

Life science and chemical industry in Małopolska



Małopolska Agencja Rozwoju Regionalnego S.A., Krakowski Park Technologiczny sp. z o.o. and Kraków Nowa Huta Przyszłości S.A. jointly implement a project titled: **“POWER UP YOUR BUSINESS IN MAŁOPOLSKA”**, co-financed by the Regional Operational Programme for the Małopolska Region for 2014–2020 (RPO WM) under Priority Axis 3: “Entrepreneurial Małopolska”, measure: “The Internationalisation of Małopolska Economy”, sub-measure “The Economic Promotion of Małopolska”.

The objective of the project is to directly promote the economic potential of Małopolska on the international scene, improve the competitiveness of regional companies on foreign markets and support foreign investments in Małopolska.

The measures of the “Power up...” project include participating in foreign fairs, organising trade missions and regional workshops, issuing publications and creating a modern information system for the entrepreneurs of Małopolska.

marr We combine the potential of our institutions: **Małopolska Agencja Rozwoju Regionalnego S.A.** (1993): the largest regional business institution implementing entrepreneurial support programmes and EU projects, offering financial instruments to implement business projects, providing services for investors and conducting international promotion activities. www.marr.pl



Krakowski Park Technologiczny sp. z o.o., managing the Special Economic Zone in Małopolska, creating modern aid systems (incubator, seed capital, clustering, etc.), primarily for ICT companies. www.kpt.krakow.pl



Kraków Nowa Huta Przyszłości S.A., managing the largest investment area in Krakow, acting in the area of logistics projects, new technologies, recreation and leisure, urban planning and development of post-industrial areas. www.knhp.com.pl

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Introduction

Małopolska is a region with a significant economic potential and high investment attractiveness. In the ranking of the Institute for Market Economics, the Małopolskie Province was ranked the fourth in terms of investment attractiveness (# 1 Śląskie Province, # 2 Dolnośląskie Province, # 3 Mazowieckie Province).¹ The study assessed location factors (including transport accessibility, labor costs, quality of human resources), the level of economic development (including the absorptiveness of the regional sales market) and the activity of the region in relation to potential investors.²

In the financial perspective 2014-2020, Małopolska has EU support at the level of EUR 3 billion (PLN 12.9 billion)³ dedicated to development projects in the field of infrastructure, entrepreneurship, new technologies and improvement of the quality of the natural environment.⁴ The high rate of Małopolska's economic growth stimulates the development of entrepreneurship and a high level of quality of life for residents.⁵ The region gives access to many markets. Thanks to its location in the central-southern part of the country, it provides very good access to national communication routes as well as international transit routes (A4 motorway connecting Germany with Ukraine, Pan-European transit corridor TENT III connecting Western Europe with Asia, international Krakow airport).

Glossary

1. CAGR - Compound Annual Growth Rate
2. R&D - Research and Development
3. EUR- Euro
4. PIPC - Polish Chamber of Chemical Industry
5. PLN/zł - Polish zloty
6. EAZ - Economic Activity Zone
7. SEZ- Special Economic Zone
8. EU - European Union
9. UP RP - Patent Office of the Republic of Poland
10. Current prices - prices actually used in the transactions of purchase and sale of goods and services in a given period. In statistics, the prices from a given year or month are usually assumed as current prices.



¹ Source: Instytut Badań nad Gospodarką Rynkową, Atrakcyjność inwestycyjna województw i podregionów Polski, 2016

² Source: Instytut Badań nad Gospodarką Rynkową, Atrakcyjność inwestycyjna województw i podregionów Polski, 2016

³ Note: converted using the PLN / EUR 4.31 exchange rate of the National Bank of Poland of 12/09/2018

⁴ Source: Doing Business in Małopolska, Kraków Nowa Huta Przyszłości

⁵ Source: Centrum Business in Małopolska, sierpień 2016

11. Sold production of the industry - the value of sold finished products, works and services provided against payment, products in the form of settlements in kind, as well as products intended to increase the value of own fixed assets.

The monetary values in the whole study is given in PLN and EUR Exchange rate of the National Bank of Poland of 14/09/2018 EUR 1 = PLN 4.3103. The course was accepted for the entire study.

A. Life science

1. Characteristics of the life science market

1.1. Main industries in Małopolska

Life science is an interdisciplinary area of the economy, on the borderline of medical, biological and biochemical sciences⁶. The group of companies operating within the scope of life science includes entities that deal with the knowledge and use of living organisms (proteins, cells and tissues, to plants and animals) in order to conduct research and development works and their implementation into technological processes. Thus, life science is an interdisciplinary industry, including:

- pharmacy,
- biology,
- biotechnology,
- genetics.

It should be emphasized that the life science industry has been recognized by the Małopolskie province as a regional smart specialization, indications in the *Regional Innovation Strategy of the Małopolskie Province 2020*. This category includes entities operating in the following areas: active and healthy life, medicinal products and medical devices, modern diagnostics and therapy, digital health, new therapeutic technologies and supporting medical devices, Innovative Medical Center (Innovative hospital), healthy food and nutrition, modern, sustainable agriculture, environment - environmental health factors, bioeconomy.

In the Małopolskie province, areas of activity conducted by scientific units within the scope of life science, including health protection, have been identified. Since 2013, the largest increase in health protection without the use of rDNA technology has been recorded. The activity in the field of animal health protection is also developing.

Apart from the area of health protection, since 2016 an increase in activity in the field of bioinformatics, industrial processing and agricultural biotechnology has been noticeable.

Since 2016, a trend growing among the number of enterprises indicating health protection, including health protection with the use of rDNA technology, bioinformatics and the environment as their main area of activity, has been noticeable. It should be noted that the number of entities

⁶ Program Strategiczny. Regionalna Strategia Innowacji Województwa Małopolskiego 2020, Załącznik nr 1 do Uchwały Nr 995/16 Zarządu Województwa Małopolskiego z dnia 30 czerwca 2016 r., Kraków 2016.

from the life science sector in Małopolska is much larger, while the following entities indicate those areas of activity as their basic ones.

1.2. Main centers in Małopolska

Kraków is the center of innovation in Małopolska and constitutes a significant scientific, educational and human resources base in the province. The scientific and local government units have so far conducted a number of investments in the field of life science. Key activities include activities of the Life Science Cluster and the Jagiellonian Center of Innovation in Kraków. This allowed industry players to enter the international arena, attract investors, the inflow of capital, including from EU funds.

2. Size of the market in Małopolska Region

2.1. Market value

The life science industry in the world is currently worth approx. USD 1 trillion with a 4.4% increase in the perspective of 2020⁷. In the last 10 years, the life science market in Poland has recorded systematic growth and in 2011 it reached PLN 22.3 billion⁸, i.e. EUR 5.17 billion. The activities of the pharmaceutical industry in 2010 contributed to the production of 0.8% of GDP.

Life science is a key industry for a knowledge-based economy for the region. Its share in GDP is currently low, estimated below 1% of GDP⁹. Małopolska is responsible for 11.65% of Poland's income from professional, scientific and technical activities¹⁰. On the other hand, the share of industrial processing, which implements life science research results, constitutes 86.3% of the market share in the Małopolskie province.



The number of revenues from professional, scientific and technical activities increased in 2017 by PLN 1 385 237 thousand (EUR 321 378.3 thousand) compared to the previous year¹¹. Percentage share in nationwide revenues from professional, scientific and technical activities increased from 4.83% in 2007 to 11.66% in 2017. It is estimated that the largest share in revenues is: natural sciences: 44.4% as well as engineering and technical sciences: 44.5% [Local Data Bank of the Central Statistical Office, 2016].

⁷ 2017 global life sciences outlook. Thriving in today's uncertain market, raport Deloitte, <https://www2.deloitte.com/pl/pl/pages/life-sciences-and-healthcare/articles/raport-2017-global-life-sciences-outlook.html>

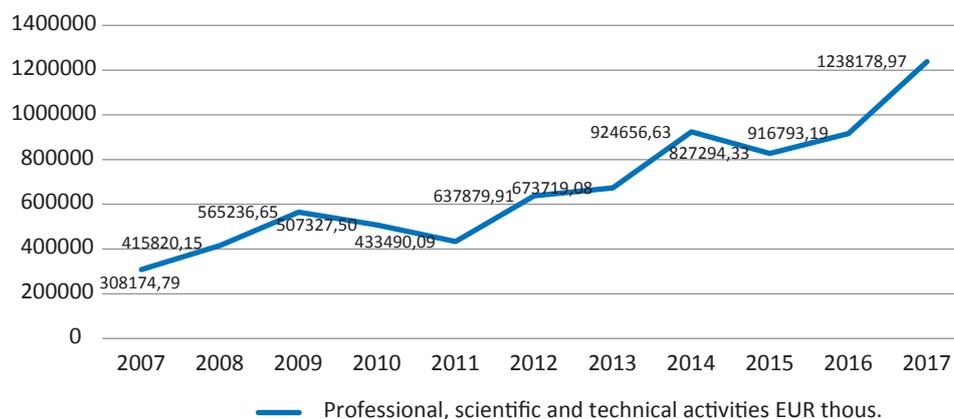
⁸ Ibidem.

⁹ 2017 global life sciences outlook. Thriving in today's uncertain market, ed. G. Reh, raport Deloitte, <https://www2.deloitte.com/pl/pl/pages/life-sciences-and-healthcare/articles/raport-2017-global-life-sciences-outlook.html>.

¹⁰ Life science has been classified as professional, scientific and technical activity due to the inclusion of interdisciplinary research in the fields of engineering, medicine, and humanities (and above all in the social field) in it.

¹¹ Exchange rate of the National Bank of Poland of 14/09/2018 EUR 1 = PLN 4.3103. The course was accepted for the entire study.

Chart 1. Revenues from professional, scientific and technical activities in the Małopolskie province in 2007-2017 [EUR thous.]



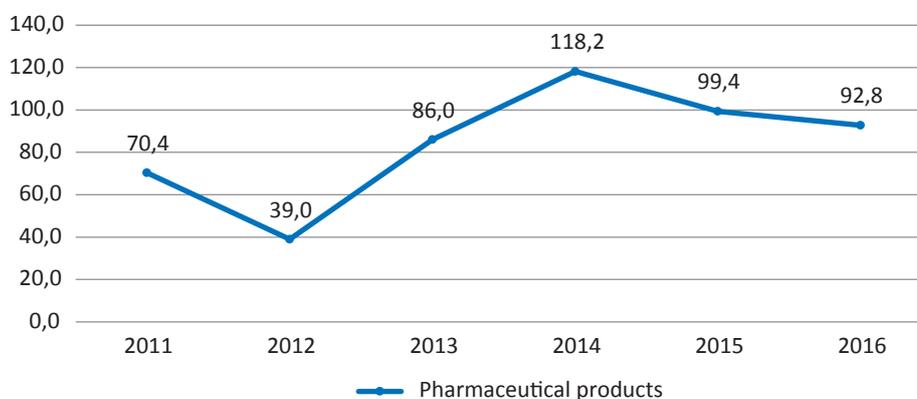
Source: Bank Danych Lokalnych Głównego Urzędu Statystycznego, <https://bdl.stat.gov.pl>

2.2. Product structure

In 2016, the sold production of pharmaceutical products amounted to PLN 246.6 million (EUR 57.2 million), which accounted for 0.3% of the industry in the Małopolskie province¹². The volume of production sold decreased by PLN 438.4 million, i.e. by EUR 101.71 million in 2016, in relation to 2010. In 2016, there was a drop in the prices of pharmaceutical products in relation to 2015 by 7.2 points. Since 2014, there has been an increase in the dynamics of sold production of pharmaceutical products by 79.2% compared to 2012. The Małopolskie Province belongs to medium provinces when it comes to dynamics of production sold in the pharmaceutical industry on a nationwide basis, which is associated with the lack of large investments.



Chart 2. Dynamics of sold production of pharmaceutical products for the Małopolskie province in 2011-2016 at constant prices from 2010



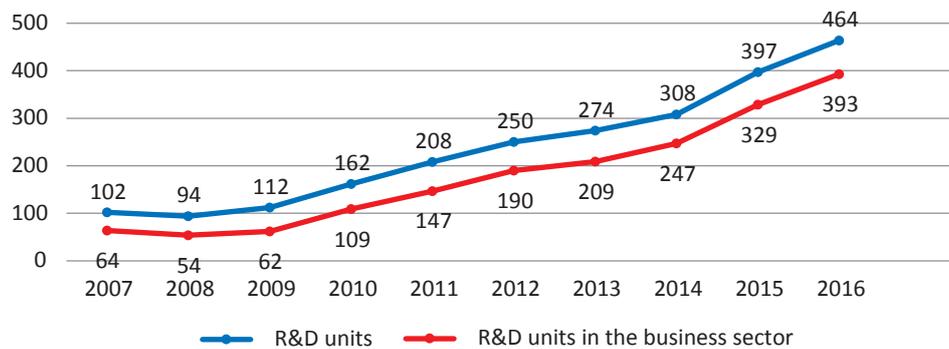
Source: Bank Danych Lokalnych Głównego Urzędu Statystycznego, <https://bdl.stat.gov.pl>

¹² Ibidem.

2.3. Product structure

In 2016, the number of scientifically active units in Małopolska increased by 362 entities compared to 2007, i.e. by 354.9% (Data of the Local Data Bank of the Central Statistical Office). Whereof the number of professionally active units in enterprises increased in that period by 329 entities, i.e. by 514.06%.

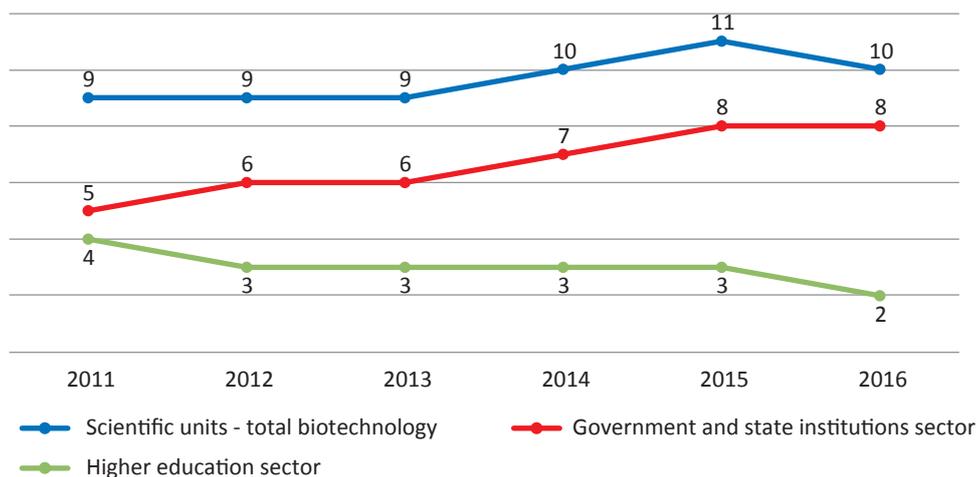
Chart 3. Number of active research units in total and in the enterprise sector in Małopolska in 2007-2016



Source: Bank Danych Lokalnych Głównego Urzędu Statystycznego, <https://bdl.stat.gov.pl>

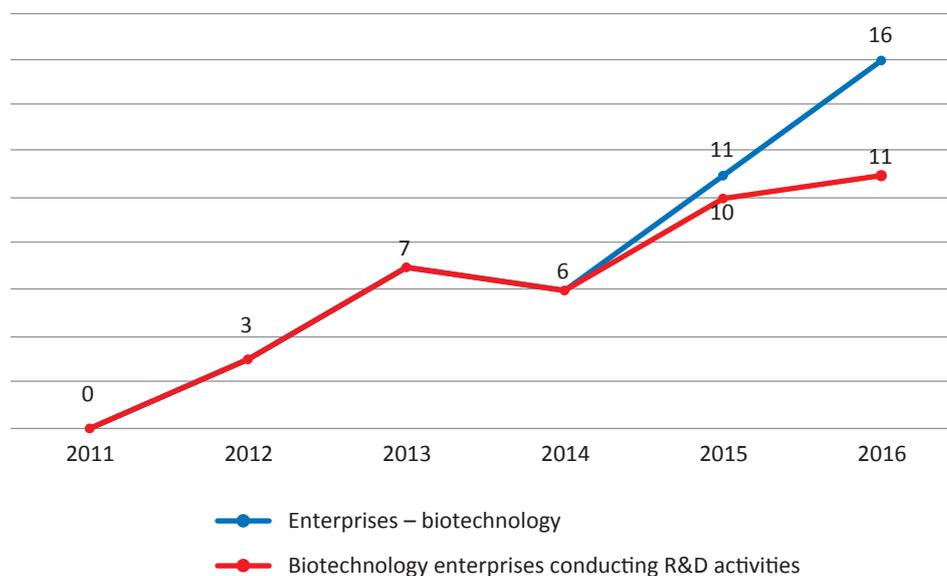
In 2016, the number of scientific units operating in the field of biotechnology increased by 1 entity compared to 2013. It should be noted that there are more state and government research entities than those conducted by universities. 10% of branches from the biotechnology sector were located in the Małopolskie province out of all the units operating in Poland.

Chart 4. Number of research units whose subject of activity is biotechnology, in Małopolska in 2011-2016



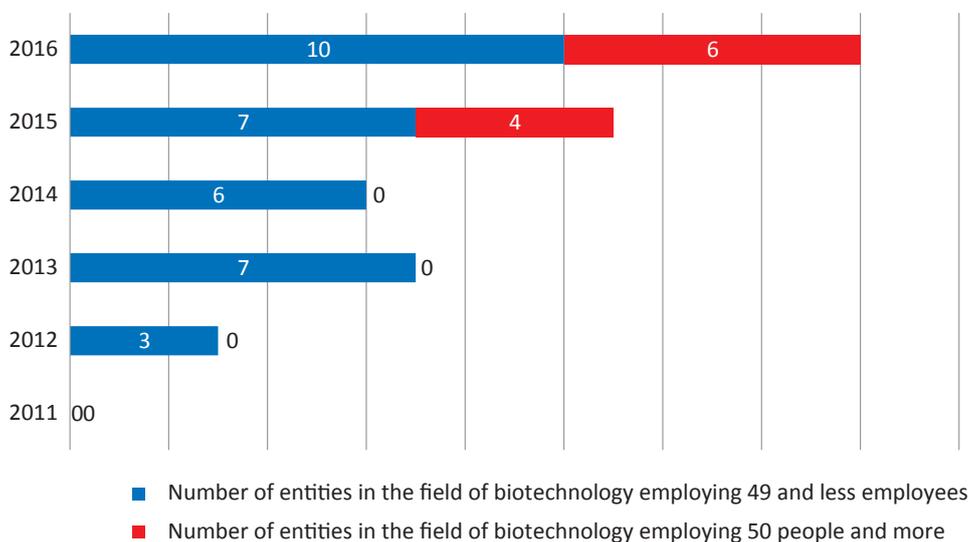
Source: Bank Danych Lokalnych Głównego Urzędu Statystycznego, <https://bdl.stat.gov.pl>

Chart 5. Number of enterprises operating in the field of biotechnology in Małopolska in 2011-2016



Source: Bank Danych Lokalnych Głównego Urzędu Statystycznego, <https://bdl.stat.gov.pl>

Chart 6. Number of entities in the field of biotechnology employing up to 49 employees and over 50 people in 2011-2016



Source: Bank Danych Lokalnych Głównego Urzędu Statystycznego, <https://bdl.stat.gov.pl>

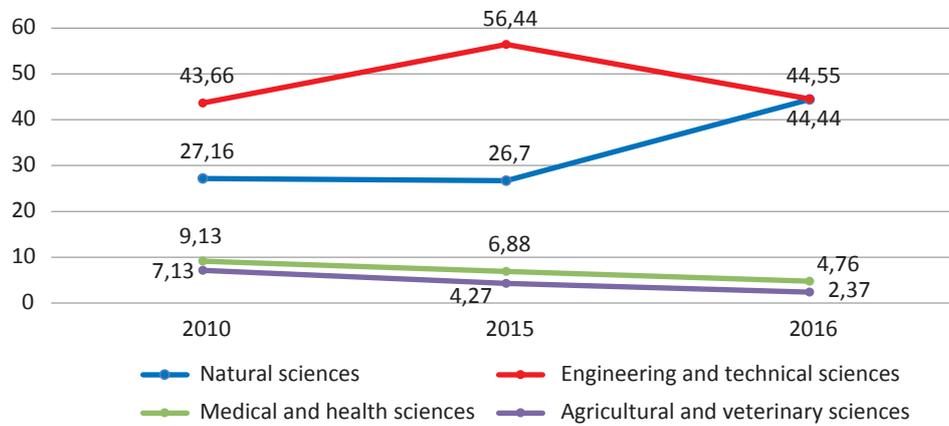
2.4. Investment expenditures¹³

In 2016, the amount of investment expenditures on research and development in Małopolska in the field of natural sciences was not much lower than expenditures on engineering and technical

¹³ Life science is an interdisciplinary field. Capital expenditures are considered for natural, medical, engineering and technical, as well as, agricultural and veterinary sciences. In this document, we focus on the production of pharmaceutical products - the leading sector for life science.

fields. In turn, since 2010 there has been a decrease in expenditure on R&D in agricultural and veterinary sciences, as well as, in medical and health sciences.

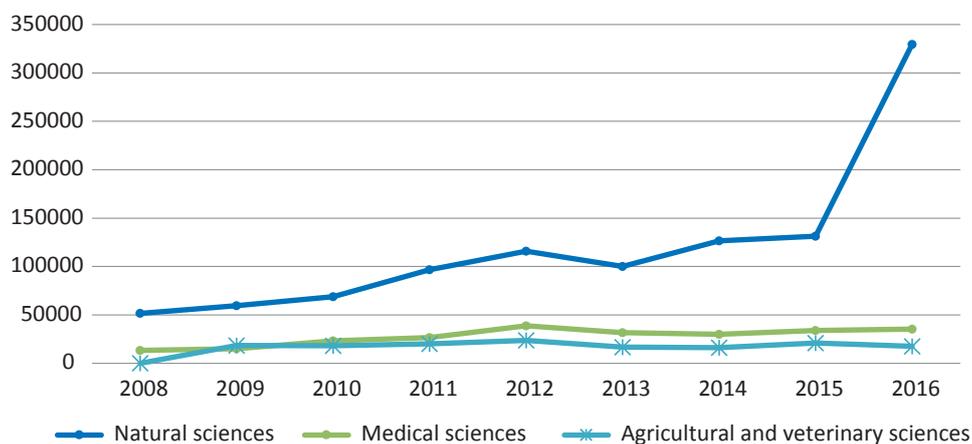
Chart 7. Percentage of internal expenditure on research and development in Małopolska in 2010, 2015, 2016 [%]



Source: Bank Danych Lokalnych Głównego Urzędu Statystycznego, <https://bdl.stat.gov.pl>

Expenditures on R&D for natural sciences and engineering sciences in the scale of total R&D expenditure constitute respectively 7.9% for each field (the exact amount of expenditure is: PLN 1 420 681.1 thousand, i.e. EUR 329 601.44 on natural sciences and PLN 1 424 429.3 thousand, i.e. EUR 330 471.03 on engineering and technical sciences).

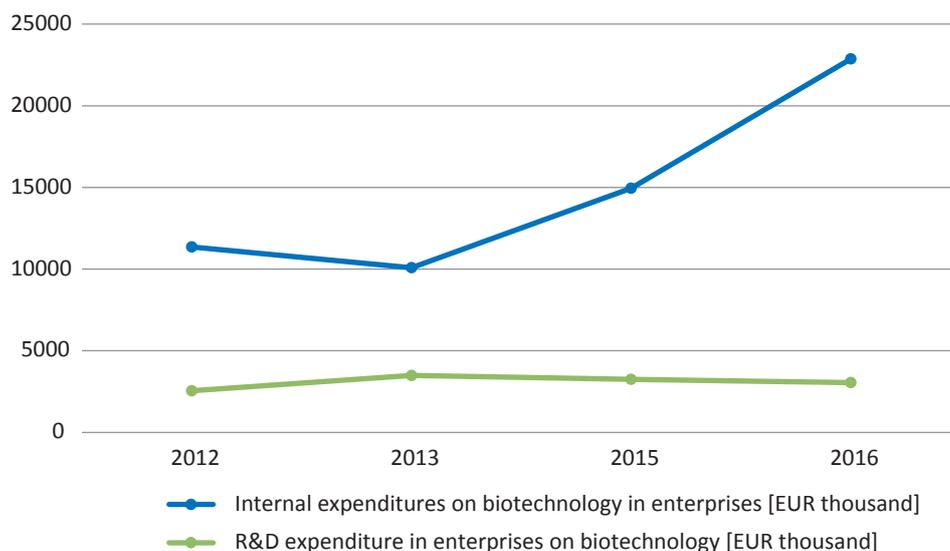
Chart 8. Amount of expenditure on research and development in Małopolska in 2008-2016 [EUR]



Source: Bank Danych Lokalnych Głównego Urzędu Statystycznego, <https://bdl.stat.gov.pl>

In 2016, the number of expenditures of enterprises on biotechnology increased by PLN 49 581 thousand, i.e. EUR 11 502.91 compared to 2012. However, the expenditures of enterprises on research and development in the field of biotechnology increased in that period by PLN 2,199.2 thousand, i.e. EUR 498,619.59

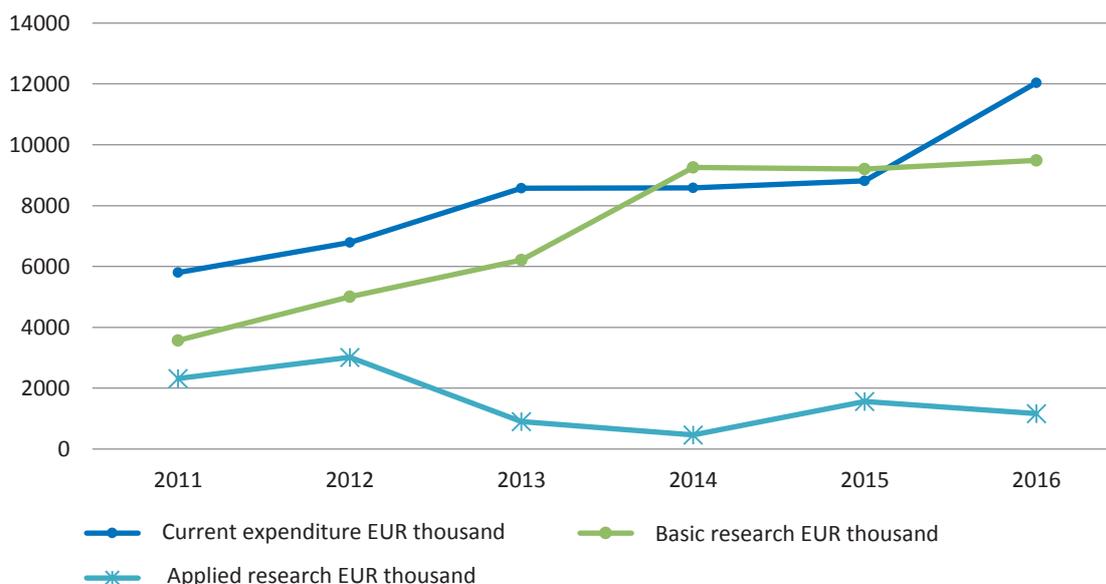
Chart 9. Internal expenditure on biotechnology in enterprises in the years 2011-2013, 2015-2016 [PLN thous., EUR thous.]¹⁴



Source: Bank Danych Lokalnych Głównego Urzędu Statystycznego, <https://bdl.stat.gov.pl>

The number of current expenditure in research units is by far the highest of all categories of expenditure. Therefore, the expenditures for applied research are insignificant (well below PLN 10,000 thousand, i.e. EUR 2,320.02). On the other hand, expenditures on basic research increased by 165.6%. This shows the trend of high costs of entry, conducting clinical trials and commercializing research in the field of biotechnology.

Chart 10. Internal expenditure in scientific units in the field of biotechnology in Małopolska in 2011-2016 [EUR thous.]



Source: Bank Danych Lokalnych Głównego Urzędu Statystycznego, <https://bdl.stat.gov.pl>

¹⁴ Social Insurance Company returns for 2014

2.5. Import and export

In 2015, the most important in the import of consumer goods were non-durable consumer goods (including medicines) with a share of 24.9% on a national scale¹⁵. The import trend of those goods has decreased compared to 2014. (25.5%).

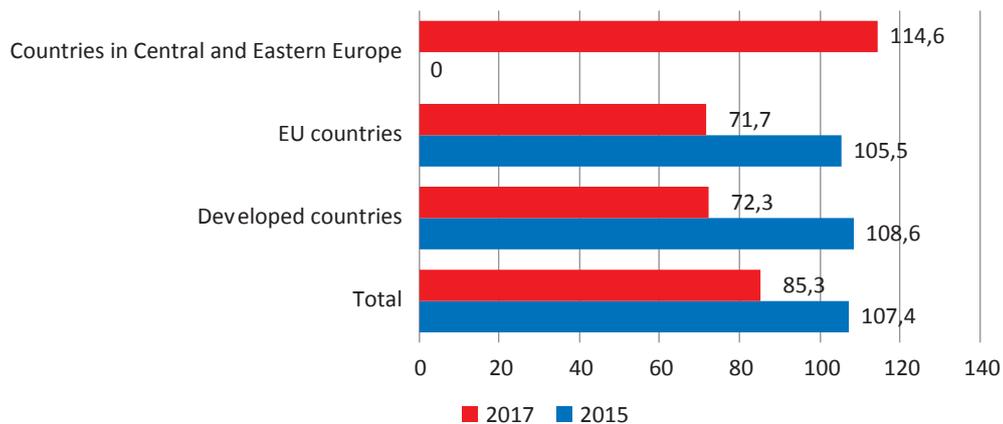


Non-durable consumer goods accounted for 22.5% of Polish exports in 2015.

Those were in particular perfumery, cosmetics preparations and medicines. In 2014, the export of those goods was 23.4% on a national scale (4.9% of which was estimated for Małopolska)¹⁶.

In 2017, the estimated export of medicines in Małopolska was 6%, or approx. 4 112.94 tons of medicines. The value of exports in 2017 decreased by EUR 1 159 129.08 thousand, i.e. PLN 4,996,194.07 compared to 2014

Chart 11. Dynamics of the increase in the export of medicines in 2015 and 2017.



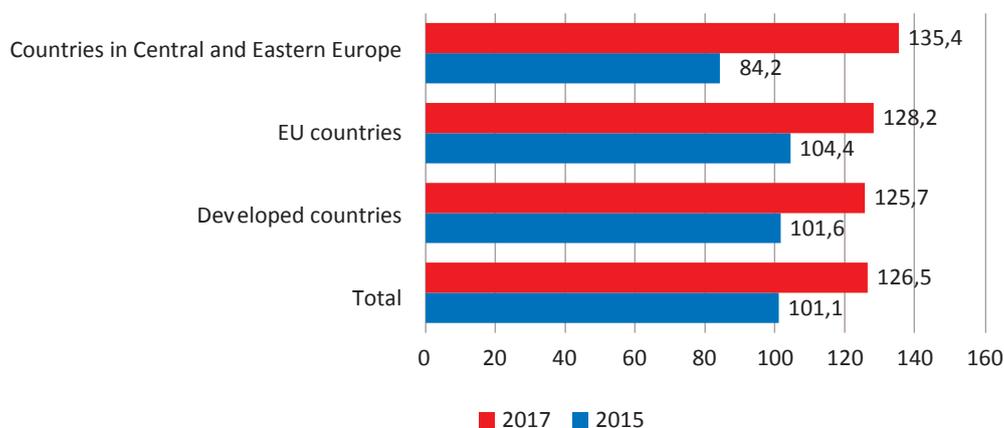
Source: *Handel zagraniczny I-IX 2017*, ed. J. Kapsa, Warszawa 2017; *Handel zagraniczny styczeń – grudzień 2015*, ed. J. Kapsa, Warszawa 2016.

It is worth emphasizing that in 2015 and 2017 an increase in the average value of exported medicines prices was noted, the highest increase was identified in 2017 in the case of Central and Eastern European countries. The value of this indicator amounted to 135.4 points in relation to the previous year.

¹⁵ *Handel zagraniczny I-IX 2017*, ed. J. Kapsa, Warszawa 2017; *Handel zagraniczny styczeń – grudzień 2015*, ed. J. Kapsa, Warszawa 2016.

¹⁶ *Ibidem*.

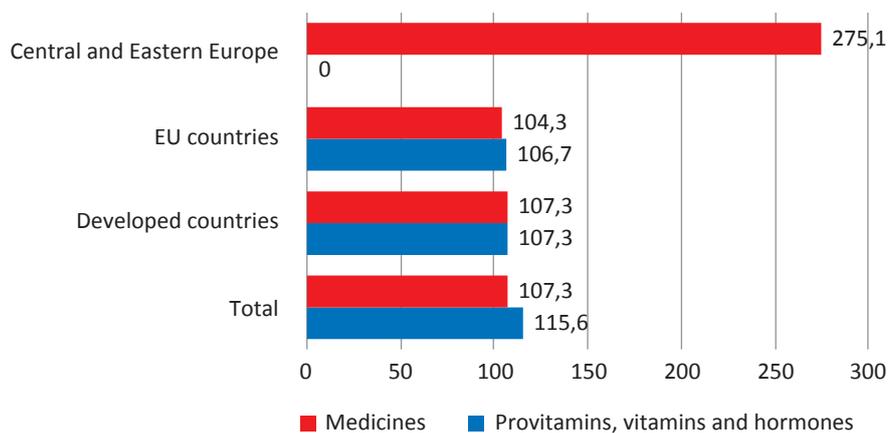
Chart 12. Dynamics of the average price value in relation to the previous year, for 2015. (2014=100). and for 2017. (2016=100)



Source: *Handel zagraniczny I-IX 2017*, ed. J. Kapsa, Warszawa 2017; *Handel zagraniczny styczeń – grudzień 2015*, ed. J. Kapsa, Warszawa 2016.

In 2017, a significant increase was recorded in the case of medicines imported from Central and Eastern Europe (mainly from the Czech Republic, Slovakia and Hungary).

Chart 13. Growth dynamics of imports of selected products and semi-finished products of the life science industry in 2017 [2016 = 100]



Source: *Handel zagraniczny I-IX 2017*, ed. J. Kapsa, Warszawa 2017; *Handel zagraniczny styczeń – grudzień 2015*, ed. J. Kapsa, Warszawa 2016.

2.6. Characteristics of the market's closer environment

In Kraków, Tarnów and Nowy Sącz, there is a number of business environment institutions, scientific units, and universities that play an important role in the development of the life science industry.

The following entities have a particularly important role in the life science industry:

LIFE SCIENCE CLUSTER IN KRAKOW¹⁷

The Life Science Krakow cluster is a network of institutions and companies from the macro-region of southern Poland that have combined common goals and vision for the development of an ecosystem of innovation in the field of biotechnology and life science. The cluster consists of entities from the following sectors: innovative activity in the field of life science and biotechnology, auxiliary activity in the business environment sector, medical and healthcare services, activity in the development research sector, science and education activities, as well as local and regional authorities. The project is coordinated by the Foundation Klaster LifeScience Kraków.



MAŁOPOLSKA CENTER FOR BIOTECHNOLOGY IN KRAKOW¹⁸

The Małopolska Center for Biotechnology (MCB) aims to create an interdisciplinary research center that allows comprehensive research to be conducted at various levels of the body's functioning. MCB includes 6 centers with various research topics and 5 laboratories.

MCB has unique in the world specialized laboratories allowing, among others for the cultivation of skin cells for therapeutic purposes (autologous transplants), or research on pathogens of the 3rd class of biosafety. The areas of scientific activity of MCB are: biotechnology, infectious diseases, food safety, structural biology, nutrigenomics, neurobiology and bioinformatics.

The created laboratory rooms contribute to the qualitative improvement of the research works conducted, the extension of the scope of the projects conducted in cooperation with the pharmaceutical, biotechnology, food processing, medicine and health care industries (e.g. the Center for Genetic Research and Nutrigenomics is planned as a pillar of NuGO - the European network of excellence on nutrigenomics).

PARK LIFE SCIENCE IN THE AREA OF THE JAGIELLONIAN UNIVERSITY¹⁹

Life Science Park is a complex of three buildings with a total area of 20 thousand m², offering services for entrepreneurs and scientists developing natural sciences. Entities are offered, among others specialist lab space rental, capital support for innovative companies, contract research services and clinical trials as well as numerous educational initiatives. The owner and manager of Life Science Park is the Jagiellonian Center of Innovation, a company founded in 2004 by the Jagiellonian University in Krakow.

Park's infrastructure enables conducting research and development works in the field of biotechnology, biomedicine, biology, chemistry, pharmacology, physics, nanotechnology and environmental protection.

¹⁷ Developed based on :<https://lifescience.pl>.

¹⁸ Developed based on :<http://www.mcb.uj.edu.pl>.

¹⁹ Developed based on: <https://www.jagiellonskiecentruminnowacji.pl>.

In addition, it's worth mentioning entities from the immediate business environment that play a significant role in the development of the life science industry in Małopolska:

KRAKOW:

1. Stanisław Staszic AGH University of Science and Technology in Krakow,
2. Academic Business Incubator of AGH
3. Center for Innovation, Technology Transfer and University Development, Jagiellonian University
4. Center for Technology Transfer AGH,
5. Center for Transfer of Medical Technology,
6. Technology Transfer Center of the Krakow University of Technology,
7. Institute of Pharmacology of the Polish Academy of Sciences
8. H. Niewodniczański Institute of Nuclear Physics of the Polish Academy of Sciences
9. Institute of Plant Physiology of the Polish Academy of Sciences
10. J. Haber Institute of Catalysis and Surface Chemistry of the Polish Academy of Sciences
11. Institute of Advanced Manufacturing Technologies
12. Jagiellonian Center of Innovation
13. Center of Materials and Nanotechnology (CENMIN)
14. T. Kościuszko Krakow University of Technology
15. Polish Academy of Skills
16. Krakow University of Economics
17. Jagiellonian University
18. Hugo Kołłątaj University of Agriculture in Krakow
19. Kraków Technology Park - Special Economic Zone

NOWY SĄCZ

1. Business Incubator of Nowy Sącz
2. State Higher Vocational School in Nowy Sącz
3. Klaster Multimediów i Systemów Informatycznych Association

TARNÓW

1. MedCluster



2. Tarnow Industrial Cluster
3. State Higher Vocational School in Tarnów²⁰.

3. Characteristics of enterprises

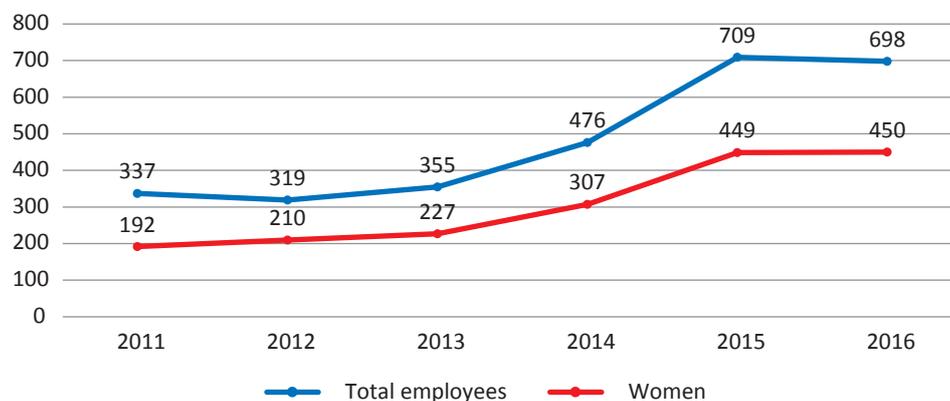
3.1. Employment

A great benefit for the life science industry in Małopolska is the availability of staff with higher education: university graduates, researchers, university staff, and industry professionals. Universities such as: The Jagiellonian University and the University of Agriculture in Krakow have been in the top positions in the rankings of universities for years ²¹.



Personnel employed in R&D in the field of biotechnology in scientific units in 2011-2016 was increased by 361 employees (i.e. over 107%) (Data of the Local Data Bank of the Central Statistical Office). In the scale of Poland, it represents 14% of all staff employed in scientific units. In Małopolska, this is a feminized profession, as women make up 65% of research personnel.

Chart 14. Employment in units in the field of biotechnology in the Małopolskie province in 2011-2016



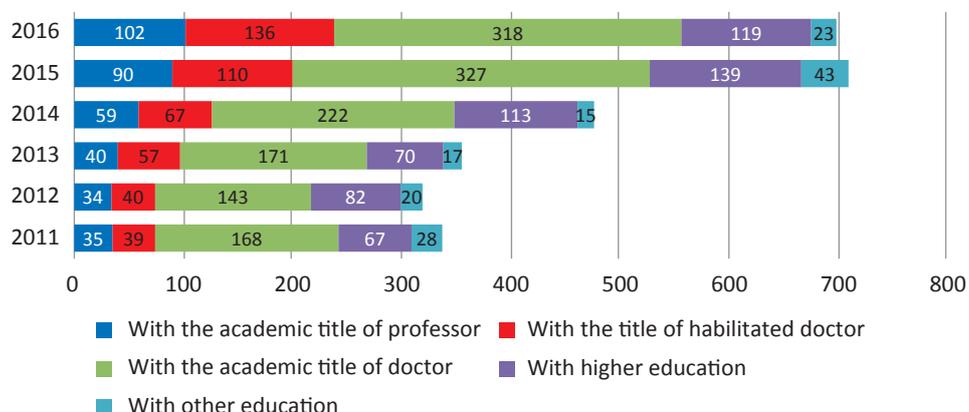
Source: Bank Danych Lokalnych Głównego Urzędu Statystycznego, <https://bdl.stat.gov.pl>

The largest increase in the employment of people with the Sc.D. degree in the biotechnology industry in scientific units was recorded in 2011-2016 - an increase of 150 people. The increase in the employment of professors (by 191%) and people with the title of doctor habilitated (by 248%) is also significant compared to 2011.

²⁰ Based on desk research.

²¹ Ranking Uczelni Akademickich 2018, <http://www.perspektywy.pl/RSW2018/ranking-uczelni-akademickich>.

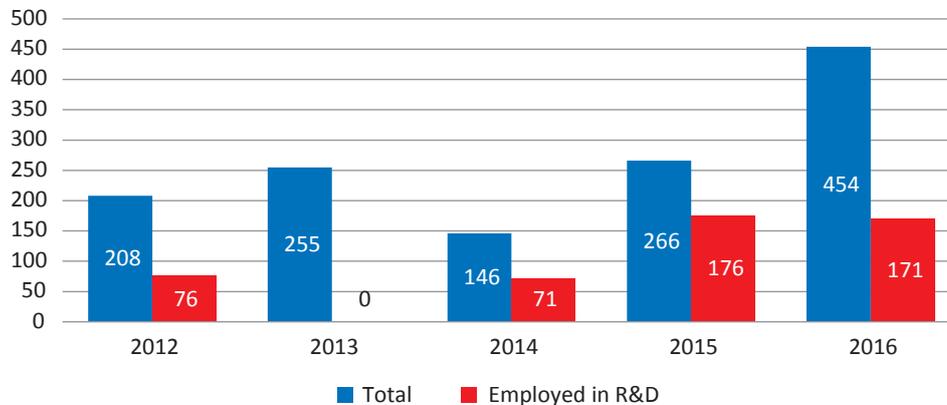
Chart 15. Employees of scientific units in biotechnology by level of education, in Małopolska in 2011-2016



Source: Bank Danych Lokalnych Głównego Urzędu Statystycznego, <https://bdl.stat.gov.pl>

In the case of enterprises in the years 2012-2016, there was also an increase in the number of employees (by 246 people), of which 125% more people compared to 2012 are employed in research and development.

Chart 16. Staff in enterprises from the biotechnology industry in 2012-2016²²



Source: Bank Danych Lokalnych Głównego Urzędu Statystycznego, <https://bdl.stat.gov.pl>

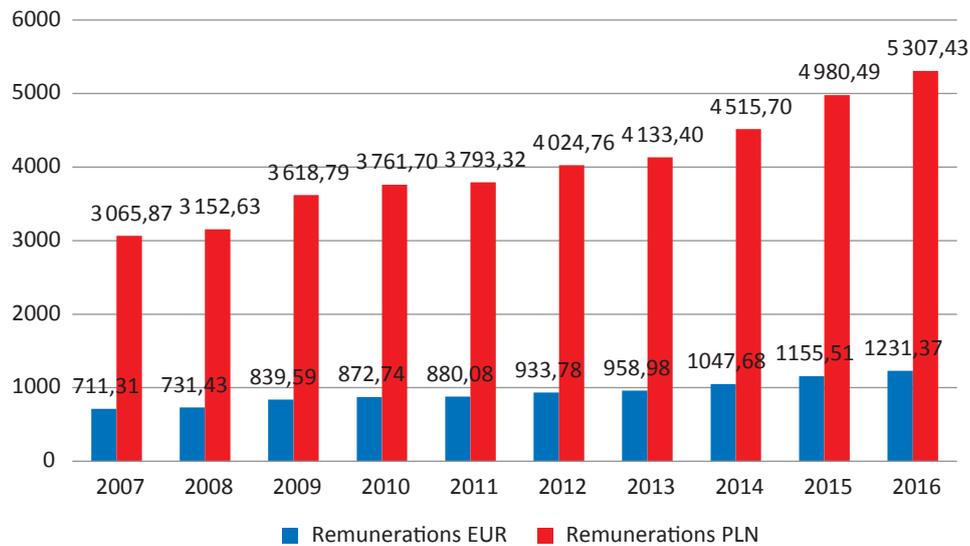
3.2. Remuneration (by industry)

In case of the staff employed in the section of professional, scientific and technical activities, the average monthly gross remuneration increased in 2007- 2016 by PLN 2 241.56 (EUR 520.05), i.e. by 73%.



²² For this chart, the value 0 means no data.

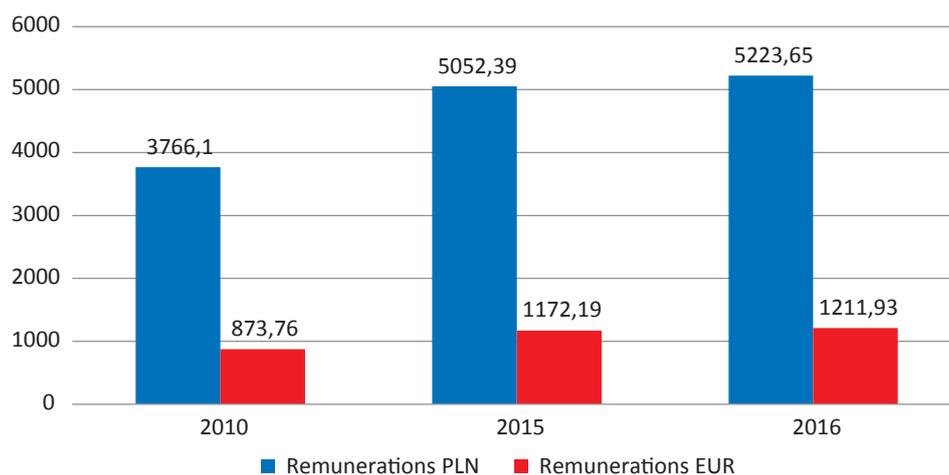
Chart 17. Average monthly gross remunerations in professional, scientific and technical activities, in Małopolska, in 2007-2016 [PLN, EUR]



Source: Bank Danych Lokalnych Głównego Urzędu Statystycznego, <https://bdl.stat.gov.pl>

In 2016, the average monthly gross remuneration increased in the case of the staff employed in the production of pharmaceutical products by PLN 1,457.55 compared to 2005. The remuneration is higher than the average remuneration in the Industrial processing section by PLN 1374.48, i.e. by EUR 318.88

Chart 18. Average monthly gross remunerations of employees employed in the production of pharmaceutical products, in Małopolska, in 2005, 2010, 2015 and 2016 [PLN, EUR]



Source: Bank Danych Lokalnych Głównego Urzędu Statystycznego, <https://bdl.stat.gov.pl>

3.3. Market value of enterprises

Poland is currently the largest in Central and Eastern Europe (and the sixth in Europe) life science market²³. Companies from the biotechnology industry have brought large profits to Polish investors in recent years. Entities from the biotechnology and biomedical industry in Małopolska are considered as companies with huge growth potential due to breakthrough projects that are the future of a knowledge-based economy.

The largest entities listed on the stock exchange were selected to analyze the market value of enterprises out of those listed in chapter 5 of this report.

Selvita S.A.

The largest company listed on the Warsaw Stock Exchange in the life science industry operating in Małopolska is Selvita S.A. It is the largest innovative biotechnology company in Central Europe. It was awarded the Economic Prize of the President of the Republic of Poland, Entrepreneur of the Year EY, it has offices in Krakow also in Boston, Cambridge and San Francisco²⁴.

As at September 26, 2018, the company is valued at PLN 859.2 million (EUR 199.34 million)²⁵. Revenues from operating activities increased in 2017 compared to 2014 by PLN 38815 thousand, i.e. EUR 9,005.38, while the net profit increased by PLN 557 thousand, i.e. EUR 129 228.34 during that period.

In 2018, the company raised PLN 136 million from investors (EUR 31.55 million) for research and development, including leading the compound SEL120, against acute myeloid leukemia (AML) and other potential indications in the area of hematopoietic tumors, up to II clinical phase, and the development of other research platforms.

Instytut Biotechnologii Surowic i Szczepionek BIOMED S.A.

Instytut Biotechnologii Surowic i Szczepionek Biomed S.A. belongs to the Biomed SA group. As at September 26, 2018, the group is valued at PLN 68.5 million (EUR 15.9 million) according to the Warsaw Stock Exchange.²⁶

Net profit increased in 2014-2017 by PLN 473 thous., i.e. EUR 109,739.69



²³ 2017 global life sciences outlook. Thriving in today's uncertain market, raport Deloitte, <https://www2.deloitte.com/pl/pl/pages/life-sciences-and-healthcare/articles/raport-2017-global-life-sciences-outlook.html>

²⁴ <https://www.bankier.pl/gielda/notowania/akcje/SELVITA/podstawowe-dane>

²⁵ <https://www.bankier.pl/gielda/notowania/akcje/SELVITA/wyniki-finansowe>. Exchange rate of the National Bank of Poland EUR 1 = PLN 4.3102 from 13/09/2018

²⁶ Exchange rate of the National Bank of Poland EUR 1 = PLN 4.3102 from 13/09/2018

COMARCH HEALTHCARE S.A.

Comarch Healthcare S.A. is a subsidiary of Comarch S.A. The value of the group is estimated at PLN 1.4 billion (EUR 0.32 billion)²⁷. Revenues from operating activities increased in 2014-2017 by PLN 64,169 thousand (EUR 14887.71 thousand).

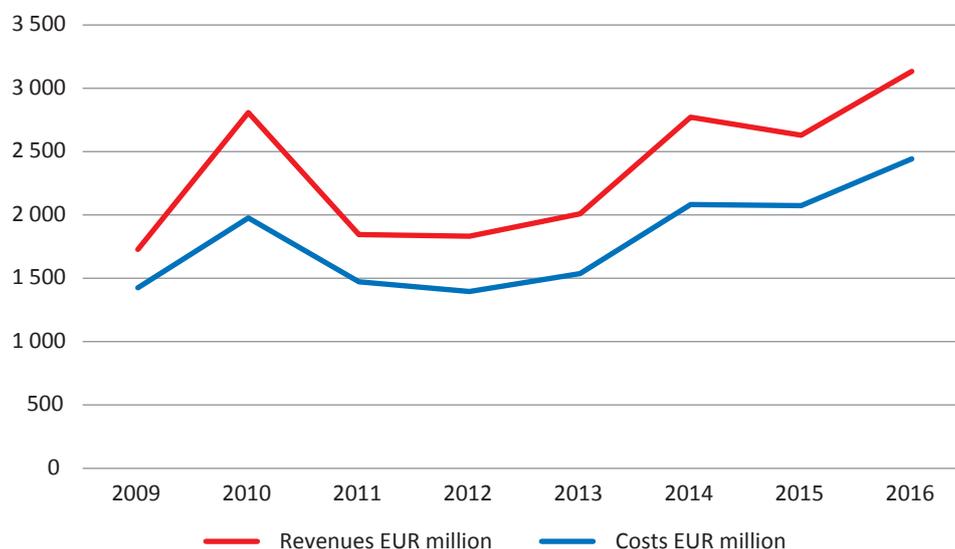


3.4. Financial flows

Current research funding in the bioengineering and biotechnology fields in Poland is financed primarily from public funds: government subsidies for research units and EU funds for enterprises. Companies of Małopolska from the life science sector require large investment expenditures. The industry is extremely capital-intensive due to the special nature (including the need to conduct clinical trials in the case of the introduction of new medicines) and the potential risk associated with the return of investment expenditures.

The number of revenues of entities from the professional, scientific and technical sectors increased in 2016 by PLN 6 059 million, i.e. EUR 1,405.70 million.

Chart 19. Income and expenses within professional, scientific and technical activities in Małopolska, in 2009-2016 [EUR million]



Source: Bank Danych Lokalnych Głównego Urzędu Statystycznego, <https://bdl.stat.gov.pl>

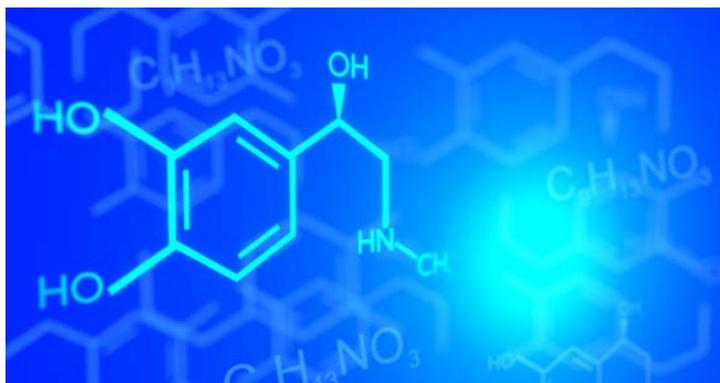
The share of costs in revenues in 2016 decreased by 4.1% compared to 2009.

²⁷ Exchange rate of the National Bank of Poland EUR 1 = PLN 4.3102 from 13/09/2018

3.5. Division of enterprises by origin of capital

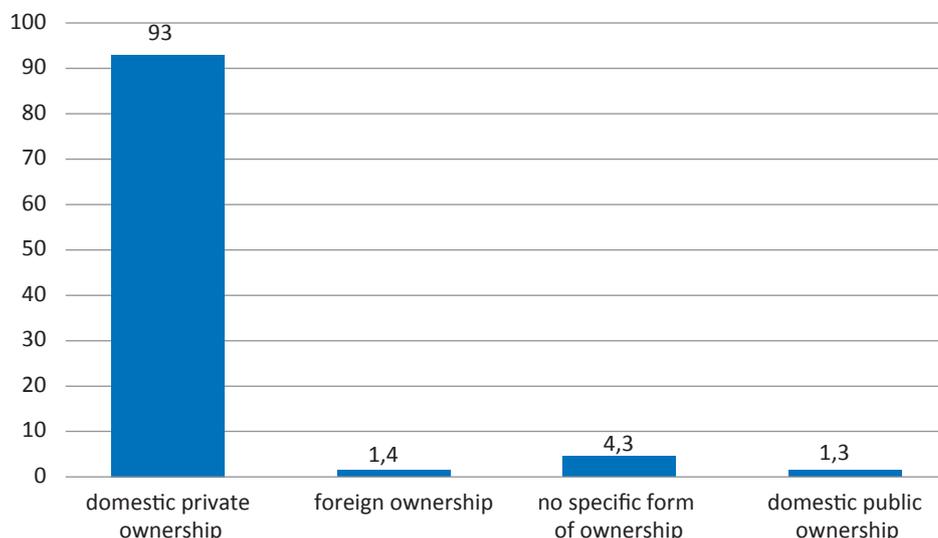
In 2017, the number of enterprises operating in Małopolska in the life science industry was:

- entities conducting research in the field of biotechnology: 39 entities;
- entities conducting research in the field of other natural and technical sciences: 357 entities;
- manufactures of basic pharmaceutical substances: 14 entities;
- manufacturers of medicines and other pharmaceutical products: 63 entities²⁸.



It was estimated that private domestic ownership in the life science industry accounts for 93% of all entities²⁹. The ownership of domestic legal persons is dominant with a share of 76%. The activity is also characterized by a relatively high share of foreign ownership - 1.4%. Public property was estimated at 1.3%.

Chart 20. Estimated structure of enterprises dealing in the food industry in the Małopolskie province by ownership sectors, as at December 2017 [%]



Source: *Kwartalna informacja o podmiotach gospodarki narodowej w rejestrze REGON deklarujących prowadzenie działalności*. Data from December 2017

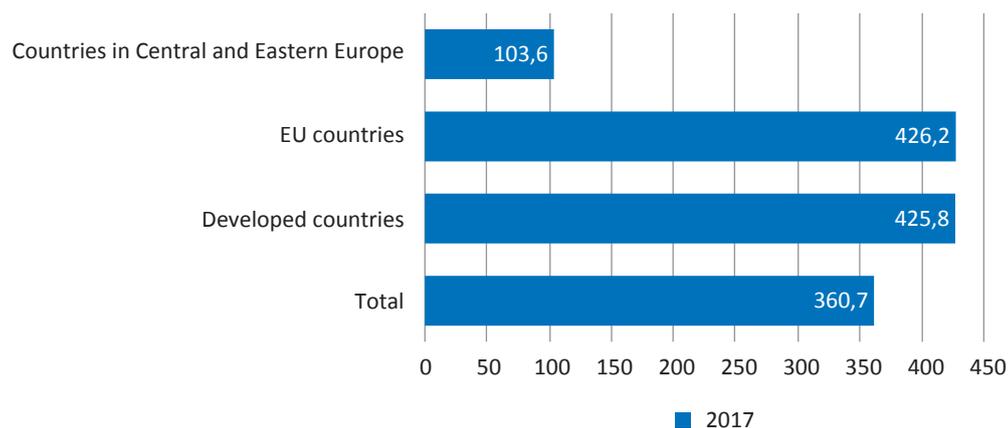
²⁸ Quarterly information on the entities of the national economy in the REGON register declaring their business activity, <http://bip.stat.gov.pl/dzialalnosc-statystyki-publicznej/rejestr-regon/liczba-podmiotow-w-rejestrze-regon-tablice/kwartalna-informacja-o-podmiotach-gospodarki-narodowej-w-rejestrze-regon-deklarujacych-prowadzenie-dzialalnosci/>.

²⁹ The structure of enterprises by the origin of capital in the Małopolskie province, based on the proportion by ownership sectors for Małopolska was developed using data for the whole country. Thus, the estimated numbers of enterprises from each category for the analyzed province were determined. This approach was applied in the analysis of the structure of origin of capital for all the analyzed types of industry.

3.6. Access to a production of raw materials (share of domestic and foreign raw materials)

The key production resources in the case of biotechnology have been classified in the category of raw materials: human blood, animal blood, toxins. In the case of exports of human blood, animal blood, vaccines and toxins, in 2017 more than a fourfold increase was recorded for developed countries, including the EU.

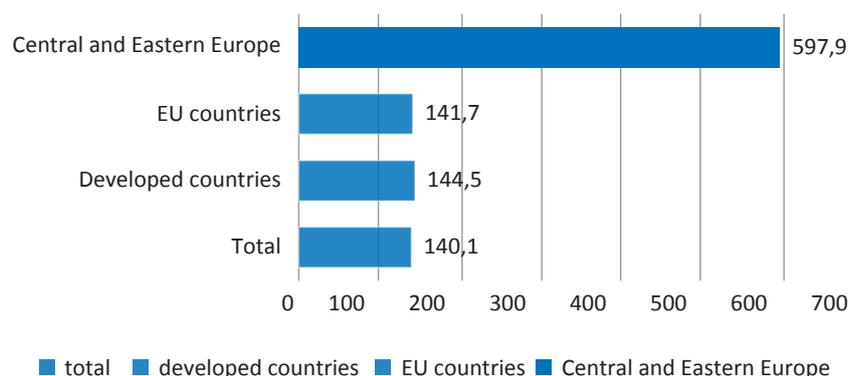
Chart 21 Export growth dynamics in 2017 in the case of human blood, animal blood, vaccines, toxins compared to the previous year [2016 = 100]



Source: *Handel zagraniczny I-IX 2017*, ed. J. Kapsa, Warszawa 2017.

In 2017, the import of human and animal blood, vaccines and toxins from the countries of Central and Eastern Europe to Poland increased almost 6 times.

Chart 22. Growth dynamics of imports of selected raw materials in the life science industry in 2017 compared to the previous year [2016 = 100]



Source: *Handel zagraniczny I-IX 2017*, ed. J. Kapsa, Warszawa 2017; *Handel zagraniczny styczeń – grudzień 2015*, ed. J. Kapsa, Warszawa 2016.

4. Domestic and foreign markets

Domestic and foreign markets for the life science industry should be indicated in the following economic sectors:

1. Agro industry:

- biofuels (biodiesel, bioethanol),
- biorefineries,
- new plant protection products.

2. Chemical industry:

- new chemicals,
- new biocatalysts,
- biotransformation and bioconversion processes;

3. Veterinary enterprises:

- new vaccines and medicines for animals,
- nutraceuticals in feed.

4. Health care sector:

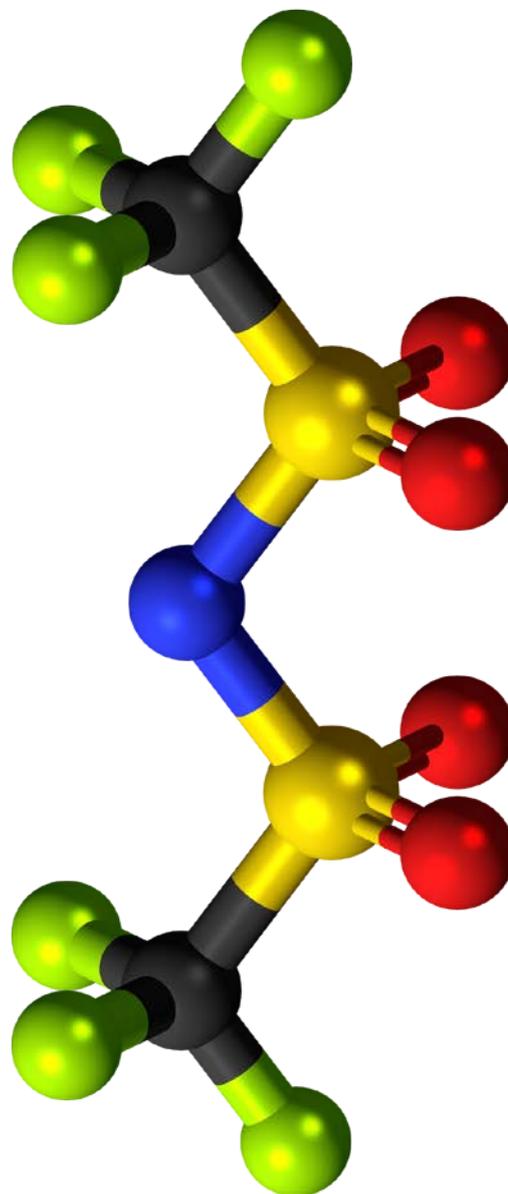
- new vaccines,
- antibiotics,
- biopharmaceuticals.

5. Food manufacturers:

- new enzymes for the food industry,
- sweeteners for diabetics,
- nutraceuticals,
- functional food.

6. Environmental protection sector:

- biogas, syngas,
- bioremediation, bioutilization^{30,31}.



A characteristic feature of the Małopolska pharmaceutical industry is that manufacturers mainly produce and sell generic medicines (approx. 20% of domestic production), while foreign manufac-

³⁰ 2017 global life sciences outlook. Thriving in today's uncertain market, ed. G. Reh, raport Deloitte, <https://www2.deloitte.com/pl/pl/pages/life-sciences-and-healthcare/articles/raport-2017-global-life-sciences-outlook.html>.

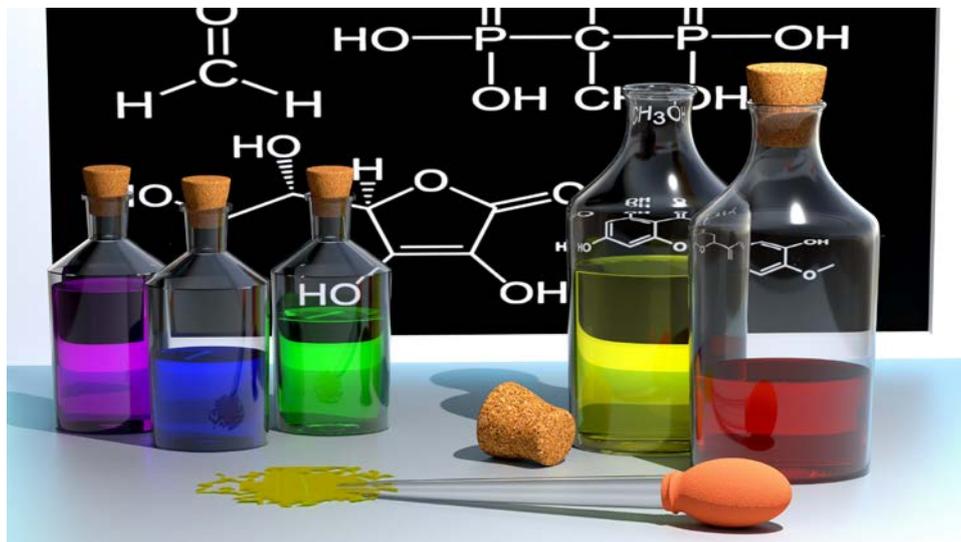
³¹ There is no detailed data on the size of sales markets for individual products, directions of sales in Poland and abroad regarding the life science industry in Małopolska.

turers sell primarily branded medicines to domestic markets (approx. 60% of medical devices imports to Małopolska)^{32 33}. This is due to the fact that the production of branded (mainly innovative) medicines requires very high expenditure on research on the new medicine and putting it on sale. International corporations are able to bear such costs, in contrast to many local, manufactures of Małopolska.

The countries selling pharmaceutical products are defined as follows ³⁴:

- Germany (the value of exports is estimated at EUR 3.8 b / PLN 16.38 b),
- United Kingdom (EUR 1.3 b/ PLN 5.6 b),
- Czech Republic (EUR 1.1 b/ PLN 4.74 b),
- France (EUR 1 b/ PLN 4.31 b),
- The Netherlands (EUR 958 m/ PLN 4,129.3 m),
- Italy (EUR 868 m/ PLN 3,741.3 m),
- Slovakia (EUR 566 m/ PLN 2,439.63 m),

Importantly, in the perspective of 2014-2020, the program of promotion of the biotechnology and pharmaceutical industry in Poland under the sub-measure 3.3.2 “Promotion of the economy based on Polish product brands - Marka Polskiej Gospodarki - Brand” of the Smart Growth Operational Programme 201-2020 (PO IR) is implemented.³⁵. Entrepreneurs from the life science industry are encouraged to diversify their product sales to countries such as: United Arab Emirates, China, India, Russia, Brazil, United States of America.



³² Rynek farmaceutyczny w 2017 roku, Warszawa 2018, http://www.nia.org.pl/wp-content/uploads/2018/01/IQVIA_Rynek_farmaceutyczny_2017_RAPORT.pdf

³³ Due to the lack of sufficient regional data, this document presents the sales market exclusively for the pharmaceutical industry which is leading for life science.

³⁴ 2017 global life sciences outlook. Thriving in today's uncertain market, ed. G. Reh, raport Deloitte, <https://www2.deloitte.com/pl/pl/pages/life-sciences-and-healthcare/articles/raport-2017-global-life-sciences-outlook.html>

³⁵ Program promocji branży biotechnologii i farmaceutyków – informacja dla przedsiębiorców, <https://www.mpit.gov.pl/media/52061/BPPbiotechnologia.pdf>

5. The largest representatives of the sector

The representatives of the life science sector in Małopolska are presented below. It is a selection of entities based on reports of the Life Science Cluster in Krakow³⁶.

MEDICINE

Table 1. Enterprises from the medical industry, operating as part of life science in Małopolska

| Company Name | Website address | Business profile |
|---|---|---|
| COSMETICS | | |
| ARRIA LABORATORIUM BIO-FARMACEUTYCZNE PROF. CZARNECKIEGO | www.arria.pl | A manufacturer of natural cosmetics from pollen and containing nucleic acids (DNA), proteins, amino acids, vegetable enzymes, flavonoids, phytosterols, beta-carotene, sugars, vitamins of all groups, micro and macroelements and ingredients of growth. |
| BIELENDA SP. Z O.O. | http://bielenda.pl/ | A manufacturer of natural cosmetics for face and body care, offering a wide range of products. The company's products are exported to Europe, as well as to South Korea, United Arab Emirates and Cyprus. It has its own laboratory facilities. |
| ELFA PHARM POLSKA SP. Z O.O. SP. K. | http://www.elfa-pharm.pl/pl/ | A manufacturer of herbal and plant cosmetics, part of a global capital group. The group operates in Poland, Slovakia and Ukraine. Is the owner of the following brands: Green Pharmacy, Vis Plantis, Intensywna Terapia Włosów, Dr Santé, Fresh Juice, O'Herbal. |
| INSTYTUT DERMOKOSMETYKÓW IDEEPHARM SP. Z O.O. | https://ideepharm.pl | A manufacturer of dermocosmetics for the body, face and hair. The company has its own research and development center. |
| LABORATORIUM KOSMETYKÓW NATURALNYCH FARMONA SP. Z O.O. | https://farmona.pl/ | The company is a manufacturer of natural cosmetics. It conducts its own research works. |
| NOVA LAB SP. Z O.O. | http://nova-lab.pl/ | The company conducts research activity in the field of physicochemical and microbiological properties of cosmetics. The entity conducts application tests and dermatological checks. |

³⁶ Medical Technologies. Innovation Potential of the Malopolska Region, Klaster LifeScience Kraków Fundacja, Kraków 2017.

Environmental Technologies. Innovation Potential of the Malopolska Region, Klaster LifeScience Kraków Fundacja, Kraków 2017.

Food Technologies. Innovation Potential of the Malopolska Region, Klaster LifeScience Kraków Fundacja, Kraków 2017.

| MEDICAMENTS AND MEDICAL DEVICES | | |
|--|---|---|
| BIOCENTRUM SP. Z O.O. | http://www.biocentrum.com.pl/pl/ | <p>A biotechnology company that conducts pre-clinical testing of medicines.</p> <p>The company also produces highly purified and highly active enzymes, inhibitors and other biologically active preparations, and provides research and development services</p> |
| BIOMANTIS SP. Z O.O. | http://www.biomantis.pl/ | <p>Production and distribution of biologically active dressings, i.e. containing larvae of the <i>Phaenicia sericata</i> species, which are intended for difficult to heal wounds (ulcers, post-operative wounds, burns, etc.).</p> |
| BIOPHAGE PHARMA S.A. | http://www.biophagepharma.pl/ | <p>The basic area of the company's activity is the development of medicinal products using bacteriophages.</p> <p>The company's activities include R&D in the fields of biotechnology, natural sciences and engineering, as well as, medicines manufacturing.</p> |
| FARMINA SP. Z O. O. | http://www.farmina.pl | <p>A manufacturer of generic medicines (Rx and OTC) and dietary supplements. In 2014, the company bought a German manufacturer Spreewaelder Arzneimittel GmbH. Farmina products are available in Ukraine, Germany, Romania, the Netherlands and the United Kingdom.</p> |
| BIOMED S.A. INSTYTUT BIOTECHNOLOGII SUROWIC I SZCZEPIONEK | http://biomed.pl | <p>A manufacturer of vaccines and probiotics. It produces vaccines based on probiotic bacterial strains and all other vaccines subject to testing, preventive vaccination schedule.</p> <p>It cooperates with scientific units in Poland in the scope of work on new products.</p> |
| SELVITA S.A. | http://www.selvita.com | <p>A manufacturer of medicines. It focuses on the design and development of new oncologic medicines, the development of molecules that can be used to treat leukemia, lymphoma and colorectal cancer.</p> <p>In 2015, Selvita signed a contract with the global biotech company Merck in the R&D work segment.</p> <p>Selvita has developed therapeutic compounds: MELK kinase inhibitors, inflammatory inhibitors and a chemical compound that inhibits the serine synthesis pathway and folic acid cycle.</p> <p>The company has one of the most modern laboratories in Poland, including a pharmacodynamic laboratory.</p> |

| | | |
|---|---|---|
| SILVERMEDIA S.A. | http://www.silvermedia.pl | An innovative company in the field of telemedicine and biocybernetics. Its solutions are used in cardiology, rehabilitation and allergology. Examples of products: SilverLife System - a telemedicine platform module enabling remote care of people staying at home. Silvermedia Cardio Desktop - a medical application that allows to conduct an ECG test. Silvermedia Cardio Web Viewer - an online ECG viewer. |
| TEVA PHARMACEUTICALS POLSKA SP. Z O.O. | http://www.teva.pl | A leader of the generic medicines segment in Poland with the product portfolio containing over 1000 molecules. It has a wide portfolio of medicinal products in the industry. |
| POLSKI LEK S. A. | http://polskilek.pl/pl | A manufacturer of dietary supplements and vitamins. The company is part of the Maspex Capital Group. It is the owner of brands such as Plusssz, Calcium Duo. |
| E-HEALTH | | |
| COMARCH HEALTHCARE S.A. | http://www.comarch.pl/health-care/ | The company is part of the Comarch Capital Group. The company offers IT systems for hospitals, radiological software and e-medical documentation for management at the clinic level. The company also provides telemedicine solutions based on own software, medical devices and infrastructure. Examples of products: - Comarch e-Care platform that allows to receive and process medical data. - Comarch PMA heart rate recorders, - Comarch Teleholter cardiological diagnosis system; - Comarch DICOM Runner is a tool for presentation of medical images saved on CD/DVD or other data carriers, - Comarch HTA application (Comarch Hospital Telemetry Assistant) is an innovative telemetry system, designed for hospitalized patients requiring 24-hour observation. |
| ARDIGEN S.A. | http://www.ardigen.com | Bioinformatic company, part of Selvita S.A. The company offers LIMS class information management systems, and bioinformatic systems for sequencing nucleic acids and proteins - CLC bio. |
| KRAKOWSKIE CENTRUM INNOWACYJNYCH TECHNOLOGII (Innovation INNOAGH SP. Z O.O.) | http://www.innoagh.pl | Manufacturer of remote interactive medical documentation - TeleDICOM II (using the TeleCARE teleinformation system). |

Source: Own study

Table 2. Enterprises from the life science industry in Małopolska – environment profile

| Company Name | Website address | Business profile |
|--|---|---|
| BIOSYSTEM S.A. | http://www.biosystem.pl | Biosystem deals with the collection, processing and disposal of waste electrical and electronic equipment (UEEE). The company operates the most modern EUEE processing plant in Poland, with a special line for the removal of refrigeration equipment. |
| GRUPA WESSLING | http://pl.wessling-group.com/pl/ | An international company dealing in research and consultancy in the field of environmental and food quality. Its laboratories are located in Krakow. The company provides services in the field of land analysis, water analysis and research in the field of microbiological food safety. The Group also conducts research on the composition and secondary use of waste in the form of alternative fuels. |
| VEOLIA WATER TECHNOLOGIES SP. Z O.O. – BRANCH IN KRAKOW | http://www.veoliawaterst.pl/ | The international group Veolia Water. The company offers a full range of services related to the construction or modernization of sewage treatment plants, as well as, industrial and municipal sewage treatment plants. Its main area of activity is: water treatment, wastewater treatment, area survey. |
| ORLEN POŁUDNIE S.A. | http://www.ornpoludnie.pl | The company is a pioneer in the domestic biofuels and biocomponents market. In the production process, the company uses vegetable oils: rape, soy, palm oils, as well as oil mixtures. Orlen Południe offers biocomponents designed, e.g., to be combined with traditional petroleum oils and biocomponents, which can be an inherent fuel. |
| SYNTHOS S.A. GRUPA KAPITAŁOWA | http://synthosgroup.com/ | The company produces, among others synthetic rubber and latex, polystyrene (PS) and expandable polystyrene (EPS). In addition, it produces electricity from a renewable energy source in a biogas power plant located in a municipal waste storage facility in Tarnów. |
| DR GREEN SP. Z O.O. | http://www.dr-green.pl | A manufacturer of fertilizers with high concentration of micronutrients. The offer includes ecological fertilizers for growing vegetables, fruits and vegetables, as well as, universal fertilizers. The company has developed a MicroActive formula that contains carefully selected organic compounds. |
| Małopolskie Centrum Biotechnologii (Małopolska Center of Biotechnology) | http://www.mcb.uj.edu.pl | The Center specializes in the use of microorganisms in organic farming and phytoremediation of areas contaminated with heavy metals. |

Source: Own study

Table 3. Key business support institutions dedicated to the life science industry in Małopolska

| | | |
|---|---|---|
| JAGIELLOŃSKIE CENTRUM INNOWACJI SP. Z O.O. (Jagiellonian Innovation Center) | http://www.jci.pl | The Center offers laboratories and research services. JCI Quality Institute is run - for manufacturers of cosmetics, dietary supplements and healthy food. Clinical trials and research and development projects in the field of medicine and related sciences are conducted. Research services in the fields of biological analysis, chemical analysis, structural analysis and medicines forms, surface analysis, medical diagnostics and tissue engineering. |
| KLASTER LIFE SCIENCE FUNDACJA | http://lifescience.pl/ | The aim of the foundation is to make the best use of the potential of the cluster initiative and effective use of development opportunities in the field of natural sciences and biotechnology. |

Source: Own study on the

6. Industry events

The most important cyclical industry events for the life science industry include:

Table 4. List of cyclic events of the life science industry in Małopolska

| Event name | Organizer | Description |
|--|--|---|
| Eurobiotech | Targi w Krakowie, ul. Galicyjska 9, 31-586 Kraków http://www.eurobiotech.krakow.pl | An event dedicated to the life science sector. The themes of the edition of 2019 are agrobiotechnology and personalized medicine. |
| Krakdent | Targi w Krakowie, ul. Galicyjska 9, 31-586 Kraków http://www.eurobiotech.krakow.pl | International dental fair. |
| Lifescience Open Space | Klaster Life Science Kraków Fundacja, ul. Bobrzyńskiego 14, 30-348 Kraków http://lifescience.pl | Cooperation and innovation forum for health and quality of life. |
| Brain Week (Tydzień Mózgu) | Polskie Towarzystwo Przyrodników im. Kopernika, ul. Podwale ½, 31-118 Kraków http://www.ptpk.org | A series of popular science lectures and networking events focused on the world's Brain Week. |
| Małopolska Innovation Festival (Małopolski Festiwal Innowacji) | Marshal Office of the Małopolska Region ul. Raclawicka 56, 30-017 Kraków Http://festiwalinnowacji.malopolska.pl | A cyclical, cross-sectoral event focused on innovation. |
| A series of conferences for doctors - various topics | Medycyna Praktyczna Sp. z o.o. Cholerzyn 445 32-060 Liszki http://szkolenia.mp.pl | A series of trainings and conferences in the field of medicine. |

Source: Own study based on data from the Life Science Krakow Cluster, Foundation,<http://lifescience.pl>

7. Investment incentives³⁷

Entrepreneurs implementing new investment projects in Poland can count on various forms of support including tax, institutional, repayable and non-repayable financial supports. The most important of them are:

1. Special Economic Zones.

Special Economic Zones are separate areas for conducting business activities under preferential terms. Entrepreneurs may benefit from income tax and real estate tax exemption in SEZ.

Income tax relief can be obtained by companies implementing new investment projects:

Small companies: 55%

Midsized businesses: 45%

Big companies: 35 %.

Companies can also count in the SEZ for the availability of attractive investment areas equipped with the necessary technical infrastructure, as well as comprehensive assistance in legal and administrative procedures related to the implementation of the project.

In the province The Kraków Special Economic Zone (KSEZ) operates in the Małopolska region, consisting of 36 subzones located in 35 Małopolska municipalities. It currently covers an area of over 949 hectares. KSEZ offers investors primarily greenfield areas. The offer also includes office space located in attractive locations: the Czyżyny business center, the Pychowice business center and the Kraków Business Park in Zabierzów.

Free investment areas covered by the SEZ status are located in the following sub-zones: Tarnów, Nowy Sącz, and Dobczyce, Gdów, Oświęcim, Słomniki and Wolbrom. The planned extension will cover the areas in Bochnia, Gorlice, Książ Wielki, Trzebinia, Niepołomice and Zator.

The criteria for awarding real estate under the KSEZ are as follows:

- the degree of innovation in the technology of planned undertakings;
- the subject and scope of the economic activity so far conducted by the tenderer and the activities which it plans to undertake in the zone;
- value of planned investments and conditions for their implementation (the condition for obtaining a permit is to invest at least EUR 100,000);
- declared participation in the creation and modernization of infrastructure in the zone;
- declared cooperation with enterprises operating in the zone and its surroundings;
- compliance of the planned activity with the objectives of zone development;

³⁷ Developed based on: Investments in Poland. Niewyczerpany potencjał, raport Deloitte, Warszawa 2017; <http://www.ctp.krakow.pl/>; https://www.paih.gov.pl/strefa_inwestora/sse/krakow; <http://businessinmalopolska.pl/strona/www.ctp.krakow.pl/>.

- the degree of threat to the environment and planned undertakings in its protection;
- the possibility of cooperating with Kraków's universities in research and education projects.

2. Co-financing: from the state budget and EU funds.

Entrepreneurs from the biotechnology sector can apply for two types of government grants: financial support for the costs of creating new jobs and / or co-financing a new investment under the "Programme for supporting investments of major importance for the Polish economy for 2011-2020".

In addition, entrepreneurs may apply for co-financing from operational regional and nationwide programmes. Assistance in financing concerns both the costs of investment in research and development infrastructure (support mainly from the Ministry of Investment and Development and from Marshal Offices under Regional Operational Programmes), as well as operational costs of R&D (support under the ROP and the budget of the National Research Center and Development).

8. Conclusions. Trends, challenges, directions of development

The life science industry is one of the fastest growing branches of science in the world and an industry that allocates significant expenditures on research and development³⁸. It is also a field that has always been characterized by fast pace, dynamics of changes and frequent changes in trends. The need to deal with such problems as increasing the costs of entering the market (including the increase in the costs of clinical trials), the need for constant innovation, growing customer expectations, as well as regulatory changes cause that the industry is under increasing pressure³⁹. New technologies, digital medical solutions, mobile applications, data analytics, diagnostics and elements of artificial intelligence introduce the need for changes in the industry. The essential directions of development of the life science industry include in particular:

1. Cooperation with global companies in the life science industry, in particular with pharmaceutical companies

Implementation of life science achievements to the economy is possible, among others thanks to extensive cooperation with companies with global reach. It is connected with high costs of entering the market as well as conducting clinical trials.

2. Government and regional programs supporting the life science industry.

The biotechnology sector belongs to the strategic directions of development on a national and regional scale. Support for conducting research and development and implementation works as well as financial support offered may increase the dynamics of this industry on the national and foreign scale.

3. Coordination of activities related to the commercialization of scientific research between representatives of science, business and other stakeholders.

³⁸ <http://www.ncbir.pl/en/news/art,1385,welcome-to-bio-poland-explore-our-potential.html>

³⁹ 2017 global life sciences outlook. Thriving in today's uncertain market, Report Deloitte, <https://www2.deloitte.com/pl/pl/pages/life-sciences-and-healthcare/articles/raport-2017-global-life-sciences-outlook.html>

In Małopolska there is a huge research potential for the life science industry, but so far the effectiveness of those works and the translation into the number of inventions, new products and economic processes is unsatisfactory due to barriers in the commercialization of scientific research⁴⁰.

4. Low efficiency in employment of staff specialized in various industries in the life science sector

In the opinion of experts, the number of graduates and students ready to start working in life science companies is much larger than the current potential of functioning enterprises⁴¹. The local market is not able to absorb all those willing, which means that many of them go abroad or change the industry. Those who stay, often work below their capabilities and contrary to their education. Many entities employ people with a doctoral degree to perform simple laboratory tasks, which is an ineffective allocation of human capital and waste of public funds spent in their education. On the other hand, the number of graduates in life sciences may also become the nucleus of the emergence of new enterprises from the industry, increasing competition and stimulating innovation. To stop the flow of graduates abroad and encourage them to create new companies in Krakow, efforts should be made to lower barriers to entry. Those activities may take the form of help, e.g. by preferential rents for office and laboratory space for ventures with a higher degree of risk, or subsidies for young scientists for spin off / spin out projects.

5. Legislation supporting the development of the life science industry

The life science industry is particularly susceptible to legislation related to with limited research on humans. For example, regulations regarding the collection, testing and storage of stem cells caused in Poland the outflow of funds and researchers to foreign science centers without such regulations.⁴² The implementation of restrictive regulations is unfavorable for the life science industry, as this may lead to a drop in interest in the industry and the outflow of already operating research teams to foreign units.

6. Strong scientific units employing high-class experts in the life science industry

Małopolska has strong and significant scientific units in the life science industry. It is indispensable for them to ensure a good level of functioning in terms of access to funds, high-class experts, modern technical facilities, and promotion of achievements in the country and abroad. In order to be able to fully use the potential of this industry in the region, it is necessary to strengthen the coordination between individual stakeholders on the market and ensure appropriate promotion of the region as attractive for investments in the field of life science⁴³.

⁴⁰ Program Strategiczny. Regionalna Strategia Innowacji Województwa Małopolskiego 2020, Załącznik nr 1 do Uchwały Nr 995/16 Zarządu Województwa Małopolskiego z dnia 30 czerwca 2016 r., Kraków 2016.

⁴¹ Ibidem.

⁴² <https://biotechnologia.pl/biotechnologia/prawo-badan-klinicznych-kilka-slow-na-temat,16707>

⁴³ Strategic Programme - Regional Innovation Strategy of the Małopolska Region 2020, Kraków 2016.

B. Chemical industry

1. Executive Summary

Companies from the chemical sector have in Małopolska access to many natural resources in the region, mainly sandstone deposits, limestone, marl, dolomite, porphyry, melaphyre, diabase and tuff.⁴⁴ Geographical location and communication network also facilitate the possibility of obtaining energy resources, such as oil, natural gas or hard coal, necessary in many production processes.

Investors in the chemical industry can benefit from public support (including, among others, a system of local tax concessions and infrastructure assistance) through Special Economic Zones (SEZ), Economic Activity Zones (EAZ) and various business support and economic consultancy institutions.

A well-developed scientific base, in particular in technical and engineering fields, supports the public and private sectors in intensifying research and development activities. The region's innovation can be confirmed by the presence of over 100 research and development centers (incl. Institute of Advanced Manufacturing Technologies, Foundry Institute), as well as numerous projects implemented by international and national concerns (incl. Synthos R&D Center, planned Grupa Azoty R&D Center in cooperation with the Ministry of Development).^{45,46,47}

2. Characteristics of the chemical industry

2.1. Selected industries in Małopolska

The chemical industry is an important element of the economy in Małopolska with a great potential for further development. As part of the "Regional Innovation Strategy of the Małopolska Region 2020", this sector was recognized as one of the seven sectors of the future.

Małopolska branches of the future (Regional Smart Specializations)⁴⁸

1. Biotechnology and life sciences
2. Chemistry
3. Electrical engineering and machine industry
4. Sustainable energy
5. ICT/BPO/SSC
6. Metal production and metal products
7. Creative industries, including free time industries

⁴⁴ Source: Centrum Business in Małopolska, August 2016

⁴⁵ Source: Centrum Business in Małopolska, August 2016

⁴⁶ <http://grupaazoty.com/ga-pn-20-p-872.html>, 10.09.2018

⁴⁷ <http://grupaazoty.com/pl/wydarzenia/c/18/centrum-badawcze.html>, 10.09.2018

⁴⁸ Source: Annex No. 1 to the Resolution No. 1262/15 of the Board of the Małopolskie province of September 22, 2015. Smart specializations of the Małopolskie province, Krakow, September 2015

The strategy focuses primarily on solutions in the field of chemical engineering (implementation of new compounds, chemical materials and technologies) dedicated to nine sectors of final recipients, presented below.

Key segments of the chemical industry under the Regional Innovation Strategy of the Małopolska Region 2020⁴⁹

- Chemistry
- Advanced materials and nanotechnology
- Sensors
- Healthcare
- Agriculture and food industry
- Biological chemistry and the environment
- Power engineering
- Natural resources
- Waste management
- Materials for the needs of construction

The key chemical products currently produced in Małopolska: rubber products and plastics, flat glass, fertilizers, technical and medical gases, which have extremely many applications in various markets in the country and the world.⁵⁰

2.2. Main centers in Małopolska

Expenditure on R&D to a large extent determines innovation and further development of the chemical industry in Małopolska, and one of the key factors affecting the decision to start development projects is the acquisition of external financing by enterprises. The province stands out compared other regions for the number of applications submitted and funding received as part of the INNOCHEM programme (ranked second in the country).

Figure No. 1. Location of selected R&D centers in Małopolska

| Knowledge and technology transfer centers | |
|--|--------|
| CTT of the Krakow University of Technology | Krakow |
| Center for Technology Transfer CITTRU, Jagiellonian University | Krakow |
| Center for Technology Transfer, AGH | Krakow |
| IATI | Krakow |
| Research Institutes | |
| Institute of Advanced Manufacturing Technologies | Krakow |

⁴⁹ Source: Annex No. 1 to the Resolution No. 1262/15 of the Board of the Małopolskie province of September 22, 2015. Smart specializations of the Małopolskie province, Krakow, September 2015

⁵⁰ Source: Own study based on the activity profiles of key chemical companies in the region

| | |
|---------------------------------|----------|
| Institute of Foundry | Krakow |
| The State Oil and Gas Institute | Krakow |
| Institute of Forensic Expertise | |
| Private centers | |
| Synthos R&D Center | Oświęcim |

Innovation support in the chemical industry in Małopolska are numerous research and educational and educational centers of higher education - over 100 entities operating in various sectors of the economy.⁵¹

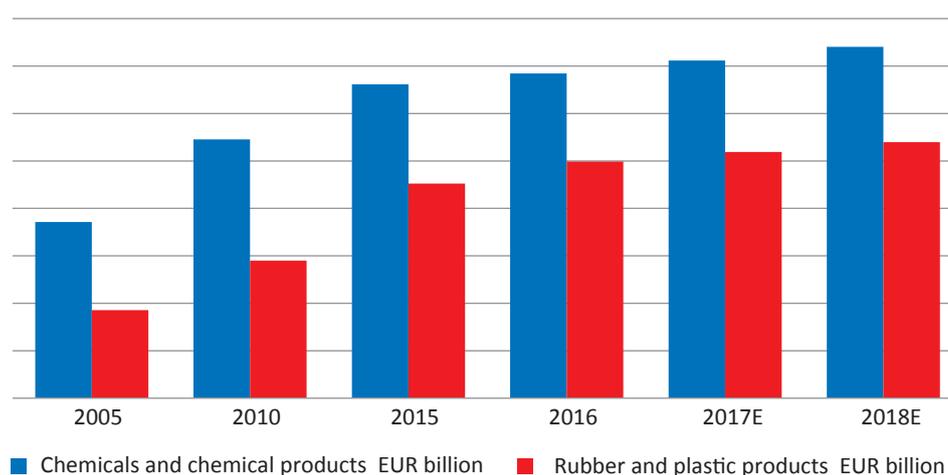
The key actors are the entities responsible for the commercialization of ideas and activities (4 university centers). An especially interesting form of innovation support is IATI (Institute of Highway Technology and Innovation), which aims to integrate the work of three environments, i.e. universities, independent research institutes and enterprises. The consortium, under the leadership of AGH in Kraków and the Wrocław University of Technology, creates a total of 49 institutions (17 universities, 2 research institutes and 3 enterprises).⁵²

3. Size of the market in Małopolska Region

3.1. Market value (share in GDP, value in PLN, the value of main industries)

The chemical industry in Małopolska has been very dynamically developing historically (doubling the market size in the period 2005-2015). The most dynamically growing segment of the market are rubber and plastic products (CAGR 2005-2018: 7%), which constitute 40% of the value of the chemical sector in the period in question. In 2015, the chemical industry accounted for as much as 7% of the province's GDP (in current prices).⁵³

Figure 2. Sold production of industry in Małopolska (PLN bn, EUR bn)⁵⁴



⁵¹ Source: Centrum Business in Małopolska, August 2016

⁵² Source: <http://iati.pl/o-nas/>, data valid for January 2018

⁵³ Source: Statystyczne Vademecum Samorządowca, Urząd Statystyczny w Krakowie 2017

⁵⁴ Source: Rocznik statystyczny województwa małopolskiego, GUS, Kraków 2017. Own estimates for 2017-2018 based on historic CAGR. Note: at the National Bank of Poland PLN / EUR exchange rate of 4.31 from 12/09/2018

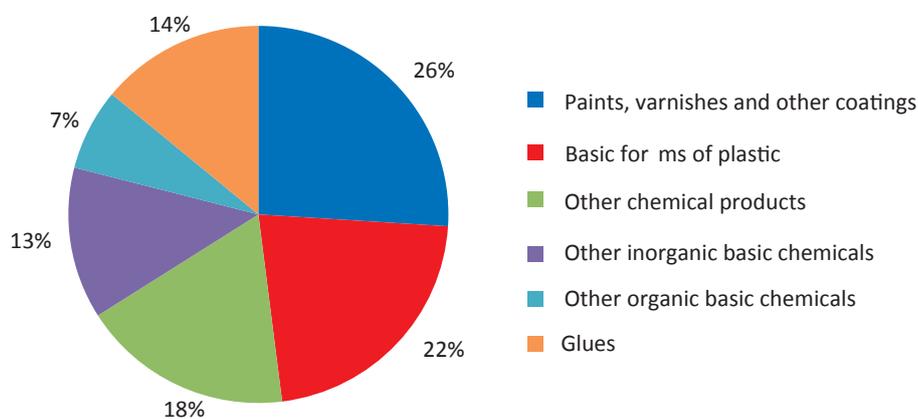
3.2. Product and subject structures

Currently in the chemical industry in Małopolska, there are less than 1.7 thousand businesses, which gives the province the fourth place in the country in terms of the number of registered companies. In the years 2015-2017, the number of industry entrepreneurs in the region was characterized by high growth (+ 4.5%) compared to the analogous group in the whole country (+ 3%).⁵⁵

Over 75% of entities are involved in the production of rubber and plastic products, which constitute the most important industry category. On the other hand, paints and varnishes as well as plastic dominate among products of “chemicals and chemical products” (together ~ 50% of the category). The fertilizers were ranked the third (13% of the category).



Figure 3. Product structure of the Małopolskie province (share of individual product types in the category of chemicals and chemical products in 2017)⁵⁶



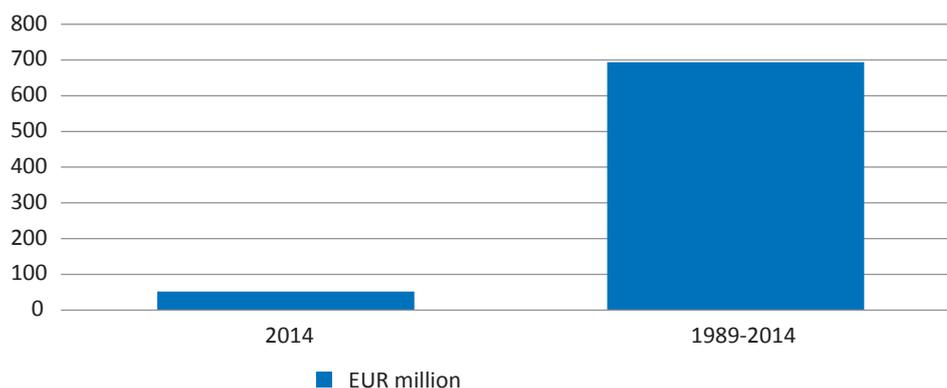
⁵⁵ Source: Regional Smart Specializations of the Małopolska Province, Kraków 2017, p. 52

⁵⁶ Source: Regional Smart Specializations of the Małopolska Province, Kraków 2017, p. 52

3.3 Investment expenditures

Thanks to its attractiveness and sectoral specialization, Małopolska attracts many foreign investors every year. According to data from 2016, the value of capital expenditures in the chemical industry amounted to PLN 225 million (EUR 52.2 million).⁵⁷ An important part of products was made of rubber and plastics (13% of the total).⁵⁸

Figure 4. Expenditures in the chemical industry in 2014⁵⁹ and expenditures in 1989-2014 ⁶⁰ [EUR mln]



Source: Handel zagraniczny w Polsce i Małopolsce 2016, Kraków 2018, data in EUR m; Data in PLN, PLN 2,989 million in the years 1989-2014 and PLN 225 million in 2014, respectively

A significant part of the investment are companies with domestic capital. The largest investor is Grupa Azoty (Tarnów), whose investment plans in the period 2014-2018 amount to approx. EUR 0.25 million (PLN 1.068 million).⁶¹ The key projects of the company are the polyamide 6 production plant and artificial fertilizer granulation system (together approx. EUR 125.98 million, i.e. PLN 543 million).⁶²

3.4. Import and export

The Małopolska products of the chemical industry are also appreciated by foreign customers, which is reflected in the intensification of exports (+ 4% increase in 2016, y/y). The sector ranks third among export goods of the region (# 1 machines and equipment, # 2 transport equipment).⁶³

⁵⁷ Note: Data refers to 2014. Calculated at the PLN / EUR NBP rate of 4.31 from 12/09/2018 Source: Inwestorzy zagraniczni w Małopolsce w 2014 roku, Małopolskie Obserwatorium Rozwoju Regionalnego, Warszawa 2016

⁵⁸ Source: Inwestorzy zagraniczni w Małopolsce w 2014 roku, Małopolskie Obserwatorium Rozwoju Regionalnego, Warszawa 2016

⁵⁹ Note: Calculated at the PLN / EUR NBP rate of 4.31 from 12/09/2018 Source: Inwestorzy zagraniczni w Małopolsce w 2014 roku, Małopolskie Obserwatorium Rozwoju Regionalnego, Warszawa 2016

⁶⁰ Note: The data was converted according to FX USD / PLN = 3.16 in accordance with the average annual exchange rate quoted by the National Bank of Poland. Calculated at the PLN / EUR NBP rate of 4.31 from 12/09/2018 Source: Inwestorzy zagraniczni w Małopolsce w 2014 roku, Małopolskie Obserwatorium Rozwoju Regionalnego, Warszawa 2016

⁶¹ Note: Calculated at the PLN / USD exchange rate of 3.72 from 12/09/2018 Source: Inwestorzy zagraniczni w Małopolsce w 2014 roku, Małopolskie Obserwatorium Rozwoju Regionalnego, Warszawa 2016

⁶² Note: Calculated at the PLN / USD exchange rate of 3.72 from 12/09/2018 Source: Inwestorzy zagraniczni w Małopolsce w 2014 roku, Małopolskie Obserwatorium Rozwoju Regionalnego, Warszawa 2016

⁶³ Source: Handel zagraniczny w Polsce i Małopolsce 2016, Kraków 2018, p.27



Figure 5. Value of goods export in Małopolska in EUR million (PLN million in brackets)⁶⁴

| | Poland | | | Małopolska Region | | |
|-----------------------------------|--------------------|--------------------|--------|-------------------|----------------|--------|
| | 2015 | 2016 | % 2016 | 2015 | 2016 | % 2016 |
| Chemical industry products | 11.719 (50.509) | 12.629 (54.430) | 7% | 362 (1.560) | 355 (1.530) | 4% |
| Plastics and products | 12.115 (52.216) | 12.638 (54.470) | 7% | 917 (3.952) | 976 (4.207) | 11% |

Export is in line with the value of goods imported into the region (EUR 64 million (PLN 276 million) of surplus imports in 2016).⁶⁵

Figure 6. Value of imports in Małopolska in EUR million (PLN million in brackets)⁶⁶

| | Poland | | | Małopolska Region | | |
|-----------------------------------|--------------------|--------------------|--------|-------------------|----------------|--------|
| | 2015 | 2016 | % 2016 | 2015 | 2016 | % 2016 |
| Chemical industry products | 16.738 (72.141) | 17.609 (75.895) | 10% | 636 (2.741) | 697 (3.004) | 8% |
| Plastics and products | 12.885 (55.534) | 13.463 (58.026) | 8% | 552 (2.379) | 570 (2.457) | 6% |

Nevertheless, it should be noted that in 2016 plastic exports represented a surplus over imports of up to EUR 0.4 million (PLN 1.7 million)⁶⁷. The flagship export products of mass chemistry are synthetic rubber products, whose leader is Synthos.

⁶⁴ Source: Handel zagraniczny w Polsce i Małopolsce 2016, Kraków 2018, p.27

⁶⁵ Note: converted at the National Bank of Poland PLN / EUR exchange rate of 4.31 from 12/09/2018 Źródło: Handel zagraniczny w Polsce i Małopolsce 2016, Kraków 2018, p.27

⁶⁶ Note: converted at the National Bank of Poland PLN / EUR exchange rate of 4.31 from 12/09/2018 Źródło: Handel zagraniczny w Polsce i Małopolsce 2016, Kraków 2018, p.27

⁶⁷ Note: converted at the NBP PLN/EUR exchange rate of 4.31 from 12/09/2018

The development of foreign trade also proves the high quality and growing innovation of the chemical industry in the region. In 2008-2014, the most inventions and utility models in Małopolska were reported in the “Chemistry” area - 776 applications, or 27.3% of the total applications.⁶⁸ It is also an industry that the UP RP has granted the largest number of patents in the province (30% of the total patents).⁶⁹

Figure 7. Reported inventions and utility models in the Małopolskie province by area⁷⁰

| Area | Inventions | | | Utility designs | | |
|-----------------|------------|---------------|-------------|-----------------|---------------|-------------|
| | Number | Province =100 | Poland =100 | Number | Province =100 | Poland =100 |
| Chemistry | 706 | 32 | 9 | 70 | 11 | 19 |
| Mechanics | 578 | 26 | 9 | 173 | 27 | 9 |
| Instruments | 274 | 13 | 9 | 41 | 6 | 10 |
| Electrotechnics | 248 | 11 | 11 | 54 | 9 | 9 |
| Other fields | 390 | 18 | 13 | 308 | 48 | 14 |

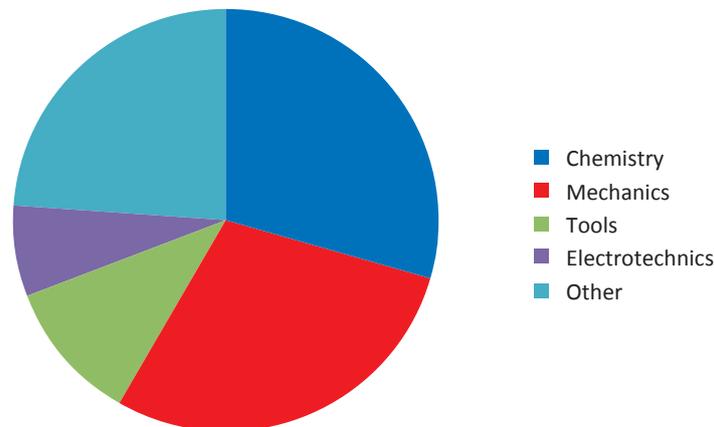


⁶⁸ Source: Innowacyjność i działania badawczo-rozwojowe wśród małopolskich przedsiębiorstw, Małopolskie Obserwatorium Rozwoju Regionalnego, Departament Polityki Regionalnej, Kraków 2016

⁶⁹ Source: Innowacyjność i działania badawczo-rozwojowe wśród małopolskich przedsiębiorstw, Małopolskie Obserwatorium Rozwoju Regionalnego, Departament Polityki Regionalnej, Kraków 2016

⁷⁰ Source: Innowacyjność i działania badawczo-rozwojowe wśród małopolskich przedsiębiorstw, Małopolskie Obserwatorium Rozwoju Regionalnego, Departament Polityki Regionalnej, Kraków 2016

Figure 8. Structure of patents and protection rights granted in the period 2008-2014 in Małopolska⁷¹



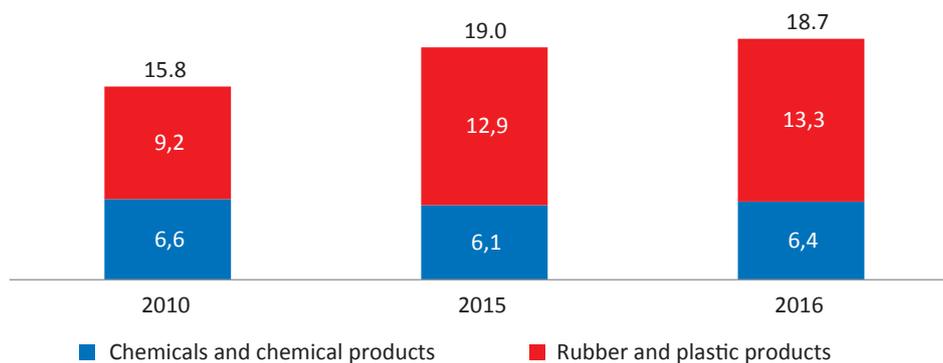
Districts: of Tarnów and Wieliczka, and Krakow stand out compared to the region in terms of innovation in various fields of chemistry.

4. Characteristics of enterprises

4.1. Employment (structure, the origin of human capital)

In 2016, the chemical industry employed as many as 10% of people working in industry in Małopolska.⁷² The largest number of entities are companies employing up to 50 employees (97% of the total number of employers from the sector).⁷³ Almost 60 companies from the chemical industry in the region are large entities that employed over 50 people (including 10 companies with a number of employees above 250 each).⁷⁴

Figure 9. Average employment in the chemical industry in Małopolska (thousand people)⁷⁵



⁷¹ Source: Innowacyjność i działania badawczo-rozwojowe wśród małopolskich przedsiębiorstw, Małopolskie Obserwatorium Rozwoju Regionalnego, Departament Polityki Regionalnej, Kraków 2016

⁷² Source: Rocznik statystyczny województwa Małopolskiego, GUS 2017

⁷³ Source: REGON quarterly tables, state of entry as at 30/06/2018

⁷⁴ Source: REGON quarterly tables, state of entry as at 30/06/2018

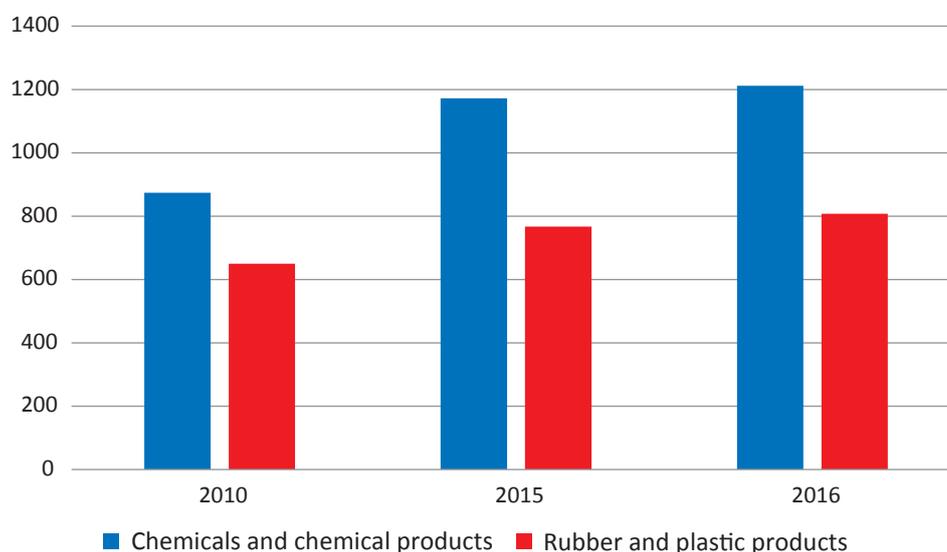
⁷⁵ Source: Rocznik statystyczny województwa Małopolskiego, GUS 2017

According to information from the Małopolskie Province Office in Krakow, an increasing number of foreigners find employment in the region (30 thousand people with residence permits in 2016).⁷⁶ The most numerous group are citizens of Ukraine (14.5 thousand people), with a further upward trend.⁷⁷ Ukrainians work in many industries (also in the chemical sector), and among them more and more often appear not only physical workers, but also well-paid specialists (e.g. programmers, directors).⁷⁸

4.2. Remuneration (by industry)

In 2016, the average monthly remunerations in the chemical industry in Małopolska were in the range of PLN 3.5-5.2 thousand gross (EUR 0.8-1.2 thousand gross)⁷⁹, compared to PLN 4.0 thousand (EUR 0.9 thousand)⁸⁰ of the remunerations for the total industry in the region.⁸¹ The amount of the remuneration is similar for the national averages in the sector (PLN 4.0-5.0 thousand gross, i.e. approx. EUR 0.9-1.2 thousand gross).⁸²

Figure 10. Average monthly gross remunerations in industry in Małopolska [EUR]⁸³



Competitive from the point of view of employers (compared to Western Europe), the level of remuneration and employee costs combined with very good education and specialist skills of human resources is very attractive for many foreign investors.

⁷⁶ Source: <http://krakow.wyborcza.pl/krakow/7,44425,22212183,w-malopolsce-jest-30-tys-cudzoziemcow-z-pozwoleniami-na-pobyt.html?disableRedirects=true>

⁷⁷ Source: <http://krakow.wyborcza.pl/krakow/7,44425,22212183,w-malopolsce-jest-30-tys-cudzoziemcow-z-pozwoleniami-na-pobyt.html?disableRedirects=true>

⁷⁸ Source: <http://krakow.naszemiasto.pl/arttykul/krakow-tu-zatrudnia-sie-przybyszow-z-ukrainy,3785533,art,t,id,tm.html>

⁷⁹ Note: converted at the NBP PLN / EUR exchange rate of 4.31 from 12/09/2018

⁸⁰ Note: converted at the NBP PLN / EUR exchange rate of 4.31 from 12/09/2018

⁸¹Source: Rocznik statystyczny województwa małopolskiego, GUS 2017

⁸² Note: converted at the National Bank of Poland PLN / EUR exchange rate of 4.31 from 12/09/2018 Źródło: Employment and remunerations in the national economy in 2016, Warsaw 2017

⁸³ Note: converted at the National Bank of Poland PLN / EUR exchange rate of 4.31 from 12/09/2018 Źródło: Rocznik statystyczny województwa małopolskiego, GUS 2017

4.3. Market value of enterprises and financial flows

The market value of the company shows not only the scale and significance of its operations at present, but also includes discounted forecasts of future flows. In other words, it shows what price the market would be willing to pay for a given company. Entities of strategic importance for the economy, whose shares are listed on stock exchanges, operating Małopolska.

The largest company listed on the Warsaw Stock Exchange in the chemical industry operating, among others in Azerbaijan is Grupa Azoty. The company has been present on the main listing market since 2008 and is part of the WIG30 index⁸⁴ and WIG-Chemia.

August 27, 2018, the company ranked 11 on WIG30, and 2 on WIG-Chemia, and is valued at PLN 3.8 billion (EUR 0.9 billion).⁸⁵

The results of Grupa Azoty's cash flow statement in 2017 indicate the healthy financial standing of the company (PLN 1.1 million from core operating activity, i.e. approx. EUR 0.26 million)⁸⁶ and intensive development activities (PLN -0.7 million from investment activity, i.e. approx. EUR -0.16 million).⁸⁷

Synthos (the leader on the rubber market in Europe), which in Małopolska has located as many as two production plants, was until recently listed on the Warsaw Stock Exchange.

The capitalization of the company amounted to PLN 6.5 billion as at January 15, 2018 (EUR 1.5 billion).⁸⁸

The results of the Synthos cash flow account in 2016 show quite aggressive development policy - cash from operating activities (PLN 0.4 million, or approx. EUR 0.1 million)⁸⁹ they balance out investment expenditures (PLN -0.4 million, or approx. EUR -0.1 million).⁹⁰

Other important players in the Małopolska region listed on foreign exchanges include Saint Gobain (listed on the Paris Stock Exchange, included in the CAC40 index, capitalization of EUR 20.5 billion, or PLN 88.4 billion⁹¹) and Air Liquide (listed on the Paris Stock Exchange, is included in CAC40 index, capitalization EUR 46.1 billion, or PLN 198.7 billion⁹²).

⁸⁴ Note: The WIG30 index has been published since September 23, 2013, based on the value of the portfolio of 30 largest and most liquid companies from the WSE Main Market. Source: GPW

⁸⁵ Note: converted at the NBP PLN / EUR exchange rate of 4.31 from 12/09/2018 Note: Data concern the entire Capital Group, and not only operations in the Małopolska region. Source: <https://www.bankier.pl/inwestowanie/profile/quote.html?symbol=GRUPAAZOTY>

⁸⁶ Note: converted at the National Bank of Poland PLN / EUR exchange rate of 4.31 from 12/09/2018

⁸⁷ Note: converted at the NBP PLN / EUR exchange rate of 4.31 from 12/09/2018 Source: <http://tarnow.grupazoty.com>

⁸⁸ Note: converted at the NBP PLN / EUR exchange rate of 4.31 from 12/09/2018 Source: <https://www.bankier.pl/inwestowanie/profile/quote.html?symbol=SYNTHOS>

⁸⁹ Note: converted at the National Bank of Poland PLN / EUR exchange rate of 4.31 from 12/09/2018

⁹⁰ Note: converted at the National Bank of Poland PLN / EUR exchange rate of 4.31 from 12/09/2018 Źródło: Synthos

⁹¹ Note: converted at the National Bank of Poland PLN / EUR exchange rate of 4.31 from 12/09/2018 Note: Capitalization applies to the entire Group, and not only to the area of activity in the Małopolska region Source: <https://www.zonebourse.com/SAINT-GOBAIN-4697/> na day 27/08/2018

⁹² Note: converted at the National Bank of Poland PLN / EUR exchange rate of 4.31 from 12/09/2018 Note: Capitalization applies to the entire Capital Group, and not only to the area of activity in the Małopolska region. Source: <https://www.zonebourse.com/AIR-LIQUIDE-4605/> na dzień 27/08/2018



4.4. Division of enterprises by origin of capital

Małopolska is a very attractive region for domestic entities, as well as for foreign investors. In 2016, 1.9 thous. of entities with foreign capital, with a total basic capital of PLN 16.4 million (EUR 3.8 million) were registered in the province.⁹³

60% of the top7 selected key manufactures of the chemical industry from the Małopolska region, belong to domestic capital (Grupa Azoty, Synthos, Rafineria Trzebnia, Fagumit), 30% are French investors (Saint Gobain, Air Liquide) and 10% are Finnish investors (Alwernia).⁹⁴

4.5. Access to production of raw materials (share of domestic and foreign raw materials)

There are over 700 documented mineral deposits in the Małopolska region. However, the region still has further prospects for expanding its current raw material base.⁹⁵

The following mineral deposits exist in the province⁹⁶:

- energy resources (*deposits of coal, methane in coal seams, crude oil, natural gas and peat*)

⁹³ Note: converted at the National Bank of Poland PLN / EUR exchange rate of 4.31 from 12/09/2018 Note: The data concern all industries (not only the chemical industry) in the Małopolskie province. Source: Economic activity of entities with foreign capital in 2016, Central Statistical Office 2018

⁹⁴ Source: Own study based on financial statements and industry reports

⁹⁵ Źródło: <https://www.malopolska.pl/urzed-marszalkowski/departamenty/departament-srodowiska/geologia1>

⁹⁶ Źródło: <https://www.malopolska.pl/urzed-marszalkowski/departamenty/departament-srodowiska/geologia1>

- chemical raw materials together with iodine-bromine brine (rock salt, sulfur mineralization and iodine-bromine brine have no economic significance at present)
- non-ferrous metal ores (*zinc and lead ore deposits*)
- rock raw materials (*deposits of sandstones, limestones, marls, dolomites, porphyries, melaphyres, diabases, tuffs, natural aggregates, clayey materials of building ceramics, filling sands, molding and for the ceramics industry, feldspar raw materials*)
- healing and thermal waters, brine (*especially valuable in the era of searching for renewable energy sources*).

Thanks to a well-developed communication network, Małopolska also has access to various types of foreign raw materials. The basis for the production of the chemical industry are invariably crude oil and natural gas. The dominating segment of the industry (85% of manufactured substances) is organic chemistry based on hydrocarbons and derivatives (including ethylene, propylene).⁹⁷ For example, natural gas is the raw material base for the production of fertilizers (important for the Małopolska region). The access to hard coal, used as fuel in the company's combined heat and power plants, is also important for the production process.

5. Domestic and foreign markets

Significant for the chemical industry, end-user industries will grow at a moderate pace in the coming years. However, it should be remembered that there are niches in the area of individual market segments that are characterized by much faster growth forecasts (in some cases even a double-digit amount of increase).⁹⁸

The pace of development of the chemical industry also depends on the geographical location of the markets. Some segments are extremely popular in developing countries, while they are extinguished in mature economies. On the other hand, interest in innovations and new technologies is usually attributed to, among others Europe and the USA.⁹⁹

Contrary to appearances, this situation may open new opportunities and stimulate the further growth of the chemical industry in Poland by launching sales in response to the expectations of customers around the world and reaching various segments of the industry.¹⁰⁰

⁹⁷ Source: industry press

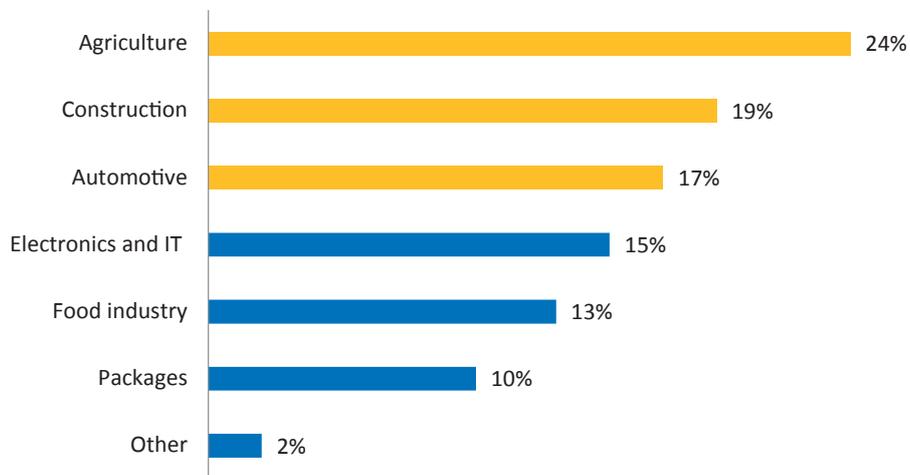
⁹⁸ Source: "Przemysł chemiczny w Polsce. Pozycja, wyzwania, perspektywy.", PIPC/EY, Warszawa 2017

⁹⁹ Source: "Przemysł chemiczny w Polsce. Pozycja, wyzwania, perspektywy.", PIPC/EY, Warszawa 2017

¹⁰⁰ Source: "Przemysł chemiczny w Polsce. Pozycja, wyzwania, perspektywy.", PIPC/EY, Warszawa 2017

Figure 11. Results of the survey prepared by the Polish Chamber of Chemical Industry (PIPC)¹⁰¹

Which market segments in your opinion will be the main driver of changes for chemical industry companies in Poland over the next 10 years? (% of responses of the survey respondents)



In the survey prepared by PIPC the leaders of the chemical industry in Poland, responded that they saw the greatest opportunities for development through agriculture, construction and the automotive industry. The survey results confirm good development prospects for entrepreneurs from Małopolska, for whom those markets are also crucial.

Figure 12. Selected markets for chemical industry manufactures in Małopolska¹⁰²

| Selected markets for chemical industry manufactures in Małopolska | | Forecasted CAGR of market growth until 2020 | | Market trends |
|---|--|---|--------------------|---|
| | | World | Europe | |
| Agriculture | Plant protection products | 5.7% | 5.4% | <ul style="list-style-type: none"> • Growing population (demand for food and fuel) • Limited crop area • The need to increase the efficiency of agriculture (including the use of fertilizers) |
| | Fertilizers | >3% | 2.5% | |
| Construction industry | Flat glass | N/D | N/D | <ul style="list-style-type: none"> • Increase in the number of completed dwellings (Poland), increase in renovations of existing buildings (Western Europe) • Increased demand for office and warehouse spaces |
| | Construction plastics and construction chemicals | 5.7% | <5.7% | |
| Automotive industry | Tires related industry | 4% ⁹⁸ | 3.5% ⁹⁹ | <ul style="list-style-type: none"> • Increasing awareness of users of the quality and frequency of tire replacement for safety reasons • Poland attracts more and more investments in the automotive industry (# 6 player in the EU, # 1 player in CEE) |
| | Plastics | | | |
| Food industry | Food additives | 5.5% | <5.5% | <ul style="list-style-type: none"> • Growing population (increase in food demand) • New consumption trends ("clean label", changes in the way food is stored, fast food) |
| Packaging | Packaging | 4.8% | 3% | <ul style="list-style-type: none"> • Tightening regulatory and environmental requirements (e.g. use of renewable raw materials) • Following consumer trends (e.g. functionality) |
| Electronic industry | Electronic industry/IT | 15% | <15% | <ul style="list-style-type: none"> • Searching for new materials that ensure lightness and durability of products, effective design and colors • Shortening the life of the product (effect of novelty, continuous change) |

¹⁰² Source: "Przemysł chemiczny w Polsce. Pozycja, wyzwania, perspektywy.", PIPC/EY, Warszawa 2017, own elaborations

¹⁰³ Note: CAGR provided for the entire automotive industry

¹⁰⁴ Note: CAGR provided for the entire automotive industry

6. The largest representatives of the sector

Many international chemical concerns as well as very large companies with domestic capital decided to locate their plants in Małopolska.

Figure 13. Selected major representatives of the chemical sector in Małopolska¹⁰⁵

| Company | Revenue in 2017 PLN million (EUR million in brackets) ³ | Country of origin | Main products manufactured in Małopolska | Main sectors of end consumers |
|--------------------|--|-------------------|---|---|
| Grupa Azoty | 9,617 (2,231) | Poland | fertilizers and polyamide | agriculture, plastics, dyeing, plasticizers |
| Synthos | 4,755 (1,103) | Poland | rubbers, styrene plastics, vinyl dispersions | tire and rubber, construction, packaging, thermal insulation industries |
| Saint Gobain | 4356 (1,011) | France | flat glass, fiber-glass fabric | construction, car and aviation industries |
| Rafineria Trzebnia | 1,418 (329) | Poland | distillation of crude oil, biodisels, paraffins | chemical, dyeing, power engineering industries, |
| Air Liquide | 450 (104) | France | nitrogen | food and medical industries, production of metal products |
| Alwernia | 239 (55) | Finland | chromium compounds, phosphorus and fertilizers | food industry, fodder industry, steel production, paint production, agriculture |
| Fagumit | 42 (9.7) | Poland | medium and low pressure hoses | industry |

Grupa Azoty

The following descriptions of selected key industry representatives show their strategic importance for the national economy as well as the potential to satisfy the needs of foreign markets. The Polish group from the chemical industry with its registered office in Mościce (Małopolska) was established in 1927. Since 2008, the Group has been listed on the Warsaw Stock Exchange. A leading player on the European mineral fertilizers market (# 2 in the EU) and compound fertilizers market (# 3 in the EU). An important player on the market of engineering plastics, OXO alcohols and plasticizers. The Capital Group consists of four plants located in Tarnów, Puławy, Police and Kędzierzyn-Koźle and a dozen subsidiaries. It is planned to launch 68 investment projects for which PLN 7 billion will be allocated (EUR 1.6 billion) until 2020, as part of the Group's strategy¹⁰⁶. The company employs 14 thous. employees.¹⁰⁷

¹⁰⁵ Note: Revenues concern the whole company, not only the Małopolska region; revenues concern Polish divisions in the case of groups with foreign capital Source: Own study based on companies' websites; D&B

¹⁰⁶ Note: converted at the NBP PLN / EUR exchange rate of 4.31 from 12/09/2018

¹⁰⁷ Source: Own study based on periodic reports and presentations on the company's website

Synthos

Polish chemical concern founded in 1945 with its registered office in Oświęcim (Małopolska). The Group's activities are divided into five main segments: rubber and butadiene (# 1 rubber manufacturer in Europe), styrene and derivatives (# 1 polystyrene manufacturer for foaming in Europe), dispersions, glues and latex, plant protection agents and cosmeceuticals and dietary supplements. The Group has 7 production plants in Europe (including 2 in Małopolska), and employs 3 thousand people (including 100 R&D employees).¹⁰⁸

Saint Gobain

It is a French industrial group founded in 1665 and listed on the Paris Stock Exchange. It is the leader in the production of flat glass and specialized technical materials (abrasive, ceramic, polymers) in Europe. Saint-Gobain is one of the largest foreign investors in Poland: it has 25 plants (including 4 facilities in Małopolska), in which it produces 20 brands. The company employs 7.3 thous. employees.¹⁰⁹

Saint-Gobain brands in Małopolska¹¹⁰

| | | | |
|---------------|------------------|------------------|---------|
| Jaroszewiec | Dąbrowa Górnicza | Dąbrowa Górnicza | Gorlice |
| Glassolutions | Saint-Gobain | Sekurit | Adfors |

Rafineria Trzebinia (Grupa Orlen)

Polish southern refinery located in Trzebinia (30 km from Krakow in Małopolska), which dates back to 1895. Since 1999, it has been part of the Orlen Group. The refinery deals with crude distillation, biodiesel production, fuel storage and paraffin production. Orlen Południe employs 640 people.¹¹¹

Air Liquide

French chemical conglomerate founded in 1902, specializing in the production of industrial gases. The Air Liquide Group has been present in Poland since 1995 and currently has four plants producing oxygen (Dąbrowa Górnicza), nitrogen (Kraków), argon (Puławy) and krypto-xenon (Głogów).¹¹²

Alwernia

A Polish company of the chemical industry, which was established in 1923 with its registered office in Alwernia (Małopolska). The owner of the company is the international KERMAS Group dealing with, e.g., production and distribution of chromium. The business profile of Alwernia includes the production of phosphorus compounds, chromium and agricultural and horticultural fertilizers.¹¹³

Fagumit

The Polish chemical company was founded in 1908. The largest manufacturer of medium and low pressure hoses in Poland, which offers more than 50 types of suction and discharge hoses as well as PVC. The company employs 200 people.¹¹⁴

¹⁰⁸ Source: Own study based on periodic reports and presentations on the company's website

¹⁰⁹ Source: Own study based on periodic reports and presentations on the company's website

¹¹⁰ Source: Synthos

¹¹¹ Source: Own study based on periodic reports and presentations on the company's website

¹¹² Source: Own study based on periodic reports and presentations on the company's website

¹¹³ Source: Own study based on periodic reports and presentations on the company's website

¹¹⁴ Source: Own study based on periodic reports and presentations on the company's website

7. Trends, challenges, directions of development

The chemical industry is today a global market where companies from all over the world cooperate and compete with each other. The market position of the company is influenced by, among others a good understanding of not only local trends, but also global changes. The chemical industry, often due to its strategic and economic significance, must take into account many external factors from various fields (including political aspects, environmental and regulatory determinants, the opinion of local communities, etc.).

As a result, when making decisions and planning the development of the chemical industry in Małopolska, it is necessary to take into account the conditions and trends, not only at the national level, but also at the European Union or the world levels.



8. Trends

The chemical industry operates in the environment of continuous change. Industry specific trends are a response to global consumer megatrends and regulatory requirements. The largest chemical concerns, called “market makers” (companies setting new trends, which are followed by other players) has focused in recent years on cost optimization, improving operational efficiency and innovation.¹¹⁵ The chemical market is significantly consolidated, as evidenced by numerous mergers and acquisitions.

Figure 14. Key selected consumer megatrends and trends in the chemical industry¹¹⁶

| Key consumer megatrends | Key trends in the chemical industry |
|---|---|
| <ul style="list-style-type: none"> • Digitization; • Globalization; • Alternative mobility; • Urbanization; • Ecology. | <ul style="list-style-type: none"> • Reorganization; • “the fourth industrial revolution”; • Increased presence in emerging markets; • Mergers and acquisitions • Growth thanks to innovations; • Environmentally friendly products and technologies; • Securing sources of raw materials. |

¹¹⁵ Source: “Przemysł chemiczny w Polsce. Pozycja, wyzwania, perspektywy.”, PIPC/EY, Warszawa 2017

¹¹⁶ Source: “Przemysł chemiczny w Polsce. Pozycja, wyzwania, perspektywy.”, PIPC/EY, Warszawa 2017, p.48

9. Challenges

Due to the challenges that are also faced by domestic manufacturers in the chemical industry, the Polish Chamber of Chemical Industry conducted a survey among its members to identify forecasted directions of changes in industry from the point of view of European manufacturers.

Figure 15. Main reasons for limiting the competitiveness of chemical industry companies in Europe [% of responses from respondents]¹¹⁷

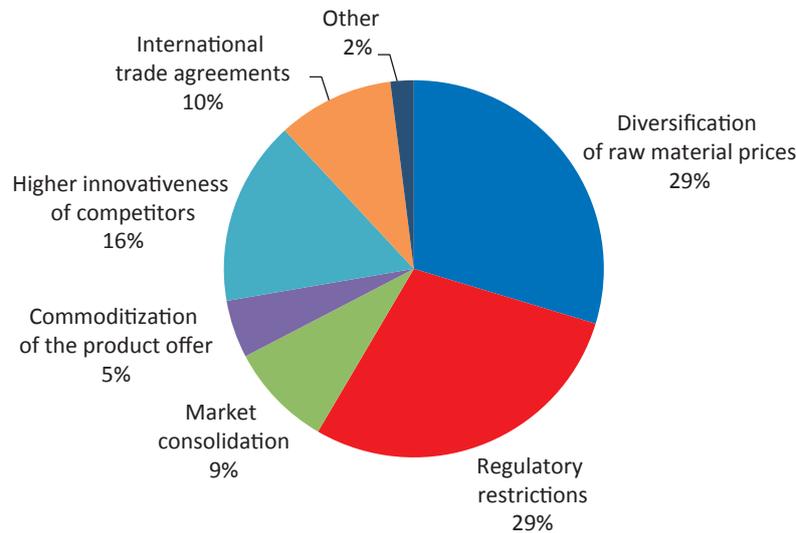
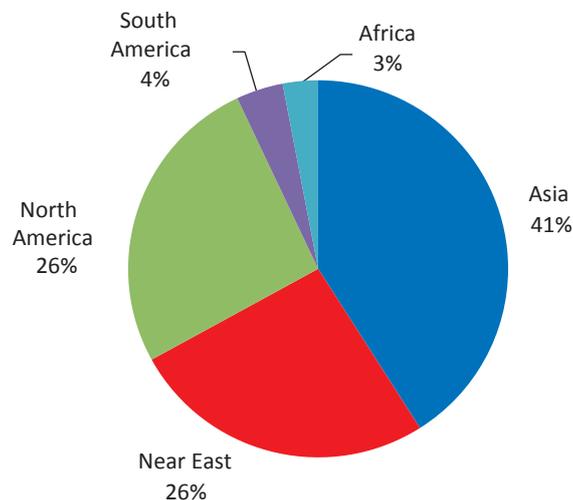


Figure 16. Respondents' opinions on the trends of strengthening the competitive position on the market of chemical industry companies in Europe in the perspective of 10 years [% of responses from respondents]¹¹⁸



Entrepreneurs mainly consider the geographical diversification of raw materials prices (30% of responses among respondents) as main challenges. The strongest competition is seen by the respondents in Asian and Middle Eastern manufactures (65% of responses from respondents).

¹¹⁷ Source: "Przemysł chemiczny w Polsce. Pozycja, wyzwania, perspektywy.", PIPC/EY, Warszawa 2017, p.44

¹¹⁸ Source: "Przemysł chemiczny w Polsce. Pozycja, wyzwania, perspektywy.", PIPC/EY, Warszawa 2017, p.44

The chemical industry will also struggle with the challenges dictated by regulators. In the next few years, several dozen active substances will fall out of use. In addition to legislation related to the products themselves, regulations related to emission and production processes also play an important role. The introduction of restrictions may cause a partial loss of competitiveness in relation to the markets of South America, Canada or the USA, which are not burdened with regulations that apply in the European Union. Nevertheless, it can also be an opportunity for Polish entrepreneurs to find new export destinations.

10. Development directions

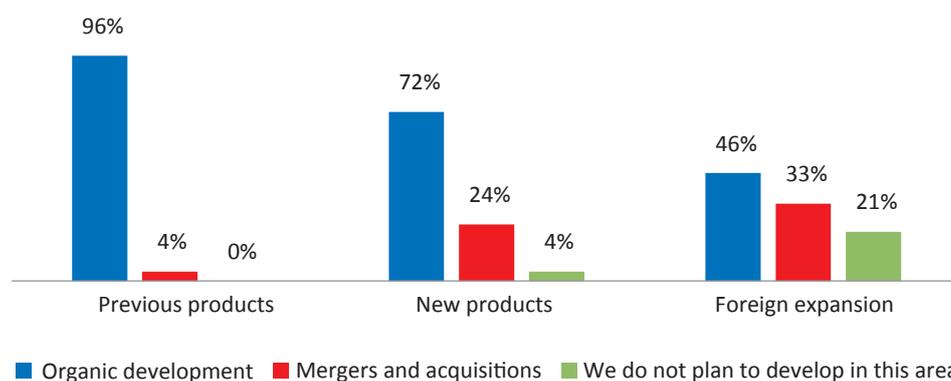
One of the main directions of the development of the chemical industry is to increase the production of specialized, high-margin products. However, the change of the production profile to specialized chemistry should be done prudently, so as not to become dependent on products that are the basis for the production of specialized chemistry.

Positive actions of entrepreneurs can be intensified by improving the relationship at the interface between science and business. Experts also emphasize the possibility of strengthening Poland's position on the large-tonnage products market, which often form the basis of specialist and innovative products, and they are a guarantee of independence from import.¹¹⁹ Polish business is particularly strong in the plastics and plastics processing segment.

From the operational side, enterprises from the chemical industry can develop primarily through improving existing products, investments in new products and expansion into foreign markets.

Figure 17. Results of the PIPC survey for entrepreneurs from the chemical industry operating in Poland¹²⁰

What type of development do you intend to pursue in the following areas in the next 10 years?
[% of responses of survey respondents]



In the survey conducted by PIPC among key entrepreneurs in the chemical industry in Poland, virtually all companies plan to develop in the area of existing and new products (mainly organic development). In turn, activity on foreign markets is considered by almost 80% of entities, one third of which considers the entry into new markets through mergers and acquisitions.¹²¹

¹¹⁹ Source: https://chemia.wnp.pl/jakie-kierunki-rozwoju-przemyslu-chemicznego-nie-tylko-chemia-specjalistyczna,312697_1_0_1.html

¹²⁰ Source: "Przemysł chemiczny w Polsce. Pozycja, wyzwania, perspektywy.", PIPC/EY, Warszawa 2017, p.56

¹²¹ Source: "Przemysł chemiczny w Polsce. Pozycja, wyzwania, perspektywy.", PIPC/EY, Warszawa 2017, p.56

11. Industry events

Małopolska is becoming an increasingly popular direction of cyclical business meetings and numerous trade fairs. 9 thous. business events that gather participants from around the world are annually organized in Krakow alone.¹²²

Selected business events

The Economic Forum in Krynica is an annual international economic meeting of the region of Central and Eastern Europe with over 25 years of tradition. The event organized by the Instytut Studiów Wschodnich Foundation is recognized as the largest meeting of representatives of politics and business in the region (over 2.5 thousand participants each year).¹²³

Investment Forum in Tarnów is part of the Forum of Regions organized within the Economic Forum in Krynica - the Forum is used to discuss challenges related to the dynamically changing economy and new pro-development trends. The Forum has operated as an independent event since 2015.¹²⁴

Annual Business in Małopolska Meeting is one of the most important cyclical economic events in Małopolska. It has been held in Krakow since 2009, the participants include many representatives of entrepreneurs, politicians and local government.¹²⁵

Selected industry events

Kompozyt- Expo is the International Trade Fair for Materials, Technologies and Composite Products, which since 2009 has been held annually in Krakow. The event attracts 240 exhibitors each year, over 3.2 thousand visitors from 22 countries around the world.¹²⁶

In 2018, the 304th International Conference on Chemical and Biochemical Engineering (ICCB), which brings together innovative scientists and industrial experts from the chemical sector from around the world was held in Krakow.¹²⁷

It is worth noting that also the professional R&D institutions organize many specialist events in Małopolska, in which speakers from the country and around the world participate.

12. Investment incentives

Małopolska offers a wide range of investment incentives for entrepreneurs in the chemical industry. All support instruments are available on the same basis for foreign investors as well as companies with domestic capital.

¹²² Source: Krakow, Małopolska Region. Meeting Compendium

¹²³ Source: <http://www.forum-ekonomiczne.pl/>

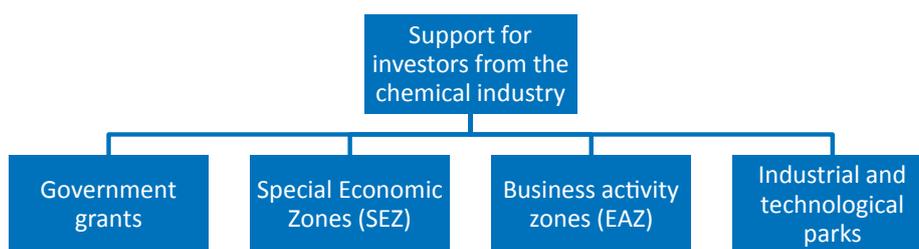
¹²⁴ Source: <http://inwestforum.pl/>

¹²⁵ Source: <https://www.malopolska.pl/aktualnosci/biznes-i-gospodarka/za-nami-7-annual-buisness-in-malopolska-meeting>

¹²⁶ Note: data forecast for 2018. Source: <http://www.kompozyty.krakow.pl/pl/>

¹²⁷ Source: <http://theiier.org/Conference2018/Poland/3/ICCB/>

Figure 18. Support for investors from the chemical industry



Entrepreneurs from the chemical industry may apply for support granted in the form of subsidies by the Ministry of Enterprise and Technology under the “*Programme to the support investments of significant importance for the Polish economy for the years 2011-2023*”.

Special financial incentives (including tax reliefs, legal facilities) for investors, which until now could only be used within the framework of Special Economic Zones, have been available throughout the country since June 30, 2018. However, the 3 Special Economic Zones in Małopolska remain an extremely interesting area for entrepreneurs:

- Krakow SEZ (ctp.krakow.pl)
- Katowice SEZ (ksse.com.pl)
- EURO- PARK Mielec (europark.arp.pl)

Under the new act, investments related to the creation of research and development centers are to be preferred. The bonus can be awarded to those projects that affect the competitiveness and innovation of the region.

Economic activity zones (EAZ)¹²⁸ are separated areas prepared for investment that meet the needs of potential investors¹²⁹, which are an interesting offer for many entrepreneurs due to:

- attractive financial conditions (fiscal, aid)
- existing and planned development (infrastructure)
- support through the supply of various (legal, transport, scientific) services
- sociocultural dimension (atmosphere, security)

The current and detailed information regarding the Małopolska offer within EAZ is available on the Internet:

- existing zones: <http://panoramy.businessinmalopolska.pl/>
- planned zones: <http://panoramy.businessinmalopolska.pl/planned/>

¹²⁸ Note: Provisions on creation and development support (EAZ) on the Małopolska channel are included in the Sub-regional Development Programme until 2020 and the Detailed Description of the Priority Axes of the Regional Operational Programme of the Małopolskie province for the years 2014-2020. A detailed, constantly updated offer of investment areas with descriptions is available on the CTP website: www.sse.krakow.pl

¹²⁹ Note: Economic Activity Zones are most often created by local governments and operating pursuant to the Act of October 20, 1994 on Special Economic Zones, Regulations of the Council of Ministers on the creation of individual zones, as well as zone regulations and plans for their development.

Małopolska has greenfield investment areas (undeveloped plots) as well as brownfield sites (built-up plots, usually already used industrially).

A special form of support is the INNOCHEM sector program, which aims to improve the competitiveness of the Polish chemical industry on global markets by commercializing innovative solutions in cooperation with the science sector. The programme perspective is 2023, and the amount of project co-financing (25% -80% of the investment value) under Competition I amounts to PLN 120 million (EUR 28 million).¹³⁰ The programme was initiated by the Polish Chamber of Chemical Industry (PIPC).

Industrial and Technological Parks are meeting places for industry and R&D centers that enable both parties to develop faster, among others through the possibility of using infrastructure dedicated to clusters.

Entrepreneurs involved in Industrial and Technology Parks may use the following services:

- consulting in setting up a company
- technology transfer
- creating conditions conducive to business development.¹³¹

One of the important clusters for the chemical industry in Małopolska is the Tarnow Industrial Cluster founded in 1999 (one of the members of the cluster is Grupa Azoty).¹³² The aim of the project is to create appropriate conditions that will encourage plastic industry manufactures to locate their projects in Tarnów.

The cluster connects companies from various sectors, including chemical, construction and electrical industries, which further extends the possibilities of cooperation and development.

In addition, there are several centers supporting investors in Małopolska, where you can find the most up-to-date information on development in the region.

| Kraków Nowa Huta Przyszłości S.A. | Centrum Obsługi Inwestora | Centrum Business in Małopolska |
|---|---|---|
| Osiedle Willowe 30, 31-902 Kraków | Bracka 1, 31-005 Kraków | Podole 60, 30-394 Krakow |
| Tel. +48 12,348 01 55 | Tel. +48 12 616 6002 | Tel. +48 12,620 91 40 |
| Mobile +48,727,432,104 | Fax +48 12 616 6001 | Fax +48 12 620 91 66 |
| Email: biuro@knhp.com.pl | Email: coi@um.krakow.pl | Email: contact@businessinmalopolska.pl |
| www.knhp.com.pl | | www.businessinmalopolska.pl |

¹³⁰ Note: converted at the NBP PLN / EUR exchange rate of 4.31 from 12/09/2018 Source: <https://www.ncbr.gov.pl/programy/fundusze-europejskie/poir/konkursy/konkurs3122015innochem/opis-programu/>

¹³¹ Source: Doing Business in Małopolska, Kraków Nowa Huta Przyszłości, 2018

¹³² Source: Kłustry w województwie małopolskim, PARP

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