

Jolanta Barbara Cichowska¹✉, Aleksandra Mreła², Jan Zawadka³

¹ Bydgoszcz University of Science and Technology

² Kazimierz Wielki University in Bydgoszcz

³ Warsaw University of Life Sciences

Analysis of demand for qualified tourism organized by branches of the Polish Tourist and Sightseeing Society (using fuzzy relations)

Abstract. The study uses the fuzzy relations method to examine the demand for qualified tourism in 16 voivodeships of Poland. Data collected by PTTK was analyzed in the field of 12 forms of tourism in five defined research areas (A1 – mountain tourism; A2 – tourism for advanced users; A3 – water tourism; A4 – walking; and A5 – extreme tourism). The analyses showed that in all regions of the country, the greatest demand was for walking and for advanced tourism users. At the same time, the largest number of people participated in these two types of tourism. There were large fluctuations in demand for trips and events, especially due to the pandemic situation in the country and the economic situation. Thanks to fuzzy relations, it is possible to study phenomena composed of variables whose values are collected by organizations and statistical offices.

Keywords: qualified tourism, tourist organizations, trips and events, purchasers of tourist services, fuzzy relations

Introduction

The Polish Tourist and Sightseeing Society (PTTK) is the oldest association of tourists and sightseeing experts, operating since 1950. It was created by merging two organizations, the Polish Tatra Society and the Polish Tourist Society (Śledzińska, 2012). According to its statute, it “arouses and deepens love for Poland and its regions, shapes patriotic attitudes, disseminates knowledge about the past, present, and development prospects of the country” and “spreads the culture of tourism and encourages the use of the cognitive, leisure and health values of hiking and recreation”. At the same time, it “popularizes the sightseeing and tourist values of Poland and its achievements among foreign tourists and makes it easier for Polish tourists going abroad to learn about the sightseeing values, life and achievements of other countries”. Additionally,

Jolanta Barbara Cichowska ORCID: 0000-0003-1285-0101; Aleksandra Mreła ORCID: 0000-0002-2059-864X; Jan Zawadka ORCID: 0000-0003-1979-0607

✉ jolanta.cichowska@pbs.edu.pl

it “actively participates in the protection of cultural property and cultural heritage, brings together social guardians of monuments, collectors and sightseeing experts, and organizes historical reconstructions”. A vital element of the society’s activities is also “setting out and marking tourist trails, maintaining them, marking them and keeping their records”. The above-mentioned activities are aimed at supporting the development of the country’s regions, as well as “supporting activities conducive to the consolidation of their features, constituting important elements of the national identity of the inhabitants of Poland”. Moreover, “to develop qualified tourism in all its forms” and at the same time “organize and operate tours and other tourist and sightseeing events” (PTTK Statute, 2018).

The research aimed to study how the demand for qualified tourism was shaping in individual voivodeships of the country over the years 2010-2022. It was checked in five research areas (considering the number of trips and events organized by PTTK and the number of their participants) using fuzzy relations, thanks to which it is possible to present the relations between complex spaces using numbers. For example, when researching the development of mountain tourism, this concept can be divided into several simpler ones, e.g., on the one hand, mountain hiking or riding, downhill skiing, and, on the other hand, walking trips in valleys or bicycle trips. Therefore, experts can build a fuzzy relationship between the complex concept of “mountain tourism” and much “simpler” forms of trips that are easier to collect data. After creating the second relationship regarding the demand for particular forms of tourism, based on the numbers of trips or participants in various forms of tourism in the studied regions and years, it is possible, by the principles of the composition of fuzzy relationships, to create a relationship between mountain tourism and the demand for it depending on the region and year.

Qualified tourism, according to Niedziółka (2020), also called specialized tourism, concerns the active spending of free time by tourists, and its development is determined primarily by the presence of specialized values in tourist reception areas. These values enable tourists to practice various active forms of recreation, e.g., mountain hiking, cycling, horse riding, kayaking, or sailing. According to the author, the most popular specialist attractions include walking, cycling, and horse riding trails. Moreover, rivers with kayaking or lakes on which tourists sail or ski and cross-country and downhill routes are the basis for skiing. This type of tourism is considered a form of sustainable tourism, which guarantees protecting of the natural environment against mass tourism.

Materials and methods

The study on the development of demand for qualified tourism in Poland was carried out using data available in the study of the Central Statistical Office on tourism in 2022 (2023). The authors (using the expert method) distinguished five research areas: A1 – mountain tourism, A2 – tourism for advanced users, A3 – water tourism, A4 – walking, A5 – extreme tourism.

Twelve forms of tourism organized by PTTK in the individual Polish voivodeships were analyzed. They are marked in the work as follows: Q1– mountain walking, Q2 – lowland

horse riding, Q3 – mountain horse riding, Q4 – canoeing, Q5 – cycling, Q6 – motor, Q7 – skiing, Q8 – lowland walking, Q9 – sailing, Q10 – diving, Q11 – on orientation, Q12 – speleology.

Research areas (A1 –A5) are more complex than the forms of tourism indicated by PTTK and realized as trips or events (Q1-Q12), so the research uses fuzzy relations introduced by Zadeh (1965). Therefore, let X be a non-empty space and let $A \subset X$. A set A is a fuzzy set if it is a set of pairs $\{(x, \mu_A), x \in X\}$, where $\mu_A : X \rightarrow [0,1]$ is a function called a membership function to set A . It determines to what extent point x belongs to set A . If X and Y are two non-empty spaces, $R \subset X \times Y$ and $\mu_R : X \times Y \rightarrow [0,1]$ is a membership function to set R , then R is called a fuzzy relation.

Three spaces X, Y i Z and two fuzzy relations were defined in the research: $R1 \subset X \times Y$ and $R2 \subset Y \times Z$. Values of the third relation $R3 \subset X \times Z$ were calculated using the formula

$$R3(x, z) = S_{y \in Y}(T(R1(x, y), R2(y, z))), x \in X, z \in Z, \quad (1)$$

where T is one of the t -norms and S is the appropriate co-norm (Rutkowski, 2023). In the article, because of the simplicity of the calculations, the following functions were chosen:

$$T(a, b) = a \cdot b, \quad S(a, b) = a + b - a \cdot b. \quad (2)$$

Let X denote the space of research areas, so $X = \{A1, A2, \dots, A5\}$ and let Y be a space of chosen by PTTK kinds of trips and events, $Y = \{Q1, Q2, \dots, Q12\}$. Hence, $R1 \subset X \times Y$ is a fuzzy relation, where $R1(Ai, Qj)$ determines to what extent the kind of trip or event Qj connects with research area Ai ($i = 1,2, \dots, 5; j = 1,2, \dots, 12$). Table 1 presents the values of this relation.

In turn, let Z denote the set of voivodeships in Poland, $\{Z = Z1, Z2, \dots, Z16\}$. The $R2 \subset Y \times Z$ relationship shows the demand for trips measured by the number of trips/events or the number of participants in trips/events in voivodeships in selected years 2010, 2015, 2017, 2018, 2020, 2021, 2022. Because the number of trips/participants is usually a number greater than 1, so the data were normalized for each voivodeship and year. Hence, $R2(Qj, Zk)$ means the normalized number of trips/events or participants of the Qj type organized by PTTK branches in the Zk voivodeship in the analyzed year.

The authors, determined the extent to which individual types of trips/events organized by PTTK correspond to selected research areas. Research area A1 (mountain tourism) contains (to a different extent) forms of tourism performed in the mountains. Research area A2 necessitates some advanced preparation from the tour participants; however, the tours are less demanding than those in A5. Research area A3 requires water equipment, and finally, A4 contains all kinds of trips based on walking tourism. Of course, trips can belong to a few research areas. For example, the authors associated mountain tourism (research area A1) with Q1 (mountain walking), Q3 (mountain horse riding), Q4 (canoeing), Q7 (skiing), and Q12 (speleology) with different levels. For example, the authors determined that the value of the membership function of the A1

area for mountain hiking is 0.2, so $R1(A1, Q1) = 0.2$; mountain horse riding: $R1(A1, Q3) = 0.3$; canoeing: $R1(A1, Q4) = 0.3$; skiing: $R1(A1, Q7) = 0.5$; speleology: $R1(A1, Q12) = 0.3$ and the other forms of tourism on the level 0% (Table 1). Values of fuzzy relations do not need to sum up to 1.

To determine the value of demand for a given type of tourism ($A1, A2, \dots, A5$), rules (1) and (2) were used to combine fuzzy relations. Therefore, the value of $R3(Ai, Zk)$ means the amount of demand (a number in the range $[0,1]$) for the type of tourism Ai in the Zk voivodeship in the examined year.

Table 1. Values of the fuzzy relation R1, determining the relationships between research areas and forms of qualified tourism organized as part of PTTK tours or events

Research area	Form of tourism											
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
A1	0.2		0.3	0.3			0.5					0.3
A2		0.4	0.6	0.3	0.4	0.3	0.4		0.4	0.5		0.5
A3				0.4					0.4	0.4		
A4	0.3							0.5			0.5	
A5							0.3			0.5		0.4

Source: authors' estimations.

Table 2. Values of the R2 relationship between the forms of qualified tourism organized as part of PTTK tours or events and the volume of demand measured by the standardized number of tours/events in the Kujawsko-pomorskie Voivodeship in the years 2010-2022

Form of tourism	Year							
	2010	2015	2017	2018	2019	2020	2021	2022
Q1	0.041	0.027	0.031	0.023	0.024	0.027	0.025	0.026
Q2	0.009	0.006	0.014	0.01	0.002	0	0.003	0.003
Q3	0	0	0	0	0	0	0.004	0
Q4	0.092	0.073	0.09	0.081	0.073	0.083	0.046	0.069
Q5	0.242	0.22	0.261	0.291	0.334	0.312	0.273	0.311
Q6	0.027	0.045	0.022	0.024	0.033	0.027	0.028	0.024
Q7	0.008	0.01	0.01	0.014	0.005	0.008	0.001	0.002
Q8	0.432	0.412	0.332	0.325	0.28	0.434	0.433	0.373
Q9	0.018	0.041	0.023	0.026	0.021	0.017	0.009	0.013
Q10	0.013	0.01	0.009	0.002	0.007	0.006	0	0.002
Q11	0.032	0.029	0.036	0.04	0.037	0.025	0.009	0.022
Q12	0.041	0.027	0.031	0.023	0.024	0.027	0.025	0.026

Source: own study based on Tourism in 2022. Retrieved from: <https://stat.gov.pl/obszary-tematyczne/kultura-turystyka-sport/turystyka/turystyka-w-2022-roku,1,20.html> (access: 09.02.2024).

Table 2 shows the normalized numbers of trips and events on the example of the Kujawsko-pomorskie Voivodeship in chosen years. The numbers of trips and events have been normalized because the membership function values are in the range [0,1]. For example, $R_2(Q_1, KP)$ means that the share of mountain hiking trips in the number of trips and events organized by PTTK in the Kujawsko-pomorskie Voivodeship (KP) in 2010 was 4.1%.

In turn, Table 3 presents the values of the R_3 relationship between research areas and the normalized values of the number of trips and events in chosen years in the Kujawsko-pomorskie Voivodeship (KP). For example, the value of $R_3(A_1, KP) = 0,04$ means the volume of demand for mountain tourism in the above-mentioned administrative unit in 2010. The above value was determined using formulas (1) and (2):

$$R_3(A_1, KP) = 1 - (1 - R_1(A_1, Q_1) \cdot R_2(Q_1, KP)) \cdot \dots \cdot (1 - R_1(A_1, Q_{12}) \cdot R_2(Q_{12}, KP))$$

Table 3. Values of the R_3 relationship between types of tourism and the volume of demand for individual forms of tourism in the Kujawsko-pomorskie Voivodeship in the years 2010-2022

Research area	Year								
	2010	2015	2017	2018	2019	2020	2021	2022	
A1	0.04	0.032	0.038	0.036	0.029	0.035	0.021	0.027	
A2	0.147	0.145	0.155	0.162	0.173	0.165	0.137	0.156	
A3	0.049	0.049	0.048	0.043	0.04	0.042	0.022	0.033	
A4	0.238	0.224	0.189	0.185	0.162	0.233	0.226	0.202	
A5	0.009	0.008	0.008	0.005	0.005	0.006	0.001	0.002	

Source: authors' estimations.

Results and discussion

The Polish Tourist and Sightseeing Society has 290 branches throughout the country. These branches are divided into smaller organizational units (circles, clubs). The following voivodeships have the highest number of branches: Śląskie (38), Mazowieckie (34), Wielkopolskie (30), and Małopolskie (29). They are followed by Dolnośląskie (23), Kujawsko-pomorskie (20), Łódzkie (17), and Zachodniopomorskie (17), Podkarpackie (16), Lubelskie (12), and Opolskie (11). The following voivodeships have ten branches: Lubuskie, Pomorskie, Świętokrzyskie, and less than 10: Warmińsko-mazurskie (7) and Podlaskie (6).

The analyses show that the number of branch concentrations in individual voivodeships results in the number of trips/events organized there, and the number of participants follows this pattern. Therefore, the higher the position in the ranking, the larger the distinguished values. In the case of the Pomorskie Voivodeship, this relationship was different. Despite being ranked 13th in terms of active PTTK branches operating there (10), the organization of recreational activities (2,058) and people using them (52,616) was impressive, placing it second in the country, after the Śląskie Voivodeship (Figure 1).

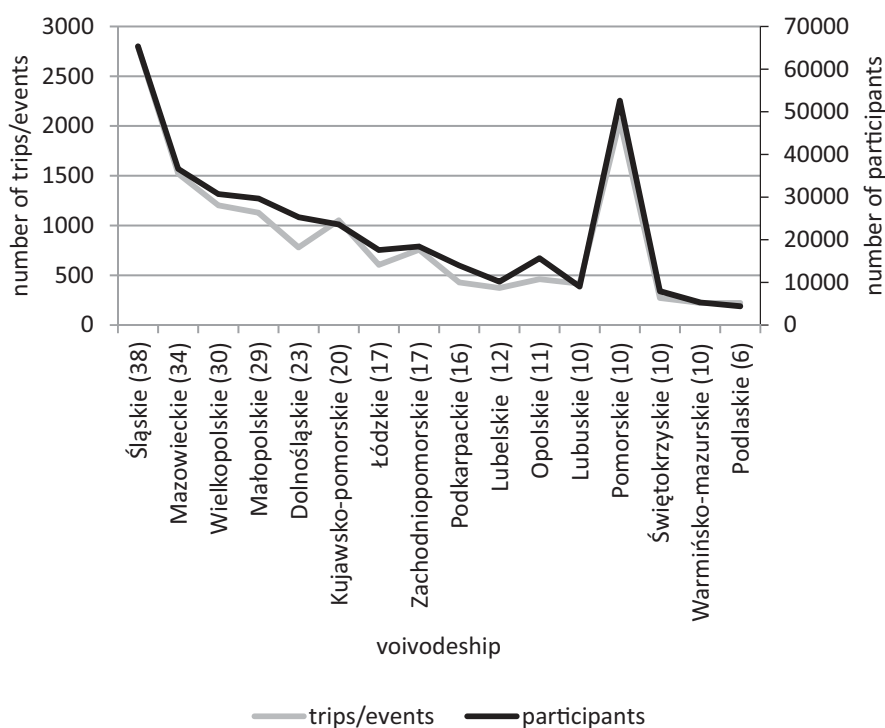


Figure 1. The number of trips/events and their participants shown according to the ranking of voivodeships in terms of PTTK branches in 2022

Source: own study.

The tourism growth in the Pomorskie Region is caused by the natural and cultural environment attractions. Interest in hiking (including walks on dunes, beaches, historic cities, and towns), advanced tourism (e.g., people practicing water sports such as windsurfing, kitesurfing, diving, and running), or activities that provide the opportunity to experience water (by swimming, sailing or sunbathing) was confirmed by the research. These research areas were the most in-demand, i.e., A4, A2 and A3. A similar relationship was noticed in the Zachodniopomorskie and Warmińsko-mazurskie Voivodeships, the latter of which can attract tourists with its diverse offers, e.g., cruises on Mazury lakes, opportunities for windsurfing, kitesurfing, wakeboarding, and skimboarding. The offer of Warmia and Mazury is famous, and an increase in participants in events/trips was observed not only in the case of A4 but also in A2.

In the Pomorze Voivodeship (Fig. 2 (right)), the numbers of organized trips/events has been increasing since 2017, mainly in the A4 area, with a slight upward trend also for its participants. There is a little interest in research areas A2 and A3, although in the case of advanced tourism, we noticed an increase in the number of people choosing this form of recreation. In the Mazurskie Region, in the COVID year 2020, participants mainly chose A2, A3 and A1, and less often A4. The organization of recreational activities by PTTK maintained an increasing level here. In turn, in the Zachodniopomorskie Voivodeship, the demand for trips/events in 2020 was targeted at all research areas (A1-A5), and an increase in participants was noticed everywhere. However, in the following years (2021-2022), we can observe upward trends only in the A4 research area.

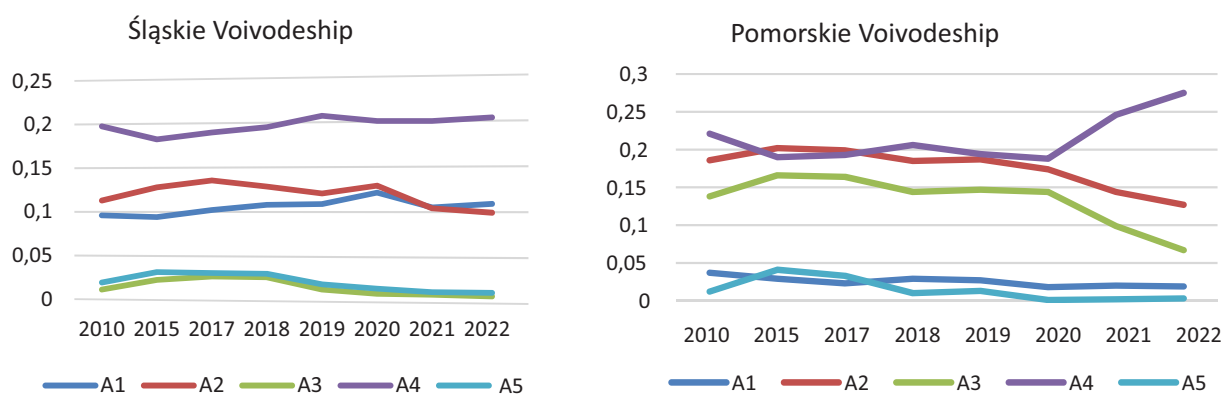


Figure 2. Comparison of the demand for types of tourism based on the number of trips/events in the Śląskie (left) and Pomorskie (right) voivodeships over the years 2010-2022

Source: own work.

The region where PTTK branches make the best use of their organizational potential in the country is Śląskie Voivodeship. According to Ruszkowski and Szczęśny (2010), the Śląskie Voivodeship (Fig. 2 (left)) has so far been perceived only in terms of industry and ecological threats. Meanwhile, using the resources of industrial and technical cultural heritage, it tries to attract tourists with an attractive (branded and comprehensive) tourist offer (e.g., Szlak Zabytków Techniki – SZT). There is a high demand for trips/events, including in designated research area A4. The proximity of the mountains favors the implementation of qualified tourism in the A2 and A1 areas. Undoubtedly, the Śląskie Voivodeship is a diverse region and rich in various types of resources, making the tourist offer here extremely attractive and multi-directional, as indicated by the Tourism Development Policy of the Śląskie Voivodeship 2030 (2022). In the A1 area, there is an upward trend in the number of activities organized and people participating in them. Many participants probably take advantage of activities outside the voivodeship due to the desire to get to know or see other attractive areas but also due to the noticeable less air pollution.

In the southern voivodeships of the country, namely Dolnośląskie, Małopolskie, Podkarpackie, and Świętokrzyskie, interest in trips/events was primarily directed at A4, A1, and A2. Only in the case of the Opolskie Voivodeship an advantage of A2 was observed. Although the Opolskie Voivodeship is the smallest administrative unit in the country, it encourages visitors to visit its picturesque areas covered with forests and waters. In particular, for tourists looking for more advanced forms of tourism, there are numerous walking and cycling trails and modern infrastructure for water skiing, wakeboarding, and kayaking. Although the highest interest has been noticed in trips/events related to the A2 research area, buyers have been more likely to choose activities from the A4 area. In 2017-2021, there was a continuing upward trend in participation in trips and their organization (especially in A1 and A5); however, a significant decline was noticed in 2022.

The increased number of trips/events in the following voivodeships Dolnośląskie, Małopolskie, Podkarpackie, and Świętokrzyskie, organized mainly within the A4 and

A1 research areas, is dictated by the proximity of mountains that are favorable for hiking. These regions are attractive considering the facilities prepared for tourists, and, therefore, they are willingly visited and popularized in the country. For example, in the Podkarpackie Voivodeship, forms of tourism from the A2 research area were chosen much less frequently, perhaps due to their seasonality. However, we see here alternating decreases and increases (small but noticeable) of participants in the A4 research area. In the Dolnośląskie Voivodeship in 2019, there was an increase in the number of participants in trips/events in A4 (it also corresponded to the number of recreational activities organized there), and then, after the announcement of the pandemic in 2020, their decrease. A similar situation was observed in the Małopolskie and Świętokrzyskie Voivodeships, with a decline in trips/events and their participants in the A4 area and a noticeable slight increase in the A1 area.

According to the conducted research, the offer from the Lubuskie and Lubelskie Voivodeships is also focused on organizing trips/events related to mountain tourism (A4, A2, and A1) – due to the proximity of the Sudetes and Carpathians, respectively. In the Lubuskie Voivodeship, recreational activities use large forested areas and water reservoirs (mainly lakes). Ecotourism is representative mainly here, like geotourism, photo safari, birdwatching, and horse tourism. The wine potential (related to vineyard cultivation) is also developing and is slowly becoming a tourist product in this region. Similarly, the developed concept of trips along the Lublin vineyard route has become an attraction for the Lublin region. The existing Lublin culinary trail and natural and cultural attractions facilitate trips/events that can be carried out, for example, within the defined A4 research area. The number of people participating in activities related to hiking in the Lublin Voivodeship in A4 since the announcement of the pandemic showed a slow but systematic increase until 2022. Interestingly, in 2020, the Lubuskie Region recorded a sharp growth in trips/events in A1, A5, and A3, as well as their participants, which could have been explained by the desire to relax from the then-prevailing pandemic situation in the country. However, in a later period (until 2022), their downward trends were already visible, and only A4 maintained an upward trend.

The highest dynamics and diversity in demand for trips and events organized in areas from A1 to A5 were observed in the eastern part of the country, mainly in the Podlaskie Voivodeship. From 2010 to 2020, the demand for hiking here has decreased. From 2015 to 2021, the share of tourism for more advanced tourists dominated, with simultaneous interest in water tourism. Since 2022, we notice a decline in interest in A4 (also A1, A2, and A3) what might be explained by the political situation in Ukraine. At the same time, the recorded declines in the organization of trips/events were related probably to the appearance of COVID-19 in Poland.

It is worth mentioning that PTTK branches from voivodeships, especially border ones, can also attract tourists from neighboring countries. The spatial aspect of tourism development in these areas is described extensively in Więckowski (2010).

Interesting observations give the research of the offers of the following voivodeships: Łódzkie, Mazurskie, Kujawsko-pomorskie, and Wielkopolskie. The study revealed that during 2020-2022, in the Kujawsko-pomorskie Voivodeship, tourism was dominated by two forms of trips and events, namely for people who prefer more advanced activities and hiking. There is a noticeable decline in organizing the latter, especially in the COVID years. Since 2019, a decrease in the number of people participating in events and trips has been observed in the A4 research area. Extreme, water and mountain tourism did not play much importance here; however, the Mazurskie Voivodeship recorded a significant increase in the organization of trips and events in the A4 research area in 2017, followed by a sharp decline, differently than in A2. This state could have been affected by the economic situation in the country because, according to Bolkowska (2018), 2017 was a favorable year for the Polish economy in many areas. During the second half of the year, the economic growth accelerated; experts estimated that the GDP indicator was close to 4.5%. The driving force for the economic growth was an increase in consumer demands, additionally influenced by the "500+" program and rising wages. Due to the above, the good economic situation in the country could result in choosing the leisure activities organized by PTTK. On the other hand, the new legal regulations introduced at that time, describing the organization of tourist events and related tourist services, could block certain activities. Three years later, the COVID year 2020 contributed to a decline in the number of people participating in events and trips in the A4 and A2 research areas in Mazurskie; however, a small but still growth was noted in A3 and A1.

To sum up, we emphasize that PTTK plays a vital role in organizing activities supporting the development of tourism and shaping demand for its various forms. The offer of trips/events includes not only those organized within the administrative borders of the voivodeship but also outside it (also outside the country). In 2022, PTTK organized 14,297 trips and events attended by 366,213 people. Since 2010, these numbers have decreased by 7,959 and 295,775, respectively. These declines can be explained by various factors, namely economic, social, and legal. The introduction on July 1, 2018, the new regulations of the "Act on Tourist Events and Related Tourist Services", introducing new solutions in the field of tourism organization, have influenced the number of trips. At the same time, it should be emphasized that society is more and more willing to organize recreation by itself; therefore, the demand for PTTK services may further decline in the upcoming years.

Conclusions

The conducted analysis allows to formulate the following conclusions:

- The research method used, with fuzzy relations, enables the analysis of complex problems based on "simpler" aspects of the social phenomena under study, namely, having data relating to various forms of tourism (mountain hiking, kayaking) makes developing analyses of more complex types (e.g., tourism for advanced users or extreme tourism) possible.

- The study provides the basis for the conclusion that the proximity of natural values influences the demand for tourist activities in the studied research areas. In the following voivodeships: Dolnośląskie, Małopolskie, Podkarpackie, and Świętokrzyskie, demand for trips/events was observed mainly in the A4 and A1. The number of people in-them participating was the highest in A4 and A1, respectively. In other voivodeships, A4 and A2 activities dominated with the number of trips/ /events and participants. Only in the case of the Opolskie Voivodeship, demand for trips/events in A2 prevailed, but there were fewer participants than in A4.
- The demand for qualified tourism may depend not only on the availability of natural resources, but also on the economic situation or the activity of PTTK branches in organizing and promoting various forms of tourism. The demand study showed that since 2020 (COVID), there has been a decline in interest in PTTK's offer, which is explained by the isolation of society. At that time, a tendency to choose trips/ /events related to mountains, water and requiring advancement was observed (e.g., in the Lubuskie, Łódzkie, Warmińsko-mazurskie, Świętokrzyskie, Wielkopolskie or Zachodniopomorskie Voivodeships), i.e., in A1, A3 and A2.
- Joint activities of PTTK branches in individual voivodeships could contribute to the promotion of qualified tourism and increase the tourist traffic and interest in a given region. Interregional cooperation ensures the experience flow between branches in organizing trips and events.
- The Śląskie Voivodeship, despite the decrease in demand for trips/events recorded over the years 2017-2022 (791 fewer were organized) and buyers of these services (a decline of 36,658 people), still holds the leading position in the country.

Literature

- Bolkowska, Z. (2018). *Gospodarka polska w 2017 roku. Buduj z Głową. Magazyn branżowy*, 1. Available online: <https://bzg.pl/poradnik/artkul/gospodarka-polska-w-2017-roku/id/15512> (access: 09.02.2024).
- Niedziółka, A. (2020). Uwarunkowania rozwoju turystyki kwalifikowanej na obszarach wiejskich. In: M. Jalinik, S. Bakier (ed.). *Obszary przyrodniczo cenne w rozwoju turystyki*. Białystok: Oficyna Wydawnicza Politechniki Białostockiej, p. 56-69. DOI: http://doi.org/10.24427/978-83-66391-25-3_4
- Polityka rozwoju turystyki województwa śląskiego 2030 (2022). Zarząd Województwa Śląskiego: Departament Turystyki Urzędu Marszałkowskiego Województwa Śląskiego, Katowice, p. 7-102.
- Ruszkowski, J. M., Szczęsny, K. (2010). Szlak zabytków techniki województwa śląskiego przykładem kreowania nowego wizerunku i marki poprzemysłowych regionów turystycznych. *Zeszyty Naukowe Uniwersytetu Szczecińskiego No 598, Ekonomiczne Problemy Usług No 53*, p. 247-257.
- Rutkowski, L. (2023). *Metody i techniki sztucznej inteligencji*. Warszawa: Wydawnictwo Naukowe PWN, p. 452.
- Statut Polskiego Towarzystwa Turystyczno-Krajoznawczego (2018). Tekst jednolity, uwzględniający zmiany uchwalone 7 kwietnia 2018 r. przez Nadzwyczajny Zjazd PTTK, p. 1-16. Available online: <https://pttk.pl/statut-pttk-wersja-2/> (access: 09.02.2024).

- Śledzińska, J. (2012). Wędruj z nami – sukces ogólnopolskich akacji PTTK. *Warsztaty Geografii Turyzmu*, 2 [13], p. 149-177. DOI: <http://dx.doi.org/10.18778/7525-713-7.10>
- Turystyka w 2022 roku (2023). Główny Urząd Statystyczny (turystyka_w_2022_tablice_dzial_V). Available online: <https://stat.gov.pl/obszary-tematyczne/kultura-turystyka-sport/turystyka/turystyka-w-2022-roku,1,20.html> (access: 09.02.2024).
- Ustawa o imprezach turystycznych i powiązanych usługach turystycznych (2018). Available online: <https://www.gov.pl/web/sport/ustawa-o-imprezach-turystycznych-i-powiazanych-uslugach-turystycznych-oraz-akty-wykonawcze-opublikowane-w-dzienniku-ustaw> (access: 10.02.2024).
- Więckowski, M. (2010). Turystyka na obszarach przygranicznych Polski. *Prace Geograficzne*, 224, p. 7-246.
- Zadeh, L. (1965). Fuzzy sets, *Information and Control*, 8, p. 338-353.