

## Article

# Indicators of Geographic Potential and Business Opportunities for the Development of Active Tourism: Kayaking in Poland

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**Abstract:** Poland's natural and geographical features, including an abundance of rivers and lakes, create favorable conditions for the development of kayaking tourism. Poland is one of the leading European countries in terms of the number of kayaking trails. The aim of this study was to propose indicators for assessing the potential of Poland's water resources for the development of kayaking activities. This research was pursued in several stages. The number of rivers where kayaking tours are organized was determined in the first stage of the study. Indicators describing the potential of the existing water bodies for the promotion of kayaking tourism were proposed in the second stage. The study produced surprising results. The number of kayaking tour operators has increased considerably in recent years, and new water tourism centers have been established in the vicinity of large urban areas. The popularity of well-established kayaking destinations in Warmia-Masuria, Podlasie and Western Pomerania, i.e., Polish regions with considerable potential for the development of water tourism, has declined. The study revealed that the success of kayaking businesses is presently determined by other factors, and further research is needed to identify these determinants.

**Keywords:** geographic potential; active tourism; kayaking tourism; business opportunities



**Citation:** Lewandowicz, E. Indicators of Geographic Potential and Business Opportunities for the Development of Active Tourism: Kayaking in Poland. *Sustainability* **2022**, *14*, 10872. <https://doi.org/10.3390/su141710872>

Academic Editors: Kayhan Tajeddini and Thorsten Merkle

Received: 6 July 2022

Accepted: 22 August 2022

Published: 31 August 2022

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## 1. Introduction

Recent years have witnessed an upsurge of interest in outdoor tourism, creating numerous opportunities for active recreation in nature [1]. Outdoor tourism is divided into several interlinked categories, including outdoor recreation, nature-based tourism, ecotourism, outdoor tourism and adventure tourism. Considerable research is being done in adventure tourism, which involves the participation in challenging outdoor activities. Adventure tourism enables participants to directly experience nature and perform various sporting activities such as mountain climbing, sea kayaking, ski touring and mountain biking. These activities are characterized by different levels of difficulty [2], distinguishing between hard and soft tourism activities. According to [3], soft adventure tourism is more popular, whereas hard tourism involves mainly individuals who form informal groups in pursuit of challenging leisure options. At present, adventure tourism is one of the most rapidly growing subsectors of the tourist industry [4]. The growing demand for outdoor tourism has contributed to the rapid development of entrepreneurship in the tourist industry. Outdoor recreation services are being increasingly commercialized [1,5]. The rising popularity of tourist activities in the natural environment has attracted the interest of researchers [1]. The relationship between natural resources and recreation has to be carefully examined, and changes in these synergistic interactions need to be monitored. New strategies are needed to preserve the existing resources and minimize the potentially destructive influence of tourist operations on the natural environment [6,7]. Such research can contribute to sustainable development that promotes the economic growth of regions while exerting only a minor impact on the geographical environment [8,9].

The popularity of water tourism and aquatic sports is on the rise around the world [10–13]. In Poland, the number of businesses organizing kayaking tours for active recreation seekers,

seniors and weekend tourists has increased in recent years. Poland has highly favorable environmental conditions for the development of active water tourism, and it is one of the leading European countries in terms of the number of kayaking trails [14,15]. Navigable rivers spanning a total length of 11,000 km and 9300 lakes, with an area greater than 1 ha, create ample opportunities for kayaking trips [13].

The abundance of rivers and lakes has encouraged many Polish businesses to organize active tourism attractions. This is evidenced by a high number of organizations affiliated with the Polish Tourist and Sightseeing Society that are registered in the National Court Register, as well as a growing number of kayaking tour operators. The number of self-employed organizers of recreational and tourist activities is also on the rise [7]. These entrepreneurs are registered in the Central Register and Information on Economic Activity (CEIDG), and they are assigned a Polish Classification of Activities (PKD) code which denotes the type of business activities conducted. PKD code 7721Z represents providers of active tourism services, involving the rental and charter of recreational and sports equipment such as kayaks, sailboats, bicycles and skis.

The number of tourist activities decreased significantly during the COVID-19 pandemic [16]. However, outdoor activities involve limited social contact and reduce the risk of virus transmission, which is why the restrictions relating to COVID-19 were first relaxed in the outdoor tourism sector. The tourist industry was transformed during the pandemic, and local tourist activities were chosen more frequently than global international travel [16].

The first aim of this study was to determine the number of Polish rivers where kayaking tours are organized. The main research objective was to calculate indicators of geographic potential (GPI) and business opportunities (BOI). They can be used to assess the potential of Polish rivers for active tourism promotion, and to calculate the indicators of water resource utilization (IWRU), and investment indicators (II) in Polish administrative units, “voivodeships”. The proposed indicators were compared to generate new information about kayaking services in Poland.

The study has two research objectives, which are reflected in the structure of the paper. The sources of data and methodology are described in Section 2, an attempt to determine the number of Polish rivers where kayaking tours are organized was made in Section 3, the GPI and BOI were calculated in Section 4, the results were discussed in Section 5, and the conclusions were formulated in Section 6.

## 2. Data and Methods

Data related to the use of water resources as kayaking trails are not available. In order to determine the number of Polish rivers where kayaking tours are organized, the following resources were analyzed:

1. Kayaking travel guides available on the Polish market;
2. Kayaking websites supported by the Kayaking Tourism Committee of the Polish Tourist and Sightseeing Society (PTTK), Tourism and Recreation Committee of the Polish Canoe Federation (PZK) and the Association of Canoeing Instructors and Trainers (SIiTK);
3. Reports on kayaking activities organized by PTTK, PZK and SIiTK as part of their statutory operations;
4. Websites of kayaking rentals and kayaking tour organizers;
5. Photographs and video footage posted online by kayaking tour participants.

The results of the analysis were used to create a database of rivers in Polish voivodeships where kayaking tours are organized. The data presented in Table 1 and the developed database of rivers were used to assess the potential of Polish voivodeships for the development of kayaking tourism.

**Table 1.** Potential of Polish voivodeships for the development of water (kayaking) tourism and the number of active tourism operators registered in the Central Register and Information on Economic Activity (CEIDG).

Voivodeship	Voivodeship Area [km <sup>2</sup> ]	Forest Area [km <sup>2</sup> ]	Area of Standing Water Bodies [km <sup>2</sup> ]	Length of Rivers [km]	Number of Rivers	Number of Businesses Registered in CEIDG
Lower Silesia	19,936	5549	156	2970	109	4038
Kuyavia-Pomerania	17,948	4174	474	3084	85	2090
Lublin	25,134	5634	362	2935	93	1109
Lubusz	13,990	7029	252	2475	97	1629
Łódź	18,194	3833	98	2168	66	2122
Małopolska	15,166	4313	305	2216	85	4456
Masovia	35,529	7903	401	4094	145	9974
Opole	9400	2496	182	1283	60	938
Podkarpacie	17,844	6642	280	2656	107	2052
Podlasie	20,193	6040	244	2394	89	1579
Pomerania	18,305	6645	872	3566	127	5071
Silesia	12,317	4034	157	1684	59	6070
Świętokrzyskie	11,697	3224	235	1466	52	1110
Warmia-Masuria	24,151	7251	1088	4831	140	3101
Wielkopolska	29,797	7642	402	4858	143	4531
West Pomerania	22,896	8217	751	3867	145	3519

The geographic potential of Polish voivodeships [17] was described based on the Database of Topographic Objects (BDOT), and the number of tourist operators was determined by analyzing CEIDG data (Table 1).

Entrepreneurship levels on the outdoor tourism market can be determined based on the geographic potential of Polish voivodeships and the number of companies offering outdoor tourism services. Various tourist function indicators have been proposed in the literature, including Baretje–Defert’s tourist function index, Charvat’s index and Schneider’s index [18,19]. These indices are expressed in terms of reference unit area or population. It can be assumed that tourist function indices on the outdoor tourism market would be most highly correlated with geographic potential and natural resources.

In the present study, the indicators were calculated using two methods. In the first method, the values presented in Table 1 were converted to the area of the reference unit (the voivodeship). The second method involved the conversion of these values per unit length of watercourses in voivodeships, based on the assumption that the length of watercourses determines the development of water tourism.

The following indicators were calculated in the first approach:

- The geographic potential indicator (GPI) in Polish voivodeships (1)–(15);
- The business opportunity indicator (BOI) in Polish voivodeships (1)–(18);
- The indicator of water resource utilization (IWRU) for kayaking in Polish voivodeships (19)–(20).

The proposed indicators were calculated based on normalized data, in subsets describing the parameters of each indicator in voivodeships. For example, the GPI was calculated based on: forest area—GPI\_forest (1)–(3); area of standing water bodies—GPI\_water (4)–(6); length of watercourses—GPI\_river\_length\_ (7)–(9); and the number of watercourses—GPI\_number of rivers (10)–(12). The GPI was calculated using Equations (13)–(15).

$$GPI_{forest}^* = \left\{ \left( \frac{Forest_{area}^1}{Voivodeship\_area\_1} \right)^1, \left( \frac{Forest_{area}^2}{Voivodeship\_area\_2} \right)^2, \dots, \left( \frac{Forest_{area}^i}{Voivodeship\_area\_i} \right)^i \right\} \quad (1)$$

where  $i = 1, 2, 3, \dots, 17$

$$GPI_{forest} = \left\{ \left( \frac{GPI_{forest}^1}{GPI_{forest}^{max}} \right)^1, \left( \frac{GPI_{forest}^3}{GPI_{forest}^{max}} \right)^2, \dots, \left( \frac{GPI_{forest}^i}{GPI_{forest}^{max}} \right)^i \right\} \quad (2)$$

where  $GPI_{forest}^{max} \geq GPI_{forest}^i$

$$GPI_{forest} = \{ GPI_{forest}^1, GPI_{forest}^2, \dots, GPI_{forest}^i \} \quad (3)$$

$$GP_{water}^* = \left\{ \left( \frac{Water_{area}^1}{Voivodeship\_area\_1} \right)^1, \left( \frac{Water_{area}^2}{Voivodeship\_area\_2} \right)^2, \dots, \left( \frac{Water_{area}^i}{Voivodeship\_area\_i} \right)^i \right\} \quad (4)$$

$$GPI_{water} = \left\{ \left( \frac{GPI_{water}^1}{GPI_{water}^{max}} \right)^1, \left( \frac{GPI_{water}^3}{GPI_{water}^{max}} \right)^2, \dots, \left( \frac{GPI_{water}^i}{GPI_{water}^{max}} \right)^i \right\} \quad (5)$$

where  $GPI_{water}^{max} \geq GPI_{water}^i$

$$GPI_{water} = \{ GPI_{water}^1, GPI_{water}^2, \dots, GPI_{water}^i \} \quad (6)$$

$$GPI_{river\_length}^* = \left\{ \left( \frac{River_{length}^1}{Voivodeship\_area\_1} \right)^1, \left( \frac{River_{length}^2}{Voivodeship\_area\_2} \right)^2, \dots, \left( \frac{River_{length}^i}{Voivodeship\_area\_i} \right)^i \right\} \quad (7)$$

$$GPI_{river\_length} = \left\{ \left( \frac{GPI_{river\_length}^1}{GPI_{river\_length}^{max}} \right)^1, \left( \frac{GPI_{river\_length}^3}{GPI_{river\_length}^{max}} \right)^2, \dots, \left( \frac{GPI_{river\_length}^i}{GPI_{river\_length}^{max}} \right)^i \right\} \quad (8)$$

where  $GPI_{river\_length}^{max} \geq GPI_{river\_length}^i$

$$GPI_{river\_length} = \{ GPI_{river\_length}^1, GPI_{river\_length}^2, \dots, GPI_{river\_length}^i \} \quad (9)$$

$$GPI_{number\ of\ rivers}^* = \left\{ \left( \frac{Number\ of_1^{rivers}}{Voivodeship\_area\_1} \right)^1, \left( \frac{Number\ of_2^{rivers}}{Voivodeship\_area\_2} \right)^2, \dots, \left( \frac{Number\ of_i^{rivers}}{Voivodeship\_area\_i} \right)^i \right\} \quad (10)$$

$$GPI_{number\ of\ rivers} = \left\{ \left( \frac{GPI_{number\ of\ rivers}^1}{GPI_{number\ of\ rivers}^{max}} \right)^1, \left( \frac{GPI_{number\ of\ rivers}^3}{GPI_{number\ of\ rivers}^{max}} \right)^2, \dots, \left( \frac{GPI_{number\ of\ rivers}^i}{GPI_{number\ of\ rivers}^{max}} \right)^i \right\} \quad (11)$$

where  $GPI_{number\ of\ rivers}^{max} \geq GPI_{number\ of\ rivers}^i$

$$GPI_{number\ of\ rivers} = \{ GPI_{number\ of\ rivers}^1, GPI_{number\ of\ rivers}^2, \dots, GPI_{number\ of\ rivers}^i \} \quad (12)$$



The GPI was calculated based on forest area, area of standing water bodies and the length and number of watercourses per unit area in each Polish voivodeship (13). The GPI was expressed as the normalized sum of the above variables (14)–(15).

$$GPI_i = \{GPI_{forest}^i + GPI_{water}^i + GPI_{river\_length}^i + GPI_{number\ of\ rivers}^i\} \quad (13)$$

$$GPI = \left\{ \frac{GPI_1}{GPI_{max}}, \frac{GPI_2}{GPI_{max}}, \dots, \frac{GPI_i}{GPI_{max}} \right\} \quad (14)$$

where  $GPI_{max} \geq GPI_k^i$  and  $k = \{\text{forest, water, river length, number of rivers}\}$

$$GPI = \{GPI_1, GPI_2, \dots, GPI_i\} \quad (15)$$

The BOI in Polish voivodeships was calculated using Equations (16)–(18).

$$BOI_{Number\ of\ businesses}^* = \left\{ \left( \frac{Number\ of\ businesses^1}{Voivodeship\_area\_1} \right)^1, \left( \frac{Number\ of\ businesses}{Voivodeship\_area\_2} \right)^2, \dots, \left( \frac{Number\ of\ businesses}{Voivodeship\_area\_i} \right)^i \right\} \quad (16)$$

$$BOI = \left\{ \left( \frac{BOI^1}{BOI_{Number\ of\ businesses}^{max}} \right)^1, \left( \frac{BOI^2}{BOI_{Number\ of\ businesses}^{max}} \right)^2, \dots, \left( \frac{BOI^i}{BOI_{Number\ of\ businesses}^{max}} \right)^i \right\} \quad (17)$$

where  $BOI_{Number\ of\ businesses}^{max} \geq BOI_{Number\ of\ businesses}^i$

$$BOI = \{BOI_1, BOI_2, \dots, BOI_i\} \quad (18)$$

The IWRU for kayaking in Polish voivodeships was calculated based on the number of rivers with kayaking trails (19). The results were normalized based on the maximum values in this set.

$$IWRU = \left\{ \left( \frac{WRU^1}{WRU^{max}} \right)^1, \left( \frac{WRU^2}{WRU^{max}} \right)^2, \dots, \left( \frac{WRU^i}{WRU^{max}} \right)^i \right\} \quad (19)$$

where  $WRU^{max} \geq WRU^i$

$$IWRU = \{IWRU_1, IWRU_2, \dots, IWRU_i\} \quad (20)$$

The values of GPI, BOI and IWRU in each voivodeship were compared to determine the presence of correlations, and to evaluate whether the development of active (kayaking) tourism in different Polish regions (voivodeships) is sustainable.

The second approach involved the assumption that water resources, in particular river length, can be expected to play the most important role in the assessment of potential kayaking tour operations. Three indicators were calculated for each Polish voivodeship based on selected data from Table 1.

- RLI: the river length in voivodeships (21) and (22);
- EI: the number of businesses registered in the CEIDG per unit length of watercourses in voivodeships (23) and (24);
- II: the investment indicator (25)–(26).

The investment indicator (II) (25) and (26) denotes the extent to which the geographic potential of voivodeships is harnessed by local businesses operating on the outdoor tourism market.

$$RII = \{ (River\ length)_{n=1,2,\dots,17}^{normalization} \} = \left\{ \frac{rl_1}{(rl)_{max}}, \frac{rl_2}{(rl)_{max}}, \frac{rl_3}{(rl)_{max}}, \dots, \frac{rl_i}{(rl)_{max}} \right\} \quad (21)$$

$i = 1, 2, 3, \dots, 17$  - voivodeship ID,

where  $(rl)_{\max} \geq rl_i$

$$RII = \{RII_1, RII_2, RII_3, \dots, RII_{17}\} \quad (22)$$

$$EI = \{(\text{Number of businesses/river length})_{n=1,2,3, \dots, 17}^{\text{normalization}}\} = \left\{ \frac{(E_1/rl_1)}{\left(\frac{E}{rl}\right)_{\max}}, \frac{(E_2/rl_2)}{\left(\frac{E}{rl}\right)_{\max}}, \frac{(E_3/rl_3)}{\left(\frac{E}{rl}\right)_{\max}}, \dots, \frac{(E_{17}/rl_{17})}{\left(\frac{E}{rl}\right)_{\max}} \right\} \quad (23)$$

$E_i$  = number of businesses registered in the  $i$ th voivodeship,

where  $\left(\frac{E}{rl}\right)_{\max} \geq E_i/rl_i$ .

$$EI = \{EI_1, EI_2, EI_3, \dots, EI_{17}\} \quad (24)$$

$$\Pi = \left\{ \frac{EI_1}{RII_1}, \frac{EI_2}{RII_2}, \frac{EI_3}{RII_3}, \dots, \frac{EI_{17}}{RII_{17}} \right\} \quad (25)$$

$$\Pi = \{\Pi_1, \Pi_2, \Pi_3, \dots, \Pi_{17}\}. \quad (26)$$

Low values of the  $\Pi$  (investment indicator) suggest that few people use the potential of watercourses for tourism-related business activities.

### 3. Determination of the Number of Rivers Where Kayaking Tours Are Organized

#### 3.1. Travel Book Publishers and Kayaking Travel Guides

In the first stage of the study, travel guides and maps in printed and electronic format were analyzed to collect data about the number of rivers where kayaking tours are organized. Kayaking travel guides were searched on the websites of travel book publishers. The websites of five companies that publish active tourism guides were analyzed: Ciekawe Miejsca, Pascal, Galileo, Empik and ExpressMap Polska (Table 2). Most of the travel guides on offer were dedicated to mountaineering, hiking and cycling. Additional search words had to be used to find kayaking travel guides. The search results (as of 25 May 2021) are presented in Table 2.

**Table 2.** Kayaking travel guides available on the Polish market.

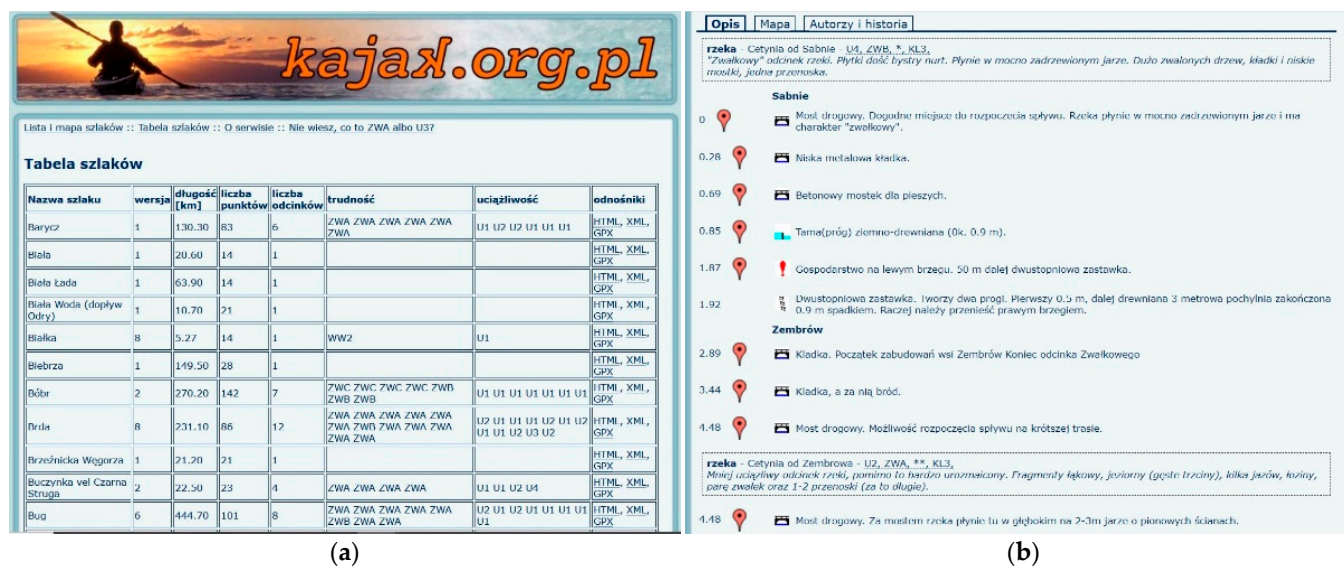
	Publisher	Category	Total Number of Active Tourism Guides	Number of Kayaking Guides	Number of Described Kayaking Trails on Rivers
1	Ciekawe Miejsca	Kayaking trails in Poland	87	16	61
2	Pascal	Travel guides for adventure seekers	9	3	3
3	Galileo	Maps for active tourists	15	3	4
4	Empik		46	5	5
5	ExpressMap Polska	Travel maps	18	0	0
	Sp. z o.o.				
	TOTAL		Without repeats		64

The data in Table 2 indicate that kayaking tourism is not extensively promoted in Poland. It should be noted that the travel guides published by Ciekawe Miejsca promoted kayaking trails mainly in the voivodeship of Masovia. Ten guide books focusing on the Warsaw region (Masovia) described kayaking trails on 34 rivers [20–22]. Other travel guides covered kayaking trails on 22 rivers in Podlasie voivodeship [23], as well as trails on five rivers in Pomerania. Ciekawe Miejsca recently launched a new series entitled Kayaking Trails in Poland, and nine travel guides in this series were published in 2021 [24,25]. The travel guides released by the remaining publishers focused on other types of tourist activities. The analysis revealed that printed travel guides described kayaking trails on a total of 64 Polish rivers. A review of online archival resources also revealed several kayaking travel guides published in previous years [26–32].

### 3.2. Community Websites Created by Polish Kayaking Enthusiasts

In addition to kayaking travel guides, information about kayaking trips and trails is also available on the websites of tourist and sports organizations. In Poland, there are at least 105 kayaking tour operators (clubs, circles, associations) affiliated with the Kayaking Tourism Committee of the Polish Tourist and Sightseeing Society (PTTK), Tourism and Recreation Committee of the Polish Canoe Federation (PZK) and the Association of Canoeing Instructors and Trainers (SiTK) [33]. These providers organize kayaking tours as part of their statutory operations. Each year, a list of kayaking activities and trips planned by these organizations is published online in the Kayaking Directory ([https://pzkaj.pl/dane/turystyka/Informator\\_Kajakarza\\_2021.pdf](https://pzkaj.pl/dane/turystyka/Informator_Kajakarza_2021.pdf), accessed on 20 August 2022).

The number of kayaking tour operators and kayaking events organized in recent years is presented in Table 3. In 2021, 94 operators organized 153 kayaking events on 98 rivers and in 22 other sites (lakes, canals and the Baltic Sea) (Kayaking Guide 2021). In 2022, kayaking events were planned in a total of 120 locations including 89 rivers, 19 lakes and nine other sites (canals, whitewater courses and lagoons). These data were included in the developed database. A community website dedicated to kayaking has been created as a joint initiative of PZK, PTTK and SiTK at <http://kajak.org.pl> (accessed on 1 January 2020). The website presents kayaking trails and provides useful information for tour organizers and the participants (<http://kajak.org.pl/splywww/>, accessed on 21 August 2022) (Figure 1). A total of 156 kayaking trails on 142 rivers are described on the website.



**Figure 1.** Selected types of information available on the community website for kayaking enthusiasts: (a) list of kayaking trails; (b) description of the waterway. Source: <http://kajak.org.pl> (accessed on 20 July 2021).

Kayaking tour operators and equipment rentals can register in the database available on the website. To date, 397 businesses, including 76 kayak manufacturers and 41 kayaking gear stores, have registered on the website. The locations of kayaking trails and the registered businesses were compared on a map, and the analysis revealed an absence of spatial correlations between these two datasets. Businesses operating in the water tourism sector (397) are not located in the proximity of the identified kayaking trails (157), which suggests that the presented data are incomplete and lack cohesion. A detailed analysis of the website revealed that most of the presented trails were described by kayaking enthusiasts from western Poland ([www.kajaki.org.pl](http://www.kajaki.org.pl), accessed on 21 August 2022). Therefore, the existing database of kayaking trails should be expanded by conducting additional research and reviewing online resources dedicated to kayaking.

**Table 3.** Kayaking events organized by tour operators based on the information presented in annual kayaking directories. Source: Kayaking Directories for 2014–2022.

Year	Number of Kayaking Tour Operators	Number of Kayaking Events
2022	89	150
2021	94	153
2020	94	163
2019	94	160
2018	95	155
2017	105	164
2016	101	158
2015	101	165
2014	105	165

### 3.3. Identification of Navigable Rivers Where Kayaking Tours Are Organized

In Poland, kayaking tours are organized mainly by private operators. These businesses are listed in official databases, and they also advertise their services online. Kayaking tour operators were searched in Google maps, and their registered addresses were identified based on location markers. These businesses advertise kayaking tours and present detailed information about kayaking trails on their websites. Tour participants post photographs and video footage from their kayaking trips on YouTube, which is also a good source of information about kayaking activities in Poland. Navigable rivers where kayaking tours are organized were catalogued based on an analysis of these websites and user posts. A total of 207 rivers were catalogued.

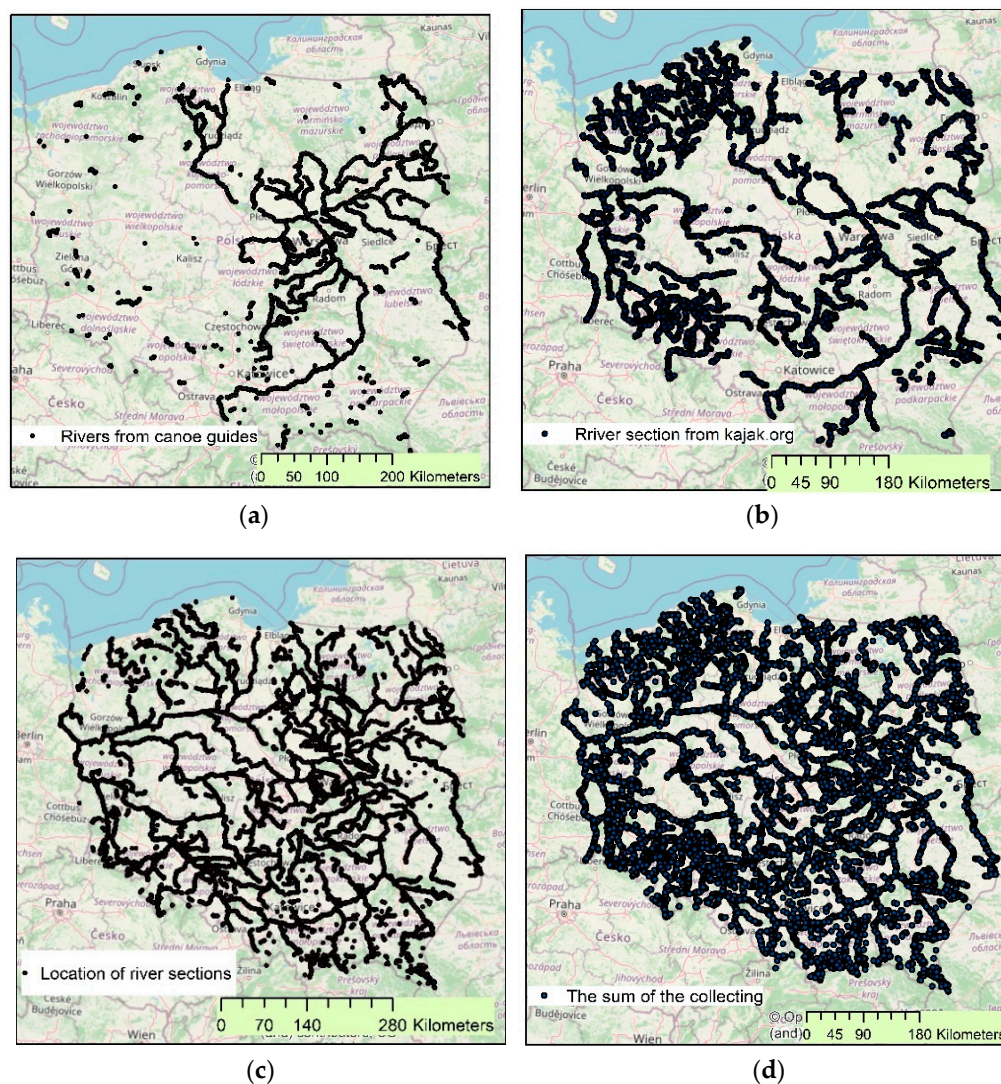
The study demonstrated that information about kayaking trails and navigable rivers is highly fragmented. A list of navigable rivers where kayaking tours are organized was developed based on a review of kayaking travel guides, websites of kayaking tour organizers and equipment rentals, the kayaking community site, as well as the results of own study. The datasets were merged with the use of GIS tools based on the names of the listed rivers, and the resources of the National Register of Geographic Names (PRNG). Vector images (Figure 2) depicting the location of navigable rivers in subsets of kayaking trails were generated. The created vector images contained sets of points distributed at intervals of 4 km along selected watercourses. A comparison of the first two data sources revealed differences in the location of businesses advertising kayaking tours and kayaking trails. The presented analysis produced more cohesive results. These findings indicate that the development of the kayaking sector should be monitored to generate more reliable data (Table 4).

**Table 4.** Number of rivers where kayaking tours are organized, based on various sources of data.

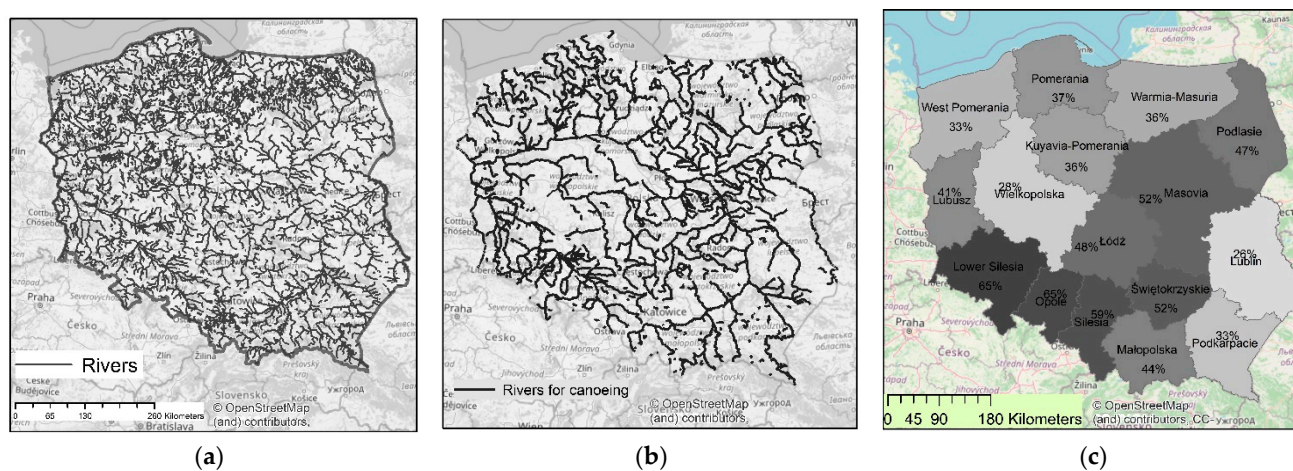
Data Source	Number of Catalogued Kayaking Trails
Kayaking travel guides	64
Website of kayaking organizations	142
Own study	207
Cumulative result	260

Based on the generated catalog of 260 rivers, the number of rivers in each Polish voivodeship, including rivers where kayaking tours are organized, is presented in Table 5. These data were used for the cartographic visualization of the potential of rivers for the development of kayaking tourism in Poland (Figure 3a), rivers where kayaking tours are organized (Figure 3b) and the percentage of rivers in Polish voivodeships that are utilized for kayaking (Figure 3c).





**Figure 2.** Visualization of the location of rivers where kayaking tours are organized based on various sources: (a) travel guides; (b) website of kayaking organizations; (c) own study; (d) cumulative result.



**Figure 3.** Water resources in Poland: (a) potential of rivers for the development of kayaking tourism; (b) rivers where kayaking tours are organized; (c) percentage of rivers in Polish voivodeships that are utilized for kayaking.

**Table 5.** Number and percentage of rivers in Polish voivodeships where kayaking tours are organized, and the indicator of water resource utilization (IWRU).

Voivodeship	Number of Rivers	Number of Rivers with Kayaking Tours	Percentage of Rivers with Kayaking Tours [%]	IWRU
Lower Silesia	109	71	65	1.00
Kuyavia-Pomerania	85	31	36	0.55
Lublin	93	24	26	0.40
Lubusz	97	40	41	0.63
Łódź	66	32	48	0.74
Małopolska	85	37	44	0.68
Masovia	145	75	52	0.80
Opole	60	39	65	1.00
Podkarpacie	107	35	33	0.51
Podlasie	89	42	47	0.72
Pomerania	127	47	37	0.57
Silesia	59	35	59	0.91
Świętokrzyskie	52	27	52	0.80
Warmia-Masuria	140	51	36	0.55
Wielkopolska	143	40	28	0.43
West Pomerania	145	48	33	0.51

On average, kayaking tours are organized on 42% of Polish rivers (Table 5). It should be noted that the percentage of rivers utilized for kayaking exceeds 50%, or even approaches 65% in some regions (voivodeships).

#### 4. Geographic Potential Indicator, Business Opportunity Indicator and the Indicator of Water Resource Utilization for Active Tourism in Polish Voivodeships

##### 4.1. Indicators Calculated per Unit of Reference Surface

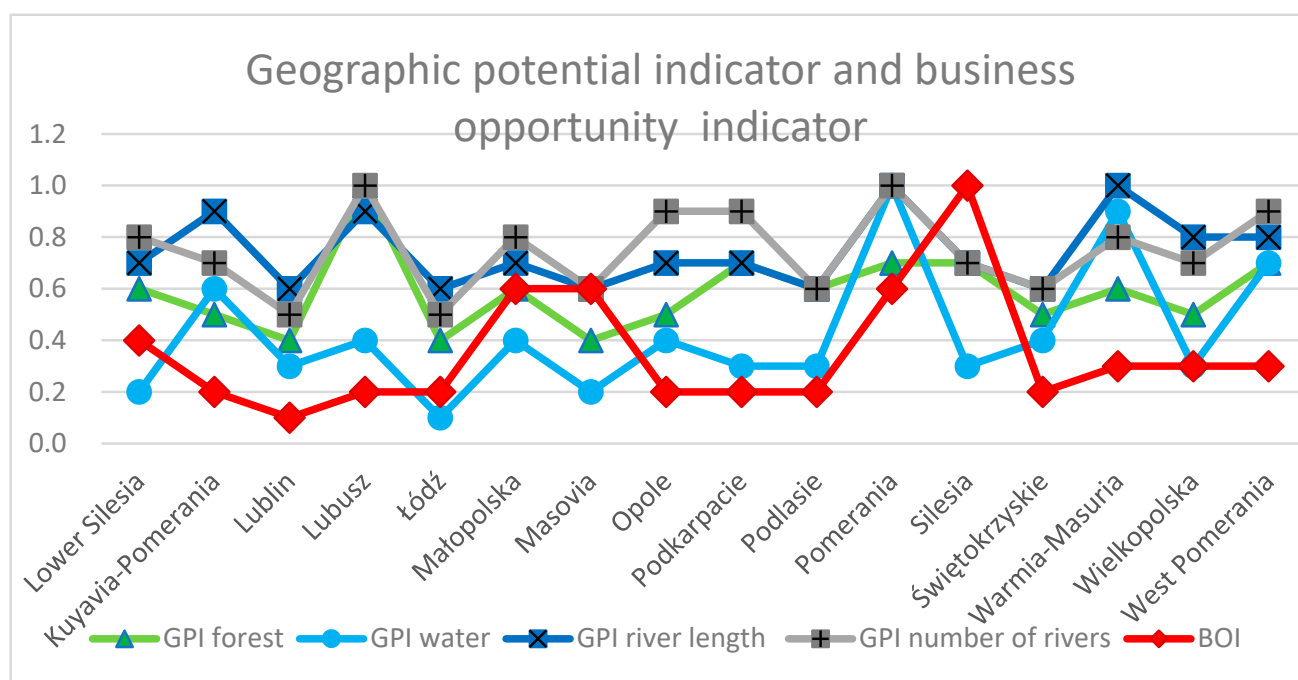
The values of GPI, BOI (based on CEIDG data) and IWRU for kayaking in Polish voivodeships were calculated based on the data presented in Table 1, and the methods described in (1)–(18). The values of the above indicators are shown in Tables 6 and 7, and in Figures 4 and 5. The data are presented on thematic maps in Figure 6.

**Table 6.** Values of the geographical potential indicator (GPI) in subsets (2, 5, 9, 18) and the business opportunity indicator (BOI).

Voivodeship	GPI <sub>forest</sub>	GPI <sub>water</sub>	GPI <sub>river_length</sub>	GPI <sub>number of rivers</sub>	BOI
Lower Silesia	0.6	0.2	0.7	0.8	0.4
Kuyavia-Pomerania	0.5	0.6	0.9	0.7	0.2
Lublin	0.4	0.3	0.6	0.5	0.1
Lubusz	1.0	0.4	0.9	1.0	0.2
Łódź	0.4	0.1	0.6	0.5	0.2
Małopolska	0.6	0.4	0.7	0.8	0.6
Masovia	0.4	0.2	0.6	0.6	0.6
Opole	0.5	0.4	0.7	0.9	0.2
Podkarpacie	0.7	0.3	0.7	0.9	0.2
Podlasie	0.6	0.3	0.6	0.6	0.2
Pomerania	0.7	1.0	1.0	1.0	0.6
Silesia	0.7	0.3	0.7	0.7	1.0
Świętokrzyskie	0.5	0.4	0.6	0.6	0.2
Warmia-Masuria	0.6	0.9	1.0	0.8	0.3
Wielkopolska	0.5	0.3	0.8	0.7	0.3
West Pomerania	0.7	0.7	0.8	0.9	0.3

**Table 7.** Values of the geographic potential indicator (GPI), the business opportunity indicator (BOI) and the indicator of water resource utilization (IWRU) for kayaking in Polish voivodeships.

Voivodeship	GPI	IWRU	BOI
Lower Silesia	0.61	1.00	0.41
Kuyavia-Pomerania	0.69	0.55	0.24
Lublin	0.50	0.40	0.09
Lubusz	0.88	0.63	0.24
Łódź	0.45	0.74	0.24
Małopolska	0.68	0.68	0.60
Masovia	0.50	0.80	0.57
Opole	0.69	1.00	0.20
Podkarpacie	0.72	0.51	0.23
Podlasie	0.56	0.72	0.16
Pomerania	1.00	0.57	0.56
Silesia	0.62	0.91	1.00
Świętokrzyskie	0.61	0.80	0.19
Warmia-Masuria	0.91	0.55	0.26
Wielkopolska	0.62	0.43	0.31
West Pomerania	0.85	0.51	0.31

**Figure 4.** Indicators of geographic potential in subsets and the business opportunity indicator.

The calculated values of the proposed indicators (Table 6) were used to determine the presence of correlations between the GPI, IWRU and BOI. The values of the correlation coefficients are very low, non-significant and varied. The coefficient of correlation between GPI and IWRU is 0.28, the coefficient of correlation between GPI and BOI is 0.06, and the coefficient of correlation between IWRU and BOI is 0.35. The values of GPI, IWRU and BOI in voivodeships are presented graphically in Figure 5.

In Figure 5, the lines presenting the values of IWRU and BOI in Polish voivodeships have fairly similar shapes, which correspond to the value of the correlation coefficient of 0.35. The values of IWRU exceeded BOI values in all regions, except Silesia.



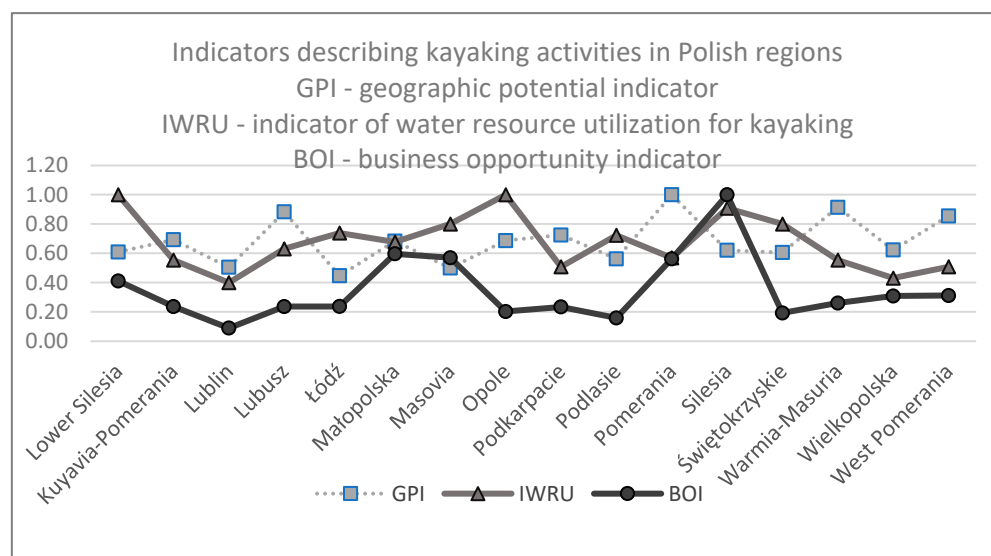


Figure 5. Indicators describing kayaking activities in Polish voivodeships.

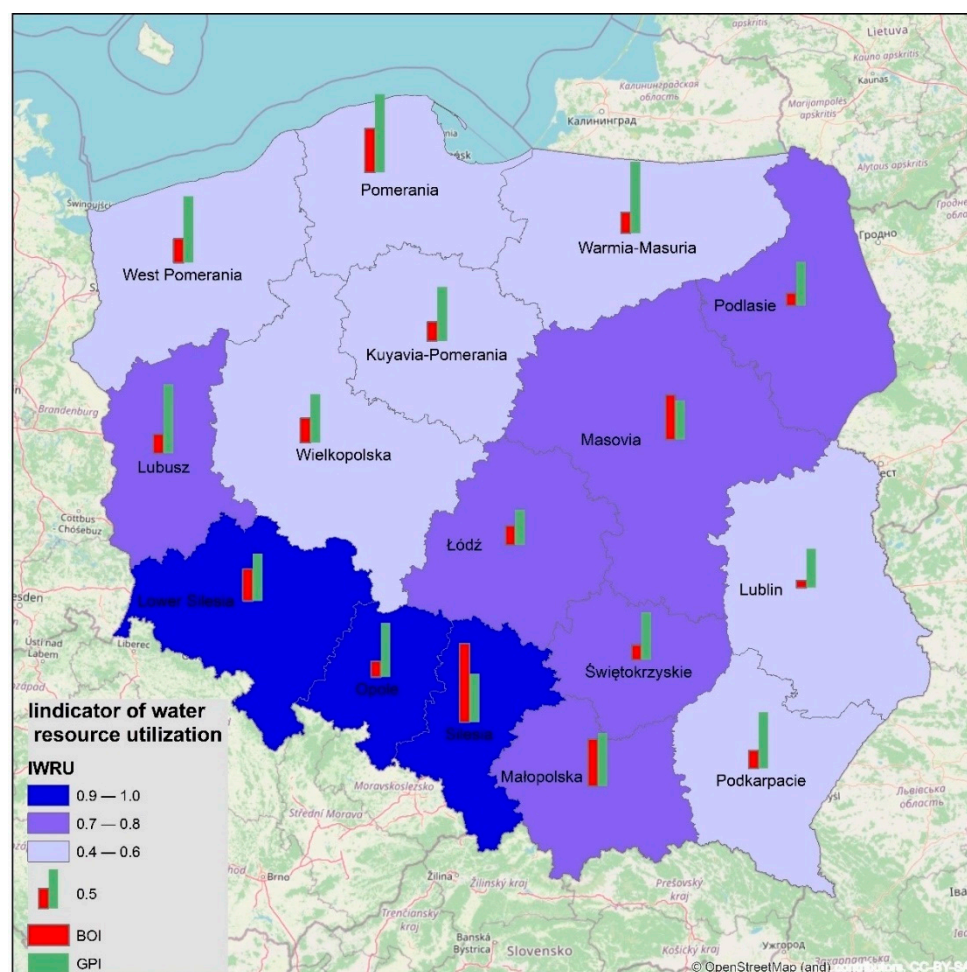
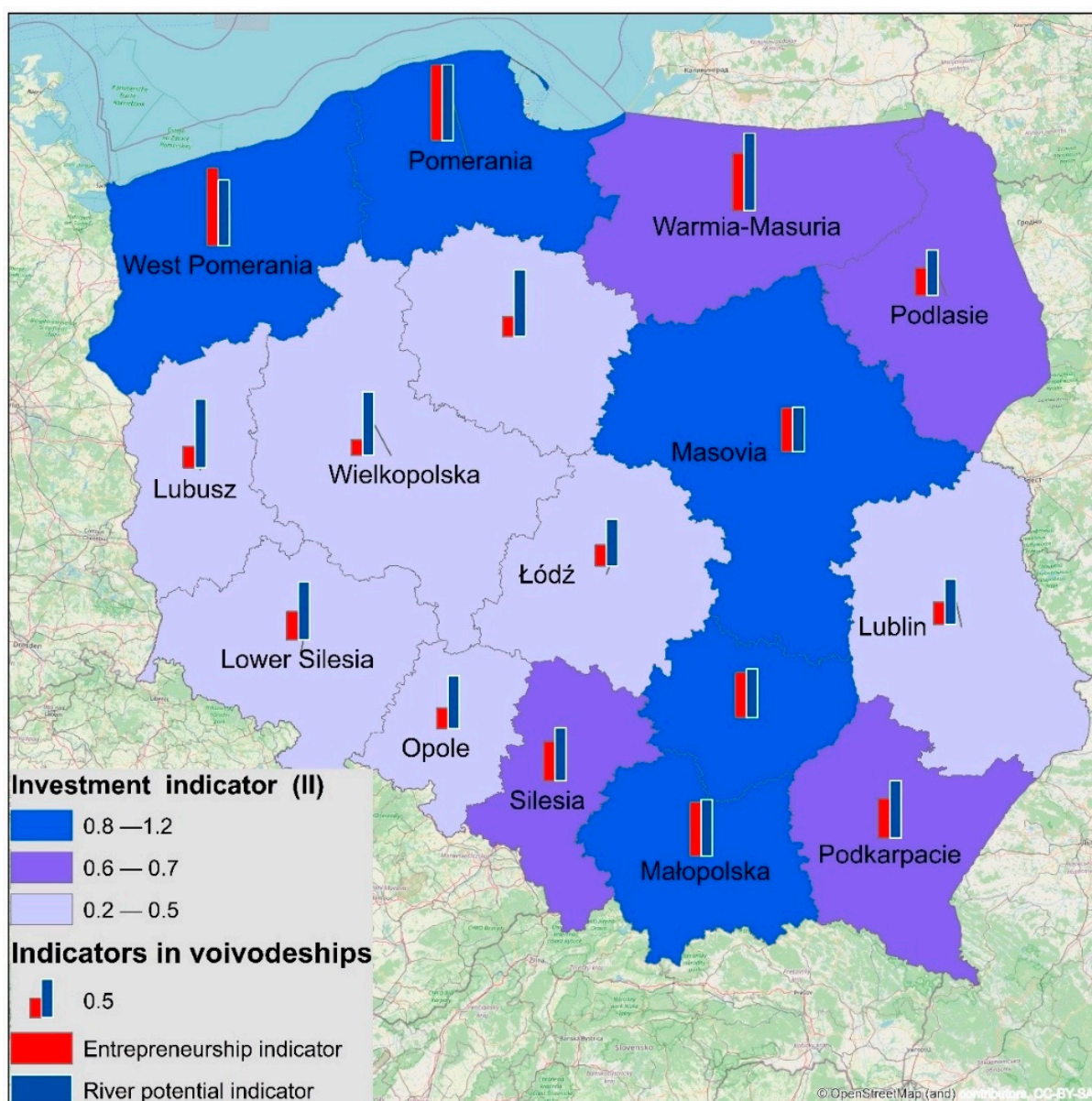


Figure 6. Entrepreneurship indicators calculated based on the geographic potential of Polish voivodeships. The values of the geographic potential indicator (GPI) and the business opportunity indicator (BOI) are presented on thematic maps. The values of the indicator of water resource utilization (IWRU) are presented on cartograms in three categories: high (1.0–0.8), moderate (0.8–0.6) and low (0.6–0.4), based on Table 6 data.

#### 4.2. Indicators Taking into Account the Length of Rivers

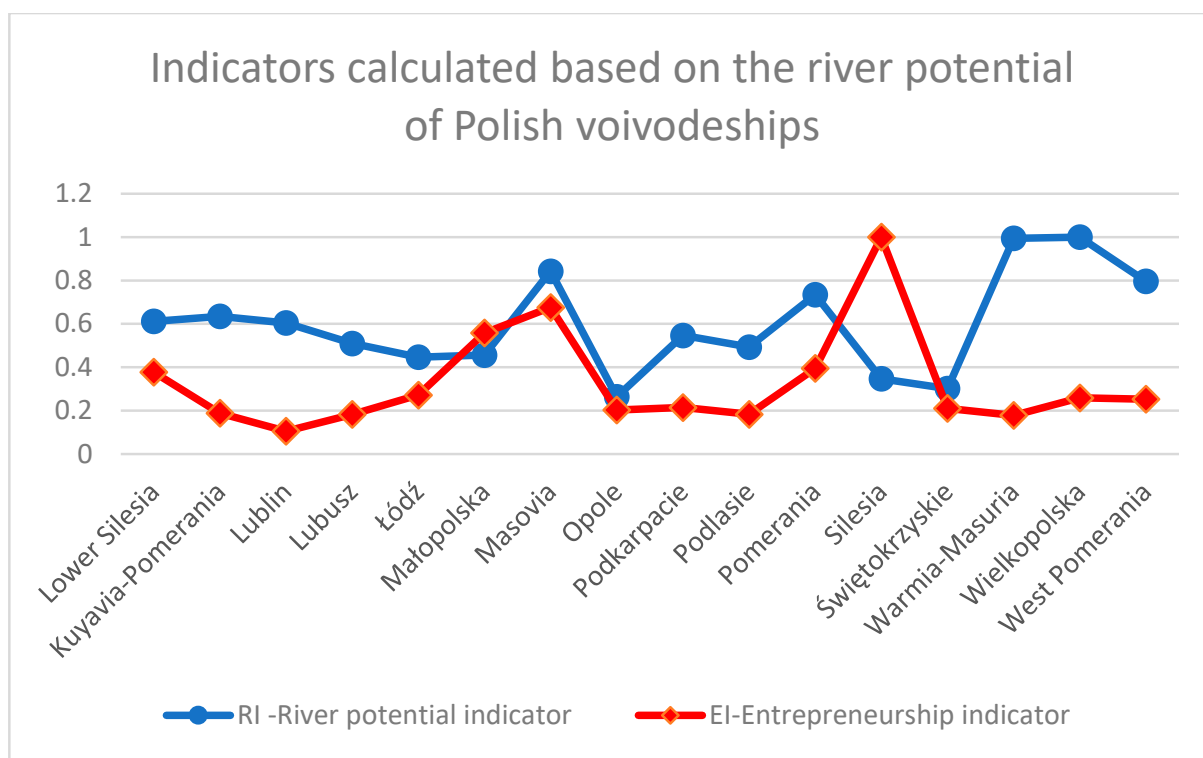
Entrepreneurship indicators, river potential indicators and investment indicators for businesses registered in the CEIDG under PKD code 7721Z are presented in Table 8 and Figure 7, taking into account the length of rivers. The results indicated that the geographic potential of Polish regions was most effectively harnessed by local businesses operating on the outdoor tourism market (kayaking tour organizers) in north-western Poland, as well as in central-eastern Poland. Low values of the investment indicator (II) in central-western Poland suggest that unlike businesses and associations registered in the KRS [7] (Figures 1 and 7), tourism operators registered in the CEIDG are reluctant to capitalize on the natural potential of their respective regions.



**Figure 7.** Entrepreneurship indicators calculated based on the river potential of Polish voivodeships. The values of the entrepreneurship indicator (EI) and the river potential indicator (RII) are presented on thematic maps. The values of the investment indicator (II) are presented on cartograms in three categories: high (1.2–0.8), moderate (0.8–0.7) and low (0.5–0.2), based on Table 7 data. The results shown in Figure 7 are presented in graphical form in Figure 8.

**Table 8.** Entrepreneurship indicators, river potential indicators and investment indicators for businesses registered in the CEIDG under PKD code 7721Z (data from this table are additionally presented graphically in Figure 7).

Voivodeship	Entrepreneurship Indicator (EI) (1)	River Potential Indicator (RI) (2)	Investment Indicator (II) $II = EI/RI$ (3)
Lower Silesia	0.36	0.74	0.49
Kuyavia-Pomerania	0.26	0.86	0.30
Lublin	0.29	0.58	0.50
Lubusz	0.28	0.88	0.31
Łódź	0.27	0.60	0.45
Małopolska	0.69	0.73	0.95
Masovia	0.57	0.58	0.99
Opole	0.27	0.68	0.39
Podkarpacie	0.51	0.74	0.69
Podlasie	0.36	0.59	0.60
Pomerania	0.97	0.97	1.00
Silesia	0.51	0.68	0.74
Świętokrzyskie	0.58	0.63	0.93
Warmia-Masuria	0.74	1.00	0.74
Wielkopolska	0.20	0.82	0.24
West Pomerania	1.00	0.84	1.18



**Figure 8.** Entrepreneurship indicator (EI) calculated based on the river potential of Polish voivodeships expressed as the river potential indicator (RI).

## 5. Discussion

The results of the research conducted with the first method, where the values presented in Table 1 were converted to the area of the reference unit (voivodeship), suggest that the local entrepreneurs have not fully tapped into the region's vast geographic potential for active tourism development. The line presenting GPI values diverges from the lines depicting the values of IWRU and BOI (Figures 5 and 6), which indicates that geographic potential is only one of the factors that drive the growth of the kayaking sector.

In Małopolska, all three indicators were characterized by similar values, which points to sustainable tourism development that makes optimal use of the region's geographic potential and the availability of navigable rivers. In Silesia, the value of BOI exceeded the values of IWRU and GPI, which indicates that this region abounds in businesses who meet local tourist needs. In Warmia-Masuria, the value of GPI was considerably higher than the values of BOI and IWRU. Similar observations were made in Lubusz, Pomerania and West Pomerania. As demonstrated by the high values of IWRU in Lower Silesia, Masovia, Opole and Świętokrzyskie, a high percentage of rivers in these regions are utilized for kayaking, although the values of GPI and BOI are relatively low. A comparison of the data presented in Figure 4 indicates that the development of kayaking tourism is determined by various factors, not only specific geographical features in a given region.

The results of the research conducted with the second method, where the values were calculated based on river potential in voivodeships, revealed that Świętokrzyskie, West Pomerania, Pomerania, Małopolska and Masovia fully utilize their water potential in active tourism. The voivodeships of western-central Poland have high water potential, but the number of tourism operators registered in the CEIDG is low in these voivodeships. Lower Silesia, Opole and Lubusz are characterized by low values of the EI, but a high percentage of rivers in these voivodeships are utilized for kayaking (Figure 3). This indicates that in these regions, kayaking tours are organized primarily by clubs, circles and associations affiliated with the PTTK, as confirmed by the information available on the community website dedicated to kayaking (Figure 2b).

The results of this study indicate that geographical features are not the only factors that drive the development of active tourism (kayaking). This suggests that there are considerable opportunities for business development in the Polish kayaking sector.

## 6. Conclusions

This study aimed to determine the number of Polish rivers where kayaking tours are organized. Kayaking tour operators and equipment rentals are not actively promoted by the Polish Tourism Organization (PTO) [7,33]. Travel guides for active recreation enthusiasts also place greater emphasis on mountaineering, hiking and cycling compared to kayaking. The only notable exception is the Ciekawe Miejsca publishing house that has recently launched a series of travel guides dedicated to kayaking trails in Masovia.

Online resources are the most abundant sources of information about kayaking tourism. The websites of kayaking tour operators and equipment rentals promote active tourism, not only by advertising their services, but also by describing kayaking trails in different Polish regions.

The results of this study indicate that the popularity of kayaking is on the rise in Poland and that this form of active recreation presents numerous opportunities for local entrepreneurs. The growth of the Polish kayaking sector is driven not only by businesses that advertise their services online and search for new trails amidst increasing competition, but also by tourists, in particular hard tourism fans, who are passionate about discovering previously untraveled rivers. Adventure tourism enthusiasts describe new trails, report on their experiences online and encourage others to visit these sites [10–19].

The calculated values of GPI, BOI, IWRU and EI, RI, II in Polish regions (voivodeships) suggest that active tourism services are developing regardless of the geographic potential of a given region. It can be hypothesized that they are developing most rapidly in the vicinity of large urban areas. The above could be attributed to the fact that many urban dwellers participate in kayaking tours during weekends. Further research is needed to validate these observations.

**Funding:** This study was financed as part of a statutory research project of the Faculty of Geoengineering of the University of Warmia and Mazury in Olsztyn, Poland, entitled “Geoinformation from the theoretical, analytical and practical perspective” (No. 29.610.008-110\_timeline: 2020–2022).

**Institutional Review Board Statement:** Not applicable.



**Informed Consent Statement:** Not applicable.

**Data Availability Statement:** Not applicable.

**Acknowledgments:** The authors would like to thank public institutions (the Head Office of Geodesy and Cartography, the Ministry of Justice, and the Ministry of Development and Technology) for providing access to public databases.

**Conflicts of Interest:** The authors declare no conflict of interest.

## References

- Margaryana, L.; Fredman, P. Bridging outdoor recreation and nature-based tourism in a commercial context: Insights from the Swedish service providers. *J. Outdoor Recreat. Tour.* **2017**, *17*, 84–92. [CrossRef]
- Patterson, I.; Pan, R. The motivations of baby boomers to participate in adventure tourism and the implications for adventure. *Ann. Leis. Res.* **2007**, *10*, 26–53. [CrossRef]
- Hall, C.M. *Tourism and Politics: Policy, Power and Place*; John Wiley & Sons: Hoboken, NJ, USA, 1994.
- Janowski, I.; Gardiner, S.; Kwek, A. Dimensions of adventure tourism. *Tour. Manag. Perspect.* **2021**, *37*, 100776. [CrossRef]
- Aasetre, J.; Gundersen, V. Outdoor recreation research: Different approaches, different values? *Norsk Geografisk Tidsskrift. Nor. J. Geogr.* **2012**, *66*, 193–203. [CrossRef]
- Lewandowicz, E. Spatial conflicts in areas particularly attractive to tourists. In Proceedings of the 18th International Multidisciplinary Scientific Geo Conferences SGEM 2018, Albena, Bulgaria, 2–8 July 2018; Conference Proceedings, Informatics, Geoinformatics and Remote Sensing Iss. 2.3: Photogrammetry and Remote Sensing, Cartography and GIS. STEF92 Technology Ltd.: Albena, Bulgaria, 2018; Volume 18, pp. 575–582. Available online: <https://www.sgem.org/index.php/jresearch-article?citekey=Lewandowicz201811575582> (accessed on 1 January 2021).
- Lewandowicz, E.; Bac-Bronowicz, J. Outdoor tourism, kayaking, tourism potential and tourism operations in central-eastern Europe: The case of Poland. *GeoJournal Tour. Geosites* **2022**, *40*, 232–241. [CrossRef]
- González-Morcillo, S.; Horrach-Rosselló, P.; Valero-Sierra, O.; Mulet-Forteza, C. Forgotten effects of active tourism activities in Spain on sustainable development dimensions. *Environ. Dev. Sustain.* **2022**, 1–21. [CrossRef]
- Elmo, G.C.; Arcese, G.; Valeri, M.; Poponi, S.; Pacchera, F. Sustainability in Tourism as an Innovation Driver: An Analysis of Family Business Reality. *Sustainability* **2020**, *12*, 6149. [CrossRef]
- Gössling, S.; Hall, C.M.; Skott, D. *Tourism and Water*; Channel View Publications: Toronto, ON, Canada, 2015.
- Gössling, S.; Peeters, P.; Hall, C.M.; Ceron, P.P.; Dubois, G.; Lehmann, L.V.; Scott, D. Tourism and water use: Supply, demand, and security. An international review. *Tour. Manag.* **2012**, *33*, 1–15. [CrossRef]
- Folgado-Fernández, J.; Di-Clemente, E.; Mogollón, J.; Campón-Cerro, A. Water Tourism: A New Strategy for the Sustainable Management of Water-Based Ecosystems and Landscapes in Extremadura (Spain). *Land* **2018**, *8*, 2. [CrossRef]
- Cholewa, J. The Factors Deciding about the Popularity of Kayaking Tourism on Industrial Areas. In *Advances in Tourism, Technology and Smart Systems*; Springer: Singapore, 2020; pp. 395–404.
- Rafalska, B.; Cholewa, J.; Tomik, R. Czynniki determinujące uprawianie turystyki kajakowej na terenie województwa śląskiego. *Folia Turistica* **2017**, *45*, 64–78. Available online: [http://folia-turistica.awf.krakow.pl/attachments/article/430/FT\\_45\\_2017.pdf#page=64](http://folia-turistica.awf.krakow.pl/attachments/article/430/FT_45_2017.pdf#page=64) (accessed on 28 June 2022). [CrossRef]
- Mazur, L. *Locja Kajakowa*; PZK: Warszawa, Poland, 1997.
- Gössling, S.; Scott, D.; Hall, C.M. Pandemics, tourism and global change: A rapid assessment of COVID-19. *J. Sustain. Tour.* **2021**, *29*, 1–20. [CrossRef]
- Szromek, A. *Pomiar Funkcji Turystycznej Obszarów za Pomocą Wskaźników Funkcji Turystycznej na Przykładzie Obszarów Państw Europejskich*, (The Measurement of Tourism Function of Areas Using Indicators of the Tourism Function on the Example of Areas of European Countries); nr 132-Zastosowania Metod Matematycznych w Ekonomii i Zarządzaniu; Studia Ekonomiczne/Uniwersytet Ekonomiczny w Katowicach: Katowice, Poland, 2013; pp. 91–103.
- Szromek, A. *Wskaźniki Funkcji Turystycznej. Koncepcja Wskaźnika Funkcji Turystycznej i Uzdrawiskowej*. (Tourism Function Indicators. The Concept of Tourism and Health Resort Function); Publishing House of the Silesian University of Technology: Katowice, Poland, 2012; pp. 1–293. ISBN 978-83-7335-916-1. Available online: [https://www.ue.katowice.pl/fileadmin/\\_migrated/content\\_uploads/8\\_A.R.Szromek\\_Pomiar\\_Funkcji\\_Turystycznej....pdf](https://www.ue.katowice.pl/fileadmin/_migrated/content_uploads/8_A.R.Szromek_Pomiar_Funkcji_Turystycznej....pdf) (accessed on 28 June 2022). (In Polish)
- Grzelak, M.M.; Roszko-Wójtowicz, E. Tourist attractiveness of voivodeships in Poland in the light of selected indicators: A dynamic approach. *Econ. Ann.* **2020**, *183*, 161–177.
- Jagiello, J. *Bzura i Jej Dopływy*; Encyklopedia Rzek Polski Wydawnictwo (Ciekawe Miejsca): Warsaw, Poland, 2013; p. 134, Indeks 13382476.
- Jagiello, J. *Jeziorka, Świder, Wilga, Okrzejka Oraz ich Dopływy*; Wydawnictwo (Ciekawe Miejsca): Warsaw, Poland, 2014; p. 90.
- Jagiello, J. *Świder Mienia Jagodzianka. Przewodnik kajakowy*; Wydawnictwo (Ciekawe Miejsca): Warsaw, Poland, 2019; p. 70.
- Darmichwał, T.; Jagiello, J.; Krajewski, T.A. *Poland-Kajakiem po Suwalszczyźnie. Przewodnik. Canoeing in the Suwałki Region*; Guide Warszawa (Wydawnictwo Ciekawe Miejsca): Warsaw, Poland, 2019.
- Jagiello, J.; Mazur, M. *Przewodnik Kajakowy, Rawka. (Kayak Guide. Rawka)*; Wydawnictwo (Ciekawe Miejsca): Warsaw, Poland, 2021.

25. Mazur, M.; Jagieło, J. *Przewodnik Kajakowy, Świder (Kayak Guide. Świder)*; Wydawnictwo CM: Warsaw, Poland, 2021; ISBN 9788366371033.
26. Wrześniowski, Z. *Kajakiem po Wodach Pomorza Zachodniego. (By Kayak in the Waters of Western Pomerania)*; Warszawa (Wydawnictwo Sport i Turystyka): Warsaw, Poland, 1955.
27. Lityński, M.; Goleń, J. *Drwęca Oraz Wel i Pojezierze Brodnickie. Przewodnik Kajakowy, (Drwęca and Wel and Brodnica Lake District. Kayak Guide)*; Wydawnictwo (Rewasz): Pruszków, Poland, 2003.
28. Kwaczonek, M. *Czarna Hańcza-Przewodnik dla Kajakarzy (Hańcza-Guide for Canoeists)*; Wydawnictwo (Pascal): Bielsko-Biała, Poland, 2003; p. 32.
29. Kwaczonek, M. *Przewodnik po Rzekach Krutyni i Czarnej Hańczy Guide to the Krutynia and Czarna Hańcza Rivers)*; Pascal: Bielsko-Biała, Poland, 2017; Kod EAN: 9788381030182.
30. Kwaczonek, M. *Kajakiem po Krutyni, Przewodnik dla Aktywnych (Kayaking in Krutynia, Guide for Active People)*; Wydawnictwo Pascal: Bielsko-Biała, Poland, 2017; ISBN 978-83-8103-019-9.
31. Kwaczonek, M. *Kajakiem po Czarnej Hańczy, Przewodnik dla Aktywnych (Kayaking on Czarna Hańcza, Guide for Active People)*; Wydawnictwo Pascal: Bielsko-Biała, Poland, 2017; ISBN 978-83-8103-018-2. Available online: <http://pascal.pl/seria-dla-aktywnych,15,0.html> (accessed on 1 January 2020).
32. Głowacki, M.; Gomulska, E.; Jaworska, E.; Książek, I.; Kühn, U.; Malinowski, T.; Oliwiak, B. *Informator Kajakarza (Kayaker's Informant)*; Ministerstwo Sportu i Rekreacji: Warsaw, Poland, 2015; pp. 1–66. Available online: [http://kajak.org.pl/dane/images\\_upload/\\*j/informator\\_kajakarza\\_2015.pdf](http://kajak.org.pl/dane/images_upload/*j/informator_kajakarza_2015.pdf) (accessed on 10 June 2021).
33. PTO Marketingowa Strategia Polski w Sektorze Turystyki na Lata 2012–2020 (Marketing Strategy of Poland in the Tourism Sector for 2012–2020). 2011. Available online: <https://www.pot.gov.pl/pl/o-pot/plany-i-sprawozdania-pot/marketingo> (accessed on 12 November 2021).