AHP & PROMETHEE II FOR THE EVALUATION OF WEBSITES OF MEDITERRANEAN PROTECTED AREAS' MANAGING BOARDS

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ABSTRACT

The role of national parks is multidimensional, diverse, and important, and maybe supported by a good website. However, a website should be evaluated to ensure that the goals of a national park are met. For this reason, an evaluation of the websites of Protected Areas Managing Boards in two Mediterranean countries, Greece and Italy, has been implemented using Multi-Criteria Decision Making models. The paper presents the effective combination of AHP with PROMETHEE II for evaluating environmental websites that contain content about the national parks. The implementation of the evaluation experiment reveals the effectiveness of the combination of AHP with PROMETHEE II in environmental website evaluation and presents the electronic presence of national parks in two Mediterranean countries. The results of PROMETHEE II are combined with another multi-criteria decision-making model called Simple Additive Weighting, which has been effectively used in the past for the evaluation of environmental websites.

Keywords: AHP; PROMETHEE II; Website evaluation.

INTRODUCTION

Mediterranean countries are well known for their beautiful physical and cultural environment. Several researchers (Romano et al., 2021) have highlighted the economic and social advantages that the National Parks (NPs) and Protected Areas (PAs), in general, offer in a country. Therefore, several countries have founded Management Bodies of Protected Areas (MBPAs). These bodies constitute an important official tool for the management and the protection of natural and cultural heritage (Papageorgiou & Kassioumis, 2005). Indeed, the role of MBPAs in NPs is multidimensional, diverse, and important, and may be supported by a good website. A website can shape the image of the MBPA and may produce a virtual experience for visitors, promote the environmental value of its area, and promote the area as an ecotouristic destination. Reviews of ecotourism literature in national parks mainly focus on political, social, cultural, and economic factors that affect ecotourism in a NP (Rhama, 2020). However, there are no studies focusing on the websites as powerful tools for promoting the ecotouristic value of NPs.

The importance of the websites for promoting environmental information is indisputable and has been mentioned by several researchers (Głąbiński, 2015; Rusielik & Zbareszewski, 2014; Su et al., 2016; Thapa & Lee, 2017; Podawca & Pawlat-Zawrzykraj, 2018). A website being able to meet the multi-dimentional goals of a MBPA is not easy. Therefore, an evaluation experiment

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should be implemented. Evaluation is an important phase of a website's life-cycle and the research areas of software engineering and human-computer interaction have paid a lot of attention in different aspects of this phase.

Evaluations are usually complicated procedures that focus on the examination of several different criteria. As a result, different Multi-Criteria Decision Making (MCDM) models have been used for evaluating websites in different domains (Kabassi et al., 2020a; Kabassi et al., 2020b; Kabassi et al., 2019a) as well as websites of environmental content (Kabassi & Martinis, 2020; Kabassi et al., 2019b). Previous work on the evaluation of websites of environmental content (Martinis et al., 2018, Kabassi & Martinis, 2020; Kabassi et al., 2019b) has revealed the criteria and the weights of importance of these criteria using the Analytic Hierarchy Process (AHP) (Saaty, 1980; Saaty & Hu, 1998). In these evaluation experiments, AHP has been implemented solely or combined with different theories such as VIKOR (Vlsekriterijumska Optimizacija I KOmpromisno Resenje) (Opricovic, 1998; Opricovic & Tzeng, 2004; 2007).

In this paper, we present how AHP (Analytic Hierarchy Process) (Saaty, 1980) can be effectively combined with PROMETHEE II (Preference Ranking Organization METHod for Enrichment Evaluations II) (Brans, 1982; Brans & Vincke, 1985) in order to evaluate the websites of MBPA. The criteria used in the evaluation experiment have been selected during previous work and have been used again for the evaluation of websites of environmental content (Martinis et al., 2018; Kabassi et al., 2019b; Kabassi & Martinis, 2020).

The choice of AHP over other MCDM theories is easily made as it presents a formal way of quantifying the qualitative criteria of the alternatives and in this way removes the subjectivity of the result (Tiwari, 2006). Nevertheless, the method has a rather complex procedure of pairwise comparison of the alternatives, which is not preferred in cases where the number of alternatives is very high. Therefore, AHP was selected to be combined with PROMETHEE II. More specifically, PROMETHEE method is software-driven, user-friendly, provides a direct interpretation of parameters, and analyzes the sensitivity of results. PROMETHEE II is a superior method for ranking and selecting from among a finite set of alternative actions while considering several conflicting criteria (Abedi et al., 2012). More specifically, PROMETHEE II outranking method was adopted for this specific evaluation experiment to aggregate the opinions of various decision-makers that comment on websites of environmental content. In view of the above, we show how AHP can be used for calculating the weights of criteria and then combined with PROMETHEE II for evaluating and comparing the websites.

The combination of AHP with PROMETHEE II has been effectively used in different domains (Vahid et al., 2014; Goswami, 2020; Singh et al., 2020) but never before for the evaluation of websites. The scope of this paper is twofold: 1) checking the effectiveness of the combination of AHP with PROMETHEE II for evaluating websites of environmental content and 2) evaluating the electronic presence of MBPAs in two different Mediterranean countries. In order to check the effectiveness of PROMETHEE II for the evaluation of websites of MPBA, we compared the results of PROMETHEE II with Simple Additive Weighting (SAW) (Hwang & Yoon, 1980), which has been used successfully before for the evaluation of environmental websites (Kabassi et al., 2020b).

PROTECTED AREAS IN MEDITERRANEAN AND THE WORLD

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A protected area is a clearly defined geographical space, recognized, dedicated, and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values (Dudley, 2008,). According to scientists at IUCN and UN Environment's World Conservation Monitoring Centre, there are 239.729 terrestrial protected areas today, covering almost 20 million square kilometers or 15.38% of the world's land, 18.165 marine protected, corresponding to 7.65% of the marine space. (IUCN, 2018; Steven et al., 2013). In the European Union (EU) the Natura 2000 network currently covers more than 27,000 areas covering a total area of around 1.150.000 square kilometers of land and sea areas. The area covered by the Natura 2000 network represents about 18% of the total. The national land cover of the Natura 2000 network ranges from around 9% to around 38%, depending on the country (EU, 2021).

Protected areas are the basis for the conservation of biodiversity while contributing to the improvement of the living standard of the local communities. In recent decades, with the contribution of collective decisions of public bodies and local communities, protected areas have rapid growth around the world (Watson et al., 2014).

Protected areas today have a very important role to play. They were created not only to protect and preserve natural and cultural heritage, terrestrial and marine ecosystems, and endangered flora and fauna but also to contribute to sustainable development, the revitalization of local communities, and the national economy through the development of mild alternatives tourist activities (Robalino & Villalobos-Fiatt, 2015; Saviano et al., 2018; Tomaskinova et al., 2019). Furthermore, protected areas can contribute to reducing climate change and enhance ecosystem services for the environment and society. It is estimated that the global network of protected areas stores at least 15% of the terrestrial carbon.

Mediterranean climates are one of the rarest of the Earth's thirteen terrestrial biomes, covering only 2% of the Earth's surface (Cox & Underwood, 2011). The Mediterranean regions having a mild climate with cool wet winters and hot dry summers, host millions of people and many of the world's largest metropolitan areas, resulting in the constant burden and degradation of terrestrial and marine ecosystems. Although Mediterranean ecosystems are considered very important for biodiversity and are widely recognized as a global conservation priority, the protected areas in the Mediterranean climate formally cover only 4.3% of the whole area (Underwood et al., 2009), which is less than half of the globally accepted ecosystem protection target. So the degradation of the protected areas and the ecosystems in the Mediterranean is quite obvious.

In recent decades, tourism has been a significant source of income and employment in the Mediterranean protected areas, while at the same time having a significant negative impact on nature and biodiversity (Monti et al., 2018). Many species in the Mediterranean region, especially those with significant habitat requirements, come into conflict with humans for space and resources (Buckley et al., 2016). A few years ago, ecotourism emerged, a mildly sustainable activity that combines recreation with respect for the environment and the principles of sustainable development. Today, protected areas are called upon to play an important role in revitalizing local economies, planning sustainable activities, while respecting the natural and cultural heritage of each place (Yergeau, 2020).

It is generally accepted that ecotourism is the best tourism activity for PAs. However, it is estimated that ecotourism is more than a touristic activity; it is a different way of life that satisfies the need of man to be close to nature. In practice, it is a comprehensive process of sustainable

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development. It is argued that ecotourism is synonymous with "integrated tourism" which "… is part of a comprehensive system that includes the environment, the community, industry, the economy, and the legal environment. Its design must be democratic and combined with relevant design procedures. Its design will help tourism and will contribute to the prosperity of a community "(Diamantis, 2004).

The main tool for succeeding in effective communication, boosting ecotourism, and provide environmental awareness is the Internet. The importance of the websites for creating perception is significant because it influences the visitors, informs them of the characteristics of a PA, the landscape, the culture, the gastronomy, and all the different parameters which constitute its profile. This virtual approach decides to visit an area easier and part of the visit may be implemented through the Internet (Doolin et al., 2002). As a result, the websites of Greek and Italian National Parks were collected. A1-A26 are the websites of Greek MBPAs and B1-B23 are the websites of Italian MBPA. All websites are presented in Table 1 and are evaluated in order to reveal if their electronic presence of Mediterranean MBPAs is satisfactory and which MBPAs have the best electronic image.

TABLE 1
THE WEBSITES OF NPS IN GREECE AND ITALY

No	MBPA	URL
A1	National Park of Schinias-Marathon	http://www.npschiniasmarathon.gr/index.php/gr/
A2	National Park of Koronia and Volvi Lakes	http://www.foreaskv.gr/
A3	Northern Pindos National Park (of Vikos gorge-Aoös river and Pindos)	http://pindosnationalpark.gr/
A4	Messolonghi Lagoon National Park	http://www.fdlmes.gr/
A5	Kerkini Lake National Park	http://kerkini.gr/
A6	Dadia-Lefkimi-Soufli Forest National Park	http://dadia-np.gr/
A7	Evros Delta National Park	http://www.evros-delta.gr/gr/2012-08-02-08-44-48
A8	Amvrakikos Wetlands National Park	http://www.amvrakikos.eu/
A9	National Park of Eastern Macedonia and Thrace (Nestos Delta, Vistonida and Ismarida lake)	http://www.fd-nestosvistonis.gr/
A10	Rodopi Mountain Range National Park	http://www.fdor.gr/index.php/el/
A11	Axios Delta National Park	http://axiosdelta.gr/
A12	Prespa National Park	http://www.junex.gr/index.php/el/ethniko-parko-prespon
A13	Chelmos-Vouraikos National Park	http://www.fdchelmos.gr/el/
A14	National Marine Park of Zakynthos	https://www.nmp-zak.org/
A15	National Marine Park of Alonissos and Northern Sporades	http://alonissos-park.gr/
A16	Protected Nature Area of Kalamas and Acheron Rivers	http://www.kalamas-acherontas.gr/perioxes-eythinis/ekvoles-stena-aheronta
A17	Kotychi and Strofylia Wetlands National Park	http://www.strofylianationalpark.gr/index.php/el/
A18	National Park of Tzoumerka, Peristeri & Arachthos Gorge	http://www.tzoumerka-park.gr/
A19	Pamvotis Lake Protected Area	http://www.lakepamvotis.gr/

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A20	Olympus National Park	http://www.olympusfd.gr/
A21	Protected Nature Area of Karpathos and Saria	http://www.fdkarpathos.gr/
A22	Oiti National Park	http://oiti.gr/
A23	Lake Karla-Mavrovouni-Kefalovryso-Velestino	http://www.fdkarlas.gr/
A24	Mount Aenos National Park	http://www.foreasainou.gr/
A25	Parnassos National Park	http://www.parnassosnp.gr/
A26	Samaria National park	http://www.samaria.gr/en/home-2/
B1	Parco Nazionale d' Abruzzo, Lazio e Molise	http://www.parcoabruzzo.it/
B2	Parco Nazionale dell'Alta Murgia	https://www.parcoaltamurgia.gov.it/
B3	Parco Nazionale dell'appennino Lucano – Val d'Agri-Lagonegrese	http://www.parcoappenninolucano.it/enteparco
B4	Parco Nazionale dell' Appennino Tosco-Emiliano	http://www.parcoappennino.it/
B5	Parco Nazionale dell'Arcipelago di La Maddalena	http://www.lamaddalenapark.it/
B6	Parco Nazionale dell'Arcipelago Toscano	http://www.islepark.it/
B7	Parco Nazionale dell'Asinara	http://www.parcoasinara.org/
B8	Parco Nazionale dell'Aspromonte	http://www.parcoaspromonte.gov.it/
B9	Parco Nazionale del Cilento, Vallo di Diano e Alburni	http://www.cilentoediano.it/
B10	Parco Nazionale delle Cinque Terre	http://www.parconazionale5terre.it/
B11	Parco Nazionale del Circeo	http://www.parcocirceo.it/
B12	Parco Nazionale delle Dolomiti Bellunesi	http://www.dolomitipark.it/
B13	Parco Nazionale delle Foreste Casentinesi, Monte Falterona e Campigna	https://www.parcoforestecasentinesi.it/
B14	Parco Nazionale del Gargano	https://www.parcogargano.it/servizi/notizie/notizie_homepage.aspx
B15	Parco Nazionale del Gran Paradiso	http://www.pngp.it/
B16	Parco Nazionale del Gran Sasso e Monti della Laga	http://www.gransassolagapark.it/
B17	Parco Nazionale della Majella	https://www.parcomajella.it/
B18	Parco Nazionale dei Monti Sibillini	http://www.sibillini.net/
B19	Parco Nazionale del Pollino	http://www.parcopollino.it/
B20	Parco Nazionale della Sila	http://www.parcosila.it/it/
B21	Parco Nazionale dello Stelvio	http://www.stelviopark.it/
B22	Parco Nazionale della Val Grande	http://www.parcovalgrande.it/
B23	Parco Nazionale del Vesuvio	https://www.parconazionaledelvesuvio.it/

The websites of PAMPBs are considered to be the alternatives in our decision-making problem.

Applying a MCDM Model

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The application of any multi-criteria decision-making theory in order to evaluate a website involves the preliminary stages (1-3). The multi-criteria decision-making theories differ in the way the weights of the criteria are calculated, while many theories do not have a predefined way for criteria weights' calculation. PROMETHEE II does not have a well-defined way for the calculation of the criteria's weights. Therefore, AHP is used for this purpose and the particular MCDM theory is implemented in the subsequent steps.

The steps (1-3) that are implemented irrelevant of the MCDM model that is applied are:

1. Forming the overall goal: For this study, the overall goal was to evaluate the MBPAs' websites.
2. Forming the set of evaluative criteria: For this study, the criteria for evaluating environmental websites were selected by the human experts participating in a previous experiment (Martinis et al., 2018) from a pool of criteria previously proposed by Tsai et al. (2010). This process resulted in the following set of criteria and is presented in detail in Kabassi et al. (2019b):
    - c1-Quality of content.
    - c2-Attractiveness.
    - c3-Navigability.
    - c4-Relevancy.
    - c5- Accessibility.
    - c6- Responsiveness.
    - c7- Links.
    - c8- Multilingualism.
    - c9- Quality of mobile interactiveness.
    - c10-Services.
3. Finding the websites to be evaluated: In this step, the websites of the MBPAs that were going to be evaluated were selected. As already mentioned, we are going to evaluate the websites of MBPA of two Mediterranean countries, Italy and Greece. In Greece, twenty-six out of the twenty-eight MBPAs have a website while in Italy 23 out of the 25 MBPA have a website. The evaluation experiment involved all the websites of Greek and Italian MBPAs and these websites are presented in Table 1.

AHP for Calculating Weights of Criteria

AHP aims to analyze a qualitative problem through a quantitative method. According to Zhu & Buchman (2000), after having developed the goal hierarchy, in order to apply AHP one has to set up the pair-wise comparison matrix of criteria. In order to apply AHP, first, we have to form the set of evaluators that would act as decision-makers in the application of AHP for the calculation of the criteria's weights. Indeed, a correct choice of an expert would give reliable and valid results. For this purpose, both domain experts and software engineers have been selected to participate in the experiment to increase the reliability of the results. This means that the group of evaluators should have both software engineers and domain experts such as environmentalists or ecologists. More specifically, five (5) human experts were used to make the pairwise comparisons of criteria. The group of human experts was formed by two (2) software engineering experts and three (3) environmentalists (one had experience in environmental awareness in National Parks and the other

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had experience in ecology and ecotourism) so that a diversity of views could have been taken into account.

The steps that need to implement are:

Setting up a pair-wise comparison matrix of criteria: In this step, a comparison is implemented among the criteria of the same level. For this purpose, a comparison matrix is constructed and each one of the decision-makers was asked to complete the comparison matrix by completing the rate that reveals that pairwise comparison of the criterion in the row with the criterion in the column. They are asked to use the values of the nine-point scale for the pairwise comparison presented in Table 2.

TABLE 2
THE NINE-POINT SCALE FOR PAIRWISE COMPARISON

Importance	Definition	Explanation
1	Equal importance	The importance of two criteria or alternatives is equal
2	Weak	
3	Moderate importance	A slight favor of one criterion or alternative over another
4	Moderate plus	
5	Strong importance	A strong favor of one criterion or alternative over another
6	Strong plus	
7	Very strong importance	A very strong favor of one criterion or alternative over another
8	Very, very strong	
9	Extreme importance	One criterion or alternative is surely favored over another

As a result, 5 different matrixes were collected. The values in the cells of the final matrix are calculated as a geometric mean of the corresponding values of the cells of the five matrixes. The final pair-wise comparison matrix of criteria is presented in Table 3.

TABLE 3
PAIRWISE COMPARISON OF CRITERIA

Criteria	Quality of content	Attractiveness	Navigability	Relevancy	Accessibility	Responsiveness	Links	Multilingualism	Quality of mobile interactiveness	Services
Quality of content	1.00	5.06	2.22	2.45	4.57	2.26	4.54	4.19	4.62	7.96
Attractiveness	0.20	1.00	1.28	0.60	1.35	0.46	1.67	1.22	2.30	2.97
Navigability	0.45	0.78	1.00	0.62	2.09	1.00	1.61	2.08	3.77	3.62
Relevancy	0.41	1.66	1.61	1.00	3.23	2.88	3.77	3.53	4.21	5.55
Accessibility	0.22	0.74	0.48	0.31	1.00	0.52	0.75	0.61	0.57	1.18
Responsiveness	0.44	2.18	1.00	0.35	1.91	1.00	1.91	2.18	4.43	2.72
Links	0.22	0.60	0.62	0.27	1.33	0.52	1.00	1.23	1.62	1.23
Multilingualism	0.24	0.82	0.48	0.28	1.63	0.46	0.81	1.00	1.10	1.12

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Quality of mobile interactiveness	0.22	0.43	0.27	0.24	1.76	0.23	0.62	0.91	1.00	2.44
Services	0.13	0.34	0.28	0.18	0.85	0.37	0.81	0.89	0.41	1.00

Calculating weights of criteria: After making pair-wise comparisons, estimations are made that result in the final set of weights of the criteria. More specifically, the principal eigenvalue and the corresponding normalized right eigenvector of the comparison matrix that is calculated, provide the relative importance of the various criteria being compared. The elements of the normalized eigenvector were the weights of criteria or sub-criteria. In terms of simplicity, we had used the 'Priority Estimation Tool' (PriEst) (Siraj et al., 2015), an open-source decision-making software that implements AHP, for making the calculations that the theory requires. This process resulted in the following weights for the ten criteria evaluated:

- Quality of content→ $w_1 = 0.274$
- Attractiveness → $w_2 = 0.181$
- Navigability → $w_3 = 0.114$
- Relevancy → $w_4 = 0.109$
- Accessibility → $w_5 = 0.083$
- Responsiveness → $w_6 = 0.058$
- Links → $w_7 = 0.055$
- Multilingualism→ $w_8 = 0.046$
- Quality of mobile interactiveness→ $w_9 = 0.046$
- Services → $w_{10} = 0.034$

PROMETHEE II for Ranking Websites

The PROMETHEE methods belong to the family of the outranking methods. The PROMETHEE family of outranking methods is one of the most recent MCDM methods and creates a partial pre-order (PROMETHEE I) or a complete pre-order (PROMETHEE II) on the set of possible actions that can be proposed to the decision-maker in order to achieve the decision problem. The steps of PROMETHEE II after having defined criteria and their weights of importance are:

Calculating the values of the criteria. In this step, the evaluators, which in general may be the same as those specifying the weights of the criteria or not, are asked to visit all the websites presented in Table 1. In the specific case, 8 decision-makers provided values to the 10 criteria of the evaluation. Those values were taken from the nine-number scale (Table 2) so the values would be comparable.

As soon as all the values of the 8 decision-makers were collected, the mean value was calculated for the corresponding values of each criterion for each website. The result of this process is presented in Table 4.

TABLE 4

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THE GEOMETRIC MEAN OF THE VALUES OF THE CRITERIA FOR ALL WEBSITES										
	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
A1	3.75	2.88	3.13	3.88	3.75	3.50	3.25	3.50	3.38	3.75
A2	3.88	3.75	4.13	3.88	4.00	3.75	3.50	2.88	3.13	3.63
A3	4.13	4.50	3.63	3.88	4.50	4.00	4.00	4.13	3.63	4.25
A4	3.75	3.13	3.88	3.88	3.88	3.75	3.88	4.75	3.25	3.75
A5	3.88	3.50	3.50	3.88	4.00	3.75	4.00	3.13	2.88	4.50
A6	3.63	3.38	3.88	3.75	3.63	3.75	3.88	2.38	2.75	3.63
A7	3.50	2.75	3.75	3.75	3.50	3.75	3.75	2.63	2.88	3.63
A8	3.75	3.00	3.38	3.88	3.38	3.75	3.13	1.75	2.88	3.38
A9	3.63	3.00	3.38	3.38	3.25	3.38	3.50	4.75	3.50	4.25
A10	4.00	3.75	4.50	3.88	3.38	3.63	4.25	2.38	3.25	4.13
A11	4.50	4.25	4.00	4.00	4.13	4.00	4.13	2.88	3.38	4.25
A12	3.63	3.25	3.88	3.50	3.88	3.75	3.50	2.38	2.63	3.63
A13	3.75	4.25	4.00	3.88	3.88	3.88	3.75	2.38	3.00	3.88
A14	3.50	3.50	3.25	3.13	3.38	3.50	3.25	2.25	3.13	3.38
A15	4.00	3.63	3.75	4.13	4.00	4.00	2.50	1.63	3.25	3.38
A16	3.13	2.50	3.13	3.13	3.25	3.13	3.38	1.25	2.63	3.38
A17	3.63	4.25	3.50	3.63	3.50	3.50	3.63	1.88	2.63	2.88
A18	3.25	3.75	3.63	3.88	4.00	3.88	3.63	2.25	3.25	3.75
A19	3.75	4.00	3.75	3.88	4.00	4.00	3.38	2.25	3.00	3.50
A20	3.75	3.00	3.50	3.38	3.38	3.13	3.75	2.13	3.00	3.38
A21	3.25	2.50	3.25	3.63	3.25	3.00	4.13	2.25	3.13	3.38
A22	3.75	3.75	3.38	3.63	3.63	3.75	2.63	2.25	2.75	2.88
A23	3.50	3.13	3.50	3.38	3.63	3.63	4.25	5.00	3.50	3.88
A24	3.13	2.63	3.38	3.25	3.25	3.38	3.50	2.25	3.38	3.63
A25	4.00	4.50	3.88	3.88	4.25	4.00	4.00	2.75	3.50	3.88
A26	4.00	4.25	4.00	4.00	3.88	3.88	4.13	2.25	3.25	3.50
B1	2.83	3.70	5.34	5.20	5.34	5.34	3.56	6.05	3.56	2.67
B2	2.80	2.80	4.58	4.84	5.33	5.34	3.84	7.22	4.59	2.67
B3	3.19	3.19	3.81	3.44	4.45	4.56	2.81	1.78	3.56	4.45
B4	3.81	2.92	3.56	3.56	5.34	5.09	4.45	4.20	4.45	2.67
B5	3.19	3.31	3.81	3.81	5.34	4.58	3.56	6.23	4.45	3.56
B6	3.81	3.69	2.92	2.19	5.34	3.56	6.36	0.89	4.45	0.89
B7	4.45	3.44	3.44	3.56	5.48	3.56	4.45	0.89	4.47	4.45
B8	5.47	3.44	3.44	3.56	5.34	4.33	3.56	1.78	4.45	3.56
B9	5.47	5.22	4.45	5.59	5.34	6.11	6.23	2.55	6.22	5.34
B10	6.34	5.33	4.45	5.34	5.34	4.45	5.34	4.84	6.23	4.45
B11	4.58	2.81	4.58	5.34	3.56	4.45	4.45	4.84	5.34	3.56

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B12	5.34	3.56	4.33	5.22	4.45	5.09	4.45	7.89	6.23	4.45
B13	3.69	5.34	4.58	4.45	5.34	5.34	3.56	3.44	6.23	4.45
B15	4.58	5.34	3.69	5.34	5.47	6.22	4.45	3.31	6.23	2.67
B16	5.47	4.58	5.34	4.45	5.34	6.22	5.34	2.92	6.23	2.67
B17	4.45	5.34	5.34	3.69	5.34	6.20	4.45	5.22	6.23	2.67
B18	6.48	6.36	6.47	5.47	6.09	5.97	6.20	4.45	7.09	3.56
B19	3.44	3.56	4.33	4.47	5.98	4.45	3.56	1.92	1.81	1.78
B20	4.33	4.33	3.56	4.45	7.27	5.23	4.45	2.55	2.69	3.56
B21	3.69	4.45	3.69	3.69	5.34	5.34	3.56	1.80	4.45	3.56
B22	4.45	4.45	6.25	5.34	5.34	5.22	4.45	4.08	4.45	5.34
B23	4.72	6.22	4.58	4.58	5.34	6.23	4.45	5.98	6.23	5.34

Making comparisons and calculate the preference degree. This step computes for each pair of possible decisions and each criterion, the value of the preference degree. Let $g_g(a)$ be the value of a criterion j for a decision a. We noted $d_j(a,b)$, the difference of the value of a criterion j for two decisions a and b.

$$d_j(a,b) = g_j(a) - g_j(b)$$

$P_j(a,b)$ is the value of the preference degree of a criterion j for two decisions a and b. The preference functions used to compute these preference degrees are defined such as:

$$P_j(a,b) = 0 \text{, if } d_j(a,b) < 0$$

$$P_j(a,b) = d_j(a,b) \text{, if } d_j(a,b) > 0$$

Aggregating the preference degrees of all criteria for pair-wise decisions. This step consists of aggregating the preference degrees of all criteria for each pair of possible decisions. For each pair of possible decisions, we compute a global preference index. Let C be the set of considered criteria and w_j the weight associated with criterion j. The global preference index for a pair of possible decision a and b is computed as follows:

$$\pi(a,b) = [\sum_{j=1}^{n} w_j P_j(a,b)] / \sum_{j=1}^{n} w_j$$

Calculate positive and negative outranking flow. This step, which is the first that concerns the ranking of the possible decisions, consists of computing the outranking flows. For each possible decision a, we compute the positive outranking flow $\emptyset^+(a)$ and the negative outranking flow $\emptyset^-(a)$. Let A be the set of possible decisions and n the number of possible decisions. The positive outranking flow of a possible decision a is computed by the following formulae:

$$\phi^+(\alpha) = \frac{1}{m-1} \sum_{b=1}^{m} \pi(\alpha,b) \quad when \ \alpha \neq b$$

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The negative outranking flow of a possible decision a is computed by the following formulae:

$$\phi^{-}(\alpha) = \frac{1}{m-1}\sum_{b=1}^{m}\pi(b,a) \quad \text{when } \alpha \neq b$$

Calculate the net outranking flow. The last step of the application of PROMETHEE II consists of using the outranking flows to establish a complete ranking between the possible decisions. The ranking is based on the net outranking flows. These are computed for each possible decision from the positive and negative outranking flows. The net outranking flow $\emptyset(a)$ of a possible decision a is computed as follows:

$$\phi(\alpha) = \phi^{+}(\alpha) - \phi^{-}(\alpha)$$

Ranking Websites and Analysing the Results

The application of steps of PROMETHEE II resulted in calculating the outranking flow $\emptyset(a)$. The higher the value of the net outranking flow for a decision, the better the decision is. As a result, the alternative websites of the parks are ranked taking into account the values of the net outranking flow $\emptyset(a)$. The higher the value $\emptyset(a)$ is, the better the website is. The ranking as well as the values of net outranking flow $\emptyset(a)$ are presented in Table 5.

TABLE 5
THE $\emptyset(a)$ VALUES OF ALL ALTERNATIVE WEBSITES

Rank		$\emptyset(a)$	$\emptyset^{+}$	$\emptyset^{-}$
1	B17	0.9153	0.9559	0.0406
2	B22	0.7803	0.8685	0.0883
3	B10	0.7677	0.8620	0.0943
4	B9	0.7546	0.8563	0.1017
5	B15	0.6836	0.8150	0.1314
6	B23	0.5950	0.7815	0.1865
7	B14	0.5859	0.7690	0.1832
8	B21	0.5484	0.7452	0.1968
9	B16	0.5379	0.7372	0.1993
10	B12	0.5114	0.7423	0.2309
11	B13	0.3512	0.6435	0.2923
12	A11	0.3268	0.6485	0.3217
13	B19	0.3070	0.6421	0.3351
14	B11	0.2730	0.6153	0.3423
15	A3	0.2532	0.6079	0.3547
16	A25	0.2317	0.5841	0.3524
17	A26	0.1449	0.5446	0.3997

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18	A10	0.0995	0.5170	0.4176
19	A2	0.0632	0.4995	0.4363
20	B8	0.0617	0.5028	0.4411
21	B7	0.0201	0.4919	0.4718
22	A13	0.0056	0.4577	0.4520
23	B20	-0.0148	0.4672	0.4820
24	B1	-0.0157	0.4820	0.4977
25	A15	-0.0377	0.4606	0.4984
26	A5	-0.0656	0.4377	0.5034
27	A19	-0.1015	0.4078	0.5092
28	B4	-0.1016	0.4240	0.5256
29	B18	-0.1241	0.4308	0.5549
30	A4	-0.1303	0.3892	0.5195
31	B2	-0.1629	0.4106	0.5734
32	B6	-0.2044	0.3820	0.5864
33	B5	-0.2336	0.3591	0.5928
34	A18	-0.2592	0.3386	0.5978
35	A6	-0.2976	0.3269	0.6245
36	A22	-0.3346	0.2956	0.6302
37	A17	-0.3719	0.2900	0.6619
38	A1	-0.3751	0.2793	0.6544
39	A12	-0.3825	0.2836	0.6662
40	A23	-0.4052	0.2794	0.6846
41	B3	-0.4066	0.2923	0.6989
42	A9	-0.4186	0.2648	0.6835
43	A8	-0.4463	0.2327	0.6790
44	A7	-0.4720	0.2456	0.7176
45	A20	-0.4875	0.2219	0.7094
46	A14	-0.6001	0.1800	0.7802
47	A21	-0.7010	0.1319	0.8330
48	A24	-0.7684	0.0981	0.8665
49	A16	-0.8990	0.0341	0.9331

All the websites of the MBPAs, information about its structure, objectives, financial statements, etc. Additionally, all of them contained information about the ecosystem of the PA and gave contact information. The final ranking of the websites of the National Parks shows that almost half of the websites (45%) are considered good. The best one is the website of Della Majiella (B17), which is considered to be much better than the second according to the value $\emptyset(a)$ calculated by the application of the MCDM model. Then the next three websites (B10 - Delle Cinque Terre, A9 - Del Cilento, Vallo di Diano e Alburni, B22 - Della Val Grande) are considered much better than the following ones. One of the best Greek websites is that of A11 - Axios Delta National Park. The websites of the National Parks that have a value $\emptyset(a)$ that is lower than zero

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are not considered very good at promoting environmental information and need a re-design and update of content.

One can easily observe in Table 4 that the first 11 places in the ranking of a website are occupied by the websites of Italian MBPA the Italian websites outbalance the websites of Greek MBPA. Furthermore, the last 8 places in the ranking are occupied by Greek MBPA's websites. Taking into account these results the websites of the Italian MBPA outrank the websites of the Greek MBPA.

Comparing Results with SAW

In order to check the effectiveness of PROMETHEE II for the evaluation of websites of environmental content, we compared the results of PROMETHEE II with SAW, which has been used successfully before for the evaluation of websites (Kabassi et al. 2020b). For this purpose, we use the values of criteria given by all users that are presented in Table 3. Then we use SAW and calculate the multi-attribute utility function U for each one of the 23 websites. More specifically, for each website a multi-attribute utility function U is calculated as a linear combination of the values of the 10 criteria:

$$U(A_j) = \sum_{i=1}^{10} w_i x_{ij}$$

Where A_j is one alternative website and x_{ij} is the value of the i criterion for the A_j alternative.

TABLE 6
VALUES AND RANKING FOR ALL WEBSITES USING SAW AND PROMETHEE II

	PROMETHEE II Ranking	PROMETHEE II $\emptyset(\boldsymbol{a})$	SAW Ranking	SAW Value
A1	38	-0.3751	41	3.46
A2	19	0.0632	27	3.77
A3	15	0.2532	16	4.11
A4	30	-0.1303	31	3.71
A5	26	-0.0656	29	3.72
A6	35	-0.2976	36	3.55
A7	44	-0.472	43	3.38
A8	43	-0.4463	44	3.37
A9	42	-0.4186	40	3.47
A10	18	0.0995	25	3.83
A11	12	0.3268	15	4.13
A12	39	-0.3825	38	3.49
A13	22	0.0056	26	3.81
A14	46	-0.6001	46	3.33
A15	25	-0.0377	32	3.67
A16	49	-0.899	49	2.94
A17	37	-0.3719	35	3.55
A18	34	-0.2592	37	3.54

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A19	27	-0.1015	30	3.71
A20	45	-0.4875	45	3.36
A21	47	-0.701	47	3.14
A22	36	-0.3346	39	3.48
A23	40	-0.4052	34	3.56
A24	48	-0.7684	48	3.11
A25	16	0.2317	18	4.00
A26	17	0.1449	22	3.90
B1	24	-0.0157	17	4.10
B2	31	-0.1629	21	3.92
B3	41	-0.4066	42	3.45
B4	28	-0.1016	24	3.84
B5	33	-0.2336	23	3.84
B6	32	-0.2044	33	3.56
B7	21	0.0201	20	3.93
B8	20	0.0617	14	4.20
B9	4	0.7546	3	5.29
B10	3	0.7677	2	5.45
B11	14	0.273	13	4.26
B12	10	0.5114	8	4.88
B13	11	0.3512	11	4.53
B14	7	0.5859	10	4.81
B15	5	0.6836	5	5.03
B16	9	0.5379	9	4.86
B17	1	0.9153	1	6.11
B18	29	-0.1241	28	3.75
B19	13	0.307	12	4.37
B20	23	-0.0148	19	4.00
B21	8	0.5484	7	4.89
B22	2	0.7803	4	5.23
B23	6	0.595	6	4.89

The data of Table 6 reveals that PROMETHEE II ranks websites in a very similar way with SAW (not identical). However, the similarity in those rankings can only be confirmed by analysis of pair-wise correlation. For this purpose, we use the Pearson Correlation Coefficient on the data of the two rows that represent the ranking of the websites. The Pearson Correlation Coefficient is calculated to 0.967, which reveals a high correlation on the rankings of the two different theories.

CONCLUSIONS

The role of MBPAs is multidimensional, diverse, and important, and maybe supported by a good website. A website can shape the image of the MBPA and may produce a virtual experience for visitors, and promote the environmental value of its area. The twenty-three websites of the MBPAs in Italy offer free information to potential visitors. However, the design, the quality of content, and the attractiveness that differentiate the different MBPA's websites are a subject of evaluation.

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Evaluations are usually complicated procedures that focus on the examination of several different criteria. For this purpose, we use MCDM models for combining these criteria. We have used the results of previous work on the evaluation of websites of environmental content (Martinis et al. 2018, Kabassi & Martinis 2020; Kabassi et al. 2019b), in which the criteria and the weights of importance of these criteria using AHP have been defined. The main contribution of the particular paper is that it presents how PROMETHEE II can be combined effectively with AHP for the evaluation of the websites of MBPA in Italy and Greece.

PROMETHEE II is a highly researched and most applied outranking method that was designed to treat multi-criteria problems. The main motivations for applying the PROMETHEE II method include that the specific model could be easily applied in the domain of website evaluation and that all collected information in the decision matrix can be fully and efficiently considered when making the final decision. PROMETHEE II is also a rather simple ranking method in concept and practice when compared with the other MCDM methods (Brans et al., 1985). The results of the evaluation of website evaluation indicate that the PROMETHEE II method can prioritize the websites effectively.

The combination of particular methods and theories makes the experiment more structured and easier to be implemented or repeated by other researchers that want to evaluate websites of environmental content.

The application of the particular theory was compared to the application of SAW, which is a theory that has been used effectively before for the evaluation of websites. The high correlation of the two theories confirms the effectiveness of PROMETHEE II for evaluating not only websites of environmental content but websites in general.

As far as the electronic presence of MBPA concerns, the results of the PROMETHEE II method revealed that about 45% of the websites of the National Parks of Italy and Greece were very good. This means that the general picture of these websites was not generally bad but certainly needs improvement. Findings are in agreement with the results of similar studies (Andreopoulou et al., 2015; Martinis et al., 2018, Kabassi & Martinis 2020) and confirm that internet technologies' adoption in MBs is still at an initial level. The usage of these technologies can and must constitute a useful tool for promoting National Parks. The evaluation also revealed that the websites of Italian MBPA outranked the websites of Greek MBPA.

It is among our plans to implement this experiment with a different MCDM model and compare the results in order to see if the selection of the MCDM model may differentiate these results or not. Furthermore, the results of the evaluation of the electronic presence of Protected Areas Managing Boards in all Mediterranean countries may provide very interesting results.

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