Interreg Alpine Space

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BeyondSnow

Final version of the Resilience Adaptation Model (RAM)

Output 1.1 – April 2024

Andraž Orehar, Philipp Corradini, Andrea Omizzolo

Who should read this report?

Local and Regional Public Authorities, to increase the knowledge base and the awareness on key concepts of vulnerability and resilience as well as their proposed assessment of the territories they are responsible for.

Local and Regional DMOs, to increase their awareness regarding the vulnerability and resilience of the Alpine Snow Tourism Destinations they are responsible for, as well as gain an understanding regarding the RAM and the RDMDT, of which they will be the final user.

Tourism SMEs, to increase their understanding on climate change effects on STDs and necessary steps and indicators, to assess their vulnerability and resilience, as well as to prepare them for the challenges and the necessary enhancement of climate and socioeconomic resilience through sustainable development alternatives.

Local communities of STDs, because they are also negatively impacted ecologically, socially and economically by climate change. By reading this document STD citizens can increase their knowledge on key concepts of vulnerability and resilience applicable to their territory.

This publication is available on the project website https://www.alpine-space.eu/project/beyondsnow/

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Mission Statements

Based on data collected and results of WP1 actions, specific in-depth analyses of each PWA, and collected scientific literature, the final version of the RAM encompasses the theoretical, methodological, and practice-oriented basis for the assessment, development and strengthening of Alpine STD resilience to CC. Its primary objective is to function as a STD resilience guideline for PWA and AS practicioners, its secondary is to serve as the conceptual basis for the RDMDT tool.

Disclaimer

The data and information in this document refer to and have been proposed specifically for the purposes and activities in the Pilot Working Areas of the BeyondSnow project. Some concepts are of course generalisable to all STDs in the Alps, but with due caution and precautions. The information and perspectives set out in this publication are those of the authors and do not necessarily reflect the official opinion of the European Commission or the Project Partners' regions. Neither the European Commission institutions and bodies nor any person acting on their behalf may be held responsible for the use that may be made of the information contained therein. Reproduction is authorized, provided the source is acknowledged (BeyondSnow (2024). O 1.1 – RAM Resilience Adaptation Model) unless otherwise stated. For use/reproduction of third-party material specified as such, permission must be obtained from the copyright. To learn more and to download additional resources please refer to the Project website https://www.alpine-space.eu/project/beyondsnow/. The information is provided without assuming any legal responsibility for correctness or completeness.

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1 Introduction and background

The goal of Resilience Adaptation Model (hereinafter RAM) is to provide a knowledge base for snow tourism destinations (STDs) to enhance their resilience considering the impacts of climate change by assessing their vulnerabilities, management capabilities, and tourism reliance. For further insights regarding the development procedure of the RAM, please refer to the BeyondSnow deliverable D.1.4.1 (Resilience Adaptation Model Compendium).

The present output has a twofold purpose. The primary objective is to function as a resilience guideline for the project's Pilot Working Areas (PWAs) and further STDs, helping them to enhance their ability to adapt and respond to climate change-related challenges. The secondary objective is to serve as the conceptual basis for the Resilience Decision-Making Digital Tool (RDMDT), which will be developed in Work Package 2 (WP2) of the BeyondSnow project. The RDMDT will build on the principles and framework established during the development of the RAM and will represent an automated, data-driven decision-making tool.

The RAM has been created as part of the activity B1.4 (Design of the Resilience Adaptation Model for Alpine STDs) and has been built upon all knowledge and resources that have been produced within the activities B1.1 (Evaluation of the changing climate conditions and future Alpine STD scenarios), B1.2 (STD vulnerability and resilience evaluation) and B1.3 (PWA in-depht analysis) as well as participatory project activities in the PWAs (WP2) and scientific literature.

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2 Overview of the assessment of STDs

The assessment process in the RAM is structured in four areas:

A. General destination indicators,
B. Climate change and environmental factors,
C. Management capabilities,
D. Tourism indicators.

Each area is divided into subcategories, within which the individual indicators are located.

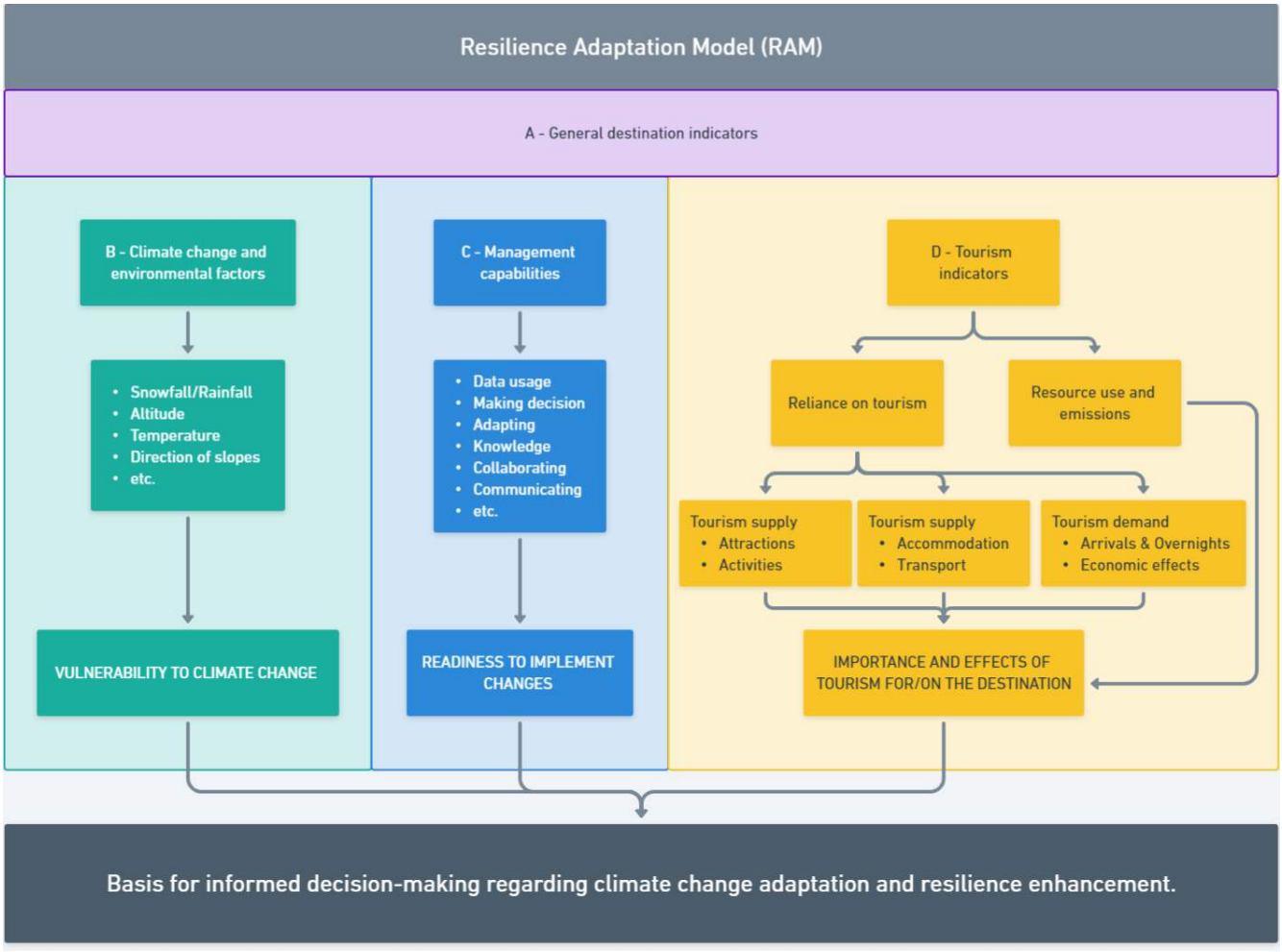

Figure 1: The structure of the Resilience Adaptation Model (RAM)

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2.1 List of indicators

A - General destination indicators
A1a Type of destination
A1b Destination area
A1c Inhabitants
A1d Number of households
A1e Demographic changes
A1f GDP
A1g GDP from hospitality and tourism
A1h Employment
A1i Employment in hospitality and tourism
A1j Precarious work

B - Climate change and environmental factors	C - Management capabilities
B1a Total seasonal snowfall	C1a Ecological transition
B1b Minimum altitude of the ski area	C1b Collaboration amongst stakeholders
B1c Maximum altitude of the ski area	C1c Tourism development strategy
B1d Snowmaking capabilities	C1d Climate change adaptation strategy
B1e Snow season length	C1e Level of data usage
B1f Days with snowmaking temperature	C1f Level of digitalisation
B1g Days with adequate snow height	C1g Local residents
B1h Frost days	C1h Change implementation
B1i Total monthly rainfall	C1i Adapting to climate change
B1j Dry periods	C1j Data usage preparedness
B1k Cardinal direction of slopes	C1k Emergency information channels

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D - Tourism indicators		
D1 - Tourism supply Attractions & activities	**D2 - Tourism supply Accommodation & Transport**	**D3 - Tourism demand**
D1a Winter activities and attractions	D2a Accommodation infrastructure	D3a Tourism arrivals
D1b Snow dependence	D2b Abandoned accommodation infrastructure	D3b Tourism overnights
D1c Summer activities and attractions	D2c Bed availability	D3c Main source markets
D1d Weather dependence	D2d Number of second homes	D3d Percentage of main source markets
D1e Used capacity – high season	D2e Traffic management in high season	D3e Daily visitors
D1f Used capacity – low season	D2f Traffic management in low season	D3f Seasonality of daily visitors:
D1g Ski lifts	D2g Traffic management measures	D3g Skiing days sold
D1h Capacity of ski lifts	D2h Public transport to/from destination	D3h Ski tourists
D1i Number of slopes	D2i Public transport in destination	D3i Cable car tickets sold in summer
D1j Number of slope km		

D - Tourism indicators – D4 Resources & emissions			
D4.1 Electricity	**D4.2 - Water**	**D4.3 Waste**	**D4.4 Emissions**
D4.1a Electricity consumption	D4.2a Water consumption	D4.3a Waste generation	D4.4a Greenhouse emissions
D4.1b Electricity capacity	D4.2b Water capacity	D4.3b Waste generation by tourism (accommodations)	
D4.1c Electricity consumption of tourism (accommodation)	D4.2c Water consumption by tourism (accommodation)	D4.3c Waste generation by tourism (other tourism services)	
D4.1d Electricity consumption of tourism (other tourism services)	D4.2d Water consumption by tourism (other tourism services)	D4.3d Waste management	
D4.1e Electricity consumption by source			

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2.2 Indicator explanation

Each indicator consists of the following components:

1. **Question**: A specific query designed to gather relevant information.
2. **Additional information for the user**: This section can include details on why the indicator is important, where the user can obtain the necessary data, if not already available, etc.
3. **Input**: Specifies the type of data required for the indicator. Depending on the question, the response format will vary between multiple-choice answers, descriptive responses and numerical inputs (e.g. number of overnight stays per month).
4. **Scale**: A guide shows how the output of several indicators can be classified on an ordinal scale (e.g. Critical, Marginal, Acceptable, Optimal). Values referring to the different elements of the ordinal scales have been derived from scientific literature as well as from expert consultations. Some of the collected data is not used for indicators and does not have scale values. It will be used in the RDMDT, but it will not influence the assessment that the destination receives. It is intedned solely to provide additional descriptive information that might be of help when interpreting the data. Many of the indicators refer to the **winter season**, which traditionally **lasts from November until April**.

2.3 Outputs

The outputs of each assessment area are strucuted as follows:

A. **General destination indicators**: The outputs will give a general overview about the destination profile and set the geographic, social and economic context for all of the following outputs.

B. **Climate Change and Environmental Factors**: The outputs will give an overview regarding possible climate change impacts on the respective destination.

C. **Management Capabilities**: The outputs will indicate how prepared the destination is to implement changes and adapt to new challenges from a management perspective.

D. **Tourism Indicators**: The outputs will reflect how tourism reliant the destination is, both in general and specifically regarding winter/snow tourism and the basic structure of the elements of overall tourism system.

Based on these outputs, STDs will be enabled to better prioritise their efforts and resources and make informed decisions to enhance their resilience and sustainability. This structured approach ensures that destinations receive a comprehensive assessment that can guide them in organising coherent responses regarding climate change-related challenges.

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3 RAM areas and assessment

3.1 A - General destination indicators

A1a Type of destination

Question	Please indicate the administrative entity, that best describes the geographical extension of your destination.
Additional information	This selection sets the scope for all following questions, meaning that each question should be answered referring to the geographical area defined selected here. If the destination covers more than one municipality, an assessment for each municipality separately can be performed to ensure accurate and comprehensive results. This approach helps maintain consistency and relevance throughout the assessment process.
Input	Single select multiple choice question
Answers	
Part of a municipality	
Municipality	
Cluster of several municipalities	
National park	
Region	

A1b Destination area

Question	Please indicate your destination area in km^2.
Input	Absolute value

A1c Inhabitants

Question	Please indicate the permanent inhabitants of your destination.
Input	Absolute value

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A1d Number of households

Question	What is the total number of households in your destination?
Input	Absolute value

A1e Demographic changes

Question (Opinion)	Do you see ageing population as an issue in your destination?
Additional information	The demographic development in a destination is crucial as it reflects the population dynamics. It includes factors like birth rate, death rate, migration rate, and age distribution. These factors can significantly influence the socio-economic aspects of a destination, including housing, education, healthcare, and infrastructure planning, but also workforce availability. Considering this indicator can support effective policy-making and sustainable development (European Commission, 2023b; Eurostat, 2024).
Input	Single select multiple choice question

Selectable options	Ageing population is an issue in our destination.	Ageing population is an issue in our destination, and measures to address it are currently being developed and/or have already been introduced.	Ageing population in our destination has been properly addressed and/or is is not an issue.
Ordinal scale reference	Critical	Acceptable	Optimal

A1f GDP

Question	Total GDP/GVA of the destination.
Input	Absolute value

A1g GDP from hospitality and tourism

Question	Percentage of GDP/GVA connected directly to hospitality and tourism

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Input	Percentage value			
Selectable options	More than 30%	Between 15% and 30%	Between 5% and 15%	Less than 5%
Ordinal scale reference	Very high economic dependency on tourism	High economic dependency on tourism	Medium economic dependency on tourism	Low economic dependency on tourism

A1h Employment

Question	Total number of employees in the destination
Input	Absolute value

A1i Employment in hospitality and tourism

Question	Number of employees in hospitality and tourism
Input	Absolute value

A1j Precarious work

Question (Opinion)	Do you face any problems with precarious work in tourism and hospitality in your destination?
Additional information	Precarious work refers to employment that is insecure, unstable, and lacks protection. This often includes temporary, part-time, and freelance jobs with low wages, limited benefits, and low job security. Workers in precarious positions face uncertain working hours, minimal career advancement opportunities, and increased vulnerability to economic fluctuations. A highgly precarious work environment can also negatively affect the overall destination system (Buckingham et al., 2020; Franklin, 2021).
Input	Single select multiple choice question

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Selectable options	Precarious work is an issue in our destination but currently no measures are envisioned to address it.	Precarious work is an issue in our destination and measures to address it are currently being developed and/or have already been introduced.	Precarious work in our destination has been properly addressed and/or is is not an issue.
Ordinal scale reference	Critical	Acceptable	Optimal

3.2 B - Climate change and environmental factors

B1a Total seasonal snowfall

Question	What is the total seasonal snowfall in the winter season?
Additional information	The total seasonal snowfall is the cumulative amount of snowfall measured in the different months of the winter season (from November to April), expressed in centimeters (cm). It provides a standardized way to compare snowfall across regions and periods, essential for weather forecasting and climate studies, as well as managing winter activities and safety measures. The variation of the values is connected to the varying seasonal importance and snow-making ability of STDs. E.g., the Christmas holidays in December are oftentimes one of the most important periods of the winter season. Therefore an adequate amount of snowfall is vital for the tourism system (BeyondSnow, 2023b).
Input	Absolute value per month in cm

November	< 10	10 > < 50	> 50
December	< 30	30 > < 100	> 100
January	< 30	30 > < 100	> 100
February	< 20	20 > < 50	> 50
March	< 30	30 > < 50	> 50
April	0	0 > < 30	> 30
Ordinal scale reference	Critical	Acceptable	Optimal

B1b Minimum altitude of the ski area

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Question	What is the minimum altitude of your ski area?
Additional information	The minimum and maximum altitude of ski areas vary widely, impacting snow conditions and difficulty levels. Lower altitudes tend to have less reliable snow and temperatures for snowmaking, while higher altitudes often guarantee better snow quality and longer seasons. Altitude ranges help skiers choose appropriate locations based on their experience and preferences (BeyondSnow, 2023a).
Input	Single select multiple choice question

Selectable options	Less than 500m	Between 500m and 1,500m	Above 1,500m
Ordinal scale reference	Critical	Acceptable	Optimal

B1c Maximum altitude of the ski area

Question	What is the maximum altitude of your ski area?
Additional information	The minimum and maximum altitude of ski areas vary widely, impacting snow conditions and difficulty levels. Lower altitudes tend to have less reliable snow and temperatures for snowmaking, while higher altitudes often guarantee better snow quality and longer seasons. Altitude ranges help skiers choose appropriate locations based on their experience and preferences (BeyondSnow, 2023a).
Input	Single select multiple choice question

Selectable options	Under 1,500m	Between 1,500m and 2,000m	Above 2,000m
Ordinal scale reference	Critical	Acceptable	Optimal

B1d Snowmaking capabilities

Question	What is the percentage of slopes with technical snowmaking capabilities?

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Additional information	Technical snowmaking allows ski resorts to ensure consistent snow coverage even during less favorable weather conditions. This allows tourism destinations to provide a reliable snow base, enhance slope conditions and extend the ski season, and is crucial for maintaining operations and attracting visitors during warmer and/or dry periods (Seilbahnen Schweiz, 2022; Soboll & Schmude, 2011; Spandre et al., 2019).
Input	Single select multiple choice question

Selectable options	Less than 50%	50% to 75%	Over 75%
Ordinal scale reference	Critical	Acceptable	Optimal

B1e Snow season length

Question	How long did the snow season last in your destination during the winter season?
Additional information	Snow seasons typically last from the first snowfall to the last melting period, affecting ski resort operations and winter activities. Reliable snowfall ensures the season, while mild winters can shorten it significantly (BeyondSnow, 2023b).
Input	Single select multiple choice question

Selectable options	Less than 2 months	Between 2 and 4 months	More than 4 months
Ordinal scale reference	Critical	Acceptable	Optimal

B1f Days with snowmaking temperature

Question	How many days with optimal temperatures for snowmaking does your skiing destination have in the winter season?

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Additional information	Snowmaking temperature is optimal when mean temperatures range between -7°C and -3°C. These conditions are important for efficient technical snow production, ensuring the necessary snow cover for ski resorts. Consistent days within this temperature range are crucial for maintaining slopes during warmer periods (BeyondSnow, 2023b; TechnoAlpin, 2024).
Input	Single select multiple choice question

Selectable options: Cable car valley station	Less than 10 days	Between 10 and 50 days	More than 50 days
Selectable options: Cable car mountain station	Less than 30 days	Between 30 and 90 days	More than 90 days
Ordinal scale reference	Critical	Acceptable	Optimal

B1g Days with adequate snow height

Question	How many days with an adequate height of snow does your skiing area have in the winter season?
Additional information	Days with a snow height exceeding 30cm, are vital for quality skiing and winter activities. This snow depth ensures safe and enjoyable conditions, preventing exposure of underlying terrain. Consistent days with over 30cm contribute to the overall success of a ski season (Abegg, 1996; Hendrikx et al., 2012; Scott et al., 2022).
Input	Single select multiple choice question

Selectable options: Cable car valley station	Less than 10 days	Between 10 and 90 days	More than 90 days
Selectable options: Cable car mountain station	Less than 30 days	Between 30 and 120 days	More than 120 days
Ordinal scale reference	Critical	Acceptable	Optimal

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B1h Frost days

Question	How many frost days do you have in the winter season?
Additional information	Frost days comprise days with minimum temperatures below 0°C. These days are crucial for maintaining snow cover and snowmaking efficiency in ski resorts. A higher number of frost days ensures better preservation of natural and technical snow, contributing to longer and more reliable ski seasons (BeyondSnow, 2023b; Olefs et al., 2021; Willibald et al., 2021).
Input	Single select multiple choice question

Selectable options: Cable car valley station	Less than 50 days	Between 50 and 120 days	Over 120 days
Selectable options: Cable car mountain station	Less than 80 days	Between 80 and 150 days	Over 150 days
Ordinal scale reference	Critical	Acceptable	Optimal

B1i Total monthly rainfall

Question	What is the total monthly rainfall in milimetres in the winter season?
Additional information	Rain-on-snow events have a very negative effect on the snow cover of slopes. Furthermore, they alter the consistency of the snow, which often results in a lower skiing quality (BeyondSnow, 2023b).
Input	Absolute value per month

B1j Dry periods

Question	What is the duration of dry periods in the winter season?
Additional information	The duration of dry periods, indicated by the maximum number of consecutive days with less than 1mm of precipitation, affects snowmaking and natural snowfall. Extended dry periods can challenge ski resorts in maintaining snow quality, necessitating effective snowmaking strategies to ensure adequate coverage (BeyondSnow, 2023a, 2023b; Polade et al., 2014).
Input	Single select multiple choice question

Selectable options	more than 100 days	between 30 and 100 days	between 10 and 30 days
Ordinal scale reference	Critical	Acceptable	Optimal

B1k Cardinal direction of slopes

Question	Percentage of cardinal direction of slopes		
Additional information	The cardinal direction of slopes influences retention, quality and consistency of snow. Slopes facing north generally retain snow longer, while on south-facing slopes, snow may melt faster. West and east-facing slopes experience moderate conditions, which can also change throughout the day, making south- and west-facing slopes more exposed to insolation and affected by higher afternoon temperatures. The percentage distribution of slopes in terms of cardinal direction can affect overall ski resort conditions and planning (Reynard, 2020; Uhlmann et al., 2009).		
Input	Percentage value per cardinal direction		
Value	South-facing slopes exceed 60% of total slopes	South-facing slopes do not exceed 60% of total slopes	South-facing slopes do not exceed 50% and west-facing slopes do not exceed 50% of the slopes
Ordinal scale reference	Critical	Acceptable	Optimal

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3.3 C - Management capabilities indicators

C1a Ecological transition

Question	What steps has your destination implemented to facilitate ecological transition?
Additional information	Ecological transition involves shifting towards sustainable practices that reduce environmental impacts and enhance the tourism destination's long-term viability. This might include initiatives like green energy adoption, sustainable waste management, and biodiversity conservation efforts (Xu et al., 2023).
Input	Multi select multiple choice question

Answers
Implementing renewable energy projects at the destination.
Enhancing waste recycling and reduction programs.
Establishing protected areas to conserve local biodiversity.
Conducting regular environmental impact assessments.
Implementing sustainable tourism practices
Other: Please specify
None

C1b Collaboration amongst stakeholders

Question	How does your destination promote and support collaboration among stakeholders?
Additional information	Effective collaboration among stakeholders such as local businesses, government agencies, and community groups is critical for shared knowledge and resources. Strong networks help in responding adaptively to environmental challenges, enhancing the overall resilience of tourism destinations (European Commission. Directorate General for Internal Market, Industry, Entrepreneurship and SMEs., 2022).
Input	Multi select multiple choice question

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Answers
Sharing knowledge through annual stakeholder meetings.
Creating permanent operational networks among stakeholders.
Developing temporary project-funded networks for specific initiatives.
Facilitating online platforms for continuous communication and collaboration.
Other: Please specify
None

C1c Tourism development strategy

Question	Does your destination have a general tourism development strategy, and at what stage of implementation is it currently in?
Additional information	A general tourism development strategy outlines long-term planning, e.g., to balance visitor needs with environmental conservation and local community benefits. Ideally, it should ensure that tourism growth does not compromise ecological integrity, cultural heritage and the quality of life of the local inhabitants (UNWTO, 2018).
Input	Single select multiple choice question

Selectable options	The destination currently has no formal tourism development strategy.	A tourism development strategy is currently being drafted with stakeholder input.	The tourism development strategy is fully implemented and is in the monitoring phase.	The tourism development strategy is implemented and under evaluation for effectiveness and potential updates.
Ordinal scale reference	Critical	Marginal	Acceptable	Optimal

C1d Climate change adaptation strategy

Question	Does your destination have a climate change adaptation strategy?
Additional information	Climate change adaptation strategies focus on modifying practices to manage and mitigate the adverse effects of climate change based on the foreseen effects of the latter, such as adjusting infrastructure to withstand extreme weather events, adopting water conservation measures envisioning severe precipitation alterations and developing climate hazard plans (European Commission, 2023a; Simpson et al., 2008).
Input	Single select multiple choice question

Selectable options	The destination lacks a formal climate change adaptation strategy.	A climate change adaptation strategy is being developed, focusing on immediate and long-term needs.	The climate change adaptation strategy is in place and currently being executed.	The destination is reviewing the effectiveness of the implemented climate change adaptation strategy and making necessary adjustments.
Ordinal scale reference	Critical	Marginal	Acceptable	Optimal

C1e Level of data usage

Question	What is the level of data usage of your destination?
Additional information	Using data allows responsibles to make informed decisions, in comparison to solely rely on qualitative information and impressions. A high level of data usage proficiency can contribute to a significant enhancement of visitor experience and operational efficiency (European Commission. Directorate General for Internal Market, Industry, Entrepreneurship and SMEs. et al., 2022; UNWTO, 2024).
Input	Single select multiple choice question

Selectable options	Almost no data is available.	Data is available in digital formats, but only rarely used.	Data is available in digital formats and its usage is increasing.	Data is available in digital format and is actively being used for tourism strategy and development.

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Ordinal scale reference	Critical	Marginal	Acceptable	Optimal

C1f Level of digitalisation

Question	What is the level of digitalisation of your destination?
Additional information	Digitalisation in destination management includes the integration of data analytics, IoT, and AI to streamline operations, enhance tourist experiences, and make informed decisions. This tech-driven approach helps to anticipate trends and manage resources efficiently (European Commission, 2024c, 2024d).
Input	Mutli select multiple choice question

Answers
Utilising data analytics for optimising tourist flow management.
Implementing IoT solutions for environmental monitoring.
Integrating visitor feedback into strategic planning via digital platforms.
Employing AI-driven predictive analytics for tourism demand forecasting.
None

C1g Local residents

Question	How do you involve local residents in tourism development in your destination?
Additional information	Engaging local communities in tourism development not only fosters greater economic benefits but also encourages cultural exchange and (social) sustainability. It includes involving residents in planning and decision-making to ensure tourism reflects and respects local values and needs (Brooks et al., 2023; Shani & Pizam, 2012).
Input	Multi select multiple choice question

Answers
Involving locals in decision-making processes through public forums.
Encouraging local entrepreneurship by providing business development support.
Promoting cultural events that involve, showcase and foster local traditions and talents.

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Establishing resident committees to oversee tourism development projects.
Other: Please specify
None

C1h Change implementation

Question	How does your destination assess its readiness and willingness to implement changes?
Additional information	Assessing readiness for change involves evaluating existing capabilities, resources, and stakeholder attitudes. It determines how prepared a destination is to implement new strategies for growth and/or sustainability (Absari et al., 2024; Jopp et al., 2010).
Input	Single select multiple choice question

Selectable options	Currently we are not assessing how to implement change in any way.	We are reactively open to changes, although their implementation time can be long.	We are proactively seeking and implementing changes.
Ordinal scale reference	Critical	Acceptable	Optimal

C1i Adapting to climate change

Question	What measures does your destination use in adapting to the effects of climate change?
Additional information	Flexibility in adapting to climate effects is crucial for maintaining the attractiveness and functionality of a destination. It might involve revising policies, investing in adaptive technologies, and training staff to handle new challenges (European Commission, 2023a; Simpson et al., 2008).
Input	Multi select multiple choice question

Answers
Developing contingency plans for extreme weather events impacting tourism.

Adjusting tourism offerings based on seasonal climate forecasts.
Training staff and tourism operators in emergency response and adaptive customer service practices.
Revising building codes to improve infrastructure resilience.
Other: Please specify
None

C1j Data usage preparedness

Question	What training programs related to data use and analysis are available at your destination?
Additional information	Training programs on data use are essential for enhancing skills in data management and analysis, crucial for informed destination management. These programs ideally target various stakeholders to improve decision-making processes and strategic planning (Gajdošík, 2019; Kovačić & Car, 2024).
Input	Multi select multiple choice question

Answers
Offering courses on data usage and analysis for marketing staff.
Conducting workshops on digital tools for all levels of management.
Providing specialized training in data security for IT staff.
Implementing continuous professional development programs in digital competencies.
Other: Please specify
None

C1k Emergency information channels

Question	Evaluate the effectiveness of the emergency information channels available in your destination for both tourists and locals.
Additional information	Effective emergency information channels ensure that both tourists and locals receive timely, accurate information during crises and extreme/extraordinary events. These systems are vital for safety management and can include various communication tools like apps, websites, and public announcements (Casal-Ribeiro et al., 2023).
Input	Single select multiple choice question

Selectable options	No emergency information channels are currently in place.	Emergency information channels are targeting local residents.	Emergency information channels target both tourists and local residents.	Emergency information channels are available as an (web)app and both tourists and local residents are actively encouraged to use it.
Ordinal scale reference	Critical	Marginal	Acceptable	Optimal

3.4 D - Tourism indicators

3.4.1 D1 Tourism supply - Attractions and activities

D1a Winter activities and attractions

Question	Which of the following winter activities and attractions are offered in your destination?
Additional information	Winter activities include a variety of outdoor and cultural experiences that are connected to different interests and fitness levels. Popular activities such as skiing, winter hiking, snowshoeing, etc. take advantage of the natural terrain as well as resources and have a high dependence on snowcover.
Input	Multi select multiple choice question

Answers	
Skiing	Wellness/Spa
Snowboarding	Relaxation/Deceleration
Winter hiking	National parks
Snowshoeing	Cultural attractions
Ski touring	Festivals
Sledding	Events
Other: Please specify	

D1b Snow dependence

Question	Are the winter activities and attractions snow dependent?
Additional information	The more essential tourism activities are highly dependent on snow (e.g. skiing), the higher the exposure of the destination towards climate change (Bassetti & Michielin, 2023).
Input	Single select multiple choice question

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Selectable options	Most of the main activities and attractions are snow dependent.	Several of the main activities and attractions are snow dependent.	A few of the main activities and attractions are snow dependent.	None of the main activities and attractions are snow dependent
Ordinal scale reference	Very high snow depencende	High snow dependence	Medium snow dependence	Low snow dependence

D1c Summer activities and attractions

Question	Which of the following summer activities and attractions are offered in your destination?
Additional information	Summer activities include a variety of outdoor and cultural experiences that cater to different interests and fitness levels. Popular activities such as hiking and mountain biking take advantage of the natural terrain, while water sports like kayaking and rafting utilize local rivers and lakes. Cultural festivals and wildlife tours offer unique opportunities to engage with the local heritage and natural environment, enhancing the overall tourist experience.
Input	Multi select multiple choice question

Answers	
Mountaineering	Kayak & Canoe
Hiking	Gastronomic/culinary workshops
Road cycling	Wellness/Spa
Mountain biking	Relaxation/Deceleration
Guided hiking tours	National park visit
Guided biking tours	Cultural attractions
Swimming	Festivals
Climbing	Events
Rafting	Other: Please specify

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D1d Weather dependence

Question	Are the summer activities and attractions you provide weather dependent?
Additional information	Typically, outdoor activities and sport are very weather dependent. While the presence of non-weather-dependent activities & attractions (e.g. museums) is oftentimes not the primary motivation for visiting a mountain destination, they can complete the overall tourism product as well as being valuable bad-weather activity alternatives.
Input	Single select multiple choice question

Selectable options	Most of the main activities and attractions are weather dependent.	Several of the main activities and attractions are weather dependent.	A few of the main activities and attractions are weather dependent.	None of the main activities and attractions are weather dependent
Ordinal scale reference	Very high weather dependence	High weather dependence	Medium weather dependence	Low weather dependence

D1e Used capacity – high season

Question	Evaluate the used capacity for activities and attractions in the high season.
Input	Single select multiple choice question

Selectable options	Most are underutilised and there is a lot of unused potential.	Most are running at full capacity with little chance of expanding.	Most are running at near full capacity with the chance of expanding.
Ordinal scale reference	Critical	Acceptable	Optimal

D1f Used capacity – low season

Question	Evaluate the used capacity for activities and attractions in the low season.
Input	Single select multiple choice question

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Selectable options	Most are underutilised and there is a lot of unused potential.	Most are running at full capacity with little chance of expanding.	Most are running at near full capacity with the chance of expanding.
Ordinal scale reference	Critical	Acceptable	Optimal

D1g Ski lifts

Question	What is the number of ski lifts in your destination?
Additional information	The number of ski lifts indicates the capacity and extent of the ski infrastructure. A higher number of lifts can reduce waiting times and can increase the overall satisfaction of skiers and snowboarders. It also reflects the destination's ability to manage high visitor flows simultaneously.
Input	Absolute value

D1h Capacity of ski lifts

Question	What is the total capacity of ski lifts in your destination (passenger per hour)
Additional information	The total capacity of ski lifts, measured in passengers per hour, reflects the expension, ski lift numbers and efficiency of the ski area in transporting skiers. Higher lift capacities can also crowding and wait times, leading to a better overall experience. Furthermore, this metric is crucial for planning and managing peak periods in the ski season.
Input	Absolute value

D1i Number of slopes

Question	What is the number of slopes in your destination?
Additional information	The total number of slopes is a key indicator of the variety and extent of available skiing opportunities. It includes all marked slopes, from beginner (blue slopes) to expert (black slopes) levels. A high diversity of slopes can enhance the destination's appeal to a broader audience.
Input	Absolute value

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D1j Number of slope km

Question	What is the number of slope kilometres in your destination?
Additional information	The total number of slope kilometers is a key indicator of the variety and extent of available skiing opportunities. It includes all marked slopes, from beginner (blue slopes) to expert (black slopes) levels. A high diversity of slopes can enhance the destination's appeal to a broader audience.
Input	Absolute value

3.4.2 D2 Tourism supply - Accommodation and Transport

D2a Accommodation infrastructure

Question	What is the number of different accommodation structures in your destination?
Additional information	Different types of accommodation structures appeal to diverse guest preferences and budgets, diversifying the destination's offer. The presence of a variety of options, from 5-star-resorts to budget-friendly hostels, ensures accessibility for all guests and reduces the (economic) dependency on specific guest types and tourism seasons (McKercher et al., 2023).
Input	Absolute value per type of accommodation

Answers	
4-5 Star Hotels	Mountain huts
3 Star Hotels	Campsites
1-2 Star Hotels	Agritourism
Resindence/Pension/B&Bs	Other
Private apartments	

Options	One accommodation type represents more than 75% of all accommodation structures.	One accommodation type makes up 50% to 75% of all accommodation structures, with some presence of other types.	One accommodation type makes up 25% to 50% of all accommodation structures, with a balanced presence of other types.	No single accommodation type makes up more than 25% of all accommodation structures, indicating a high level of diversity.
Ordinal scale reference	Critical	Marginal	Acceptable	Optimal

D2b Abandoned accommodation infrastructure

Question	What is the number of accommodation infrastructures, that are currently abandoned in your destination?
Input	Absolute value

D2c Bed availability

Question	What is the number of bed of the different accommodation structures in your destination?
Input	Absolute value per accomodation type

Answers	
4-5 Star Hotels	Mountain huts
3 Star Hotels	Campsites
1-2 Star Hotels	Agritourism
Resindence/Pension/B&Bs	Other
Private apartments	

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D2d Number of second homes

Question	What is the number of second homes in your destination?
Additional information	A high number of second homes can negatively impact destinations by excessively increasing property prices, making housing unaffordable for locals. This may lead to seasonal population fluctuations, straining local resources and services. Additionally, they can create a less diverse, community-focused atmosphere as temporary residents often do not engage in local activities, and in general are less present within the destination throughout the year (Cash, 2022; Garton Grimwood et al., 2022).
Input	Absolute value

Selectable options	More than 30% of second homes in relation to the total households	From 15% to 30% of second homes in relation to the total households	From 5% to 15% of second homes in relation to the total households	Less than 5% of second homes in relation to the total households
Ordinal scale reference	Critical	Marginal	Acceptable	Optimal

D2e Traffic management in high season

Question (Opinion)	How would you describe the traffic management of the destination during the high season?
Input	Single select multiple choice question

Selectable options	Frequent congestion, long delays, and slow traffic flows are common.	Occasional congestion and delays, but generally managed appropriately.	Rare congestion, smooth traffic flows, and effective management practices in place.
Ordinal scale reference	Critical	Acceptable	Optimal

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D2f Traffic management in low season

Question (Opinion)	How would you describe the traffic management of the destination during the low season?
Input	Single select multiple choice question

Selectable options	Frequent congestion, long delays, and slow traffic flows are common.	Occasional congestion and delays, but generally managed appropriately.	Rare congestion, smooth traffic flows, and effective management practices in place.
Ordinal scale reference	Critical	Acceptable	Optimal

D2g Traffic management measures

Question	Does your destination have any of the following traffic management measures in place?
Additional information	Effective traffic management measures are essential for reducing congestions, improving safety, and enhancing the visitor experience. These measures can include traffic calming zones, parking restrictions, and the creation of pedestrian and bike-friendly areas. Proper traffic management supports sustainable tourism by minimizing the environmental impact of private car use.
Input	Multi select multiple choice question

Answers	
Traffic-calmed zones	Road signage improvements
Parking restrictions	Traffic monitoring systems
Pedestrian zones	Other: Please specify
Bike lanes and paths	None
Congestion charging	

D2h Public transport to/from destination

Question	How would you describe the public transport offer to and from your destination?
Additional information	The availability of public transport options for arriving at and departing from the destination is crucial for destination accessibility and sustainability. Options such as trains, buses, and shuttle services provide convenient and eco-friendly alternatives to private car use, helping reduce traffic congestions and emissions.
Input	Single select multiple choice question

Selectable options	Public transport options are limited, infrequent, and often overcrowded.	Public transport options meet basic demand but may have occasional shortages or delays.	Public transport options are comprehensive, frequent, reliable, and well-regarded by users.
Ordinal scale reference	Critical	Acceptable	Optimal

D2i Public transport in destination

Question	How would you describe the public transport offer in your destination?
Additional information	The availability of public transport options within the destination is crucial for destination sustainability and viability. Options such as buses, and shuttle services provide convenient and eco-friendly alternatives to private car use, helping reduce traffic congestions and emissions within the destination.
Input	Single select multiple choice question

Selectable options	Public transport options are limited, infrequent, and often overcrowded.	Public transport options meet basic demand but may have occasional shortages or delays.	Public transport options are comprehensive, frequent, reliable, and well-regarded by users.
Ordinal scale reference	Critical	Acceptable	Optimal

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3.4.3 D3 Tourism demand

D3a Tourism arrivals

Question	What is the number of tourism arrivals in your destination per month?
Additional information	Tourism arrivals refer to guests who arrive in the destination and spend at least one night in a tourism accommodation infrastructure.
Input	Absolute value per month

D3b Tourism overnights

Question	What is the number of tourism overnights in your destination per month?
Additional information	Tourism overnights, also known as nights spent, refer to each night a guest or tourist actually spends in a tourist accommodation infrastructure.
Input	Absolute value per month

D3c Main source markets

Question	Define the 5 main source markets for your destination, inserting the number of monthly overnights of the guests from the respective country of origin. Please use “domestic” for the overnights spent by tourists from the country where your destination is located.
Input	Absolute value per month

D3d Percentage of main source markets

Question	What are the percentages of overnights between the 5 main source markets?
Input	Percentage value per market

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D3e Daily visitors

Question	What is the estimated number of daily visitors in your destination per month?
Additional information	Daily visitors refer to guests who visit a destination, but do not spend any night there.
Input	Absolute value per month

D3f Seasonality of daily visitors:

Question	Seasonality of daily visitors
Input	Percentage value per season W/S

D3g Skiing days sold

Question	How many skiing days were sold in the last ski season within your destination?
Additional information	The number of skiing days sold is crucial for an destination as it directly impacts economic revenue, supports local businesses, and indicates the popularity and viability of the destination's skiing offer.
Input	Absolute value per month

D3h Ski tourists

Question (Opinion)	Evaluate the percentage of ski tourists based on the number of total guests per winter season.
Additional information	Evaluating the percentage of ski tourists among total winter guests is important as it helps to envision the destination's reliance on ski tourism. It can be estimated considering the number of overnight stays, daily visitors, number of inhabitants and skiing days tickets sold. It can be useful regarding the evaluation of marketing strategies, infrastructure investments, and economic planning, ensuring that resources are effectively allocated to support this important segment of the overall tourism system.
Input	Percentage value

D3i Cable car tickets sold in summer

Question	How many tickets for the cable car were sold during the summer season?
Additional information	The number of sold cable car tickets in the summer season is important as it indicates the destination's ability to attract off-winter-season tourists. It helps to assess the cable car utilization during the summer season (from May until October), indicating also the level of attractiveness of the destination's mountain summer tourism.
Input	Absolute value per month

3.4.4 D4 Resources & emissions

D4.1 Electricity

D4.1a Electricity consumption

Question	What is the total electricity consumption in your destination (in kWh) per year? (Brown & Jones, 2024; Hafner & Raimondi, 2022; Satrovic & Abul, 2022)
Input	Absolute value of annual electricity consumption in kWh

D4.1b Electricity capacity

Question	Is the electricity supply in your destination adequate?
Additional information	Having an adequate electricity supply is crucial for ensuring the frictionless functioning of daily activities, supporting local businesses, and guaranteeing the smooth provision of tourism services. The reliable electricity supply is essential for operating accommodations, transport, and attractions, thereby ensuring the minimum threshold of visitor satisfaction.
Input	Single select multiple choice question

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Selectable options	Frequent power shortages and significant supply disruptions.	Occasional power shortages and supply issues, but generally meeting basic demand.	Generally sufficient for daily needs with minor occasional shortages during high season.	Completelly adequate and no shortages throughout the year.
Ordinal scale reference	Critical	Marginal	Acceptable	Optimal

D4.1c Electricity consumption of tourism (accommodation)

Question	What is the percentage of yearly electricity consumption of accommodation structures in your destination? (Rixen et al., 2011)
Input	Absolute value or estimated percentage value

Selectable options	Accommodation structures consume more than 20% of the total	Accommodation structures consume between 10% and 20% of the total	Accommodation structures consume less than 10% of total
Ordinal scale reference	Critical	Acceptable	Optimal

D4.1d Electricity consumption of tourism (other tourism services)

Question	What is the percentage of yearly electricity consumption of other tourism services at your destination? (Rixen et al., 2011)
Additional information	For example: ski lifts, restaurants, museums etc.
Input	Absolute value or estimated percentage value

Selectable options	Other tourism services consume more than 20% of total	Other tourism services consume between 10% and 20% of the total	Other tourism services consume less than 10% of the total
Ordinal scale reference	Critical	Acceptable	Optimal

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D4.1e Electricity consumption by source

Question	Electricity consumption by source in your destination
Additional information	In 2022, the total electricity production in the EU amounted to 2,641 terawatt hours (TWh). Almost 40% of the electricity generated in the EU in 2022 came from renewable sources. 38.6% came from combustible fuels (such as natural gas, coal and oil). 21.9% came from nuclear power stations. Among the renewable energy sources, the highest share of electricity generation in 2022 was from wind turbines (15.9%), followed by hydropower plants (11.3%) and solar power (7.6%) (European Council, 2024).
Input	Single select multiple choice question

Selectable options	Consumed electricity is primarily generated by non-renevable sources (less than 10% of electricity from renevable sources)	Consumed electricity is partially generated by non-renevable sources (10% to 30% of electricity from renevable sources)	Consumed electricity is partially generated by renevable sources (30% to 50% of electricity from renevable sources)	Consumed electricity is substantially generated by renevable sources (more than 50% of electricity from renevable sources)
Ordinal scale reference	Critical	Marginal	Acceptable	Optimal

D4.2 Water

D4.2a Water consumption

Question	What is the total water consumption in your destination (in m^3) per year? (EurEau, 2021; Eurostat, 2022b)
Input	Absolute value of annual water consumption in m^3

Options	Municipal water use is above the EU average (more than 5,000 m^3 per capita).	Municipal water use is around the EU average (3,000-5,000 m^3 per capita).	Municipal water use is slightly below the EU average (2,000-3,000 m^3 per capita).	Municipal water use is significantly below the EU average (less than 2,000 m^3 per capita).
Ordinal scale reference	Critical	Marginal	Acceptable	Optimal

D4.2b Water capacity

Question	Is the water supply in your destination adequate?
Input	Single select multiple choice question

Selectable options	Frequent water shortages, strict rationing, and regular supply disruptions.	Occasional shortages and restrictions, but generally meets basic needs.	Generally sufficient for daily needs, with minor occasional shortages.	Consistently meets all daily needs with no shortages or restrictions.
Ordinal scale reference	Critical	Marginal	Acceptable	Optimal

D4.2c Water consumption by tourism (accommodation)

Question	What is the percentage of yearly water consumption of accommodation structures in your destination? (Llausàs, 2020)
Input	Absolute value or estimated percentage value

Selectable options	Accommodation structures consume more than 20% of the total	Accommodation structures consume between 10% and 20% of the total	Accommodation structures consume less than 10% of total
Ordinal scale reference	Critical	Acceptable	Optimal

D4.2d Water consumption by tourism (other tourism services)

Question	What is the percentage of yearly water consumption of other tourism services at your destination?
Additional information	For example: ski lifts, restaurants, museums etc. (Gössling et al., 2012).
Input	Absolute value or estimated percentage value

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Selectable options	Other tourism services consume more than 20% of the total	Other tourism services consume between 10% and 20% of the total	Other tourism services consume less than 10% of the total
Ordinal scale reference	Critical	Acceptable	Optimal

D4.3 Waste

D4.3a Waste generation

Question	What is the monthly waste generation in your destination?			
Additional information	On average, 513 kg of municipal waste per capita were generated in the EU in 2022. The municipal waste generation totals vary considerably, ranging from 301 kg per capita in Romania to 835 kg per capita in Austria (Eurostat, 2022a; Weghmann, 2023).			
Input	Absolute value of kg per month			
Options	Consistently meets all daily needs with no shortages or restrictions. Municipal waste generation is above the EU average (more than 600 kg per capita).	Municipal waste generation is around the EU average (500-600 kg per capita).	Municipal waste generation is slightly below the EU average (400-500 kg per capita).	Municipal waste generation is significantly below the EU average (less than 400 kg per capita).
Ordinal scale reference	Critical	Marginal	Acceptable	Optimal

D4.3b Waste generation by tourism (accommodation)

Question	What is the percentage of yearly waste generation of accommodation structures in your destination?
Input	Absolute value or estimated percentage value

Selectable options	Accommodation structures generate more than 30% of the total	Accommodation structures generate between 10% and 30% of the total	Accommodation structures generate less than 10% of total
Ordinal scale reference	Critical	Acceptable	Optimal

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D4.3c Waste generation by tourism (other tourism services)

Question	What is the percentage of yearly waste generation of other tourism services in your destination?
Additional information	For example: ski lifts, restaurants, museums etc.
Input	Absolute value or estimated percentage value

Selectable options	Other tourism services generate more than 30% of the total	Other tourism services consume between 10% and 30% of the total	Other tourism services consume less than 10% of the total
Ordinal scale reference	Critical	Acceptable	Optimal

D4.3d Waste management

Question	Do you have any waste management measures implemented in your destination?
Additional information	Effective waste management measures, such as recycling programs, composting, and proper waste disposal, are essential for maintaining environmental sustainability and public health. Implementing these measures reduces pollution, conserves resources, and enhances the overall cleanliness and appeal of the destination, benefiting both residents and visitors.
Input	Single select multiple choice question

Selectable options	No waste management measures in place; widespread littering and pollution.	Basic waste collection but minimal recycling or composting; occasional issues.	Regular waste collection with some recycling and composting programs; generally effective.	Extensive waste management including recycling, composting, and proper disposal; highly effective and well-maintained.
Ordinal scale reference	Critical	Marginal	Acceptable	Optimal

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D4.4 Emissions

D4.4a Greenhouse emissions

Question	What is the expected reduction rate of greenhouse gas emissions in your destination in 2030 based on 1990 levels?
Additional information	Each municipality within the European Union (EU) plays a crucial role in achieving the EU's ambitious climate goals. The EU aims to become the world's first continent to achieve carbon neutrality by 2050. As part of this goal, the EU aims to reduce its greenhouse gas emissions by 55% by 2030, compared with 1990 levels (European Commission, 2024b, 2024e, 2024a).
Input	Single select multiple choice question

Selectable options	Little to no progress has been made (reduction of less than 20%).	Some progress has been made (reduction between20% and 40%).	Progress has been made towards the goal (reduction between 40% and 54%).	Making substantial progress towards the goal (reduction of more than 55%).
Ordinal scale reference	Critical	Marginal	Acceptable	Optimal

4 Conclusion

The indicators chosen for the RAM are not all-encompassing, since the main objective of the tool is to be an entry-level assessment, which can be completed by users in a timely manner. It serves as one of the first steps that destinations can take autonomously before seeking the assistance of experts. To ensure that destinations can easily obtain the necessary initial results certain compromises were made during the creation of the indicator scales and inputs. These results can function as a basis for further in-depth assessments.

4.1 Summary of key findings

The Resilience Adaptation Model (RAM) is a crucial tool for STDs to assess their vulnerability and resilience regarding climate change effects. This output outlines the importance of understanding the interaction between three main parts of the RAM assessment: climate change and environmental factors, management capabilities, and tourism indicators.

Key findings of the RAM assessment include:

- **Climate Change and Environmental Factors:** This part helps destinations understand their susceptibility to climate change. It highlights the potential impacts climate change can have on the destinations in the coming years, emphasising the urgency and scope of the connected issues.
- **Management Capabilities:** Underlining the fact that destinations will have to consider minor adjustments or even major systemic changes in order to adapt to climate change effects, this section provides a basic assessment of the destination management's readiness to implement change and empower the destination to adapt to new challenges. It assesses the ability of the management to guide its destination towards a resilient and sustainable future by identifying strengths and weaknesses regarding their management practices.
- **Tourism Indicators:** These indicators illustrate how reliant the destination is on tourism and provide information regarding the destination's tourism system. For example, a destination with a high dependency on winter tourism (exemplified e.g., by high tourism flows in the winter months) might face significant challenges if climate change severely impacts snow conditions. Conversely, if tourism constitutes a small part of the local GDP, the overall economic struggle might be less severe and the tourism system less reluctant to change, although it still poses challenges for actors directly and indirectly connected to the tourism industry. Oftentimes the issues become more pronounced when tourism plays a more critical role in the local economy.

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In summary, the RAM provides a comprehensive framework for destinations enabling them to take informed steps towards improving their resilience and sustainability based on all three factors. Understanding and addressing the factors highlighted by the RAM can help destinations to better prepare for and adapt to the challenges posed by climate change.

4.2 Future Outlook

The RAM and its indicators will need to be updated as new information, benchmarks, and scales (e.g., what is considered Critical or Optimal) gradually emerge. The RAM, and most of all the RDMDT, need to be seen as continuously evolving tools based on to the latest data and newly developed research and insights. This ongoing development will be discussed in the deliverable "D.2.1.1 – RDMDT Long-Lasting Sustainability Agreement & Plan,", which will be developed in RP5 of the BeyondSnow project, ensuring the tool remains relevant and effective over time.

The results gener"ted by the RDMDT will also need to be validated during the project. If necessary, adjustments will be made to improve accuracy and reliability. Destinations will receive their reports with personalised recommendations based on the latest validated data, ensuring they have actionable insights tailored to their specific circumstances and needs.

Aggregated results from the RAM and RDMDT can be used for benchmarking and through that providing valuable data for future projects. This information can help destination managers and decision-makers to better focus efforts and resources, allowing future initiatives to build on the foundations established by the RAM and RDMDT and their ongoing improvements.

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La FABRIQUE des TRANSITIONS

BeyondSnow is an Interreg - Alpine Space project co-funded by the European Union. It aims at decreasing the snow-dependency of Alpine Space snow tourism destinations, strengthen their resilience to climate change and retain/increase the viability for residents and their attractiveness for tourists.