

**TECHNOLOGY POTENTIAL IN THE AREA OF PRODUCTION AND MATERIAL PROCESSING -  
CASE OF ŚLĄSKIE REGION**

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[lilla.knop@polsl.pl](mailto:lilla.knop@polsl.pl), [slawomir.olko@polsl.pl](mailto:slawomir.olko@polsl.pl)**Abstract**

The paper presents the main findings indicating relevant technologies for the development of the sector of production and material processing in Śląskie Region, Poland. The findings are results of analysis carried out by the observatory of material technologies operating within the framework of a network of specialist regional observatories in the region. According to the adopted assumptions, the analyses included technologies used in the region for the production and processing of: metallic materials, ceramics and plastic materials. The findings are crucial for rationalising the public support from the Regional Operational Programme (ROP) for the companies. According to European policy the entities receiving support should implement regional smart specialisation. In Śląskie region smart specialisations are complemented by technology areas indicated in technology development program for the years 2010-2020. The technologies in the area of production and material processing were analysed using two criteria: interconnections between technologies used in the region and the opportunity to create new products of the region.

**Keywords:** Technology assessment, regional development, material processing, metal manufacturing, smart specialisations

**1. INTRODUCTION**

Almost every region has the ambition of development disruptive innovation, according to Christiansen associated with new technologies that cause a shift in the technological paradigm and business routines; they create new products that eventually lead to the demise of existing products [1]. Disruptive innovation impacts the productivity of national economies [2], however the existing production and business potential of many European regions, including Śląskie, is based on traditional, commonly used technologies, which continuation does not lead to this kind of disruptive shift. The role of regional smart specialization strategy, according to EU strategic documents [3] is to foster the existing potential with knowledge created in regional scientific institutions [4]. The model of such cooperation may include a way of creating and using intellectual property [5]. Foray et al. proposed an approach of 6 steps and 18 sections for developing research and innovation strategies for smart specialisation [6]. Assuming that the process has to be rational and with the participation of important regional stakeholders, in the paper the method of description the potential of the production and material processing in Śląskie region is presented. The main goal of such analysis is rationalization of regional innovation policy - the main findings indicating relevant technologies are used for the diagnosis in the regional Technology Development Program (TDP). The main goal of the paper is to show that production and processing area has very high potential for the pretechnological development of the Śląskie region. In the paper some evidence confirming this thesis were presented. In this aspect it fits in general and wide discussion corresponding to the question what evidence indicates a high potential of technological area (group of technologies).

## 2. TECHNOLOGY POTENTIAL - LITERATURE REVIEW

Technology is a part of the knowledge which is used in practice. Burgelman et al. propose a broad understanding of technology, stressing that some elements of the technology are in the minds of the employees but the key components are related to norms, standards and intellectual property [7].

In order to rationalize regional innovation policy towards technologies regional institutions, under the auspices of regional authorities created a regional specialist observatories. Presently there are 6 active observatories in the following technology areas: information and communication technologies, nanotechnologies, medical technologies, material production and processing, environmental technologies, power engineering technologies. Target vision is to create a network of 8 observatories, including two technology areas: machinery and transport. The observatories act as a consortium of institutions which specializations are consistent with the certain technology area. For example, observatory in the area of production and processing of materials was created by Silesian University of Technology, Organization and Management Faculty and Institute of Non-Ferrous Metals.

The main goal of observatory is to provide the knowledge for rationalizing regional policy on the current state of the technological area (production and processing of materials) using the information from industry and science. The concept of the observatories was based on the technological observatories established in the area of Key Enabling Technologies (KET), according to definition "*Observatory aims to provide EU, national and regional policymakers with information on the deployment of KETs both within the EU-28 and in comparison to other world regions (East Asia and North America)*" [8].

The technology observatory plays important role in the strategic process determining and developing regional smart specializations. The policy of smart specialisations raise political, social and scientific disputes concerning the level of public support concentration, impact on the level of regional product and unemployment rate. Term "smart specialization" is a concept and tool within the scope of innovation policy used to specify and create current and future position of a region or country in the knowledge-based economy. [9] Benefits resulting from smart specialisations should be noticeable first and foremost in the growth of companies' innovativeness and improvement of public services. In Śląskie region the following smart specializations have been determined [10]:

- Energy - in the areas of advanced materials in energy distribution, advanced manufacturing systems (energy distribution, power generation/renewable sources of energy).
- Medicine - in the areas of ageing societies (residential care activities); public health and well-being (basic pharmaceutical products & pharmaceutical preparations, biotechnology and human health activities, e.g. medical services; public health & security (services - scientific research & development).
- ICT - in the areas of cleaner environment & efficient energy networks (e.g. smart grids), power generation/renewable sources), industrial biotechnology, advanced manufacturing systems, public health & well-being, micro and nano-electronics, computer programming, consultancy & related activities.

In March 2017 regional smart specialization have been updated by adding two areas [11]:

- green economy - resource management; renewable energy sources; energy and material efficiency; clean technologies of production; protection of biodiversity; corporate social responsibility; sustainable consumption and production patterns,
- emerging industries - eco-industries, maritime industries, creative industries, mobility, mobile services, personalised medicine.

The scope of the analysis in the material production and processing observatory was defined by the kind activity of the entities using the technology. The activities were specified by the following NACE codes:

- Division C22 Manufacture of rubber and plastic products,
- Division C23 Manufacture of other non-metallic mineral products,
- Division C24 Manufacture of basic metals,
- Division C25 Manufacture of fabricated metal products except machinery and equipment.

### 3. IDENTIFYING REGIONAL TECHNOLOGY POTENTIAL

#### 3.1. Methodology

The approach to identifying regional technology potential was based on the analysis different kind of information. The following methods have been used to collecting the information for identifying technology potential:

- opinions and reports provided by scientist representing material processing science,
- analysis of statistical data on the regional level in comparisons with the national data,
- direct interview with representatives of 36 companies representing material production and processing sector.

Identification of regional technology potential was carried out as a part of an update of Technology Development Programme (TDP) for Śląskie Voivodeship. The first version of TDP for the years 2010-2020 was adopted in 2011 by regional authorities, and from this time required adaptation to significant changes in the environment.

#### 3.2. Findings - regional technology potential in Śląskie

One of the most important elements of the technology potential is the potential of regional companies representing the material manufacturing sector and the related sectors. This aspect represents the potential users of the technology - the companies implementing or developing adequate technologies. In Śląskie voivodeship we can identify high values of indicators in the following sectors:

- metal production (54 % of domestic production in 2016),
- automotive production (41 % of domestic production),
- production of metal products (24 % of domestic production),
- production of the rubber and plastics products (15 % of domestic production).

In the region dominates industry as it is the second top Polish voivodeship of sold production of industry which is 18.2 % of total number for Poland [12]. All above sectors are directly connected with the material and manufacturing and processing defined by NACE codes. In the **Table 1** we can see the basic economic indicators characterizing the material manufacturing sector in the region. The sector gets very high contribution to the regional domestic products (for the divisions 24 and 25 it is almost PLN 40 billions) and employs large number of employees. According to the Polish Information and Foreign Investors Agency the sectors with huge potential in the region are automotive (as numerous renown enterprises and developed network of suppliers of this industry are present in the region: FIAT (largest factory in Europe), General Motors Manufacturing, Isuzu Motors, Delphi Automotive Systems, Tenneco Automotive, etc.), business process outsourcing and IT [13].

The Śląskie region is also ranked second as the Polish region where innovation investments are directed to manufacturing. In the **Table 2** the value of internal R&D expenditures in the material sector are presented. The highest value can be observed in rubber and plastic sector - it is not relevant to the revenues of the sector (compare with the data in **Table 1**). As we can observe not in all sectors represented by NACE divisions the value of the expenditures raised in the period 2015-2016.

**Table 1** Basic measures characterizing the business potential of Śląskie in the area of production and processing materials. Source: a [14] - data for the year 2015, b [15]

Divisions of NACE	Number of enterprises	Number of employees	Sales revenues (product and services) (PLN thousands)	Sales revenues (materials) (PLN thousands)
Division 24 and 25	5,121 (a) 513 (b)	70,697 (a)	39,672,818	2,910,004
24 - Manufacture of basic metals	340 (a) 84 (b)	22,613 (a)	23,770,608	1,108,582
25 - Manufacture of fabricated metal products except machinery and equipment	4,781 (a) 429 (b)	48,084 (a)	15,902,210	1,801,422
22- Manufacture of rubber and plastic products	1,287 (a) 217 (b)	27,762	9,972,384	992,645
23 - Manufacture of other non-metallic mineral products	1,070 (a) 89 (b)	15,646	7,359,410	858,273

**Table 2** Internal R&D expenditures in the enterprises of the Śląskie region. [15]

NACE Division	Description	Internal R&D expenditures of enterprises (PLN thousands)	
		2015	2016
23	Manufacture of other non-metallic mineral products	2,508.2	11,102.3
24	Manufacture of basic metals	8,743.9	4,588.8
25	Manufacture of fabricated metal products except machinery and equipment	31,101.7	27,668.2
22	Manufacture of rubber and plastic products	n.d.	48,604.4

**Table 3** Percent of enterprises implementing product and process innovation in analysed sectors in Śląskie. [15]

NACE division	Description	Percent of enterprises implementing product innovations in the years 2013-2015 (%)		Percent of enterprises implementing process innovations in the years 2013-2015 (%)	
		POLAND	ŚLĄSKIE	POLAND	ŚLĄSKIE
		1	2	3	4
22	Manufacture of rubber and plastic products	16,3	22,2	15,4	16,8
23	Manufacture of other non-metallic mineral products	14,6	19,5	13,7	9,8
24	Manufacture of basic metals	16,8	22,2	22,7	28,2
25	Manufacture of fabricated metal products except machinery and equipment	9,1	9,7	12,7	9,5

In the **Table 3** the characteristics of enterprises implementing product and process innovation were presented. Plastic and rubber sector as well as basic metals sector are the most innovative sectors in this set in the area of product innovations. These sectors are also relatively more innovative in comparisons with the companies in whole country. The process innovations are mainly revealed in implementing or improving technologies. The

most innovative in this set is basic metals sector where 28,2 % of companies implementing process innovations.

Technology potential of the regional businesses is fostered by the following supporting and intermediary institutions in Śląskie: 6 technology parks, 11 business incubators, 6 technology transfer offices and innovation centers, 20 Chambers of commerce, 9 Loan Funds and Guarantee Funds and 35 Training and Consulting Centers.

Large number of this institutions supports companies representing material processing sector. There are also 35 clusters in Śląskie voivodeship and specializations of two following clusters are consistent with the material processing sector:

- Polish Aluminum Cluster (of 58 members) - obtained a status of National Key Cluster,
- Cluster of Mining Machines in Gliwice.

#### 4. CONCLUSIONS

As we can observe the technology area of material production and processing has a very high potential for the future development. The detailed conclusions can be formulated as follows:

- 1) Used technologies in regional sectors of material production and processing are widespread and well known in the world, there is no typical endogenous technologies - discovered and implemented in the region nor identified disruptive innovation.
- 2) While there is very low probability for disruptive innovation implementation we can identify big opportunities of implementing technology (process) innovations in the area of energy and cost reduction, environmentally friendly issues, circular economy.
- 3) In the findings we can observe increasing science-industry cooperation: number of joint R&D projects, large number of industry-science constant cooperation.
- 4) The respondents declared an expected growth of R&D expenditures in the sector of material production and processing. For business this declaration means that increasing or stable revenues from the primary markets are expected.
- 5) We have to be aware that low number of the companies participating in the analysis is the limitation of the research. However, the respondents did not indicate that other, more advanced technologies are used by regional competitors.

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