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Original Article

Sports infrastructure vs. sport development in Poland

IWONA MÜLLER-FRĄCZEK
Faculty of Economic Sciences and Management, Nicolaus Copernicus University in Toruń, POLAND

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Abstract:
The article presents a continuation of the research on sport development in Poland. In previous studies (Müller-Frączek, 2020a, 2020b), we focused on sports participants, now we analyzed the sports infrastructure, since it is necessary to practice many disciplines, and thus is one of the factors that can positively affect the development of sport. In the presented research, we were not interested in the level of infrastructure (e.g. compared to other countries) or its spatial differentiation. We only studied the relation between sports infrastructure resources and the sport development. We asked whether more sport-wise developed regions have better infrastructure. In the study, we used all available data on sports facilities in Poland. These data are collected and provided by the Central Statistical Office. We conducted the survey at the NUTS 2 level for the years 2010, 2014 and 2018. To characterize the sports infrastructure, we used a synthetic approach, i.e. we combined individual indicators related to different types of sports facilities into one composite indicator. Thus, we achieved the indirect aim of the study, we constructed a synthetic measure of sports infrastructure in Poland at the NUTS 2 level. We considered four composite indicators differing in the number of individual indicators and the method of construction. Before we proceeded with the main research, we concluded that the resources of sports infrastructure are not a consequence of the wealth of the region. We found no positive correlation between the synthetic measure of infrastructure and any measure of regional wealth. Such an observation made the planned study more interesting.We also used a synthetic approach to characterize the sport development. For this study, we adapted composite indicators constructed for previous researches. The individual indicators used for the construction concerned people related to sport, i.e. players (including women and juniors), coaches and judges. The conducted analysis showed a positive relationship between each measure of infrastructure and each measure of sport development, i.e. the higher the resources of sports facilities, the higher the average level of sport development. In each year and for each variant considered, the strength of the correlation was at least moderate, but it was never very strong.
Key Words*:* **sports facilities, composite indicator of sports infrastructure, synthetic measure of sport development, determinants of sport development**

Introduction

The article presents a continuation of the research on sport development in Poland. Broadly understood physical education is important for many reasons. Due to the beneficial effects of sport on health and quality of life of the society (compare e.g. Brodáni, Spišiak & Paška, 2015, De Souza, De Carvalho & Ferreira, 2018, Gaetano, 2016, Piotrowska & Pabianek, 2019), the sport development is an important part of the social policy of countries. In Poland, the government publishes sport development strategies and programs that define appropriate monitoring indicators (MST, 2015, 2019). Sport is also important for economic reasons, both the production of sports accessories and the industry related to organizing sporting events are developing. It is not without reason that the largest cities bid to organize the Olympics or the World Cup (Górecka, 2020). For these (and many other) reasons, we are looking for determinants of sport development. So far (Müller-Frączek, 2020a, 2020b) we have analyzed the wealth of society from this point of view. In this study, however, we focused on sports infrastructure (compare Nugroho, Suherman & Nanda, 2020). This type of research has not yet been conducted in Poland.

As most sports disciplines require special sports facilities, therefore the development of infrastructure should positively affect the development of sport. We ask how strong this affect is. The answer to this question is especially important for decision-makers responsible for sport development. In Poland, they focus primarily on investing in sport infrastructure. But if the relationship between the development of infrastructure and the development of sport is not strong, it may turn out that their actions do not bring the expected results.

To characterize the sports infrastructure in the region, we used a synthetic approach, i.e. we combined all available information on sports facilities into one composite indicator. Thus, we achieved the indirect aim of the study, i.e. we constructed composite indicators of sports infrastructure in Poland at the NUTS 2 level. We compared these composites with synthetic measures of sports development in regions adapted from previous studies (Müller-Frączek, 2020a, 2020b). In Poland, the synthetic approach in sports analyzes is not popular.

Corresponding Author: IWONA MÜLLER-FRĄCZEK, E-mail: muller@econ.umk.pl

Previously, researchers from the Central Statistical Office (CSO, 2019a, 2019b)) constructed a composite indicator of sport development and a kind of synthetic measure of sport infrastructure, but they used different methods and variables.

Material & methods

We used data on sports facilities (excluding school facilities) collected and provided by the Central Statistical Office (CSO, 2011, 2015, 2019). Every four years, owners, local governments and sports clubs report the facilities they own or operate. In the study, we used all available information for 2010, 2014 and 2018. The data is shared at the NUTS 5 level, but for the purposes of the study we aggregated them to the NUTS 2 level, because at the lower aggregation level, many indicators equalled zero. In table 1 we have listed all types of the considered sport facilities.

Table 1. Sports facilities

No.	Description	No.	Description	No.	Description
1	Stadiums	6	Sport fields for handball	11	Indoor tennis courts
2	Sport halls	7	Sport fields for volleyball	12	Outdoor tennis courts
3	Gyms	8	Universal sport fields	13	Skateparks
4	Sport fields for football	9	Indoor swimming pools	14	Shooting ranges
5	Sport fields for basketball	10	Artificial skating rinks	15	Ski jumps

We have listed the ski jumps last as there were only 21 in 2018, moreover all such facilities were located in 4 regions (out of 16 NUTS 2 regions in Poland). Taking into account such a specific variable could distort the results, so we conducted two versions of the study: with and without the ski jumps. The number of the remaining 14 types of facilities was varied, ranging from less than 200 handball fields in 2010 to over 7,000 football fields in 2018. In general, in the analyzed period, there was an increase in the number of all types of facilities, except for volleyball fields; however, for only 8 of the 15 types, there was an increase in each region.

Before the actual analysis, we solved two issues that would trivialize the research problem posed in the article. First of all, we examined whether the sports infrastructure resources in the region are not a simple consequence of the size of the population. To resolve this issue, we determined the correlations of the number of facilities (of all types in each year of the study) with the number of people. The correlations were always positive, but at very different levels, ranging from 0.34 to 0.98. Moreover, there was no visible trend over time, for some type of facilities the correlation increased, for some it decreased, and for the others, the highest correlation was observed for the middle period of the study. Thus, it seems that the relationship between the number of sports facilities and the population is not obvious.

The second issue to be resolved before starting the actual study concerned the relationship between the resources of sports infrastructure and the wealth of the region. We compared the number of facilities with the revenues of the local budgets, because according to the Act of June 25, 2010, local governments have the obligation to create conditions for the development of sport. We analyzed the budgets of NUTS 2 regions and the budgets of NUTS 4 and NUTS 5 regions aggregated to NUTS 2. The correlation of the number of facilities with any of the analyzed types of income was not strong, for any type of facility or for any year of analysis, there were correlations both positive and negative. In conclusion, we did not find a clear relationship between the number of facilities and the wealth of regions.

For the purpose of proper analysis, we determined the indicators of sports infrastructure, i.e. the number of sports facilities in relation to the number of people. The basic characteristics of these indicators are presented in Table 2. As for the number of sport facilities, there was an increase in all indicators, except for volleyball fields per capita.

Table 2. Basic characteristics of sports infrastructure indicators

No.	Minimum			Maximum			Coefficient of variation			Poland		
	2010	2014	2018	2010	2014	2018	2010	2014	2018	2010	2014	2018
1	0.319	0.343	0.324	1.443	1.653	1.442	0.442	0.451	0.381	0.581	0.620	0.616
2	0.125	0.158	0.135	0.315	0.348	0.446	0.250	0.211	0.300	0.211	0.248	0.278
3	0.125	0.166	0.177	0.470	0.474	0.385	0.305	0.236	0.192	0.277	0.288	0.310
4	0.469	0.626	0.799	3.136	4.116	3.953	0.522	0.466	0.416	1.410	1.701	1.868
5	0.049	0.107	0.105	0.174	0.351	0.535	0.344	0.344	0.434	0.110	0.194	0.244
6	0.012	0.024	0.024	0.070	0.100	0.117	0.401	0.415	0.462	0.042	0.049	0.062
7	0.108	0.071	0.086	0.423	0.361	0.412	0.374	0.419	0.386	0.203	0.170	0.197
8	0.287	0.435	0.579	0.928	0.976	1.176	0.357	0.247	0.229	0.569	0.703	0.877
9	0.060	0.088	0.099	0.164	0.222	0.209	0.288	0.274	0.254	0.112	0.135	0.151
10	0.013	0.023	0.033	0.065	0.090	0.126	0.380	0.328	0.382	0.043	0.065	0.078
11	0.000	0.008	0.008	0.090	0.117	0.201	0.783	0.596	0.514	0.042	0.064	0.100
12	0.183	0.301	0.250	0.508	0.641	0.687	0.299	0.237	0.274	0.335	0.334	0.311
13	0.031	0.074	0.080	0.075	0.169	0.217	0.221	0.252	0.283	0.056	0.109	0.139
14	0.017	0.017	0.024	0.117	0.164	0.195	0.640	0.697	0.589	0.046	0.056	0.071
15	0.000	0.000	0.000	0.015	0.017	0.021	1.572	1.829	1.874	0.004	0.005	0.005

At the beginning, we determined regions rankings for all indicators of sports infrastructure. Table 3 presents such rankings for the middle year of the analysis. You can see that these rankings differ significantly, therefore it makes no sense to analyze the relationship between the development of sport and each of the indicators separately, because for different indicators we could get different conclusions. In addition, we are interested in the entirety of sports infrastructure, not its individual components. For these reasons, we used a synthetic approach in the study.

Table 3. Rankings of NUTS 2 regions according to sports infrastructure indicators in 2014

NUTS 2 region	Sport infrastructure indicators														
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Dolnośląskie	2	3	15	2	1	8	11	14	10	9	6	6	7	9	4
Kujawsko-pomorskie	11	6	8	7	8	11	6	10	3	8	7	9	9	12	5
Lubelskie	12	8	4	3	14	14	16	16	5	13	8	16	16	8	5
Lubuskie	4	10	3	14	10	5	2	12	11	12	2	10	5	4	5
Łódzkie	10	13	16	13	12	10	12	11	7	14	14	8	4	11	5
Małopolskie	7	14	9	11	9	7	14	3	8	5	9	4	12	5	2
Mazowieckie	16	15	14	16	16	13	10	4	12	3	11	2	11	16	5
Opolskie	1	4	1	4	4	2	5	5	2	6	3	5	3	2	5
Podkarpackie	5	5	2	6	3	4	15	2	1	1	5	7	8	1	3
Podlaskie	15	9	7	12	13	15	7	7	15	15	16	13	15	15	5
Pomorskie	8	2	6	9	7	9	9	15	13	7	13	12	13	13	5
Śląskie	13	16	13	15	15	12	8	8	9	11	15	3	14	14	1
Świętokrzyskie	14	12	11	5	11	16	13	1	16	16	12	15	10	10	5
Warmińsko-mazurskie	9	11	10	8	6	6	4	6	6	10	10	1	6	6	5
Wielkopolskie	6	1	5	10	2	3	3	13	4	2	1	11	1	7	5
Zachodniopomorskie	3	7	12	1	5	1	1	9	14	4	4	14	2	3	5

Synthetic variables combine several individual indicators into one composite indicator, e.g. to order the regions linearly. Composite indicators are widely used in a variety of social issues due to their easy interpretation (Bandura, 2011). However, building a good synthetic variable is not a simple task (compare Saltelli, 2007). Basic methods can be found e.g. in Casadio Tarabusi & Guarini (2013) or Saisana & Saltelli (2011).

For the purposes of this study, we constructed four types of composite indicators. Since we decided that the sports infrastructure in the region is determined by the number and not the type of facilities, we chose the arithmetic mean for the aggregation of individual indicators, i.e. we constructed so-called compensatory composite indicators. However, we normalized the indicators in two ways. We used standardization and scaling (or min-max normalization), i.e. methods that we previously used to create synthetic measures of sport development. Moreover, we used two sets of individual indicators, the first one contained all objects, in the second we omitted the ski jumps.

We also used data collected by the Central Statistical Office to characterize the level of sport development. These data concerned participants in institutionalized sport. We used a synthetic approach again. We have adapted previous research (Müller-Frączek, 2020a, 2020b). We used two methods that differed in the set of individual indicators and the construction method. Since we decided that all the considered aspects of sport development should be sustainable (Escher, 2020), unlike for the infrastructure, we constructed the so-called non-compensatory composite indicators.

In the first method, modelled on the paper by Müller-Frączek (2020a), we used ten individual indicators (Table 4) that represented four dimensions of sport. We aggregated the indicators using the arithmetic mean inside the dimensions and using the geometric mean between the dimensions. We have changed the normalization method compared to the mentioned paper. Instead of anti-pattern normalization (Müller-Frączek, 2019), which was originally used to construct a cyclical measure, we used scaling because the current study was supposed to be static. Unfortunately, due to the lack of data, we were unable to construct a composite indicator for 2010 with this method.

Table 4. Indicators of sport development (version1)

Dimension	Description of individual indicator
Participants	Persons practising sports in sports clubs per 100 inhabitants
	Competitors registered in Polish sports associations per 100 inhabitants
Staff	Sports judges per 1000 inhabitants
	Sports judges with international class per 100 sports judges
	Members of coaching staff in sports clubs per 1000 inhabitants
Women	Females practising sports in sports clubs per 1000 population
	Females practising sports in sports clubs per 10 persons practising sports in sports clubs
	Female competitors registered in Polish sports associations per 10 competitors
Young	Youth aged up to 18 practising sports in sports clubs per 10 persons aged up to 18
	Juniors (no seniors) per 100 inhabitants

The second method was modelled on the article by Müller-Frączek (2020b). We used only four sport development indicators (Table 5), the values of which were available for all years of the analysis. These

individual indicators were standardized and then aggregated using the Mazziotta-Pareto method (De Muro, Mazziotta & Pareto, 2011, Mazziotta & Pareto, 2015, 2016, 2018). Compared to the quoted article, we changed the level of aggregation because the results there concerned NUTS 4 regions.

Table 5. Indicators of sport development (version 2)

Dimension	Description of individual indicator
Participants	Persons practising sports in sports clubs per 100 inhabitants
Staff	Members of coaching staff in sports clubs per 100 persons practising sports in sports clubs
Women	Females practising sports in sports clubs per 1000 inhabitants
Young	Youth aged up to 18 practising sports in sports clubs per 100 inhabitants

Results

Tables 6 and 7 present composite indicators of sports infrastructure (values and ranks). The first one presents composites based on all individual indicators, the second one omits ski jumps.

Table 6 Composite indicators of sports infrastructure (all types of sports facilities)

NUTS 2 region	Standardization						Scaling					
	2010		2014		2018		2010		2014		2018	
Dolnośląskie	0.53	4	0.25	5	0.60	3	0.58	4	0.48	5	0.59	3
Kujawsko-pomorskie	-0.21	11	-0.05	9	-0.31	11	0.36	11	0.38	9	0.33	11
Lubelskie	-0.64	14	-0.63	15	-0.72	15	0.23	14	0.21	15	0.20	15
Lubuskie	0.04	9	0.18	6	0.12	8	0.44	9	0.45	6	0.45	9
Łódzkie	-0.61	13	-0.57	12	-0.60	12	0.25	13	0.24	13	0.25	12
Małopolskie	0.14	7	0.11	7	0.10	9	0.47	7	0.44	7	0.46	8
Mazowieckie	-0.30	12	-0.58	13	-0.69	14	0.34	12	0.24	12	0.22	14
Opolskie	0.36	5	0.96	2	0.69	2	0.53	5	0.67	2	0.63	2
Podkarpackie	1.02	1	1.03	1	0.53	5	0.71	1	0.69	1	0.57	4
Podlaskie	-0.81	15	-0.80	16	-0.85	16	0.19	15	0.17	16	0.19	16
Pomorskie	0.18	6	-0.16	10	0.32	6	0.48	6	0.36	10	0.51	6
Śląskie	-0.20	10	-0.48	11	-0.24	10	0.37	10	0.27	11	0.37	10
Świętokrzyskie	-0.94	16	-0.59	14	-0.68	13	0.15	16	0.23	14	0.24	13
Warmińsko-mazurskie	0.04	8	0.06	8	0.22	7	0.44	8	0.42	8	0.49	7
Wielkopolskie	0.79	2	0.73	3	0.97	1	0.66	2	0.61	3	0.68	1
Zachodniopomorskie	0.60	3	0.53	4	0.54	4	0.59	3	0.55	4	0.56	5

Table 7. Composite indicators of sports infrastructure (without ski jumps)

NUTS 2 region	Standardization						Scaling					
	2010		2014		2018		2010		2014		2018	
Dolnośląskie	0.52	4	0.23	6	0.62	4	0.59	4	0.49	6	0.61	3
Kujawsko-pomorskie	-0.18	10	-0.02	8	-0.29	10	0.39	10	0.41	9	0.35	10
Lubelskie	-0.64	14	-0.63	14	-0.74	15	0.24	14	0.22	15	0.21	15
Lubuskie	0.09	8	0.23	5	0.16	8	0.47	8	0.49	5	0.48	8
Łódzkie	-0.61	13	-0.57	11	-0.61	12	0.26	13	0.25	12	0.26	12
Małopolskie	-0.01	9	-0.02	9	-0.06	9	0.43	9	0.41	8	0.43	9
Mazowieckie	-0.30	11	-0.58	12	-0.70	14	0.36	11	0.25	11	0.24	14
Opolskie	0.43	5	1.07	1	0.78	2	0.57	5	0.71	1	0.67	2
Podkarpackie	0.94	1	0.98	2	0.46	5	0.70	2	0.68	2	0.56	5
Podlaskie	-0.82	15	-0.82	16	-0.87	16	0.20	15	0.18	16	0.20	16
Pomorskie	0.18	6	-0.14	10	0.38	6	0.50	6	0.39	10	0.55	6
Śląskie	-0.32	12	-0.68	15	-0.42	11	0.35	12	0.22	14	0.33	11
Świętokrzyskie	-0.96	16	-0.59	13	-0.69	13	0.16	16	0.25	13	0.25	13
Warmińsko-mazurskie	0.09	7	0.10	7	0.27	7	0.47	7	0.45	7	0.52	7
Wielkopolskie	0.90	2	0.83	3	1.08	1	0.71	1	0.65	3	0.73	1
Zachodniopomorskie	0.69	3	0.61	4	0.62	3	0.63	3	0.59	4	0.61	4

The synthetic results in all variants were very similar. It can be said that the normalization method did not matter, both the linear and rank correlations for the indicators that differed in normalization were close to 1 in each year of the study. Interestingly, the inclusion of ski jumps in the study only slightly changed the situation of the regions. Composite indicators compared in pairs (the same normalization but different number of individual indicators) were very similar, linear correlations in each year of the analysis exceeded 0.99, while rank correlations exceeded 0.95.

We compared the obtained synthetic infrastructure indicators with the wealth of the regions. We considered four measures of this wealth, i.e. local budgets revenues (all per capita):

1. NUTS 2 regions,
2. NUTS 4 regions aggregated to NUTS 2,
3. NUTS 5 regions aggregated to NUTS 2,
4. sum of the above.

Table 8 presents the corresponding linear (marked with r) and rank (marked as ρ) correlations.

Table 8. Correlation of synthetic measures of sports infrastructure with local revenues

Local revenue per capita		All types of sports facilities						Sports facilities without ski jumps					
		Standardization			Scaling			Standardization			Scaling		
		2010	2014	2018	2010	2014	2018	2010	2014	2018	2010	2014	2018
NUTS 2	r	0.11	0.03	-0.08	0.10	0.01	-0.07	0.15	0.05	-0.06	0.14	0.04	-0.05
	ρ	0.06	-0.08	-0.04	0.06	-0.06	-0.05	0.16	0.00	-0.02	0.14	-0.02	-0.04
Aggregated	r	0.14	0.10	0.29	0.16	0.12	0.28	0.17	0.12	0.32	0.19	0.14	0.32
NUTS 4	ρ	0.21	0.19	0.36	0.21	0.20	0.30	0.23	0.16	0.35	0.25	0.20	0.34
Aggregated	r	-0.08	-0.45	-0.17	-0.07	-0.43	-0.18	-0.12	-0.45	-0.17	-0.11	-0.43	-0.18
NUTS 5	ρ	-0.06	-0.38	-0.06	-0.06	-0.36	-0.07	-0.11	-0.47	-0.07	-0.13	-0.43	-0.06
Sum of local	r	-0.05	-0.40	-0.17	-0.04	-0.39	-0.18	-0.06	-0.39	-0.15	-0.05	-0.37	-0.15
revenues	ρ	0.06	-0.40	-0.03	0.06	-0.36	-0.05	0.10	-0.41	-0.02	0.08	-0.38	-0.02

The research did not confirm the supposition that the infrastructure is a consequence of the wealth of the regions. The results were varied, but there was never a significant positive correlation. The positive correlations were weak or very weak. While negative correlations were the stronger, but they were of moderate strength at most.

We began the main research by calculating synthetic measures of sport development in the two versions described in the previous section. Table 9 shows their values and the positions of the regions.

Table 9. Synthetic measures of sport development

NUTS 2 region	10 individual indicators				4 individual indicators					
	2014		2018		2010		2014		2018	
Dolnośląskie	0.504	6	0.572	4	93.08	13	97.63	11	99.33	10
Kujawsko-pomorskie	0.508	5	0.537	6	98.30	9	104.99	3	104.70	3
Lubelskie	0.377	11	0.350	15	101.03	7	98.90	10	94.75	13
Lubuskie	0.546	3	0.631	3	100.65	8	101.14	7	104.67	4
Łódzkie	0.329	14	0.364	14	91.08	16	93.68	14	92.87	15
Małopolskie	0.571	2	0.690	2	102.92	6	104.13	4	103.96	5
Mazowieckie	0.357	12	0.478	10	94.14	12	94.36	13	94.67	14
Opolskie	0.410	9	0.512	9	94.70	11	100.25	8	102.22	7
Podkarpackie	0.715	1	0.692	1	114.40	1	114.29	1	112.81	1
Podlaskie	0.354	13	0.366	13	109.03	2	105.28	2	103.79	6
Pomorskie	0.309	15	0.448	11	94.73	10	90.62	15	95.07	12
Śląskie	0.421	8	0.563	5	92.77	15	96.24	12	101.93	8
Świętokrzyskie	0.148	16	0.072	16	92.79	14	84.26	16	78.01	16
Warmińsko-mazurskie	0.404	10	0.396	12	103.58	5	100.24	9	97.94	11
Wielkopolskie	0.446	7	0.524	8	104.48	3	103.14	5	105.12	2
Zachodniopomorskie	0.529	4	0.531	7	104.15	4	102.81	6	101.17	9

In the next step, we compared composite indicators of sports infrastructure (Tables 6 and 7) and synthetic measures of sport development (Table 9). The values of the linear and rank correlation coefficients are included in Table 10.

Table10. Correlation of sport development with resources of sports infrastructure

Measure of sport development		All types of sports facilities						Sports facilities without ski jumps					
		Standardization			Scaling			Standardization			Scaling		
		2010	2014	2018	2010	2014	2018	2010	2014	2018	2010	2014	2018
10 indicators	r		0.67	0.57		0.66	0.54		0.62	0.51		0.61	0.50
	ρ		0.72	0.51		0.73	0.53		0.61	0.49		0.64	0.50
4 indicators	r	0.39	0.56	0.50	0.37	0.56	0.49	0.38	0.53	0.46	0.36	0.52	0.45
	ρ	0.40	0.44	0.43	0.40	0.44	0.45	0.43	0.40	0.44	0.42	0.40	0.44

In all analyzed variants, the correlation was significant, always positive, most often of moderate strength. The strongest correlation in all variants occurred in 2014.

Discussion

In aging societies, physical activity becomes an increasingly significant aspect of life, therefore stimulating the development of sport is an important task of social policy. In Poland, the government's actions in this area focus mainly on expanding sports infrastructure. Hence the question of how strongly the material base stimulates the development of sport.

In this article, we have tried to answer this question at least partially. Our research was largely general, i.e. the data covered the entire territory of Poland, and we also combined various aspects of sports development and many types of sports facilities. For this reason, we have used a synthetic approach to both characterize the development of sport and the development of infrastructure. In order to assess the strength of the relationship between phenomena, we analyzed the correlation between the composite indicators of sport development and the composite indicators of the development of sports infrastructure in different years.

A synthetic approach to characterizing the development of sport in Poland is not popular. Except the

author's research (Müller-Frączek, 2020a, 2020b), it was also used in the study by the Central Statistical Office (CSO, 2019a). Interestingly, the authors of the study combined into one composite indicator both variables related to participation in sport and sports infrastructure. The researchers of the Central Statistical Office also used a synthetic approach to characterize sports infrastructure (CSO, 2019b), but this study only concerned fitness facilities, i.e. fitness clubs and gyms.

Although the research presented in this article showed a positive correlation between the development of sport and the development of sports infrastructure, it was weaker than expected, generally of moderate strength. For policymakers, this may mean that in order to develop sport, they should also use tools other than investments in infrastructure. Interestingly, we found the strongest relationship between sports infrastructure and the development of sport for 2014, i.e. the year in which there was the strongest negative correlation between sports infrastructure and local budgets revenues. We cannot explain this observation.

It seems that the method of normalization of individual indicators did not affect the obtained results, but perhaps the results would differ slightly if we used a different method of aggregation. However, in our opinion, the use of the arithmetic mean was the most justified because the type of sport facility was not important in our research. We were not concerned about the sustainable development of various disciplines. We decided that other disciplines may be popular in different regions, due to e.g. tradition, successes in sports of local teams or players, geographic conditions, etc. Therefore, the arithmetic mean in which deficiencies in ski jumps can be compensated for e.g. by a larger number of tennis courts, seemed appropriate.

Interestingly, the inclusion in the study of such a specific variable as the mentioned ski jumps did not make much difference. On the other hand, the results could have been influenced by the fact that among the sport facilities there were some that are available to both professionals and amateurs, while the sports development indicators concerned only institutional sports (information came from sports clubs). Unfortunately, we did not have data on amateur sport.

It is clear that without an adequate material base, sport can develop only to a limited extent. However, a question arises whether by stimulating the development of sports infrastructure it is possible to stimulate the development of sport. The study did not resolve this issue. We will conduct further research in this direction. Particularly interesting would be studies on a less general level, for example on a small area with data concerning individual objects.

Conclusions

In this article, we analyzed the spatial differentiation of sports infrastructure in Poland, not however to compare regions in this respect, but to compare the resources of sports infrastructure with the level of sports development in the region. We conducted the survey at the NUTS2 level for the years 2010, 2014 and 2018.

To characterize the infrastructure, we used a synthetic approach, i.e. we combined individual indicators related to different types of sports facilities into one composite indicator. We considered four composites that differ in the number of individual indicators and the method of construction.

Before we proceeded with the actual research, we disproved the hypothesis that infrastructure resources are a consequence of the region's wealth.

We also used a synthetic approach to characterize the development of sport. For the purposes of this study, we adapted previous methods. We have modified two composite indicators for the development of sport in Poland described in the articles by Müller-Frączek (2020a, 2020b).

The conducted analysis showed a positive relationship between each measure of sports infrastructure and each measure of sports development, i.e. the higher the resources of sports facilities, the higher the average level of sports development in the region. In each analyzed year and for each of the considered variants, the strength of the correlation was at least moderate, but it was never very strong.

In conclusion, we found a positive (statistical) relationship between the development of sport in the region and the resources of the sports infrastructure. However, the question of whether the increase in the number of sports facilities will increase the level of sport development requires further research.

Conflicts of interest - The author declares that there is no conflict of interest.

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