

ACADEMIC POTENTIAL OF POLISH CITIES. FROM CENTRES OF ADVANTAGE TO CENTRES OF VULNERABILITY

Piotr CZAKON

Institute of Urban and Regional Development, Warsaw-Krakow; pczakon@irmir.pl,
ORCID: 0000-0001-9724-9176

Purpose: The purpose of the article is to compile a list of Polish cities according to their academic potential.

Design/methodology/approach: The starting point of the article is to indicate the significance of human capital and education to build the economic position of Polish cities. The main part of the analysis is based on the data prepared by the Ministry of Education and Science on the number of universities, the number of students, the structure of majors and ministerial scholarship holders in 2021.

Findings: The analysis allowed for the preparation of a proposal to classify Polish cities according to their academic potential. Cities with absolute advantages, lower potential, but compensated by unique characteristics, cities difficult to classify, cities exceeding their size and rank in terms of academic potential, and cities representing the greatest challenge to build human capital and shape pro-investment policy were included in the division.

Originality/value: The article is based on the latest data provided by the Ministry of Education and Science. The results may prove to be useful for local governments and persons responsible for shaping regional development policies.

Keywords: Socio-economic geography, higher education, regional development.

Category of the paper: Research paper.

1. Introduction

The significance of higher education for urban development is determined by several factors. Academic centres not only contribute to the concentration of a relatively young and educated population, but also in the long run their aim is to create intellectual added value. Depending on the size, rank and dominant function of a city, its academic centres can either concentrate the local resources of a learning cohort of people up to the age of twenty or - due to its national attractiveness - lead to a spatial concentration of students coming from various places.

There is no greater doubt that the assessment of the academic potential of Polish cities depends not only on the absolute number of universities located within their area or the number of students, but also on the structure of majors offered, the share of students in the local population and their scientific achievements.

Since the mid-twentieth century, the opinion that the explanatory value of natural and material capital resources in explaining the spatial differentiation of welfare is limited is increasingly commonly shared among development researchers, and the list of determinants should in this case be extended to non-economic and qualitative dimensions (Pogonowska, 2004; Sachs, 2003). Recent decades have brought the development of views that valued the significance of knowledge and cultural content in determining the level of economic development (Sachs, 2003). Human capital, i.e. knowledge and skills of individuals (Becker, 1994, p. 15) that enable them to create economic value, is considered the basis of sustainable economic growth and social development (including Hansen, Winter, 2014; Schwab, Xavier, Sala-i-Martin, 2016).

It is sometimes emphasized that some definitional aspects of human capital could be encountered in some early works which date back to the beginning of the twentieth century. In 1906 in his renowned essay "Protestant sects and the spirit of capitalism" Max Weber described the role of one's qualifications and education in determining their level of consumption (Trutkowski, Mandes, 2005, p. 50). In 1916, Lyda Judson Hanifan drew up some conclusions regarding the correlation between the accumulation of knowledge among individuals and the level of wealth of rural areas. In other words, Hanifan highlighted the importance of regionally allocated human resources in the form of pupils' literacy skills (Putnam, 2008, p. 34). Some time later, in 1957, a report published by the Canadian government defined the system of universities and schools as crucial public infrastructure (Growiec, 2011, p. 34). It is also worth noticing that Jane Jacobs (2014, p. 151), one of the most prominent figures in the development of urban studies, in her text from 1961 praised the value of social cohesion which she defined as city's human capital.

Fast forward to the modern times. The availability of talent appears to be a key factor in the location of companies from the modern service sector (Micek et al., 2017; Skowroński, 2017). What's more, areas with high human capital gain an advantage over other areas in terms of productivity, wage growth and employment (Gwosdz et al., 2019; Murzyn-Kupisz, Działek, 2017). It is also noted that high human capital resources translate into higher income, greater propensity to use services, and greater public involvement.

Current data of the Ministry of Education and Science on the base of academic centres, the number of majors, their structure and the number of ministerial scholarship holders may constitute the basis for describing the academic potential of Polish cities. In order to present this information in a broader context, it has been extended to include the parameters of the size of the working-age population.

2. Findings

In 2021, only nine cities had a university base exceeding ten centres (Table 1). These were the following voivodeship cities: Warsaw, Wrocław, Poznań, Kraków, Łódź, Gdańsk, Katowice, Szczecin and Białystok. They gathered a total of 210 out of 484 national higher education institutions (43.4%). It is worth paying attention to the scale of disproportions within the above-mentioned top rankings. In the capital city alone, there were 63 universities in 2021 (which accounted for over 13% of all institutions). On the other hand, the five most affluent cities in higher education institutions have 156 universities (i.e. over 32% of institutions). Immediately behind the leaders, there are a further three voivodeship capitals: Lublin, Bydgoszcz and Kielce, which host 9 universities each (which account for 1.89% of the national resource, respectively). Further down the list there are Rzeszów, Olsztyn, Opole, Gorzów Wielkopolski and Zielona Góra. Their common feature is not only a low number of universities, but also being overtaken in this respect by some cities with a lower administrative rank, such as Radom and Bielsko-Biała.

Data on the number of majors offered and the number of students largely confirms the information about a significant concentration of academic potential within the above-mentioned nine cities. They account for over 60% of the offered majors and over 70% of the total number of students. Also now, the position of the undisputed leader is occupied by Warsaw, which educates almost a fifth of Polish students (228,000, which is 18.52% of the total pool) gathered within over 1,000 majors (13% of the national offer). It is worth noting, however, that despite a much more modest university base than in the case of the capital city, Kraków's universities provide education in over 800 majors (10.67% of the national offer) to over 131 thousand students (10.67% of the total). The academic position of Poznań and Wrocław is very strong and comparable in scale. Both cities boast over a hundred thousand students (which translates into 8% of the total). Four subsequent voivodeship cities educated approx. 4-5% of the share of the general pool of students. They are: Łódź, Gdańsk, Katowice and Lublin. In 2021, approximately 60,000 students were educated in each of these centres. In this context, two classes of voivodeship capitals can be distinguished on a working basis - those which, in terms of the number and share of students, are at the end of the list of voivodeship cities, and those which, due to the reported indicators, are overtaken by some cities with a lower administrative rank. The former include Białystok, Bydgoszcz, Kielce, Rzeszów, Olsztyn and Opole. There are around 20 thousand people studying there, i.e. approx. a 2% share in the title category. Gorzów Wielkopolski and Zielona Góra have even lower potential in this respect. Both cities fulfilling the role of the capital of the Lubusz Voivodeship, even if included together, currently educate just over 10 thousand people, which is less than 1% of the student cohort. Thus, Bielsko-Biała (6 thousand students, 0.5% share) or Gliwice (17 thousand students, 1.4%

share) turn out to be larger academic centres than Gorzów Wielkopolski and Zielona Góra, included separately.

The results are slightly different when the number of students per every thousand people of the working-age population is taken into account. High results - exceeding 300 students - are recorded in Wrocław, Katowice, Lublin and Rzeszów. On the other hand, Kraków is only slightly below the above-mentioned threshold. The presented data leads to at least partial softening of the absolutely hegemonic position of Warsaw, which was previously drawn based on absolute quantitative data. Thus, Kraków and Wrocław can be described as very attractive academic centres. They attract students so much that this process has a significant impact on the structure of their population. In a similar way, the high position of Lublin and Rzeszów indicates the presence of academic potential, which is not necessarily revealed when referring to absolute numerical data on the size of the cohort of students receiving education. However, the position of higher education centres in Lubusz, Gorzów Wielkopolski and Zielona Góra, remains low. While the last of the mentioned cities with its result at the level of 110 students per one thousand people of the working-age population does not look very favourable compared to other voivodship capitals, the value for Gorzów Wielkopolski - 39 students per one thousand people of the working-age population - can be assessed as very low.

The division of majors offered by the cities allows for the preparation of a specific map of academic specializations. For the purposes of the analysis, some of the disciplines taught were assigned to five qualitative categories (Table 2), which may be particularly important from the point of view of enhancing the innovative and creative potential of the cities. What is meant here are the majors which - on one hand - contribute to the cultivation of hard technological, IT and business skills, not omitting - on the other hand - linguistic and artistic disciplines also very useful for the description and creation of the present.

Interestingly, Gliwice is becoming an academic centre that specializes in IT as well as technology and engineering disciplines. Undeniably, in terms of integers, universities in the largest cities offer more places in the majors considered. In this case, however, what is interesting is the internal structure of the disciplines taught within each city. For Gliwice, there is therefore a clear shift towards information technologies (16.4%) and engineering and technical sciences (64.3%), with a simultaneous low saturation with business (9.9%), linguistic (1.7%) and artistic (0.9%) majors. The high share of these two disciplines is also a characteristic of Bielsko-Biała. Although they do not gather nearly 80% of students of all majors, as is the case in Gliwice - every third student in Bielsko-Biała represents information technology sciences (12%) or engineering and technology sciences (22.8%). The above-average percentage of engineering and technology students is also a characteristic of Gdynia (27.6%), with the difference that the city is also characterized by a high proportion of students of majors that fit into business and administration issues (42.9%). The last of the mentioned clusters of disciplines also achieves high values in Warsaw (26.1%), Toruń (32.3%) and Opole (30.1%). Returning to information technologies, in relative, but also absolute values, Warsaw (9%) and

Wrocław (8.2%) are very important centres of higher education. When it comes to engineering and technology, Kraków is becoming a leader among the largest Polish cities of academic education (21% of shares and over 27,000 students). Katowice turns out to be a city with an above-average high potential for higher education in terms of both linguistic and artistic majors, which may confirm earlier observations available in literature about the concentration of creative capital within Upper Silesia and Zagłębie (Gwosdz, Sobala-Gwosdz, Czakon, 2021). Considered independently, linguistic disciplines turn out to be popular in Poznań (10.6%), while the artistic ones are popular in Łódź (6%).

With the use of the collected and processed data, several conclusions regarding vulnerabilities or weaknesses of academic cities can also be presented. It should be noted that Katowice's relatively strong ties with the linguistic and artistic profile are accompanied by low results regarding the number of students of information technology (5.1%) and engineering and technology (2.7%). This is an additional argument for Metropolis GZM to be considered as one administrative entity, with individual cities filling different areas of specialization. Although this sentence may sound obvious, the collective information indicates a much greater potential of GZM as a whole than the cities analysed separately. In other words, while Warsaw, Kraków and Wrocław are strong centres of higher education, even without taking into account their functional area, Metropolis GZM can only compete with them as a whole.

A similar situation of specialization and complementing the areas of relative weakness also takes place in the Tri-City, where the relatively low share of students of information technology, linguistic and artistic disciplines in Sopot and Gdynia are compensated by their higher percentages in Gdańsk.

When discussing the potential shortcomings of the educational offer of the cities, it is worth paying attention to the relatively weak position of some voivodship capitals in terms of artistic majors. While in the case of the largest academic centres - Warsaw, Kraków, Wrocław, Poznań - their share in the structure of students is 3-4%, for smaller voivodeship capitals - Lublin, Olsztyn, Gorzów Wielkopolski - this ratio is below 1%.

Information on the number of scholarships awarded by the Minister of Education and Science (previously the Minister of Science and Higher Education) for the years 2012-2022 shows the scale of spatial concentration of scientific achievements (Table 3, Table 4). Within the ten cities from the top of the list, there are over 5.3 thousand students from the general pool of 6.4 thousand scholarship holders (which constitutes over 82% of this group). Moreover, the concentration measures for the five strongest cities in the ranking turn out to be high. They concentrate 4.1 thousand of scholarship holders, i.e. 64% of the pool, while Warsaw and Kraków higher education institutions in the period in question can boast about 20% concentration of scholarship holders. In fact, both cities, in terms of the absolute number of scholarship holders, clearly exceed the barrier of one thousand, significantly distancing Poznań, holding third place in the ranking (595 scholarship holders). This information can be further illustrated by a tabular summary of the ten national universities whose students in the

last ten years (2012-2022) were awarded the highest number of ministerial scholarships. The list is opened by the Jagiellonian University in Kraków (834 scholarships, 12.96% share) and the University of Warsaw (759 scholarships, 11.80% share), which received immeasurably more distinctions than the Adam Mickiewicz University in Poznań (267 scholarships, 4.15% share).

Looking again at the summary by city order, four classes of voivodeship capitals can be distinguished on a working basis. Apart from the aforementioned Warsaw and Kraków, i.e. the centres with the unquestionably highest share of scholarship holders, one can also mention voivodeship cities with a high, moderate and low percentage of scholarship holders. The second category includes Poznań (9.25%), Wrocław (8.29%) and Lublin (6.12%). Voivodeship capitals with a moderate share of scholarship holders are Katowice (4.93%), Łódź (3.93%), Toruń (3.58%), Gdańsk (2.86%), Kielce (2.81%), Rzeszów (2.67%) and Białystok (2.21%). Below the threshold of 2% share in the total pool there are cities-voivodeship capitals with the lowest potential in terms of academic achievements of students. These are: Szczecin (1.8%), Olsztyn (1.69%), Bydgoszcz (1.62%), Zielona Góra (0.75%) and Opole (0.75%). A common feature of those voivodeship centres, which obtain less than 1% of the share of scholarship holders, is being overtaken by cities with a lower administrative rank (Gliwice 1.38%; Siedlce 0.99%; Radom 0.95%).

3. Instead of a summary - a proposal for the classification of cities with academic centres

The table below (Table 5) is a proposal for a synthetic summary of all previously presented information. Selected urban centres, due to their potential in the title scope, were assigned to four separate qualitative descriptive categories. The first one was filled by Warsaw, Kraków, Wrocław and Poznań, i.e. urban centres which, by all means, have the greatest academic potential. Not only do they have the largest number of students and higher education institutions, but they also rank high in the ranking of the number of students per 1,000 people of the working-age population, but also receive the highest share of ministerial scholarships. Taking all this into account, the first category was called the absolute advantage zone. The situation of the second subgroup of cities, i.e. the zone of compensatory advantages, is more complex. This list includes Katowice, Łódź, Gdańsk, Lublin, Kielce and Rzeszów. Due to the smaller university base, they cannot directly compete with the above-mentioned leading academic centres. However, they are able to compensate for some of their shortcomings with the help of some component features, relative measures or relations with neighbouring local government units. As it is in the case of Katowice and Gdańsk, whose position within the Municipal Functional Area (or the official metropolitan body) is much higher than in the case

of functioning in the comparisons separately. Compensation for deficiencies in absolute position may also include: a relatively large number of students per 1,000 of the in the working-age population (Lublin), a relatively high share of scholarship holders (Kielce), or signs of specialization in engineering and technology (Rzeszów). It is difficult to unequivocally assess the position of several subsequent voivodship capitals: Białystok, Szczecin, Olsztyn, Bydgoszcz, Toruń and Opole. Obviously, their university base is correspondingly smaller than that of the leading cities. At the same time, however, they do not show any signs of compensation, which means that in most of the measures taken, they do not differ significantly from the average value for all cities with higher education institutions. Due to the lack of any characteristic features, this zone was referred to as question marks. Certain controversies may arise from distinguishing another subcategory of urban centres - outperformers (Gliwice, Gdynia, Bielsko-Biała). As the etymology of the term may indicate (to outperform - achieve better results), this group includes those centres which, in certain dimensions, show greater academic potential than their rank would directly imply. This should be understood as - for example - the number of students exceeding some voivodship cities, signs of specialization in the field of pro-innovative majors, or high examination achievements of students. Although controversial, this category is worth further analysis and observation. As a consequence of separating outperformers, it was also decided to draw up a separate vulnerability zone. It includes two voivodship capitals - Zielona Góra and Gorzów Wielkopolski - which have very low results in virtually all of the measures included. They not only attract a small number of students, but also they are not characterized by significant students' achievements. Therefore, Zielona Góra and Gorzów Wielkopolski definitely constitute a challenge in the context of shaping regional human capital and pro-investment policy.

Table 1.*Universities and colleges, students, majors in 2021*

No.	City	Number of universities	Share of universities (in %)	Number of majors	Share of majors (in %)	Number of students	Share of students (in %)	Students per 1,000 people of the working-age population of the city	Share of part-time students (in% within the city)
1	Warsaw	63	13.02	1002	13.00	227,944	18.52	223.4	39.75
2	Wrocław	28	5.79	510	6.61	105,953	8.61	284.7	35.55
3	Poznań	24	4.96	522	6.77	102,932	8.36	336.3	37.15
4	Kraków	23	4.75	816	10.58	131,304	10.67	287.2	24.81
5	Łódź	18	3.72	440	5.71	66,644	5.41	177.9	36.66
6	Gdańsk	16	3.31	323	4.19	68,215	5.54	252.3	37.23
7	Katowice	14	2.89	265	3.44	52,768	4.29	313.4	28.82
8	Szczecin	12	2.48	303	3.93	31,172	2.53	135.8	30.57
9	Białystok	12	2.48	173	2.24	24,828	2.02	140.4	27.36
10	Lublin	9	1.86	385	4.99	59,634	4.84	303.7	24.57
11	Bydgoszcz	9	1.86	227	2.94	24,702	2.01	124.8	50.85
12	Kielce	9	1.86	135	1.75	18,316	1.49	165.6	36.50
13	Radom	7	1.45	70	0.91	7,694	0.63	63.2	55.91
14	Bielsko-Biała	7	1.45	55	0.71	6,326	0.51	66.0	57.00
15	Rzeszów	6	1.24	184	2.39	35,824	2.91	306.4	33.56
16	Toruń	5	1.03	190	2.46	26,468	2.15	229.5	31.54
17	Olsztyn	5	1.03	143	1.85	17,901	1.45	179.1	24.88
18	Częstochowa	5	1.03	134	1.74	13,184	1.07	106.7	35.95
19	Gdynia	5	1.03	65	0.84	11,249	0.91	80.4	50.69
20	Tarnów	5	1.03	47	0.61	5,146	0.42	82.3	36.13
21	Opole	4	0.83	170	2.20	19,313	1.57	261.8	36.14
22	Łomża	4	0.83	32	0.42	3,017	0.25	80.5	39.24
23	Gorzów Wielkopolski	4	0.83	37	0.48	2,804	0.23	39.8	34.49
24	Sopot	2	0.41	13	0.17	2,538	0.21	131.8	51.93
25	Gliwice	1	0.21	81	1.05	17,057	1.39	167.2	21.32
26	Zielona Góra	1	0.21	99	1.28	9,002	0.73	110.5	34.49
Total value*		484	100	7710	100	1,230,988	100	141.7	36.11

*The data in the table does not add up to 100%, the table is a fragment of a larger data set.

Source: the author's elaboration based on data from the Ministry of Education and Science and the Local Data Bank of Statistics Poland.

Table 2.

Number and percentage of students of majors important from the point of view of pro-innovation policy in 2021

No.	City	Number of students					Share of students					
		Information technology	Engineering and technology	Business and administration	Linguistic	Artistic	Information technology	Engineering and technology	Business and administration	Linguistic	Artistic	Total
1	Warsaw	20,489	29,806	59,422	14,360	8,376	9.0	13.1	26.1	6.3	3.7	100
2	Wrocław	8,739	17,835	26,596	9,464	2,479	8.2	16.8	25.1	8.9	2.3	100
3	Poznań	6,237	11,832	26,882	10,927	2,488	6.1	11.5	26.1	10.6	2.4	100
4	Kraków	8,434	27,510	31,205	10,774	3,152	6.4	21.0	23.8	8.2	2.4	100
5	Łódź	5,035	6,702	14,673	3,391	4,024	7.6	10.1	22.0	5.1	6.0	100
6	Gdańsk	5,520	9,432	16,253	4,904	1,659	8.1	13.8	23.8	7.2	2.4	100
7	Katowice	2,703	1,451	9,763	5,453	3,027	5.1	2.7	18.5	10.3	5.7	100
8	Szczecin	1,942	5,535	7,477	2,095	833	6.2	17.8	24.0	6.7	2.7	100
9	Białystok	1,457	3,940	4,392	1,006	340	5.9	15.9	17.7	4.1	1.4	100
10	Lublin	3,720	8,518	9,506	4,914	494	6.2	14.3	15.9	8.2	0.8	100
11	Bydgoszcz	1,567	3,595	5,339	1,559	927	6.3	14.6	21.6	6.3	3.8	100
12	Kielce	182	3,657	4,120	986	211	1.0	20.0	22.5	5.4	1.2	100
13	Radom	361	1,566	1,223	366	142	4.7	20.4	15.9	4.8	1.8	100
14	Bielsko-Biała	761	1,441	1,015	614	58	12.0	22.8	16.0	9.7	0.9	100
15	Rzeszów	2,270	7,347	7,373	2,608	448	6.3	20.5	20.6	7.3	1.3	100
16	Toruń	762	254	8,559	2,209	565	2.9	1.0	32.3	8.3	2.1	100
17	Olsztyn	979	2,734	2,556	1,211	137	5.5	15.3	14.3	6.8	0.8	100
18	Częstochowa	1,093	2,568	2,833	1,597	314	8.3	19.5	21.5	12.1	2.4	100
19	Gdynia	551	3,110	4,827	207	0	4.9	27.6	42.9	1.8	0.0	100
20	Tarnów	302	279	1,348	460	176	5.9	5.4	26.2	8.9	3.4	100
21	Opole	1,312	2,167	5,814	1,299	143	6.8	11.2	30.1	6.7	0.7	100
22	Łomża	254	192	768	96	0	8.4	6.4	25.5	3.2	0.0	100
23	Gorzów Wielkopolski	170	198	535	257	0	6.1	7.1	19.1	9.2	0.0	100
24	Sopot	0	679	401	0	26	0.0	26.8	15.8	0.0	1.0	100
25	Gliwice	2,799	10,970	1,686	287	160	16.4	64.3	9.9	1.7	0.9	100
26	Zielona Góra	788	1,838	1,817	702	219	8.8	20.4	20.2	7.8	2.4	100
Total value*		85,289	179,415	293,677	87,626	31,996	6.9	14.6	23.9	7.1	2.6	100

*The data in the table does not add up to 100%, the table is a fragment of a larger data set.

Source: the author's elaboration based on data from the Ministry of Education and Science and the Local Data Bank of Statistics Poland.

Table 3.

Scholarship holders of the Minister of Science and Higher Education / Minister of Education and Science in 2012-2021 (data by city)

No.	City	Number of universities with scholarship holders	Number of scholarship holders	Share of scholarship holders
1	Warsaw	32	1,445	22.46
2	Kraków	16	1,194	18.56
3	Poznań	15	595	9.25
4	Wrocław	14	533	8.29
5	Lublin	8	394	6.12
6	Katowice	6	317	4.93
7	Łódź	11	252	3.92
8	Toruń	2	230	3.58
9	Gdańsk	7	184	2.86
10	Kielce	7	181	2.81
11	Rzeszów	5	172	2.67
12	Białystok	5	142	2.21
13	Szczecin	6	116	1.80
14	Olsztyn	2	109	1.69
15	Bydgoszcz	6	104	1.62
16	Gliwice	1	89	1.38
17	Siedlce	1	64	0.99
18	Radom	5	61	0.95
19	Zielona Góra	1	48	0.75
20	Opole	4	48	0.75
21	Częstochowa	2	30	0.47
22	Pułtusk	1	15	0.23
23	Zamość	1	13	0.20
24	Gdynia	2	12	0.19
25	Słupsk	1	10	0.16
26	Koszalin	1	9	0.14
27	Chełm	1	9	0.14
28	Bielsko-Biała	2	6	0.09
Total value		192*	6,433	100

*The data in the table does not add up to 100%, the table is a fragment of a larger data set.

Source: the author's elaboration based on data from the Ministry of Education and Science and the Local Data Bank of Statistics Poland.

Table 4.

Scholarship holders of the Minister of Science and Higher Education / Minister of Education and Science in 2012-2021 (data according to universities - top 10)

No.	Name of University	Number of scholarship holders	Share of scholarship holders (in %)
1	Jagiellonian University in Kraków	834	12.96
2	University of Warsaw	759	11.80
3	Adam Mickiewicz University in Poznań	267	4.15
4	Nicolaus Copernicus University in Toruń	226	3.51
5	Wrocław University of Science and Technology	222	3.45
6	Warsaw University of Technology	211	3.28
7	University of Silesia in Katowice	158	2.46
8	Maria Curie-Skłodowska University in Lublin	156	2.42
9	University of Wrocław	139	2.16
10	Jan Kochanowski University in Kielce	137	2.13
Total value of the top 10 universities		3,109	48.33

The data in the table does not add up to 100%, the table is a fragment of a larger data set.

Source: the author's elaboration based on data from the Ministry of Education and Science and the Local Data Bank of Statistics Poland.

Table 5.
Academic potential - summary (selected cities)

No.	City	List of advantages / weaknesses	Quality category
1	Warsaw	<ul style="list-style-type: none"> + The largest number of universities, students and majors + High share of students of information technology as well as business and administration + The largest number of ministerial scholarship holders + The largest number of projects co-financed by the National Science Centre - Not the highest student share per 1,000 people of the working-age population in the city 	Absolute advantage zone
2	Kraków	<ul style="list-style-type: none"> + The second highest number of majors and students (despite the fact that the university base is half that of Warsaw) + The share of students per 1,000 people of the working-age population of the city is higher than Warsaw + Second best result in the country in terms of the number of ministerial scholarship holders + The Jagiellonian University as an independent university with the largest number of ministerial scholarship holders + High share of engineering and technology students + Second best result in terms of the number of projects co-financed by the National Science Centre 	
3	Poznań	<ul style="list-style-type: none"> + Third largest independent centre in terms of the number of universities, students and majors (fourth in the ranking taking into account urban functional areas) + The highest value of the student share per 1,000 people of the working-age population of the city + Third in terms of the number of ministerial scholarship holders + Third in terms of the number of projects co-financed by the National Science Centre + High share of students of linguistic majors + Third in terms of the number of projects co-financed by the National Science Centre 	
4	Wrocław	<ul style="list-style-type: none"> + Second highest number of universities + Fourth highest number of ministerial scholarship holders + Fourth in terms of the number of projects co-financed by the National Science Centre - There is no clear profiling in terms of majors important from the point of view of pro-innovation policy 	
5	Katowice	<ul style="list-style-type: none"> + High share of students of linguistic and artistic majors + High student share per 1,000 people of the working-age population of the city - One of the lowest shares of engineering and technology students among voivodship capitals - The region's potential is revealed only when Metropolis GZM is taken into account as a whole - Low number of projects co-financed by the National Science Centre 	Compensatory advantage zone
6	Łódź	<ul style="list-style-type: none"> + High share of students of artistic majors + In terms of the number of projects co-financed by the National Science Centre, a slightly better situation than entire Metropolis GZM - Relatively low student share per 1,000 people of the working-age population in the city - Not represented in the list of top 10 universities with the highest number of ministerial scholarship holders in 2012-2022 	

Cont. table 5.

7	Gdańsk	<ul style="list-style-type: none"> + Sixth independent centre in terms of the number of universities, students and majors + As part of the Municipal Functional Area, the fifth centre in terms of the number of projects co-financed by the National Science Centre - No clear profiling in terms of important majors from the point of view of pro-innovation policy <ul style="list-style-type: none"> - Low number of ministerial scholarship holders - Not represented in the list of top 10 universities with the highest number of ministerial scholarship holders in 2012-2022 <ul style="list-style-type: none"> - The region's potential is revealed only if it is considered together, as the Gdańsk-Sopot-Gdynia metropolitan area 	
8	Lublin	<ul style="list-style-type: none"> + High student share per 1,000 people of the working-age population of the city <ul style="list-style-type: none"> + Relatively high number of students as for the university base + Relatively high number of majors offered + High on the list of ministerial scholarship holders - No clear profiling in terms of majors important from the point of view of pro-innovation policy <ul style="list-style-type: none"> - Low percentage of students of artistic majors 	
9	Kielce	<ul style="list-style-type: none"> + Tenth place among the cities with the largest number of ministerial scholarship holders in 2012-2022 + Jan Kochanowski University as a university in the list of top 10 universities with the highest number of ministerial scholarship holders in 2012-2022 - No clear profiling in terms of majors important from the point of view of pro-innovation policy <ul style="list-style-type: none"> - Low percentage of IT students 	
10	Rzeszów	<ul style="list-style-type: none"> + High student share per 1,000 people of the working-age population of the city <ul style="list-style-type: none"> + High share of students of engineering and technology majors - Low number of projects co-financed by the National Science Centre 	
11	Białystok, Szczecin, Olsztyn, Bydgoszcz, Toruń, Opole	<ul style="list-style-type: none"> - Lower potential in terms of the number of universities, students and majors - In general no clear profiling in terms of majors important from the point of view of pro-innovation policy - Student share per 1,000 people of the working-age population of the city at the average level <ul style="list-style-type: none"> - Not the highest number of ministerial scholarship holders 	Question mark zone
12	Gliwice	<ul style="list-style-type: none"> + Relatively high number of students + Relatively high number of ministerial scholarship holders + Clear profiling in terms of information technology as well as engineering and technology majors 	Outperformer zone
13	Gdynia	<ul style="list-style-type: none"> + Relatively high number of students + Clear profiling in terms of engineering and technology as well as business and administration majors 	
14	Bielsko-Biała	<ul style="list-style-type: none"> + Clear profiling in terms of information technology as well as engineering and technology majors 	

Cont. table 5.

15	Zielona Góra, Gorzów Wielkopolski	- Small number of universities, majors and students - Small number of ministerial scholarship holders - Low value of the student share per 1,000 people of the working-age population of the city - Low results in the eighth grade final examinations and secondary school final examinations - The lowest number of projects co-financed by the National Science Centre	Vulnerability zone
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Source: The author's categorization based on the data of the Ministry of Education and Science and the Local Data Bank of Statistics Poland.

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