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The Use of Collaborative Practices for Climate Change Adaptation in the Tourism Sector until 2040—A Case Study in the Porto Metropolitan Area (Portugal)

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Abstract: When climate change became a global concern in the 1980s, mitigation was considered the best strategy to address all challenges. For a long time, it was thought possible to stabilize atmospheric concentrations of greenhouse gases (GHGs), which, according to many experts, brought on an unfit adaptation. There are international agreements designed to significantly reduce CO_2 emissions and achieve carbon neutrality by 2050, but the policy measures taken so far are insufficient to achieve this goal. In addition, the crisis caused by the COVID-19 pandemic highlighted the relevance of placing this issue at the core of international policies and the need for bottom-up measures and options. The purpose of this paper is to explore how collaborative planning can contribute to adapting the urban tourism sector to climate change in the Porto Metropolitan Area (PMA), located in the northern region of mainland Portugal. In this investigation, we used mixed methods based on the following: (1) the discussion of urban tourism's adaptation planning to climate change with undergraduate students; (2) the application of a modified Delphi questionnaire survey, to 47 international researchers and technicians in the first round and 35 international researchers and technicians in the second round, about the predictability of the adaptation measures; and (3) a theoretical-practical workshop aimed to discuss the main action intentions and ways of adaptation in the short and medium term. All empirical data were collected during the year of 2021. This research highlights the need for more detailed information, the weak interaction between stakeholders and the limitation of resources. Our research identifies the main impacts and local vulnerabilities and determines priorities for adaptation and implementation of actions, aimed at mitigating the effects of climate change and maintaining tourism attractiveness in urban areas. In addition, this investigation allowed the definition of a research agenda, which seeks to guide the area of tourism climatology regarding the new challenges imposed by the COVID-19 pandemic.

Keywords: urban tourism; climate change; adaptation; planning; Porto Metropolitan Area

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1. Introduction

A decision-making approach involves several stakeholders, including in the stages of public participation and risk communication. The sixth IPCC report advises stakeholder engagement and a context of support, including processes of decision-making and knowledge transfer tools between entities and institutions [1].

This participation contributes to improving the quality of decision-making, to gaining greater acceptance of policies, to widening the understanding of environmental problems and ensuring the principle of democratic legitimacy [2–4]. This premise promotes the transition from adaptation and mitigation-based policies to new climate resilience-based orientations.

Moreover, climate resilience plays a major role in climate mitigation and adaptation actions, while seeking to create opportunities for territories such as the Porto Metropolitan Area (PMA) and more specifically the municipality of Porto (regional urban tourism segment core). Thus, we chose to outline the following question: *what can we do when it comes to tourism activity to improve the quality of life of residents and the capacity of visitors to enjoy urban spaces and cope with climate change scenarios?*

Based on the growing importance assumed by outdoor recreation activities and the need to adapt urban areas to new post-pandemic challenges [5], it is mandatory that the tourism sector plays an effective role in climate resilience. To this end, an innovative research methodology was used (based on mixed approaches), where the debate on a set of defined action measures was stimulated through collaborative methods, according to the identification, inventory and diagnosis of PMA's particularities. First, six undergraduate students participated in the winter of 2020–2021 in the study with the launch of preliminary strategic guidelines for the adaptation of the urban tourism sector, in the context of a few opportunities arising from the pandemic situation. The second collaborative method used was the application of a modified Delphi questionnaire survey to 45 international researchers and technicians in the first round and 35 international researchers and technicians in the second round, focusing on the predictability of the measures to cope with climate change. The last one was a workshop held to assess what participants (while tourists) would be willing to do, namely, through a World Café, where some of the main actions to be carried out in different time horizons were outlined.

After this brief introduction, the following sections are dedicated to the dissection of the relevance of using collaborative practices for adaptation of urban tourism to climate change, namely, the last trends of policymaking emerging during the COVID-19 period. Next, in Section 3, the methodology underlying the study is presented, followed by its major findings related to the application of collaborative practices in PMA (Section 4). Finally, the discussion of results and its main conclusions are presented in Section 5.

2. Adaptation of Urban Tourism to Climate Change Based on Policy-Making Trends Emerging during the COVID-19 Period

Due to COVID-19, the 26th Conference (COP 26) of the United Nations Framework Convention on Climate Change (UNFCCC) was in doubt last year. It eventually took place in Glasgow, Scotland, between 31 October and 13 November 2021 [6]. Despite the global health emergency caused by COVID-19, it was the largest COP in history in terms of participants and was associated with massive street protests. This conference made clear the need to invest in inclusive governance, particularly in that peculiar moment where COVID-19 was central. In 2018, an IFRC World Disaster Report entitled 'Leaving no one behind' had already mentioned that we do not need to leave anyone behind, particularly those who inhabit or visit urban spaces [7].

Although these reports insist on some new principles, many of the climate adaptation policies in the cities are based on various proposals and analysis made by several international authors [8–11]. From these orientations emerge interdisciplinary approaches, following the issues of the physical, social, ecological, and cultural quality of the urban environment. This type of policy can be relevant in the context of a (post-) pandemic period [5,12,13].

Variations in the goals and priorities defined in the urban environment over several decades (essentially since 2000 in Portugal) demonstrate that policymakers can make cumulative changes in the adaptation of public space for tourism enjoyment [14].

There are several reasons that can contribute to this transformation of public space in the context of adaptation to climate change, namely: (i) experience related to the impacts of certain natural risks [15,16]; (ii) type of incentives (national regulations, guidelines and climate plans, sectoral policies—coastal border regulations) capable of generating imperative actions [15,17–19]; and (iii) banks' and foundations' support for development,

which can also serve as an incentive to action through the provision of financial and technical assistance to cities [20].

There are different types of measures associated with the impacts of climate change aimed at reducing heat, floods, and water scarcity, only partly reflected in current climate projections: the increase in duration, frequency and/or intensity of heat waves, extreme precipitation and drought events [21–23]. Adaptation and mitigation measures are essential at different spatial scales, from interventions regarding construction (e.g., roofs and green walls) to urban-scale interventions (e.g., green corridors in urban areas) [24–26].

Despite the differentiation of geographic scales, measures in different urban areas are proposed with actions based on different planning instruments and considering the intervention of different stakeholders (politicians and public administration technicians, businesses, local community, and tourists) [27,28].

It should be noted in this regard that measures such as the re-naturalization of rivers cannot be established exclusively in the urban sphere. Urban plans offer the possibility to establish interventions (registered within the urban sector of rivers), but also promote coordination with other levels of planning (e.g., regional planning) [29,30].

In the context of climate change, these interventions can mitigate future extreme climate risk and help make tourism more enjoyable in its time and spatial dimensions (e.g., the creation of temporary shops; the transformation of spaces into outdoor venues; the widening, if in an orderly manner, of terrace cafés in public space; the creation of areas exclusively intended for pedestrian use) [31–33].

The observation of urban spaces as 'living organisms' replaces the emphasis on certain actions on specific spaces of the city, such as green spaces, squares, green roofs, vertical gardens, or green facades [34,35].

Therefore, the theory of tactical urbanism applied to tourism and related activities aims to rethink urban spaces associated with several dimensions among which the flows generated by tourism, the functions of the built space (buildings, housing, equipment, and infrastructure), the stimulation of sociability and the understanding of these interventions and their ability to readapt the city to future climate change scenarios [27,36].

The integration of qualitative–quantitative criteria (QUAL–QUANT) is fundamental for the evaluation of the effectiveness of adaptation to climate change. From this perspective, this research shares the positions defended by several authors [33,37,38] based on the importance of defining recommendations at the level of urban design guidelines. The model suggested regarding the adaptation of urban areas towards the improvement of tourism enjoyment is based on the approaches proposed in the Place Diagram, in Whyte (1980) [8], PPS (2000) [39], Jacobs (2016) [40], and, more recently, Santos Nouri and Costa (2017) [41] with the introduction of the dimension of thermal comfort.

3. Methods and Data

3.1. Study Area

The Porto Metropolitan Area (PMA) has 17 municipalities and 1,737,395 inhabitants (a reduction of 1.26% between 2011 and 2021) (INE, 2021) spread over almost 2.040 km^2. In 2021, 16.8% of the Portuguese population resided in NUTS III PMA [42]. The main tourist destination in the urban and city breaks segment is Porto, which indicates the recognition of its quality among the main tourist destinations in Portugal and Europe (e.g., European Best Destination, 2012, 2014 and 2017). In 2021, Porto was ranked among the 100 cities with the highest tourism performance index (68th place according to Euromonitor International) [43].

Considering the geographical location, tourism will certainly be affected by significant changes in weather patterns [44], notably by:

(a) Increase in the number of hot days (between 23 to 62 days) and very hot days (between 5 to 15 days);
(b) Higher frequency of heat waves and increased temporal duration;
(c) Increase in the number of tropical nights, which can reach 21 nights;

(d) Increase of 5 days per year of drought for each increase of 100 ppm of CO_2.

Figure 1 summarizes the main climate risks identified in each municipality (PMA), reflecting the type of effects of climatic–meteorological and hydrometeorological conditions in the area under study.

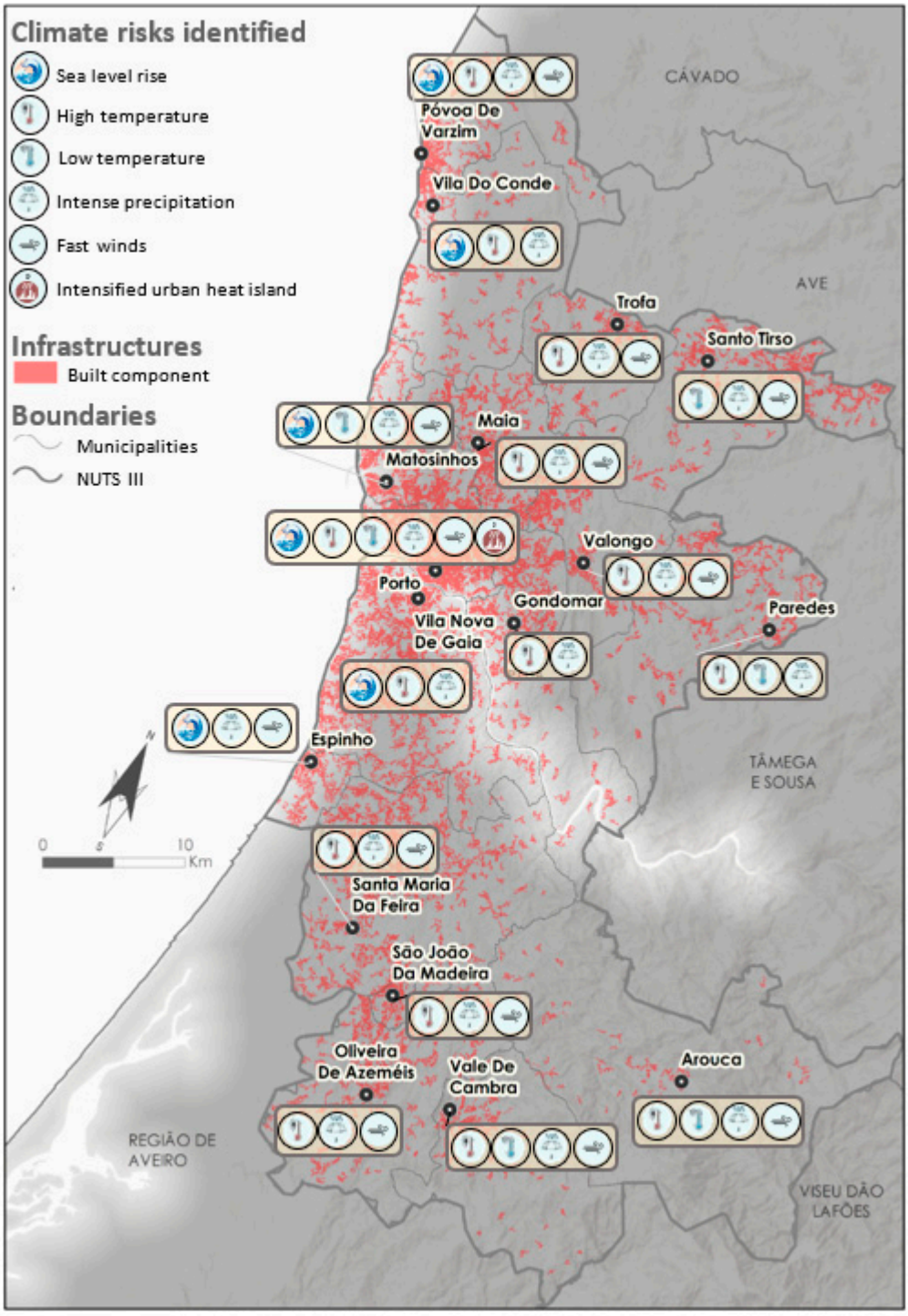

Figure 1. Study area—main climate risks identified. Source: Adaptation of Lopes (2022) [45].

In this context, extreme climatic events are likely to occur in a framework of climate variability in the medium and long term, with a tendency to become more intense. However, proximity and distance from the coastline or urban morphology (especially densification) may contract or intensify the risk level.

In view of this climate vulnerability scenario, several positive or negative effects (and in some circumstances both) on tourism can be identified (Table 1).

Table 1. Main consequences of climate change in the medium and long term—trends, projected changes and influence on the tourism sector.

Climatic Variable	Tendency	Projected Changes	Influence on the Tourism Sector (Level and Direction)
Temperature	Annual average temperature rise, in particular maximum temperatures	**Annual and seasonal average** Annual average temperature rise, between 1 °C and 4 °C at the end of the century. Significant increase in T_{max} in autumn (between 1.3 °C and 3.6 °C) and summer (between 1.3 °C and 4.1 °C). **Very hot days** Increase in the number of days with very high temperatures (≥35 °C) and tropical nights, with minimum temperatures ≥20 °C. **Heat waves** More frequent and intense heat waves.	*Level* *Direction*
Precipitation	Annual average precipitation decrease (increase in droughts and decrease in water reserves)	**Annual and seasonal average** Decrease in annual average rainfall at the end of the 21st century, ranging from 5.0% to 12%. In the winter months, the trend is for a slight increase in precipitation, ranging from 0.0% to 17.0%. In the remaining intra-anual period, a decrease is expected, which can vary between 9.0% and 25.0% in spring, between 13.0% and 51.0% in summer and between 14.0% and 22.0% in autumn. **Most frequent and intense droughts** Decrease in the number of days with precipitation, between 11 and 25 days per year. Increased frequency and intensity of droughts in southern Europe [1,45,46] [IPCC, 2014; 2018; 2021].	*Level* *Direction*
Sea rise	Average seawater level rise	**Average** Average sea level increase between 0.17 m and 0.38 m for 2050, and between 0.26 and 0.82 by the end of the 21st century (global projections) [45]. Other authors indicate an increase that could reach 1.10 m in 2100 (global projections) [47]. **Extreme events** Average sea level rise with more severe impacts, when combined with the rise in sea level associated with storms (*storm surge*).	*Level* *Direction*
Extreme events 	Increase in extreme precipitation phenomena	**Extreme events** An increase in two extreme phenomena, in particular, intense or very intense precipitation (results evidenced in national projections—Soares et al., 2015), with consequences on the fast and intense floods (mainly by the location on the coast and next to riverside areas—e.g., Ribeira do Porto). More intense winter storms, accompanied by rain and strong wind.	*Level* *Direction*

Trend: Decrease, Increase; Level: Little Very much; Direction: Positive, Negative.
Source: Authors' own elaboration, considering the various Municipal Strategies for Adaptation to Climate Change (EMAAC) of the Porto Metropolitan Area (PMA).

These effects may influence the destination differently, relying on the level (depending on whether it is high or low) or the direction (whether it is positive or negative). The effects of the increase in temperature, for instance, are notoriously relevant. Nevertheless, even though the aforementioned increase may cause problems in the summer, it can be beneficial in the winter.

Regarding the climate change risk reaction in the tourism sector, it is worth mentioning all the identifiable positive (softening) and negative (aggravating) aspects in PMA when it comes to the climate change scenario, with the collaborative contribution of regional and local stakeholders. Based on this articulation, the measures to be established will be more oriented to issues affecting these communities, tourism segments, and stakeholders' network participation.

3.2. The Use of Participatory-Based Methodologies

Perhaps the most difficult task in any research is integrating political contributions or strategies based on collaborative techniques.

In this study, the use of collaborative techniques to support the definition and implementation of strategies and policies for adapting the tourism sector to climate change comes after several stages of research, namely: (i) longitudinal literature review with a scope on tourism and climate change with analysis of 889 publications since 1940 [48]; (ii) the identification of the main climatic stressors before and during COVID-19 [5,27]; and (iii) the determination of thermal comfort range for tourism, namely, in areas more susceptible to urban heat stress [27,49]. Research oriented towards citizen science and community action can provide more information, an opportunity for the identification and education of the various stakeholders and reasons to start the action.

Moreover, this methodology allows us to integrate both stakeholders and researchers in the same intervention by documenting and interpreting the efforts of all. For this process, the basic principles inherent to observation, knowledge and action are identified (i.e., Stringer and Aragón's Look–Think–Act theory) [50]. This research focus on three phases: (1) problem formulation and description; (2) interpretation and explanation of the situation and efforts to address the problem; and (3) the attempt to solve the problem and formulate solutions [50].

The principle of citizen science is kept in mind, which is based on collaborative techniques designed to guide current and future tourism research, particularly in the context of climate change in PMA. Accordingly, three distinct tools were used to achieve the defined purpose:

(i) The opinion of undergraduate students in Geography and Planning, from the University of Minho (Portugal), about tourism strategies for coping with climate change.
(ii) The views of experts on tourism, town planning, and climate change regarding important decisions as well as a strategy closer to the needs of the territory through a Modified Delphi Approach (MDA);
(iii) A workshop with a view to design a final strategy to be delivered to decision-makers.

A collaborative study should be conducted in view of the interconnection of the moments that might contribute to the improvement of tourism planning practices in the context of climate change and in the face of the challenges imposed by COVID-19 in the assumption of a third order of intervention [5,48]. In this investigation, we propose a collaborative model called *TIP (Territory—Interventions—Proposal*—Figure 2*)*, which includes the following research phases:

(1) The *diagnosis*—where a survey of the particularities of the territory under analysis was made;
(2) The *assessment*—which has been considered a key element in the establishment of research priorities and potential measures since the start;
(3) The *dissemination practices*—building solutions for territorial context, based on measures and actions to be developed to cope with climate change.

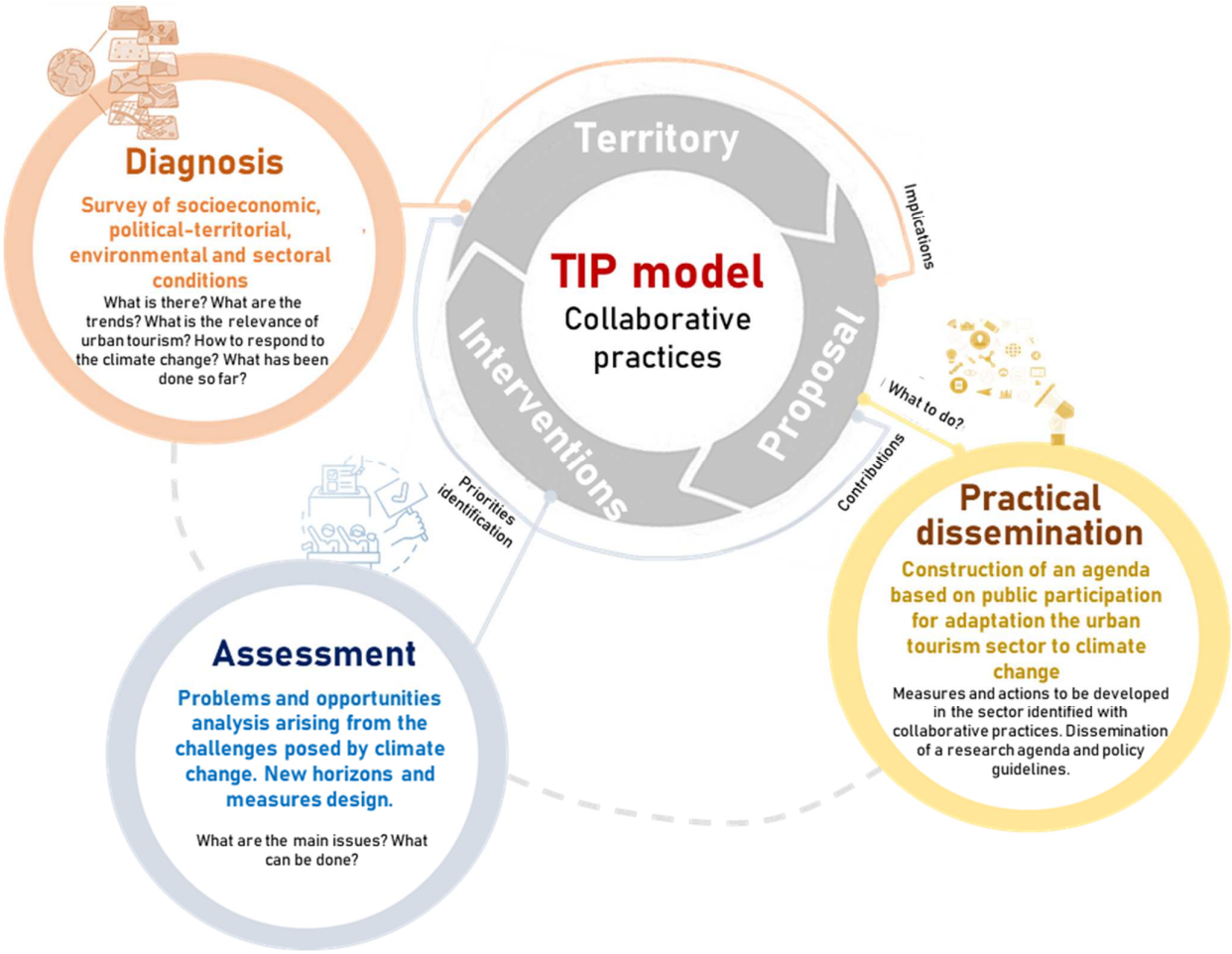

Figure 2. Proposed collaborative research methodology—TIP model (Territory, Intervention, Proposal). Source: Authors' own elaboration.

Table 2 summarizes the main phases and collaborative-based techniques used to respond to each of the topics necessary for the implementation of a proposal for adaptation to climate change in the urban tourism sector.

Table 2. TIP model implementation—research topic, phase and collaborative practice used.

Topic	Brief Description	Phase	Basic Collaborative Technique
Elements of adaptation in study area	Establish the conditions of the study area to address climate change and concerns around tourism. To be included: 1—The relevance of the consideration of urban tourism as a critical factor for local climate resilience. 2—Local examples. 3—*Experts* selected to guide the planning process (theoretical sessions with case studies presented).	Diagnosis	Opinions of undergraduate students in Geography and Planning, from the University of Minho.
Introduction to the planning structure	Introduction to the planning structure by guiding participants through an active process for identifying tourism resources and preparing a plan to protect local resources.	Diagnosis	Opinions of undergraduate students in Geography and Planning, from the University of Minho. Delphi panel with experts on tourism, town planning, and climate change.

Table 2. *Cont.*

Topic	Brief Description	Phase	Basic Collaborative Technique
Identify tourism resources in the study area	Characteristics and identification of existing resources important for adaptation to climate change.	Diagnosis	Opinions of undergraduate students in Geography and Planning, from the University of Minho.
Involvement of *Stakeholders*	Identification of *relevant* stakeholders to meet the challenge of climate change in the tourism sector.	Diagnosis	Opinions of undergraduate students in Geography and Planning, from the University of Minho.
Vulnerability assessment of identified tourism resources	Identification of the basic components of vulnerability, types of assessment and how they are used to address climate change.	Assessment	Delphi panel with experts on tourism, town planning, and climate change.
Definition of a mitigation, adaptation and resilience plan in the face of changes	Application of the planning process to protect resources. The process includes prioritizing actions, developing an implementation plan, and making commitments for implementation progress. Setting the agenda for intervention.	Assessment and pratical dissemination	Delphi panel with experts on tourism, town planning, and climate change workshop and final strategy to be delivered to decision-makers.

Source: Authors' own elaboration.

3.2.1. Strategies Design Based on the Opinion of Undergraduate Students in Geography and Planning

The integration of students—whose opinions are often central to territorial planning—is inherent in spatial thinking theories [51,52]. The participants of this research project were recruited among the students enrolled in the Curricular Unit of Geography of Tourism, in Geography and Planning, during the first semester (Autumn–Winter) of the school year 2020–2021, at the University of Minho—Campus de Azurém (located in NUTS III do Ave and NUTS II do Norte, Portugal). During this semester, 6 students participated in the study. They were expected to develop opinions and critical support on areas where it would be essential to draw planning actions to improve tourism enjoyment in a climate change framework.

The students were given the development of a proposal for strategic intervention to adapt tourism in the face of the context of climate change in PMA (and in an area considered with high urban value and strong tourism dynamism) as a challenge. To meet these assumptions, it was sought that students were able to discuss, in pairs, the following questions:

- What can be done in the short-term?
- What innovative solutions can be developed?
- How do they mitigate the effects of climate change? And how to improve the thermal comfort of those who visit the urban destination?
- The students also considered the following objectives for the purposes of the method:
- Identify the positive and negative aspects of urban tourism;
- Assess the comfort of public space to be used by tourists;
- Point out some solutions to mitigate the negative aspects of tourism in a climate change framework.

The students' opinion was summarized using a toolkit (Appendix A), which was built through an inter-observer agreement, seeking to synthesize the main premises and criteria underlying the evaluation of public space. This methodology was based on proposals defined by European initiatives to measure the degree of sustainability and urban quality.

The main key operations based on the students' opinion rewarded the following tasks: (1) analysis of tourism indicators and existing planning; (2) analysis and criticism of the existing tourism structure in this urban destination; (3) evaluation of public space and

tourism comfort dimension; and (4) proposal of an urban system that promotes tourism through the integration of several stakeholders.

After this process, experts and regional and local stakeholders were sounded out on possible strategies to address climate change in PMA.

3.2.2. Delphi's Approach to Addressing Climate Change Challenges

Several authors report that Delphi's approach facilitates the organization of group communication, through structured surveys, allowing us to deal with multifaceted and complex problems in various iterations [53–57].

In this investigation, it was decided to structure the technique with some modifications, as will become evident during the presentation of the method. In this context, we chose to use the designation Modified Delphi Approach (MDA), considering that it would be hard to find a consensus, but above all to synthesize measures to be delineated based on two iteration rounds.

Experts (or relevant regional and local stakeholders) are invited to give their opinion in sequential questionnaires, based on group feedback from the previous round. Feedback on sequential rounds encourages participants to re-evaluate, change and/or develop their opinions [57–59]. We opted for answers from anonymous participants to ensure that none of the experts monopolized or dominated the process [60,61], although some authors choose to reveal the identity of the participants [57,62].

Two questionnaires were provided for this study (Appendices B and C). The first panel made it possible to evaluate and predict the measures to be developed for a tourism strategy in the context of adaptation to climate change. Several elements for discussion and reflection were proposed regarding the promotion of the tourism sector and its resources.

Both questionnaires reflected the exhaustive longitudinal review of the scientific literature and previous studies conducted by the research team (Table 3). The questionnaire was tested by 8 local experts who verified the used language, comprehension and ease of response, and consistency of the instrument. An inter-observer agreement was also established based on three team meetings held prior to the start of the questionnaire application to reduce potential gaps and standardize information to be transmitted to MDA participants.

The first questionnaire was organized into 4 groups, in which we sought to identify: (i) the scale of action of tourism for the adaptation of the urban tourism sector to climate change; (ii) climate change constraints in the tourism activity; (iii) measures for adaptation and mitigation of climate change in the tourism sector; and (iv) the Delphi panel technical participants selected. The questionnaire was structured in 22 questions, some of them subdivided into sub-items and open questions.

In each topic, participants were invited to assess the probability of different tourism propositions in PMA in a climate change scenario, in the short, medium, and long term. This method is supported by the De Loë Model (1995) [63], using a 5-point Likert scale, with an additional option for those who 'don't know'. Each of the participants were nevertheless asked to explain their reasoning whenever they considered it useful, based on the relevant evidence of support for their decision-making. The last question allowed us to suggest relevant facts for reflection and discussion that were not considered a priori. After this round, the answers were processed and disclosed anonymously to the other members of the panel.

In this study, we chose to apply the MDA to 47 experts and regional and local stakeholders from various national and international academic institutions, companies, associations, and local and regional organizations (namely, Spain, Germany, Hungary, Canada, Brazil, and Turkey) between 22 January 2021 and 12 April 2021. A total of 34 of the 47 professionals in the first round participated in the second questionnaire (72.3% of the initial sample—Table 2). According to the latest review articles in the field, the number of participants in both questionnaires was quite acceptable [64–66]. The first questionnaire sought to identify the relevance of a package of measures related to climate change. The second questionnaire

aimed to identify the predictability and priority of the initial measures and those added by the participants. The time horizon was created based on the United Nations proposal included in the 2030 Agenda—Sustainable Development Goals (SDGs) and the latest report by the European Travel Commission (2018) [67], as a response to the challenges posed by the 2015 Paris Agreement.

Table 3. Sociodemographic profile of expert panel.

Variables	Features	Round 1 (n = 47) Type: Relevance and Preparation		Round 2 (n = 35) Type: Priority and Predictability	
		No.	%	No.	%
Gender	Male	30	63.8	18	51.4
	Female	17	36.2	17	48.6
Education	Degree	7	14.9	5	14.3
	Master's	4	8.5	3	8.6
	Doctorate	36	76.6	27	77.1
Age	25–34	6	12.8	5	14.3
	35–44	5	10.6	3	8.6
	45–54	19	40.4	14	40.0
	55–64	15	31.9	12	34.3
	≥65	2	4.3	1	2.9
Work experience (in years)	≤5	3	6.4	3	8.6
	6–10	8	17.0	6	17.1
	11–15	4	8.5	3	8.6
	16–20	10	21.3	9	25.7
	21–25	12	25.5	8	22.9
	26–30	4	8.5	2	5.7
	>30	6	12.8	4	11.4
Type of employment	University	36	76.6	27	77.1
	Government	5	10.6	4	11.4
	NGO	2	4.3	1	2.9
	Companies and businesses	4	8.5	3	8.6

Source: Authors' own elaboration based on two rounds of MDA.

3.2.3. The Workshop as the Final Stage of Research—The Launch of an Intervention Agenda for Urban Tourism

The latest method of research analysis, a workshop entitled '1st Workshop on Strategies for adapting urban tourism to climate change', was held in a framework of (post-) pandemic opportunities. This workshop aimed to outline an intervention agenda for PMA and the municipality of Porto and to contribute to the advancement of the scientific subarea of tourism climatology. It sought to integrate other territorial stakeholders, namely, tourism agents (travel agencies, companies in the sector, politicians, and technicians from local and regional institutions) instead of just considering the opinion of academics.

Eighty-five participants attended the workshop, synchronously and in-person, on 20 October 2021. The workshop was held in three sessions, of which:

(1) Two were online sessions about the impacts of climate change on urban tourism in the Mediterranean and the need of public policies, as well as a communication agenda to address the problem;
(2) One was an in-person session, with all relevant issues being discussed in a 'World Café' (Appendix D).

Initial activities and presentations have contributed to a greater awareness of climate change at regional and local level. The second moment allowed the participants to identify and consider potential impacts and to reflect on the importance of their role as professionals directly or indirectly related to the area.

This workshop was aimed at master's and PhD students in several social and environmental disciplinary areas (e.g., Geography, Tourism, Urban Planning, Architecture and Urbanism, Sciences Communication and Sociology), senior technicians of municipal councils working in the fields of urban planning, environment and public space, and other professionals who exercise functions in thematically related areas of intervention (e.g., regional, and urban development).

The following were among the workshop's main objectives:

(i) Identify good practices developed at international level;
(ii) Analyze the results of research carried out in PMA;
(iii) Contribute to innovative tourism solutions capable of fostering guidelines for urban design in areas of growth and priority of action for the bioclimatic rehabilitation of public space in a climate change context.

The workshop was planned to discuss local problems and concerns, as well as provide tools capable of promoting climate change adaptation actions. It included interactive and participatory moments and as wide a variety of activities as possible to promote action among the civil community, companies, and decision-makers.

One of the activities associated with this workshop was the identification of the main actions to be developed to adapt the tourism sector to climate change and the 'intentions of action' to cope with the posed challenges (Appendix E). The 'intentions of action' refer to whatever participants in the workshop would be willing to do to foster change in a time horizon ranging from 'up to 1 month', 'up to 6 months', to 'between 6 months and 1 year'. The idea inherent in this exercise aims to encourage participants to consider the experience resulting from the workshop as something facilitating climate action in the immediate term. In addition, this activity helped participants clear any doubts on climate adaptation in the urban tourism sector.

4. Results

4.1. First Contributions to the Definition of the Strategy—The Territorial Dimension

Several positive aspects can contribute to greater or lesser ease in the implementation and operationalization of adaptation measures in the tourism sector in the context of climate change, namely:

(i) Physical–natural conditions—oceanic proximity and weather conditions favorable to the elimination of the effect of pollutants; proximity to natural parks and other green areas;
(ii) Economic conditions—the existence of good economic indicators associated with the growth of the tourism sector in PMA; although there is a decline in the tourism sector due to COVID-19, adaptation and resilience measures in the tourism sector can reduce the consequences caused by the pandemic;
(iii) Sociodemographic and housing conditions—young people predominate in age groups, contributing to increased public awareness of climate change and mitigation measures;
(iv) Political–sectoral conditions—the articulation capacity between the mayors of the different municipalities in various matters of community interest and in a framework of interaction between several institutional figures and sectoral entities is not to be neglected.

However, there are a few factors that can slow down adaptation measures, including the different paces of economic growth, different resources, and consumption levels. The diverse interests of local institutions and entities can make the policy of action less precise and those environmental measures and strategies not capable of responding to the problem in advance.

We cannot see that the physical–territorial conditions, which contribute to peculiar conditions, deserve to be the subject of reflection. The Atlantic Ocean proximity contributes to control the increase in air temperature. PMA's morphological diversity (between valley and mountain areas) contributes to the lack of knowledge of the complexity of local

climatic mosaics. Another problem is the absence of a dense and well-distributed climate monitoring network.

Therefore, there is a need to rethink urban areas according to traffic flows, including tourism activity. It is essential to contribute to good urban planning and tourism, in a 'greener' city, where heavy structures are reduced, and shaded areas are created. The realization of these 'post-it' interventions must comply with the theoretical principles of 'urban acupuncture' [31,68]. In densely constructed areas, it can contribute as an obstacle to ventilation, while in other places, it can favor a reduction in overheating.

Regarding the interventions, other dimensions, besides thermal comfort and climate change, should always be considered, contributing, thus, to the sustainability triad (environmental, economic, and social). Although it is a subjective exercise, the students included in the project identified thermal comfort and environmental quality as dimensions that deserve particular focus (of a set of 11 dimensions and 64 items). In addition, the areas selected by the students correspond to three areas of great tourist interest (Trindade, Avenida dos Aliados and Praça da Liberdade, and Morro da Sé) and where green infrastructures should be enhanced (Figure 3).

The PMA and the city of Porto lack green spaces, and some of them are of lower quality and inscribed in areas of great environmental deprivation [69,70]. The expansion of the subway line (namely, the pink line) could increase this level of environmental deprivation and potentially lead to other consequences caused by the subsurface urban heat island, whose empirical body of evidence is still very small and should be given particular attention in the coming years (issues inherent in the expansion of the metro line and the existence of piped water distribution systems throughout the city).

4.2. Identification of Problems, Opportunities and Potential Measures Related to Climate Change—The Intervention of Experts and Stakeholders

The role played by public administration (technical adaptation), businesses (business adaptation), tourists and citizens (behavioral adaptation) should be assessed according to the real standards of the territory [71]. This occurs within a variety of actions and numerous adaptation measures related to tourism, namely, management techniques or regulation and control measures to raise awareness and risk education.

Based on the measures subjected to evaluation by experts in two assessment rounds, the most relevant measures were selected (with 85.0% or more of experts having assigned them a rating of 4 and 5 on the Likert Scale) and the action priorities were set (high priority (level 2) and maximum priority (level 1)—with 65.0% or more of the experts having considered the measure as a priority—Table 4).

Twenty-three measures were identified (twelve for public administration, five for tourism companies, three for tourists and visitants) to be developed in a framework of great importance for the adaptation of the sector to climate change in the tourist destination. Seven of the measures were considered for short-term implementation.

One of the conclusions reached during the workshop is that little is known about how we as tourists can act and to what extent our actions can be pivotal. This lack of knowledge is widespread and not limited only to activities directly intrinsic to the sphere of tourism. Only 28 of the 85 participants in the workshop answered about the changes they are willing to bring to their daily routine as to contribute for this path towards adaptation.

The participants demonstrated a predisposition to increase their use of public transport, soft modes and to reduce air travel (with the exception of long-distance destinations—n = 16); to reduce water consumption, the use of air conditioning, excessive meat consumption (and increased consumption of organic products) and plastic (n = 9); to reuse and recycle better (even outside the usual housing—n = 7) and to promote the dissemination of information on climate, in leisure (family and friends) and professional contexts (travel meetings (n = 6)).

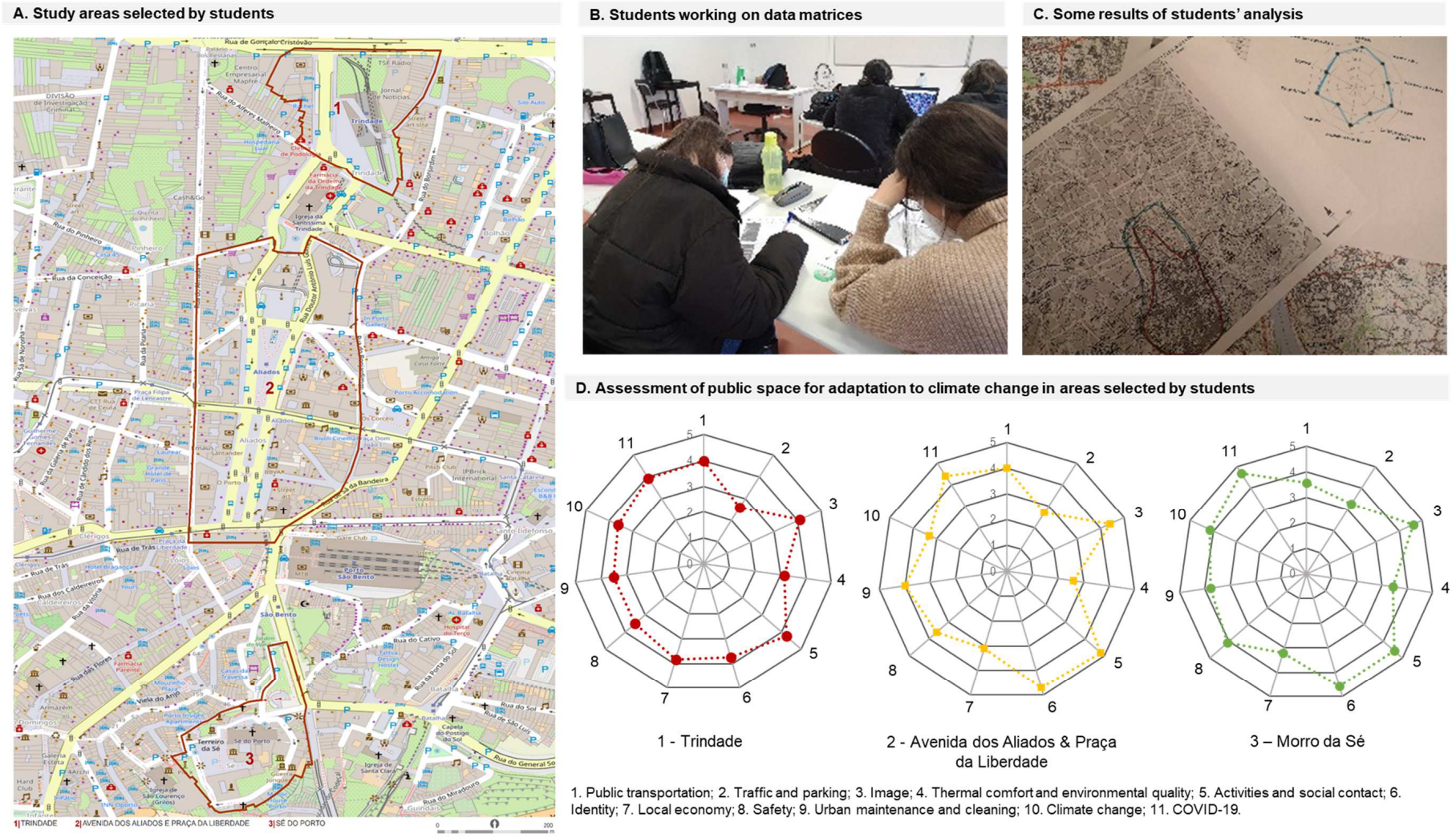

Figure 3. Evaluation of public space in the Porto Metropolitan Area—diagnostic phase (Territory). (**A**) Study areas selected by students; (**B**) Students working on data matrices; (**C**) Some results of student analysis; (**D**) Assessment of public space for adaptation to climate change in areas selected by students. Source: Authors' own elaboration. Photos were taken by the authors on 8 December 2021 (**B**) and 5 January 2021 (**C**).

Table 4. Main measures identified by experts for the adaptation of the urban tourism sector to climate change in PMA—priority of action, stakeholders enrolled and measurement category.

Measure	Priority of Action	Stakeholders Enrolled	Measurement Category
***Short term*(in 2/3 years)**			
Restrict building in areas susceptible to collapse with potential damage to people and property.	Level 1 (Top Priority)	Public administration	Regulatory
Mapping of climate risk areas.	Level 1 (Top Priority)	Public administration	Regulatory
Use more sustainable tourism practices.	Level 1 (Top Priority)	Tourists and visitors	Soft and Market oriented
Assess the carrying capacity of sensitive areas—urban and natural areas (e.g., management of tourist movements/entries (in monuments,. . .)).	Level 2 (High Priority)	Tourists and visitors	Soft
Promote the use of soft modes during the visit (e.g., bicycle use).	Level 2 (High Priority)	Tourists and visitors	Soft and Market oriented
Incentives to change the energy system.	Level 2 (High Priority)	Local community	Soft
***Medium term*(until 2030)**			
Planning depending on the carrying capacity.	Level 1 (Top Priority)	Public administration	Regulatory
Increase and improvement of public transport.	Level 1 (Top Priority)	Public administration	Soft and regulamentar
Expansion and improvement of pedestrian network and provision of cycle paths.	Level 1 (Top Priority)	Public administration	Soft and regulamentar
Privileging the maintenance and/or implementation of permeable surfaces through NBS (Nature Based Solutions).	Level 2 (High Priority)	Public administration	Soft and regulamentar
Creating new regulations for urban areas that promote more sustainable practices.	Level 2 (High Priority)	Public administration	Regulatory
Adapt urban spaces according to environmental indicators.	Level 2 (High Priority)	Public administration	Regulatory
Encourage stakeholders' participation in adaptation measures from the early stage of the planning process.	Level 2 (High Priority)	Public administration	Soft
Promote the use of electric vehicles, bicycles, and soft modes among tourists.	Level 2 (High Priority)	Public administration	Soft
Make the use of renewable energy a priority.	Level 1 (Top Priority)	Tourism sector companies	Regulatory
Introduce circular practices in the management of water cycle.	Level 1 (Top Priority)	Tourism sector companies	Soft
Sensitize the tourism sector to the efficient management of resources.	Level 2 (High Priority)	Tourism sector companies	Soft
Requiring tour operators to provide less pollutant mobility and passenger transport solutions.	Level 2 (High Priority)	Tourism sector companies	Regulatory
Increase the emphasis on climate change within mandatory training and education programs for higher technicians.	Level 2 (High Priority)	Tourism sector companies	Regulatory
Promote the use of soft modes during the visit (e.g., bicycle use).	Level 2 (High Priority)	Local community	Soft
Reduce car use.	Level 2 (High Priority)	Local community	Soft
Sensitize tourists to more sustainable tourist practices.	Level 2 (High Priority)	Local community	Soft

Source: Authors' own elaboration based on two rounds of MDA.

Twenty-seven participants mentioned they needed up to 1 month to introduce any changes in their daily routines, seventeen up to 6 months, and eight from 6 months to 1 year. In this context, some actions seem to be of rapid scope and may begin to take place (inherent to the consumption of water, electricity, and food), while others will take longer to implement (up to 1 year, in particular, the lower use of cars in short/medium distance journeys).

It was concluded that some of the participants were willing to make two changes in their daily routine as tourists and citizens in order to shift the paradigm (12 of the 28 participants who indicated their intentions of action); six of them were willing to make three changes, while other five mentioned four; two of the participants would go as far as five; and one would stick to just one change.

After having listened to the experts, the following has been deemed necessary:

(1) Disseminate knowledge on sustainable solutions for the adaptation of urban tourism to climate change;
(2) Build evidence-based strategies with a focus on specific and achievable objectives;
(3) Put the need for adaptation to climate change on the urban tourism agenda (which includes training, public policies, public–private partnerships, licensing of activities and tourism scrutiny);
(4) Define criteria and recovery systems for the recognition of good practices and recapitalization of organizations with funds for climate resilience;
(5) Promote projects that integrate local communities and tourists and ensure the return of social, cultural, economic, and environmental capital, motivating tourism among the community (not necessarily tourist promoters);
(6) Educate for active citizenship and climate literacy;
(7) Control mass tourism, polluting transport, and the effects of seasonality on tourism activity (controlling peaks and low seasons);
(8) Activate empowerment of tourism stakeholders (where tourists are included) as climate change mitigating agents.

Based on these guidelines, needed solutions were identified. Considering the available funds, the interest of the proposal and the effective response capacity, some means and/or resources capable of addressing the societal challenges that prevail were identified (Table 5).

Although considered a priority, in the context of pandemic and post-pandemic economic recovery, there are measures which cannot be implemented in the short term. It might be because the first step should be to recover the tourism flows lost during COVID-19 or because there are no financial, operational, and administrative conditions to put them into practice. In this latter case, it would be necessary to provide medium and long-term conditions, which means that even if they are considered urgent, they will have to be postponed.

The introduction of sustainable environmental measures requires a local commitment from the political forum and the creation of means for their implementation over time.

Measures to rehabilitate or requalify public spaces (structural measures) toward more environmentally sustainable tourism models should be carried out in the short term, if there are financial and technical conditions for its implementation, and regardless of the rate of recovery of the tourist flow. Measures involving an additional financial effort for tourism companies (hotels, restaurants, transport, and entertainment) should be transferred to the medium term.

Table 5. Needs, resources, and solutions in adaptation responses to climate change in the urban tourism sector in PMA.

Sectoral Groups	Needs	Solutions
Public administration	− Investing in urban rehabilitation, with the creation of new green areas (in areas more susceptible to extreme heat; less ventilated)—edaphoclimatic conditions should be considered; strategies based on the principles of bioclimatic urbanism. − Promoting soft mobility and improving the public transport network (the metro system is being improved with the densification of the network, but some problems persist in the distribution of the bus network and the current offer of interfaces). − Training of technicians (with the identification of future problems and solutions; intervention measures; and what to do in the framework of territorial plans). − Supporting university research for data collection and personalized studies for territories (with local case studies). − Creating an advisory board and observatory with several institutional representatives with meetings open to citizen participation three times a year. − Integrating the technology in the visit to the destination (virtual visits; the number of places available; suitable times to visit.	• Solve some green problems in certain areas (namely, in the city of Porto)—adequacy of the species; considering the possibility of the citizen choosing between areas exposed to the sun, semi-shadows, and shadows (considering the seasons) and nature-based solutions (NBS). • Albedo-based solutions to decrease LST during the summer in areas of greater susceptibility to extreme heat. • Pedestrianize more areas (namely, in the city of Porto), with limited car circulation areas. • Support the rehabilitation of local housing (e.g., with double windows, energy certification). • Promote studies for monitoring the effects of climate change adaptation measures in the tourism sector. • Campaigns to raise awareness of the directors of the hotel units to the need of reducing waste and establishing the message that should be transmitted to tourists. • Provide information about the city where it is possible to identify the air quality or the assessment of the weather situation on the day(s) of the visit (and in the following days)—with alert system. • Limit the load capacity in the city, according to the periods of the year to avoid peaks. • Create a promotional campaign (video and pamphlet—available on tourism promotion platforms in Porto and Northern Portugal) which appeals to the sensitivity of tourists to the need to preserve and safeguard resources, value local production and more sustainable consumption during the stay. • Provide means to encourage reuse—e.g., places for low-priced water supply for tourists who bring their own bottles—with an enlightening message on the benefits it will have on the environment. • Promote the visit and acquisition of products in local commerce (sensitize tourists regarding endogenous products, traditional commerce and the work of the local community). • Assess the feasibility of creating an extra tourist tax up to 4.0% of the basic value of the tourist package. The creation of this extra-fee was based on other studies that refer to the need for additional fees to deal with climate change [72,73] and by taking into account the results of the MDA. • In case the additional tourist tax is applied, there is an "Eco Tourist" app planned, which includes a sort of code of conduct, a set of commitments and a system of evaluation and monitorization of tourist behavior. Information on the app should be made available in various places of the city, including local trade and tourism offices and agents. This model can be based on the amortization, for example, of the environmental tourist tax on the next visit to the city within a maximum of 3 years (monetize resources and create the expectation of returning).

Table 5. *Cont.*

Sectoral Groups	Needs	Solutions
		• Promote domestic tourism and, above all, tourism practices in segments not massified during the urban visit (creative tourism; experience tourism), with specific routes and detailed programming throughout the year—these segments were reinforced during COVID-19.
		• Create a bike circuit in urban space, with bicycle parking stations, associated with an urban route (the paid fee would be refunded upon returning the bicycle).
Universities and research centers	− Realizing free and rigorous research, based on the greenwashing and the demystification of concepts based on generalist ideas. − Supporting collaboration between higher education institutions and scientific laboratories. − Conducting customized studies to support climate-weather monitoring and new challenges to tourism activity.	• Develop multidisciplinary studies with the collaboration of various institutions and laboratories.
		• Exchange data and equipment between institutions to realize diagnostic work and to share information.
		• Create studies in tourism aimed to continuously understand if the nationality interferes in the evaluation of thermal comfort (and how it changes), based on measures that are being implemented in different areas of the city.
		• Compete for structural funds in collaborative projects—with clear objectives and specific landmarks.
		• Dedicate part of general training curricula of undergraduate courses to climatology and meteorology issues (and the influence of climate change)—according to different knowledge ideologies and counter-argumentation based on scientific evidence.
		• Promote scientific events on priority topics concerning climate change and tourism—every two years (in different cities).
Tourism companies	− Creating partnerships between tourism companies, aiming at reducing greenhouse gas (GHG) emissions. − Making the use of renewable energies a priority. − Introducing circular practices in resource management.	• Subsidies for eco-efficiency in hotel and catering units (reuse of wastewater and rainwater for urban cleaning and watering, low-consumption lamps, industrial appliances with greater energy efficiency).

Source: Authors' own elaboration based on collaborative methods used in investigation.

4.3. Practical Dissemination of the Proposed Lines of Action for Urban Tourism—The Proposal

Levels of governance are key elements and demonstrate the relevance of municipal and metropolitan levels, particularly in European cities or regions [74]. The absence of a scale of action means that there is no accountability of the entities for the creation of measures and strategies capable of mitigating the extreme effects caused by climate change. Scientific and technological knowledge is considered the crucial element of response to these conditions [75,76]. In the specific case of urban tourism, it is verified that the action must be developed at governmental and municipal level. These results are, to some extent, in line with other studies conducted at PMA regarding other sectors of activity [44,77] and other geographical areas for tourism [78].

The huge difficulty in establishing causative relationships between anthropogenic actions (at local and sub-regional level) and climatic phenomena (physical dimension) brings along some surprises—some with socio-economic implications and a relevant number of fatalities [75,76]. The main problems are related to:

(1) The lack of subsidiarity between policy instruments and climate action, namely, between regional, sub-regional and local scale;
(2) The absence of a scale-up of adaptation and mitigation policies and strategies in the urban and city operations domain; and
(3) The late action in solving problems related to climate change, namely, when the risk is communicated and how it reaches the players (e.g., climate resilience of local communities).

It is essential to anticipate solutions to future problems related to urban areas and in times of COVID-19 pandemic [5,13,27,79,80]. However, there are also general frameworks for action, included in the agenda of global level institutions (notably the World Tourism Organization and the United Nations) which should incorporate some contributions to be established in the short, medium, and long term in the study area. Within the United Nations Development Program (UNDP) [81], there are some premises to basic principles of adaptation of the urban tourism sector that we identify as pressing for PMA and for the main cluster of urban tourism—the city of Porto.

Other research follows the same guidelines and has added value in structuring climate change intervention at a regional level [82–84]. These assumptions are in line with the results obtained under the measures presented to the elements enrolled in this study, namely, students, experts, regional and local stakeholders, and citizens designated to respond to the problems related to climate change in the study area, including the following: (1) identification of the socio-demographic and economic context of the geographical area and its capacity to adapt to climate change; (2) establishment of adaptation levels, considering that the implementation of the measures takes place at the level of destination, through actions in the public administration, companies, or isolated projects (e.g., street awareness actions, defined from the local community and hotel companies); (3) using the experience and knowledge produced to establish adaptation measures to future climate variability and change; (4) determining interaction levels for tourism adaptation through implementation, monitoring, evaluation, and adjustment tasks over time ((creation—execution—evaluation—change—(re)analysis (definition of an intervention cycle)).

The time scale of intervention for climate change is the main difference in how stakeholders should be integrated into decision-making. The main differences stem from the following:

(1) *Scheduling activities*—in case weather and climate conditions are favorable, programming can be intensified, especially in the short term, through the provision of activities and complementary products; if conditions are not favorable, programming should be reconsidered by outlining several alternatives;
(2) *Marketing and promotional campaigns*—once again, in case of favorable conditions, it is necessary to further promote the destination, with the inclusion of weather forecasts; in case of adverse weather conditions the promotional planning strategy should be changed in the medium and long term; bear in mind that planning should be changed in a period no shorter than 5 years, and no longer than 30 years;
(3) *Economy growth* (employment and services)—depending on the conditions, it will be possible to generate jobs and services, or the offer will have to be redirected with adjustments in staff service and provisioned offer;
(4) *Adaptation, mitigation, and resilience plan*—under beneficial conditions to cope with climate change adaptation, preventive measures that are granted to this purpose should be made; nevertheless, in unfavorable situations it will be useful to implement an emergency plan (set up a priori, with assessment and monitoring of resources over time, resilience in the face of damage).

5. Discussion and Conclusions

5.1. Main Conclusions

The impacts of climate change will probably become more serious in the coming decades. Cities are the places where the effects and consequences will be most seri-

ous [74,85,86]. Changes in regional meteorological variables, such as temperature and precipitation, can modify the flows of the urban energy balance, which in turn will feed back to the other meteorological variables.

The use of collaborative practices in tourism investigations and related activities arises from the need to rethink the spaces based on tourism flows [87,88]. The generation and stimulation of sociability and the understanding of specific interventions in the built space (buildings, housing, equipment, and infrastructure) should consider thermal comfort and the ability to readapt urban space to future climate change scenarios [27].

Based on this research, urban and sectoral planning measures have been found to improve the tourism enjoyment of urban space in the face of climatic and meteorological conditions as well as in the context of climate change. In fact, although there are currently thermally pleasing conditions for tourism (particularly during the summer), in the future, they may become scarce because of the increase in extreme phenomena, such as heat waves.

Twenty-three priority measures to be implemented in the short, medium, and long term have been identified. These measures should be based on an intervention guided by the governing authorities (national and local) structured in local government, companies, tourists, and local community actions. These measures will not be very easily implemented, requiring some additional investment in some cases. Given the pandemic context, action on climate change has gained additional momentum, but it is known that some of the measures will have to be implemented over a longer period of time. To contribute to these measures, some solutions have been delineated based on the companies themselves and on public administration, but also with the support of university research units.

The pandemic context also highlighted a wide range of weaknesses that characterize tourist destinations, especially those related to the city-break segment [5].

The climate crisis has become the central theme of the various political agendas, which caused different projects of varying scale to emerge (e.g., the Glasgow Declaration, the New European Bauhaus, Recommendations for the Transition to a Green Travel and Tourism Economy). Many of the countries have begun to work on carbon neutrality targets and regional and municipal entities have now included objectives based on "green" and "blue" infrastructures in regulations and municipal strategies, under actions of "renaturalization" of the city (renaturalization of watercourses, pedestrianization and afforestation) [89,90].

PMA was not indifferent to international trends and several actions were followed in this regard, namely, in the urban tourism core. The research showed that the different stakeholders demonstrated the existence of an ambiguous process in understanding the problem, information needs and a weak interaction and articulation among actors–resources–tasks. The effectiveness and efficiency of collaborative planning and the targets set by 2040 for adapting urban tourism to climate change can thus be overlooked. That is why the identification of these actions is essential considering their short-, medium- and long-term performance. This research shows that changes at this level can only occur with the involvement of the various stakeholders, namely, citizens, companies and commerce, and policymakers. This is supported by several studies carried out at the international level that demonstrate the relevance of this multilevel process [44,72,78,91].

The present work proved to be innovative, considering that it enabled the integration of different stakeholders using multiple methods. Thus, we sought to diversify the target audiences and reduce the effects of a strictly academic vision.

5.2. Limitations and Future Research Directions

The present research faced a few limitations, namely, the impossibility of gathering many people in the same space at the same time due to COVID-19, a fact which came to significantly affect these processes of collaboration and citizen science. Another gap is related to the impossibility of hearing all the stakeholders, depending on the type of method to be applied. In another study developed by the team, tourists were asked about their perception of the destination [5,27]. Nonetheless, we believe that in the medium and

long term, it will be necessary to go a step further and include them in this exercise of planning tourism resources in the face of the challenges of climate change.

However, the inclusion of stakeholders and experts in planning proposals contributes to an integrated assessment based on general market trends, demographic changes, travel behavior and the relationship with climatic conditions.

Several studies have highlighted the need for further research on an international scale and with a more detailed analysis at local level. Therefore, we must emphasize the importance of developing guidelines for a more resilient adaptation to climate change and, in the context of this research, several considerations should be made for future investigations, including the following:

(1) A holistic assessment is essential to address other sectors directly or indirectly related (e.g., transport, agriculture, and energy); in addition, more information on the impacts of climate change on urban tourism is needed during the various seasons;
(2) There are still not enough innovative services capable of translating and adapting complex climate information from decision-makers to decision-making related to urban tourism; market and feasibility studies of the measures, with guidance on how to interpret the results and how to prepare and adapt to climate change can benefit the destination;
(3) We should work the several data from this research to account for the effects of some of the measures, solutions and resources identified;
(4) New workshops should be held, bringing together the academic community, politicians and decision-makers, municipal council technicians, tourism company workers and members of the civil community; previous insights into the review and application of methodologies have already been validated and other requirements and needs of end-users (tourists) have been discussed, but this approach deserves continuous adaptation;
(5) Creation of a web platform where the data resulting from this research project is disseminated and fed with other additional initiatives.

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Institutional Review Board Statement: Ethical review and approval were waived for this study. The project 'The influence of Climate and Urban Morphology in the Porto Metropolitan Area on Tourism Activity: Perceptions and Simulation of Bioclimatic Comfort' was approved in September 2017 (funded by FCT Portugal, grant number SFRH/BD/129153/2017 and approved at University of Minho with reference ICS-120/2017). The University of Minho began to demand the approval of projects by the ethics committee in 2018 (deliberation CEUMinho-2/2018, December 2018). This project was not covered by the deliberation. Therefore, ethics committee approval was not required.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data presented in this study are available on request from the corresponding author by reasonable request.

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

Appendix A

Proposal for Urban Tourism Intervention in Porto to cope with Climate Change

Winter 2020 - 2021

Tourism Geography| Degree in Geography and Planning

Mark with a cross (X) for each of the items the score you assign. The scale is as follows: (1) Very bad; (2) Bad; (3) Reasonable; (4) Good; (5) Very good; (NA/DK/NR) Not applicable/Don't know/No answer.

Dimension	1	2	3	4	5	NA/DK/NR	Values (points)
1 – Public Transportation							
Ability to travel by public transportation (e.g., presence of nearby stops - including those for the tours)							
Access to several transportation options (e.g., bus, train, subway, taxi, TVDE)							
Comfort in passenger embarkation/ disembarkation places (e.g., shelters at stops, benches, presence of smoke or bad smell)							
							/3 =___ points
2 – Traffic and Parking							
Circulation management (e.g., public transport routes, pedestrian priority, cycle paths)							
Noise from road traffic and/ or rail							
Proper and legal parking (e.g., vehicles do not invade the pedestrian area, making it possible to enjoy the public space)							
Sharing places and bicycle parking							
							/4 =___ points
3 – Image							
Urban furniture (e.g., benches, dustbins, street lighting, flower pots, drinking fountains)							
General condition of the architectural elements (e.g., conservation of the building, presence of signs of abandonment, degradation)							
Striking elements of the urban landscape (e.g., values transmitted by the surroundings of the city - museums, local shops, restaurants, heritage, circulation of people)							
Signage of itineraries, monuments and main points of visit of the city							
							/4 =___ points

Dimension	1	2	3	4	5	NA/DK/ NR	Values (points)
4 – Thermal comfort and environmental quality							
Thermal comfort on streets and open public spaces (e.g., shadows, shelters, air circulation)							
Air quality (e.g., air pollution, presence or absence of smoke and bad smells)							
Urban trees (trees in the streets and squares)							
Small-scale green spaces with maintenance (e.g., garden beds, planters)							
Blue spaces with maintenance (e.g., contact with water - fountains, riverside, waterways)							
Comfort solutions (by heating / or cooling) for terraces and public places (e.g., outdoor heaters, water nebulisers, roofing structures)							
Noise levels (e.g., from road and/ or rail traffic or from another type of source)							
							/7 = ___points
5 – Activities and social contact							
Use of public space (e.g., existence of people on the streets)							
Use the public space by different populations (e.g., children, young, the elderly, handicapped, ethnic groups, different nationalities)							
Use for recreation and leisure (e.g., presence of leisure activities - festivals, concerts, music, dance and theater performances)							
Sociability (e.g., spaces that provide the meeting and the relationship between people, namely tourists)							
							/4 = ___ points
6 – Identity							
Heritage and historical value (e.g., presence of tourists, buildings of unique architecture, own identity)							
Existence of material and immaterial elements (e.g., urban art, iconic and symbolic elements)							
							/2 = ___ points

Dimension	1	2	3	4	5	NA/DK/NR	Values (points)
7 – Local economy							
Diversified commercial offer (e.g., different products, grocery stores, fresh and organic products)							
Offer of museums and permanent exhibitions							
Offer of restaurants, bars and cafes							
Offer of street markets and hawkers							
							/4 =___ points
8 – Safety and security							
Walking safely (e.g., wide sidewalks and pedestrian paths, with ramps when accessing the street, without barriers, with the regular floor)							
Crossing the street safely (e.g. pedestrian crossings, traffic lights)							
Walking with suitcases, strollers, baby walkers or wheelchairs (e.g., wide sidewalks, with ramps when accessing the street, regular floor, without barriers)							
Cycling safely [e.g., bike lanes or cycle paths, which can be dedicated (exclusive use for cycles) or for shared traffic]							
Presence of policing							
Feeling of security (e.g., dead ends, vacant spaces - urban voids, interstitial spaces, abandoned buildings, signs of vandalism, garbage, signs of additive consumption)							
							/6 =___points
9 – Urban maintenance and cleaning							
Conservation of streets and sidewalks (e.g., floors and walls, well maintained public space)							
Cleaning the streets (e.g., vandalism, garbage on the floor, graffiti, animal waste and dirt)							
							/2 =___ points

Dimension	1	2	3	4	5	NA/DK/NR	Values (points)
10 – Climate change							
Significant car traffic (e.g., major traffic jams)							
Llow pollutant city buses							
Use of soft modes (e.g., bicycle use)							
Existence of permeable surfaces (choice of favorable permeability materials - e.g., interlocked pavement, porous concrete, ecological paver terraway, lown or meadow)							
Large and airy public spaces							
Concern with the albedo (i.e., reflection of a surface) of urban surfaces (through lighter colors) and low conductivity materials							
Conditioning to car use							
Thermal insulation of buildings							
Existence of air conditioning in large numbers in the surrounding buildings							
							/9 =___ points
11 – COVID-19							
Mask use in public space							
Certification of hotels in relation to clean-safe practices							
Wide and airy spaces for restaurants, supermarkets and shops							
Minimum distance of 2 meters between people in places to support tourism and attractions							
Signaling in multiple languages for the COVID-19 adjusted to the needs of public spaces and areas dedicated to tourism							
Tours with security conditions adjusted to the pandemic context							
Hygienic conditions in places of visit and tourism attractions							
Transport infrastructures with the necessary safety conditions for pandemic contexts							
							/8 =___ points

Appendix B


Universitat de Barcelona
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Language:
Delphi Questionnaire
SPECIALISTS IN TOURISM, URBANISM, CLIMATE & CLIMATE CHANGE
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Delphi questionnaire

[1ªround]

Thank you for accessing this Delphi panel. It was created to evaluate the measures to be developed for a tourism strategy in the Porto Metropolitan Area (PMA) and the municipality of Porto, in a context of adaptation to climate change. A group of strategies to enhance the tourism sector and its resources will be proposed for discussion and reflection, for cooperation at local, sub-regional and regional, interinstitutional, intersectoral and interterritorial levels and for promoting a common image of the territory.

The questionnaire is organized in 4 sections.

A. Scale of action in tourism in the face of climate change.
B. Conditions, impacts and consequences of climate change in the tourism sector.
C. Climate change adaptation and mitigation measures in the tourism sector.
D. Characterization of the panel member.

At the end of this questionnaire, you will find some space to suggest relevant facts for reflection and discussion, as well as to make comments or suggestions. After this round, your answers will be treated and made known, anonymously, to the other panel members. Please, if you have not totally responded this questionnaire, submit it anyway. As soon as we receive the answers from all experts, we will compare and summarize the conclusions.

Your individual responses to the investigation will be strictly confidential and will not be disclosed to anyone, including other panel members. Thanks for your help.

A. SCALE IN PRACTICE TOURISM FACE CLIMATE CHANGE

1. Rate on a scale from 1 (very little responsibility) to 5 (much responsibility), what is the level of responsibility that attaches to the following entities for the resolution of climate change issues in the sector of tourism in the Porto Metropolitan Area (PMA).

Geographic scale and other elements	Very little responsibility (1)	Little responsibility (2)	Neither little nor much responsibility (3)	Some responsibility (4)	Much responsibility (5)	I don't know (0)
1.1. International organizations	○	○	○	○	○	○
1.2. European Union	○	○	○	○	○	○
1.3. Government	○	○	○	○	○	○
1.4. Central public administration	○	○	○	○	○	○
1.5. Regional (Regional Development Commission - *CCDR Norte*)	○	○	○	○	○	○
1.6. PMA Intermunicipal Community (sub-regional unit – corresponding to NUTS III)	○	○	○	○	○	○
1.7. Municipal councils (public administration at municipal level)	○	○	○	○	○	○
1.8. Parish councils (public administration at sub-municipal scale)	○	○	○	○	○	○
1.9. Business and private sector	○	○	○	○	○	○
1.10. Associations and NGOs	○	○	○	○	○	○
1.11. Hotels and accommodation	○	○	○	○	○	○
1.12. Restaurants, shops and similar activities	○	○	○	○	○	○
1.13. Local community	○	○	○	○	○	○
1.14. Tourists and visitors	○	○	○	○	○	○

B. CONDITIONS, IMPACTS AND CONSEQUENCES OF CLIMATE CHANGE ON TOURISM SECTOR

2. Evaluate on a scale between 1 (very irrelevant) to 5 (very relevant) the relevance of the following conditions for the development of the tourism sector in the context of climate change.

Conditions	Very irrelevant (1)	Irrelevant (2)	Neither irrelevant nor relevant (3)	Relevant (4)	Very relevant (5)	I don't know (0)
Physical and territorial						
2.1. Influence of the ocean on the temperature values	○	○	○	○	○	○
2.2. Frequency of weather conditions favorable to aeration and elimination of pollutants, especially those that promote the "greenhouse effect"	○	○	○	○	○	○
2.3. Prevalence of green spaces of public and private domain	○	○	○	○	○	○
2.4. Dimension of the PMA flattened (narrow and extended) in size and shape along the coastline	○	○	○	○	○	○

Conditions	Very irrelevant (1)	Irrelevant (2)	Neither irrelevant nor relevant (3)	Relevant (4)	Very relevant (5)	I don't know (0)
2.5. High tourist demand promoted by the climatic pleasantness that characterizes the tourism destination	○	○	○	○	○	○
2.6. Morphological diversity, which increases the complexity of local climate patterns whose features are unknown by the absence of a climate monitoring network	○	○	○	○	○	○
2.7. Fragmentation of land uses associated with a different growth pattern (e.g., contributes to the dispersion of pollutants)	○	○	○	○	○	○
Economics						
2.8. Growth in tourism demand and profits resulting from economic activity	○	○	○	○	○	○
2.9. Urban mobility excessively based on individual transport	○	○	○	○	○	○
2.10. Poor coordination of the transport network for the tourism activity among municipalities of PMA (e.g., southeast sector of the PMA has low territorial coverage of public transport)	○	○	○	○	○	○
2.11. Water consumption increased	○	○	○	○	○	○
2.12. High levels of pollutant emissions from different sources	○	○	○	○	○	○
2.13. Shortage of CO_2 sinks in relation to emissions	○	○	○	○	○	○
Sociodemographic						
2.14. Lower percentage of elderly people compared to the national average	○	○	○	○	○	○
2.15. The historic center of Porto has very high levels of gentrification (i.e., implantation of new commercial points and construction of new buildings, affecting the permanence of former residents by the increase in rent price)	○	○	○	○	○	○
2.16. High adaptability of population to market needs	○	○	○	○	○	○
2.17. Bioclimatic comfort housing and tourism accommodations deficiences (in lower categories of hotels, hostels and some AirBnB accommodations)	○	○	○	○	○	○
2.18. High population density in the coastal area and smaller in suburban areas adjacent to consolidated urban area	○	○	○	○	○	○
Political-sectorial						
2.19. Good inter-municipal coordination to solve problems common to most municipalities	○	○	○	○	○	○
2.20. Discussion and outline of problem-solving strategies at the metropolitan scale	○	○	○	○	○	○
2.21. Existence of sectorial entities responsible for key areas in the PMA (e.g., Metropolitan Council; *Turismo do Porto e Norte de Portugal*)	○	○	○	○	○	○
2.22. Insufficient investment in environmental measures and strategies by the municipalities	○	○	○	○	○	○
2.23. Climate adaptation plans with little significance and intangibility measures [the Metropolitan Plan of Climate Change Adaptation presents more concrete strategies than the policies defined under the Municipal Climate Change Adaptation Strategy (although at subregional scale)]	○	○	○	○	○	○

3. During the summer of 2019 and 2020 and winter of 2019-20 we inquired Porto's tourists. The results show that tourists felt good at a temperature of 23°C. During these surveys, situations of reduced cloudiness and no precipitation prevailed. The wind was generally weak or with a light breeze. In any case, tourists expressed displeasure in situations where breezes occurred. In lower temperature situations, the preference for a weaker wind became more intense, and in hot days, they preferred the existence of breezes.

Based on the two future scenarios defined below by the IPCC (2007, 2014) [until 2070 - Scenario 1 – RCP 4.5. (optimistic view) and Scenario 2 – RCP 8.5. (pessimistic view)], how will be the availability of tourists and visitors to visit the PMA?

Scenario 1.
The temperature will increase 0.58°C and the precipitation will decrease 49.78 mm per year. The average temperature will be 22.4°C during the day in July and August, 10.4°C in winter, 13.9°C in spring and 17.8°C in autumn. Winters will be warmer and there will be an increase in the frequency of heat waves.

Scenario 2.
The temperature will increase 1.19°C and the precipitation will decrease 37.40 mm per year. The average temperature will be 22.9°C during the day in July and August, 11.0°C in winter, 14.4°C in spring and 18.7°C in autumn. Winters will be warmer and there will be an increase in the frequency of heat waves.

Season	Scenario 1						Scenario 2					
	Very unpleasant (1)	Unpleasant (2)	It's indifferent (3)	Pleasant (4)	Very pleasant (5)	I don't know (0)	Very unpleasant (1)	Unpleasant (2)	It's indifferent (3)	Pleasant (4)	Very pleasant (5)	I don't know (0)
3.1. Summer	○	○	○	○	○	○	○	○	○	○	○	○
3.2. Autumn	○	○	○	○	○	○	○	○	○	○	○	○
3.3. Winter	○	○	○	○	○	○	○	○	○	○	○	○
3.4. Springer	○	○	○	○	○	○	○	○	○	○	○	○

C. ADAPTATION AND MITIGATION MEASURES FOR CLIMATE CHANGE IN THE TOURISM SECTOR

4. Assign a scale from 1 (very irrelevant) to 5 (very relevant) the level of importance to the following measures to improve the tourism industry address climate change:

Measures	Very irrelevant (1)	Irrelevant (2)	Neither irrelevant nor relevant (3)	Relevant (4)	Very relevant (5)	I don't know (0)
Public administration						
4.1. More sustainable environmental actions and practices for the tourism sector	○	○	○	○	○	○
4.2. Creation of information panels in public space about thermal comfort and air quality	○	○	○	○	○	○
4.3. Stimulate scenario planning, flexible adaptation paths and multifunctionality to achieve the adaptation goals through spatial planning	○	○	○	○	○	○
4.4. Map climate risk areas	○	○	○	○	○	○
4.5. Creating new regulations for urban areas that promote more sustainable practices	○	○	○	○	○	○
4.6. Promote the use of electric vehicles, bicycles and soft modes among tourists	○	○	○	○	○	○
4.7. Re-naturalization of relevant waterways	○	○	○	○	○	○
4.8. Increase and improvement of public spaces for tourism enjoyment	○	○	○	○	○	○
4.9. Improve the planning and investment in multifunctional green spaces [e.g., the choice of arboreal stratum (herbaceous, shrub, arboreal) depending on the type of area (leisure or residential spaces)]	○	○	○	○	○	○
4.10. Expansion and improvement of pedestrian network and provision of cycle paths	○	○	○	○	○	○
4.11. Increase and improvement of public transport	○	○	○	○	○	○
4.12. Establish co-responsibility practices between the public and private sectors	○	○	○	○	○	○

Measures	Very irrelevant (1)	Irrelevant (2)	Neither irrelevant nor relevant (3)	Relevant (4)	Very relevant (5)	I don't know (0)
4.13. Encourage the participation of stakeholders in adaptation measures from the early stage of the planning process	○	○	○	○	○	○
4.14. Associate tourism promotion with the sustainability of the destination	○	○	○	○	○	○
4.15. Increase the availability of regional and local spatial data on climate change scenarios, impacts and vulnerabilities through the Internet.	○	○	○	○	○	○
4.16. Financial support through grants or investment programs to facilitate strategic planning and adaptation responses	○	○	○	○	○	○
4.17. Planning depending on the carrying capacity (number of tourists/ visitors without depreciating the quality of the physical and social environment)	○	○	○	○	○	○
4.18. Rehabilitate hotels and tourism apartments	○	○	○	○	○	○
4.19. Improve areas that are obsolete and degraded in urban terms	○	○	○	○	○	○
4.20. Homogenize regulations between administrations	○	○	○	○	○	○
4.21. Limit the power of the real estate sector	○	○	○	○	○	○
4.22. Communicate better urban regulations to tourism agents and enterprises	○	○	○	○	○	○
4.23. Establish environmental management standards for tourism companies	○	○	○	○	○	○
4.24. Encourage the development of environmental labels	○	○	○	○	○	○
4.25. Promote fiscal policies to encourage tourism	○	○	○	○	○	○
4.26. Promote fiscal policies to discourage tourism	○	○	○	○	○	○
4.27. Encourage the exchange of a wide range of good adaptation practices through an accessible web portal	○	○	○	○	○	○
4.28. Increase the availability of tools (through toolkits and strategic guidelines) to assist planners (and companies) in developing adaptation responses	○	○	○	○	○	○
4.29. Increase the emphasis on climate change, impacts and adaptation within mandatory training and education programs for higher technicians	○	○	○	○	○	○
Companies						
4.30. Sensitize tourists to more sustainable tourism practices	○	○	○	○	○	○
4.31. Reduce car use	○	○	○	○	○	○
4.32. Reduce airplane use	○	○	○	○	○	○
4.33. Encourage the use of soft modes to visit the destination	○	○	○	○	○	○
4.34. Improve sustainable practices in destination	○	○	○	○	○	○
4.35. Application of additional fees for environmental management	○	○	○	○	○	○
4.36. Improve environmental awareness among companies	○	○	○	○	○	○
4.37. Make the use of renewable energy a priority	○	○	○	○	○	○
4.38. Use codes of good practice and environmental labels	○	○	○	○	○	○

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Measures	Very irrelevant (1)	Irrelevant (2)	Neither irrelevant nor relevant (3)	Relevant (4)	Very relevant (5)	I don't know (0)
4.39. Investing in energy certification	○	○	○	○	○	○
4.40. Increase the availability of regional and local spatial data on climate change scenarios, impacts and vulnerabilities, including through the web	○	○	○	○	○	○
4.41. Increase the availability of tools (through toolkits and strategic guidelines) to assist workers in developing adaptation responses in the tourism sector	○	○	○	○	○	○
4.42. Increase the emphasis on climate change, impacts and adaptation within mandatory training and education programs for higher technicians	○	○	○	○	○	○
Tourists and visitors						
4.43. Use more sustainable tourism practices	○	○	○	○	○	○
4.44. Reduce airplane use	○	○	○	○	○	○
4.45. Reduce car use	○	○	○	○	○	○
4.46. Promote the use of soft modes during the visit (e.g., bicycle use)	○	○	○	○	○	○
4.47. Accept increased fees to support environmental management expenses	○	○	○	○	○	○
Local community						
4.48. Sensitize tourists to more sustainable tourism practices	○	○	○	○	○	○
4.49. Reduce car use	○	○	○	○	○	○
4.50. Promote the use of soft modes by tourists during the visit (e.g., bicycle use)	○	○	○	○	○	○
4.51. Accept increased fees to support environmental management expenses	○	○	○	○	○	○

4.52. If applicable, identify other measure(s) you consider relevant to mitigate the consequences of climate change on tourism for each stakeholder group.

Public administration

Companies

Tourists and visitors

Local community

5. What do you consider the availability of tourists to pay an additional fee for travel packages to promote environmental sustainability?

Not willing at all ○ Unwilling ○ Maybe ○ Willing ○ Very willing ○ I don't know ○

6. What percentage do you think they would be available to overpay in order to improve the environment?

0% ○ 1-4% ○ 5-10% ○ 11-25% ○ 26%-40% ○ 41%-50% ○ >50% ○ I don't know ○

7. Indicate between 1 (very irrelevant) to 5 (very relevant) the relevance of the following items to improve the quality of public space in the present context of climate change.

Dimensions	Very irrelevant (1)	Irrelevant (2)	Neither irrelevant nor relevant (3)	Relevant (4)	Very relevant (5)	I don't know (0)
Public transportation						
7.1. Ability to travel by public transportation (e.g., presence of nearby stops - including those for the tours)	○	○	○	○	○	○
7.2. Access to several transportation options (e.g., bus, train, subway, taxi, TVDE)	○	○	○	○	○	○

Dimensions	Very irrelevant (1)	Irrelevant (2)	Neither irrelevant nor relevant (3)	Relevant (4)	Very relevant (5)	I don't know (0)
7.3. Comfort in passenger embarkation/ disembarkation places (e.g., shelters at stops, benches, presence of smoke or bad smell)	○	○	○	○	○	○
7.4. Fleet of low pollutant city buses	○	○	○	○	○	○
Traffic and Parking						
7.5. Circulation management (e.g., public transport routes, pedestrian priority, cycle paths)	○	○	○	○	○	○
7.6. Noise from road traffic and/ or rail	○	○	○	○	○	○
7.7. Proper and legal parking (e.g., vehicles do not invade the pedestrian area, making it possible to enjoy the public space)	○	○	○	○	○	○
7.8. Bicycle sharing places and parking	○	○	○	○	○	○
7.9. Significant car traffic (e.g., major traffic jams)	○	○	○	○	○	○
7.10. Use of soft modes (e.g., bicycle use)	○	○	○	○	○	○
Image						
7.11. Urban furniture (e.g., benches, dustbins, street lighting, flowerpots, drinking fountains)	○	○	○	○	○	○
7.12. General condition of the architectural elements (e.g., conservation of the building, presence of signs of abandonment, degradation)	○	○	○	○	○	○
7.13. Striking elements of the urban landscape (e.g., values transmitted by the surroundings of the city - museums, local shops, restaurants, heritage, circulation of people)	○	○	○	○	○	○
7.14. Signage of itineraries, monuments and main attractions in the city	○	○	○	○	○	○
Thermal comfort and environmental quality						
7.15. Thermal comfort on streets and open public spaces (e.g., shadows, shelters, air circulation)	○	○	○	○	○	○
7.16. Air quality (e.g., air pollution, presence or absence of smoke and bad smells)	○	○	○	○	○	○
7.17. Urban trees (trees in the streets and squares)	○	○	○	○	○	○
7.18. Small-scale green spaces with maintenance (e.g., flowerbeds, gardens, pocket parks)	○	○	○	○	○	○
7.19. Blue spaces with maintenance (e.g., contact with water - fountains, riverside, waterways)	○	○	○	○	○	○
7.20. Comfort solutions (by heating/ or cooling) for terraces and public places (e.g., outdoor heaters, water nebulizers, roofing structures)	○	○	○	○	○	○
7.21. Noise levels (e.g., from road and/ or rail traffic or from another type of source)	○	○	○	○	○	○
7.22. Existence of permeable surfaces (choice of favorable permeability materials - e.g., interlocked pavement, porous concrete, ecological paver, terraway, lown or meadow)	○	○	○	○	○	○
7.23. Large and airy public spaces	○	○	○	○	○	○

Dimensions	Very irrelevant (1)	Irrelevant (2)	Neither irrelevant nor relevant (3)	Relevant (4)	Very relevant (5)	I don't know (0)
7.24. Concern with the albedo of urban surfaces (i.e., reflection) through lighter colors and also low conductivity materials	○	○	○	○	○	○
7.25. Conditioning the private car use	○	○	○	○	○	○
7.26. Thermal insulation of buildings	○	○	○	○	○	○
7.27. Existence of air conditioning in large numbers in the surrounding buildings	○	○	○	○	○	○
Activities and social contact						
7.28. Use of public space (e.g., existence of people on the streets)	○	○	○	○	○	○
7.29. Using the public space by different populations (e.g., children, young people, elderly, handicapped, ethnic groups, different nationalities)	○	○	○	○	○	○
7.30. Use for recreation and leisure (e.g., presence of leisure activities - festivals, concerts, music, dance and theater performances)	○	○	○	○	○	○
7.31. Sociability (e.g., spaces that provide the meeting and the relationship between people, namely tourists)	○	○	○	○	○	○
Identity						
7.32. Heritage and historical value (e.g., presence of tourists, singular and emblematic architecture, self-identity)	○	○	○	○	○	○
7.33. Existence of material and immaterial elements (e.g., urban art, iconic and symbolic elements)	○	○	○	○	○	○
Local economy						
7.34. Diversified commercial offer (e.g., different products, grocery stores, fresh and organic products)	○	○	○	○	○	○
7.35. Offer of museums and permanent exhibitions	○	○	○	○	○	○
7.36. Offer of restaurants, bars and cafes	○	○	○	○	○	○
7.37. Offer of street markets and hawkers	○	○	○	○	○	○
Safety and security						
7.38. Walking safely (e.g., wide sidewalks and pedestrian paths, with ramps when accessing the street, without barriers, with the regular floor)	○	○	○	○	○	○
7.39. Crossing the street safely (e.g. pedestrian crossings, traffic lights)	○	○	○	○	○	○
7.40. Walking with suitcases, strollers, baby walkers or wheelchairs (e.g., wide sidewalks, with ramps when accessing the street, regular floor, without barriers)	○	○	○	○	○	○
7.41. Cycling safely [e.g., bike lanes or cycle paths, which can be dedicated (exclusive use for cycles) or for shared traffic]	○	○	○	○	○	○
7.42. Presence of policing	○	○	○	○	○	○
7.43. Feeling of security (e.g., dead ends, vacant spaces – urban voids, interstitial spaces, abandoned buildings, signs of vandalism, garbage, signs of additive consumption)	○	○	○	○	○	○

Dimensions	Very irrelevant (1)	Irrelevant (2)	Neither irrelevant nor relevant (3)	Relevant (4)	Very relevant (5)	I don't know (0)
Urban maintenance and cleaning						
7.44. Conservation of streets and sidewalks (e.g., floors and walls, well maintained public space)	◯	◯	◯	◯	◯	◯
7.45. Cleaning the streets (e.g., vandalism, garbage on the floor, graffiti, animal waste and dirt)	◯	◯	◯	◯	◯	◯
COVID-19 and possible future pandemic contexts						
7.46. Mask use in public space	◯	◯	◯	◯	◯	◯
7.47. Certification of hotels in relation to clean-safe practices	◯	◯	◯	◯	◯	◯
7.48. Wide and airy spaces for restaurants, supermarkets and shops	◯	◯	◯	◯	◯	◯
7.49. Minimum distance of 2 meters between people in places to support tourism and attractions	◯	◯	◯	◯	◯	◯
7.50. Signaling in multiple languages for the COVID-19 adjusted to the needs of public spaces and areas dedicated to tourism	◯	◯	◯	◯	◯	◯
7.51. Tours with security conditions adjusted to the pandemic context	◯	◯	◯	◯	◯	◯
7.52. Hygienic conditions in places of visit and tourism attractions	◯	◯	◯	◯	◯	◯
7.53. Transport infrastructures with the necessary safety conditions for pandemic contexts	◯	◯	◯	◯	◯	◯

8. When you hear about the tourism brand 'Porto', how do you consider its suitability in environmental terms and in strategies for adapting to climate change?

Very weak ◯ Weak ◯ Neither weak nor good ◯ Good ◯ Very good ◯ I don't know ◯

9. How does COVID-19 influence the climate emergency policies considered in the PMA and in Porto, in particular?

Very low ◯ Low ◯ Neutral ◯ Quite ◯ Very quite ◯ I don't know ◯

D. CHARACTERIZATION OF THE PANEL MEMBER

Finally, let us ask you some questions of a more personal nature.

Please give us some more information about yourself, which will not be released.

10. Name: 11. Year of birth:

12. What academic degree do you have?

13. Please specify the area of your academic degree:

14. What year did you complete the academic degree you indicated?

15. Indicate other training(s) you have that you consider relevant in the context of this panel:

Order	Training	Year of training
1.		
2.		
3.		

16. Indicate your main profession:

17. Indicate the organization, entity, company, association or university to which you belong and that fits the participation in this panel:

18. Date of entry into the organization, entity, company, association or university to which it belongs, and which falls in the participation in the panel:

19. Main position:

20. When did you take this position?

21. Considering your intervention in the field of tourism and climate change, indicate whether:

You make decisions. ◯ You usually participate and/ or influence decision-making. ◯ You apply decisions made by others. ◯ You do not take, participate, influence or apply decisions. ◯ Other. Which?

ADDITIONAL COMMENTS

22. Please, if you want to suggest relevant facts for reflection and discussion, you can use this space to do.

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Appendix C

Delphi Questionnaire

[2nd. round]

NATIONAL AND INTERNATIONAL EXPERTS AND RELEVANT LOCAL AND REGIONAL STAKEHOLDERS IN TOURISM, URBANISM AND CLIMATE CHANGE

Thank you for accessing this 2nd. Delphi panel created to evaluate and envisage the measures to be developed for a tourism strategy in the Porto Metropolitan Area (PMA) and the municipality of Porto in a context of adaptation to climate change. In this context, a set of measures to enhance the tourism sector and its resources will be proposed for discussion and reflection, based on cooperation at local, sub-regional and regional levels, enabling enhancement of the region to cope with climate variability.

The major goal of this questionnaire is to assess the main adaptation and mitigation measures in the tourism sector to the face of climate change scenario, which should be prioritized in short, medium, and long term.

This questionnaire is organized in 2 sections:

A. Climate change adaptation and mitigation measures in the tourism sector.
B. Other information about the panel member.

At the end of the questionnaire, you will find space to suggest relevant facts for reflection and discussion that have not been covered, as well as to make comments or make suggestions. After this round, your answers will be treated and made known, anonymously, to the other panel participants. If you have not responded, this 2nd. round to all questions, please submit it anyway. As soon as we receive responses from all experts, we will compare and summarize the conclusions.

Your individual responses to the investigation will be confidential and will not be disclosed to anyone, including other panel members.

Thanks for your help.

Founded by:

A. CLIMATE CHANGE ADAPTATION AND MITIGATION MEASURES IN THE TOURISM SECTOR

1. After questioning the relevance of the measures to deal with climate change in the Porto Metropolitan Area, the most relevant (with a greater degree of consensus) or considered to be debated by experts and local and regional agents are considered for discussion. We ask you to indicate the **priority level** (relevance of measures for the climate change scenario) and **predictability** (how much time is needed to put these measures into practice to mitigate the effects of climate change), based on your knowledge, to adapt and mitigate the potential effects of climate change in the tourism sector in urban space in the metropolitan context of Porto.

MEASURES	CONSENSUS [Level – Options 4 + 5 (relevant and very relevant)]	PRIORITY LEVEL				PREDICTABILITY (time horizon)			
		Prioritary	Additional	No priority	I don't know	Short term (2022 – 2023)	Mid-term (2024 – 2030)	Long term (after 2030)	I don't know
A – LOCAL PUBLIC ADMINISTRATION									
1. More sustainable environmental actions and practices for the tourism sector.	95.7%	☐	☐	☐	☐	○	○	○	○
2. Improve the planning and investment in multifunctional green spaces [e.g., the choice of arboreal stratum (herbaceous, shrub or sparse vegetation) depending on the type of area (leisure spaces or residential locations)].	95.7%	☐	☐	☐	☐	○	○	○	○
3. Creating new regulations for urban areas that promote more sustainable practices.	93.6%	☐	☐	☐	☐	○	○	○	○
4. Mapping of climatic risk areas.	91.5%	☐	☐	☐	☐	○	○	○	○
5. Promote the use of electric vehicles, bicycles, and soft modes among tourists.	91.5%	☐	☐	☐	☐	○	○	○	○
6. Expansion and improvement of pedestrian network and provision of cycle paths.	91.5%	☐	☐	☐	☐	○	○	○	○
7. Increase and improvement of public transport.	91.5%	☐	☐	☐	☐	○	○	○	○
8. Renaturalization of relevant waterways.	89.4%	☐	☐	☐	☐	○	○	○	○
9. Encourage stakeholder's participation in adaptation measures from the early stage of the planning process.	89.4%	☐	☐	☐	☐	○	○	○	○
10. Stimulate scenario planning, flexible adaptation paths and multifunctionality to stimulate the achievement of adaptation goals through spatial planning.	87.2%	☐	☐	☐	☐	○	○	○	○
11. Increase and improvement of public spaces for tourism enjoyment.	87.2%	☐	☐	☐	☐	○	○	○	○
12. Establish co-responsibility practices between the public and private sectors.	87.2%	☐	☐	☐	☐	○	○	○	○
13. Associate tourism promotion with the sustainability of the destination.	87.2%	☐	☐	☐	☐	○	○	○	○
14. Planning depending on the carrying capacity (number of tourists/ visitors without depreciating the quality of the physical and social environment).	87.2%	☐	☐	☐	☐	○	○	○	○

MEASURES	CONSENSUS [Level – Options 4 + 5 (relevant and very relevant)]	PRIORITY LEVEL				PREDICTABILITY (time horizon)			
		Prioritary	Additional	No priority	I don't know	Short term (2022 – 2023)	Mid-term (2024 – 2030)	Long term (after 2030)	I don't know
A – LOCAL PUBLIC ADMINISTRATION (continuation)									
15. Establish environmental management standards for tourism companies.	85.1%	☐	☐	☐	☐	○	○	○	○
16. Increase the emphasis on climate change, impacts and adaptation within mandatory training and education programs for higher technicians.	85.1%	☐	☐	☐	☐	○	○	○	○
17. Increase the availability of regional and local spatial data on climate change scenarios, impacts and vulnerabilities through the Internet.	83.0%	☐	☐	☐	☐	○	○	○	○
18. Improve areas that are obsolete and degraded in urban terms.	83.0%	☐	☐	☐	☐	○	○	○	○
19. Encourage the development of environmental labels.	83.0%	☐	☐	☐	☐	○	○	○	○
20. Financial support through grants or investment programs to facilitate strategic planning and adaptation responses.	78.7%	☐	☐	☐	☐	○	○	○	○
21. Homogenize regulations between administrations.	78.6%	☐	☐	☐	☐	○	○	○	○
22. Communicate better urban regulations to tourism agents and enterprises.	76.6%	☐	☐	☐	☐	○	○	○	○
23. Increase the availability of tools (through toolkits and strategic guidelines) to assist planners (and companies) in developing adaptation responses.	76.6%	☐	☐	☐	☐	○	○	○	○
24. Privileging the maintenance and/or implementation of permeable surfaces through NBS (Nature Based Solutions): draining soil coverings and water reservoirs, retention basins (wet and dry), trenches and infiltration ditches and/or rain gardens.	—	☐	☐	☐	☐	○	○	○	○
25. Adapt urban spaces according to environmental indicators (e.g., Porto's environmental index - Article 57, of the Porto 2020 Municipal Master Plan).	—	☐	☐	☐	☐	○	○	○	○
26. Restrict building in areas susceptible to collapse with potential damage to people and property [e.g., areas identified on a geotechnical map (i.e., escarpments, slopes, and embankments)].	—	☐	☐	☐	☐	○	○	○	○
27. Promote the landscape recovery of escarpments, making these places pleasant for observation of the landscape for residents and tourists (e.g., areas over the Douro River).	—	☐	☐	☐	☐	○	○	○	○

MEASURES	CONSENSUS [Level – Options 4 + 5 (relevant and very relevant)]	PRIORITY LEVEL				PREDICTABILITY (time horizon)			
		Prioritary	Additional	No priority	I don't know	Short term (2022 – 2023)	Mid-term (2024 – 2030)	Long term (after 2030)	I don't know
A – LOCAL PUBLIC ADMINISTRATION (continuation)									
28. Encourage management of the urban water cycle [intervention in the public space based on Strategic Plans/Directors of Water Supply and Drainage (Domestic Wastewater, Rainwater, Rivers and Beaches) with hydraulic adaptation and improvement of structural and flow conditions at critical points (bridges, aqueducts)].	—	☐	☐	☐	☐	○	○	○	○
29. Pedestrianize or create shared streets (sidewalk and road circulation area at the same level), giving the possibility to adapt the street to the needs (close or open the circulation of vehicles when necessary – e.g., during cultural events).	—	☐	☐	☐	☐	○	○	○	○
30. Replicate the progressive conditioning, in certain streets, with access of private vehicles in the Historic Center (necessary adaptations to residents, loading/unloading and assistance).	—	☐	☐	☐	☐	○	○	○	○
31. Create incentives for positive discrimination in access to the historic center of electric or hybrid vehicles.	—	☐	☐	☐	☐	○	○	○	○
32. Create mobility conditions based on the reorganization of the transport network (intermodally).	—	☐	☐	☐	☐	○	○	○	○
33. Encourage companies to be sustainable with financial support (e.g., installation of solar panels).	—	☐	☐	☐	☐	○	○	○	○
34. Create a working group for the integration and articulation of legislation for bioclimatic planning and architecture.	—	☐	☐	☐	☐	○	○	○	○
B – TOURISM SECTOR COMPANIES (INCLUDES ACCOMMODATION, CATERING AND SIMILAR)									
35. Make the use of renewable energy a priority.	95.7%	☐	☐	☐	☐	○	○	○	○
36. Increase the emphasis on climate change, impacts and adaptation within mandatory training and education programs for higher technicians.	95.7%	☐	☐	☐	☐	○	○	○	○

MEASURES	CONSENSUS [Level – Options 4 + 5 (relevant and very relevant)]	PRIORITY LEVEL				PREDICTABILITY (time horizon)			
		Prioritary	Additional	No priority	I don't know	Short term (2022 – 2023)	Mid-term (2024 – 2030)	Long term (after 2030)	I don't know
B – TOURISM SECTOR COMPANIES (INCLUDES ACCOMMODATION, CATERING AND SIMILAR) (continuation)									
37. Investing in energy certification.	95.7%	☐	☐	☐	☐	○	○	○	○
38. Sensitize tourists to more sustainable tourism practices.	91.7%	☐	☐	☐	☐	○	○	○	○
39. Use codes of good practice and environmental labels.	91.5%	☐	☐	☐	☐	○	○	○	○
40. Improve environmental awareness among companies.	89.4%	☐	☐	☐	☐	○	○	○	○
41. Increase the availability of tools (through toolkits and strategic guidelines) to assist workers in developing adaptation responses in the tourism sector.	89.4%	☐	☐	☐	☐	○	○	○	○
42. Encourage the use of soft modes to visit the destination.	87.2%	☐	☐	☐	☐	○	○	○	○
43. Reduce car use.	85.1%	☐	☐	☐	☐	○	○	○	○
44. Increase the availability of regional and local spatial data on climate change scenarios, impacts and vulnerabilities, including through the web.	76.6%	☐	☐	☐	☐	○	○	○	○
45. Give responsibility for companies in the sector for non-compliance with environmental protection measures and response to climate change.	—	☐	☐	☐	☐	○	○	○	○
46. Adopt measures to adapt to climate change in the company's mission, to be increased in terms of licensing the activities, and/or in situations of change/expansion of activities.	—	☐	☐	☐	☐	○	○	○	○
47. Define codes of conduct and promotion of carbon footprint certificates.	—	☐	☐	☐	☐	○	○	○	○
48. Sensitize agents in the tourism sector, namely hotels, retail, and restaurants to the efficient management of resources, promoting the implementation of integrated and intelligent solutions for infrastructures and services.	—	☐	☐	☐	☐	○	○	○	○
49. Introduce circular practices in the management of water cycle, through measures and solutions for the reuse of wastewater and rainwater, namely for cleaning and urban irrigation.	—								

MEASURES	CONSENSUS [Level – Options 4 + 5 (relevant and very relevant)]	PRIORITY LEVEL				PREDICTABILITY (time horizon)			
		Prioritary	Additional	No priority	I don't know	Short term (2022 – 2023)	Mid-term (2024 – 2030)	Long term (after 2030)	I don't know
B – TOURISM SECTOR COMPANIES (INCLUDES ACCOMMODATION, CATERING AND SIMILAR) (continuation)									
50. Requiring tour operators to provide mobility and passenger transport solutions less carbonic.	—	☐	☐	☐	☐	○	○	○	○
51. Promote the installation of bike-sharing systems and encourage their use by tourists.	—	☐	☐	☐	☐	○	○	○	○
52. Choose for the placement of solar panels or implementation of energy sharing services from renewable energy solutions (example Copernicus Cooperative) in tourism companies and enterprises.	—	☐	☐	☐	☐	○	○	○	○
C – TOURISTS AND VISITORS									
53. Use more sustainable tourism practices.	93.6%	☐	☐	☐	☐	○	○	○	○
54. Promote the use of soft modes during the visit (e.g., bicycle use)	91.5%	☐	☐	☐	☐	○	○	○	○
55. Reduce car use.	80.9%	☐	☐	☐	☐	○	○	○	○
56. Accept increased fees to support environmental management expenses.	78.7%	☐	☐	☐	☐	○	○	○	○
57. Adopt an "Enviromental Code" made available by PMA to all visitors and tourists (on the web), with definition of the environmental conduct to consider on arrival at the destination.	—	☐	☐	☐	☐	○	○	○	○
58. Create the program 'a tourist, a measure to improve the environment'.	—	☐	☐	☐	☐	○	○	○	○
59. Measuring the carbon footprint associated with tour packages.	—	☐	☐	☐	☐	○	○	○	○
60. Assess the carrying capacity of sensitive areas – urban and natural.	—	☐	☐	☐	☐	○	○	○	○
D – LOCAL COMMUNITY									
61. Sensitize tourists to more sustainable tourist practices.	95.7%	☐	☐	☐	☐	○	○	○	○
62. Promote the use of soft modes by tourists during the visit (e.g., bicycle use).	91.5%	☐	☐	☐	☐	○	○	○	○
63. Reduce car use.	86.1%	☐	☐	☐	☐	○	○	○	○

MEASURES	CONSENSUS [Level – Options 4 + 5 (relevant and very relevant)]	PRIORITY LEVEL				PREDICTABILITY (time horizon)			
		Prioritary	Additional	No priority	I don't know	Short term (2022 – 2023)	Mid-term (2024 – 2030)	Long term (after 2030)	I don't know
D – LOCAL COMMUNITY (continuation)									
64. Granting tax benefits to using public transport.	—	☐	☐	☐	☐	◯	◯	◯	◯
65. Develop strategies to promote the feeling of belonging to the place.	—	☐	☐	☐	☐	◯	◯	◯	◯
66. Incentives to change the energy system.	—	☐	☐	☐	☐	◯	◯	◯	◯
67. Integration in local adaptation processes and in the design of the city (citizen participation).	—	☐	☐	☐	☐	◯	◯	◯	◯
68. Information through the web to tourists (smart destination – a message to the tourist – host policy).	—	☐	☐	☐	☐	◯	◯	◯	◯

2. What do you consider the availability of tourists to pay an additional fee for travel packages to promote environmental sustainability?

Not willing ◯ Willing ◯ I don't know ◯

3. What percentage would you think would be available to overpay to improve the environment?

1 – 4% ◯ 5 – 10% ◯ 11 – 25% ◯ I don't know ◯

A. INFORMATION OF THE PANEL MEMBER

4. Name:

ADDITIONAL COMMENTS

5. Please, if you want to suggest relevant facts for reflection and discussion, you can use this space to do so.

Thank you very much for your collaboration on this 2nd. round of the Delphi technique. 😊

Appendix D

QUESTIONS TO ASK DURING WORLD COFFEE

1. What can be done in Portugal, in the Porto Metropolitan Area (PMA) and in the city of Porto regarding urban tourism to cope with climate change?

2. And what am I willing to do to adapt to climate change as a tourist? As a member of a company? As a citizen? Or as a political decision maker?

Appendix E

INDIVIDUAL ACTION INTENTIONS

1—What do you think are the main actions to be developed over the next two years to adapt the Portuguese tourism sector to climate change?

2—What are you willing to do in your daily life to adapt to climate change? Identify the time horizon for each of your intentions, taking into account the following time scale: up to 1 month, up to 6 months and between 6 months and 1 year.

I'm willing to…

How much time do you need?

- ○ Up to 1 month
- ○ Up to 6 months
- ○ Between 6 months and 1 year

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