



ICT sector in Krakow and 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.

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Introduction

Małopolska region is one of the most interesting and fast developing investment areas in Europe. This region lies in southern Poland, and its southern border is also the border between Poland and the Republic of Slovakia. In the west it borders with the Slaskie province (Silesia), in the east – with the Podkarpackie province and in the north with the Swietokrzyskie province. The largest cities in the region include Kraków, Tarnów and Nowy Sącz. Beyond them there are also some interesting places from the economic point of view, such as Wieliczka, Chrzanów or Bochnia. The area of the province is 15,183 km² (4.9% of the area of Poland), in the north-south dimension, it stretches over a length of 151 km, and in the east-west dimension, the span is 167 km. The number of inhabitants is almost 3,4 million, of which 51.5% are women, and 48.5% are men. In the years 2002-2016, the number of inhabitants increased by 4.5%. The population density is maintained at 223 people/km². 62% residents of Małopolska are of working age, 18.9% in the pre-productive age, and 19.1% residents are in the post-working age. In 2016 the balance of internal migration reached the level of 3,376, while the external one was 296. The capital of the region – Kraków is the second largest city in Poland, both in terms of area, occupying 327 km², and population of 766.7 thous. people¹.

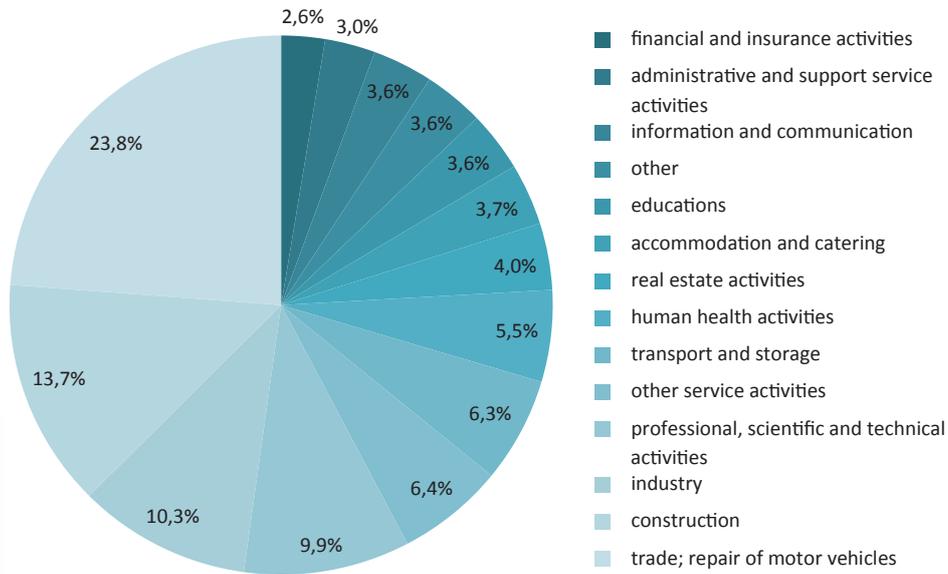
Małopolska has also a socio-economic potential. It has its share in the production of Polish GDP at the level of 7.8%, and its activity is carried out by approx. 360 thous. business entities. The region is particularly attracted by the high technology, automotive, tourism and BPO sectors, especially due to the high research and educational potential of higher education, appropriate scientific background, availability of qualified engineering staff and workforce as well as favorable natural and climatic conditions. Such foreign corporations like Motorola, MAN, IBM, Delphi, Valeo, Shell, Philip Morris and Capgemini, have their branches in the region.

According to the data of the Central Statistical Office (CSO, *pol.* GUS) in Małopolska at the end of December 2016, there were 371.1 thous. registered entities of the national economy², that is 2% more than the year before. The private sector was 359.9 thous. entities, that is 97.0% of the total number of entities, and the public sector – 7.9 thous. As part of the total number of registered entities, the following sections dominated by the Polish Classification of Business Activities 2007 (CBA, *pol.* PKD): trade; repair of motor vehicles – 88.2 thous. (by 1.0% less than a year earlier), construction – 50.9 thous. (increase by 2.5% in relation to the previous year), professional, scientific and technical activity – 36.8 thous. (increase by 4.6% in annual terms) and industrial processing – 36.0 thous. (increase by 0.9% compared to the end of 2015).

¹ „Polska w liczbach” portal, <http://www.polskawliczbach.pl/malopolskie> [access: 20.11.2017]

² Art. 2 pt. 11 of the Act of 29.06.1995 about public statistics (Dz. U. z 2016 r. poz. 1068) states that it is a legal person, an organizational unit without legal personality or a natural person running a business.

Chart 1: Structure of entities of the national economy according to the CBA section in Małopolska in 2016 (as of 31 December)

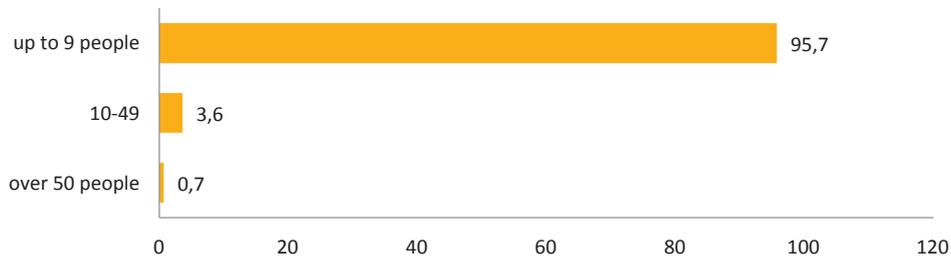


Source: CSO

Among the enterprises, the highest number were those employing up to 9 people, which at the end of 2016 were 355.1 thous. (by 2% more than at the end of 2015). Small entities employing 10-49 employees were 13.3 thous. (1% more than a year earlier), medium and large with at least fifty employees – 2.7 thous. (0.3% more).



Chart 2: Structure of entities of the national economy by the number of employees in 2016 (as of 31 December).



Source: CSO.

The aim of this work is to examine the conditions in which enterprises from the sector of modern information and telecommunications technologies (ICT) operate, having their headquarters or branch in the Małopolskie province. The work is a desk research and it's based on data and studies available on the Internet in November 2017. The main data comes from public statistics, although there are also those that were developed on the basis of commercial reports, widely shared by their authors. The data used in this work come from the years 2014-2017. The monetary values quoted in the paper are expressed in Polish zlotys (PLN) and in addition in euro (EUR) according to the exchange rate of the National Bank of Poland, which in November 2017 amounted to an average of 4.23 PLN for 1 EUR.





I. Characteristics of the ICT industry in the Małopolska region

1. Objective and subjective scope of the ICT sector

The concept of ICT (*Information and Communication Technologies*) covers a wide range of all technologies that allow manipulation and transmission of information³. Regional Strategy of Innovation in Małopolskie province 2020 defines ICT as all activities involving „production and use of telecommunications and IT devices and related services, as well as the collection, processing, sharing of information in electronic form using digital techniques and any electronic communication tools. Multimedia and companies from the creative sector using information and communication technologies play a special role in this area of key specialization in the region”⁴. The ICT sector is therefore the whole of enterprises whose main activity is the production and operation of IT and telecommunications equipment (hardware) and related services, as well as software and applications; their economic profile also includes activities related to the collection, processing and sharing of information using digital techniques and electronic communication tools.

In connection with the above, the most general division of the sector into the IT and telecommunications sectors can be made. Information technology, related to information processing technologies and manufacturing devices that implement them, includes enterprises involved in software development, provision of various types of IT services as well as production and maintenance of computer hardware. On the other hand, within the telecommunications industry, there are companies primarily involved in the provision of telecommunications services (including voice calls, information encryption, digital data transfer), but also the production and distribution of telecommunications equipment and devices. It should be emphasized that this sector belongs to one of seven smart specializations, where Małopolska focuses its investment and development activities in 2014-2020.

Tab. 1: Division of the ICT sector by sections and divisions of the economy.

CBA	Business description
Section C div. 26	manufacture of computers and peripheral equipment; manufacture of (tele)communication equipment
Section J div. 58	publishing of computer games and other software
Section J div. 61	wired, wireless, satellite and other telecommunications
Section J div. 62	Computer programming activities, Computer consultancy activities, Computer facilities management activities, Other information technology and computer service activities
Section J div. 63	Data processing, web portals, hosting and related activities

Source: based on CBA classification.

³ *Słownik pojęć Strategii Rozwoju Transportu do 2020 roku (z perspektywą do 2030 roku)*, in: Ministry of Transport, Construction and Maritime Economy, http://mib.gov.pl/media/3510/Slownik_pojec_SRT.pdf [access: 27.10.2017], p. 26

⁴ *Program Strategiczny Regionalna Strategia Innowacji Województwa Małopolskiego 2020*, zał. nr 1 do Uchwały nr 995/16 Zarządu Województwa Małopolskiego z dnia 30 czerwca 2016 r., p. 47.

2. ICT entities in Małopolska

Due to the availability of statistical data, the ICT sector entities are those registered in the REGON⁵ system in the sections and divisions of CBA mentioned above. At the end of September 2017, in the Małopolskie province, the register contained 343,413 entities running a business, including 10,792 (3,1%), in which the declared predominant activity is in the ICT sector.

Tab. 2: Number of entities in the REGON register declaring activity in a specific industry.

Branch	Number of entities	Percent
manufacturers of computers and peripherals	162	1.5
manufacturers of telecommunications equipment	60	0.6
computer games publishers	73	0.7
software publishers	201	1.9
telecommunication operators and service providers	875	8.1
software activities	5,511	51.0
consultancy in the field of computer science	1,235	11.4
management of IT devices	354	3.3
other services in the field of information and computer technologies	782	7.2
data processing and hosting	543	5.0
web portals	796	7.4
other information services	200	1.9
Sum	10,792	100.0

Source: own elaboration based on CSO.

The ICT sector in the region is dominated by entities operating in the field of IT software and consultancy (62.4%), which is mainly the producers of computer programs and applications, companies designing and creating websites, as well as companies designing comprehensive computer systems connecting hardware, software and communication systems. Quite a numerous group, about 14.3% of the sector in total, is an information service provider. These include all enterprises offering hosting services, cloud computing providers, as well as operators of web portals that gather and provide up-to-date information. There are also relatively many entities from the telecommunications services industry that provide support, maintenance and sharing of voice, data, sound, image and text transmission systems over wired, wireless or satellite networks. These include network operators, Internet Service Providers (ISPs), etc.

⁵ The National Register of Entities of National Economy kept by the President of CSO.

Tab. 3: Ranking of ICT enterprises with headquarters in the Małopolskie province in 2016 according to „ITwiz Best 100” report along with their revenues and employment level.

Company name	Revenue from IT in 2016 in thous. PLN	Revenue from IT in 2015 in thous. PLN	Change (in %)	Employment	Headquarters
Comarch	743,053	738,456	0.6	5,304	Kraków
Veracomp	616,432	782,000	-21.2	255	Kraków
Arrow ECS	450,000	626,516	-28.2	86	Kraków
Luxoft Poland	395,844	292,022	35.6	2,000	Zabierzów
Clico	219,386	185,798	18.1	90	Kraków
S4E	189,276	225,462	-16	60	Kraków
DreamLab	90,775	33,749	169	600	Kraków
Ailleron	89,045	68,157	30.6	n.a.	Kraków
NEC Display Solutions GmbH	76,000	72,000	5.6	n.a.	Kraków
IT Works	32,704	34,630	-5.6	160	Kraków
Unima 2000	31,411	26,915	16.7	n.a.	Kraków
VSoft	24,496	23,213	5.5	127	Kraków
Blobber Team	16,688	11,657	43.2	n.a.	Kraków
Soneta	15,670	14,684	6.7	83	Kraków
Compendium Centrum Edukacyjne	12,223	11,565	5.7	33	Kraków
DataConsult	4,997	4,702	6.3	21	Kraków
INSOFT	4,826	4,883	-1.2	30	Kraków
Red Stack Tech	3,926	2,695	45.7	25	Kraków
Edison	3,481	3,109	12	n.a.	Kraków
BMS Creative T. Wyrozumski	1,291	1,397	-7.6	n.a.	Rączna
Quantum Software	1,157	814	42.1	n.a.	Kraków
iFun4all	957	422	126.8	n.a.	Kraków
Sum	3,023,638	3,164,846	-4.5		

Source: own elaboration based on „ITwiz Best 100” report.

There is a general decline in the ICT sector’s revenue in a few percent in 2016 as compared to 2015. However, this is a nationwide trend. According to the “Computerworld.pl” portal, the IT industry’s revenue decreased in 2016 by 5.2%, and telecommunications companies by 0.7%. Thus, the total revenues of the entire ICT market were 3.4% lower than in 2015⁶. The reasons for this are primarily due to a decline in investments in the entire domestic economy, which could be influenced by factors such as a sense of uncertainty about the economic slowdown abroad, as well as announcements of new state authorities at the end of 2015, regarding improving the collection of public

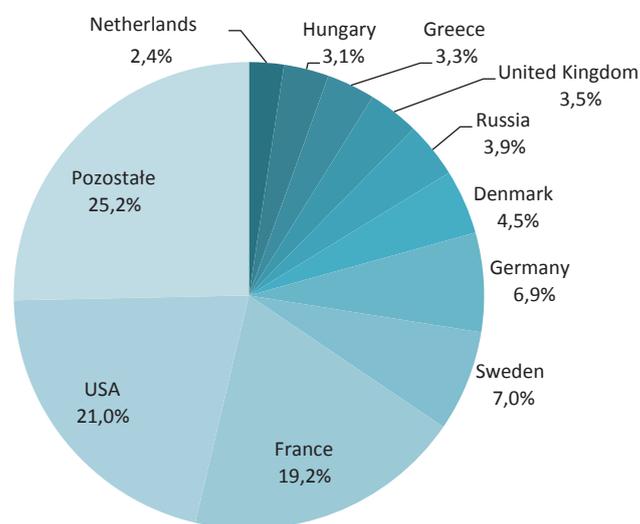
⁶ T. Bitner, *Bum! Spadek przychodów w polskim IT*, w: „Computerworld.pl”, 22.06.2017, <https://www.computerworld.pl/news/Bum-Spadek-przychodow-w-polskim-IT,408201.html> [access: 07.11.2017]

levies and tax controls in the private sector⁷. However, a significant reason for the decline in the ICT sector's revenues was a slowdown, and in some cases even halting the implementation of IT projects for public administration. It may be related to the public sector's desire to save in this area, e.g. by attempting to choose another IT model. On the IT market, there is a noticeable decline in sales of traditional computer systems (eg. servers and associated infrastructure, software) for the use of external IT services (cloud computing, on-line services, hosting).

3. Foreign capital in the ICT sector

Małopolska is characterized by a large concentration of enterprises with foreign capital. In 2014 there were 4,819 of them, that was 5.8% of all entities with foreign capital registered in the country, with the region taking sixth place in this respect after the Mazowieckie, Dolnośląskie, Wielkopolskie, Śląskie and Zachodniopomorskie provinces⁸. Most of these companies were based in Kraków, where there were 3,583 of them registered or 74.4% of all operating in the region⁹. Foreign capital came from 28 countries (5 more than in the previous year 2013), the highest value was achieved by the capital from the United States (21%). The second one was France which was the leader among European countries. For years, these two countries have been among the leaders in the context of the scale of capital involvement in the region. The total value of the European capital was the highest and amounted to 71%; apart from France, Sweden (7%) and Germany (6.9%) are distinguished here, while the level of investments from entities from other European countries was a few percent. A relatively small share of capital from Asian countries should be noted, i.e. China (1.3%), Japan (0.8%), India (0.3%) and South Korea (0.2%)¹⁰.

Chart 3: Structure of the share of foreign capital in enterprises in Małopolska in 2014



Source: own elaboration based on „Województwo Małopolskie 2016”.

⁷ Por. M. Chądzyński, *Gwałtowny spadek inwestycji w Polsce. Firmy boją się wydawać*, w: „Forsal.pl”, 31.08.2016, <http://forsal.pl/artykuly/971798,gwaltowny-spadek-inwestycji-w-polsce-firmy-boja-sie-wydawac.html> [access: 07.11.2017].

⁸ *Inwestorzy zagraniczni w Małopolsce w 2014 roku*, Małopolskie Obserwatorium Rozwoju Regionalnego (MORR), Warszawa 2016, p. 21

⁹ *Ibidem*, p. 25.

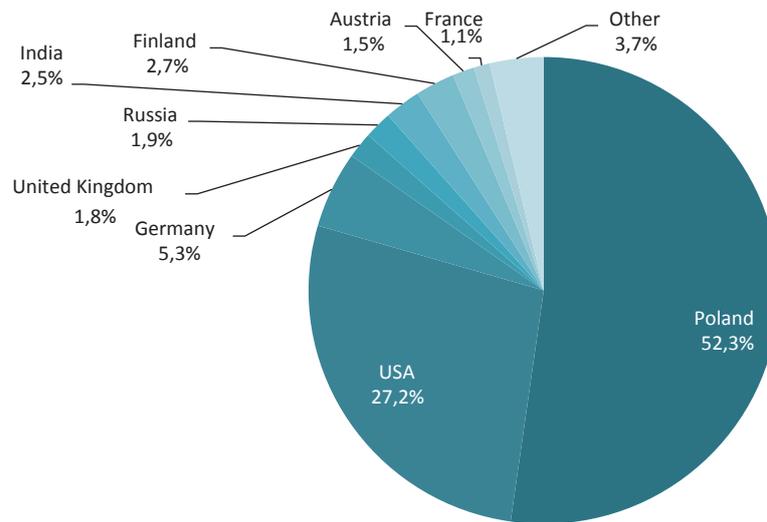
¹⁰ Por. *Raport Województwo Małopolskie 2016*, Kraków 2016, p. 173-174, <http://www.malopolska.pl> [access: 07.11.2017]





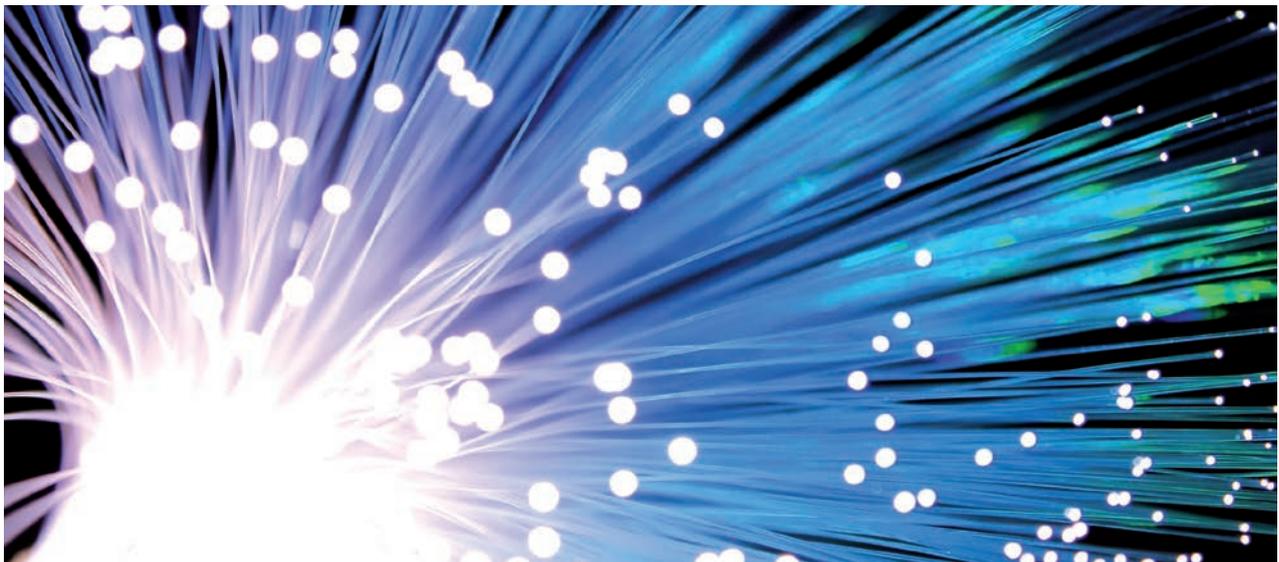
The data presented concern, however, the structure of the share of foreign capital in relation to the total number of enterprises operating in the Małopolskie province, without the division into industries. In the ABSL report entitled „Business Services and IT Sector in Małopolska”¹¹ from 2013, 158 IT enterprises from the region were surveyed in terms of the amount of employment and the origin of capital.

Chart 4: Employment structure in Małopolska IT enterprises by origin of capital in 2013.



Source: ABSL „Business Services and IT Sector in Małopolska”.

The majority of employees (52%) work in Polish companies or with a majority share of Polish capital. Most foreign companies come from the United States, including large American corporations such as Motorola Solutions, Cisco, IBM or Saber, employed a total of 27.2% of ICT specialists. The share of German capital is also significant (5.3%), which remains e.g. the largest Polish online portal Onet.pl. In enterprises with capital from other European countries and India, Canada, Japan and Brazil, over 15% of employees work.



¹¹ *Business Services and IT Sector in Małopolska*, ABSL 2013, p. 12



II Investment attractiveness of Krakow and the region for ICT investors

1. Factors influencing the choice of Małopolska for location for investment

Małopolska is a region that attracts with its over 1000-year history and the heritage of both new residents and tourists. Only in 2015, Kraków was visited by 10 million visitors, and a year earlier the city was declared the best tourist destination in Europe in the ranking of Zoover.com¹², overtaking such popular places as Venice or Seville. A factor conducive to visiting the region is the international airport in Kraków-Balice allowing for fast and direct communication with several dozen European cities, as well as developed road connections with Germany, Ukraine, Czech Republic, Slovakia and Austria and a railway line to the main Polish cities (e.g. 2.5 hours to Warszawa). 30 higher education institutions take care of the human capital potential. In 2016 over 175,000 people were studying there and in the academic year 2015/2016 there were nearly 50 thousand graduates. In 2015, Małopolska generated 7.9% of Polish GDP, whose per capita value reached PLN 49,239 (EUR 9,962), where the national average is PLN 45,764 (EUR 11,055). In this respect, the region occupies the seventh position in comparison with other provinces.

Tab. 4: General economic characteristics of the Małopolskie province.

Specification	Małopolska
Population (31.12.2016), incl.	3,382,317
- in working age	62.0%
- in the pre-productive age	18.9%
- in post-working age	19.1%
Area (m ²)	15,183
Density of population	223 people./km ²
The average monthly gross wage	4077.91 PLN (95% Poland)
Registered unemployment rate (September 2017)	5.5% (6.8% Poland)
GDP <i>per capita</i> in 2016 (PLN/person)	39,867 (44,670 – Poland)
Potential of labor resources	
- graduates of higher education institutions in thous. (2015/2016)	48.3
- number of employees in thous. (Dec. 31, 2016)	781.3

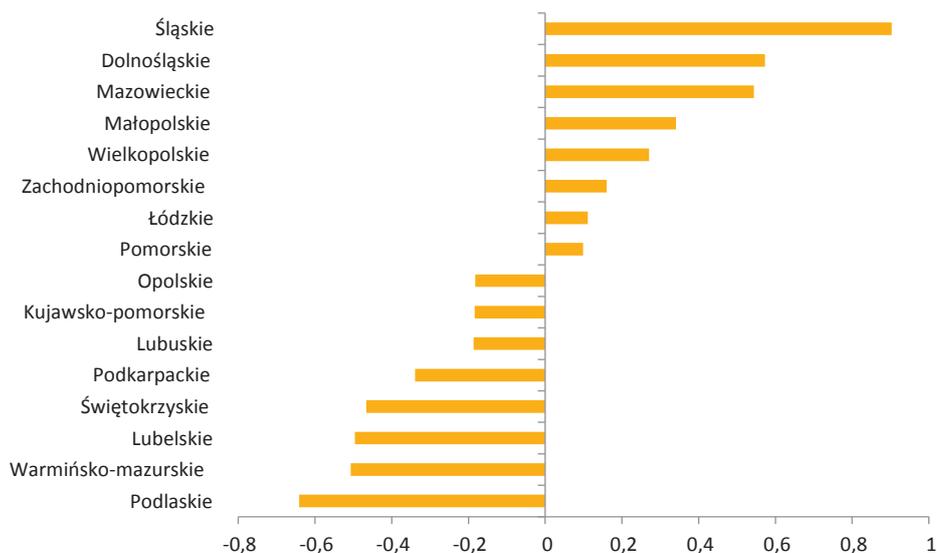
Source: own elaboration based on CSO.

A detailed study of investment attractiveness of Małopolska is carried out by the Institute for Market Economics Research (IBnGR)¹³. Invariably since 2013, the region is ranked fourth in the overall ranking of investment attractiveness of provinces.

¹² The study was conducted abroad on a sample of 30 thousand Zoover users. Cf. *Krakow named the best tourist destination of 2014*, MFA, 15.01.2014, http://www.mfa.gov.pl/en/news/krakow_named_the_best_tourist_destination_of_2014 [access; 09.11.2017].

¹³ *Atrakcyjność inwestycyjna województw i podregionów Polski 2016*, Instytut Badań nad Gospodarką Rynkową, Gdańsk 2016, p. 9

Chart 5: Investment attractiveness indicator for provinces in 2016.



Source: IBnGR

In IBnGR research, seven groups of indicators were taken into account to assess the factors affecting the investment attractiveness of individual provinces:

- 1. Work resources and costs.** In this respect, Małopolska ranks second in the country, just behind the Śląskie province. The region's main strengths include the very high density of people employed in industry, construction and services, as well as a high level of entrepreneurship. Secondary and higher education, educating qualified specialists desired on the labor market, is strongly developed here. In addition, there are also low-skilled labor resources with low wage expectations.
- 2. Provinces activity in attracting investors.** This indicator mainly shows the size of the offered space for investment areas, as well as promotional activity of the region abroad. In this respect, the Małopolskie province occupies the eighth place, primarily due to the shortage of attractive investment areas¹⁴.
- 3. The transport accessibility** of the region was also rated lower (tenth place), with provinces neighboring Germany as the best results. This position may come as a surprise, because Małopolska is crossed by the A4 motorway, along which Kraków and Tarnów are situated, and the connection with the western border of the state is direct. In addition, the second largest Polish airport is located in Kraków-Balice. However, the overall average position may be affected by the low transport accessibility of the southern and south-eastern part of the province due to the mountainous terrain and the low category of roads¹⁵.
- 4. The size of the market** depends mainly on the number of households and the level of their wealth. Almost 3.4 million people live in Małopolska, but within a radius of 100 km from Krakow, the potential sales market covers even about 8 million inhabitants, 60% of which are people under 45 years of age. In addition, the average gross remuneration in 2015 amounted to PLN 3,907 (EUR 912.5, 5th place in the country), and the disposable income per person in the household

¹⁴ Cf. J. Donimirski, *Zagraniczne inwestycje. Co przyciąga firmy do Małopolski?*, in: „wyborcza.pl – Magazyn Krakowski”, 12.05.2016, <http://krakow.wyborcza.pl/krakow/1,42699,20065855,zagraniczne-inwestycje-co-przyciaga-firmy-do-malopolski.html> [access 08.11.2017].

¹⁵ Cf. R. Guzik, *Dostępność transportowa wybranych miast Małopolski*, Kraków 2014, p. 6-7.

amounted to PLN 1,305 (EUR 308.5, 8th place). In terms of market absorption, therefore, the region takes the place just behind the podium.

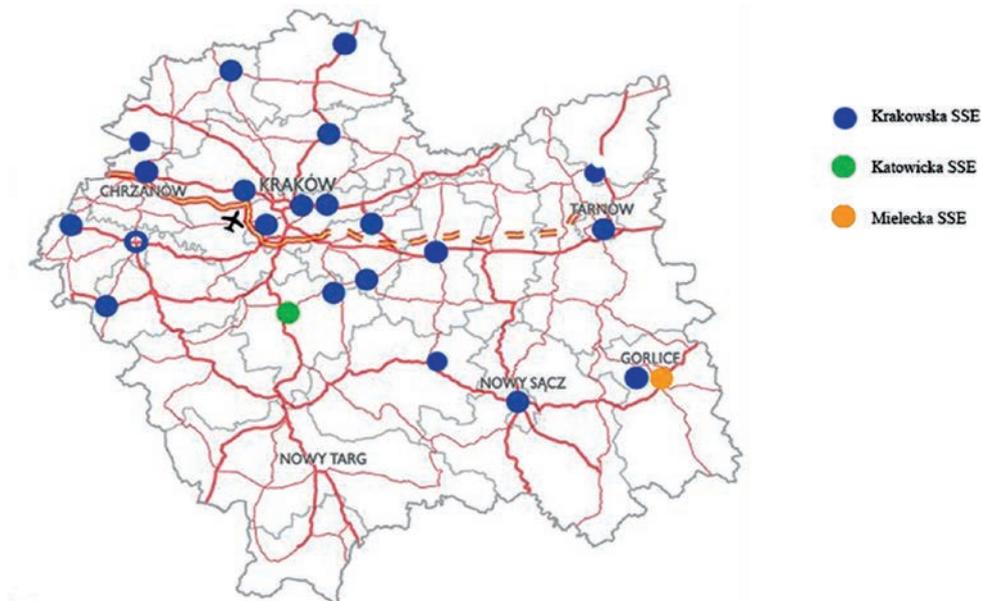
5. The region occupies the same place in terms of the **level of development of economic infrastructure**. We are dealing here with the presence of a well-developed advanced research and development (R&D) sector.
6. The **level of development of social infrastructure** in the Małopolskie province belongs to one of the highest (second to the Śląskie), mainly due to the tourist attractiveness and expanded tourist infrastructure, as well as a thriving cultural sector. In the region there are objects inscribed on the UNESCO World Heritage List such as the Old Town in Kraków, “Auschwitz-Birkenau - German Nazi Concentration and Extermination Camp (1940-1945)”, historic salt mines in Wieliczka and Bochnia or the Wooden Architecture Route.
7. The **level of public security** is a domain of regions with low level of urbanization, whose capitals are not big metropolises. Hence the place of Małopolska in the middle of the rate (eight), but with significantly better result than the worst in this respect regions of Dolnośląskie, Mazowieckie and Śląskies.

Investigating investment attractiveness from the point of view of service activities, the Małopolskie province ranks in the top three just behind Śląskie and Mazowieckie. Certainly this is related to the fact that in these regions there are metropolises attracting enterprises from the service sector to the greatest extent on a national scale. The position of Małopolska is even better if you consider investment attractiveness for high-tech activities. In this ranking, the region ranks just behind the leader, i.e. Mazowieckie. Undoubted advantages in this context are the size and quality of labor resources and the absorption of the institutional market, as well as the fairly good condition of the natural environment. However, the level of development of social infrastructure is important, especially for the technologically advanced sector. The relatively high level of public safety is also important for a region whose capital is Kraków - the second largest city in Poland in terms of population and area.



It should also be mentioned that investments can be located in specially separated economic areas offering extraordinary conditions for doing business, such as preferential rates or even exemptions from income tax. Such areas are Special Economic Zones (SEZs, *pol.* SSE), three of which have been created in the region.

Dwg. 2: Map of SEZs in Małopolska.

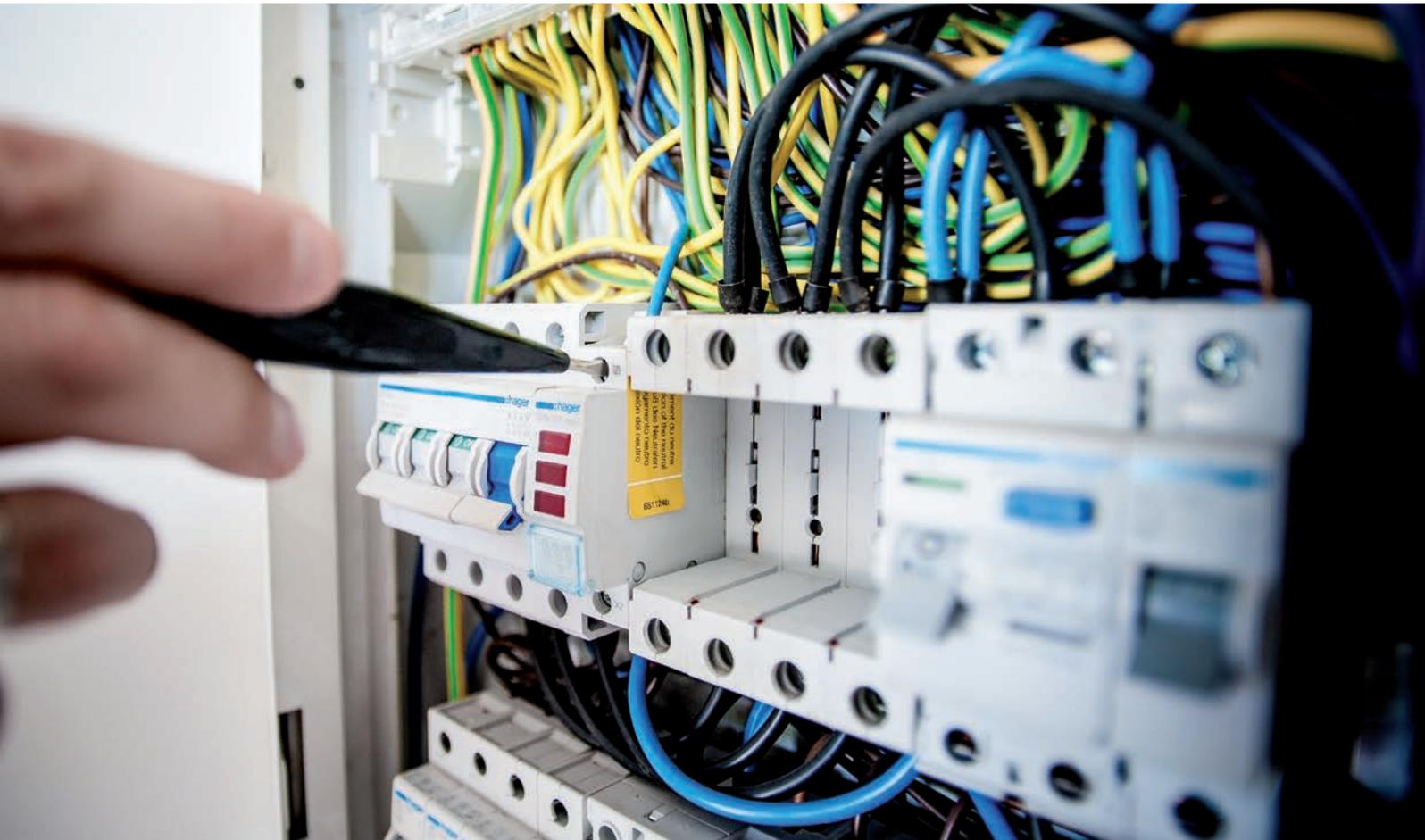


Source: own elaboration

- Krakow SEZ, which is managed by the Kraków Technology Park, consists of 36 subzones located in 35 communes of the Małopolska, Podkarpackie and Świętokrzyskie voivodships with a total area of 949 ha. KTP mainly offers greenfield areas as well as office space; until the end of June 2017, it issued 242 permits to operate in SEZ, while entrepreneurs declared investment outlays at the level of PLN 4.5 billion. In total, there are over 23 thousand jobs. Public aid is 35% for large companies, 45% for medium and 55% for small enterprises. The ICT sector is represented here by Comarch, Ericpol, Fideltronik, Luxoft, Motorola Solutions¹⁶.
- Katowice SEZ is dispersed – in the Małopolskie province only Myślenice commune belongs here.
- Mielec SEZ – Euro-Park Mielec, is mainly located in south-eastern part of the region – subzone Gorlice.

Regional attractiveness research is also carried out in the European Union. The 2016 Commission study regarding the measurement of the RCI index (Regional Competitiveness Index) places the Małopolskie province at 171st place in 273 EU regions (42.4% of the possible points). The index illustrates the region's ability to offer an attractive and friendly environment for companies and residents - in the context of work and quality of life. The authors of the study emphasize that Małopolska has many strengths compared to regions of similar attractiveness. Of course, they include the level of education as well as the activities of the institutions. The innovation opportunities are also much higher if they relate to regions with a similar level of economic development

¹⁶ <http://www.kpt.krakow.pl/> [access 18.11.2017]



(such as Lithuania, the Italian regions of Calabria and Campania, Croatia, Greek Voreio Aigaio). The region is also favorable in terms of GDP per capita (60.31% of the EU average) and in the context of unemployment, which is lower than the EU average of 9.4%. The advantage is the amount of expenditures on research and development in relation to GDP (1.3%), which can be compared to the

results of regions such as Lombardy (Italy, 1.3%), Lower Normandy (France, 1.22%), Luxembourg (1.3%), West Flanders (Belgium, 1.37%) and Kent (UK, 1.29%)¹⁷.

2. Krakow in investors rankings

The capital of the province in 2017 occupied the eighth position among the hundred best locations for outsourcing services in the global Tholons ranking entitled „Services Globalization Index 2017”¹⁸. From the point of view of this work, this classification is so reliable that a large part of enterprises in this sector located in the region offers IT/ICT services. In Europe, only Dublin was ranked higher (ranked 7th), while Warsaw was ranked 23rd and Wroclaw 78th. The authors of the ranking took into account a number of factors, such as the level of innovation in the digital field (e.g. number and diversity of startups, government incentives and support policies), labor market (workforce, availability of qualified specialists), infrastructure and costs (communication and transport, life costs, high-class office space), quality of life (political risk, social risk, social infrastructure).

¹⁷ *Analiza rynku małopolskiego, Kraków 2017*, p. 39.

¹⁸ *Disruption by Digital. Digital Nations & Super Cities, Tholons 2017*, <http://www.tholons.com/TholonsTop100> [access: 09.11.2017].

Tab. 5: List of selected cities from the ranking Tholons 2017 „Services Globalization Index 2017”.

City	position in 2017	position in 2016	City	position in 2017	position in 2016
Bangalore (India)	1	1	Prague (Czech Republic)	17	14
Bombay (India)	2	3	Warszawa (Poland)	23	25
Delhi (India)	3	4	Budapest (Hungary)	25	24
Manila (Philippines)	4	2	Beijing (China)	29	13
Hyderabad (India)	5	6	Moscow (Russia)	28	58
Sao Paulo (Brazil)	6	27	Guangzhou (China)	53	38
Dublin (Ireland)	7	10	Wrocław (Poland)	78	59
Kraków (Poland)	8	9	Tianjin (China)	84	46

Source: own elaboration based on Tholons 2017.

Krakow also holds top positions in the Financial Times ranking – “fDi Polish Cities of the Future 2017/18”¹⁹. The authors of the classification took into account demographic factors (population, migrations), the labor market (number of unemployed, occupational activity, wages), economic (life costs, education, accommodation, culture, GDP, foreign capital, real estate prices), infrastruc-

¹⁹ C. Mullan, *Polish Cities of the Future 2017/2018*, 13.02.2017, <http://www.fdiintelligence.com/Locations/Europe/Poland/Polish-Cities-of-the-Future-2017-18> [access: 09.11.2017].



ture level technical (roads, public transport, telecommunications networks and their capacity) and social infrastructure.

Tab. 6: The position of Krakow in the „fDi Polish Cities of the Future 2017/18” rankings in comparison with other Polish cities.

City	General	Economical potential	Human capital and lifestyle	Communication	Business friendliness
Warszawa	1	1	1	1	1
Kraków	2	3	2	5	4
Wrocław	3	2	3	9	2
Poznań	4	4	4	-	3
Gdańsk	5	5	6	6	5
Łódź	6	6	10	-	6
Grodzisk Mazowiecki	7	7	-	2	7
Katowice	8	8	-	-	10
Błonie	9	9	-	3	-
Gdynia	10	10	-	10	9

Source: own elaboration based on Financial Times.



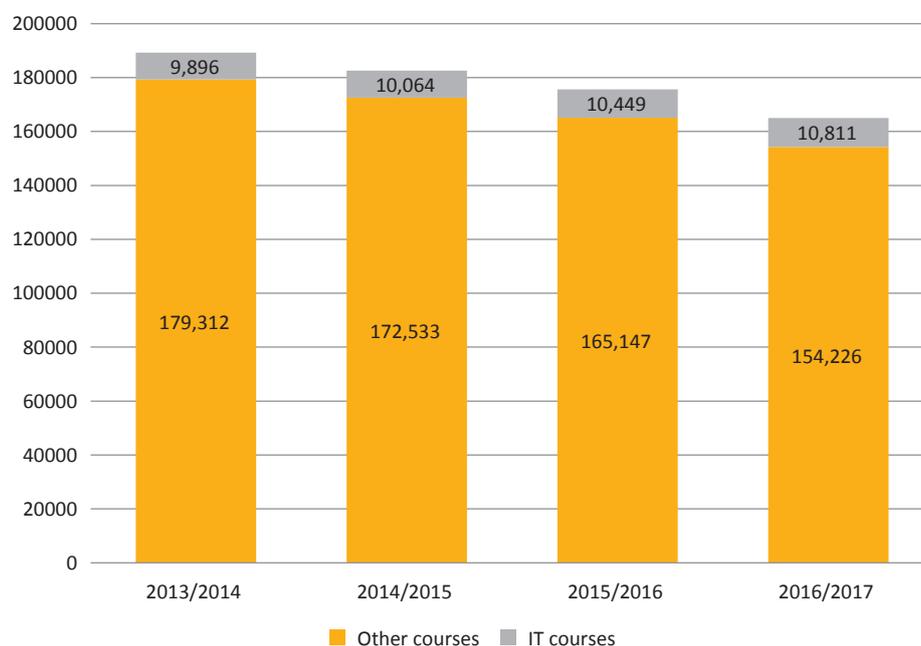


III. Potential of the Małopolska labor market of the ICT industry

1. ICT students studying in the region

In the 2016/2017 academic year, a total of 168,136 people studied in the Małopolskie province, including 125,152 (74.4%) in full-time studies and 42,984 (25.6%) in part-time studies. 10,811 of them studied in fields related to ICT, which 6.4% of all students.

Chart 6: The total number of students in the Małopolskie province in 2013-2017, including the number of IT students.

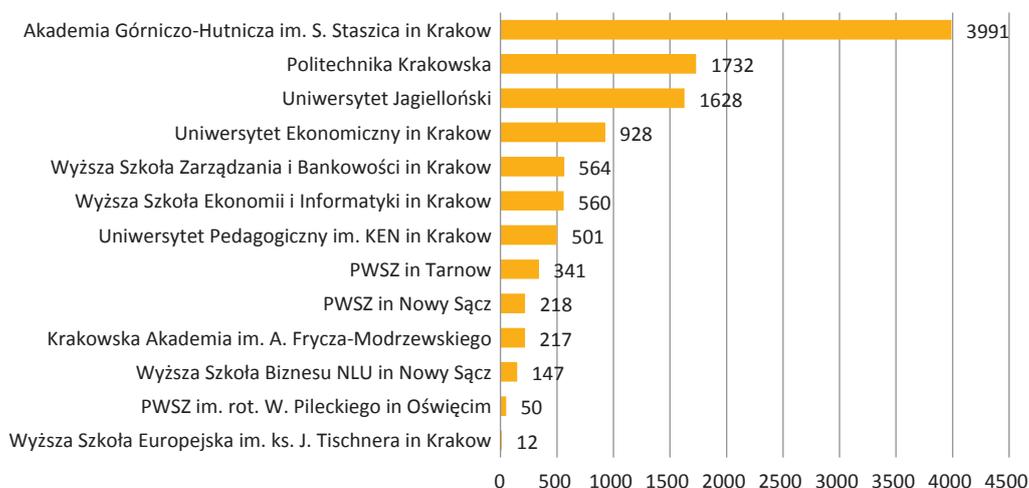


Source: own elaboration based CSO.

The overall decline in the number of students in recent years is clearly noticeable, which is mainly due to the demographic decline and changes in educational preferences. It should be noted, however, that there is a reverse trend for IT fields of studies, where the number of students from year to year is constantly growing (in 2016, the increase was over 3%). This situation should be explained by the huge demand for ICT specialists in the labor market and relatively high earnings in the industry.

In the 2016/2017 academic year, as many as 13 universities in the region had ICT-related fields of study, including 8 public and 5 non-public schools. Most of them, i.e. 9, are located in Kraków, others in smaller urban centers such as Nowy Sącz (2), Tarnów (1) and Oświęcim (1).

Chart 7: The number of students in the field of IT in individual universities of the region in the academic year 2016/2017



Source: own elaboration based on CSO.

The largest number of students studying ICT-related faculties was Akademia Górniczo-Hutnicza im. Stanisława Staszica in Kraków (University of Science and Technology, AGH). The university was chosen by 3,991 people, i.e. 37.2% of all those studying telecommunications. It is worth paying attention to the fact that in recent years the AGH University has been in the leading position in the IT faculties ranking of the “Perspektywy” Foundation²⁰ in the category of technical fields of study²¹. As many as four departments are in the top ten, taking second, third, fifth and seventh respectively, and these include very high quality of publications of AGH employees, very good marks among employers employing graduates, as well as the number of granted patents and protection rights. We should also mention the highly-rated IT fields of study at the Uniwersytet Jagielloński (Jagiellonian University). In the “Perspektywy” ranking, in the category of computer science as an exact science conducted by non-technical universities, two faculties of the university occupy the second and third place respectively²².

From the ICT industry’s point of view, specialties in which students of IT faculties are educated are particularly interesting. These directions are grouped according to the ISCED classification²³ used in statistical surveys. A group of education particularly important for entities from the ICT sector can be distinguished, namely “Information and communication technologies” divided into several subgroups to which IT fields of study are qualified: design and administration of databases and networks, creating and analyzing software and applications, teleinformation technologies

²⁰ Non-governmental educational organization, whose council consists of former and current rectors of Polish universities, as well as other public figures interested in the development of higher education in Poland. One of the foundation’s initiatives is to promote Polish universities abroad through a multi-annual program „Study in Poland” <http://studyinpoland.pl>.

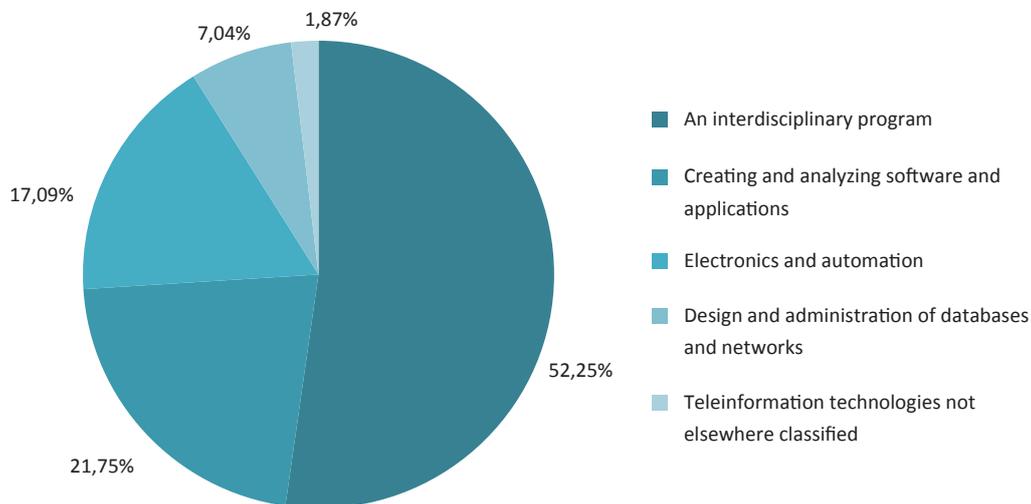
²¹ Ranking Studiów Inżynierskich Perspektywy 2017, Informatyka, <http://www.engineering.perspektywy.pl/tabele/show.php?table=45> [access: 29.10.2017].

²² Ranking Kierunków Studiów Perspektywy 2017, Informatyka, <http://www.perspektywy.pl/RSW2017/ranking-kierunkow-studiow/kierunki-scisle/informatyka> [access: 29.10.2017].

²³ Międzynarodowa Standardowa Klasyfikacja Edukacji: Kierunki kształcenia 2013

not elsewhere classified, interdisciplinary programs and including information and communication technologies.

Chart 8: The popularity structure of individual specializations in the field of ICT in the academic year 2016/2017



Source: own elaboration based on CSO.

The largest number of students (5,649 people – 52.6%) studies in the field of information technology based on an interdisciplinary educational program, in which the most intentional learning time is devoted to teleinformation technologies. Subsequently, 2,351 people (21.8%) chose the IT faculty classified as creating and analyzing software and applications, consisting in training in the design and development of computer systems and computing environments, that is mainly programming and development of programming languages, analytical informatics, operating systems and others. 17.1% of students (1,848 people) of the AGH University studied computer science and teleinformatics, which were classified in another ISCED group, i.e. “Technique, Industry, Construction” in the “Electronics and automation” category. These are the sciences about planning, designing, development, maintenance and monitoring of electronic devices, machines and systems. These include design of computers and equipment for communication, data processing technologies, network technologies, robotics and others. 761 students (7.0%) studied IT in the field of “design and administration of databases and networks”, the assumption of which is education in the design, maintenance and integration of software applications, i.e. installation and management of computer networks, databases, web design and others. The remaining 1.9% of students (202 people) studied at the “Electronic information processing” at the Jagiellonian University, which was not classified in any of the above education programs.

2. The labor market of the ICT

a) Employment in the sector

As it was mentioned earlier in the report, at the end of September 2017, 343,413 enterprises were registered in REGON; 10,792 of them declared an activity that can be classified into the ICT sector according to the Polish CBA.

Tab. 7: Number of ICT entities in the REGON register in terms of employment in the Małopolskie province as at 30 September 2017, by CBA divisions.

Branch	0-9	10-49	50-249	250+
producers of computers and peripherals	155	6	1	-
manufacturers of telecommunications equipment	49	9	2	-
computer game publishers	67	6	-	-
software publishers	194	7	-	-
telecommunications operators and service providers	849	23	3	-
software activities	5,378	115	16	2
consultancy in the field of computer science	1,224	10	1	-
management of IT devices	347	6	1	-
other services in the field of information and computer technologies	767	13	2	-
data processing and hosting	533	8	1	1
Internet portals	776	16	1	3
other information services	199	1	-	-
Sum	10,538	220	28	6

Source: own elaboration based on CSO.

Among the ICT enterprises in the region, the largest number, 97.6% (10,538), were micro entities employing up to 9 employees. The share of small companies employing from 10 to 49 people was 2.0% (220), while medium and large enterprises employing 50 or more persons accounted for only 0.3% of all respondents (28 and 6 enterprises respectively).

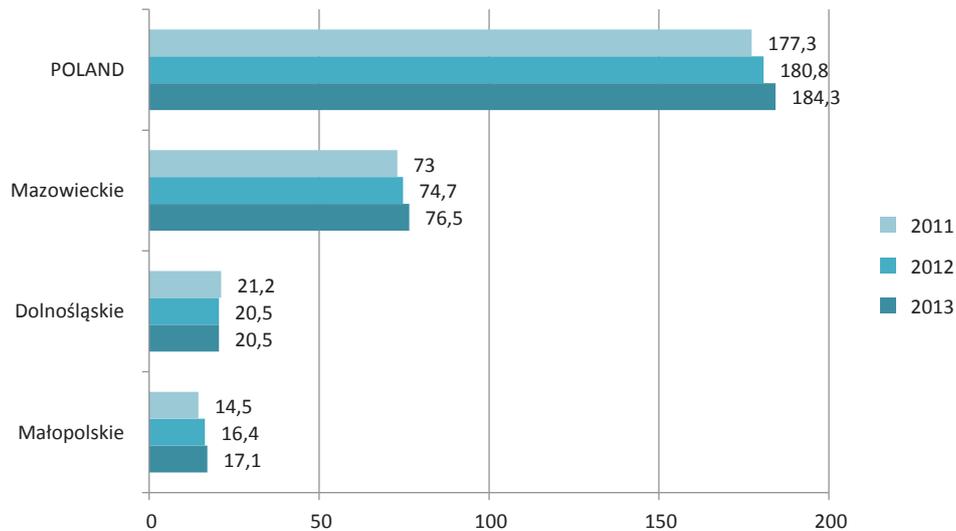
According to current CSO data (as of 30 September 2017), the average employment in the region in the enterprise sector amounted to 485,700 persons, which is an increase of more than 3% compared to the previous year (average annual value of 460.4 thousand). It is estimated that in 2016, the average employment in the region increased in all sectors compared to 2015, and the highest dynamics was recorded in companies providing mainly business services, especially in the information and communication industry (+21.2%)²⁴. The main reason for big increases is the dynamic development of shared service centers and business process outsourcing.

According to CSO report devoted the ICT sector in 2013²⁵ the number of employees in the ICT sector was 17.1 thousand. people, which placed the region in the third place in the country (9.3%) for the Mazowieckie (41.5%) and Dolnośląskie (11.1%) provinces. It is worth noting, however, that in the surveyed years 2011-2013 in Małopolska there was a significantly higher percentage increase in employment (17.9%) compared with the leaders of the ranking - Mazowieckie (4.8%) and Dolnośląskie, in which a decline was observed (3.3%).

²⁴ *Ocena sytuacji na rynku pracy województwa małopolskiego w roku 2016*, Załącznik do Uchwały nr XXXVI/552/17 Sejmiku Województwa Małopolskiego z dnia 29 maja 2017 r., p. 22.

²⁵ GUS, *Zdefiniowanie zakresu podmiotowego sektora informacyjno-telekomunikacyjnego (ICT) oraz opracowanie danych sektora ICT na poziomie kraju i województw (NTS-2)*, p. 31.

Chart 6: Employment in the ICT sector in 2011-2013 (in thousands of people).



Source: CSO.

The largest enterprises in the ICT sector in the region employing more than 1,000 people are Comarch, Luxoft Poland, Sabre Poland, Cisco, Motorola Solutions Systems²⁶.

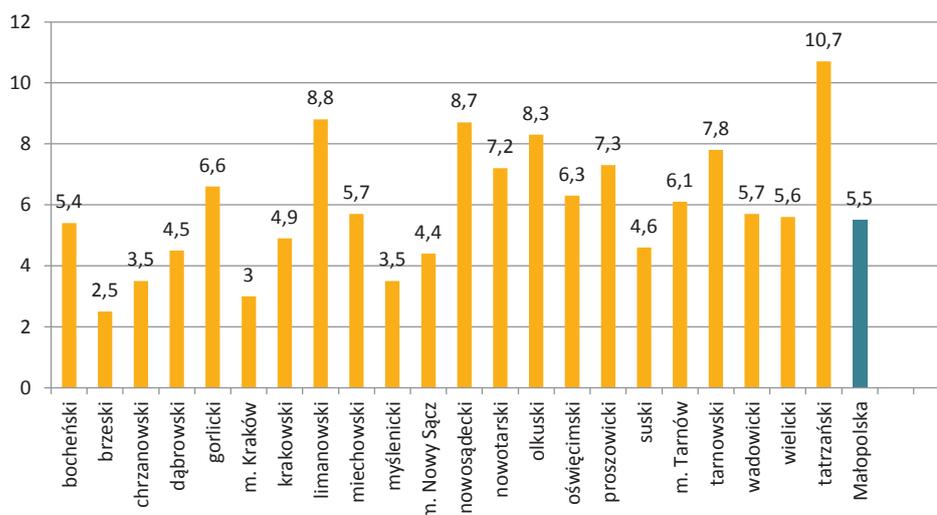
b) Unemployment rate

The decrease in unemployment in the region is clearly noticeable in recent years. The unemployment rate currently reaches 5.5%, which is of 1.2 percentage point lower than in the same period of 2016 (6.7%; in 2015 the unemployment rate was 8.3%). There were 81,900 unemployed registered in labor offices, by over 14,000 persons less than a year earlier (14.8%) and 35.4 thous. less than in 2015 (30.4%). With the average unemployment rate of 6.8% for the whole country, Małopolska, ex aequo with the Śląskie province, reached the second lowest share of people remaining without work (behind leading Wielkopolska 4.0%)²⁷. A significantly different level of unemployment is maintained in particular areas of the province. Such a trend in individual poviats²⁸ of the region has been visible for years. The lowest unemployment rates are recorded in Kraków (3.0%) and poviats located in the near vicinity of the city (eg, Myślenice, Brzesko, Chrzanów, and Sucha). The highest values occur in more remote areas, mainly in the east and south of the province (Limanowski, Nowosądecki, and Tatrzański poviats). In nine poviats, the value of the rate was lower than the province level, and in the remaining twelve poviats – higher. In addition, it should be noted that the difference between the highest rate (10.7% in the Tatrzański powiat in the south of the region near the Slovakian border) and the lowest (2.5% in the Brzesko powiat between Kraków and Tarnów) was more than fourfold.

²⁶ Cf. p. 9-10.

²⁷ <http://www.krakow.stat.gov.pl> [access 18.11.2017]

²⁸ Administrative division of Małopolska http://en.wikipedia.org/wiki/Lesser_Poland_Voivodeship#Administrative_division

Chart 10: Unemployment rate in poviats of the Małopolskie province in September 2017 (in%)


Source: own elaboration based on CSO.

In 2016, the supply of vacancies significantly increased - up to 100,600 offers from employers to poviat labor offices (pol. abbr. PUP), by 18,960 more than a year earlier (increase by 23.2%). Among them, 2,236 (2.2%) concerned vacancies in the positions of specialists in the field of ICT.

Tab. 8: Request for ICT specialists in the Małopolskie province in 2016 according to the code of the profession.

Profession	inflow of job offers during the year	number of job offers submitted to the PUP - state at the end of the year
Managers in the ITdepartments	201	1
ICT engineer	23	0
ICT system analyst	219	0
Consultant on teleinformatic systems	22	0
Designer / architect of teleinformatic systems	22	1
Other analysts of computer systems	17	6
Specialist for the improvement and development of applications	138	0
Specialist for software development and information systems	249	1
Architects and website development specialists	11	2
Designer of multimedia applications, animations and computer games	2	0
Other designers of network and multimedia applications	3	0
Application developer	228	6
Mobile application developer	18	0
Other application developers	18	2
Medical computer specialist	3	0

Profession	inflow of job offers during the year	number of job offers submitted to the PUP - state at the end of the year
A specialist in IT applications	167	0
Testers of software and teleinformatic systems	354	4
Database administrators, analysts, designers	43	0
Computer systems administrator	58	3
System and computer networks specialists	344	3
Software security specialist	3	0
Security specialist in IT systems	93	0
Sum	2,236	29

Source: own elaboration based on Poviats Labor Office in Krakow.

The biggest demand had the widely understood software industry. Free jobs for software developers, programmers, analysts and administrators in the field of software and databases concerned 47.7% of offers (1,067). This group of professions is deficient according to Occupation barometer 2017²⁹. A further increase in demand is expected in Kraków, Nowy Sącz and neighboring poviats.

c) Staff fluctuation

The reason why there are so many offers of vacancies at the labor offices is certainly also noticeable for some time the phenomenon of personnel fluctuation among IT specialists. Experts in this field have the prospect of very high salaries and attractive additional benefits, so they can look for better working conditions. Research shows that IT specialists, especially young people, prefer employment as contract employees, which further weakens their relationship with the employer. Their decisions are dictated by a higher level of remuneration, the opportunity to choose interesting and development projects, flexibility in employment, independence from the brand and the lack of unnecessary administration³⁰. Therefore, the average period in which an IT specialist is associated with a given company is 30 months³¹. From the point of view of the organization that a qualified employee leaves, the costs and time associated with finding and implementing a new person can be significant. According to the “WskaznikniHR 2017” report by Sedlak & Sedlak, the rate of resignation from work among IT specialists is more than 1.5 percentage points (6.2%) higher from nationwide results (4.6%). At the same time, the redundancy rate in the IT sector is twice as small. Therefore, employers in the industry more often decide to promote employees in order to stop them, they try to ensure that the offered position is creative, propose participation in prestigious training, as well as provide a relaxation zone in the work place, the so-called chill rooms.

²⁹ The study annually carried out at the request of the Ministry of Family, Labor and Social Policy coordinated by voivodship labor offices (<http://barometrzwodow.pl>).

³⁰ J. Kłosowska, *Fluktuacja kadr wśród pracowników IT*, 18.06.2013, <http://rynekpracy.pl/artykuly/fluktuacja-kadr-wsrod-pracownikow-it> [access: 15.11.2017].

³¹ *Pracodawca na rynku pracownika - jak firmy z branży IT przyciągają kandydatów?*, w: „Gazeta Prawna” z 23.10.2016, <http://serwisy.gazetaprawna.pl/praca-i-kariera/artykuly/986483,pracodawca-na-ryнку-pracownika-jak-firmy-z-branzy-it-przyciągaja-kandydatow.html> [access: 15.11.2017].

d) Foreigners in the ICT labor market

The consequence of the drop in the number of those who look for a job and those who may take it, is the leveling of staff shortages by employers by searching for employees abroad. Mainly the countries whose citizens do not have to obtain a work permit in Poland are taken into account and only the registration in the PUP about the intention to entrust work to a foreigner is required. In the Małopolskie province, in 2016, declarations regarding almost 101.5 thousand of people from these countries were registered, mostly from Ukraine - 95%. Much less submissions concerned Moldovan citizens - 3%, Russia and Belarus - 1.5%. Most of the needs related to low-demand jobs, mainly related to physical work (84%).

However, in recent years, there have been more and more declarations regarding more complex professions requiring more specialized qualifications. The Małopolska province Office issues more and more such permits: in 2014 – 34, in 2016 – 554. Definitely more, because 19-fold, work permits were also issued in IT professions: in 2014 – 45, in 2016 – 869³². Małopolska, compared to the national average, noted an above-average dynamics of change. In 2015-2016, the number of specialists in the field of information technology in the region increased by 91%, with the national average of 74%. Thus, the share of IT specialists receiving a work permit in Małopolska in the total number of IT specialists coming to Poland increased from 10% in 2014 to 32% in 2016. Their origin is diverse: over a half are Ukrainians (51% of all IT specialists receiving a work permit in Małopolska), Russians (15%), Indians (10%), Brazilians (6%), Belarusians (5%). In the case of other countries, the inflow was insignificant and amounted to 20 or fewer people³³.

It is difficult to examine the number of employees from the EU/EEA and Switzerland, because their citizens do not have to apply for a work permit in Poland. From the registration data for temporary stay, it appears that their inflow has also increased: between 2013 and 2014 by 6%. It can be assumed that most of them have started work³⁴. The upward trend is also observed in the case of the number of immigrants from India – in 2016 there were twice as many as in 2011. In 2011-2016, the inflow of immigrants from Far East countries (China, Vietnam, North Korea, Japan and South Korea) and from English-speaking countries (USA, Canada, Australia) decreased.

e) Wages

Another consequence of the shortage of employees is wage pressure. In other words, along with the increase in labor supply, the level of remuneration in the ICT sector is also gradually increasing. It should be emphasized, however, that this applies to the IT industry to a larger extent than telecommunications. The remuneration is primarily influenced by the level of competence and experience in a given specialty. On the market there are mostly developers of all specializations, with particular emphasis on the ability to use the most desirable technologies, e.g. Java. In their

³² *Ocena...*, *op. cit.*, p. 30.

³³ *Ruch migracyjny w Małopolsce*, MORR, Kraków 2017, p. 91.

³⁴ *Ibidem*, p. 80-81.





case, we are dealing with the highest growth rate of wages. However, the lower one can be seen in the case of testers and administrators. In addition, specialists working in the B2B model earn 20% more than their counterparts working under a contract of employment. The soft interpersonal skills (communicativeness, cooperation in the group) successes and projects implemented so far, knowledge of foreign languages, including English, also have an importance for the amount of earnings. The impact, apart from the above, also has a regional specificity - competition for the best specialists between the largest cities, such as Kraków or Wrocław, implies increasing wages and the need to invest in additional tools, such as building an employer brand³⁵.

The Antal payroll report shows the indicative levels of earnings in the IT industry without division into regions. The given amounts should be treated as a point of reference, so the table lists wage ranges, not their averaged values.

³⁵ *Raport płacowy Antal. Wynagrodzenia oferowane specjalistom i menedżerom 6. edycja, 2016, p. 21-22.*

Tab. 9: Wages offered at chosen IT workplaces in Poland in 2016.

Position	Monthly gross salary in PLN
IT sale	5,000 – 30,000 (1,182 – 7,092 EUR)
Helpdesk 3. Linia	6,000 – 17,000 (1,418 – 4,019 EUR)
WWW developer (front-end)	5,500 – 16,000 (1,300 – 3,783 EUR)
WWW programmer (back-end)	5,800 – 16,000 (1,371 – 3,783 EUR)
Java programmer	6,500 – 18,000 (1,537 – 4,255 EUR)
C++ programmer	8,000 – 17,000 (1,891 – 4,019 EUR)
Mobile applications programmer	7,500 – 18,000 (1,773 – 4,255 EUR)
Data base administrator	9,000 – 12,000 (2,128 – 2,837 EUR)
Network administrator	8,000 – 14,000 (1,891 – 3,310 EUR)
IT analyst	8,000 – 13,000 (1,891 – 3,073 EUR)
Project manager	9,000 – 18,000 (2,128 – 4,255 EUR)
QA (specialist, analyst, manager)	8,000 – 17,000 (1,891 – 4,019 EUR)
Security Operations Center (analyst, manager, director)	6,000 – 24,000 (1,418 – 5,674 EUR)

Source: elaboration based on Antal report.

Own statistical research on remuneration is also conducted by the Central Statistical Office. However, available data refer to averaged amounts grouped not according to specific job positions, but based on their own “Classification of professions and specialties”. As in the case of the Antal report, the pay data is nationwide.





Tab. 10: Average gross remuneration of employees in the ICT sector in Poland in 2014 (as at 30 October).

Profession / specialty	general (PLN)	public sector (PLN)	private sector (PLN)
Managers for information and telecommunications technologies	10,478.37 (2,477 EUR)	8,042.30 (1,901 EUR)	10,800.37 (2,553 EUR)
System analysts and developers	7,189.85 (1,700 EUR)	6,191.58 (1,464 EUR)	7,294.77 (1,725 EUR)
Specialists for databases and computer networks	6,563.83 (1,552 EUR)	5,247.01 (1,240 EUR)	6,961.64 (1,646 EUR)
Technicians for information and communication technologies and assistance for users of teleinformation devices	4,892.13 (1,157 EUR)	4,069.59 (962 EUR)	5,219.64 (1,234 EUR)
Telecommunications and transmission equipment technicians	4,619.50 (1,092 EUR)	4,857.65 (1,148 EUR)	4,452.71 (1,053 EUR)

Source: own elaboration based on CSO.

Some studies and reports based on 2014 data, show that in the IT industry the remuneration median amounted to PLN 6,333 (1,497 EUR) gross monthly, and every fourth employee in the industry earned 9,800 PLN (2,317 EUR) and more³⁶. In 2016, the median pay for IT specialists in Kraków is PLN 6,000 (EUR 1,418) gross (25% of employees earn less than PLN 4,000 [EUR 946] and 25% more than PLN 9,000 [EUR 2 128]), in telecommunications, it is PLN 4,825 (EUR 1,141, 25% less than PLN 3,000 [EUR 709] and 25% more than PLN 7,500 [1,773 EUR])³⁷.

³⁶ P. Figurski, *Ile się zarabia w Krakowie i Małopolsce [RAPORT]*, in: „Wyborcza.pl”, 08.04.2015, http://krakow.wyborcza.pl/krakow/1,44425,17721359,Ile_sie_zarabia_w_Krakowie_i_Malopolsce__RAPORT_.html [access: 16.11.2017].

³⁷ J. Dolna, *Gdzie w Małopolsce zarobki są najwyższe? Kto płaci najmniej? [RAPORT PŁAC]*, w: „Gazeta Krakowska”, 30.04.2016, <http://www.gazetakrakowska.pl/strefa-biznesu/wiadomosci/a/gdzie-w-malopolsce-zarobki-sa-najwy->



IV Innovation of the sector in the region

1. Leaders of innovation in the ICT sector in Małopolska

According to the CSO, in 2014 the average share of innovative enterprises among all companies operating in the Małopolskie province was 13.5%. This percentage was lower than the national one at the level of 14.5%, which, in this respect, placed the region in the 10th place in the country. In the analyzed years, a downward trend in the share of innovative companies in the total number of enterprises operating in the region is noticeable.

Although public statistics indicate as innovative only 13.5% of companies, the query of randomly selected entrepreneurs for their level of innovation shows that only a few (6%) identify themselves as non-innovative.³⁸

Statistically, the average share of innovative enterprises in relation to the total number of entities operating in the region does not say anything negative about the potential in this respect. For several years, Małopolska has been at the forefront of the provinces with the greatest potential for innovation, second only to Mazowieckie. According to the study “Millennium Index - Regional Innovation Potential 2017” the distance to the leader of the ranking, however, decreases³⁹. The authors of the report take into account six innovation criteria, i.e. labor productivity (PLN million/number of employees), added value (%), research and development expenditure (R&D in relation to GDP), post-secondary education (number of students per 10 thousand inhabitants), the number of employees in R&D (per 1 thousand professionally active) and the number of issued patents (per 1 million inhabitants). The first two criteria determine the efficiency of the operations of enterprises and the technological advancement of production. Expenditures for research and development and the number of employees in the R&D sector are indicators of the innovative activity of companies and provide evidence of the region’s intellectual background; the number of students informs about the potential of the workforce. The number of issued patents is an indicator of the effectiveness of created innovations. In the case of the Małopolska expenditure on R & D are essential, which is a consequence of high academic, scientific and economic potential. This is associated with excellent results in terms of the number of students and people working in R&D (according to CSO this percentage in 2014 reached 1.44%, the average for the country: 0.96%). The Kraków agglomeration is considered one of the best educational centers in the country offering innovative courses of study and attracting the most talented individuals. There are also not many patent applications and applications for protection rights for the registration of utility models filed with the Polish Patent Office. In the years 2008-2014, in the scale of the whole country, there were 2,336 (9,3%) and 692 (11,6%) respectively, and in 2015 further 530 and 101⁴⁰.

zszekto-placi-najmniej-raport-plac,10156400/ [access: 16.11.2017].

³⁸ *Województwo małopolskie 2016*, Urząd Marszałkowski Województwa Małopolskiego, Kraków 2016, p. 163.

³⁹ http://www.bankmillennium.pl/documents/10184/25989931/Indeks_Millennium_2017.pdf [access 18.11.2017]

⁴⁰ *Analiza rynku...*, op. cit., p. 48.



Numerous research and development centers from the ICT sector operate in the Małopolskie province. One of them is the ABB Corporate Research Center belonging to the global ABB concern operating in the power industry and automation sector. One of the areas of ABB's involvement is the provision of specialized applications for the needs of scientific and research projects, new products and business solutions. The company's portfolio includes desktop, mobile and Internet software, often dedicated for devices manufactured by the company. Kraków engineers have developed applications, among others for remote control of installation of the intelligent building,



energy monitoring system or a diagnostic application for the UMC100 universal motor controller⁴¹.

In Kraków, one of its world's leading technology centers has a leader in the telecommunications industry – Motorola Solutions. In the center employing over 1,600 people, software for the most modern digital wireless communication systems is created, enabling the management of radio networks and terminals in TETRA, APCO-25 and LTE systems.

Apart from ABB and Motorola, there are also other centers of such well-known international brands as Capgemini (center of software and IT services), IBM (innovation center), Saber, International Paper (IT project management, IT services, etc.) and others.

Certainly Kraków's Codewise operating in the internet advertising market is one of the innovative enterprises of Małopolska. Its flagship products are Zeropark tools used to sell traffic on the Internet, and Voluum, allowing to analyze and optimize advertising campaigns. The most notable is the impressive increase in the company's turnover - in 2012-2015 it amounted to 13,000%. Thanks to this, it has achieved top positions in prestigious rankings of the fastest growing companies in Europe, e.g. Financial Times FT1000 (2nd place) or Deloitte Technology Fast50 CE (1st place). The analyzes are based on the percentage increase in operating revenues from the sale of products at the turn of several years preceding the survey. In the second ranking there was also Miquido, a producer of mobile applications (8th place). This is not the debut of the Małopolska IT companies in international rankings. For example, in 2013,

Softhis was recognized as the first in Poland and the third in Central Europe, the fastest growing technologically innovative enterprise by Deloitte. The software producer existing since 2005 operates on the market of dedicated IT solutions, such as CRM, ERP, workflow solutions, e-signatures and systems for generating a Uniform Control File.

Another example of innovative activity in the software industry is Kraków's Aplixcom Solutions. In

⁴¹ <http://new.abb.com/pl> [access 18.11.2017]

2016, for the SCADA-MES system he created, he became the laureate of the 10th edition of the Innovator Małopolski competition in the information and communication technologies category. The system is intended for manufacturing companies and gives the opportunity to monitor the operating status of the machinery park and production progress in real time. It can cooperate with any ERP system or independently. Operators, using computer workstations, have access to the necessary information about the production order, production process and documentation in electronic form (e.g. technology cards, instructions). Thanks to this, document management is more efficient and it is possible to eliminate its paper circulation⁴².

The innovative IT company is also Silvermedia, specialized in creating applications for the needs of telemedicine. The company is a producer of unique algorithms for biomedical signal evaluation supporting diagnostics and monitoring of the patient's health status in the field of cardiology, audiology, geriatrics and allergology. Noteworthy, among others, Silvermedic Cardio WebViewer application - an online ECG results viewer supporting the remote detection of specific cardiac diseases. The doctor can analyze the data anywhere, anytime on his personal computer or laptop connected to the Internet. The program is available via the web without having to install on the device. Specialist consulting the recording has the ability to edit, scale and compile data, also has access to historical data, thanks to which he can quickly and effectively compare ECGs⁴³. The solution was awarded in the Innovator Małopolski 2012 competition. It is used, among others, by the Institute of Cardiology in Warsaw, one of the most modern centers for the treatment of heart disease in Poland.

Finally, it should be mentioned that in the CSO report on innovative business operations, it is pointed out that enterprises from the ICT sector implemented innovations more often than other surveyed entities in general (industrial and service). The share of innovative ICT companies was 24.9%⁴⁴. According to CATI surveys conducted for the Marshal Office of the Małopolska Region, entities from the ICT sector, as part of their research and development plans, intend to launch new products or services on the market within the next two years and introduce new technologies in the enterprise (44.3% and 42.6% respectively), while slightly less (34.4%) will look for external (EU) funding for the development of innovation. The smallest number of companies have plans to conduct research and development (9.8%)⁴⁵.

Tab. 11: Research and development plans of ICT companies for the next two years.

Planned activity	Percent of affirmative answers
launching new products or services on the market	44.3
introduction of new technologies in the enterprise	42.6
conducting research and development	9.8
use of external services related to R&D, introduction of new products or services or new technologies	14.8
searching for external (EU) funding for development innovation	34.4

Source: own elaboration based on *Innowacyjność i działania badawczo-rozwojowe...*

⁴² <http://www.scada-mes.pl> [access 18.11.2017]

⁴³ <http://www.silvermedia.pl> [access 18.11.2017]

⁴⁴ *Działalność innowacyjna przedsiębiorstw w latach 2012-2014*, GUS, Warszawa 2015, p. 41.

⁴⁵ *Innowacyjność i działania...*, op. cit., p. 32.



2. Social and institutional support for startup projects

The startup enterprises are developing dynamically in Małopolska. In studies of Startup Polska from 2017⁴⁶, Kraków is the place where 7% of such companies operate in scale of the whole country. A similar number can be praised by Poznań, while more are located in Wrocław (12%) and Warszawa (25%). The nationwide data show that the majority of starters are people aged 30-39 (58%), with higher education (82%). The dominant segment of sales of products is Big Data (19%), analytics and research tools (17%), Internet of Things (14%), tools for programmers and developers (14%). In the Małopolskie province, mainly in Kraków, startups specialize primarily in beacons, Bluetooth Enabled Devices, B2B, SaaS solutions and games.

One of the most important conditions for the development of the ICT sector is its social and institutional environment. The ease of starting a business or its expansion into foreign markets often depends on the activity of supporting institutions. These include, for example, science and technology parks. One of the first in the region was the Kraków Technology Park established in 1997,

⁴⁶ *Polskie Startupy. Raport 2017*, Warszawa 2017

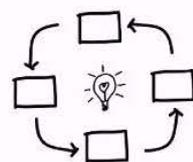
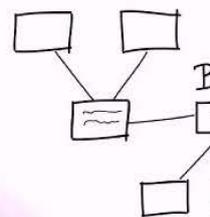
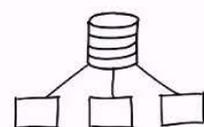
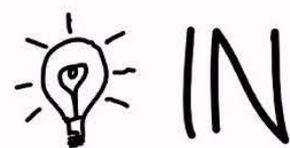


bringing together such renowned ICT companies as Comarch or Motorola, which obtained business permits already at the turn of 1999/2000. KTP participates in numerous long-term projects financed to a large extent from European Union funds, and the basic criterion for their selection is the possibility of giving real help to companies at various stages of their development, as well as promotion of knowledge and entrepreneurship⁴⁷. The park offers infrastructure, logistics and administrative facilities, access to EU funds, legal, business, marketing, financial and patent consulting. The KTP manages a special economic zone in which there are over 23 thousand jobs. Particularly interesting KTP initiatives include:

- technological incubator - the largest in Krakow, from 2008 supporting young, not older than two years, companies using innovative solutions from the high tech sector (including games industry, smart city solutions and others), which can count on preferential lease terms, entry into a large group of companies from the same industry and a quick start. The criterion for admission to the incubator is innovation, having an interesting and unusual product or service, an ambitious business plan;

⁴⁷ <http://www.kpt.krakow.pl/nasze-projekty/> [access 18.11.2017]





NOVATION



- office space dedicated for companies from the ICT industry, including startups being on the market for no longer than two years;
- rental of computer hardware and peripheral devices, e.g. 3d printers;
- Data Center for server collocation and a cloud computing laboratory with parameters exceeding 0.5 PB (petabytes) of data space and 7 TB (terabytes) of RAM.

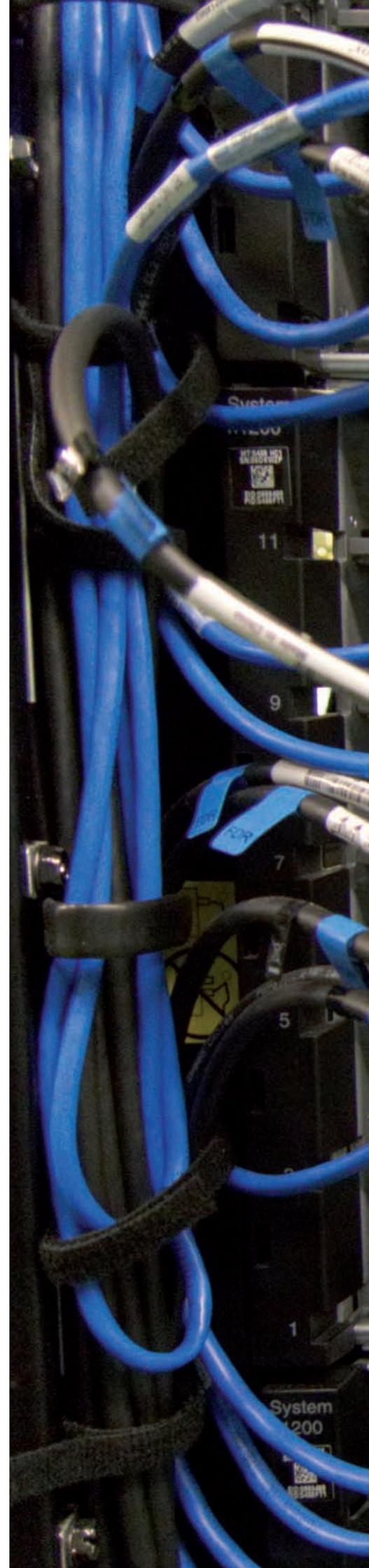
Support for young companies is offered by business incubators, funds and accelerators. These include, for example, the Innovation Nest supporting high-tech entrepreneurs, focusing on activities in the area of the Internet or technologies using the network. The Fund offers both financial support and activities without cash investments (training, workshops and other substantive support)⁴⁸. Deutsche Telekom also invests in startups through its hub:raum incubator, thanks to which the German telecommunications operator acquires innovative ideas from young companies, while creating business opportunities for both parties. The incubator's activity also includes the implementation of development programs and hackathons for programmers⁴⁹. Another initiative is the Bitspiration Booster startup accelerator supporting projects whose activities are focused around machine self-learning, Big Data, artificial intelligence, FinTech (financial services via the Internet), biotechnology (BioTech) and medical technologies (MedTech)⁵⁰. Similar activities, as described above, are also carried out by entities such as Satus Venture, Innoventure, Leonardo Fund, Seed Fund of the Krakow Technology Park.

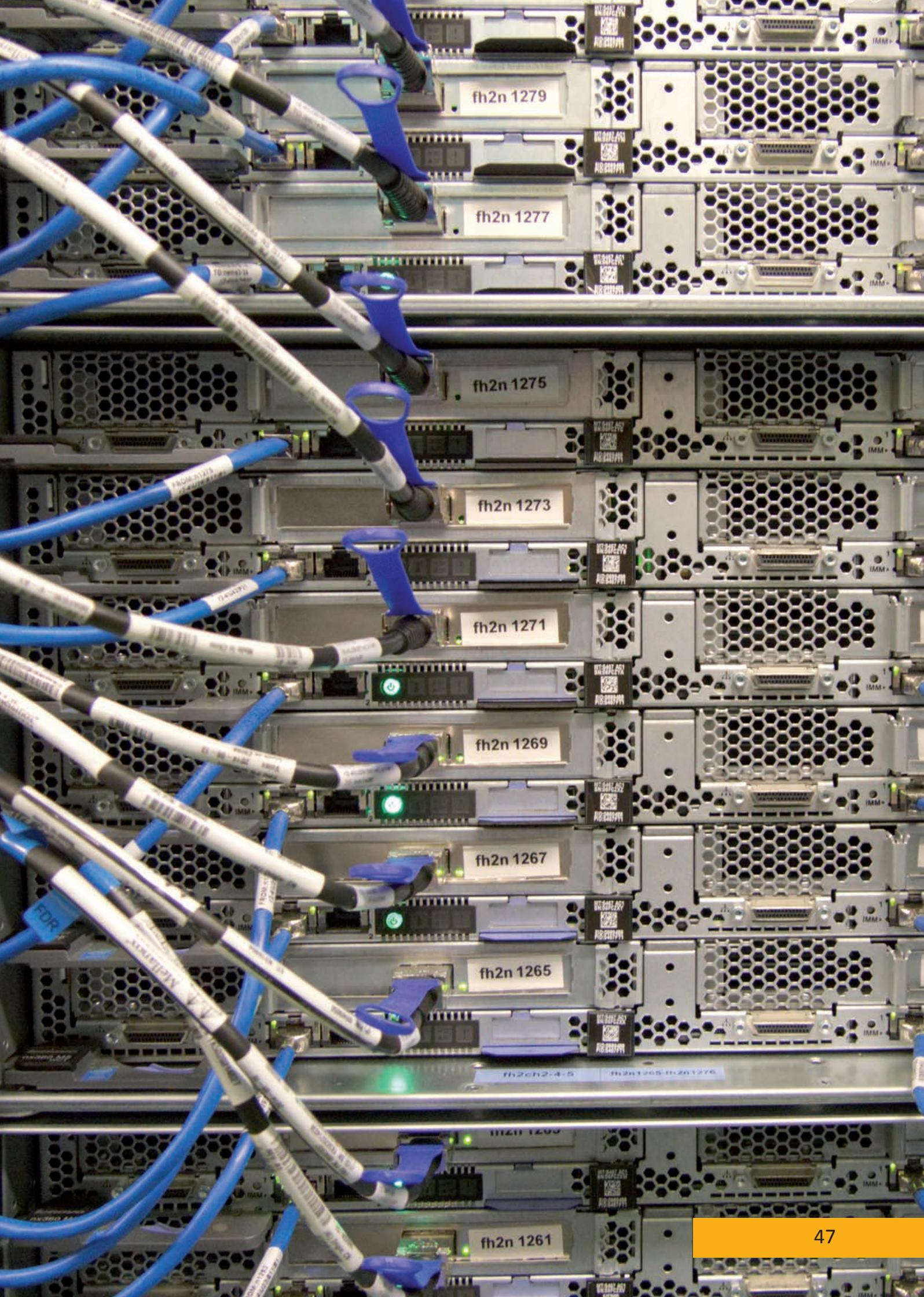
Cluster is another support tool whose idea is to create a cooperation network for enterprises, universities, local government and business environment institutions. Within the cluster, there are economically connected entities that, acting together, can build a competitive advantage, create new enterprises, products as well as new jobs for highly qualified and well-paid employees. Among the Małopolska clusters, there is, among others Digital Entertainment Cluster bringing together 16 companies from the computer games sector. The basic task of the cluster is to organize cooperation between Polish companies, develop the potential of the Polish industry at foreign gaming fairs and support in obtaining financing for participation in them. It also significantly increases the chances of promoting Polish companies at international events, and also supports the process of acquiring foreign business partners

⁴⁸ <http://innovationnest.pl/> [access 18.11.2017]

⁴⁹ <http://www.hubraum.com/> [access 18.11.2017]

⁵⁰ <http://booster.bitspiration.com/> [access 18.11.2017]





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by domestic companies in the industry. Since 2010, the Myślenicki Cluster has also been operating. Its purpose is to integrate local enterprises in the field of modern IT and telecommunications techniques. The agreement, under the patronage of the National Chamber of Ethernet Communications, consists of 11 entities that are ISP operators. The effect of their cooperation is to be a new traffic exchange node with such services as data transmission, IPTV, VoIP, data center and cloud computing.

According to the information from the Małopolskie province website, other clusters of enterprises from the ICT sector operate in the region: Małopolska Cluster of Information Technologies (Małopolski Klaster Technologii Informatycznych), Cluster of Multimedia and Information Systems (Klaster Multimedii i Systemów Informatycznych), Małopolska IT Cluster E-cluster (E-klaster Małopolski Klaster Informatyczny), European Games Center (Europejskie Centrum Gier), Trident IT Cluster (Klaster Informatyczny Trident)⁵¹.

Attention should also be paid to numerous events organized. The Małopolska Festival of Innovation has the biggest scale. It is a collection of events taking place in the entire region, concerning the broadly defined startup activity, implementation of high-tech solutions and supporting young businesses. Among the dozens of different events, you can also find those from the IT industry. In the last edition, the company 1000 Realities presented, for example, applications and costs of virtual reality (VR) implementation in the context of the enterprise. Other events within the framework of the Festival concerned 3D printing, an innovative application supporting the rehabilitation of speech disorders, holograms and artificial intelligence in business⁵². Another interesting example is the cyclically organized (since 2012) largest conference in Central Europe for professionals and companies in the video game industry – Digital Dragons. The latest edition attracted nearly 1,500 participants from dozens of countries around the world, including over 100 exhibitors and speakers. Apart from the fact that the conference is a good opportunity to establish contacts and B2B and B2A cooperation; it is also a place that gives startups and freelancers the opportunity to present their games to a wide range of specialists and enthusiasts from the industry, and also to take part in a series of competitions with prestigious prizes⁵³. Other events



⁵¹ <http://www.malopolska.pl/biznes/bizneswmalopolsce/instytucje-wspierajace-biznes/klastry-w-malopolsce> [access 18.11.2017]

⁵² <http://www.festiwalinnowacji.malopolska.pl/> [access 18.11.2017]

⁵³ <http://digitaldragons.pl/> [access 18.11.2017]



that deserve attention are Bitspiration (educational conference for entrepreneurs and start-ups), Smogathon (technology in the fight against smog), Startup stage (meetings regarding trends in the technological world of business) and others.

3. Public projects stimulating innovation

The self-government of the Małopolska province undertakes various types of activities aimed at supporting Małopolska entrepreneurs by stimulating their innovativeness and implementing new technologies. This applies to project “SPIN - Małopolska Knowledge Transfer Centers”, offering services of technology audit and knowledge transfer using the potential of the scientific community. The target group of the initiative are Małopolska micro, small and medium enterprises, wishing to increase their level of innovation and develop in the area of key regional specializations, including ICT technologies. Services for this sector are carried out by the Center of Intelligent Information Systems at the AGH University of Science and Technology in Kraków. They are free of charge thanks to funding from the European Regional Development Fund, and the quality of provided assistance

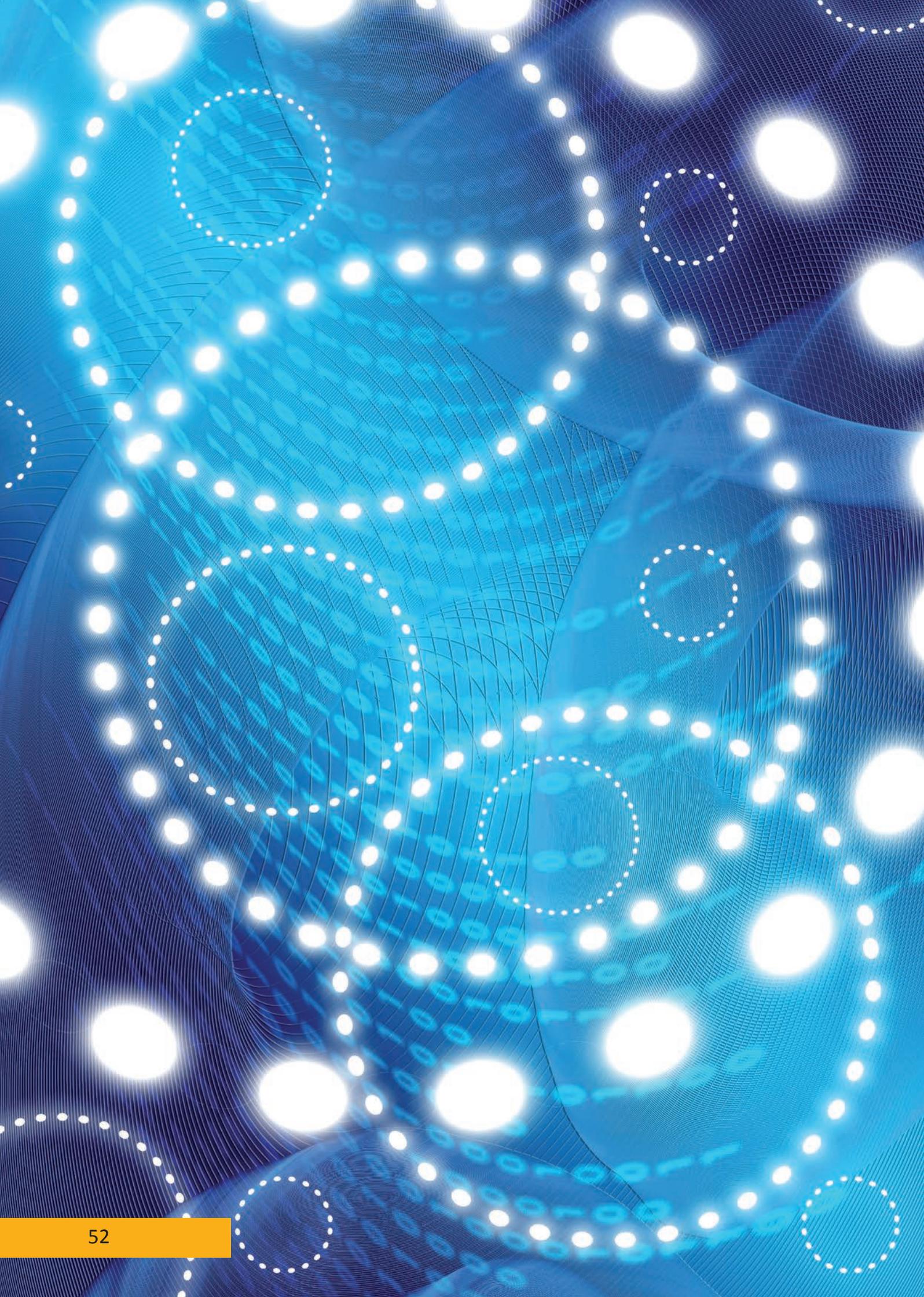
is ensured through cooperation with AGH research staff. The Center's offer includes pro-innovative services in the field of intelligent systems related to the processing of large amounts of data and the use of knowledge from analyzes to improve quality and efficiency: technology audits, market analysis of the company, analysis of advertising strategies, support in formal and legal procedures related to *de minimis* support. Enterprises may also receive assistance in the form of consultancy (e.g. in the area of obtaining grants, seeking investors, legal), carrying out various research, analyzes, campaigns, training and others⁵⁴.

⁵⁴ <http://cisi.agh.edu.pl/> [access 18.11.2017]



Various types of competitions for co-financing enterprises under operational programs (Intelligent Development, Regional Operational Programme) are also being announced. In 2017, for example, several projects concerned support for investments related to research and development – industrial research, experimental development works, infrastructure, implementation of results of R&D works or industrial property objects.





Conclusions

The importance of ICT in the economy is constantly increasing. According to the Ministry of Development, the sector in Poland is growing at a rate of 20% per annum, and its value is PLN 32 billion (EUR 7,565 billion)⁵⁵. In the next five years, industry revenues are expected to double. Teleinformation technologies are just as indispensable in an enterprise as electricity or raw materials for production. However, this is not about the truism that is the necessity of providing a computer equipment, but about modern cooperation of entities based on the use of electronic data exchange methods and techniques, automation of information processing processes. Therefore, all European and global forecasts indicate that ICT will definitely be the most important sector in the perspective of economic development in all sectors.

In the coming years, key trends in ICT will be cloud computing, Big Data, Internet of Things (IoT) and cybersecurity. In the case of Poland, segments with the highest forecasted growth dynamics in which one can specialize are: production of hybrid cars and intelligent transport, computer games industry, IoT, FinTech and telemedicine and medical equipment. As shown in this work, ICT companies from Małopolska are also developing their own solutions in these areas. It is worth remembering one of the most tangible elements of the IoT trend – beacons, microcomputers that communicate with mobile devices via Bluetooth. When the device is within the range of the beacon, it receives various types of information from it, depending on how it is programmed, for example, commercial information emitted by a nearby store. Also the gaming market will continue to grow dynamically due to the fact that games are, and will certainly also be a very popular entertainment method in the future. In the Małopolskie province, this market is more important than the film industry; in Kraków itself there are a dozen or so producers and publishers of games (e.g. Bloober team, iFun4All, Reality Pump, Ganymede Technologies), whose titles enjoy the recognition of users. Here, too, there is an opinion-making Internet portal related to the gaming industry - “GRY-OnLine.pl”.

At the end, the question may be asked: can the capital of Małopolska Region become the second Silicon Valley? The key to the success of the US high-tech industry, where such giants as Apple, AMD, Google, Intel and Facebook are headquartered, are close to excellent universities and government research centers, availability of a large number of educated employees, as well as access to venture capital. Kraków largely meets such criteria. It is a city of young people - at 800,000 of the population 25% are students, of whom over 10,000 studies IT courses, including those from the absolute national leaders. Many global corporations have built here their research and development centers and outsourcing service centers. Such climate certainly favors new business initiatives, especially since they can count on various forms of support from public and private institutions - economic zones, business incubators, funds, accelerators, etc. In terms of startups achieving global successes, Kraków stands out against the background of the entire country. The capital as well as the whole region attracts crowds of foreigners, thanks to which there is an international atmosphere here. These features, in comparison with other Polish cities, certainly predestine Kraków to stand as a “Polish Silicon Valley”. Perhaps, however, instead

⁵⁵ *Informacja nt. potencjału innowacyjnej gospodarki cyfrowej w Polsce*, Ministerstwo Rozwoju, Warszawa 2017, p. 3.

of looking for an analogy with the American symbol, it is better to go your own way and gradually build your own brand - become one of such “valleys”, at least on the scale of the Central and Eastern Europe. Małopolska may become one, and even become a leader building its own quality and identity around the ICT sector.



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