TransformAr

Accelerating and upscaling transformational adaptation in Europe: demonstration of water-related innovation packages

Beliefs towards transformational adaptation conceptual map

Deliverable 1.4

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EXECUTIVE SUMMARY

The TransformAr project aims to demonstrate solutions and pathways to help us adapt better to climate change and improve our social resilience. Among the project's key objectives is gaining insights into the public's level of acceptance regarding these adaptative solutions, while promoting active engagement from both the public and stakeholders. The aim is to ensure that the solutions developed are genuinely embraced through collaborative endeavors.

This report serves to present the analyses conducted by the research group COSOYPA from the University of Santiago de Compostela, on evaluating the attitudes and beliefs held by stakeholders that may either hinder or facilitate the adoption of behaviors conducive to transformative change. The findings presented herein pertain specifically to the analysis of different workshops and meetings carried out in three of the sites of the project: Galicia, Guadeloupe and Oristano. COSOYPA's assessment focused on discerning stakeholder attitudes and beliefs that could potentially impact their embrace of transformational behaviors as proposed in WP1 on Innovation ecosystems for transformational adaptation in demonstrators. The core objective of the analysis was to both identify shared elements and discern subtle distinctions within them using a standardized approach. This analytical process is designed to methodically structure and elucidate the available information, thus facilitating a more precise identification of pivotal factors that might impact the reception or dismissal of the proposed solutions. By doing so, this report lays down a robust groundwork to analyse social acceptance. This resource is proposed to support subsequent project phases. The results of this report are expected to yield valuable insights that can significantly benefit both WP6 and WP7. For the WP6, these insights can shed light on how EU citizens perceive the project's solutions and their potential applicability in other EU regions. For the WP7, this report provides a deeper understanding of stakeholder attitudes and preferences, making a meaningful contribution to the evolving climate policy landscape. These insights can be used to tailor planned communication actions, such as social media and the project's public website.

Accordingly, this report is structured as following: First, the method followed to analyze the information collected with stakeholders is discussed. In this section, the profile of stakeholders involved in the project is described. The stakeholder profile for the project varies by region, with participants primarily from key economic sectors like agriculture, aquaculture, and tourism. In Galicia, representatives from private sector associations actively participated, while in Oristano, involvement extended to both public and private sector actors. Guadeloupe saw participation from institutional representatives and investors.

The data analysis process involved qualitative content analysis using ATLAS.ti version 23. It encompassed several phases: 1) Building a coding system through an inductive approach; 2) Dividing the data into coding units, ensuring single coding per semantic domain; and 3) Testing the coding system for reliability.

Next are discussed the results in tables by semantic domain and for site comparisons. The content analysis of stakeholder perceptions yielded insights across seven semantic domains.1) Climate Change (consequences of climate change, such as temperature shifts, ecosystem changes, biodiversity decline, and the proliferation of invasive species); 2) Consequences of Climate Change in Sectors (effects and repercussions of climate change on various economic sectors, including decreased productivity and adverse economic impacts); 3 and 4) Perception of Distance/Proximity: (Within this domain, stakeholders' psychological distance from or proximity to climate change is analysed); 5) Sectorial Dynamics (challenges related to stakeholder coordination, government policies, data availability, and responses to changing market conditions); 6. Sectorial Requirements (needs of various sectors, including economic viability, nature-based solutions, regulatory adjustments, sustainability efforts, societal changes, technological innovations, monitoring systems, and business model transformations); and 7) Attitudes and Responses with Proposed Solutions (how individuals and communities engage with and evaluate proposed climate change solutions. It includes collaboration, adaptation, and questioning).

These results are shaped by specific regional contexts, with Galicia emphasizing temperature shifts and data-driven decision-making, Guadeloupe focusing on extreme weather events and challenges in

stakeholder coordination, and Oristano highlighting natural resource degradation and sustainability efforts. The analysis identifies both barriers and facilitators, such as a lack of coordination among stakeholders, disconnect in political management, and the importance of using data for decision-making. By aligning strategies with these insights, the project aims to overcome barriers and leverage facilitators to drive positive change and enhance social acceptance of climate change solutions.As the collection of these different stakeholder sensitivities has not followed a similar protocol across all the sites, this document outlines an annex with a comprehensive protocol for conducting Focus Groups as part of stakeholder engagement in various research sites. The protocol make some specific recommendations to carry a focus group and gather stakeholder insights effectively in future stages of the project or similar projects in the future. The protocol defines the key phases of conducting Focus Groups, from preparation to data analysis, ensuring a structured and organized approach. By adhering to this protocol, researchers can ensure standardized data collection and analysis, enhancing the quality of research outcomes and supporting informed decision-making.

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INTRODUCTION

This report provides the results of a comprehensive analysis conducted to address the objectives outlined in Task T1.3, which is centered on "Identifying Barriers to Implementation and Behavioral Change" within the TransformAr project. The primary focus of this task is to understand and address various aspects related to climate adaptation and governance. Furthermore, we propose a protocol for gathering this type of information in future occasions.

In this task, we delve into the identification of barriers that could potentially hinder the successful implementation of proposed solutions and impede behavioral change. Our goal is to pinpoint obstacles that may obstruct the execution of these solutions. This analysis draws from documents generated after consultations with stakeholders through workshops and meetings where participants were introduced to climate projections and potential solutions related to various project sites.

These engagements served as a preliminary assessment to explore stakeholders' attitudes and beliefs in this context. The objective was to comprehend how these factors either hinder or facilitate the adoption of behaviors essential for transformative change. The insights gained from the implementation of transformative adaptation solutions within the project will play an important role in shaping the desired behaviors. By identifying these attitudes and beliefs, we can discern both barriers and facilitators for the adoption of necessary behaviors, thereby offering essential input for subsequent project phases in WP3 on Envisioning transformative pathways for the demonstrators and T4.1. on Behavioural change solutions.

Additionally, this report focuses on the qualitative analysis of information gathered during workshops and meetings, specifically related to social acceptance in the first two years of the TransformAr project. In this study, we examined documents collected from three distinct sites to understand stakeholder perceptions of climate change projections, site-specific issues, and their views on proposed solutions. As a result, this study offers both a comprehensive analysis by semantic domain and an analysis based on the three project sites that shared their primary findings from consultations conducted during workshops and meetings with various stakeholders. Here, we present the results of our analysis, which aimed to identify commonalities and nuances within the proposals from each site using a standardized approach (Willig & Stainton-Rogers, 2017). The primary objective of this analysis is to systematically organize and clarify the available information, thus enabling a more precise identification of key factors that could influence the acceptance or rejection of proposed solutions. Ultimately, this report establishes a robust foundation for informed decision-making, with the potential to guide future project stages through its comprehensive and in-depth examination of the data collected on social acceptance.

In addition, this report introduces in the annex 1 and 2 a protocol for conducting focus groups to gauge public perceptions and social acceptance of proposed adaptation solutions. Derived from insights gained during the TransformAr project, this protocol offers a standardized approach to data collection with stakeholders.

While not implemented within the project, this methodology provides a valuable tool applicable to similar projects for enhanced data collection and analysis. The protocol includes a set of survey items and scales tailored to measure social acceptance-related constructs, offering more targeted insights to augment the data already gathered.

Designed to involve a diverse range of participants, the protocol incorporates measures for various variables, including cognitive responses and behavioral intentions. The outcomes from this focus group methodology will furnish valuable insights into the social acceptance of climate change adaptation solutions, benefiting future initiatives in this field. Our hope is that this protocol can also serve as a model for forthcoming studies.

The report qualitatively analyses information already gathered in the workshops and meetings of three sites where the TransformAr project is presented related to social acceptance. In this report, we present the outcomes of the analysis, which was undertaken to identify commonalities and nuances within the proposals from each site in a standardized manner. This analysis aims to systematically organize and clarify the information at hand (Braun & Clarke, 2006), thereby enabling a more precise identification of key factors that could influence the acceptance or rejection of the proposed solutions. This report establishes a solid foundation for informed decision-making that could serve in future project stages by providing a comprehensive and in-depth examination of the data collected on social acceptance.

The following pages detail how the data were obtained and analyzed, along with the key findings from the qualitative study.

1. DESCRIPTION OF DATA ANALYZED

In order to gather the data for our documentary analysis, a call was initiated, inviting all TransformAr collaborators to contribute information regarding their interactions with stakeholders. This call was executed during the Consortium Meeting 4, convened in Santiago de Compostela, Spain from May 10th to 12th, 2023. Furthermore, to motivate the participation reminders were dispatched via email throughout the months of June and July.

Specifically, collaborators were asked to provide reports, meeting minutes, transcripts and/or recordings that documented their interactions with stakeholders and included relevant information about the latter's perceptions regarding climate change projections, problems specific in their areas and opinions on the proposed solutions.

Of all the sites that are part of TransformAr, collaborators from Galicia, Guadeloupe and Oristano responded to the call. Therefore, our documentary analysis focused on these three sites, as detailed in Table 1.. Once the documents were submitted by the partners, an independent review was carried out by two researchers. Throughout this review, were identified and selected documents that delve into stakeholders' perceptions, opinions, and attitudes concerning climate change projections and the solutions put forth by TransformAr during meetings and workshops.

After the initial independent review to select documents, as mentioned earlier, we proceeded to analyze 16 out of 18 documents provided for Galicia. In Guadeloupe, we examined 3 out of 4 provided documents, and in Oristano, we selected 3 out of the 6 provided. Files that exclusively provided descriptions of the solutions proposed by TransformAr's partners or that contained notes of meetings without information related to stakeholder perceptions of climate change projections, site-specific issues, and their views on proposed solutions were excluded from the document analysis. Once the selection of documents was completed, data analysis was undertaken.

While the number of documents varies, in Galicia is much larger (N = 16) compared to Guadeloupe (N = 3) and Oristano (N = 3), the analysed content, expressed as text segments, for the three demonstrators is comparable (see Table 1). The files shared by collaborators in Galicia mainly consist of meeting minutes conducted with one or at most two stakeholders, resulting in documents ranging from 2 to 4 pages in length. Conversely, in the case of Guadeloupe and Oristano, the files comprise reports and workshop minutes conducted with larger participant groups, yielding documents spanning from 11 to 20 pages.

Furthermore, it is pertinent to consider that in the executed documentary analysis, the study unit, commonly referred to as a "citation," comprises text segments, which may be a word, phrase, sentence, or paragraph. These text segments are utilized for analysis when it is identified that they significantly contribute to the comprehension of the studied phenomenon (Braun & Clarke, 2006; Hernández, Fernández & Baptista, 2010), that in this case is related to social acceptance.

Table 1 Documents Analyzed

Site	Type of documents	Stakeholder profile	Number of documents	Units analysed (Textual segments)
Galicia, Spain	Meeting minutes	Association representatives (private sector) Workers in the economic sector (aquaculture)	16	204
Guadeloupe, France	Workshop reports	Institutions and investors in the territory Workers in the economic sector (agriculture and tourism)	3	387
Oristano, Italy	Workshop minutes	Association representatives (public and private sector) Workers in the economic sector (agriculture and aquaculture)	3	315
Total			22	906

Stakeholders profile

Based on the information collected from the files shared by the three sites the participant's profile varied across regions in coherence to the stakeholders that can be involved or affected for the solutions proposed by TransformAr within the context of climate change adaptation by each site. The predominant profile of the participants consisted of people working in the economic sectors of agriculture (in Guadeloupe and Oristano), aquaculture (in Galicia and Oristano), and tourism (in Guadeloupe).

Furthermore, in Galicia, there was active involvement from representatives of associations affiliated with the private sector, while in Oristano, participation extended to actors from both the public and private sectors. Additionally, representatives of institutions and investors in the region participated in Guadeloupe.

2. DATA ANALYSIS PROCESS

Based on the available documentation, a qualitative content analysis was carried out. With the purpose of identifying thematic patterns, categories and significant relationships about the projections and solutions proposed in the project (Braun & Clarke, 2006). The ATLAS.ti version 23 software was used for the content analysis process.

The content analysis consisted of the following five phases:

Phase 1. Build a coding system: An inductive approach was applied to build the coding system. First, it started from a reading of the entire data set to establish the semantic domains (also known as central categories of analysis). Also, there were selected some specific examples of each code for clarification. Figure 1 shows the coding system.

The definition of each semantic domain and each code is found in Annex 3. This coding system was used as a standard instrument of comparison to derive inferences, produce reliable, valid and replicable results (Krippendorff, 2008).

Phase 2. Divide the data set into units to be coded: The data set was divided into units to be coded. For this, text fragments were selected from the documents that consisted of a sentence or set of sentences, fragments of images of post it notes, which were established as quotes to be used as coding units. It was ensured that each unit was assigned only one code per semantic domain, although it could be assigned several codes from different semantic domains.

Phase 3. Test the coding system: the coding system was tested through an independent coding process conducted by two researchers at COSOYPA. This process aimed to improve reliability and reduce any possible bias in the results obtained (Díaz et al., 2021; Krippendorff, 2008).

Once both researchers completed the coding of all units of analysis, different agreement coefficients (simple percentage, Holsti index, Binary α, cu-α and Cu-α) were used to evaluate the reliability of the coding system, as shown in Table 2. The higher the coefficient obtained, the greater the agreement observed between both coders. A value of $\alpha \geq 0.67$ is considered to be the minimum threshold required to obtain valid conclusions, while a value of $\alpha \geq 0.80$ is considered evidence of high reliability in the coding (Díaz et al., 2021; Krippendorff, 2008).

In the initial round of coding, the predetermined minimum thresholds were not met within the semantic domains of Climate Change Effects, Psychological Proximity and Attitudes and Responses to Proposed Solutions, as outlined in Table 2. The primary discrepancies in coding emerged within the documents from Guadeloupe and Oristano, primarily due to the length of citations because some segments of these documents had to be coded as image fragments because they were originally digitized as images. Moreover, disagreements arose concerning certain text segments characterized by ambiguous or unclear language, which posed challenges in determining their meaning. Consequently, a second round of coding was undertaken, structured around deliberative meetings involving the two researchers responsible for coding. This iterative process facilitated the achievement of consensus in coding the units that exhibited disparities.

After the second round of coding, it can be concluded that there is evidence of reliability in the content analysis carried out in this study, as shown in Table 2.

Table 2 Intercoder Agreement Coefficients, Comparison between the First and Second Round of Coding

Indicator	Semantic domain	Round 1	Round 2
simple % agree	Effects of climate change	54.30%	89.00%
The percentage of coding in which those who code agree are calculated among the total coding carried out.	Consequences of climate change in sectors	60.30%	89.30%
	Psychological distance	65.10%	100.00%
	Psychological proximity	26.00%	79.00%
	Sectoral dynamics	70.60%	96.10%
	Sectoral requirements	65.70%	94.80%
	Attitude and responses with proposed solutions	37.30%	96.10%
	Total	63.10%	92.90%
Holsti index	Effects of climate change	67.90%	92.20%
It is calculated by dividing the number of coding on which coders agree by the total number of coding, and then multiplying the result by 100. In other	Consequences of climate change in sectors	74.20%	93.60%
	Psychological distance	78.90%	100.00%
	Psychological proximity	40.40%	88.30%
	Sectoral dynamics	81.50%	98.00%

words, it measures agreement relative to the number of matching coding.	Sectoral requirements	77.10%	97.10%
	Attitude and responses with proposed solutions	54.30%	98.00%
	Total	72.90%	95.00%
α Binary	Effects of climate change	0.728	0.961
It is a measure of the degree of agreement with which coders choose to apply or not apply a semantic domain. The calculation of the binary c-Alpha index takes into account both positive agreements (when people code the same) and negative agreements (when people code differently) relative to the expected probability of random agreement. The range of the binary c-Alpha index is from 0 to 1.	Consequences of climate change in sectors	0.756	0.949
	Psychological distance	0.787	1
	Psychological proximity	0.446	0.882
	Sectoral dynamics	0.838	0.979
	Sectoral requirements	0.796	0.97
	Attitude and responses with proposed solutions	0.530	0.980
	Total	0.774	0.966
cu-α	Effects of climate change	NA	0.949
It is a measure of the degree of agreement with which coders choose to apply codes within each semantic domain.	Consequences of climate change in sectors	NA	0.977
	Psychological distance	1	1
	Psychological proximity	NA	1
	Sectoral dynamics	0.952	1
	Sectoral requirements	NA	0.996
	Attitude and responses with proposed solutions	1	1
Cu-α		0.854	0.972
(It is a global measure of the goodness of the distribution in semantic domains. It measures the degree of reliability in the decision to apply the different semantic domains, regardless of the chosen code).			

Phase 4. Summarize and outline the results: After achieving a satisfactory level of intercoder agreement and ensuring the accurate assignment of codes to the units of analysis, we proceeded to select one of the ATLAS.ti files for data extraction. Subsequently, we conducted relevant analyses, summarizing the primary findings from the content analysis in tables categorized by semantic domains and comparison tables. .

Phase 5. Interpret and present the findings: After synthesizing the results, patterns were identified. These findings are summarized in this report to guide future project stages.

3. REPORT OF THE MAIN RESULTS

Below, the results obtained from the content analysis are presented. The results were structured according to the seven semantic domains (see Figure 1).

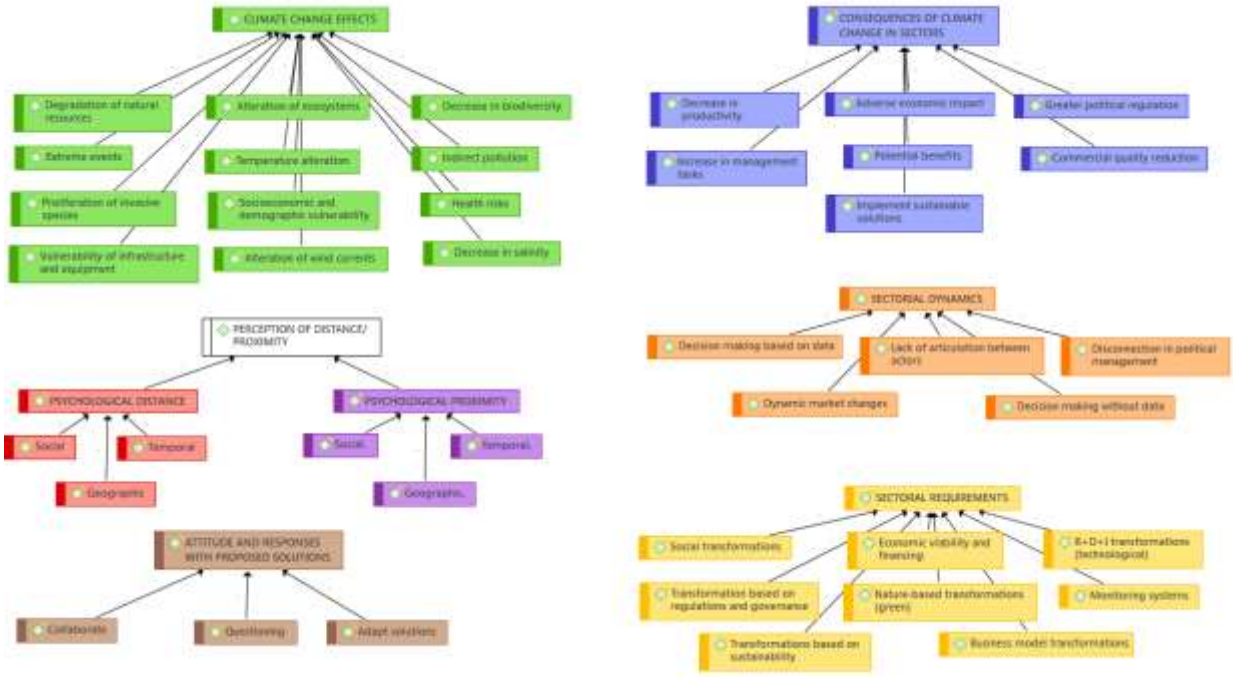

Figure 1 Coding System

First, tables are presented with codes organized by frequency of application, from highest to lowest. Similarly, an excerpt from group sessions (also known as coding unit or quotation) is presented.

Recommendations regarding the interpretation of the results

It is crucial to consider certain recommendations when interpreting the results presented below.

- In this study, we examined documents collected from three distinct sites to understand stakeholder perceptions of climate change projections, site-specific issues, and their views (barriers and facilitators for adoption) on proposed solutions.
- As a result, this study offers both a comprehensive analysis by semantic domain and an analysis based on the three project sites that shared their primary findings from consultations conducted during workshops with various stakeholders. The percentages in the tables are calculated as column percentages, which offer a better insight into how the code appears in relation to the specific site where the data were collected, not in comparison with the other sites to control overrepresentation
- We have conducted an individualized analysis for each site within each domain, acknowledging that variations exist among sites due to distinct cases, problems, and solutions presented.

Climate change

The "Climate Change" semantic code covers two main domains. Firstly, it addresses the "Effects of Climate Change," encompassing various consequences resulting from global or regional climate variations, including alterations in temperature, extreme weather events, decreased salinity in bodies of water, degradation of natural resources, the proliferation of invasive species, changes in wind currents, indirect pollution, health risks, biodiversity decline, alterations in ecosystems, socioeconomic and

demographic vulnerability, as well as vulnerability of infrastructure and equipment to climate change impacts (European Commission, 2023).

Secondly, it encompasses the "Consequences of Climate Change on Sectors," which include references to the specific impacts of climate change on economic sectors, such as reduced productivity, lower commercial quality, adverse economic effects, increased political regulation, heightened management tasks to be carried out by some actors in the productive sectors analyzed (for example to combat the proliferation of algae or invasive species), potential benefits, and the adoption of sustainable solutions within these sectors (Cinner et al., 2022; Hayhoe et al., 2018).

Climate change effects

The semantic domain of effects of climate change grouped together all the quotes in which the participants expressed various consequences resulting from global or regional climate variations, including alterations in temperature, extreme weather events, decreased salinity in bodies of water, degradation of natural resources, the proliferation of invasive species, changes in wind currents, indirect pollution, health risks, biodiversity decline, alterations in ecosystems, socioeconomic and demographic vulnerability, as well as vulnerability of infrastructure and equipment to climate change impacts (See table 3 for examples and table 4 for frequency of appearance of codes in each site).

Table 3 Semantic Domain of Climate Change Effects: Associated Codes and Example Quotes

Code	Quote
Degradation of natural resources	“Soil degradation, damage and loss”
Alteration of ecosystems	“Destruction of wildlife habitats”
Decrease in biodiversity	“Decrease in biodiversity due to rising water levels”
Extreme events	“The main tourist sites may remain closed today for several months due to intense weather events such as heavy rain”
Temperature alteration	“They also detect increased surface temperature”
Indirect pollution	“Finally, he highlighted that sometimes foam is perceived whose origin is believed to be from surrounding companies”
Proliferation of invasive species	“Extremely tolerant invasive species that thrive in all conditions”
Socioeconomic and demographic vulnerability	“Elderly more vulnerable to water restrictions”
Health risks	“Water pollution causes health problems (for example, ear infections)”
Vulnerability of infrastructure and equipment	“Farm infrastructure and guttering not coping with extreme rainfall”
Alteration of wind currents	“He confirms that the north wind has decreased a lot (it no longer removes the upper layer of water as before)”
Decrease in salinity	“The decrease in salinity”

Table 4 Absolute and Relative Frequency of Appearance of Codes Semantic Domain of Climate Change Effects

Code	Galicia		Guadeloupe		Oristano	
	E	%	E	%	E	%
Degradation of natural resources Gr=57	3	3,57%	6	16,22%	48	26,23%
Alteration of ecosystems Gr=52	16	19,05%	5	13,51%	31	16,94%
Decrease in biodiversity Gr=43	12	14,29%	4	10,81%	27	14,75%
Extreme events Gr=42	9	10,71%	9	24,32%	24	13,11%
Temperature alteration Gr=34	18	21,43%	5	13,51%	11	6,01%
Indirect pollution Gr=26	8	9,52%	4	10,81%	14	7,65%
Proliferation of invasive species Gr=18	12	14,29%	1	2,70%	5	2,73%
Socioeconomic and demographic vulnerability Gr=10	0	0,00%	0	0,00%	10	5,46%
Health risks Gr=8	0	0,00%	2	5,41%	6	3,28%
Vulnerability of infrastructure and equipment Gr=7	0	0,00%	0	0,00%	7	3,83%
Alteration of wind currents Gr=5	4	5%	1	3%	0	0%
Decrease in salinity Gr=2	2	2,38%	0	0,00%	0	0,00%
Totals per site	84	100,00%	37	100,00%	183	100,00%

In Galicia, climate change effects most frequently mentioned included temperature alteration, which referred to significant temperature changes in specific areas or ecosystems due to climate change, including heatwaves, seasonal shifts, reduced day-night temperature differences, and increased humidity levels. Ecosystem alterations were also commonly mentioned, encompassing landscape transformations, habitat degradation, disruptions in biogeochemical cycles, and shifts in biological communities. Participants also noted the decrease in biodiversity, manifesting as species extinction, forced population migration, loss of natural habitats, and reduced genetic variability. Additionally, the proliferation of invasive species was frequently mentioned.

In Guadeloupe, the most frequently cited effects of climate change were extreme weather events, characterized as extraordinary or unusual climatic events occurring more frequently or intensively, including floods, droughts, hurricanes, storms, wildfires, heatwaves, and extreme precipitation. Participants also highlighted natural resource degradation, which referred to the decline in the capacity of natural resources to regenerate, including disruptions in species reproduction, soil degradation, desertification, and reduced forest regeneration. Temperature and ecosystem alterations were also commonly mentioned.

Lastly, in Oristano, participants frequently reported climate change effects, including natural resource degradation, ecosystem alterations, reduced biodiversity, and extreme weather events.

Consequences of Climate Change in Sectors

This semantic code covers references to the specific effects and repercussions of climate change on a particular economic or industrial sector (e.g., tourism, agriculture, or aquaculture). Consequences can range from the impacts of extreme weather events to changes in product or service demand, as well as

financial, regulatory, and operational considerations affecting various key actors within the sector (see table 5 for quotes examples, and table 6 for frequency of appearance of codes in each site).

Table 5 Semantic Domain of Climate Change Consequences: Associated Codes and Example Quotes

Code	Quote
Decrease in productivity	"They wonder if it will have something to do with the decrease in clam production, if it affects, for example, the larval period"
Adverse economic impact	"On the other hand, he adds that climate change will have a great impact on the energy costs of the activity"
Greater political regulation	"Failure to meet certain objectives of the water framework directive"
Increase in management tasks	"a greater increase in algae and therefore an increase in cleaning tasks"
Potential benefits	"Before they harvested shellfish for 5-6 months, and now all year round"
Commercial quality reduction	"Crop failure/poorer quality"
Implement sustainable solutions	"Regenerations are being made (sometimes with sand from the bank itself)"

Table 6 Absolute and Relative Frequency of Appearance of Codes Semantic Domain of Consequences of Climate Change in Sectors

Code	Galicia		Guadeloupe		Oristano	
	E	%	E	%	E	%
Decrease in productivity Gr=73	32	46,38%	6	26,09%	35	63,64%
Adverse economic impact Gr=33	5	7,25%	15	65,22%	13	23,64%
Greater political regulation Gr=13	9	13,04%	0	0,00%	4	7,27%
Increase in management tasks Gr=8	7	10,14%	0	0,00%	1	1,82%
Potential benefits Gr=9	8	11,59%	1	4,35%	0	0,00%
Commercial quality reduction Gr=7	6	8,70%	0	0,00%	1	1,82%
Implement sustainable solutions Gr=4	2	2,90%	1	4,35%	1	1,82%
Totals per site	69	100,00%	23	100,00%	55	100,00%

The most frequently reported types of consequences include a decrease in productivity, which is particularly relevant in Galicia and Oristano. This refers to a decline in the capacity to produce goods, services, or income due to climate-induced factors. These factors encompass disruptions in natural cycles, increased species mortality, soil degradation, and impacts on agriculture, livestock, and tourism.

Adverse economic impacts were also frequently mentioned, especially in Guadeloupe and Oristano. This category implies references to increased costs, loss of income, deterioration of economic infrastructure, and other factors that have a negative impact on the stability and economic development of the sector.

Perception of distance/proximity

The "Distance/proximity" semantic code encompasses the perception of climate change's psychological distance and proximity. It includes references to psychological distance, where individuals may disconnect from or downplay the significance of climate change, considering it a distant or irrelevant problem. On the other hand, psychological proximity refers to expressions showing concern and understanding of climate change and its present or future consequences.

Psychological distance

The semantic domain of psychological distance grouped all the quotations in which participants expressed disconnection from the issue of climate change or minimized its importance. This involves social aspects, where people may lack awareness of climate change's effects or believe it won't impact them or their close community. It also addresses geographic distance, where climate change is seen as having distant or insignificant repercussions nearby. Additionally, there's a temporal dimension, where climate change might be viewed as a past or future concern, not significant in the present (see table 7 for quotes examples, and table 8 for frequency of appearance of codes in each site).

Table 7 Semantic Domain of Psychological Distance: Associated Codes and Example Quotes

Code	Quote
Social	"The president indicates that he has not noticed variations due to climate change"
Temporal	"At the same time, it is detected that they feel that there are more immediate problems on which they are currently focusing their interest and efforts"
Geographic	"This need is not shared, since the rise in sea level will not be as notable as in other places with more extended coasts"

Table 8 Absolute and Relative Frequency of Appearance of Codes Semantic Domain of Psychological Distance.

Code	Galicia		Guadeloupe		Oristano	
	E	%	E	%	E	%
Social Gr=10	9	64,29%	0	0,00%	1	100,00%
Temporary Gr=3	3	21,43%	0	0,00%	0	0,00%
Geographic Gr=2	2	14,29%	0	0,00%	0	0,00%
Totals per site	14	100,00%	0	0,00%	1	100,00%

The most frequently reported type of distance was social, while geographical distance was the least common. However, differences were observed among the sites regarding psychological distance. In the case of Galicia, psychological distance was reported most frequently, whereas in Guadeloupe, it was not mentioned at all, and in Oristano, social psychological distance was mentioned only once (see Table 8).

Psychological proximity

Psychological proximity refers to references that demonstrate concern and understanding of climate change and its current or future consequences. This includes social proximity, which involves perceiving climate change as an urgent problem and understanding its effects, with awareness that it impacts oneself and the local community. It also encompasses geographical proximity, where climate change's repercussions are experienced or anticipated nearby, and temporal proximity, with climate change considered a current and relevant concern (see table 9 for quote examples).

Table 9 Semantic Domain of Psychological Proximity: Associated Codes and Example Quotes.

Code	Quote
Social	"Willingness of local actors to adapt"
Temporal	"The participants are focusing on issues that are very present at this moment. Water stress, for example, is a problem that could arise in the future, but the issues with the highest percentage are very relevant in the current environment. We relate more to problems that we can see and feel now than in the future"
Geographic	"Local actors know the field and the needs"

The most frequently reported type of psychological proximity was temporal, while social proximity was the least common. However, differences were observed among the sites regarding psychological proximity. This code appeared more frequently in the case of Oristano, where temporal and geographic proximity were reported most often, in contrast to the sites of Guadeloupe and Galicia (see Table 10).

Table 10 Absolute and Relative Frequency of Appearance of Codes Semantic Domain of Psychological Proximity

Code	Galicia		Guadeloupe		Oristano	
	E	%	E	%	E	%
Temporary Gr=6	1	50,00%	0	0,00%	5	50,00%
Geographic Gr=5	0	0,00%	1	33,33%	4	40,00%
Social Gr=4	1	50,00%	2	66,67%	1	10,00%
Totals per site	2	100,00%	3	100,00%	10	100,00%

Stakeholders

The semantic code 'stakeholders' encompasses a wide range of semantic domains related to the interaction of different actors in a specific context, such as in the project and at different sites. It addresses issues related to climate change projections and their potential impact on production, as well as the identification of sector-specific dynamics, obstacles in actor coordination, misalignment of government policies with sectoral needs, the importance of data-backed decision-making, and adaptation to market changes. Additionally, expressions related to climate change adaptation are considered, including the assessment of economic viability, nature-based transformations, regulatory and governance changes, sustainability, social changes, technological innovation, monitoring systems, and transformations in business models. Finally, the attitudes and responses of individuals and

communities to proposed solutions are explored, including active collaboration, perception of effectiveness, questioning, and adaptation of solutions to address specific climate challenges in different geographical contexts. Below, each of these semantic domains capturing the sensitivities of various stakeholders in different sites is described in detail.

Sectorial dynamics

The 'Sectorial Dynamics' semantic domain focuses on the dynamics shaping specific economic sectors, encompassing challenges related to stakeholder coordination, government policies, data availability, and responses to changing market conditions (see table 11 for quotes examples, and table 12 for frequency of appearance of codes in each site).

Table 11 Semantic Domain of Sectorial Dynamics: Associated Codes and Example Quotes.

Code	Quote
Decision making based on data	"They have a laboratory that takes weekly T and S data, they also consult INTECMAR"
Lack of articulation between actors	"Although she warns that it may be counterproductive to bring the clam sector together with the mussel sector, as there are those who maintain that the increase in mussel production negatively affects clam farming, she personally believes that rather than clashing, we should work together. Solutions should be sought instead of confrontation"
Disconnection in political management	"There seem to be some administrative obstacles to making fertilizers from seaweed"
Dynamic market changes	"On the other hand, it is observed that the consumption of cans has decreased, that life is expensive, and they are not replenished as much as before on the supermarket shelves"
Decision making without data	"They say they are not currently looking at oceanographic data anywhere"

Table 12 Absolute and Relative Frequency of Appearance of Codes Semantic Domain of Sectorial Dynamics.

Code	Galicia		Guadeloupe		Oristano	
	E	%	E	%	E	%
Decision making based on data Gr=18	15	31,91%	1	10,00%	2	50,00%
Lack of articulation between actors Gr=17	11	23,40%	5	50,00%	1	25,00%
Disconnection in political management Gr=12	7	14,89%	4	40,00%	1	25,00%
Dynamic market changes Gr=9	9	19,15%	0	0,00%	0	0,00%
Decision making without data Gr=5	5	10,64%	0	0,00%	0	0,00%
Totals per site	47	100,00%	10	100,00%	4	100,00%

This sectorial dynamics domain is more prominent in the Galicia Workshops, where participants emphasize they use data (such as oceanographic or meteorological data from research centers and public institutions) for decision-making, which involves making sector-specific decisions based on accurate data and current information from monitoring systems. Additionally, the lack of articulation between actors is frequently mentioned, indicating issues in coordinating and collaborating among diverse stakeholders in a specific context, leading to challenges like poor communication, differing objectives, fragmented sectors, and limited harmonized action.

In the case of Guadeloupe, participants also commonly mention the lack of articulation between actors and the disconnection in political management. The latter refers to situations where government decisions and policies do not align with the requirements of an economic sector or project, resulting in issues like conflicting regulations, inadequate support, and a lack of alignment with sector needs.

In Oristano, this domain is mentioned less frequently. However, when it is mentioned, the need to base decisions on data is the most commonly expressed aspect.

Sectoral requirements

The 'Sectoral Requirements' domain encompasses the adaptation needs of various sectors to climate change. It includes economic viability, nature-based solutions, regulatory adjustments, sustainability efforts, societal changes, technological innovations, precise monitoring systems, and business model transformations to enhance sector resilience (see table 13 for quotes examples, and table 14 for frequency of appearance of codes in each site).

Table 13 Semantic Domain of Sectorial Requirements: Associated Codes and Example Quotes.

Code	Quote
Social transformations	"Awareness campaigns/Roundtable exchanges"
Economic viability and financing	"Creation of the Fund in relation to supporting actors in the agricultural world to guide them appropriately with a view to sustaining their structures and systems."
R+D+I transformations (technological)	"Support from engineers and technicians in charge of climate issues"
Transformation based on regulations and governance	"We need to completely rethink governance around these priorities"
Nature-based transformations (green)	"More trees and wildlife"
Monitoring systems	"Daily data on soil temperature and moisture will hopefully help with nutrient use efficiency, forage choice, etc."
Transformations based on sustainability	"Plan cities resilient to climate change to guarantee the continuity of essential services for tourism"
Business model transformations	"Completely rethink the tourism sector (reinvent yourself, professional recycling)"

Table 14 Absolute and Relative Frequency of Appearance of Codes Semantic Domain of Sectoral Requirements.

Code	Galicia		Guadeloupe		Oristano	
	E	%	E	%	E	%

Social transformations Gr=80	3	11,11%	52	20,23%	25	16,03%
Economic viability and financing Gr=68	2	7,41%	50	19,46%	16	10,26%
R+D+I transformations (technological) Gr=67	3	11,11%	47	18,29%	17	10,90%
Transformation based on regulations and governance Gr=64	2	7,41%	40	15,56%	22	14,10%
Nature-based transformations (green) Gr=50	1	3,70%	18	7,00%	31	19,87%
Monitoring systems Gr=39	14	51,85%	10	3,89%	15	9,62%
Transformations based on sustainability Gr=36	1	3,70%	9	3,50%	26	16,67%
Business model transformations Gr=36	1	3,70%	31	12,06%	4	2,56%
Totals per site	27	100,00%	257	100,00%	156	100,00%

In the Galicia site, the most frequently mentioned code was 'monitoring systems,' described as easy-to-access systems that allow for recording, for example, cultivation areas, spawning data, salinity data, and local current data, emphasizing the importance of these systems being regularly updated, providing frequent information, and offering a user-friendly interface. Stakeholders also expressed a need for 'R+D+I transformations (technological),' focusing on strategies and actions involving new technologies and innovative approaches to enhance resilience, mitigate risks, and improve efficiency. Economic viability and financing of proposed solutions were frequently discussed, emphasizing the analysis of financial capacity, available resources, and financing strategies for climate change adaptation projects.

For Guadeloupe, the most commonly mentioned needs, in order of frequency, were 'social transformations,' involving strategies to change societal attitudes and behaviors for effective climate adaptation, promoting sustainable practices, altering consumption patterns, and mobilizing communities through campaigns, awareness programs, and policies. Participants also discussed economic viability and financing, 'R+D+I transformations (technological),' and transformations based on regulations and governance, which entail reviewing and modifying existing regulations, policies, and decision-making procedures.

In Oristano, participants frequently mentioned 'Nature-based transformations (green),' highlighting strategies to address climate change by strengthening biodiversity and ecosystems. 'Transformations based on sustainability' were also emphasized, aiming to adapt to climate change while fostering sustainable development that balances economic well-being, environmental health, and social welfare. Additionally, participants mentioned social transformations, transformations based on regulations and governance, 'R+D+I transformations (technological),' and the economic viability and financing of proposed solutions.

Attitude and responses with proposed solutions

This domain explores how individuals and communities engage with and evaluate proposed climate change solutions (see table 15 for quotes examples, and table 16 for frequency of appearance of codes in each site).

Table 15 Semantic Domain of Attitude and Responses with Proposed Solutions: Associated codes and example quotes.

Code	Quote
Collaborate	“There is another association, Agacomar, Galician Association of Seafood Marketers, perhaps interested in participating”
Questioning	“The development of payment and support systems has a limited lifespan”

Adapt solutions	"The adaptation strategies to be adopted will depend on several factors such as: the size of the farm or the current level of resilience of the activity (for example: a monoculture farm is less resilient than a multi-crop farm. Adaptation actions will be different)"

Table 16 Absolute and Relative Frequency of Appearance of Codes Semantic Domain of Attitude and Responses with Proposed Solutions.

Code	Galicia		Guadeloupe		Oristano	
	E	%	E	%	E	%
Collaborate Gr=20	16	66,67%	1	16,67%	3	18,75%
Question Gr=14	2	8,33%	1	16,67%	11	68,75%
Adapt solution Gr=12	6	25,00%	4	66,67%	2	12,50%
Totals per site	24	100,00%	6	100,00%	16	100,00%

In the case of Galicia, participants frequently mentioned the code 'collaborate,' which encompasses the willingness of individuals and communities to actively participate in implementing solutions. This involves offering suggestions, establishing contacts, and providing relevant information for collaboration. Additionally, 'adapt solutions' was commonly referred to, indicating the need to customize and adjust solutions to specific geographical areas or contexts.

In Guadeloupe, the most frequently mentioned code was 'adapt solutions.' Participants emphasized the importance of adapting solutions to local conditions.

In Oristano, the most frequently mentioned code was 'questioning,' where participants expressed doubts, questions, or criticisms regarding the effectiveness, feasibility, or impact of proposed solutions.

4. CONCLUSIONS

This qualitative analysis of the report serves as a significant step toward well-informed decision-making in the subsequent phases of the project. This report serves the task goal of identifying "stakeholders' attitudes and beliefs that hinder or facilitate the adoption of the behaviors that lead to transformative change", evaluating the attitudes and beliefs held by stakeholders that may either hinder or facilitate the adoption of behaviors conducive to transformative change. It systematically collects and organizes the insights from the different workshops, focusing on social acceptance. The approach was carried out using a robust qualitative content analysis process facilitated by the ATLAS.ti version 23 software, ensuring the integrity and reliability of the findings. The results, structured around seven distinct semantic domains, offer a comprehensive perspective on how stakeholders perceive climate change projections and the proposed solutions.

What emerges from this analysis is a variety of insights. We have explored the diverse consequences of climate change, ranging from shifts in temperature and extreme weather events to the subtle but impactful transformations in ecosystems and biodiversity. Equally important is the recognition that the effects of climate change are not uniform; they vary significantly across different regions.

Moreover, exploring psychological distance and proximity to climate change generated interesting results. Stakeholders' attitudes vary widely, with some perceiving climate change as a distant concern while others are acutely aware of its present and future ramifications. This insight has implications for how we communicate and engage with various stakeholders.

We have examined the dynamics within economic sectors and their responses to climate change. These dynamics include the need for coordinated action, the importance of data-driven decision-making, and the specific adaptation requirements of different sectors. Understanding these nuances is critical in crafting strategies that resonate with each sector's unique challenges and opportunities.

Finally, our analysis of how stakeholders respond to proposed solutions, such as social transformations, monitoring systems or changes in the business model, reveals various attitudes. Some stakeholders are enthusiastic collaborators, ready to actively participate in implementing solutions, while others approach cautiously, questioning the proposed measures' feasibility and effectiveness.

It is necessary to note that the findings are not one-size-fits-all; the specific contexts of each site influence them. Therefore, nuanced interpretation is essential. Decision-makers should pay particular attention to the column percentages in the tables, as they shed light on how codes align with the realities of individual sites.

Particularly, per region, participants in Galicia highlighted temperature alterations, landscape transformations, and biodiversity decline as the most common consequences of climate change. They also frequently mentioned the proliferation of invasive species. Regarding the consequences in Sectors, decreased productivity and adverse economic impacts were frequently discussed in this region. Stakeholders here emphasized the importance of using data for decision-making.

For Guadeloupe, extreme weather events like floods and droughts were the most frequently cited climate change effects in Guadeloupe. Natural resource degradation and temperature alterations were also commonly mentioned. Similar to Galicia, Guadeloupe faced decreased productivity and adverse economic impacts. The lack of coordination among stakeholders and disconnect in political management were prominent challenges.

Oristano participants frequently reported natural resource degradation, ecosystem alterations, reduced biodiversity, and extreme weather events as climate change effects. Reduced productivity and adverse economic impacts were common consequences in Oristano. Stakeholders also emphasized the importance of nature-based transformations and sustainability efforts.

These site-specific findings underscore the importance of tailoring strategies to address the unique challenges and opportunities in each region. It's crucial to consider these variations when making decisions related to climate change initiatives, as they directly influence social acceptance and support for proposed solutions.

Our comprehensive analysis has not only uncovered regional nuances in stakeholder perceptions of climate change but has also identified key barriers and facilitators that can significantly impact the adoption of the necessary behaviors and the success of our project's adaptive pathways.

Barriers:

Lack of Coordination Among Stakeholders: In both Galicia and Guadeloupe, a notable barrier emerged in the form of insufficient coordination among stakeholders. This barrier hampers effective decision-making and collaborative efforts, hindering the implementation of climate change solutions. Addressing this challenge should be a priority in our subsequent phases to enhance stakeholder engagement and cooperation.

Disconnect in Political Management: Guadeloupe experienced a disconnect between government decisions and the requirements of economic sectors, resulting in conflicting regulations and inadequate support. This poses a significant barrier to the smooth adoption of climate change solutions and necessitates alignment between policy and sectoral needs.

Psychological Distance: While not uniform across regions, the presence of psychological distance in certain stakeholders can hinder their engagement with climate change solutions. It is essential to address this psychological barrier through targeted communication and engagement strategies.

Facilitators:

Use of Data for Decision-Making: Galicia and Oristano emphasized the importance of data-driven decision-making. Leveraging data and information from monitoring systems can facilitate more informed and effective responses to climate change challenges. This facilitator should guide our strategies in WP3 on Envisioning transformative pathways for the demonstrators and WP4 on Actionable adaptive solutions implementation.

Nature-Based Transformations: Oristano underscored the significance of nature-based transformations and sustainability efforts. These facilitators can serve as key strategies for addressing climate change impacts while promoting environmental sustainability.

Collaboration: In Galicia, stakeholders frequently expressed a willingness to collaborate actively in implementing solutions. This collaborative attitude can be harnessed as a facilitator to drive positive change.

Tailoring Strategies for WP3 and WP4: To guide the priorization of adaptive pathways in Task 3.4 and the design of specific activities for citizens and stakeholders in WP4 (T4.1.1, T4.1.2, and T4.1.3), it is imperative that we consider these identified barriers and facilitators. Our strategies should aim to overcome barriers by promoting coordination, addressing disconnects in political management, and bridging psychological distance. Simultaneously, we should leverage facilitators such as data-driven decision-making, nature-based transformations, and collaboration to enhance the adoption of behaviors aligned with our project's goals.

By aligning our efforts with these insights, we can tailor our approaches to effectively trigger behavioral changes and advance our project's objectives. The identified barriers will guide us in mitigating challenges, while the facilitators will serve as drivers for successful outcomes in the upcoming phases of our project.

This report is a valuable resource, offering a comprehensive and detailed examination of stakeholder perspectives on climate change and the proposed solutions. It provides a solid foundation for strategic decision-making by clarifying the challenges and illuminating the paths forward. Understanding and addressing social acceptance is central to climate change initiatives, and this report equips us with the insights needed to chart that course effectively.

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ANNEX 1: FOCUS GROUP PROTOCOL

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1. Introduction

This report proposes a protocol for conducting focus groups to understand public perceptions and social acceptance of proposed adaptation solutions. The development of this protocol stems from the reflections made during the TransformAr project (Accelerating and upscaling transformational adaptation in Europe: demonstration of water-related innovation packages). While this protocol may not be implemented within the project, it serves as an opportunity and methodology applicable to similar projects for enhanced data collection and information analysis.

The protocol encompasses a set of proposed survey items and scales specifically designed to measure constructs related to social acceptance. This approach can yield more focused and actionable insights into enhancing social acceptance in future projects, complementing the valuable information already gathered within the project. The protocol we are developing can represent a significant project outcome with potential applications in future projects.

The protocol's design aims to include a diverse group of participants from varying backgrounds, ages, and educational levels. Additionally, the protocol incorporates proposed measures for various variables, such as cognitive responses and behavioral intentions.

The results obtained through this focus group methodology will provide valuable insights into the social acceptance of climate change adaptation solutions. These insights can inform the implementation of future climate change adaptation initiatives. Furthermore, we aspire for our protocol to serve as a model for future studies in this field.

2. Purpose and Characteristics of the Focus Groups

A focus group is a research technique in which a small group of people are brought together to discuss a particular topic or issue in depth. The group is typically moderated by a facilitator who guides the conversation and ensures everyone can share their thoughts and opinions. By bringing together a diverse group of participants, focus groups can provide a range of perspectives and opinions that can help organizations make more informed decisions.

It is important to remember that the main purpose of conducting focus groups is to allow participants to express their opinions and perceptions freely, without the restrictions of a standardized interview format. The moderator's role is to guide the discussion in a way that addresses the research questions while still allowing for a natural conversation flow. Sometimes, participants spontaneously address the research questions during the discussion, and the moderator should take note of these and refrain from repeating them or trying to delve into those aspects that are of interest but have yet to be sufficiently developed. The information gathered through the focus groups will provide both quantitative data (from the surveys) and qualitative data (of the interactions that arise in the group discussion), which will help us design more effective communication campaigns to promote better acceptance of the proposed solutions.

The principal aim of this focus group study is to investigate whether the acceptance of climate change adaptation solutions is influenced by both the source presenting the solution and the context in which this information is presented. Human behavior adapts in response to contextual factors, affecting how arguments are articulated and discussions unfold across diverse sources and settings.

As we examine the dynamics of human behavior in reaction to varying contextual influences, the specific focus pertains to how the source of information shapes perceptions of formality and the level of discourse that ensues. It is widely acknowledged that different sources of information are associated with varying degrees of credibility and influence. For instance, information disseminated by an expert in the field is often regarded as more formal, whereas content emanating from an unknown or less established source may be regarded as less formal and may not undergo rigorous scrutiny.

This leads us to a fundamental question: How does this adaptability in behavior impact how arguments are formulated and discussed? This constitutes the core inquiry of the proposed research endeavor. It is posited that the source plays a key role in determining the quantity and quality of arguments presented, the extent of opposition encountered, and the degree of freedom individuals experience in expressing their viewpoints. For example, within the confines of a formal academic setting, there is frequently a heightened emphasis on constructing detailed and well-supported arguments.

Conversely, in more informal contexts, the emphasis may shift toward emotive arguments designed to elicit strong reactions.

Through systematic exploration of human conduct across various information contexts, the objective is to comprehensively understand how perceptions adapt to context, thereby influencing argumentative styles. This research bears significant implications for the approach to discussions and debates, potentially yielding more nuanced arguments conducive to public acceptance.

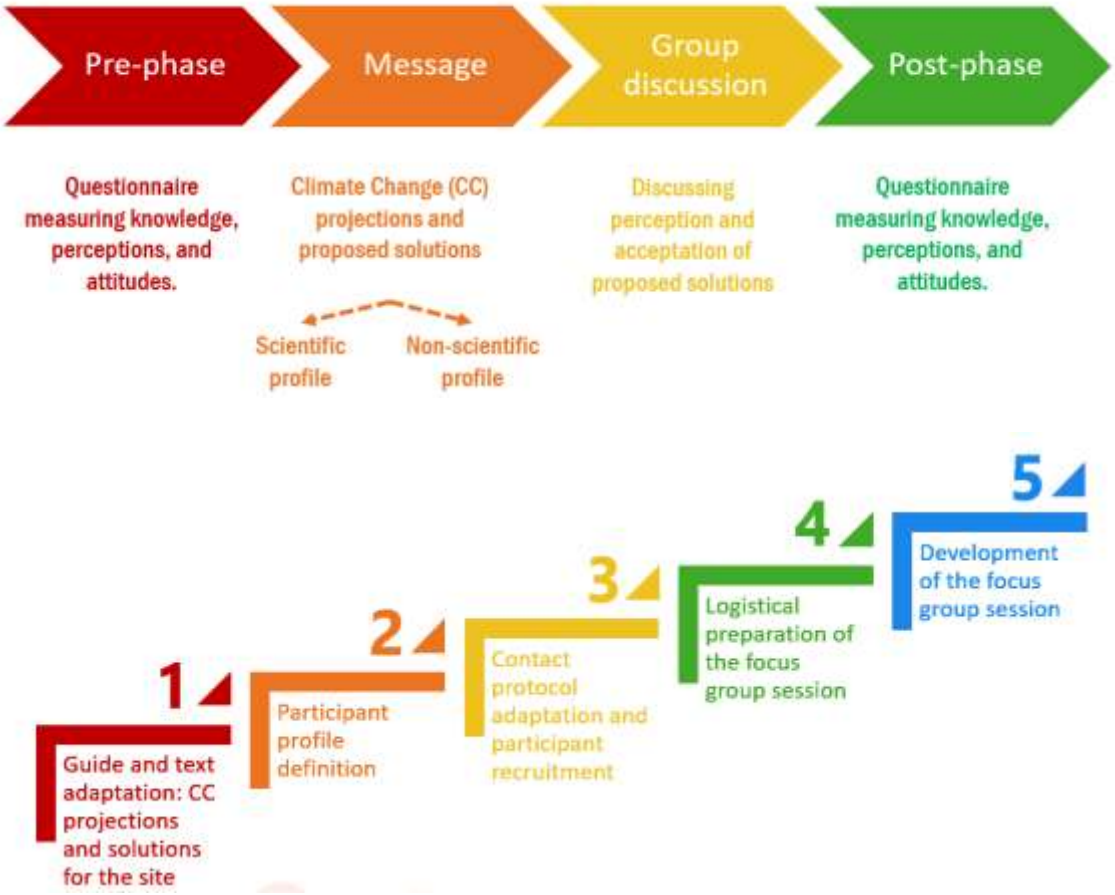
Considering the previous, the proposal incorporates manipulating information sources, effectively relocating focus group discussions from formal settings. The working hypothesis posits that acceptance levels will be higher and skepticism less pronounced when an individual presents the solution with a scientific background, provided that this source is also considered reliable. Thus, the presenter's identity emerges as a key factor in surmounting potential barriers to acceptance.

An integral facet of the proposal involves engagement with stakeholders who have yet to be contacted and may be indirectly affected by the proposed solutions, even if they are not directly involved in the project. It is asserted that anticipating potential barriers among these influential groups is essential. These stakeholders possess the capacity to impact the implementation of solutions and project outcomes significantly.

The aim is not to create barriers or opposition but to proactively address these concerns. The intention is to formulate inclusive and effective communication strategies that will engage these stakeholders in the process, aligning with one of the project's fundamental objectives.

3. Phases

Our protocol encompasses a series of meticulously planned steps and comprehensive instructions to facilitate the systematic execution of the entire process. For clarification, we present the information framed in the objectives of the TranformAr project.



4. Focus group preparation

Adequate preparation is necessary for conducting a successful focus group study. Before initiating the focus group sessions, defining the primary aim the study seeks to achieve is necessary. Clarity in outlining this main aim is crucial for guiding the entire research process.

1.1 4.1. DEFINE THE MAIN AIM

Clearly outline the main aim the focus group has.

The main aim of the focus group study should be articulated with precision and conciseness. It guides the direction of the research and ensures that the objectives remain aligned with the overarching goal. Defining this aim involves several key considerations:

Clarity of Purpose: The aim should be unambiguous, leaving no room for misinterpretation. It should answer the fundamental question of what the study seeks to investigate.

Relevance to Research Questions: The main aim should directly correlate with the research questions posed at the study's outset. It should reflect the central theme that the study aims to explore, which, in our case, is the influence of source credibility on acceptance levels and inquiries regarding climate change adaptation solutions.

Alignment with Hypotheses: The aim should harmonize with the study's hypotheses, ensuring that it encapsulates the anticipated outcomes. Our study aligns with the hypothesis that acceptance will be higher when a scientifically qualified source presents the solution.

Scope and Focus: It is essential to delineate the boundaries of the aim, specifying what falls within its scope and what lies outside of it. This prevents the study from becoming overly broad or tangential to the core research objective.

Practical Implications: Consideration of the practical implications of the aim is important. How will the findings from the focus group study contribute to the broader project objectives and, ultimately, to the field of climate change adaptation? Understanding the significance of the aim helps contextualize the research within the larger framework.

Ethical Considerations: Ensuring that the aim adheres to ethical principles is critical. This includes safeguarding participant confidentiality, obtaining informed consent, and ethically conducting the study.

EXAMPLE FOR TRANSFORMAR: The primary aim of our focus group study is to investigate the impact of the presenter's profile—distinguishing between individuals with scientific expertise and those without—on the levels of acceptance and the extent of inquiry regarding climate change adaptation projects. Specifically, we seek to determine whether the presenter's background significantly influences the

participants' willingness to accept proposed climate change adaptation solutions and the depth of questioning during the discussions. Our central hypothesis posits that solutions presented by individuals with scientific qualifications will exhibit higher acceptance rates and encounter fewer queries than those presented by non-scientific individuals.

1.2 4.2. Questionnaire for Pre and Post Focus Group Phase:

Select Established Measures

In the preparation phase of the focus group study, carefully selecting measurement tools is important to ensure the reliability and validity of the data collected. We emphasize the utilization of well-established and psychometrically validated measures whenever feasible. These measures have undergone rigorous testing in prior research, thus demonstrating their reliability and validity in assessing the constructs of interest.

When considering which measures to incorporate, we recommend reviewing existing literature and research to identify instruments that have proven effective in evaluating the specific factors aimed to explore. This process involves scrutinizing the reliability and validity metrics derived from previous studies, guaranteeing that the chosen measures are both dependable and capable of accurately capturing the targeted phenomena.

By drawing upon the knowledge accumulated in the field, we recommend employing measures that have already demonstrated their utility in assessing the acceptance and questioning of climate change adaptation projects. This strategic approach enhances the data collection process's robustness and bolsters the findings' credibility.

Response Options

In designing the questionnaire for both the pre and post-focus group phases, careful consideration is given to providing appropriate response options. The selection of response formats is a critical aspect of ensuring the reliability and validity of the data.

We incorporate a variety of response options, including Likert scales, multiple-choice questions, and open-ended queries, to accommodate diverse participant preferences and encourage comprehensive responses. Utilizing these varied response formats allows for a nuanced understanding of participant perspectives, ranging from quantitative assessments to qualitative insights.

To minimize response bias and maintain the integrity of the data, we implement balanced scales whenever applicable. Balanced scales encompass an equal number of positive and negative response options, thus mitigating the potential for respondents to exhibit systematic response tendencies. It ensures that the data collected through the questionnaire accurately reflects the nuances of participant perceptions and attitudes, enabling us to draw robust conclusions from the ensuing analysis.

EXAMPLE FOR TRANSFORMAR:

Construct	General statement	Adapted item	Measurement	Application time
Perception of effects of Climate Change (CC)	Below are some consequences/ transformations associated with climate change. Please indicate how likely you think these consequences/transformations will affect Galicia, taking into account that 1 is "very unlikely" and 7 is "very likely."	Changes in the quantity and quality of mussels and clams	5-point Likert scale (1 = very unlikely to 5 = very likely)	Pre-phase Post-phase
		Changes in the quantity and quality of foods produced in the sea, such as fish or shellfish.		
		Increase in sea water temperature		
		Changes in sea level		
		Increase in extreme events in winter (e.g. waves and storms)		
		Increase in extreme events in summer (e.g. heat and fires)		
		Excessive algae growth and the formation of red tides		
Psychological Distance (DS)	With what probability do you think that climate change will significantly affect Galicia? (DS Geographic)		With 1 being "Not at all likely" and 5 being "Very likely."	Pre-phase Post-phase
	In what time frame do you think climate change will become a really serious problem in Galicia? (Temporary DS)		Never = 1 Long term = 2 Medium term = 3 Short term = 4 Already a problem = 5	
	How likely do you think climate change will affect you or your family? (DSSocial)		With 1 being "Not at all likely" and 5 being "Very likely."	
Importance of aquaculture	How important do you think aquaculture is for Galicia?		5-point Likert scale (1 = not at all important to 5 = very important)	Pre-phase Post-phase
	With what probability do you think that climate change will affect aquaculture in Galicia?		With 1 being "Not at all likely" and 5 being "Very likely."	

Construct	General statement	Adapted item	Measurement	Application time
Perception of effectiveness of TransformAr solutions	Below are a series of technical and engineering solutions to address climate change. Please rate how effective you think each of these solutions is in adapting to climate change in Galicia, using a scale of 1 to 7, where 1 means "totally ineffective" and 7 means "totally effective."	Create systems and resources that allow us to have enough water in times of drought to supply the population and agriculture.	5-point Likert scale (1 = completely ineffective to 5 = completely effective)	Pre-phase Post-phase
		Use technology to improve the management of mussel ponds and thus be able to better adapt to climate changes		
		Find ways to grow plants that need less water and can better withstand changes in climate		
		Look for new ways to manage shellfish beds and find places where they can continue to be exploited in an environment of climate change		
		Strengthen structures that are vulnerable to rising water levels, such as bridges, so they do not erode or become damaged		
		Develop a tool that allows identifying areas that need to better adapt to climate change and give them priority in the allocation of resources and adaptation strategies		

Construct	General statement	Adapted item	Measurement	Application time

Acceptance of TransformAr solutions	On a scale where 1 is "Totally disagree" and 7 is "Totally agree", how much would you agree to implement the following adaptation solutions to climate change in Galicia:	Create systems and resources that allow us to have enough water in times of drought to supply the population and agriculture.	5-point Likert scale (1 = strongly disagree to 5 = strongly agree)	Pre-phase Post-phase
		Use technology to improve the management of mussel ponds and thus be able to better adapt to climate changes		
		Find ways to grow plants that need less water and can better withstand changes in climate		
		Look for new ways to manage shellfish beds and find places where they can continue to be exploited in an environment of climate change		
		Strengthen structures that are vulnerable to rising water levels, such as bridges, so they do not erode or become damaged		
		Develop a tool that allows identifying areas that need to better adapt to climate change and give them priority in the allocation of resources and adaptation strategies		

Construct	**General statement**	**Adapted item**	**Measurement**

Perception of change of opinion	Do you consider that the person who prepared the document you have read has competent knowledge of the topic addressed? (Fountain)	5-point Likert scale (1 = not at all competent to 5 = much better)	Post-phase
	Do you think the information presented in the text about climate change projections for Galicia and adaptation solutions offers competent knowledge on the topic addressed? (Fountain)	5-point Likert scale (1 = not at all competent to 5 = much better)	
	To what extent are you concerned about the projections presented on the effects of climate change in Galicia? (projections)	5-point Likert scale (1 = not at all worried to 5 = very worried)	
	To what extent has the information provided by the person in the text and/or the discussion generated in the group influenced your response to this questionnaire? (source vs discussion comparison) • The information provided by the person in the text • The discussion that was generated among the group	Not at all = 1 Very little = 2 Neither at all nor much = 3 Quite a bit = 4 A lot = 5	
	Which of the ideas presented in the text or that emerged from the discussion have interested you the most and for what reason? (source vs discussion comparison)	Open question	

1.3 4.3. Text for Discussion

In the context of our focus group study, the Text for Discussion is key in facilitating a meaningful and informed exchange of ideas among participants. It serves as the vehicle through which we present crucial information regarding the projections of climate change effects and the proposed adaptation strategies. To ensure the effectiveness of this text, we adhere to the following guidelines:

a. Clear and Accessible Language

We recognize the significance of clear and accessible language for effective communication. The text should be crafted to be comprehensible to participants from diverse backgrounds, ensuring that no one is excluded due to linguistic or technical barriers. We recommend using plain language principles to make complex scientific concepts and adaptation strategies accessible to all participants.

b. Begin with the Region Context

The text commences by providing a contextual backdrop specific to the region under study. By grounding the discussion in the regional context, participants comprehensively understand the geographical, ecological, and sociocultural factors at play. This regional context primes participants to comprehend better the significance of climate change effects and the rationale behind proposed adaptation strategies.

c. Present Information on Present and Future Impacts

Provide participants with a comprehensive overview of the region's present and anticipated future impacts of climate change. This includes clear and evidence-based descriptions of the challenges posed by climate change, such as rising temperatures, changing precipitation patterns, and their consequences on ecosystems, economies, and communities.

d. Explain Adaptation Strategies

In tandem with elucidating the climate change challenges, the text introduces and explains the adaptation strategies devised within the project. Outline the strategic initiatives and interventions to mitigate the identified risks and enhance the region's resilience to climate change. Each adaptation strategy should clearly describe its objectives, methods, and expected outcomes.

Emphasize the practical implications of these strategies, highlighting how they are tailored to address the specific needs and vulnerabilities of the region. The text should focus on

the pragmatic aspects of implementation, striving to convey how the strategies will tangibly benefit the community and ecosystem.

TRANFORMAR EXAMPLE FOR GALICIAN SITE:

Projections of climate change in the estuaries in Galicia and adaptation solutions

Galicia is one of the most important fishing regions in the European Union, with a great dependence on income from this sector. However, the Galician coast is very vulnerable to climate change.

On the one hand, the concentration of industrial activity and habitability in the Rías Altas and Rías Baixas increases pressure on coastal ecosystems; and fishing and aquaculture activities can unbalance the natural functioning of ecosystems. On the other hand, the rise in sea level and winter storms represent a latent threat to coastal infrastructure, potentially causing flooding and its progressive deterioration. Additionally, the increase in the intensity and frequency of extreme events, such as heat waves, droughts and prolonged fire seasons, will negatively impact shellfish aquaculture and the conservation of marine species.

Projections indicate that the water temperature in the estuaries of Galicia will increase by 2.4 degrees Celsius per century and the sea level by 9.8 cm per decade. Likewise, precipitation in wind regimes can accelerate erosion and sedimentation processes and contribute to desertification and the development of arid areas. Additionally, coastal acidification can have negative effects on marine life.

Due to this, the aquaculture sector faces threats such as the alteration of nutrient fertilization patterns, the presence of invasive species, the increase in harmful algal blooms and the negative impact of extreme weather events on the structures of the ponds. mussel and the biomass losses associated with the detachment of mussels from the ropes. Furthermore, increasing water temperatures and relevant fluctuations in coastal oceanographic and hydrological variables increase clam mortality and reduced productivity. Consequently, it is urgent to implement adaptation measures to address the challenges posed by climate change in marine and coastal ecosystem.

In response to this need, three innovative solutions for adaptation to climate change in the estuaries of Galicia have been proposed.

The first solution proposed is the digitalization of mussel trays, which improves the management capacity of the aquaculture sector and allows an immediate response to dangers related to climate change through real-time monitoring.

This solution has several advantages. On the one hand, it allows you to obtain real-time information on environmental conditions, such as water temperature, water quality, oxygen levels and salinity. This enables early detection of possible alterations and the adoption of preventive or mitigation measures to protect crops and reduce negative impacts.

Furthermore, the digitalization of mussel trays optimizes aquaculture management. Data collected in real time provides precise monitoring of environmental conditions and mussel growth, helping to optimize farming processes and improve productivity. It also allows aquaculturists to adjust operations according to environmental conditions and optimize processes related to the supply of food and medicine. In short, it contributes to more profitable and sustainable production.

However, it is important to consider the potential economic and technological barriers associated with implementing this solution. The costs of acquiring equipment and technology, as well as training staff, can be significant and represent a barrier for small aquaculture businesses or those with limited financial resources. Additionally, the adoption of digital technology and real-time monitoring systems may require specialized technical skills and knowledge, making it difficult to implement and manage effectively in the absence of access to training and technology experts.

The second solution seeks to characterize and model intertidal sandbanks in order to acquire accurate and detailed data on their current state and predict possible future changes. This resulting information provides a more complete understanding of the factors that influence the distribution and availability of marine resources used in shellfish harvesting. By having this knowledge, the planning and management of shellfishing activities can be improved, achieving greater sustainability and minimizing negative impacts.

Furthermore, the characterization of intertidal sandbanks would allow early identification of alterations in the sediment and coastal ecosystems. This early detection is essential to take timely measures and mitigate the negative effects of climate change.

However, it is important to consider the possible technological and economic barriers that could arise when implementing this solution. First, characterization and modeling require specialized techniques and technologies, such as sediment sampling, geospatial analysis, and

numerical modeling. Lack of access to these tools or lack of adequate technical knowledge can make their implementation difficult.

Additionally, the costs associated with data acquisition, implementation of modeling techniques, and staff training can be significant. This may limit the accessibility and viability of the solution, especially for communities or institutions with limited financial resources.

Likewise, while the solution would allow for greater knowledge and better projections, the practical application of this data can present challenges. Factors such as regulations, availability of resources, and acceptance of new practices can influence the effectiveness of the solution.

Finally, the third proposed solution is to generate a resilience index for the mussel aquaculture value chain, providing stakeholders and policy makers with an assessment and decision-making tool.

This index would allow strategically identifying priority areas to focus adaptation efforts, promoting awareness and behavior change.

This solution has several significant advantages. Firstly, by providing an approach based on objective data, the resilience index would facilitate informed decision-making, allowing the identification of critical and strategic areas in the mussel aquaculture value chain.

Furthermore, the resilience index would be a dynamic tool that will allow monitoring and evaluating changes over time. This facilitates continuous improvement and adaptation of climate change adaptation strategies, through regular assessments, monitoring progress and adjusting actions as necessary.

However, there are challenges to consider in implementing the resilience index. On the one hand, existing regulations and institutional structures may not be prepared to incorporate this approach into decision-making. Lack of alignment with existing policies and regulatory frameworks can hinder their effective integration into planning and management processes.

Furthermore, the adoption of new tools and approaches may encounter resistance from stakeholders and policy makers, especially if the importance of climate change adaptation in the mussel aquaculture value chain is not fully recognized. This can make it difficult to accept and integrate the resilience index into decision-making processes.

1.4 4.4. Discussion guide

The Discussion Guide is fundamental in orchestrating productive and insightful focus group sessions. It is designed to guide the conversation, ensuring that key topics are explored comprehensively and that participants are encouraged to express their views openly. To adhere to the highest standards of focus group facilitation, we adhere to the following principles in crafting this guide:

a. Prepare a Discussion Guide (Script)

The Discussion Guide, similar to a script, is a document that outlines a series of open-ended questions and topics to be addressed during the focus group session. It serves as a roadmap for the facilitator, guaranteeing that critical issues are addressed and that the session flows cohesively.

b. Start with Icebreaker Questions

The guide commences with carefully selected icebreaker questions designed to foster a comfortable and engaging atmosphere. These questions serve the dual purpose of breaking the ice among participants and introducing them to the central themes of the discussion. Icebreakers are intentionally light and non-controversial, serving as a gentle introduction to the broader topics.

c. Use Open-Ended Questions

Throughout the guide, open-ended questions take centre stage. Open-ended questions encourage participants to provide detailed and thoughtful responses, allowing for a deeper exploration of their perspectives and experiences. These questions are intentionally formulated to elicit rich narratives and diverse viewpoints, steering clear of yes-or-no responses.

d. Sequence Questions Logically

Logical sequencing of questions is critical to the guide's effectiveness. Questions are organized coherently and progressively, each building upon the preceding one. This sequencing ensures a natural flow of discussion and facilitates the exploration of complex topics systematically.

e. Submit the Guide to Expert Peer Review

In our commitment to methodological rigor, the Discussion Guide undergoes an expert peer review process. This entails subjecting each question in the guide to a meticulous

evaluation by experts in the field. The review assesses each question's relevance, sufficiency, coherence, syntax, and semantics.

By submitting the guide to expert peer review, we ensure that the questions posed are pertinent to our research objectives and linguistically sound and comprehensible to participants. The feedback garnered from this review process serves as a valuable quality control mechanism, enhancing the overall effectiveness of our focus group discussions.

TRANFORMAR EXAMPLE:

Guiding categories	Axis of inquiry	Guiding questions	Relevance	Sufficiency	Coherence	Syntax and semantics
Psychological distance: perception that people have about the proximity, in temporal, social and geographical terms, of the effects of climate change on their lives.	Temporary: perception that people have about when the effects of climate change will occur.	How do you think climate change will affect your future and that of future generations?				
	Social: perception that people have about the closeness or distance they have with the social groups affected by the effects of climate change.	Do you think people believe that climate change is currently a problem?				
		Which people do you think could be most affected by climate change in Galicia? Are you worried about anyone in particular?				
		What economic activities do you think may be affected by climate change?				
	Geographic: perception that people have about the physical distance between them and the effects of climate change.	How do you think climate change affects/will affect the estuaries (or directly regional seafood/aquaculture production)?				

Guiding categories	Axis of inquiry	Guiding questions	Relevance	Sufficiency	Coherence	Syntax and semantics
Threat perception: person's assessment of the degree of danger or risk posed by the effects of climate change, including their personal and collective capacity to confront and respond to said threat.	Risks: people's assessment of the possible dangers or threats that may arise as a result of climate change.	What are the consequences/effects of climate change that concern you most?				
	Personal or collective capacity: It refers to the perception that people have about their individual or collective ability to confront and respond effectively to the consequences of climate change.	What measures do you think we should take to adapt to climate change?				
		What personal or collective changes do you think would be necessary to adapt to the effects of climate change?				

Guiding categories	Axis of inquiry	Guiding questions	Relevance	Sufficiency	Coherence	Syntax and semantics
Perception of the proposed solution: people's assessment of the effectiveness and viability of proposed solutions to adapt to climate change.	Effectiveness: perception of the capacity of the proposed solution to address and resolve the problems associated with climate change, taking into account the limitations and resources available.	What do you think of the proposed solutions?				
		What doubts do you have?				
		Do you think they have positive effects on the aquaculture and shellfish sector? which is it? And in other sectors/actors?				
		Do you think they have negative effects on the aquaculture and shellfish sector? Which ones? And in other sectors/actors?				
		What adaptation measures to climate change would you propose for the sector?				
		How feasible do you think it is to implement the proposed solutions?				
		What do you think would be the main effects that the proposed solutions would have?				
		Do you think the proposed solutions are useful/appropriate for the needs and resources we have in Galicia?				

Guiding categories	Axis of inquiry	Guiding questions	Relevance	Sufficiency	Coherence	Syntax and semantics
Perception of the proposed solution: people's assessment of the effectiveness and viability of proposed solutions to adapt to climate change.	Barriers: obstacles or difficulties that people perceive to exist in implementing the proposed climate change adaptation solution, including barriers that structurally disadvantage certain groups (structural barriers), financial barriers, time barriers, and insufficient knowledge and deterrence effect of a complex topic (insufficient knowledge/complexity of the topic).	What limitations/barriers do you see to implementing the proposed solutions?				
		Who do you think could be harmed by the proposed solutions?				
		How do you think people involved in the aquaculture sector will view the proposed solutions?				
Acceptance of the proposed solution: willingness to support and adopt the proposed climate change adaptation solution.		What do you think of the proposed solutions to adapt to climate change in Galicia?				
		Do you think that in general these proposed solutions would gain support?				
		What do you think is important to take into account so that the proposed solutions can be accepted?				

5. Focus group execution

The execution phase of the focus group is characterized by meticulous planning and adherence to established protocols. This phase encompasses several critical steps to ensure focus group sessions' smooth and ethical conduct.

1.5 5.1. Development

Before initiating the focus group session, it is necessary to verify that all essential materials and preparations are in place. This includes:

- Informed Consent: Ensuring that informed consent forms are readily available for all participants. These forms provide participants with a comprehensive understanding of the study's objectives, procedures, and their rights as participants.
- Printed Text Presenting Solutions: Ensuring that printed copies of the text presenting climate change adaptation solutions are available and in suitable condition. These texts serve as the foundation for the discussion and must be easily accessible to all participants.
- Recorder: Confirming the functionality of the audio/video recorder, which is instrumental in capturing the dialogue and interactions during the session. This recording is vital for the accuracy of data analysis.
- Focus Group Question Guide: Verifying the presence of the meticulously crafted Discussion Guide, which serves as a facilitator and ensures that critical topics are covered during the session.

Execution Sequence:

MODERATOR PRESENTATION AND GENERAL INTRODUCTION: The session begins with the moderator's introduction, outlining the purpose of the focus group and setting the tone for the discussion. Participants are provided with a general overview of the session's dynamics, ensuring they know what to expect.

ETHICAL CONSIDERATIONS: EXPLANATION AND INFORMED CONSENT: Before delving into substantive discussions, participants are provided with a detailed explanation of the study's ethical principles. This includes emphasizing the voluntary nature of participation, confidentiality of responses, and the right to withdraw from the study at any point without consequences. Participants are then asked to provide informed consent, affirming their willingness to participate based on a clear understanding of these principles.

RECORDING: SETTING UP AUDIO/VIDEO RECORDING: The audio/video recording equipment is set up and tested to ensure it functions optimally throughout the session. This recording is conducted with the utmost regard for participant privacy, adhering to ethical standards.

DISCUSSION COMMENCEMENT: With all preparations in place and informed consent secured, the facilitator initiates the discussion following the Discussion Guide. The guide serves as a structured framework for the conversation, guiding participants through a systematic exploration of the designated topics and questions.

During the execution phase, the focus is on creating a conducive environment for open and candid dialogue while adhering to ethical principles and procedural protocols. This rigorous approach guarantees the integrity of our data collection process and fosters a respectful and constructive atmosphere for participant engagement.

1.6 5.2. Tips for Moderator presentation

The role of the moderator in facilitating a focus group session is fundamental in creating an environment of trust, openness, and productive discussion. The moderator's introductory presentation is critical to establishing rapport and ensuring participants' comfort. Here are some tips to guide the moderator's presentation:

a. Express Gratitude for Participation: Begin the presentation by expressing genuine gratitude for the participants' willingness to contribute to the research project. Recognize the value of their time and insights, emphasizing the significance of their involvement in advancing the understanding of climate change adaptation.
b. Seek Permission to Record and Use Information: Request permission to record the focus group session and utilize the information collected for research purposes. Ensure that participants understand the purpose of recording, primarily to capture their valuable contributions accurately.
c. Explain Data Privacy Policy: Provide a concise overview of the privacy policy, highlighting the measures to safeguard participant confidentiality and anonymity. Clarify participants' concerns about data security and reassure them of the commitment to protecting their information.

d. Obtain Consent: Ask participants to review and, if they agree, sign the informed consent form. This formalizes their voluntary participation in the study, demonstrating their understanding of the research's ethical framework.
e. Discuss Session Duration: Inform participants about the expected duration of the focus group, which typically ranges from one to one and a half hours. This allows them to allocate their time accordingly and ensures they are prepared for the session's duration.
f. Summarize Research Objectives: Provide a concise summary of the overarching objectives of the research project. This includes outlining the study's central themes, such as examining the impact of the presenter's profile on the acceptance and questioning of climate change adaptation solutions. Ensure participants have a clear understanding of the study's goals.
g. Emphasize Personal Experiences and Perceptions: Highlight the importance of participants' personal experiences, perceptions, and attitudes in contributing to the study. Their unique insights and perspectives are invaluable in shaping the research's outcomes. Encourage them to share openly and honestly.

These tips for moderator presentation establish a conducive atmosphere for productive focus group discussions. This approach promotes participant engagement and stresses the commitment to ethical research practices and the respectful treatment of the valued participants.

1.7 5.3. Tips for the Moderator During the Discussion

The role of the moderator during the focus group discussion is also critical in steering the conversation toward productive outcomes. To ensure a well-managed and inclusive discussion, here are some tips for the moderator:

a. Maintain Time Management: Effective time management is essential to cover all intended topics or questions within the allocated session time. The moderator should keep a watchful eye on the clock and discreetly use cues to manage the pace of the discussion. Gentle reminders help ensure discussions remain focused and on schedule, allowing for comprehensive coverage of all essential points.

b. Encourage Equal Participation: One of the moderator's key responsibilities is to foster an environment where all participants feel comfortable sharing their perspectives. It is crucial to actively encourage quieter participants to express themselves and ensure no voice goes unheard. Employ strategies such as direct invitations to quieter individuals and moderation of dominant voices to balance participation.

c. Summarize Key Points: Periodically summarizing key points made by participants serves multiple purposes. It helps maintain clarity and understanding within the discussion, ensuring that important insights are not lost in the conversation's flow. Additionally, summarizing allows participants to confirm that their views have been accurately represented, promoting a sense of validation and engagement.

d. Conclude the Discussion: As the discussion approaches its conclusion, the moderator should facilitate a smooth wrap-up. Express gratitude to participants for their invaluable contributions to the research project, acknowledging the importance of their insights in advancing the understanding of climate change adaptation. Invite participants' final thoughts or comments to ensure that no critical ideas or perspectives are left unexplored.

6. Focus group data analysis

The data analysis phase of the focus group study is a meticulous process aimed at deriving meaningful insights from the collected data.

1.8 6.1. Main steps for data analysis

In this section, we will outline the main steps involved in the data analysis process. These steps are integral to our approach, ensuring the effective handling and interpretation of the data we gather.

a. Data Management*:* Managing all recorded audio, video, or written data is central to data analysis. We prioritize the safe storage and management of these materials, ensuring that personal information remains confidential and that data is anonymized when necessary to protect participant identities.

b. Transcription: Transcription is a fundamental step in the data analysis process. It involves converting the spoken words from audio or video recordings into written text. We may utilize transcription software or services to enhance efficiency while maintaining a commitment to accuracy and completeness.

c. Data Familiarization: Upon obtaining transcribed data, the initial analysis phase involves familiarizing ourselves with the content. This entails reading or listening to the transcripts to understand the discussion's dynamics, participants' contributions, and the context in which the conversation unfolded.

d. Create a Coding System*:* A critical step in data analysis is developing a systematic coding system. We create a codebook that defines each code, offering clear descriptions and illustrative examples of what falls under each code category. This meticulous process ensures consistency and reliability when coding the data.

1.9 6.2. Main steps for the report

In this section, we outline the key steps in our report creation process, which are instrumental in presenting the outcomes of our analysis effectively. These steps guide us in transforming raw data into meaningful insights:

a. *Thematic Analysis:* We group related codes to form broader themes or categories during the analysis phase. These themes encapsulate the essence of what participants discussed, allowing us to clarify the core findings from the data. Themes may evolve and be reorganized as the analysis progresses.
b. *Data Reduction:* Data reduction involves condensing the data within each theme. We summarize the content, identifying key quotes or excerpts that exemplify each theme. These selected excerpts serve as evidence to support our findings, enriching the depth of our analysis.
c. *Data Interpretation:* Beyond summarizing, we interpret the meaning behind the themes and patterns identified. This step involves considering the context, nuances, and implications of participants' responses, allowing us to derive deeper insights.
d. *Discussion and Interpretation:* In the final phase of the report, we discuss the implications of our findings and their alignment with our research objectives. We consider the practical implications of our analysis and explore any recommendations from the study. This discussion and interpretation phase provides a comprehensive perspective on the significance of our research in the context of climate change adaptation.

7. Conclusion

To understand public perceptions and enhance social acceptance of climate change adaptation solutions, we have presented a comprehensive proposal for a protocol to conduct focus groups within the TransformAr project (Accelerating and upscaling transformational adaptation in Europe: demonstration of water-related innovation packages). This protocol represents a valuable tool for achieving the research objectives.

Our focus group protocol encompasses a series of essential elements that ensure the research process's integrity, inclusivity, and rigor. From delineating research objectives to developing a systematic discussion guide, every facet of the protocol is crafted to clarify the methodological procedure.

Throughout the proposal, we have emphasized the significance of clear and accessible communication. We recognize our participants' diverse backgrounds and perspectives and are committed to fostering an environment where all voices are heard. Our approach to moderator presentation, participant engagement, and data analysis prioritizes inclusivity and ethical considerations.

In the data analysis phase, we emphasize the importance of systematic coding and thematic analysis to clarify meaningful insights from the rich data collected during focus group sessions. By adhering to these established practices, we aim to provide robust findings that inform the implementation of climate change adaptation initiatives.

As we contemplate the proposed protocol's potential impact, we recognize its broader applicability beyond the TransformAr project. It is a valuable tool that can be harnessed in similar projects, enhancing data collection, promoting informed dialogue, and improving social acceptance of climate change adaptation solutions.

ANNEX 2: FOCUS GROUP PROTOCOL PRESENTATION

TransformAr

Accelerating and upscaling transformational adaptation in Europe:
demonstration of water-related innovation packages

Planning of Focus Group

This project has received funding from the European Union's Horizon H2020 innovation action programme under grant agreement 101036683.

01 Executive Summary

1.Introduction
2.Purpose and Characteristics of a focus group
3.Phases
4.Focus group preparation
5.Focus group execution
6.Focus group data analysis

1. Introduction

Project objective

The EU-funded TransformAr project aims to create solutions to introduce large-scale adaptive transformation processes that reduce climate impacts in vulnerable regions and communities across Europe. This aim will be achieved through a co-innovation process involving co-creating adaptation pathways with stakeholders' input.

Purpose of focus group

Analyze whether the **acceptance of solutions** focused on climate change adaptation **varies according to the source presenting the solution**. Our hypothesis is that acceptance will be higher and there will be less questioning when the solution is presented by a person with a scientific profile compared to a non-scientific profile.

2. Purpose and Characteristics of a focus group

What is a focus group?

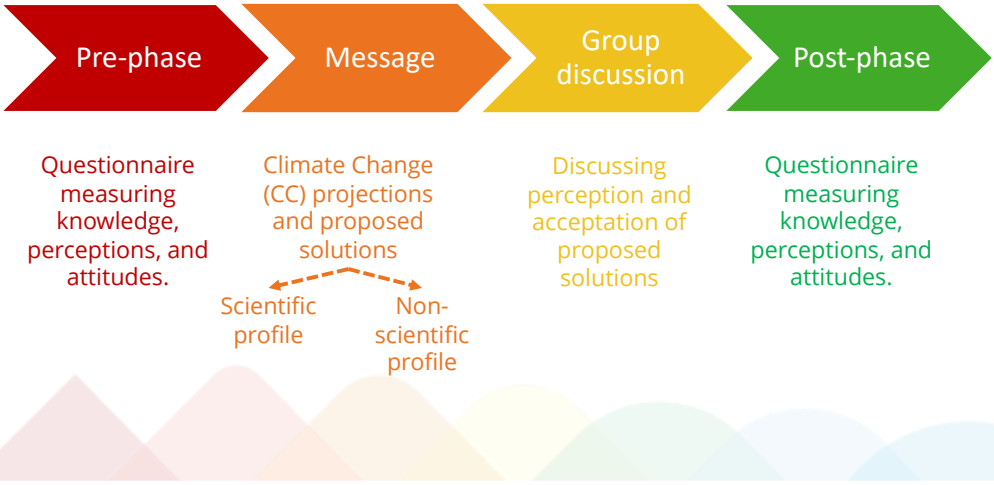
A focus group is a **conversational data collection technique**. It consists of gathering a small group of people (usually 4 to 5) to obtain information about their attitudes, perceptions, and experiences related to a specific topic, such as climate change projections and solutions for adaptation proposed by TransformAr.

During the focus group session, **the participants are asked open-ended questions and encouraged to discuss and share their opinions and experiences**. The purpose is to obtain detailed and in-depth information on a particular topic through interaction and dialogue among participants (Onwuegbuzie et al., 2009).

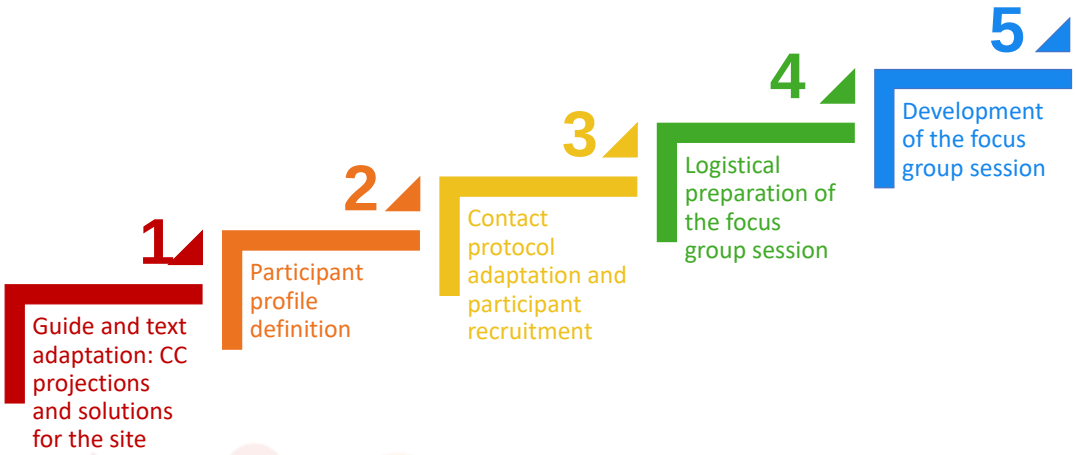
Characteristics of a focus group

- Duration: between 1 to 1:15 hours
- Small groups: 4 to 5 participants
- Participants should be selected based on the objective, with a focus on key stakeholders who are not directly involved.
- The moderator's role is to guide the discussion and ensure the guidelines are followed.

3. Phases



TransformAr
3. Phases



4 Focus group preparation

1 • **Define the Main Aim:**

Clearly outline the main aim that you have with the focus group.

• **Our Main Aim for TransformAr**

To investigate the influence of the presenter's profile (scientific vs. non-scientific profile) on the acceptance and reception of climate change adaptation projects. With the focus groups, we want to explore whether the profile of who presents the solution affects the level of acceptance and the extent of questioning among participants. Specifically, we hypothesize that solutions presented by scientific individuals will be more readily accepted and subjected to fewer inquiries than those presented by non-scientific individuals.

2 • Develop a Questionnaire for Pre and Post Focus Group Phase:

a. Select Established Measures

- Whenever possible, use well-established and validated psychometric measures that have been tested for reliability and validity in previous research. Consider reliability and validity from previous work.

b. Response Options:

- Provide appropriate response options (e.g., Likert scales, multiple-choice, open-ended).
- Use balanced scales (e.g., an equal number of positive and negative response options) to minimize response bias.

TransformAr
Focus group preparation
Questionnaire for Pre and Post Focus Group Phase

Construct	General statement	Adapted item	Measurement	Application time
Perception of effects of Climate Change (CC)	Below are some consequences/ transformations associated with climate change. Please indicate how likely you think these consequences/transformations will affect Galicia, taking into account that 1 is "very unlikely" and 7 is "very likely."	Changes in the quantity and quality of mussels and clams	5-point Likert scale (1 = very unlikely to 5 = very likely)	Pre-phase Post-phase
		Changes in the quantity and quality of foods produced in the sea, such as fish or shellfish.		
		Increase in sea water temperature		
		Changes in sea level		
		Increase in extreme events in winter (e.g. waves and storms)		
		Increase in extreme events in summer (e.g. heat and fires)		
		Excessive algae growth and the formation of red tides		
Psychological Distance (DS)	With what probability do you think that climate change will significantly affect Galicia? (DS Geographic)		With 1 being "Not at all likely" and 5 being "Very likely."	Pre-phase Post-phase
	In what time frame do you think climate change will become a really serious problem in Galicia? (Temporary DS)		Never = 1 Long term = 2 Medium term = 3 Short term = 4 Already a problem = 5	
	How likely do you think climate change will affect you or your family? (DSSocial)		With 1 being "Not at all likely" and 5 being "Very likely."	

Focus group preparation

Questionnaire for Pre and Post Focus Group Phase

Construct	General statement	Adapted item	Measurement	Application time
Importance of aquaculture	How important do you think aquaculture is for Galicia?		5-point Likert scale (1 = not at all important to 5 = very important)	Pre-phase Post-phase
	With what probability do you think that climate change will affect aquaculture in Galicia?		With 1 being "Not at all likely" and 5 being "Very likely."	
Perception of effectiveness of TransformAr solutions	Below are a series of technical and engineering solutions to address climate change. Please rate how effective you think each of these solutions is in adapting to climate change in Galicia, using a scale of 1 to 7, where 1 means "totally ineffective" and 7 means "totally effective."	Create systems and resources that allow us to have enough water in times of drought to supply the population and agriculture.	5-point Likert scale (1 = completely ineffective to 5 = completely effective)	Pre-phase Post-phase
		Use technology to improve the management of mussel ponds and thus be able to better adapt to climate changes		
		Find ways to grow plants that need less water and can better withstand changes in climate		
		Look for new ways to manage shellfish beds and find places where they can continue to be exploited in an environment of climate change		
		Strengthen structures that are vulnerable to rising water levels, such as bridges, so they do not erode or become damaged		
		Develop a tool that allows identifying areas that need to better adapt to climate change and give them priority in the allocation of resources and adaptation strategies		

Focus group preparation

Questionnaire for Pre and Post Focus Group Phase

Construct	General statement	Adapted item	Measurement	Application time
Acceptance of TransformAr solutions	On a scale where 1 is "Totally disagree" and 7 is "Totally agree", how much would you agree to implement the following adaptation solutions to climate change in Galicia:	Create systems and resources that allow us to have enough water in times of drought to supply the population and agriculture.	5-point Likert scale (1 = strongly disagree to 5 = strongly agree)	Pre-phase Post-phase
		Use technology to improve the management of mussel ponds and thus be able to better adapt to climate changes		
		Find ways to grow plants that need less water and can better withstand changes in climate		
		Look for new ways to manage shellfish beds and find places where they can continue to be exploited in an environment of climate change		
		Strengthen structures that are vulnerable to rising water levels, such as bridges, so they do not erode or become damaged		
		Develop a tool that allows identifying areas that need to better adapt to climate change and give them priority in the allocation of resources and adaptation strategies		

Focus group preparation

Questionnaire for Pre and Post Focus Group Phase

Construct	General statement	Adapted item	Measurement	Application time
Perception of change of opinion	Do you consider that the person who prepared the document you have read has competent knowledge of the topic addressed? (Fountain)		5-point Likert scale (1 = not at all competent to 5 = much better)	Post-phase
	Do you think the information presented in the text about climate change projections for Galicia and adaptation solutions offers competent knowledge on the topic addressed? (Fountain)		5-point Likert scale (1 = not at all competent to 5 = much better)	
	To what extent are you concerned about the projections presented on the effects of climate change in Galicia? (projections)		5-point Likert scale (1 = not at all worried to 5 = very worried)	
	To what extent has the information provided by the person in the text and/or the discussion generated in the group influenced your response to this questionnaire? (source vs discussion comparison) • The information provided by the person in the text • The discussion that was generated among the group		Not at all = 1 Very little = 2 Neither at all nor much = 3 Quite a bit = 4 A lot = 5	
	Which of the ideas presented in the text or that emerged from the discussion have interested you the most and for what reason? (source vs discussion comparison)		Open question	

Focus group preparation

Text for Discussion

3 Text for discussion

Generate a text to present the projections of the effects of climate change and the proposed adaptation strategies

a. Use clear and accessible language

b. Begin with the region context

c. Provide information on the present and future impacts of climate change in the region

d. Explain the Adaptation Strategies from TransformAr

3 Text for discussion

Generate a text to present the projections of the effects of climate change and the proposed adaptation strategies

a. Use clear and accessible language

b. Begin with the region context

c. Provide information on the present and future impacts of climate change in the region

d. Explain the Adaptation Strategies from TransformAr

Focus group preparation
Text for Discussion

3 Text for discussion

Projections of climate change in the estuaries in Galicia and adaptation solutions

Galicia is one of the most important fishing regions in the European Union, with a great dependence on income from this sector. However, the Galician coast is very vulnerable to climate change.

On the one hand, the concentration of industrial activity and habitability in the Rías Altas and Rías Baixas increases pressure on coastal ecosystems; and fishing and aquaculture activities can unbalance the natural functioning of ecosystems. On the other hand, the rise in sea level and winter storms represent a latent threat to coastal infrastructure, potentially causing flooding and its progressive deterioration. Additionally, the increase in the intensity and frequency of extreme events, such as heat waves, droughts and prolonged fire seasons, will negatively impact shellfish aquaculture and the conservation of marine species.

Projections indicate that the water temperature in the estuaries of Galicia will increase by 2.4 degrees Celsius per century and the sea level by 9.8 cm per decade. Likewise, precipitation in wind regimes can accelerate erosion and sedimentation processes and contribute to desertification and the development of arid areas. Additionally, coastal acidification can have negative effects on marine life.

Due to this, the aquaculture sector faces threats such as the alteration of nutrient fertilization patterns, the presence of invasive species, the increase in harmful algal blooms and the negative impact of extreme weather events on the structures of the ponds. mussel and the biomass losses associated with the detachment of mussels from the ropes. Furthermore, increasing water temperatures and relevant fluctuations in coastal oceanographic and hydrological variables increase clam mortality and reduced productivity.

3 Text for discussion

Projections of climate change in the estuaries in Galicia and adaptation solutions

Consequently, it is urgent to implement adaptation measures to address the challenges posed by climate change in marine and coastal ecosystem.

In response to this need, three innovative solutions for adaptation to climate change in the estuaries of Galicia have been proposed.

The first solution proposed is the **digitalization of mussel trays**, which improves the management capacity of the aquaculture sector and allows an immediate response to dangers related to climate change through real-time monitoring.

This solution has several advantages. On the one hand, it allows you to obtain real-time information on environmental conditions, such as water temperature, water quality, oxygen levels and salinity. This enables early detection of possible alterations and the adoption of preventive or mitigation measures to protect crops and reduce negative impacts.

Furthermore, the digitalization of mussel trays optimizes aquaculture management. Data collected in real time provides precise monitoring of environmental conditions and mussel growth, helping to optimize farming processes and improve productivity. It also allows aquaculturists to adjust operations according to environmental conditions and optimize processes related to the supply of food and medicine. In short, it contributes to more profitable and sustainable production.

However, it is important to consider the potential economic and technological barriers associated with implementing this solution. The costs of acquiring equipment and technology, as well as training staff, can be significant and represent a barrier for small aquaculture businesses or those with limited financial resources. Additionally, the adoption of digital technology and real-time monitoring systems may require specialized technical skills and knowledge, making it difficult to implement and manage effectively in the absence of access to training and technology experts.

TransformAr
Focus group preparation
Text for Discussion

3 Text for discussion

Projections of climate change in the estuaries in Galicia and adaptation solutions

The second solution seeks **to characterize and model intertidal sandbanks** in order to acquire accurate and detailed data on their current state and predict possible future changes. This resulting information provides a more complete understanding of the factors that influence the distribution and availability of marine resources used in shellfish harvesting. By having this knowledge, the planning and management of shellfishing activities can be improved, achieving greater sustainability and minimizing negative impacts.

Furthermore, the characterization of intertidal sandbanks would allow early identification of alterations in the sediment and coastal ecosystems. This early detection is essential to take timely measures and mitigate the negative effects of climate change.

However, it is important to consider the possible technological and economic barriers that could arise when implementing this solution. First, characterization and modeling require specialized techniques and technologies, such as sediment sampling, geospatial analysis, and numerical modeling. Lack of access to these tools or lack of adequate technical knowledge can make their implementation difficult.

Additionally, the costs associated with data acquisition, implementation of modeling techniques, and staff training can be significant. This may limit the accessibility and viability of the solution, especially for communities or institutions with limited financial resources.

Likewise, while the solution would allow for greater knowledge and better projections, the practical application of this data can present challenges. Factors such as regulations, availability of resources, and acceptance of new practices can influence the effectiveness of the solution.

Finally, the third proposed solution is **to generate a resilience index for the mussel aquaculture value chain**, providing stakeholders and policy makers with an assessment and decision-making tool.

3 Text for discussion

Projections of climate change in the estuaries in Galicia and adaptation solutions

This index would allow strategically identifying priority areas to focus adaptation efforts, promoting awareness and behavior change.

This solution has several significant advantages. Firstly, by providing an approach based on objective data, the resilience index would facilitate informed decision-making, allowing the identification of critical and strategic areas in the mussel aquaculture value chain.

Furthermore, the resilience index would be a dynamic tool that will allow monitoring and evaluating changes over time. This facilitates continuous improvement and adaptation of climate change adaptation strategies, through regular assessments, monitoring progress and adjusting actions as necessary.

However, there are challenges to consider in implementing the resilience index. On the one hand, existing regulations and institutional structures may not be prepared to incorporate this approach into decision-making. Lack of alignment with existing policies and regulatory frameworks can hinder their effective integration into planning and management processes.

Furthermore, the adoption of new tools and approaches may encounter resistance from stakeholders and policy makers, especially if the importance of climate change adaptation in the mussel aquaculture value chain is not fully recognized. This can make it difficult to accept and integrate the resilience index into decision-making processes.

4 • Develop Discussion Guide:

Prepare a discussion guide (script) with a list of open-ended questions and topics to cover during the session.

- Start with icebreaker questions
- Use open-ended questions
- Sequence questions logically
- Submit the guide to expert peer review (to review per question: relevance, sufficiency, coherence, syntax and semantics)

Focus group preparation

Discussion guide

Guiding categories	Axis of inquiry	Guiding questions	Relevance	Sufficiency	Coherence	Syntax and semantics
Psychological distance: perception that people have about the proximity, in temporal, social and geographical terms, of the effects of climate change on their lives.	Temporary: perception that people have about when the effects of climate change will occur.	How do you think climate change will affect your future and that of future generations?				
	Social: perception that people have about the closeness or distance they have with the social groups affected by the effects of climate change.	Do you think people believe that climate change is currently a problem?				
		Which people do you think could be most affected by climate change in Galicia? Are you worried about anyone in particular?				
		What economic activities do you think may be affected by climate change?				
	Geographic: perception that people have about the physical distance between them and the effects of climate change.	How do you think climate change affects/will affect the estuaries (or directly regional seafood/aquaculture production)?				

Focus group preparation

Discussion guide

Guiding categories	Axis of inquiry	Guiding questions	Relevance	Sufficiency	Coherence	Syntax and semantics
Threat perception: person's assessment of the degree of danger or risk posed by the effects of climate change, including their personal and collective capacity to confront and respond to said threat.	Risks: people's assessment of the possible dangers or threats that may arise as a result of climate change.	What are the consequences/effects of climate change that concern you most?				
	Personal or collective capacity: It refers to the perception that people have about their individual or collective ability to confront and respond effectively to the consequences of climate change.	What measures do you think we should take to adapt to climate change?				
		What personal or collective changes do you think would be necessary to adapt to the effects of climate change?				

Focus group preparation

Discussion guide

Guiding categories	Axis of inquiry	Guiding questions	Relevance	Sufficiency	Coherence	Syntax and semantics
Perception of the proposed solution: people's assessment of the effectiveness and viability of proposed solutions to adapt to climate change.	Effectiveness: perception of the capacity of the proposed solution to address and resolve the problems associated with climate change, taking into account the limitations and resources available.	What do you think of the proposed solutions?				
		What doubts do you have?				
		Do you think they have positive effects on the aquaculture and shellfish sector? which is it? And in other sectors/actors?				
		Do you think they have negative effects on the aquaculture and shellfish sector? Which ones? And in other sectors/actors?				
		What adaptation measures to climate change would you propose for the sector?				
		How feasible do you think it is to implement the proposed solutions?				
		What do you think would be the main effects that the proposed solutions would have?				
		Do you think the proposed solutions are useful/appropriate for the needs and resources we have in Galicia?				

Focus group preparation

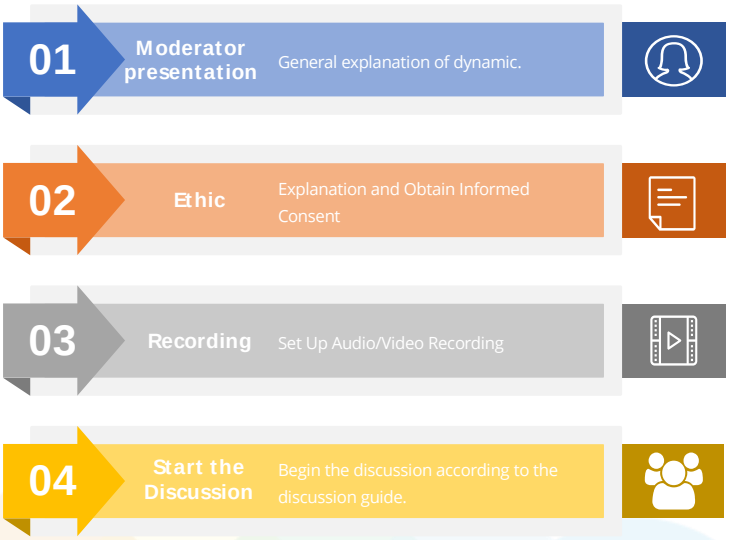
Discussion guide

Guiding categories	Axis of inquiry	Guiding questions	Relevance	Sufficiency	Coherence	Syntax and semantics
Perception of the proposed solution: people's assessment of the effectiveness and viability of proposed solutions to adapt to climate change.	Barriers: obstacles or difficulties that people perceive to exist in implementing the proposed climate change adaptation solution, including barriers that structurally disadvantage certain groups (structural barriers), financial barriers, time barriers, and insufficient knowledge and deterrence effect of a complex topic (insufficient knowledge/complexity of the topic).	What limitations/barriers do you see to implementing the proposed solutions?				
		Who do you think could be harmed by the proposed solutions?				
		How do you think people involved in the aquaculture sector will view the proposed solutions?				
Acceptance of the proposed solution: willingness to support and adopt the proposed climate change adaptation solution.		What do you think of the proposed solutions to adapt to climate change in Galicia?				
		Do you think that in general these proposed solutions would gain support?				
		What do you think is important to take into account so that the proposed solutions can be accepted?				

5 Focus group execution

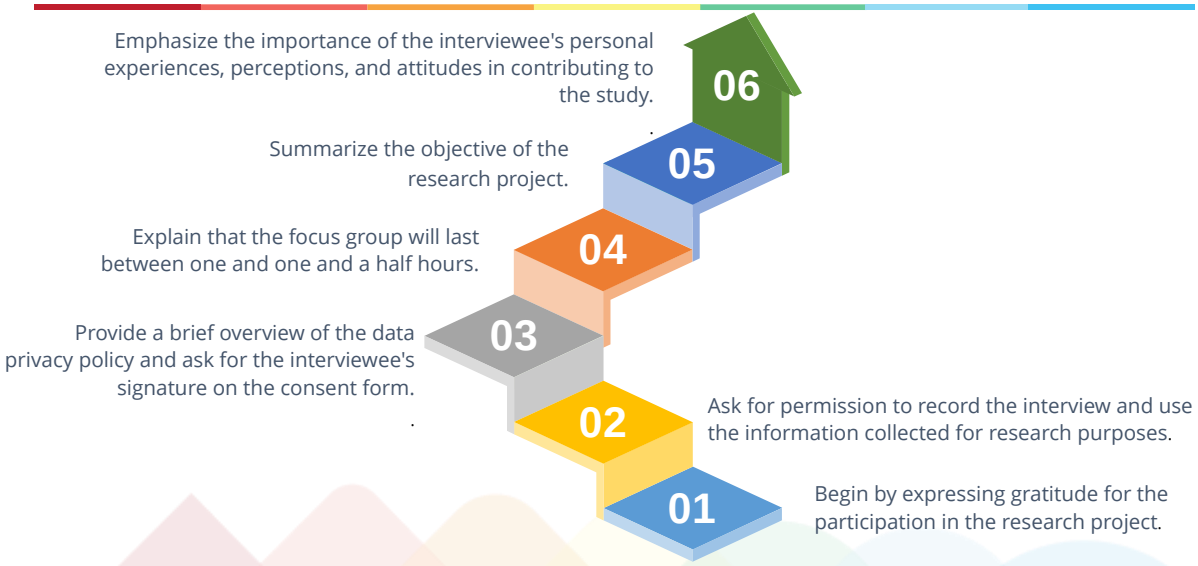
Before starting, verify that all the material is in condition to carry out the focus group session:

- Informed consent
- Printed text presenting solutions
- Recorder
- Focus group question guide



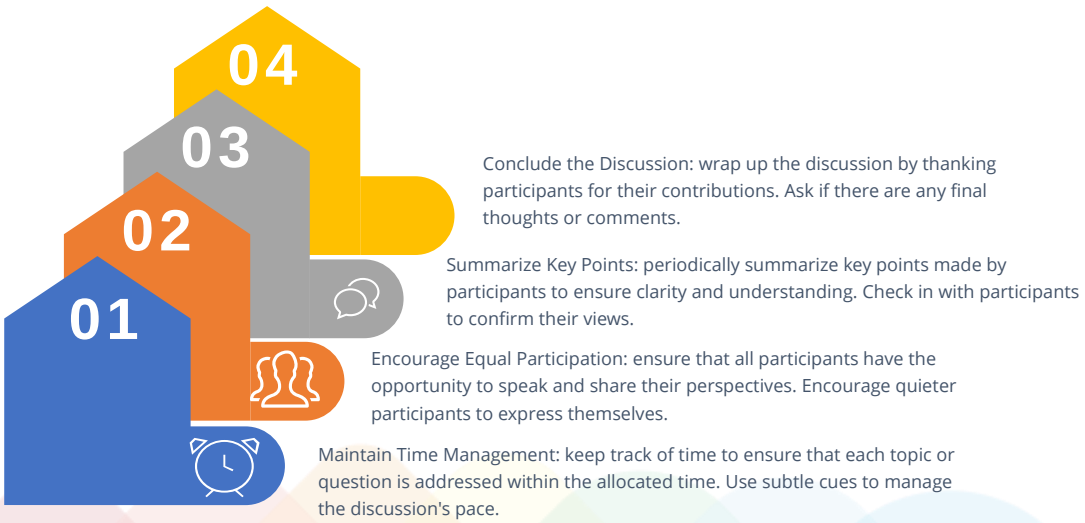
Focus group execution

Tips for Moderator presentation

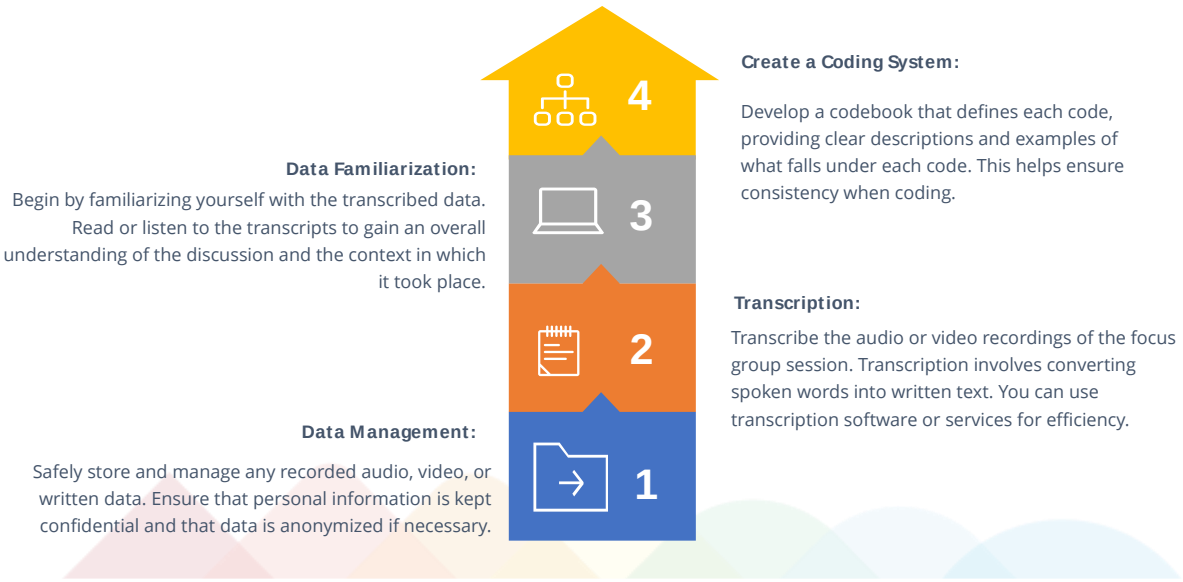


Focus group execution

Tips for the moderator during the discussion



6 Focus group data analysis



Focus group data analysis

Main steps for the report

Data Reduction

Condense the data by summarizing the content within each theme. Identify key quotes or excerpts that exemplify each theme. These excerpts can be used as evidence to support your findings.

Thematic Analysis

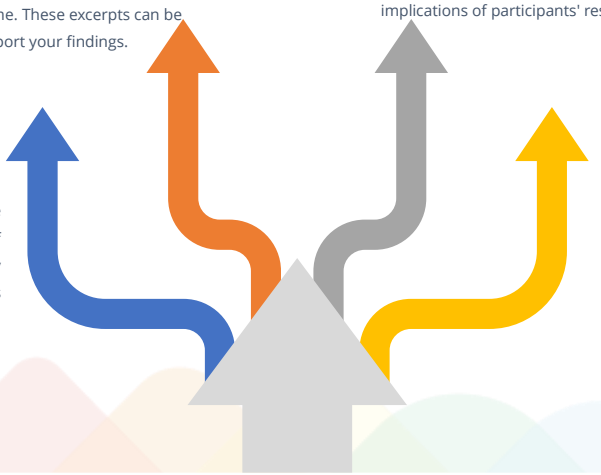
Group related codes together to form broader themes or categories. These themes should capture the essence of what participants discussed. You may need to reorganize codes and themes as the analysis progresses.

Data Interpretation

Interpret the meaning behind the themes and patterns you've identified. Consider the context, nuances, and implications of participants' responses.

Discussion and Interpretation

Discuss the implications of your findings and how they relate to your research objectives. Consider the practical implications and any recommendations that arise from the analysis.



ANNEX 3: CODING SYSTEM

STAKEHOLDERS

The semantic code 'stakeholders' encompasses a wide range of semantic domains related to the interaction of different actors in a specific context, such as in the project and at different sites. It addresses issues related to climate change projections and their potential impact on production, as well as the identification of sector-specific dynamics, obstacles in actor coordination, misalignment of government policies with sectoral needs, the importance of data-backed decision-making, and adaptation to market changes. Additionally, expressions related to climate change adaptation are considered, including the assessment of economic viability, nature-based transformations, regulatory and governance changes, sustainability, social changes, technological innovation, monitoring systems, and transformations in business models. Finally, the attitudes and responses of individuals and communities to proposed solutions are explored, including active collaboration, perception of effectiveness, questioning, and adaptation of solutions to address specific climate challenges in different geographical contexts. Below, each of these semantic domains capturing the sensitivities of various stakeholders in different sites is described in detail.

1. **Sectoral Dynamics:** References to the dynamics that characterize a particular economic sector.

- *Lack of Articulation Among Stakeholders*: References to situations where there are obstacles or deficiencies in the coordination and collaboration among different actors or stakeholders within a specific context, such as an economic sector or a project. These obstacles can manifest as a lack of effective communication, disagreements in objectives and strategies, absence of alliances or synergies, fragmentation of an economic sector, confrontation between sectors, or any other limitation that hinders harmonized action among those involved.
- *Disconnection in Political Management:* References to situations where government decisions and policies are not aligned or are inconsistent with the needs and objectives of a specific economic sector or project. This can manifest as contradictory regulations, lack of government support for key initiatives, a lack of understanding of sector dynamics, or a general lack of synchronization between public policy and the needs of the economic sphere in question.
- *Decision-Making Without Data:* References to situations where strategic, operational, production, or commercial decisions within an economic sector are made without the support of accurate data or updated information from monitoring or tracking systems.
- *Data-Driven Decision-Making:* References to the practice of making strategic, operational, production, or commercial decisions within an economic sector based on precise data and updated information from monitoring or tracking systems.
- *Changes in Market Dynamics:* Reference to situations where significant alterations in market dynamics that affect a particular economic sector are observed. These changes can manifest in various ways, such as increased demand for specific products, the need to adapt production practices to meet new demands, increased import or export of products, and the reorganization of production or sales schedules in response to changes in consumption patterns.

2. **Sectoral Requirements:** References to the needs of sectors in relation to climate change adaptation.

- *Economic Viability and Financing:* References to the importance of evaluating and considering economic viability and the necessary sources of funding for the implementation of solutions aimed at climate change adaptation. It also includes references that highlight the need to analyze

financial capacity, available resources, and required financing strategies for carrying out climate change adaptation projects and actions.

- *Nature-Based Transformations (Green):* References to strategies and actions implemented to address and adapt to climate change by strengthening biodiversity and ecosystems. These adaptation solutions, known as nature-based solutions, seek to improve the quality of aquatic and terrestrial ecosystems, as well as the diversity of species within them. Examples of these actions include habitat restoration and the promotion of biodiversity to enhance ecosystem resilience to the impacts of climate change.
- *Regulatory and Governance-Based Transformations:* References to changing regulations and/or governance to promote effective climate change adaptation. These references may include reviewing and modifying existing regulations, policies, and decision-making procedures to address the challenges posed by climate change adequately.
- *Sustainability-Based Transformations:* References to strategies and actions aimed at addressing the challenges of climate change through actions that promote sustainability in its economic, environmental, and/or social dimensions. These solutions aim to adapt to climate change in a way that not only mitigates its negative impacts but also fosters sustainable development that balances economic well-being, environmental health, and the social welfare of affected communities.
- *Social Transformations:* References to strategies and actions to promote societal changes and people's behavior to adapt to climate change effectively. These solutions seek to generate changes in attitude, opinion, and action regarding climate change challenges, promote sustainable practices, alter consumption patterns, and mobilize the community to address climate impacts collectively. They may include educational campaigns, awareness programs, and policies that promote behavior change towards greater climate resilience.
- *Research, Development, and Innovation (R&D+I) Transformations (Technological):* References to strategies and actions involving research, development, and implementation of new technologies, methods, and innovative approaches to address and adapt to climate change. These solutions aim to apply technological and scientific advancements to enhance resilience and adaptability to climate impacts, developing tools and systems that help mitigate risks, improve efficiency, and promote sustainable practices.
- *Monitoring Systems:* References to the need to implement meticulous and highly precise monitoring systems in specific contexts to collect significant data related to natural resources, biodiversity, and ecosystems and assess risks and consequences associated with climate change. Likewise, references to these monitoring systems should be regularly updated, provide frequent information, and be accessible through a user-friendly interface.
- *Business Model Transformations:* References to strategies and actions that involve substantial reconfiguration of existing business models with the purpose of adapting to the impacts of climate change. These solutions aim to redirect commercial operations, products, and services to make them more sustainable and resilient to adverse climate effects or even undertake sectoral transformations.

3. **Attitude and Responses to Proposed Solutions:** References to the disposition and attitudes adopted by individuals and communities in response to the solutions proposed by the "TransformAr" project.

- *Collaborate:* References to the willingness and readiness of individuals and communities to actively collaborate in implementing proposed solutions. This disposition can be expressed by

suggesting areas where these solutions could be applied, offering to establish useful contacts, transferring relevant information to their respective organizations, or recommending other stakeholders considered crucial for the collaboration process.

- *Perception of Effectiveness:* References to the perception of the utility of proposed solutions concerning climate change adaptation. It includes the opinions and assessments of individuals and communities regarding the effectiveness of these solutions in addressing climate challenges, enhancing resilience, and being useful for their sector.
- *Questioning:* References to doubts, questions, or criticisms raised by individuals and communities regarding the proposed solutions for addressing climate change. This includes any form of questioning, concerns, or skepticism expressed regarding these solutions' effectiveness, feasibility, or impact..
- *Adapt the Solution:* References to the need to customize and adjust solutions to effectively address the challenges of climate change in specific geographical areas or particular contexts. This entails considering and adapting strategies to each polygon or location's unique conditions, considering factors such as sedimentation, new constructions, resilience indices, industrial waste management (such as mussel hatchery purification), spawning data, and vandalism.

PERCEPTION OF DISTANCE/PROXIMITY

The "Distance/proximity" semantic code encompasses the perception of climate change's psychological distance and proximity. It includes references to psychological distance, where individuals may disconnect from or downplay the significance of climate change, considering it a distant or irrelevant problem. This involves social aspects, where people may lack awareness of climate change's effects or believe it won't impact them or their close community. It also addresses geographic distance, where climate change is seen as having distant or insignificant repercussions nearby. Additionally, there's a temporal dimension, where climate change might be viewed as a past or future concern, not significant in the present. On the other hand, psychological proximity refers to references showing concern and understanding of climate change and its present or future consequences. This includes perceiving climate change as an urgent problem and understanding its effects, with awareness that it impacts oneself and the local community. It also involves geographical proximity, where climate change's repercussions are experienced or anticipated nearby, and temporal proximity, with climate change considered a current and relevant concern.

1. Psychological Distance: Any reference to a disconnection from the consequences of climate change or a minimization of its importance.

- *Social:* References to the perception of climate change as a distant, irrelevant, or overrated problem, or indicating a lack of understanding of its effects. It also includes references that suggest that climate change has no or will have no effects on oneself or on people close, such as family, friends, and the local community.
- *Geographical:* References to the perception that climate change is a problem whose repercussions are considered distant or not impactful in one's nearby geographic environment.
- *Temporal:* References to perceptions that the issue of climate change is considered a sporadic concern in the past or will be relevant in the medium or long term future, but is not seen as a significant concern in the present.

2. Psychological Proximity: Any reference to concern or understanding of the problem of climate change and its present or future consequences.

- *Social:* References to the perception of climate change as a relevant or urgent problem or indicating an understanding of its effects. It also includes references that suggest that climate change has or will have effects on oneself or on people close, such as family, friends, and the local community.
- *Geographical:* References to the perception that climate change is a problem whose repercussions are being experienced or will be experienced in one's nearby geographic environment.
- *Temporal:* References to perceptions that the issue of climate change is considered a current concern and relevant in the present.

CLIMATE CHANGE

The "Climate Change" semantic code covers two main domains. Firstly, it encompasses the "Consequences of Climate Change on Sectors," which include references to the specific impacts of climate change on economic sectors, such as reduced productivity, lower commercial quality, adverse economic effects, increased political regulation, heightened management tasks, potential benefits, and the adoption of sustainable solutions within these sectors.

Secondly, it addresses the "Effects of Climate Change," encompassing various consequences resulting from global or regional climate variations, including alterations in temperature, extreme weather events, decreased salinity in bodies of water, degradation of natural resources, the proliferation of invasive species, changes in wind currents, indirect pollution, health risks, biodiversity decline, alterations in ecosystems, socioeconomic and demographic vulnerability, as well as vulnerability of infrastructure and equipment to climate change impacts.

1. Consequences of Climate Change on Sectors: References to the specific effects and repercussions of climate change on a particular economic or industrial sector (e.g., tourism, agriculture, or aquaculture). Consequences can range from the impacts of extreme weather events to changes in product or service demand, as well as financial, regulatory, and operational considerations affecting various key actors within the sector.

- *Decreased Productivity*: References to the reduction in the ability to generate products, services, or income due to factors such as changes in natural cycles (e.g., planting, species reproduction), increased species mortality, soil degradation, heat stress in livestock, loss of productive land, and temporary or permanent closure of tourist destinations.
- *Reduction in Commercial Quality*: References to situations or evidence indicating a decrease in the quality of products, goods, or services offered in the sector. This reduction can manifest in various ways, such as a decrease in technical characteristics, durability, efficiency, safety, reliability, presentation, or any other aspect that negatively affects the perception or commercial value of a product or service.
- *Adverse Economic Impact*: References to increased costs, loss of income, deterioration of economic infrastructure, and other factors negatively affecting the stability and economic development of the sector.
- *Increased Political Regulation*: References to the increase in government regulation and changes in regulations in response to the challenges and threats posed by climate change. This includes government measures, policies, and legal changes designed in response to the challenges and threats posed by climate change.
- *Increased Management Tasks*: References to an increase in actions aimed at managing certain effects of climate change that negatively impact a specific sector. These actions may be designed to address issues such as algae and pest proliferation, increased phosphate levels in aquatic

ecosystems, soil erosion and resulting pollution, as well as an increase in wildfires, among other impacts.

- *Potential Benefits*: References to economic opportunities and advantages that have arisen or may arise as a result of changing climate conditions, including increased productivity in specific sectors, the adoption of new agricultural and commercial practices, and the generation of economic benefits through the proper management of natural resources in a climate change context.
- *Implementing Sustainable Solutions*: References to the adoption and implementation of sustainable practices, technologies, or strategies by specific sectors with the purpose of continuing their economic activities and, at the same time, counteracting the negative effects of climate change; and that were not promoted within TransformAr. These actions may include the adoption of renewable energy sources, efficient natural resource management, and other measures that promote economic and environmental sustainability.

2. Effects of Climate Change: References to the consequences and repercussions caused by global or regional climate variations. These effects can range from extreme weather events, such as droughts and floods, to changes in temperature and precipitation patterns, affecting ecosystems, infrastructure, and the daily lives of communities.

- *Temperature Alteration:* References to notable variations in the average temperatures of a particular geographical location or ecosystem resulting from climate change. These variations can include heatwaves, modifications in seasons, a reduced difference between daytime and nighttime temperatures, and an increase in humidity levels.
- *Extreme Events:* References to extraordinary or unusual climatic events that occur more frequently or intensively due to climate change. These events may include, but are not limited to, floods, droughts, hurricanes, storms, wildfires, heatwaves, and extreme precipitation.
- *Decreased Salinity:* References to the decrease in the concentration of dissolved salts in bodies of water, such as oceans, seas, lakes, or estuaries, as a result of climate change. This may be related to phenomena such as glacier melting, increased precipitation, or desalination due to rising global temperatures.
- *Natural Resource Degradation:* References to the reduction in the natural regeneration capacity of natural resources, such as fertile soils, animal or plant species populations, due to the effects of climate change. This may include changes in species reproduction cycles, soil damage, desertification, decreased regeneration of forested areas after wildfires, disturbances in natural water purification processes, and other phenomena affecting nature's ability to replenish its resources sustainably.
- *Proliferation of Invasive Species:* References to situations where there is a significant increase in the population and territorial expansion of non-native or invasive species, such as algae or pests, in a specific ecosystem. This may include the spread of plants, animals, insects, or other organisms that, lacking natural predators or competitors in the new environment, can cause ecological imbalances and threaten local biodiversity.
- *Alteration of Wind Currents:* References to changes in wind current patterns and directions resulting from climate change. These changes can include deviations from usual wind currents, alterations in wind speed and frequency, as well as modifications in the influence of dominant winds in a specific region.
- *Indirect Pollution:* References to environmental pollution caused by climate change, including phenomena such as increased wildfires and the runoff of contaminating substances into natural ecosystems. This pollution is not directly related to specific sectors mentioned by stakeholders

and may result from extreme weather events or altered climate patterns negatively affecting air and water quality, as well as ecosystem health.

- *Health Risks:* References to threats and hazards affecting human health and that of other animals as a result of climate change-induced alterations and extreme weather events. These threats include, but are not limited to, vector-borne diseases, respiratory problems, heat strokes, specific risks for vulnerable populations like the elderly, general health degradation, climate-sensitive diseases, livestock stress, and deaths due to heat stress. Additionally, this code also covers mental health risks related to extreme climate events such as hurricanes or droughts.
- *Biodiversity Decline:* References to the significant loss or reduction of animal and plant species diversity in a specific geographical area due to the effects of climate change. This may manifest as species extinction, forced population migration, loss of natural habitats, and decreased genetic variability.
- *Ecosystem alteration:* References to significant and detrimental changes in natural ecosystems as a direct or indirect result of climate change. These changes can manifest themselves in the transformation of landscapes, the degradation of habitats, the interruption of biogeochemical cycles, and the alteration in the structure and functioning of biological communities.
- *Socioeconomic and demographic vulnerability:* References to the exposure and susceptibility of specific communities, regions or sectors to the negative impacts of climate change on their socioeconomic conditions. This may include assessing the vulnerability of populations to extreme climate events, loss of livelihoods, decreased food security, increased adaptation costs, infrastructure degradation, risk of forced migration, as well as the identification of populations and sectors particularly vulnerable to climate change.
- *Infrastructure and equipment vulnerability:* References to the exposure and susceptibility of physical infrastructure and equipment to the adverse impacts of climate change. This encompasses the assessment of how structures, buildings, roads, bridges, energy systems, communications and other physical assets may be affected by extreme weather events, such as floods, storms, droughts and changes in weather conditions.

Climate change impacts are here and now. The impacts on people, prosperity and planet are already pervasive but unevenly distributed, as stated in the new EU Blueprint strategy (European Commission-EC, 2019). To reduce climate-related risks, the EC and the IPCC agree that transformational adaptation is essential. The TranformAr project aims to develop and demonstrate products and services to launch and accelerate large-scale and disruptive adaptive process for transformational adaptation in vulnerable regions and communities across Europe.

The 6 TransformAr lighthouse demonstrators face a common challenge: water-related risks and impacts of climate change. Based on existing successful initiatives, the project will develop, test and demonstrate solutions and pathways, integrated in Innovation Packages, in 6 territories.

Transformational pathways, including an integrated risk assessment approach are co-developed by means of 9 Transformational Adaptive Blocks. A set of 22 tested actionable adaptive solutions are tested and demonstrated, ranging from nature-based solutions, innovative technologies, financing, insurance and governance models, awareness and behavioral change solutions.

TransformAr

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