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The Application of Cluster Analysis in the Research on Central European National Park Websites

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Abstract:

Purpose: *The article aims to present and compare the features of the websites of all national parks located in Central Europe.*
Design/Methodology/Approach: *The article applies the following research methods: the descriptive method and selected descriptive statistics and cluster analysis methods.*
Findings: *The research hypothesis which was adopted is that the national parks in Central European countries, even though they do have a common tradition, and the goals of their functioning seem to be coinciding with the guidelines of the International Union for Conservation of Nature, the national park websites differ in terms of the scope of the information they provide. The scope of the information provided by the national park websites justifies the division into website classes, which enable to determine the thematic scope, targeting a specific audience, and the role of a national park in a given region.*
Practical Implications: *The research results may be applied i.a. by the management of protected areas (e.g., national parks, landscape parks) for the assessment of websites, as well as for the analysis and verification of the spectrum of information which is made available on these websites.*
Originality/Value: *Applying cluster analysis methods for the assessment of websites. A comparison of the level of national park website development. A possibility of comparing the results with other national park websites around the world.*

Keywords: *National park, nature protection, tourism, websites, websites assessing criteria, Central European countries.*

JEL Classification: *Q56, L86, Q01, C38.*

Paper type: *Study research.*

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1. Introduction

Protected areas benefit the natural environment and also provide significant economic and social benefits. Many protected areas were created worldwide, especially in the 20th century (UNEP-WCMC, IUCN, and NGS, 2018). What proves the scale of this phenomenon is the data of the world database of protected areas, which, as per the information published in January 2021, includes 258,000 protected areas in 245 countries and territories (UNEP-WCMC, 2021). As the protected areas were created in varying socio-economic conditions and different periods, there was a great diversity of them, both in terms of the terminology and of the lack of common standards for their functioning. One of the global initiatives handling the issues related to the protection of nature is the International Union for Conservation of Nature (IUCN), established in 1948. The IUCN World Commission on Protected Areas (WCPA) defined the categories of protected areas. One of the protected area categories distinguished by IUCN is a national park.

As per IUCN, *national parks* are defined in the context of three primary areas of responsibility - distinguishing features. First, "to protect large-scale ecological processes, along with the complement of species and ecosystems characteristic of the area". Second "to provide a foundation for environmentally and culturally compatible, spiritual, scientific, educational, recreational, and visitor opportunities", and third, "to contribute to local economies through tourism" (Dudley, 2008).

Ever since the creation of the first contemporary protected area, i.e., the Yellowstone National Park in 1872, there is an ongoing debate regarding creating natural parks, implementing, and the mutual relations between the areas mentioned above of responsibility. The matters regarding the protection and preservation of the nature of national parks are juxtaposed with recreation and giving access to their areas to tourists (Hirst, 1997).

Organizations, including national parks, communicate with their surroundings, create their image, e.g., via their official websites. The article aims to present the features of the websites of all national parks located in Central European countries and discover the connections between the variables characterizing the said websites. A picture of the similarities of the websites of European national parks was obtained based on the conducted analysis.

2. Literature Review

Due to the uniqueness of the features, manifesting in elusiveness and the durability of information and data, the Internet is the subject of the ongoing research within the scope of its multidimensionality and multithreading, generally referred to as "web studies." The peculiarity of websites also results from the fact that, in terms of research, they can be treated in a two-fold manner – as a research tool or as an object of study. The research issues within the sphere of the Internet most often regard the following areas:

- the content transmitted via the websites, including the linguistic research on the new language variety, referred to as the "cybertext" (Grzenia, 2006; Dytman-Stasieńko, and Stasienko, 2012).
- the page structure (information architecture), i.e., the text, the visualization, the sound (Perdue, 2002; Loureiro, 2014; Park and Huang, 2017).
- the usability of websites related to the creation of a website, and which most often regard to the view statistics of a given website (Dytman-Stasieńko and Stasieńko, 2008; Chang and Chen, 2008; Wen, 2009; 2012; Wang *et al.*, 2015).
- the www users (Wu *et al.*, 2019; Zhang *et al.*, 2020).

The literature on the subject is abundant in evaluating the service sector websites supporting all forms of operation. Many of them were focusing on websites:

- tourist websites (Chung and Law, 2003; Hu, 2009; Ostovare and Shahraki, 2019; Park and Huang, 2017) where there was an evaluation of the quality of hotel booking services;
- sports and recreation websites (Hącia and Łapko, 2018), where, by using the valorization method, an evaluation of the Baltic seaport websites was made;
- government websites (Lee-Geiller and Lee, 2019; Verkijika and De Wet, 2018), to develop a model making it possible for websites to live up to their promises of ease, efficiency, and legibility of the communication with the citizens;
- educational websites (Liu, Liu, Hwang, 2011, Acosta-Vargas, González, Luján-Mora, 2020), where a method allowing to improve online educational games for the visually impaired was presented;
- websites of cultural facilities, including museums (Kabassi, 2017), where the unique aspects of the application of information-communication technologies in museums, such as the application of handheld devices and virtual tours, have been evaluated;
- medical services websites (Randeree and Rao, 2004; Owczarek and Zdonek, 2014), where an attempt has been made at defining the areas and the criteria regarding the quality of hospital websites, especially in terms of the quality of the information, the accessibility, and the functionality of such websites. Defining the quality of information is just as tricky as defining information itself. This depends on the field of knowledge and the research area within which this quality is considered. The selection of quality attributes depends on the intended use of the information itself and its potential user (Kolbusz, 1993; Gretzel *et al.*, 2000). Information quality is a subjective concept, and it depends on a recipient's needs and expectations. As it was noted, there is no uniform list of features determining good quality information in the literature (Abdallah, 1996).

An expanded website evaluation model, mainly based on the extended opinions of experts and survey data, was used to evaluate Taiwanese national park websites (Tsai, Chou and Lai, 2010). A limitation of this method is the dynamic character of the

websites, resulting in varied research results depending on when it has been conducted - the subjectivity of the experts' opinions in the second limitation.

A different approach is the evaluation of websites within the scope of the evaluation of the functional stages of the development of e-administration (Layne and Lee, 2001; Rao, Metts and Mora-Monge, 2003), which was used for the evaluation of Greek (Koliouska *et al.*, 2015) and Polish (Osóch and Zbaraszewski, 2020) national parks. The method consists of separating the e-service implementation stages (the presence, the interaction, the transaction, the transformation), entailing higher costs of operating the website, higher technological requirements, and greater complexity. Having reviewed the literature, one can assume that there is no single, commonly accepted method or technique for evaluating websites.

3. Research Methodology and Data

The following article contains an attempt at implementing the cluster analysis of the attributes of websites (Table 1) for classifying websites by detecting the connections between the objects (the websites of national parks) with objects belonging to the same group. The proper research consisting of examining 61 official websites of national parks in Central Europe (Table 2) in the scope of their 33 attributes has been preceded by initial qualitative research of protected area websites, including national parks. The goal of the initial research was to identify the existing attributes of the websites within these areas. The 33 attributes of the websites of Central European national parks (Table 1) are the basis for further research. The entire research was conducted in October-November 2020.

Table 1. *The attributes of national park websites and their classification*

Sequence number of the	Feature	Class
2	frequently asked questions (FAQ)	Class I
4	calendar	
6	articles (at least 5 articles >5.000 letters)	
11	audio material	
13	online questionnaire	
14	online communication form	
15	actual weather forecast	
18	event calendar app	
20	newsletter	
21	RSS	
23	online ticket purchase	
24	possibility of booking e.g. a visit, stay	
26	online shop	
28	live webcam	
29	sharing articles on social media	
31	forum	
32	the ability to download mobile applications	
33	virtual walk around the park, museum, attractions, etc.	
3	site map	

5	information on educational and recreational activities in the park (articles or mentions about the NP area)	Class II
7	up-to-date information (articles not older than 30 days)	
8	two or more languages	
9	information about activity in the park region (articles or notes about the	
10	NP map	
12	search engine on the site	
16	links to other public institutions, local government, ministries, etc.	
17	files to download	
25	security (https://)	
30	profile in social media (facebook ONLY)	
19	references / links in articles to other sites	Class III
22	advertising of companies operating in the park's surroundings	
27	links to service companies operating in the vicinity of the park (e.g. accommodation facilities, rentals, gastronomy)	

Source: *Own elaboration.*

The next stage of the research involved analyzing the presence or lack of the identified attributes on the websites. Thus, for each of the websites, an attribute was given a value of 1 if it was present and 0 if it was not present.

The resulting diagram (Figure 1) was made based on the transformation of the matrix containing the data, which was the subject of the analysis, i.e., the attributes of the websites of Central European national parks. The operating principle of this method is grouping the elements into relatively uniform classes. The grouping basis is a set of similar or standard features determined at the beginning of the analysis, referred to as "the similarity between the elements." As far as our data matrix is concerned, these are websites of the parks with the largest, equal number of attributes. These are collected into clusters of elements that differ more and more (Murtagh, 1984; Lewis, 2001).

All the objects from the initial set are combined in the final stage. If clusters of similar objects are visible in the graph, such a structure will be reflected in the hierarchical tree, taking the form of separate branches (Jobling *et al.*, 2004). As a result of the statistical analysis, three apparent heterogeneous clusters, simultaneously being homogenous within the group, were created. The percentage discrepancy measure was used for the agglomeration of the data from the matrix into clusters. The "Correspondence Analysis" module in Statistica 13.1. the package was used for handling the calculations. An additional form of presenting the researched group was the application of a column graph. With the assistance of rectangles in a two-dimensional Cartesian system, the quantitative (measurable) data was presented, and it showed the degree of the implementation of the classes on national park websites following the researched countries.

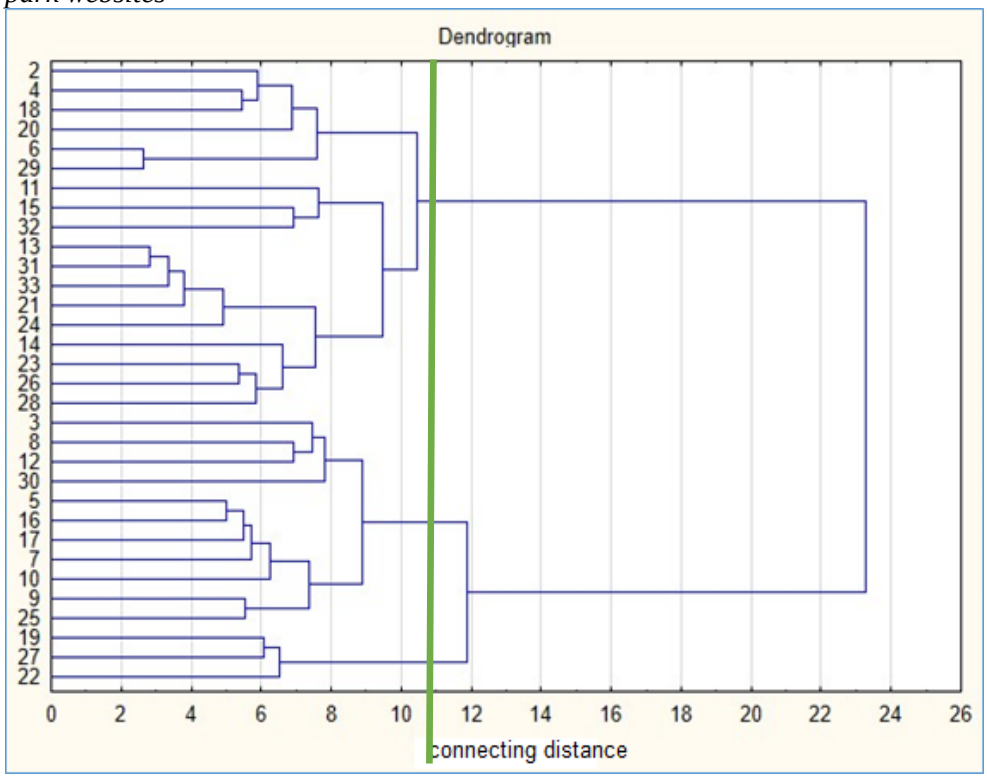
4. Research Results

Out of all the 33 analyzed features, only one, however, a basic one, being the contact information, was present on all of the researched national park websites. Taking into

consideration the 61 websites of Central European national parks, the most significant implementation degree regarded features such as information about the educational and recreational activities within the parking area (90.2%), information about the activities in the region of the park (85.3%), a map of the national park (82%), links to other public institutions, or a local government (82%). The features which were present to the slightest degree in the researched websites were a forum (1.6%) and an online survey (3.3%). There was a relatively low degree of a virtual walk around the park, a museum, the attractions (5%), and RSS (6.6%).

The conducted research, because of which the regularities of the features of websites of Central European national parks were identified, allowed to distinguish the classes (Figure 1). Based on the classes obtained, one may indicate the relations between the categories of the analyzed variables, which made it possible to identify the regularities regarding the attributes of the websites of the analyzed national parks. Simultaneously being homogenous within the group, three heterogeneous clusters were created because of the statistical analysis.

Figure 1. *The diagram of the hierarchical classification of the attributes of national park websites*



Source: *Own elaboration.*

The regularities which have been identified can be classified into three classes:

Class I: this one regards the national park websites, which are oriented on presenting and promoting their advantages, which encourage the user to directly or virtually visit the area of the park, and thus above all, "provide a foundation for environmentally and culturally compatible, spiritual, scientific, educational, recreational, and visitor opportunities," which manifests itself in publishing the following on the websites: answers to the frequently asked questions – FAQ (2), the possibility of browsing the calendar of the events taking place in the park (4), and simultaneously using an application related to this calendar (18). Allowing a web user to receive a newsletter (20), get familiar with the articles (6), as well as sharing them on social media (29).

A web user visiting a national park website can have a virtual trip to the park owing to the possibility of getting familiar with the published audiovisual materials and gets a chance of taking a virtual walk around the park, museum, or its attractions (33), or remotely find out what the current weather is and what the forecast is too (15). They also have a chance to download mobile apps, e.g., guides, maps (32), or even, owing to a link published on the park's website sending you to a web camera, of viewing broadcasts live (28). The elements which encourage to visit the park are the possibility of purchasing tickets online (23), making a reservation of, e.g., a visit, a stay (24), as well as the possibility of shopping at the online store (26). The openness of national park management to the visitors is completed by features such as an online survey (13), a forum (31), RSS (21), and a form for online communication (14).

Class II: includes national park websites which, owing to their attributes, are focused on presenting and promoting the advantages of the national park region, presenting a wide range of events, in particular of the region predestined for educational and recreational activities (5), which is moreover friendly to visitors speaking other languages, which is manifested in publishing content in two or more languages (8). Moreover, this class is characterized by current, up-to-date information published on the park websites, understood as information not older than 30 days (7), and informs about the activities within the parking area, e.g., in the form of articles or mentions (9). A search engine is a part of the website (12), making it possible to reach a broad audience with your message.

These are the websites of the parks focusing on actively cooperating with the local community. The access to the message gets multiplied owing to the social media link posted on the website (30), but there are also links to other public institutions, to the local government (16). The whole picture is completed by posting a map of the national park on the website (10), as well as posting a map of the website (3) with the possibility of downloading various files (17) in a safe environment with a Secure Socket Layer - HTTPS protocol (25).

Class III: includes those website attributes which particularly emphasize the relations of the protected area with the companies functioning within the vicinity of this area, which is proved by the fact that this class encompasses attributes such as: posting on

the protected area websites links to service enterprises operating near the park, e.g., accommodation facilities, rentals, catering facilities (27), and even advertising materials of the companies operating near the park (22), which is additionally made stronger by posting links to other websites in the articles on national park websites (19).

The next stage of the research includes an analysis of the websites of the analyzed parks in the context of the degree of the implementation of the attributes in the distinguished classes (Table 2).

Table 2. *The level of the implementation of the distinguished attribute classes on national park websites.*

National Park	Official website	% realization of Class I features	% realization of Class II features	% realization of Class III features
Hortobágy Park	http://www.hnp.hu/	27,8%	81,8%	100%
Kiskunsági Park	https://www.knp.hu/	0%	63,6%	33,3%
Bükki Nemzeti	https://www.bnpi.hu/	27,8%	90,9%	100%
Aggteleki Nemzeti Park	https://anp.hu/	33,3%	90,9%	100%
Fertő-Hanság Nemzeti	https://www.ferto-hansag.hu/	38,9%	100%	100%
Duna-Dráva Nemzeti	https://www.ddnp.hu/	5,6%	72,7%	100%
Körös-Maros Nemzeti	http://www.kmnp.hu/	33,3%	54,5%	0%
Balaton-felvidéki	https://www.bfnp.hu/	33,3%	100%	66,7%
Duna-Ipoly Nemzeti Park	https://www.dunaipoly.hu/	55,6%	90,9%	66,7%
Őrségi Nemzeti Park	https://orseginemzetipark.hu/	38,9%	90,9%	33,3%
Krkonošský národní park	https://www.krnap.cz/	55,6%	100%	33,3%
Národní park Podyjí	https://www.nppodyji.cz/	38,9%	100%	33,3%
Národní park České	https://www.npcs.cz/	33,3%	100%	100%
Národní park Šumava	https://www.npsumava.cz/	38,9%	100%	100%
Triglavski Narodni Park	https://www.tnp.si	27,8%	81,8%	100%
Schweizerischer	https://www.nationalpark.ch/d	44,4%	100%	100%
Nationalpark Hohe	https://hohetauern.at/	22,2%	90,9%	66,7%
Nationalpark Neusiedler	http://www.nationalpark-	0%	54,5%	33,3%
Nationalpark Donau-	https://www.donauauen.at	16,7%	81,8%	66,7%
Nationalpark Kalkalpen	https://www.kalkalpen.at/	0%	54,5%	33,3%
Nationalpark Thayatal	https://www.np-thayatal.at/	38,9%	81,8%	66,7%
Nationalpark Gesäuse	https://www.nationalpark.co.at	33,3%	63,6%	0%
Babiogórski Park	http://www.bgpn.pl/	16,7%	72,7%	0%
Białowieski Park	https://www.bpn.com.pl/	0%	72,7%	0%
Biebrzański Park	https://www.biebrza.org.pl/	22,2%	100%	33,3%
Bieszczadzki Park	https://www.bdpn.pl/	27,8%	81,8%	0%
Park Narodowy Bory	https://www.pnbt.com.pl/	11,1%	81,8%	0%

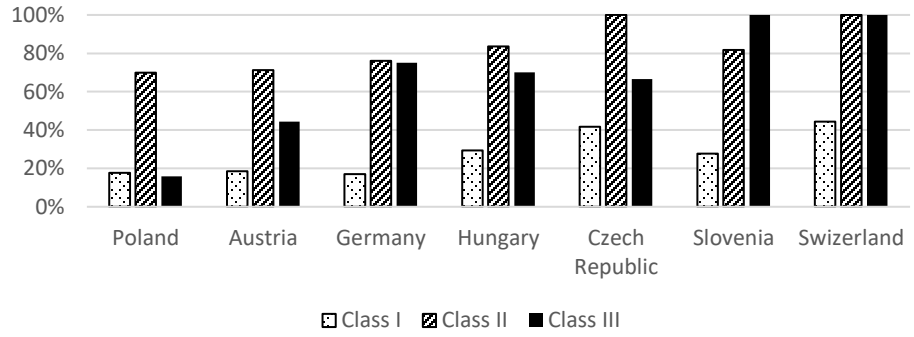
Drawieński Park	https://dpn.pl/	27,8%	63,6%	0%
Gorczański Park	https://www.gorczanskipark.pl	33,3%	72,7%	0%
Gór Stołowych Park	https://www.pngs.com.pl/	16,7%	90,9%	0%
Kampinoski Park	https://www.kampinoski-	5,6%	90,9%	0%
Karkonoski Park	https://kpnmab.pl/	33,3%	81,8%	33,3%
Magurski Park Narodowy	http://www.magurskipn.pl/	11,1%	54,5%	66,7%
Narwiański Park	https://www.npn.pl/	11,1%	54,5%	0%
Ojcowski Park Narodowy	http://www.ojcowskiparknaro	16,7%	54,5%	0%
Pieniński Park Narodowy	https://www.pieninypn.pl/	27,8%	72,7%	66,7%
Poleski Park Narodowy	http://www.poleskipn.pl/	22,2%	72,7%	33,3%
Roztoczański Park	http://roztoczanskipn.pl/	22,2%	72,7%	0%
Słowiński Park Narodowy	http://slowinski.parknarodowy	0%	27,3%	66,7%
Świętokrzyski Park	https://www.swietokrzyskipn.	16,7%	72,7%	33,3%
Tatrzański Park	https://tpn.pl/	33,3%	72,7%	33,3%
Park Narodowy Ujście	https://www.pnujsciewarty.go	22,2%	90,9%	0%
Wielkopolski Park	http://www.wielkopolskipn.pl/	5,6%	27,3%	0%
Wigierski Park Narodowy	http://www.wigry.org.pl/	16,7%	72,7%	0%
Woliński Park Narodowy	http://www.wolinpn.pl/	5,6%	54,5%	0%
Nationalpark Bayerischer Wald	https://www.nationalpark-bayerischer-wald.bayern.de/	33,3%	100%	66,7%
Nationalpark Berchtesgaden	https://www.nationalpark-berchtesgaden.bayern.de/index	22,2%	90,9%	100%
Nationalpark Schleswig-Holsteinisches	https://www.nationalpark-wattenmeer.de/sh	0%	72,7%	100%
Nationalpark Niedersächsisches	https://www.nationalpark-wattenmeer.de/nds	16,7%	45,5%	100%
Nationalpark Hamburgisches	https://www.nationalpark-wattenmeer.de/hh	5,6%	45,5%	66,7%
Nationalpark Jasmund	http://www.nationalpark-	5,6%	54,5%	33,3%
Müritz-Nationalpark	http://www.mueritz-	11,1%	81,8%	66,7%
Nationalpark Sächsische Schweiz	https://www.nationalpark-saechsische-schweiz.de/	27,8%	81,8%	100%
Nationalpark Unteres Odertal	https://www.nationalpark-unteres-odertal.eu/de/	27,8%	81,8%	100%
Nationalpark Vorpommersche Boddenlandschaft	http://www.nationalpark-vorpommersche-boddenlandschaft.de/	0%	72,7%	100%
Nationalpark Hainich	https://www.nationalpark-	27,8%	72,7%	66,7%
Nationalpark Eifel	https://www.nationalpark-	22,2%	90,9%	100%
Nationalpark Kellerwald-Edersee	https://www.nationalpark-kellerwald-edersee.de/	16,7%	81,8%	33,3%

Nationalpark Harz	https://www.nationalpark-harz.de/de/startseite/	16,7%	100%	33,3%
Nationalpark Schwarzwald	https://www.nationalpark-schwarzwald.de/	22,2%	90,9%	33,3%
Nationalpark Hunsrück-Hochwald	https://www.nationalpark-hunsrueck-hochwald.de/	16,7%	54,5%	100%

Source: *Own elaboration.*

In class I, meaning websites focusing on presenting and promoting their advantages and offer, these encourage to visit the parking area directly or virtually, with the highest share of fulfilling the attributes characteristic of this class, as 55.6% of the share was recorded in the websites of two national parks: the Hungarian Duna-Ipoly Nemzeti Park and the Czech Krkonošský Národní Park. However, the absence of any of the attributes of this class was noted in as many as 7 national park websites, this including: two German ones (Nationalpark Schleswig-Holsteinisches Wattenmeer and Nationalpark Vorpommersche Boddenlandschaft), two Polish ones (Białowieski Park Narodowy, Słowiński Park Narodowy), two Austrian ones (Nationalpark Neusiedlersee-Seewinkel and Nationalpark Kalkalpen), and one Hungarian one (Kiskunsági Nemzeti Park).

Figure 1. *The level of the implementation of the features in the distinguished classes by the national park websites by country*



Source: *Own elaboration.*

Class II encompasses the national park websites, which, owing to their features, are focused on presenting, and promoting the advantages of the national park alone and, above all, of the entire region, one of the elements of the national park area. This class is represented by the most significant number of the analyzed national park websites. As many as 32 of the websites had over 81.8% of the implemented attributes. This website group consists of, 7 Hungarian parks, 4 Czech parks, 3 German parks, 7 Polish parks, and 9 German parks. 10 national park websites can boast the full implementation of the attributes (2 Hungarian ones, 4 Czech ones, 1 Swiss one, 2 German ones, and 1 Polish one). The lowest value of the implemented attributes is 27.3% and regards only 1 Polish national park website.

In class III, one may notice the largest disproportions in the share of the feature implementation, which is probably imposed by the smallest number of the attributes which have been analyzed and which are included in this cluster. Seventeen park websites are characterized by a full 100% implementation of the features. The exact number of park websites indicated a zero-feature implementation share.

Based on the allotment as per the country, the lowest disproportion in the degree of implementing the features is indicated by a Swiss national park website. Both class II and class III are implemented 100% here. The Czech and Slovenian national park websites also show a total 100% share of class II and III implementation. The most excellent dispersion of the implemented features appears on Polish and Austrian websites, reaching no more than 70%. The German national park websites implement class II and III at a similar level - however, they do not exceed 80%.

5. Conclusion

Taking into consideration the research goal, the research hypothesis which was adopted is that the national parks in Central European countries, even though they do have a common tradition, and the goals of their functioning seem to be coinciding with the guidelines of the International Union for Conservation of Nature, the national park websites differ in terms of the scope of the information they provide.

The conducted research and the application of the cluster analysis method, particularly the possibility of creating a hierarchical classification on this basis, allowed to determine the relations between the attributes of national park websites. During the conducted analysis, it was revealed that three national website classes that were distinguished based on the existing attributes presented the thematic scope and that the websites were targeting a specific recipient group. Based on the conducted research, especially the implementation of the identified attributes, it was possible to establish the advantages and disadvantages of the functioning national park websites.

The conducted research proves that national park websites show similarity within the country in which they are located. Thus, the class I attributes which predestine national park websites to refer to them as focusing on the presentation and promoting their advantages to the greatest extent were implemented by the parks in Switzerland (44.4%), the Czech Republic (41.7%), and in Hungary (29.5%).

Class II encompasses the national park websites, which, owing to their attributes, are focused on presenting, and promoting the advantages of the entire national park region. This approach is primarily characteristic of the national parks in Switzerland (100%), the Czech Republic (100%), and Hungary (83.6%).

Class III attributes, which manifested themselves primarily on the national park websites in Switzerland (100%), Slovenia (100%), and Germany (75%), emphasize the relations of a protected area with the companies operating in the surroundings of the national park. It seems that national park websites, as a commonly available

source of information regarding an attractive region with numerous functions, i.e., educational, recreational, tourist, or research one, will be the subject of further thorough research.

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