expected outcome | - Creation of support programmes corresponding to European systems<br>- Increase the number of technology companies bringing a product to market |
| **Name** | **Network of regional SOs** |
| Response to specific objective | G4 |
| Role in *Silesia 2030* strategy | Part of the undertaking *Innovative Silesia, the Highway of the Companies of the Future* with the scope of:<br>- Supporting the development and cooperation of companies operating in the areas of smart specialisation<br>- Supporting companies in the field of export activity<br>- Developing and providing complex support during the patenting process and implementations |
| Extent | - Continuing of SO RIS activities<br>- Improving methods and tools for collecting and disseminating knowledge about technological and market trends in SO RIS activity areas<br>- Implementing the EDP and indicating new methods of conducting the process<br>- Establishing a cyclical survey of indicated groups of companies<br>- Expanding the group of stakeholders in each SO in order to build permanent relationships and to gather knowledge for more effective management<br>- Developing and implementing services provided by the members of the network aimed at supporting a company in the region in producing and implementing innovations, among other things<br>- Providing information on, and promoting, good practices<br>- Initiating and animating key regional R&D programmes |
| Expected outcome | - Facilitate access to up-to-date knowledge on the region's smart specialisations<br>- Efficient EDP with the participation of regional innovation ecosystem entities |

| Name | Programme for improving and changing professional qualifications to service the needs of green energy |
|---|---|
| Response to specific objective | G4 |
| Role in *Silesia 2030* strategy | Part of the *Educational Silesia* undertaking with the scope of:<br>- Developing educational and peri-educational infrastructure, including universities<br>- Developing an effective system of vocational education and professional re-orientation, including greater inclusion of entrepreneurs and an individualised approach to vocational guidance |
| Extent | - Providing upgrading and re-training for jobs related to technologies, including renewable energy, mechanical ventilation (recuperation), hydrogen, transportation electrification, building renovation, and a resource efficient economy |
| Expected outcome | - Provide human resources for a sector with high growth potential<br>- Retrain workers leaving the fuel and energy sectors |
| **Name** | **Laboratory for New Technologies in Żory** |
| Response to specific objective | G4 |
| Role in *Silesia 2030* strategy | Part of the *Educational Silesia* undertaking with the scope of:<br>- Developing educational and peri-educational infrastructure, including universities<br>- Developing an effective system of vocational education and professional re-orientation, including a greater inclusion of entrepreneurs and an individualised approach to vocational guidance<br>- Developing new models of education with the use of innovative technologies, including ICTs |
| Extent | - Construction of a technology centre aimed at educating children, youths and adults using modern experimentation methods<br>- Promotion of entrepreneurship in areas related to new technologies |
| Expected outcome | - Dissemination of issues related to the development of new technologies in the western sub-region (still strongly associated with the mining industry) |

# 4 Action plan for the roadmap

## *4.1 Assessment and prioritisation of the proposed measures*

The smart specialisation in the current RIS for the Silesian Voivodship includes priority areas, the symbiosis of various technologies, products and services developed and offered on the domestic and foreign markets by entities in the regional innovation ecosystem, which, thanks to the financial support, will be able to gain a competitive advantage in the international arena and contribute to the economic growth and to an improvement in the quality of life for the region's residents. Defining a list of smart specialisations by the Silesian Voivodship was a prerequisite for the use of structural funds under the Objective 1 of the Cohesion Policy,

according to the document: *A smarter Europe through supporting innovation and smart economic transformation in the years 2021–2027*.

In 2014–2020, the Silesian Voivodship selected at first three and, after an update in 2018, five smart specialisations. The first three were identified on the basis of the foresight process conducted under the theme "*Priority technologies for the sustainable development of the Silesian Voivodship*" and were based on complementary work related to the preparation of the *Technology Development Programme* of the Silesian Voivodship for 2010–2020. The list of smart specialisations in the beginning included energy, medicine and ICTs. The two new smart specialisations that have been proposed in subsequent years, based on the EDP and a mid-term analysis, were green economy and emerging industries [2].

According to the assumptions behind conducting the EDP in the region, a number of works and data analyses were conducted to verify the adopted specialisations and to look for emerging new technological groups. The process, led by the Office of the Marshal of the Silesian Voivodship in Katowice, used various available instruments to maintain transparency and provide the possibility of listening to many stakeholders.

The regional specialisations that developed originally resulted from an extensive regional dialogue, including an extensive foresight process. The discourse involved various groups of stakeholders, specialists and researchers. The group of specialisations defined in the process was so well identified that they became a permanent core, indicating the innovative direction of the region's development. Due to the continuous process of research, analysis and data publication, the Specjalist Observatories Regional Innovation Strategy (SO RIS) system is unique, having no equivalents in other systems in Poland. At the same time, due to the clearly defined directions of interest of the Specjalist Observatories (SOs), the Marshal's Office conducted individual studies to reveal a broader technological horizon. The research system proposed in this way made it possible to obtain data revealing new technological groups and provided in-depth data concerning the regional specialisations indicated earlier.

During consultations with the members of the SOs, it was indicated that the further process of EDP conducted by the SOs could be directed towards the acquisition and publication of a wider range of data, obtained directly from the main regional entities representing the indicated specialisations. Making some modifications supplemented the source of information and data, which allowed for better indications of the direction of industrial development, the direction of expected support and the advantage of international potential. It was also important to obtain information on key projects and the direction of scientific work of an implementation nature. The consultations indicated that the process should continue to be directed and modified by the Office of the Marshal, as the entity that had the greatest knowledge and tools to be able to continuously improve the efficiency of the system of data collection and analysis. It was also recognised that the recommendations previously developed in the region for conducting the EDP were valid.

The recommendations highlighted the need to integrate distributed and unstructured data concerning technological areas. The data acquired by the SO RIS, related to global trends, the latest research and implemented innovations, and about local stakeholders in the innovation ecosystem, is currently a scattered set of information. The integration of specialised data on projects, the offer of scientific and research units and business environment institutions, and the needs of entrepreneurs can be used as sources of new ideas and concepts for marketable products and technologies, the realisation of which will be possible using regional resources and the cooperation of various entities. In this regard, it is suggested that the already operating "Innobservator Silesia" portal needs to be extended with new functionalities and integrated with existing databases.

Another recommendation underlined the need to provide a mechanism for making detailed statistical data available. Despite a number of limitations related to the availability and detail of

the data, public statistics are an important source of information on technological areas in the Silesian Voivodship.

The next recommendation was to intensify and improve the quality of the needs analysis process. The needs survey is the main instrument for realising the process of entrepreneurial discovery and obtaining reliable information on the effectiveness of implemented solutions in the area of innovation support. However, the intensity of the needs analysis process varies and requires a continuous improvement in competence by the SOs carrying it out. The development of the needs analysis process and its dissemination, supported by improvements in the competence of the staff of the SOs and the promotion mechanism, will make it possible to obtain complementary information at regular intervals that is very important for the decision-making process.

Another recommendation indicated that it is necessary to update the offer of scientific entities because the needs of entrepreneurs in particular technological areas could be met by regional research resources and by regional scientific staff. Entrepreneurs, especially from the SMEs field, cannot fully engage in the laborious process of searching among dispersed R&D units for what they need and often end up choosing solutions at random, often reaching for R&D potential outside the region. A coherent offer of conducted and completed research, infrastructure and services, made available in one place, would have significant utility to professional R&D services.

In accordance with the next recommendation, there is a need to create links between the R&D sphere and entrepreneurs by, inter alia, supporting the development of high-ranking centres, laboratories, scientific and technology parks. In these, it will be possible to conduct research in interdisciplinary teams of specialists with the participation of the enterprise sector, and involving the further development of cluster initiatives, scientific and industrial consortia to support the creation of spin-off and spin-out companies, initiating and supporting patents, start-up and grant funds, and enabling the practical implementation of technology transfer tools.

The last recommendation concerns developing methods for identifying and assessing areas of technological advantage. Experience from the Silesian EDP has shown that the effectiveness of the process of identifying and assessing areas of technological advantage depends on the wide use of different methods and tools. Especially important are those that ensure the direct involvement of stakeholders from different technological areas. The continuation and intensification of the EDP requires a comprehensive approach to the services provided by the SOs, such as technology intelligence and consulting, technology scouting, the development of business models, identification of value chains, etc. In addition to dedicated solutions, smart specialisation panels could be set up in the region to engage representatives from different technological areas in discussions on identifying and updating smart specialisations.

Updating the list or scope of smart specialties and selecting more flagship projects should result from applying procedures under the following mechanisms:

- the EDP;
- interdisciplinary monitoring and the evaluation of smart specialisations; and
- public–private partnerships.

## *4.2 Specification of the set of actions required to implement the roadmap*

**Process of updating smart specialisations in the current RIS of the Silesian Voivodship**

The RIS of *Silesia 2030* lays out objectives and actions in the field of technological and innovative development for the region to enable fulfilment of the vision of the region defined as *Silesia 2030*, i.e. a modern European region with a competitive economy, which is the result

of responsible transformation, providing opportunities for the development of its inhabitants and offering a high quality of life in a clean environment.

The Silesian Voivodship has applied the process of entrepreneurial discovery (EDP) within the *Network of Regional Specialised Observatories*. In the period leading up to 2030, the process of entrepreneurial discovery will be realised in three ways: public statistics, the technological work of the SOs RIS, and analytical and coordination work carried out by a team from the Marshal's Office of the Silesian Voivodship. Efforts will be made to ensure that the allocation of public funds is strongly linked to the system of data collection, which, in anonymised form, will be an additional source of valuable information on the impact of public intervention and activity in regional specialisations. The SOs included in the RIS will introduce a modification of the data collection methodology, placing a stronger emphasis on cooperation with numerous groups of enterprises, as well as higher education and science entities, in order to develop a canon for permanent data collection on technological and market aspects related to innovation potential in the region, including in smart specialisations [2].

Bearing in mind the fair transformation process that the Silesian Voivodship is supposed to go through in the following years, one might expect a slow and sudden disappearance of some traditional industries and their replacement by new economic initiatives. The Office of the Marshal of the Silesian Voivodship intends to continue to conduct cyclical thematic research in order to identify areas of growth, to draw conclusions in the context of gaps and opportunities for development, and to set new and/or update smart specialisations.

In particular, the following process (see also Figure 2) is assumed:

- identification of signals and events in the activities carried out by SO RIS actors in their ecosystems; this involves appropriately using the position and role of SO RIS actors in different areas of the economic, scientific and educational sectors in the region to identify signals and events that require further research;
- cyclical thematic research and the assessment of gaps and opportunities for development based on data, including quantitative data (public statistics, industry reports), data from reports made by RIS SO entities and information obtained during the process of researching the needs of entrepreneurs and entities in the system of higher education and science;
- definition of an area of a new or updated smart specialisation based on the confrontation of conclusions from research and the assessment of gaps and opportunities for development with expert opinions, as well as the development of proposals for new or updated smart specialisations by expert teams; and
- promotion of support instruments among the entities of intelligent specialisation in order to engender innovative activity, together with initiating animation processes by RIS SO entities or other entities in the regional innovation ecosystem, undertaking the role of animator of development processes in a given intelligent specialisation.


**Figure 2: Procedure for identifying and updating smart specialisations [2]**

The use of a bottom-up approach (Figure 2) makes it possible to focus the support system on real needs, leading to the smart and sustainable development of the region, where the main premise is the development of endogenous regional resources and the effective involvement of enterprises in R&I. The process of the ongoing monitoring of smart specialisation is carried out in the RIS. The Marshal's Office of the Silesian Voivodship aims to ensure the broad

involvement of various stakeholder groups in the process of development on the basis of smart specialisation [2].

**Implementation and financing of the RIS**

As mentioned above, the RIS is part of the complex *Silesia 2030* development strategy, which is the basic planning document for the region. In 2021, the RIS was adopted by the Board of the Silesian Voivodship. The self-governing Voivodship is responsible for its implementation. Coordination work related to the implementation of the strategy is carried out by the Regional Development Department of the Regional Innovation Strategy Unit.

The main areas of activity of the local government of the Voivodship in implementing the strategy include:

- allocating funds earmarked for the implementation of strategic provisions under the Regional Operational Programme of the Silesian Voivodship for 2021–2027;
- allocating funds earmarked for the implementation of strategic provisions within the Voivodship budget;
- striving for the mobilisation of additional external resources, particularly national resources for the implementation of the strategic provisions;
- making efforts to take into account the specificity and scale of the need for innovation support in the Silesian Voivodship resulting from ongoing transformational processes in the national solutions;
- supporting the initiatives of the participants in the regional ecosystem for innovation; and
- supporting local initiatives for innovativeness.

In the management of the RIS, the Board of the Voivodship draws on the opinions of two bodies, to which representatives of the circles forming the regional ecosystem for innovation have been appointed. These bodies are the Steering Committee of the RIS and the Silesian Innovation Council. The Steering Committee of RIS advises the Voivodship Board on matters concerning the implementation of the RIS and the programming, coordination, implementation, monitoring and evaluation of the Voivodship development policy in terms of innovations. The actions of the Steering Committee are supported by the Silesia Innovation Council, which aims to undertake substantive work on the main tasks resulting from the current needs of the region with regard to innovation development. The results from the Council's work are presented as expert opinions and written reports at Steering Committee meetings.

The key partners for implementing the RIS mainly include the entities forming the SO RIS network, along with universities, research institutes, business environment institutions, cluster initiatives and funds that are not directly included in the SO RIS network. Interdisciplinary monitoring and the evaluation of smart specialisations will be based on the establishment of interdisciplinary groups for smart specialisations in the Silesian Voivodship, and will include a foresight process. These groups will constitute an opinion-giving forum, charged with making current decisions on detailed solutions concerning the implementation of policy towards smart specialisations, mainly in the field of creating guidelines for the selection and implementation of key regional R&D projects.

Looking ahead, *Technologies of the Silesian Voivodship with a view to 2050* will be another edition of a large regional project in the field of prospective studies, involving a wide group of experts from the regional innovation ecosystem, as well as from outside. It is assumed that the foresight process will allow key thematic areas for the long-term technological development of the region to be determined.

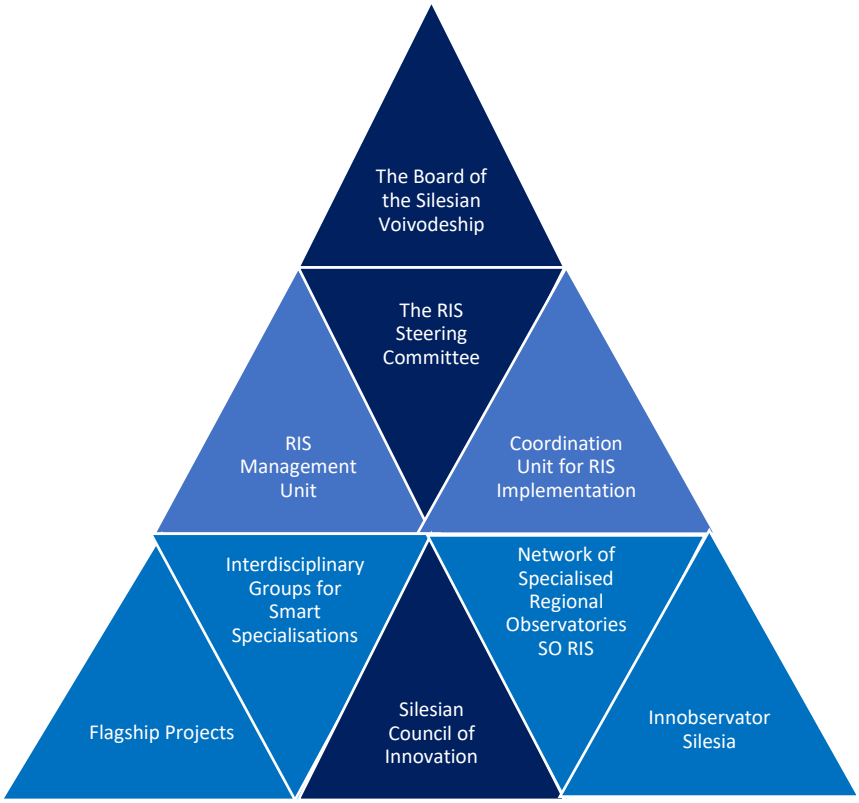


**Figure 3: Structure of the management and implementation of the RIS in Silesia [2]**

## Financial framework

The main source of financing for the RIS will be the European Funds SL for 2021–2027, relating to the implementation of Objective 1 of the Cohesion Policy. Contributions for co-financing the projects are to come from the beneficiaries' own resources or, possibly, from within the framework of financial engineering, supplemented by resources from instruments such as loans, credit lines, guarantees or venture capital, and from regional and national public funds [2].

It is foreseen that, as a result of the activities undertaken by enterprises and other institutions in the innovation ecosystem of the Silesian Voivodship, available financial resources from national operational programmes and international support programmes for the promotion of R&D (e.g., Horizon Europe) will be used. In order to increase interregional cooperation, including in the context of the exchange of good practices and the realisation of joint investments or for establishing scientific and business cooperation, European support programmes will be used [2].

One of the financing mechanisms supporting the implementation of projects related to the strategy will involve those resources remaining at the disposal of the Silesian Development Fund. It has been decided to build a durable, long-term system of financing for SMEs and local self-government units in the region through repayable financial instruments. It would be advisable for the resources coming from the repayable instruments to be directed to the implementation of the RIS and for these to finance part of its objectives from the moment of its implementation.

It is also envisaged that the funds available for the Facility for Reconstruction and Increased Resilience will be able, in part, to finance the objectives of the *Silesia 2030* strategy, especially in terms of economic transformation and human resources development. Directions of support in this context have been taken into account in the intervention logic matrix of the Regional Plan for Equitable Transformation of the Silesian Voivodship 2030 [2].

### Monitoring and evaluation

Monitoring of the RIS comes under the monitoring and evaluation system of the development strategy *Silesia 2030*. Responsibility for the monitoring and evaluation of the implementation of the RIS lies with the Board of the Silesian Voivodeship. The Department of Regional Development will be responsible for the monitoring and cyclical evaluation of the process [2]. Cyclical and thematic evaluations will be carried out via the ordering of independent expert studies and in the form of consultations with the previously described groups, which include representatives of the entities forming the regional ecosystem for innovation, such as the Steering Committee of the RIS and the Silesian Innovation Council [2].

The regional SOs will carry out long-term research on groups of companies, the selection and number of which will be determined by a research methodology developed by a committee from the Marshal's Office of the Silesian Voivodship. Data will be included in annual reports from the SOs and will be periodically transferred, according to the methodology, to the Office of the Marshal of the Silesian Voivodship. In this way, the Marshal's Office will have a new, reliable resource of constantly updated knowledge, coming directly from enterprises [2].

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