

Chapter 3

PP3 Lower Silesia

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1. Overview

Lower Silesia is a region fully committed to the circular economy cause although circular economy is a quite new topic in Poland. That's why Lower Silesia is also very keen to learn from policy experiences in other European Regions who share the same circular ambitions.

On the national level, a road map of transformation towards a circular economy in Poland has been prepared, which is one of the strategic projects of the Strategy for Responsible Development. The Roadmap is intended to identify, in particular, actions to increase resource efficiency and reduce waste generation. But encompassing a much broader range of activities, it has a comprehensive set of tools to move from a linear economy to a circular economy.

In the Lower Silesian Voivodship, the principles of circular economy are also implemented. Effective waste policy at the municipal level and the involvement of production companies in innovative projects that fit into the closed loop economy. At the level of regional self-government, the Economy Division in the Department of Regional Development of the Marshal's Office of Lower Silesia started cooperation with selected European regions in the area of closed-loop economy within the framework of the Circular Economy Project.

2. Strategic analysis

Regional Innovation Strategy for Lower Silesia Province for the years 2011-2020 constitutes currently applicable strategic document defining challenges the region faces in terms of knowledge-based economy and innovation growth in Lower Silesia. This strategy was adopted by the Regional Board in 2011. Although the title of the document does not refer to the Smart Specialisation Strategy (the RIS3 concept was formulated after the Regional Innovation Strategy for Lower Silesia Province has been adopted), it contains elements recommended by the European Commission as regards this concept. In the RIS for Lower Silesia Province, the so-called key industries and scientific and

technological specialisations according to research centres and enterprises operating in the region were identified. The document is based on the SWOT analysis and describes a system for monitoring objectives, evaluation of the entire programme and the proposed sources of financing the identified actions. In addition to the RSI, the Strategy Implementation Plan for the years 2012-2014 was developed. The document was drafted by various working groups involving business and science; their representatives had a seat on the RSI Steering Committee.

Due to the fact that the RSI was drafted primarily on the basis of source data from the years 2009-2010, it was necessary to add an attachment thereto, which takes into account recent changes in the sectors of R&D and business.

This attachment is entitled ***Strategic Framework for Smart Specialisations of Lower Silesia*** and indicates areas of smart specialisations of Lower Silesia along with verification mechanism and programmed process of entrepreneurial discovery. Its purpose is to help the region adhere to the European Commission guidelines on Smart Specialisations, thereby helping Lower Silesia fulfil the criteria of ex ante conditionality in the context of funds for research and innovation under the Regional Operational Programme 2014-2020.

There are 6 smart specialisations identified in Lower Silesia:

- 1) CHEMICAL AND PHARMACEUTICAL INDUSTRY**
- 2) SPATIAL MOBILITY**
- 3) HIGH QUALITY FOOD**
- 4) NATURAL RESOURCES AND RECYCLABLE MATERIALS**
- 5) MACHINES AND EQUIPMENT MANUFACTURING, MATERIALS PROCESSING TECHNOLOGY**
- 6) INFORMATION AND COMMUNICATION TECHNOLOGIES (ICT)**

Circular Economy topics can be found in each specialisation. Considering the relevance and potential in circular economy we decided to work on two areas: High Quality Food and Natural Resources and Recyclable Materials. High Quality Food and Natural Resources And Recyclable Materials are complementary with the sectors chosen for the Circe project: Raw Materials, Biomass

and Food Waste. Analysis of opportunities for the two of the sectors was performed, as they are of greater interest than the third.

Details

HIGH QUALITY FOOD includes the following sub-areas:

1. Foodstuffs used in the initial or supplemental prophylactic and therapeutic procedure.
2. Dietary supplements and foodstuffs intended for particular nutritional uses.
3. High quality feeds and alternative foods in pharmacotherapy of livestock and domesticated animals.
4. Specialist animal feeds and supplements.
5. Organic, traditional, regional and local food.
6. Functional foods and nutraceuticals.
7. Nutritionally enhanced foods.
8. Technologies for packaging and storing products from sub-areas of smart specialisation.
9. Methods for assessing the quality of products from sub-areas of smart specialisation.
10. Technologies for manufacturing products from sub-areas of smart specialisation.

The food industry was not ranked among major specialisations of Lower Silesia Province. It shows no geographical concentration in the region across the country, either in terms of the number of business entities or production value. Foodstuffs account for about 3% of regional exports. As far as the structure of industrial production is concerned, the food industry represents slightly more than 5% of the value, but the growth in production value is quite dynamic compared to the situation a few years ago (by approx. 40%). Although the industry shows a decline in employment in recent years, 11,800 people is working in the food industry.

A chance for this industry growth lies in the rebuilding food processing industry capacity but primarily in the development of functional, organic and traditional food production and dietary

supplements with the use of regional scientific and technological potential. In the food sector, expenditures on innovation activity account for 3.5% of expenditures in the whole industry, but in the years 2009-2012 they increased in value nearly three times, which certainly must be regarded as a positive phenomenon, conducive to new challenges.

Functional food (a food given an additional function, often one related to health-promotion or disease prevention) and nutraceuticals (products derived from food sources that are purported to provide extra health benefits, in addition to the basic nutritional value found in foods) play an increasingly important role in healthy eating, contributing to the prevention against lifestyle diseases (also called diseases of civilisation) in terms of public health. This market segment will continue to develop because of the challenges arising from increased prevalence of metabolic diseases caused by poor nutrition. Epidemiological studies and clinical trials clearly indicate that lifestyle involving well-balanced diet and physical activity has tremendous impact on human health. According to the World Health Organisation, by 2020 nutrition-related chronic diseases will account for almost three-quarters of all deaths in the world. This shows an important role of disease prevention, including proper nutrition. Thus, food (especially next-generation food with distinct characteristics related to human health such as functional food and nutraceuticals), and healthy diet make up an essential element of public health.

Nutraceuticals and functional foods processing technologies are sophisticated, highly-advanced and precise, and do not significantly impact biological activity of natural substances; moreover, they even improve nutritional value of final products. Generally, these are innovative technologies that require high intellectual and engineering as well as financial investments.

Strengths:

- well-developed research infrastructure and strong R&D base (research centres and R&D facilities),
- advanced manufacturing facilities,
- consolidation of scientific community in Lower Silesia as regards joint actions,
- market knowledge in enterprises involved in the health foods production,

- good quality of products offered by the food sector, excellent natural conditions for food production and agricultural development,
- traditions of the food sector in the region,
- the presence of clusters (consolidation in the food industry).

Weaknesses:

- low level of expenditures on research and development, conducting mainly basic research,
- insufficient funds for investments financing,
- the shrinkage of the agri-food sector in the region,
- the dominance of small producers,
- the food industry and agriculture are low-tech sectors,
- low level of consolidation within manufacturer groups,
- lack of research and development facilities in enterprises,
 - low consumer awareness of functional foods,
 - insufficient cooperation between the agri-food sector and science,
 - low expenditures on the development of innovative health-related products,
 - poor mobilisation of scientific community as regards start-ups creation.

Opportunities:

- fast-growing functional food segment in Europe and Poland,
- population aging and the need for health prevention in the area of diet-related diseases,
- increase in consumer awareness in the area of functional foods and preventive healthcare, fashion for functional foods,
- increase in wealth of the society, hence growing interest in health-related behaviours,
- interdisciplinary nature (a combination of the agri-food sector, the chemical, medical, and pharmaceutical industry),
- preference for local and Polish products,
- regional cluster initiatives to support agricultural producers,
- health-oriented education,

- the presence of active scientific community involved in the development of innovative ingredients in foodstuffs of major importance for health, including the establishment of the Regional Centre for Innovative Technologies for Production, Processing and Food Safety,
- active scientific community supporting the establishment of sectoral start-ups with the use of new technologies,
- internationalisation of this specialisation within Lower Silesian technology parks.

Threats:

- higher prices of functional foods,
- consumers' fear of modified foods,
- impoverishment of the society (choosing cheaper, conventional food),
- taking over the market by multinational corporations, globalisation of the food industry,
- deterioration of eating habits among young people and lack of awareness of diet-related and civilisation diseases,
- growing amount of paperwork and dynamically changing legal regulations regarding health foods, including dietary supplements.

NATURAL RESOURCES AND RECYCLABLE MATERIALS

This specialisation includes the following sub-areas:

1. Natural resources (acquisition, advanced processing and use):
 - a) technologies for acquisition, processing and use of mineral resources,
 - b) technologies for acquisition of new products from the main mineral,
 - c) integrated systems for monitoring of threats in the vicinity of mining plants,
 - d) technologies for acquisition, purification and use of ordinary, thermal and mineral waters,
 - e) technologies for acquisition, processing and use of wood and plant materials in innovative products,

- f) new therapeutic and spa services based on the use of natural resources.
- 2. Technologies for useful materials recovery, recycling and waste treatment.
- 3. Advanced materials:
 - a) new forms of raw materials (powders, microstructures, nanostructures, amorphous materials, etc.),
 - b) composite materials,
 - c) intelligent materials,
 - d) materials for industrial applications,
 - e) design and development of technology for manufacturing materials of functional properties.

What undoubtedly distinguishes Lower Silesia compared to other Polish provinces is the mining and primary (raw materials) sector and the natural resources processing sector. Polish, and thus regional, primary industry leaders include KGHM Polska Miedź SA, which is one of the largest Polish exporters and employees in Lower Silesia, and PGE GiEK SA Oddział Kopalnia Węgla Brunatnego Turów (the Turów brown coal mine). The Legnica – Głogów Copper District, where copper and silver are mined, and the Turoszów brown coal basin have to be mentioned in this context as well.

According to the analysis of the size of hard rock mining in the years 2001-2012, Lower Silesian Province is ranked first (among all Polish provinces) in mining of crush stones, stone blocks and regular elements production, and second in gravel and sand extraction. They are basic raw materials used in railway and road construction, residential construction and building construction. Lower Silesia is famous for its rich clay mineral deposits, including clays used to produce stoneware and porcelain, fire clays, white burnt clays, and kaolin. In the years 2001-2012, Lower Silesian Province was the only exploiter of quartzite slates, mica slates, bentonites, feldspars, and fire-proof and vein quartzite country-wide. It is worth noting that 95% of all mineral deposits occur in Lower Silesian igneous and metamorphic rocks.

The region is also rich in thermal and therapeutic waters, including unique radon springs, used in spa medicine and balneology. The region is also famous for its wood used in the pulp and paper and furniture industry.

Lower Silesia is an important research centre in the field of advanced materials and nanotechnology. The leaders in this area include: the Wrocław University of Technology, the University of Wrocław, the University of Environmental and Life Sciences, the Włodzimierz Trzebiatowski Institute of Low Temperatures and Structural Research of the Polish Academy of Sciences in Wrocław, the Institute of Electrical Engineering in Wrocław, the Wrocław Research Centre EIT+, KGHM Cuprum Sp. z o.o. Research and Development Centre and Opencast Mining Institute 'Poltegor Institute'.

Currently, the management structure of the Knowledge and Innovation Community (KIC) in the field of strategic raw materials is being established. One of such KICs (also known as the Co-location Centre (CLC) for Central and Eastern Europe) operating within EIT Raw Materials is dedicated to the primary industry in Wrocław. Within the KIC structure, research, educational and SMEs development-related activities are coordinated in cooperation with KGHM and the related companies. EIT Raw Materials gathers 116 partners from across Europe, including such world renowned market players as Umicore, Atlas Copco, Sandvik, Outotec and BASF. Both the industry interest and the participation of foreign entities have made it possible to specify needs related to the access to research findings on commercial terms.

The existing infrastructure of laboratories and pilot lines will be extended in cooperation with research centres from Lower Silesia, including: KGHM Cuprum Sp. z o.o. Research and Development Centre, KGHM Quality Research Centre, the Wrocław University of Technology (Geocentrum), the WRC EIT+ and industry entities such as KGHM SA and KGHM ZANAM Sp. z o.o. The project will enable the development of specialist research in the area of the mining industry and materials engineering. It is worth noting the experience of the WRC EIT+ in the field of research on the development of photonic and photovoltaic technologies, including the preferred light source (Solid State Lighting), new light-emitting diodes, next-generation photovoltaic cells based on organic materials and polymers as well as laser-based sensors. Another distinctive area covers research work in the field of functional materials such as nanomaterials, nanostructures, composite materials, and SMART

materials. The WRC EIT+ supports the primary sector by providing access to modern analyses of raw materials, steel industry products or manufacturers of end products in the areas of non-ferrous metals, unconventional sources of oil and gas and rare-earth metals.

The Lower Silesian Mineral Resources Cluster is located on the territory of the province and brings together the following entities: KGHM Ecoren SA, PCC 'Rokita' SA, the Strzegom Association of Masons (Stowarzyszenie Kamieniarzy Ziemi Strzegomskiej), universities and research institutions including: the Wrocław University of Technology, the University of Wrocław, the Opencast Mining Institute 'Poltegor Institute', Lower Silesian Advanced Technology Centre in Wrocław, and Lower Silesian Chamber of Commerce.

Recently, the Wałbrzych Raw Materials (Wałbrzyskie surowce) Cluster has been established. Its purpose is to gather together regional firms from the primary segment of the economy around advanced material technologies to encourage cooperation with business, science, local government units, and business environment institutions. The Stone Cluster (Klaster Kamieniarski) coordinated by the Foundation Basalt (Fundacja Bazalt) in Strzegom has a similar role to play in integrating companies from the primary sector.

Strengths:

- natural resources wealth in the region, including deposits of extrusive igneous rocks (e.g. basalt),
- strong global enterprises,
- flourishing research centres and R&D institutions as well as modern infrastructure,
- chain of laboratories operating within research centres and R&D centres,
- great consolidation of R&D environment,
- strong business environment institutions to attract businesses from outside Lower Silesia,
- large number of business environment institutions and industrial parks operating in the region.



Weaknesses:

- lack of natural resources processing industry, domination of companies involved in raw materials extraction,
- lack of innovation and poor investment in R&D on the part of small businesses,
- limitations related to environmental impact and risk of raw materials extraction.

Opportunities:

- re-industrialisation of Poland and the region,
- exploitation of rare-earth elements,
- search for alternatives to critical materials,
- diversification of KGHM business activity,
- making use of KGHM global position for the internationalisation of SMEs on the extra-EU markets,
- establishment of a knowledge and innovation community in the field of non-energy commodities (EIT KIC Raw Materials) and execution of two projects related to strategic natural resources, namely the GEO – 3EM Complex (Kompleks GEO – 3EM) and the Competence Centre for Strategic Natural Resources (Centrum Kompetencji Naturalnych Surowców Strategicznych),
- development of spa resorts based on regional resources of therapeutic and thermal waters,
- establishment of the Institute of Balneology using regional research potential for the development of spa medicine,
- establishment of composite technology cluster based on local natural resources, including basalt fibres,
- cross-border cooperation, including with Dresden and Saxony,
- exploitation of fossil fuels.

Threats:

- raw materials price fluctuations on world markets,



- increase in extraction costs,
- depletion of natural resources,
- high capital and social costs of opening of new mines,
- a long time elapsing between making a decision to open a new mine and actual beginning of commercial production,
- low social acceptance for new initiatives related to mining activities (including exploration of new deposits, location of mining infrastructure facilities, mining waste disposal).

3. The sectors analysis

In order to improve identifying promising sectors for Circular Economy solutions the following NACE codes for sectors have been used to represent the Circe sectors:

- built environment:
 - o F41 - Construction of buildings
 - o F42 - Civil engineering
 - o E38 - Waste collection, treatment and disposal activities; materials recovery – Just for built environment waste sector
- food waste:
 - o A1 - Crop and animal production, hunting and related service activities FOOD WASTE
 - o C10 - Manufacture of food products
 - o C11 - Manufacture of beverages
 - o E38 - Waste collection, treatment and disposal activities; materials recovery – Just for food waste sector
- Biomass (wood, paper, biomass):
 - o C16 - Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
 - o C31 - Manufacture of furniture
 - o E38 - Waste collection, treatment and disposal activities; materials recovery – Just for biomass waste sector



- Raw materials:
 - o C23 - Manufacture of other non-metallic mineral products
 - o C24 - Manufacture of basic metals
 - o B7 - Mining of metal ores
 - o B8 - Other mining and quarrying

The analysis was performed on these sectors to find and understand the opportunities for Circular Economy that the region have in the industry.

4. Opportunities

Lower Silesia region collected the information needed to identify circular economy opportunities thanks to meeting and dialogue with regional Stakeholders and units of Marshall Office.

RAW MATERIALS

Identification of opportunities and development niches

The most frequently mentioned developmental niche is the use of post-mining waste, which can be a source of valuable raw materials, which have not been used yet but can be valuable resources in the future. As an example, the experts point out the development of waste piles as sources of lanthanides (which do not occur in Poland as natural raw materials) and use them in new materials and devices such as hybrid motors. Furthermore, the accumulated multi-millionth waste of flotation waste and slag smelters as a result of KGHM activities become the subject of extremely profitable processing business. The concepts of using them as a raw material for the construction materials industry and in geoen지니어ing are well known. A part of the concept at this stage remains undisclosed.

-development of a technology that minimizes the impact of mining on the environment and promotes and disseminates the extractive industry as an indispensable industry for the functioning of every human being and the functioning of a number of consumer goods.

-production of processing machines and equipment for the mining industry and the processing of raw materials



-the use of hard-to-sell materials, unused and undemanding R&D expenditures, produced during the processing of rock raw materials, which are currently waste for the entrepreneur, and in other areas could be used industrially for example as a bitumen additive or for the production of mineral wool (except for the raw materials used for this purpose). In addition to using the smallest fraction for the production of mineral wool, they can be used for petroleum products (basalt lava) produced by melting rocks and casting them into desired shapes, e.g. acid-resistant pipes and sinks, and even usually cobblestones. It is also possible to connect basalt fibres into composites, e.g. with polyethylene. A part of the potential solutions at this stage remains undisclosed because of potential military applications. Fine basalt and melaphifone fractions, due to their chemical composition, can be used as slowly decomposed organic fertilizer. These type products are at the prices of EUR 3980 per ton while basal grits cost PLN 150 per ton.

-the technology of the system of exploitation of copper ore deposits in associated conditions at depths below 1200 m should also be developed. The authors of the study point out that, given the successive increase in depth and the constrained operating conditions, the risk of bumps in the future is to be expected.

The growing demand for demand for mineral resources, while the depletion of mineral resources, results in the fact that the development of mineral-based extraction technology should be a priority.

-development potential of the industry. Both the exploitation and processing of natural resources, as well as processing of wood, are historically related to these areas. The entrepreneurs applying the technological heritage see its possible imperfections and try to counteract them. The research shows that in the last 10 years, more than 1/3 companies (34.5%) have introduced innovations to their businesses, which is the evidence of the industry's growth potential.

-range of scientific research and teaching facilities of the region - Lower Silesia has a lot of potential in the existing universities and research institutes. The factor which can be an opportunity and real support for the development of innovation is to meet the expectations of the entrepreneurs and a demand from the labour market by pursuing specific fields of study at the universities of the region.

-growing demand for innovative products/services - For many years there has been an increase in the demand for the innovative products and services in the country and in the world. The innovations implemented by the companies are one of the response to the dynamic changes taking place in the market environment.

-increase in wealth of the society - The innovative products, arising through the use of the modern technology as a rule have a higher price, at least in the early stages of marketing. The success of RIS3 depends on some degree on the wealth in the region and the whole Poland. The continuing upward trend in wages and rising GDP are the indicators of positive developments in this area.



-development of environmentally friendly technologies - The specialisation based on natural raw materials, including non-renewable raw materials, impacts on the environment as a rule. Its entities constitute potential beneficiaries and creators of solutions that improve the environment or minimize the negative impact on its condition. Such solutions are an opportunity for the development of the industry, increasing its potential and opportunities for environmentally safe extraction and processing.

BIOECONOMY

Identification of opportunities and actions

- **identification of potential of local biomass:** identification of the source of bio-material of local demand. There is no reason for long distance transportation of biomass due to environmental issues. Both the supplier and the recipient should come from the same region as bio-material.

- **creating local links between entities cooperating within chain of values:** identification of barriers and initiators to create bio-community;

- **creating local biorafinery:** support for development of creating biorafinery, which enable of producing biomass with high standardized parameters consistent with expectation of the customers (industry);

- **models of economic activities in bioeconomy:** identification and activities for promotional activities of attractive areas for agroturism development and new forms of services development

-**increase of local biomass usage and increase of usage of biomass waste for power industry:** identification activities increasing production of domestic biomass for energy production, from local sources located not further than 200km. There will be proposed policy changes in this regard.

-**creation of environment to develop around one installation of biogas plant in rural municipality and rural-urban municipality (agricultural biomass producers):** support opportunities and regulatory barriers to the creation of biogas plants.

- **stimulating demand for bioproducts:** promotional campaigns for bioproducts launched to educate consumers that they can have the same or better attributes than other products, and at the same time are environmentally friendly and are produced based on natural ingredients;

- **creating norms and standards for bioproducts:** the activities to standardize bioproducts should increase of consumer confidence;





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- **support start-up development which specialize in industrial biotechnology:** support programs for new entrepreneurs operating in the economy sector and realizing idea of CE;
- **strengthening of R+D activities:** due to significant potential of the bio-economy, identification of barrier concerning research development and introduce of mechanisms to search for new bio-based products and replace raw materials with bio-materials.

