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A Bridge between Coastal Resilience and Tourism-Recreation: Multifunctional Benefit of Boardwalk Design for Sustainable Development in the Western Black Sea Region, Turkey

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Abstract: The researchers utilized a participatory approach based on expert opinion, which was used to assess the environmental, social, economic, and visual value and accessibility benefits of the Güzelcehisar Beach Boardwalk (GBB) application in the province of Bartın in Turkey's Western Black Sea Region. The questionnaire was administered face-to-face and online to 120 professionals from various subject area fields. According to field specialists, the benefits of the GBB are as follows: social benefit, visual value and accessibility, economic benefit, and environmental benefit. The GBB was evaluated as an example of infrastructure within the scope of effective solutions for tourism and recreation activities and resilience within sustainable development of rural coastal landscapes using a participatory approach, so the results will guide Integrated Coastal Zone Management planning for the area.

Keywords: boardwalk; coastal resilience; rural landscape; sustainable development; tourism-recreation; Güzelcehisar

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1. Introduction

More than half of the people in coastal countries live within 100 km of a coastal zone. Settlements within coastal areas are concentrated in the first 5 km and at altitudes less than 20 m. Coastlines provide resource, trade, and commercial opportunities [1,2], and such advantages have led to settlement and tourism growth. When considering the fragility of coastal areas as well as these trends, coastal resilience is critical [2,3].

It is emphasized that in addition to recreational activities on the coasts, it is necessary to integrate planning, stakeholder participation, and conservation processes with a multidisciplinary approach for the welfare of the community [4,5]. de Groot et al. [6] state that coastal and marine ecosystems play a crucial role in supporting economic prosperity and social welfare within adjacent human communities [1]. Costanza et al. [7] state that the maintenance and enhancement of such activities, and the multiple benefits available from marine ecosystems, depend on how societies and governments balance the demand and the supply of benefits from marine ecosystems [1].

Wilson et al. [8] emphasize the positive economic values that coastal services supply. It is stressed that coastal recreational activities, such as walking, provide major economic benefits to rural communities via tourism. So, it is becoming more widely understood that coastal walking routes promote rural landscape variety, creative experiences, and regional development [9,10].

Coastal locations are among the most appealing for tourism and recreation, yet they are also among the most vulnerable to the effects of climate change. Sustainable adaptation strategies are critical for dealing with negative impacts, as coastal areas are particularly

susceptible to the severe effects of climate change (for example, rising sea levels and extreme weather events) [11].

Many plans are underway for adapting coastal regions to sea level rise impacts [12,13]. The resilience of the built and unbuilt environment morphology in urban and rural areas to climate change is dependent on the adaptation decisions and practices created and executed in these locations. In this context, coastal infrastructure applications focused on increasing the resilience and adaptation of coastal settlements are of increasing importance.

1.1. Resilience and Coastal Resilience

The concept of resilience has been included in the literature stemming from "ecological system" studies by C. S. Holling [14] and Walker et al. [15]. Obtaining maximum benefits from sustainability studies can be enhanced by ensuring the stability of ecological systems; furthermore, securing social and economic sustainability has been adopted as an approach for providing resilience [16]. Resilience is used to express the prevention of changes, risks, and surprises or to ensure system sustainability by keeping pace with such uncertainties [14,16]. The term resilience is generally used for the prediction of future problems in a system by understanding its current values, issues, and potential to be ready for uncertainties plus adaption ability.

Resilience is seen as a key characteristic of coastal systems [14,17–19]. There has been scholarship addressing coastal resiliency around the world with specific reference to climate-induced stress on shoreline communities [20–25]. There has also been research on methods of assessing coastal resiliency [13] as well as the design of resilient coastal infrastructure [26]. Studies have been done to generate future adaptation-based plans/designs to create more resiliency against sea level rise. Overflow and floods are among the primary subjects of coastal resilience [13,26].

Current and future climate-related coastal impacts necessitate a new strategy for constructing and managing coastal infrastructure. Nature-based, structural, and non-structural hybrid solutions are better equipped to meet a wide range of goals, including ecological remediation, long-term adaptation, and societal benefits.

Multifunctionality is related to increased resilience. Multifunctional usage is associated with increased durability. The more multifunctional a system is, the better it can absorb disturbances while maintaining its original function [27,28]. In terms of contributing to coastal resilience through multifunctionality, coastal boardwalk applications is an example of infrastructure with physical features that provide economic and/or social benefits and mitigate some climate change impacts. A successful design can also facilitate access to the beach for tourism and recreation purposes [27,29,30].

Boardwalks require little and inexpensive maintenance and have a low environmental impact. In addition, boardwalk use can contribute to public awareness of the vulnerability of dune habitats. Therefore, in recent years, infrastructure such as boardwalks have become common applications in many coastal areas with high conservation value and degraded areas that need restoration [5].

Coastal dunes around the world are continually changing as a result of sea level rise, erosion, climate change, and land alterations [5]. In this context, boardwalks stand out among multifunctional applications to limit the free movement of tourists on the fragile vegetation of the dunes to protect the ecosystem [5,31] and to adapt to the effects of climate change in addition to tourism and recreation opportunities [27].

As a coastal example, the headlands are the most exposed stretch of the New Jersey shore in the USA, with open ocean views subject to the direct action of wind and waves. New Jersey's headlands were among the first sites of tourist-oriented occupation of the northern New Jersey coast. The first boardwalk was built in New Jersey to prevent sand from entering beachside buildings, and, over time, boardwalks have become an iconic emblem of New Jersey shore tourism. This was the case for many oceanfront boardwalks worldwide [32]. This joint design demonstrates how coastal biological and geomorphologi-

cal structures might increase coastal regions' ability to rebound from storms and sea level rise [33].

1.2. Resilience and Tourism-Recreation on the Black Sea Coast of Turkey

Turkish coasts are chosen for travel due to their natural beauty and cultural and historical values, yet they are also subject to greater environmental stress [30,34,35]. Beaches in Turkey are open to the public. Beaches are not only vital assets for the natural balance of coastal ecosystems, but they are also important tourism resources. Coastal tourism is a significant source of revenue for Turkey [36]. Low elevation coastal areas make up around 3% of Turkey's beaches [37]. According to Williams and Micallef [38], one of the key issues of beach management is the difficulties faced and potential solutions for the sustainable use of beaches, which is part of the integrated coastal zone management strategy [36].

Because of its growth, location, and history, the Black Sea basin is a unique and extremely complex habitat. In recent years, there has been a surge in scientific curiosity about the processes and systems that govern this field. The basin's well-known environmental issues include pollution, eutrophication, overfishing and biodiversity loss, erosion, storms, and sea level rise, impacting several coasts around the Black Sea [39]. The Black Sea coast is well-known for its numerous coastal erosion factors [29,30].

Ceyhunlu et al. [40], in their study of the climatic change caused by global warming in sea surface temperatures and wind speeds along Turkey's Western Black Sea coast, found that increasing trends in sea surface temperatures were seen in daily and annual analyses. As a result, they noted that the research area's marine life, fish population, precipitation regime, and tourism behaviors were all predicted to change as a result of these rising trends. The Black Sea has been studied in terms of climate change, and such studies have revealed an increase in water temperature.

1.3. Research Background and Aims

Since there is no similar scientific study in this framework in Turkey, the results obtained from this article contain important references for future studies in the development of ICZM strategies for areas of similar character in the Western Black Sea Region. This article adds to the literature in this way.

The Güzelcehisar Beach Boardwalk (GBB), located in the research area, is the first and only application example for the Western Black Sea Region. This is the first application incorporating post-occupancy multifunctional (environmental, social, economic, visual value and accessibility) evaluations of the GBB application, with a participatory approach based on expert opinion, integrated with coastal resilience compatible with climate change and tourism and recreation infrastructure. It is critical for future research in similar areas because it provides basic data that will guide Integrated Coastal Zone Management strategies.

Previous scientific studies on the Güzelcehisar are as follows: evaluation of the visitor understanding of coastal geotourism and geoheritage potential based on sustainable regional development in Güzelcehisar, Bartın [41]; landscape application project for tourism and recreation purposes for the city of Güzelcehisar lava columns and coast [42]; Güzelcehisar coastal landscape heritage project [43] visual landscape assessment in coastal areas in the example of Güzelcehisar village for the sustainable development of rural landscapes [44]; ecological plan proposal for the Güzelcehisar coastal settlement [45]; and evaluating coastal scenery using fuzzy logic: application at selected sites in the western Black Sea coastal region of Turkey [46].

Several scientific studies have been conducted that focus solely on the inventory of natural and cultural resource values, as well as tourist and recreation possibilities for the research region. However, it is an innovative and original study for the research field, as there is no integrated participatory approach within the scope of coastal resilience planning and design, as well as scientific studies covering the existing tourism and recreation opportunities in Güzelcehisar.

2. Conceptual Framework and Research Questions

Tourism and recreation opportunities and practices in rural coastal landscapes are considered sustainable regional development factors [47]. In its two sustainability goals (14.2 and 14.5), Sustainable Development Goal 14 strives to safeguard and sustainably utilize ocean, sea, and marine resources by expressly mentioning coastal areas [48]. Moreover, the fifth IPCC report highlights the social, environmental, and economic benefits of strategies and practices for climate change adaptation [11,49,50].

As sea levels rise, approaches that can sustain and even boost social and economic activities will draw tourists to the coastal area, supporting coastal tourism and long-term development. Boardwalks and piers along the coastal environment are examples of coastal facilities that attract both tourists and locals [33].

The primary goal of the study is to conduct multifunctional (environmental, social, economic, visual value and accessibility) evaluations following the use of the GBB application using a participatory approach based on coastal resilience compatible with climate change and integrated with tourism and recreation infrastructure.

This article outlines four major research questions:

(RQ1) What is the priority order of the benefits offered by the GBB, according to expert opinion, within the framework of its multifunctional (environmental, social, economic, accessibility and visibility) evaluations? What is the general level of satisfaction among professionals regarding the GBB's benefits?

(RQ2) How does the GBB contribute to tourism and recreation activities in the context of rural coastal landscape features?

(RQ3) What is the GBB's contribution as an example of coastal resilience infrastructure in terms of the environmental advantages it gives to coastal communities?

(RQ4) What, in the view of experts, is the contribution of the GBB to sustainable local development?

Site Description

Güzelcehisar, the research area chosen, is located inside the province of Bartın (Figure 1). It is a natural bay located 17 km west of the city center. Güzelcehisar Bay is both an Archaeological Site (Güzelcehisar Castle) and a Natural Protected Area (Güzelcehisar Bay). The usage area of the 1st Degree Archaeological Site is 1.57 ha, while the usage area of the 1st Degree Natural Site is 15.15 ha, divided into sandy and rocky sections. It concludes with the Lava Pillars at the southern end of the beach. The entire Güzelcehisar coast is a First Degree Natural Protected Area; there are a few scattered towns around the region, and the forested lands behind them are of recreational importance [42].

In the research area, which has Black Sea climate features, intensive tourism activities take place exclusively during the summer months, depending on the "sun and sea". Diversifying tourism is critical for sustainable development in rural coastal areas, reducing the region's severe seasonality, and developing new businesses and innovative techniques. In this perspective, Güzelcehisar is a rural coastal village ideally suited for the development of alternative tourism activities that lessen seasonal reliance and open new potential for the Western Black Sea Region. Güzelcehisar is a regionally significant touristic coastal settlement due to its natural sandy beach, rich forest areas, agricultural product diversity, archaeological values, preserved rural coastal landscape character, and basalt columns [41]. In Güzelcehisar, it is important to increase the coastal resilience against continued sand movement activity as well as increasing wave level movement and sea level rise as a result of tidal currents in the summer and winter months.

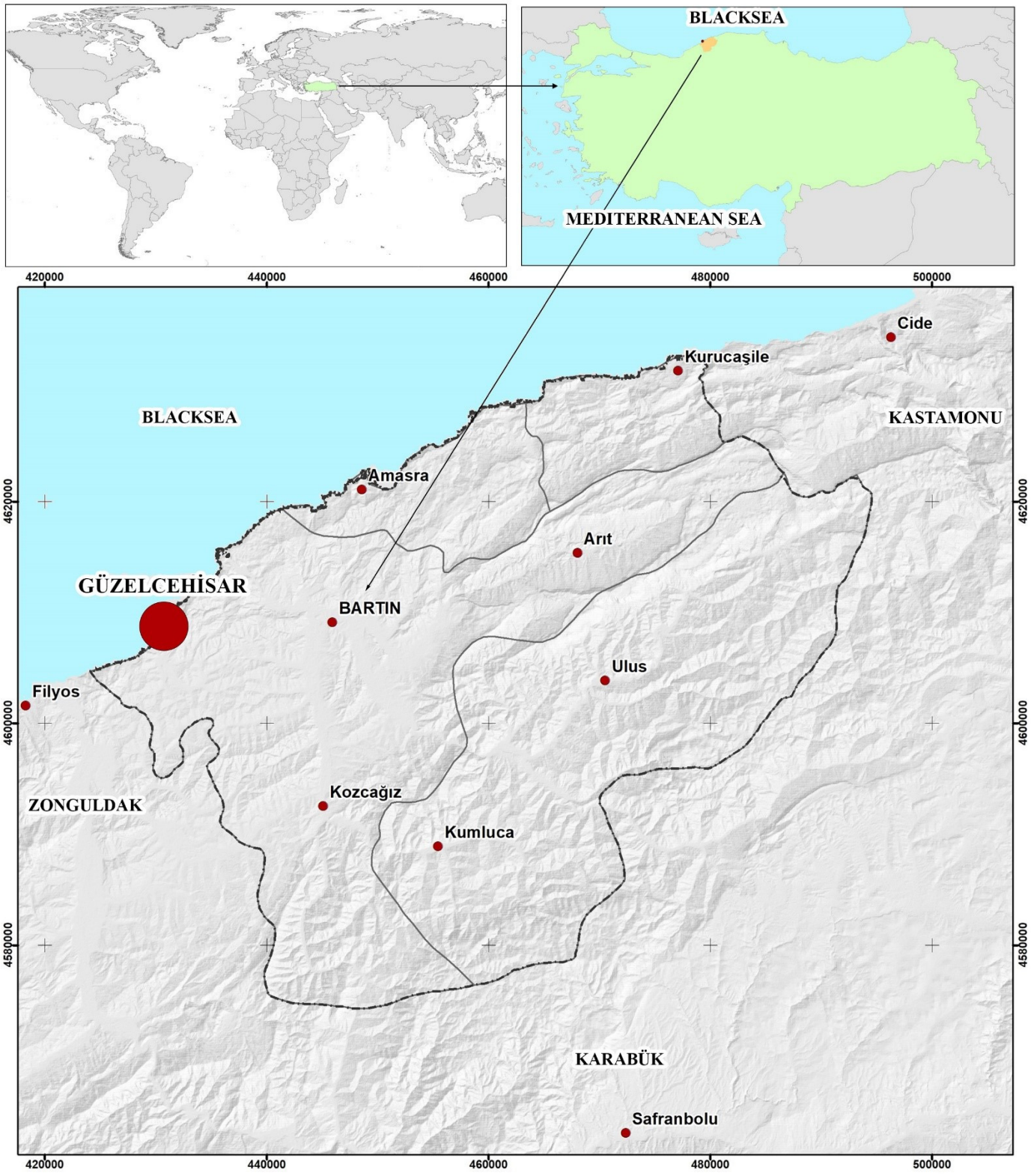

Figure 1. Location of the research area.

The "Landscape Application Project for Tourism and Recreation Purposes in Bartın Province Güzelcehisar Lava Columns and Coastal Columns" was supported by the Western Black Sea Development Agency's (BAKKA) 2016 Small Scale Infrastructure Financial Support Program. The purpose of this project was to improve the visibility and accessibility of the Güzelcehisar basalt columns. The GBB is the region's only and most important

boardwalk application as an example of coastal resilience infrastructure compatible with the effects of climate change. It also supports the coastal geotourism potential in Güzelcehisar, as well as spatially integrative use of the coastal area and year-round use of the coast.

The GBB is an important example of regional infrastructure offering visibility and access to the basalt columns in the south, beginning with the observation deck (viewing platforms of boardwalk) in the north of the coastline and extending along the coast.

Simultaneously, by connecting the beach and the rocky island, the boardwalk has increased the seasonal length of usage of the beach. The boardwalk, which is 3 m wide and 850 m long, was built in compliance with the Güzelcehisar Conservation Plan. Pedestrian routes, stairs, and ramps were designed in compliance with design standards. The GBB is an example of infrastructure that allows everyone, including the disabled and the elderly, to enjoy an unbroken seaside experience from the viewing terrace to the basalt columns [42]. The GBB was built along the shore with a bored pile system in the +1 code, considering sand movement and wave height in the dynamic Güzelcehisar coastal area.

The following are the precise goals stated for the completion of this project [42] (Figure 2):

- **A:** Observation Terrace: To the north of the study area, a wooden Observation Deck was created so that the basalt columns could be seen along the Güzelcehisar coastal scenery;
- **B:** Beach Boardwalk: It allows an unbroken promenade along the Güzelcehisar beach connecting the observation decks in the area's north and south, providing walkability for everybody;
- **C:** Boardwalk beach-rocky island connection and observation terrace: By connecting the beach to the south of the GBB study area and the rocky island, the length of usage of the shore has been extended while simultaneously increasing visibility and accessibility of the basalt columns. In addition, a wooden platform has been created on the island for tourists to observe the basalt columns, coastal landscape, and sea view, as well as to obtain information and take photographs.

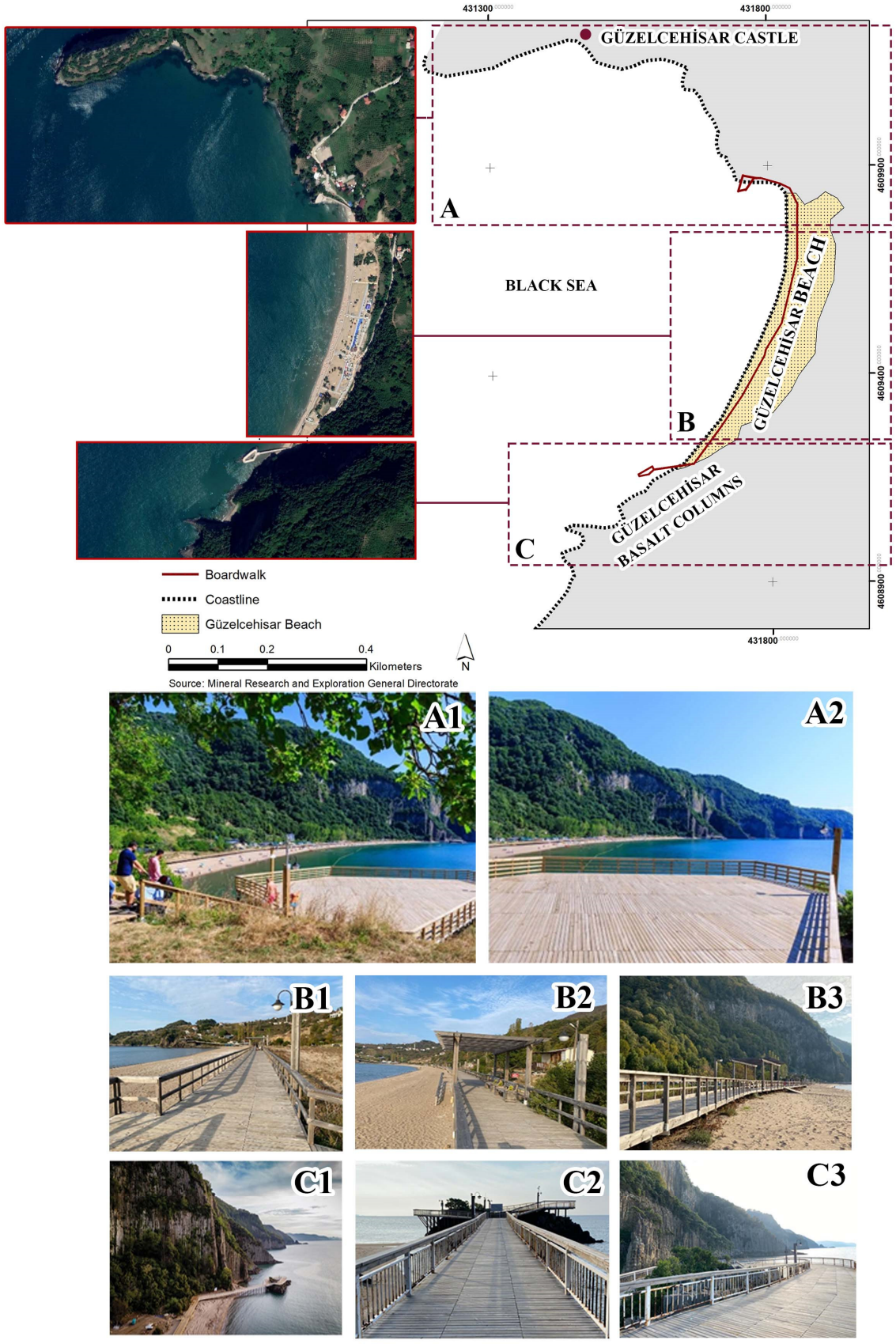

Figure 2. Güzelcehisar Beach Boardwalk. (**A1**,**A2**): Observation Terrace. (**B1**–**B3**): Beach Boardwalk. (**C1**–**C3**): Boardwalk beach-rocky island connection and observation terrace. ((**A1**,**A2**,**C1**), Source: [42]. (**B1**–**B3**,**C2**,**C3**), Source: Author's work).

3. Materials and Methods

Data collection: Data were collected by survey measurement and evaluation method. A survey study was conducted to determine the evaluations of different expert groups regarding the environmental, social, economic, visual value and accessibility benefits of the GBB.

Survey: A face-to-face and online survey study was conducted with different expert groups to make multidimensional (environmental, social, economic, visual value and accessibility) evaluations after the use of the GBB application with a participatory approach based on the opinions of field experts who visited Güzelcehisar.

The work of Townend et al. [19], Guaita-Garca et al. [51], and Vassiljev et al. [52] was employed. The survey's field experts are scientific-technical professionals from many fields in the environmental, social, and economic dimensions. Guaita-Garca et al. [51], Sealey et al. [53], Raymond et al. [54], and Tătui et al. [39] were utilized to determine the expert evaluation group.

The questionnaire, taken by 120 professionals (50 academics, 40 public and 30 private sector employees) who visited the field, was completed both in-person and online. The survey was conducted in January 2022. The judgmental sampling method, which was one of the non-random sampling methods, was employed to determine the research sample. The sample size was determined to be 120 under the conditions of 8.95% sampling error, 95% confidence level (α = 0.05), and maximum uncertainty (p = q = 0.5).

The questionnaire form is divided into two sections.

- In the first part of the survey, seven questions containing the demographic characteristics of the field experts are asked (age, gender, education level, expert group, professional experience, city where they live, institution where they work);
- In the second part, the field experts are asked to evaluate the benefits of the GBB with four main criteria: environmental (5 questions), social (4 questions), economic (3 questions), visual value and accessibility (5 questions) for a total of 17 Likert-type questions with a 5-point scale There are a total of 24 questions (1 strongly disagree, 2 disagree, 3 neutral, 4 agree, 5 highly agree) (Table 1).

Data evaluation: For frequency, % frequency calculations, data visualization, summary statistics for 5-point Likert type questions, % satisfaction, exploratory factor analysis, and reliability analysis for demographic questions, the SPSS V.26.0 statistical software and Excel 2016 programs were used. Evaluations of the scale and the items were used for the expert responses to the 5-point Likert-type questions in the questionnaire. Exploratory factor analysis (CFA) was used with the Varimax rotation method to identify the factor structure of the scale addressing the benefits of the GBB. The Kaiser-Meyer-Olkin sample adequacy test and Bartlett's test of sphericity were used to assess the applicability of factor analysis. Environmental benefit, social benefit, economic benefit, and visual value and accessibility are the four factors defined by CFA. The composite reliability (CR) and average variance extracted (AVE) values, as well as Cronbach's alpha values for each factor group, were determined (Table 2).

Table 1. Criteria and its sub-criteria.

Criteria	Sub-Criteria	Likert Scale				
		1	**2**	**3**	**4**	**5**
I. Environmental Benefit	Q1.1. It is a good example of coastal resilience (design).					
	Q1.2. It is an example of good design for adaptation to climate change.					
	Q1.3. It creates awareness about geological diversity and contributes to the understanding of nature conservation.					
	Q1.4. It is an effective design example in preventing coastal erosion.					
	Q1.5. It is an example of infrastructure that allows for the preservation, recognition and year-round use of heritage coastal property.					
II-Social Benefit	Q2.1. It provides mobility opportunities for geotourism.					
	Q2.2. It offers multifunctional use (walking, cruising, resting, socializing).					
	Q2.3. It increases the level of satisfaction by increasing the user comfort of the visitors.					
	Q2.4. It provides a safe environment for visitors with its camera control system.					
III-Economic Benefit	Q3.1. It is in a focus/landmark position in the development of tourism (creating a destination) in Güzelcehisar.					
	Q3.2. Thanks to the formation of tourism infrastructure, it contributes to the local and regional economy by reducing seasonal dependence.					
	Q3.3. It is important for rural development thanks to the opportunities it provides for tourism and recreation.					
IV-Visual value and Accessibility	Q4.1. It allows the visibility of the parts of the basalt columns that cannot be seen from the land along the coast.					
	Q4.2. It offers better viewing and perception of the Güzelcehisar coast view (Basalt columns + Beach + Güzelcehisar Castle + Forest areas + Rural residential areas).					
	Q4.3. It contributes to a better perception of the unity of basalt columns and beach.					
	Q4.4. It contributes to a better perception of the unity of basalt columns and the sea.					
	Q4.5. It provides a visual connection between Güzelcehisar Basalt Columns and Güzelcehisar Castle.					

Table 2. Descriptive information about the sample.

Sample	120 questionnaire responses applied to the expert group (Specialization/Expertise)
Sampling Procedure	Intentional (decisional, judgmental) sampling; Sample size was found to be 120 under 8.95% sampling error, 95% confidence level ($\alpha = 0.05$), maximum uncertainty condition ($p = q = 0.5$).
Information Processing	SPSS V.26.0 statistical software and Excel 2016 program were used for frequency, % frequency calculations, data visualization, summary statistics for 5-point Likert type questions, % satisfaction, Exploratory factor analysis and reliability analysis for demographic questions.

4. Results

In this study, 38.3% of respondents (participants) were female ($n = 46$, mean age: 43.4, standard deviation: 12.0), whereas 61.7% were male ($n = 74$, mean age: 44.36, standard deviation: 14.67). The participants' education levels are as follows: 39.2% University ($n = 47$), 38.3% PhD ($n = 46$), 20.0% MSc ($n = 24$), and 2.5% Secondary ($n = 3$). Table 3 provides summary data of the expert group (Specialization/Expertise) and professional experience of participants from within and outside of Bartın. According to Table 3, 70.8% ($n = 85$) of the field experts are from Bartın, while 29.2% ($n = 35$) are from outside Bartın. Furthermore, 41.7% ($n = 50$) of the participants belong to the Academician (Academician) expert group, 25.0% ($n = 30$) to the Private sector (Private), and 33.3% ($n = 40$) to the Public Employee (Public) expert group. Approximately 10.8% ($n = 13$) of the field experts had less than 5 years (below 5 years), 15.8% ($n = 19$) had 5–9 years (5–9 years), and 73.3% ($n = 88$) had at least 10 years (at least 10 years) of professional experience.

Table 3. Field expertise of the participants in terms of residence.

Residence (*n*, %)	**Specialization/Expertise (*n*, %)**	**Professional Experience (*n*, %)**
Inside Bartın (85, 70.8%)	Academician (36, 30.0%)	less 5 years (7, 5.8%)
	Private (17, 14.2%)	5–9 years (11, 9.2%)
	Public (32, 26.6%)	at least 10 years (67, 55.8%)
Outside Bartın (35, 29.2%)	Academician (14, 11.7%)	less 5 years (6, 5.0%)
	Private (13, 10.8%)	5–9 years (8, 6.7%)
	Public (8, 6.7%)	at least 10 years (21, 17.5%)

The distribution regarding the residence status of the participants in terms of the expert group (Specialization/Expertise) and professional experience is shown in Figure 3. Accordingly, the participation of academicians (Academician) from inside Bartın (72.0%, $n = 36$) is higher than from outside of Bartın (28.0%, $n = 14$). Among the private sector employees (Private), the participation from inside Bartın (56.7%, $n = 17$) is higher than the participation from outside of Bartın (43.3%, $n = 13$). It is seen that the participation of public institution employees (Public) from within Bartın (80.0%, $n = 32$) is higher than the participation from outside of Bartın (20.0%, $n = 8$). When the expert groups are analyzed, it is seen that the participants mostly have at least 10 years of professional experience (Academician: 82.0%, $n = 41$; Private: 63.3%, $n = 19$; Public: 70.0%, $n = 28$).

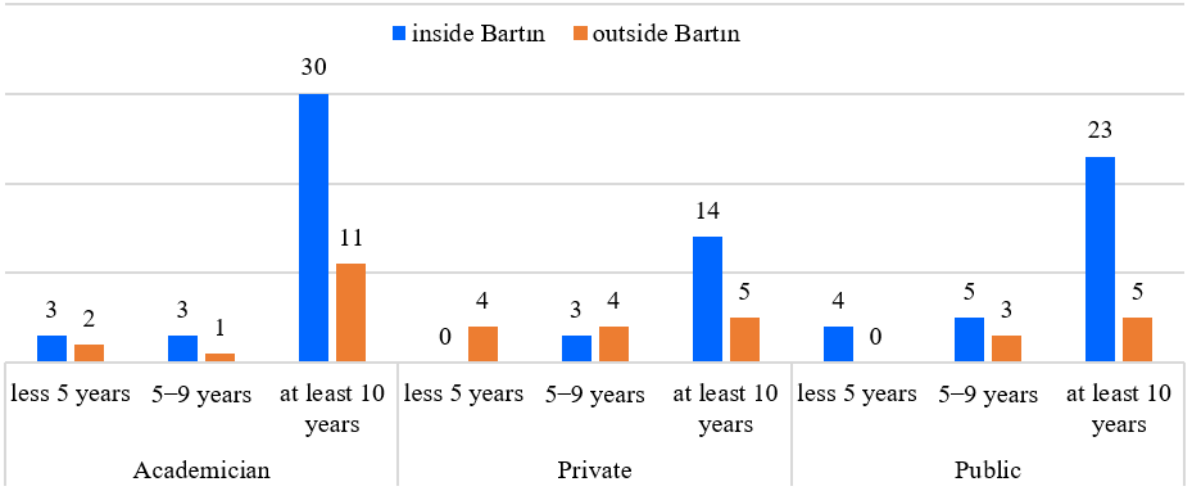

Figure 3. Distribution of the participants in terms of Specialization/Expertise and Professional experience.

Table 4 shows the descriptive statistics for the 5-point Likert-type 17 questions in the questionnaire, as well as the % age satisfaction. The item with the lowest average score is Q1.4, while the item with the highest average score is Q2.2, as shown in Table 4. The calculated % satisfaction for Q1.4 and Q2.2 is 75.6% and 96.0%, respectively. The general evaluation score of the field experts for the GBB was 4.40 (out of 5), and the standard deviation was 0.681, based on their responses to the questionnaire's 5-point Likert-type questions. As a result, 88% of field experts are satisfied with the benefits of the GBB. According to Table 4, experts are 87.8% satisfied with the fact that boardwalk contributes to the local and regional economy by minimizing seasonal dependence due to its tourism infrastructure. Furthermore, experts are 87.4% satisfied with the value of the GBB in terms of rural development due to the chances for tourism and recreation development.

The SPSS package program was used to examine the scale and items for the expert answers to the 5-point Likert-type questions in the questionnaire. Exploratory factor analysis (CFA) was used with the Varimax rotation method to identify the factor structure of the scale addressing the benefits of the Güzelcehisar Beach Boardwalk. The Kaiser-Meyer-Olkin sample adequacy test and Bartlett's test of sphericity were used to assess the applicability of factor analysis. Environmental benefit, social benefit, economic benefit, and visual value and accessibility are the four factors defined by CFA. Cronbach's alpha values estimated for the overall and for each factor group in Table 5 were found to be more than the suggested value of 0.70. Furthermore, because the Cronbach coefficient is sensitive (high) in the presence of a large number of items and sample size, Table 3 includes composite reliability (CR) and average variance extracted (AVE) values. CR values were found to be higher than the necessary 0.70, while AVE values were found to be higher than the recommended 0.50. The relevant scale has acceptable reliability, according to the CR results. Convergent validity is satisfactory, according to the AVE results. As a result, the CFA, Cronbach's alpha, CR, and AVE values for 17 5-point Likert-type items are shown in Table 5.

The mean (standard deviation) of the environmental benefit questions in Table 5 was 4.05 (0.715); the mean (standard deviation) of the social benefit questions was 4.64 (0.594); the mean (standard deviation) of the economic benefit questions was 4.34 (0.682); and the mean (standard deviation) of the visual value and accessibility questions was 4.57. (0.582). Accordingly, the field experts' satisfaction levels with the GBB are 92.8% for social benefit, 91.4% for visual value and accessibility, 86.8% for economic benefit, and 81.0% for environmental benefit. According to % satisfaction, social benefit (92.8%) and visual value and accessibility (91.4%) are higher than overall satisfaction (88.0%) and lower than the others.

Table 4. Descriptive statistics of 5-point Likert questions and % satisfaction.

Item	*n*	Minimum	Maximum	Mean	Std. Deviation	% Satisfaction
Q1.1	120	2	5	4.06	0.639	81.20
Q1.2	120	2	5	3.88	0.735	77.60
Q1.3	120	2	5	4.19	0.652	83.80
Q1.4	120	2	5	3.78	0.793	75.60
Q1.5	120	2	5	4.34	0.601	86.80
Q2.1	120	2	5	4.60	0.627	92.00
Q2.2	120	3	5	4.80	0.422	96.00
Q2.3	120	3	5	4.63	0.549	92.60
Q2.4	120	2	5	4.55	0.578	91.00
Q3.1	120	2	5	4.27	0.753	85.40
Q3.2	120	2	5	4.39	0.652	87.80
Q3.3	120	2	5	4.37	0.634	87.40
Q4.1	120	3	5	4.71	0.509	94.20
Q4.2	120	2	5	4.53	0.648	90.60
Q4.3	120	2	5	4.41	0.615	88.20
Q4.4	120	3	5	4.61	0.555	92.20
Q4.5	120	3	5	4.60	0.541	92.00
General	120	2	5	4.40	0.681	88.00

Table 5. KFA, Cronbach α, CR, and AVE results of 5-point Likert questions.

Definition	Item	λ	α	CR	AVE
Environmental Benefit: (α = 0.856)	Q1.1	0.856	0.856	0.834	0.504
	Q1.2	0.706			
	Q1.5	0.686			
	Q1.3	0.654			
	Q1.4	0.624			
Social Benefit: (α = 0.844)	Q2.2	0.814	0.844	0.803	0.507
	Q2.1	0.703			
	Q2.4	0.681			
	Q2.3	0.639			
Economic Benefit: (α = 0.860)	Q3.3	0.892	0.860	0.838	0.637
	Q3.2	0.846			
	Q3.1	0.632			

Table 5. *Cont.*

Definition	Item	λ	α	CR	AVE
Visual Value & Accessibility: (α = 0.871)	Q4.2	0.839	0.871	0.838	0.514
	Q4.4	0.747			
	Q4.3	0.739			
	Q4.1	0.711			
	Q4.5	0.505			
Complete Survey (α = 0.896)	KFA-Summary: Total Variance Explained: 63.434% KMO: 0.847; Approx. Chi-Square: 1202.309; df: 136, sig: 0.000				

5. Discussion

5.1. Theoretical Implications

The use of natural resources with maximum benefit and minimum harm requires the sustainability of ecosystem services at all scales, from global to local. According to Ramos and Costa [47], tourism and recreation opportunities and practices in rural coastal landscapes are considered sustainable regional development factors. However, because of climate change, sea levels on a global scale are rising on almost all coasts. Coastal communities need plans to sustain ecology, economies, and social activities and ensure community continuity [33]. In this context, boardwalk applications, which are infrastructure examples with physical features that provide economic and/or social benefits, are widely used and contribute to building resilience. Boardwalks can act directly against the effects of climate change, and when properly designed, they can also facilitate access to the beach for tourism purposes [27]. At the same time, boardwalks are important for preserving the coast from sea erosion [5,55].

The GBB contributes to the development of coastal tourism infrastructure in Güzelcehisar, as well as to the spatial use of the coastline and the duration of use. In addition, Panin and Nicolae [29] and Yüksek et al. [30] noted in their studies that the ongoing sand movement activity, which is produced as a result of the tidal movement, increases the resistance of the coastal zone against the movement and force of the increasing wave levels.

Parallel to the purpose of this article, in addition to recreational activities, Van der Best et al. [4] and Prisco et al. [5] emphasized the consensus that coastal dunes should be managed with an integrated perspective for human well-being with an interdisciplinary approach to spatial planning, stakeholder interests, and ecosystem protection. Simultaneously, Townend et al. [19] conceive resilience by highlighting the breadth of indicators and information that could be associated with coastal resilience, and so they are handled based on their social, economic, and environmental characteristics.

The article's methodology is to determine the evaluations of field experts who visited Güzelcehisar based on stakeholder participation in the GBB. In line with this goal, Molino et al. [20] and Hamin et al. [56] indicated in their study that stakeholder assessments are critical for coastal resilience decisions. In their study, Raymond et al. [54] noted that the knowledge and preferences of various stakeholder groups allowed perceptions of resilience impacts to be presented and that this information can be used to the advantage of future actions. The field experts who participated in the survey are scientific-technical specialists from many disciplines in the environmental, social, and economic dimensions, as part of the scope of the multifunctional evaluations of the GBB. In this context, Sealey et al. [53] performed a multifunctional performance evaluation of existing coastal structures in South Florida with a multidisciplinary expert group with expertise in architecture, ecology, economics, engineering, design, and public art in order to understand their functionality.

Boardwalks are used for a variety of purposes throughout the world. Such a structure is targeted at coastal resilience and tourist development on the Tuscan Coast of Northern

Italy [12], the protection of the Italian dune environment [5], and the usage of coastal tourism and recreation, as well as the Costa de Sol Boardwalk and La Cala de Mijas Boardwalk in Spain. In terms of intended use, the Carolina Beach Boardwalk in North Carolina [42] is similar to this study.

Increasing access to the Güzelcehisar Basalt Columns, which have significant potential for coastal geotourism and cultural tourism, would help to diversify tourism and increase its national and worldwide prominence. The GBB's coastal geotourism activities continue all year, and its role in the development of tourism infrastructure is critical for local and regional rural development. Güzelcehisar is a coastal location in the Western Black Sea Region that is vulnerable to the effects of climate change, according to Cengiz et al. [45], and it is a "Heritage Coast" due to its geologic features. It has been recommended as a "National Geological Heritage" area in this context.

Few empirical studies have been conducted to assess the economic benefits of coastal walking trails, as well as the impact of expanding the walkability for users and the length of the useable coastal areas [9]. Our study is one of the few that addresses this topic. In this context, the 850 m-long boardwalk provides social benefits by increasing access to the basalt columns in the south, increasing usable shore length, and improving user comfort, beginning at the observation terrace in Güzelcehisar bay's north end and connecting to the rocky island before continuing along the coast. According to Banerjee et al. [57], extending the beach connection and length is also significant for the beneficiary target groups. According to the expert assessment, the increased accessibility of the GBB was judged to be in second place in the survey, and it was also beneficial for the visibility of the landscape. Similarly, the study by Barry et al. [9] indicated that the walking route established in a seaside recreation area in the west of Ireland has favorably influenced the number of trips by improving public access. Furthermore, differences in landscape quality and contribution to the ecological quality, rather than recreational values for walking, were investigated.

We found that there was a high degree of satisfaction that the GBB increases visitor comfort. We also found that within the scope of social benefits, the GBB stands out with its multifunctional use (walking, watching, resting, socializing) as having the highest level of satisfaction from expert evaluations. This result is similar to the boardwalk features examined by Banerjee et al. [57]. In this context, Barry et al. [9] emphasized that the recreational use of walking trails is important for improving the comfort value of the local coastline as well as improving the amenity value of the local coastline.

According to Banerjee et al. [57], the implementation of boardwalks in Barbados, used as a coastal infrastructure to reduce vulnerability and increase resilience, has reduced beach erosion and property damage as well as provided significant benefits for tourists and residents alike. This approach can be applied to similar climate-sensitive coastal areas by highlighting tourism as an economic development strategy. Unlike the Barbados study, the GBB, according to evaluations made within the scope of environmental benefits, has a high satisfaction level for coastal resilience design mitigation and adaptation. However, it is below the overall satisfaction level in preventing coastal erosion.

In this study, a participatory approach based on the opinions of experts (academics, public and private sector employees) in different fields was adopted in order to make multifunctional evaluations of the coastal resilience and tourism and recreation infrastructure compatible with climate change for the GBB application. The study by Tătui et al. [39], which is similar to our study, includes expert evaluations in different fields (research, academia, government institutions, non-governmental organizations) to determine storm and coastal erosion changes caused by climate variability in Black Sea coasts.

RQ1 evaluations

The benefits of the GBB are social, visual value and accessibility, economic, and environmental benefits. Expert reviews highlight that the GBB provides multifunctional use (walking, viewing, resting, and socializing) in terms of social advantages. The fact that the GBB provides visibility of areas of the Güzelcehisar Basalt Columns that are not visible from

the land along the coast ranks highest in terms of visual value and accessibility. According to economic benefit assessments, the GBB benefits the local and regional economies by minimizing seasonal dependence, owing mostly to its tourism infrastructure. When the GBB is analyzed in terms of the environmental advantages it provides, the research is an example of infrastructure that allows for the protection, acknowledgment, and use of the heritage coastal features all year. Field experts are generally pleased with the benefits of the GBB, with an overall satisfaction % age of 88%. Social benefit and visual value and accessibility are higher than overall satisfaction.

RQ2 evaluations

According to the evaluations, the GBB plays an important role in the development of tourism and recreation activities due to its multifunctional use opportunities such as walking, watching, sitting, resting, and socializing, increasing visitor comfort, creating a safe visiting environment, and providing mobility for geotourism.

The GBB provides visibility along the coast of parts of the basalt columns that cannot be seen from the land. At the same time, basalt columns + beach + Güzelcehisar Castle + forest areas + rural settlement areas provide better monitoring and perception of the holistic landscape unity. In this context, the visual value and accessibility benefit has important functions in terms of tourism and recreation activities in the formation of scenic viewing points and ensuring easy accessibility.

According to the expert evaluations, very high levels of satisfaction were determined in terms of tourism and recreation activities in the context of environmental benefits. Based on the natural and cultural landscape features, the GBB has significant potential to support awareness of environmental protection as an infrastructure example that also allows the preservation, recognition, and year-round use of the heritage coastal feature of the research area.

RQ3 evaluations

Scientific studies for the Black Sea coast forecast an increase in sea level, wave size, and wind speed as a result of climate change and storm events. Although it has a high level of satisfaction as an example of good design for coastal resilience within the framework of climate change mitigation and adaptation, it falls short of the general satisfaction level in preventing coastal erosion, according to an expert evaluation conducted within the scope of environmental benefits.

RQ4 evaluations

The notion that the GBB helps the local and regional economy by spreading tourism activities across 12 months of the year and minimizing seasonal dependency as a tourism infrastructure is widely acknowledged. Furthermore, among economic issues, the contribution of the GBB to the diversification of tourism and recreation activities is significant in terms of rural development and so has the highest level of expert satisfaction.

Cengiz et al. [41] state that Güzelcehisar's geotourism potential provides a feasible means of local and regional economic growth. Access to the Güzelcehisar Basalt Columns, made possible by the boardwalk, plus the growing number of visitors, play a key role in socioeconomic and sustainable development. Simultaneously, it was emphasized in the study that geotourism activities are not only an important source of employment but also have a significant potential to support environmental protection awareness with activities focusing on welfare, lifelong learning, personal development, science, and education.

5.2. Managerial Implications

According to Ferro-Azcona et al. [58], protected areas not only help to maintain and offer ecosystem services but also play an important role in improving the adaptive ability and resilience of coastal communities. So, there is a need to implement participative, comprehensive, and adaptable management strategies for protected areas. There is a need for coastal management planning that is flexible, adaptable, and has a vision that incorporates benefits for coastal communities for the sustainability of Güzelcehisar beach, which holds the status of 1st Degree Natural Protected Area.

Combining engineering structures and ecosystems as a coastal adaptation method (Ecological Engineering), especially considering the social functions of the measures to be implemented, and utilizing their synergies is critical in strengthening coastal protection and resilience [59,60]. Lukoseviciute and Panagopoulos [31] support the necessity to create recreational routes and boardwalks along the coastline, which increases tourist demand so that visitors may enjoy the unique views of the beaches without endangering the ecology. In this context, the GBB application is significant on a regional and local scale as an example of multifunctional coastal infrastructure.

A long-term and adaptable governance approach that attempts to supply society with information, experience, and learning processes can generate long-term solutions for the management of design and planning processes. By studying the relationship generated by contact and assuring the sustainability of the developed systems, the resilience method can develop practical solutions in terms of their contribution to quality of life.

Climate change impacts include [20,61] coastal erosion and floods as in the UK [62], as well as erosion, storms, and sea level rise on several Black Sea coasts [39]. According to Nicholls et al. [63], it is critical to use integrated coastline management approaches to address these threats in the context of regional-scale coastal dynamics [19].

Education on ICZM is lacking in Black Sea countries. Only a few ICZM disciplines have been defined, such as engineering, oceanography, marine biology, and environmental sciences. Coastal management, on the other hand, necessitates the integration of several processes that encompass biophysical, ecological, socioeconomic, and cultural components. An integrated approach to coastal management should be included within the framework of collaboration between state institutions, local governments, and academia [39].

5.3. Limitations and Future Research Directions

In this study, the multifunctional use of the GBB in the Western Black Sea Region was evaluated in terms of tourism-recreation and coastal resilience. It provides basic data for detailed and comprehensive studies to be carried out in the next stage. In future studies, based on the basic data presented in this study, the survey studies to be applied can be designed in more detail, and more inclusive results can be achieved. In the context of the participatory approach, the survey was applied only to the experts who visited Güzelcehisar village. Therefore, the selection of experts constitutes a representation limitation. The COVID-19 pandemic process has been a limiting factor in the application of the survey to the local population. In order to increase stakeholder participation in future studies and obtain more inclusive data, the participation of local people in the survey can also be ensured.

The most obvious limitation of this study is that it is the only boardwalk application in the Black Sea region. Because this study is site specific, it was not possible to make comparative evaluations. Therefore, multifunctional evaluations were limited to the local scale of Güzelcehisar village and can be examined only on general features. Another limitation of the study was that the study was evaluated on only one sample. In addition to the GBB application, the scope of future studies can be expanded by examining different coastal structures (pier, breakwater, etc.) to obtain more comprehensive findings.

In future studies, it is critical to determine the route, viewing angles, and time spent stopping or staying at a certain spot in terms of how tourists experience the GBB design. Furthermore, the evaluation of the research area in terms of landscape diversity and three sections of the boardwalk will provide essential data for Güzelcehisar's tourism-recreation development.

The boardwalk was evaluated in terms of environmental, social, economic, and visual attributes, as well as accessibility benefits. In addition to these benefits, the boardwalk-landscape types of interaction (forest landscape, agricultural landscape, archaeological landscape, rural landscape, and basalt columns landscape) for Güzelcehisar's sustainable development should be thoroughly evaluated with the ICZM plans that are currently being developed.

The article's satisfaction levels will inform future studies on the sustainable development of the Güzelcehisar coastline. According to the study's findings, it is advised that multidisciplinary scientific studies focused on improvement and development for advantages below the general satisfaction level be conducted.

6. Conclusions

Few studies on practical applications have studied the interactions, synergistic effects, and co-benefits of integrated approaches to climate change impacts and adaptation, according to Cheong et al. [59] and Schoonees et al. [60]. Rather than focusing on a single method, the study emphasized multifunctional approaches to coastal adaptation. Burger et al. [33] developed a framework for planning efforts based on the Toms River-Barnegat Bay ecosystem in New Jersey (east coast of the United States, 90 km south of New York City). This article is one of the few on the subject, as it includes the results of a multifunctional evaluation of the use of a boardwalk in Güzelcehisar with an innovative approach and the infrastructure feature provided by experts after being used. It also contains important data for the Western Black Sea Region in terms of Integrated Coastal Zone Management.

This investigation addressed four major concerns based on expert opinions regarding the multifunctional (environmental, social, economic, visual value and accessibility) evaluations of the GBB in terms of coastal durability and tourist and leisure infrastructure.

The boardwalk is a tourism infrastructure that stands out in the research area's rural coastal scenery. It contributes to sustainable regional development by diversifying tourism and generating new destinations, with beneficial effects on tourism and recreation potential. According to Barry et al. [9], it is widely acknowledged that coastal recreation activities such as walking have the potential to deliver major economic advantages to rural communities through tourism, encouraging rural diversity, innovation, and regional development.

Multifunctional assessments were conducted of the boardwalk application, one of the infrastructure applications in the coastal areas of Güzelcehisar, which has rural landscape features in the Western Black Sea Region. The GBB, which is supportive of the region's sustainable development, has been evaluated using an interdisciplinary participatory method in terms of environmental benefit, social benefit, economic benefit, and visual value and accessibility benefits. The Güzelcehisar Beach Boardwalk has integrated functions in terms of mitigating the effects of climate change in coastal areas, diversifying tourism and recreation opportunities, spreading them throughout the year, and creating new tourism destinations.

Evaluation of tools for determining ICZM strategies in terms of sustainability of rural coastal areas and their contribution to regional development serves to improve planning and policymaking. Satisfaction levels obtained with a participatory approach are an important strategic tool for decision-makers in order to make the most of the functions provided by the services provided in terms of coastal zone management and to determine the most appropriate actions. Thus, increasing the economic and environmental benefits of the GBB will contribute to sustainable regional development.

The Güzelcehisar Beach Boardwalk was evaluated as an example of infrastructure within the scope of effective solutions for tourism and recreation activities and resilience within sustainable development of rural coastal landscapes using a participatory approach, so the results will guide Integrated Coastal Zone Management planning for the area.

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