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# Climate risk for economic activities of the Province of Belluno (NE Italy). III. Demonstration case

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# 1. Foreword

The unprecedented threat of climate change is posing a severe risk for human economic activities, due to the increasing frequency and magnitude of extreme events.

Practitioners in multiple economic sectors, from infrastructural to financial ones, are becoming increasingly more aware of the importance of **climate proofing** in strategic planning and decision-making, to cope with **climate risk**.

Essential information for climate proofing is the assessment of risk to exposed receptors, considering their vulnerability to climate hazards (e.g. floods, heat waves, etc.) in the different combinations of environmental and socio-economic features, within the so-called as social-ecological system.

The dimensions of risk to be considered, according to the IPCC (2012) definitions are:

- **Hazard**, i.e. "*the potential occurrence of a natural or human-induced physical event that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision,*



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*and environmental resources*";

- **Exposure**, defined as the presence of receptors, i.e. "*people; livelihoods; environmental services and resources; infrastructure; or economic, social, or cultural assets in places that could be adversely affected*" by hazard events;
- **Vulnerability,** i.e. "*the propensity or predisposition to be adversely affected*" by hazard events.

In the Alpine Region, climate change has already shown remarkable effects in terms of temperature rise (2 °C over the last 120 years) at a pace that is as much as twice the global average, with dramatic consequences in terms of glacier retreat and disappearance.

Future projections confirm the past trend and foresee further effects on temperature, seasonality of precipitation, global radiation, relative humidity and frequency/intensity of extreme precipitation and floods (Gobiet et al., 2014). The limited accessibility of mountain areas, due to harsh geomorphological gradients, may exacerbate consequences of extreme events, for example when damaged connections between settlements prevents or slows down the recovery from critical situations.

Recent extreme events in the Belluno Province (eastern Alps at the border between Italy and Austria), such as the disastrous Vaia storm in 2018, provide further evidence of the importance of climate proofing in spatial planning to cope with adverse effects climate change for ordinary and extraordinary management of infrastructures and to grant access to essential public services, i.e. water, electric power, etc.

This working paper presents the second part of results on sectora risks to climatic hazards of a collaborative project between Venice International University (VIU), the Foundation Euro-Mediterranean Centre on Climate Change (CMCC) and Ca' Foscari University of Venice, with the financial support of Enel Foundation.

The main aim of the project was the assessment of multiple risks from climatic hazards in the Belluno Province. The approach adopted herein derives from the **Socio-Economic Regional Risk Assessment** (**SERRA**) method developed by the EU Kulturisk Project (Giupponi et al., 2015). This integrated approach combines accurate spatial risk assessment with socio-economic analysis and valuation, to estimate the potential damages associated with risks of different kind and magnitude. These features made it suitable for the assessment of four key economic sectors of the Belluno Province: summer tourism, the eyewear industry, electricity distribution and winter sports and events.

As previously reported, the **SERRA integrated approach** combines classical spatial risk assessment with socio-economic analysis, enabling the estimation of the damages associated with potential risks of different types and entities (see **Errore. L'origine riferimento non**

**è stata trovata.**), based on the following sequence of steps (Mojtahed et al. 2013):

1. qualitative and quantitative description of the hazards;
2. identification and description of the environment subject to the hazards considered (e.g. urban areas, ecosystems, infrastructures);
3. selection of receptors exposed directly and indirectly to hazards (residential buildings, industrial areas, warehouses, retailers, people, infrastructures, vehicles, etc.);
4. identification of the spatial characteristics of susceptibility, coping and adaptive capacities mapped by means of indicators which are subsequently aggregated into a vulnerability index for each type of receptor;
5. identification of the set of value factors for exposed receptors and their indirect correlations;
6. calculation of the risk from the previous steps;
7. designation of the risk of receptors in the quadrants of the Total Cost Matrix.

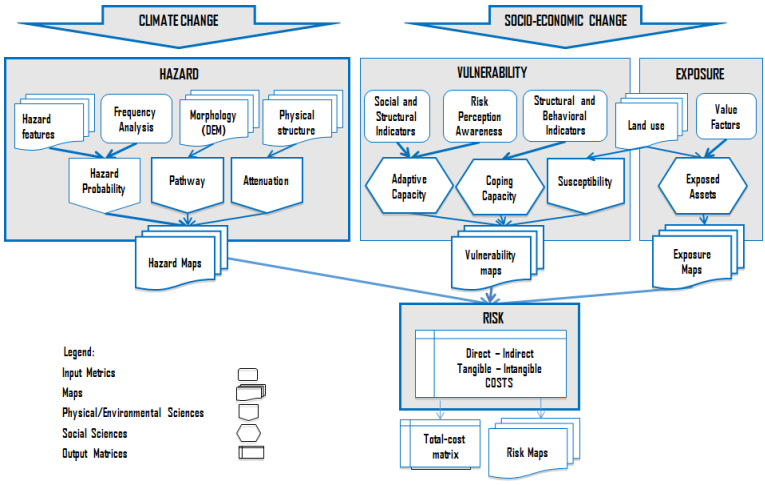


fig. 1-1
General flow-chart of the SERRA methodological framework for risk assessment

This study is based on high-resolution regional climate simulations that represent the most advanced knowledge regarding the climate change expected in Italy. Moreover, it involves the use of spatial in-

dicators based on the local characteristics of the area and on the hazards to be analysed. Such approach follows the conceptual framework proposed by the Intergovernmental Panel on Climate Change (IPCC) in the fifth Assessment Report which, in turn, is in line with the prevailing literature on risk reduction (Disaster Risk Reduction - DRR) (IPCC 2012; 2014b). According to that framework, the three dimensions of risk previously defined (Hazard, Exposure and Vulnerability) are quantified by means of case specific indicators from which the sectoral climate risk indexes are calculated and mapped. This index-based approach is widely used in the literature, furthermore it has been adopted within the Italian National Plan for Adaptation to Climate Change (MATTM, 2017).
The **climate risk indexes** are quantified on the basis of the general formula:

$$Risk = f(Hazard, Exposure, Vulnerability)$$

In this work, the general formula has been implemented with a combination of multiplicative and multi-criteria operators adapted to the four sectors assessed.

The analysis of multiple risks, multiple receptors and multiple climatic scenarios generates a huge number of possible combinations. The current work has opted for a statistical approach, aimed at providing both synthesis by means of averaged results and maps of risk, and also extensive documentation of the various sources of uncertainty and their effects on final results. Therefore, the results are presented as sets of maps (and related statistical summaries), focused on highlighting the diversity of situations within the study area, taking due account of the uncertainty deriving from the different data sources considered, such as the multiplicity of possible future scenarios.

This issue of VIU WPs reports on a demonstration study for climate-proofed solutions for local development . The two previous WPs presented the analysis of climate related risk and the results of the the analysis of the exposure of economic activities and vulnerability of local socio-ecosystems a.

# 2. Climate-proofed solutions for local development: a demonstration study

This paper presents the results of a demonstration study carried out to show how the results of the project, covering the whole Province of Belluno, could be used to move from spatial analysis, towards the support of real world decision processes in which climatic risks are taken in due consideration for climate proofing of future decisions.

We demonstrate below how a detailed study on a specific location of the Province, pointed out by our project as of higher interest for both the level of risk and the opportunities for reorienting future local development, could be conducted with the involvement of stakeholders and decision makers. It is a demonstration study,



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aimed at presenting the methodology, without any intention to contribute concretely to the local decisions, because it did not had, nor it wanted to have, the needed acknowledgement of role by competent administrations and stakeholders.

### 2.1. Mountain tourism and climate change

Climate change is a threat for the tourism industry, especially for those types of tourism, like mountain tourism, which are heavily weather dependent. In the Alpine region, tourism represents one of the main source of income for the local communities that, as a result, are highly exposed to the disruptive action of global warming.

A flourishing body of literature discusses the negative effect of climate change on the ski tourism industry (among the many: Wolfsegger et al., 2008; Wyss et al., 2014), which would reach a "tipping point" i.e. a critical threshold at which a change is required since current strategies might longer be effective or even become detrimental (van Ginkel et al., 2020). Winter tourism and related sport activities are those that are more exposed to climate change risks.

The so-called "snow-reliability", measured via different indicators, like the 100-days rule is paramount for the viability and survival of ski resorts1. In a critical review on more than 100 papers, Steiger et al. (2017) find a significant decrease in natural snow reliability and shorter ski seasons, with direct and indirect effects on mountain economies. Scott et al., (2020) estimate a decrease to a third of the number of reliable natural ski days, while Marty et al., (2017), analyzing the alpine resorts, estimate a loss of 70% of snow cover, by 2100.

In order to manage climate uncertainty, local agents have started implementing adaptive strategies to cope with both the weather variability and the change in tourism trends. In this regard, several studies (Baush and Unseld, 2017; Baush and Garner, 2020) point to a change in tourists' preferences, with a decrease in the share of people practicing traditional ski. In fact, "baby boomers" are a large proportion of the ski demand while "millennials" do not exhibit a strong preference for such activities but instead they visit winter sport destinations for various other reasons.

To provide a quick solution to the lack of snow, ski resorts with

[1] For a complete review on the indicators we refer the readers to Abegg et al., 2020.

higher financial support have made large use of snow making facilities. This is indeed an effective short-term measure to be more ski reliable and protect against competition of nearby resorts (Falk and Hagsten, 2018). However, in addition to the huge investment costs and related expenses, making artificial snow has also severe negative effects on the local environment. As pointed by Club Alpino[2] (2020), the production of artificial snow implies a huge water and energy consumption, taken away from other ecosystems.

On a longer term, differentiation of tourism revenues could be the key for survival, decreasing the snow-dependency of mountain resorts (Hock et al., 2019). In a recent paper, Vaghefi et al. (2021) investigate how investing in off-season activities could, to some extent, compensate the lack of snow and guarantee financial viability.

In addition, among the different adaptation strategies, we also mention slope contouring, glacier protection, conglomerate business models and financial hedging through the investment in weather derivatives (Scott and McBoyle, 2007)

The adaptive capacity of ski resorts, i.e. their ability to adjust to climate change, depends mainly on economic resources (e.g. to invest in snow making facilities), innovative ability (e.g. create snow-independent products) and physical situation (e.g. water access or altitude) (Dannevig et al., 2020). Concerning this last point, existing studies show how the negative effect of climate change of snow cover, is not constant. In this regard, elevation is a key determinant of future snow reliability and, consequently, the survival of ski resorts. Projections for the near futures in the Alpine region show a drastic decrease in snow availability especially for elevations below 2000m (Gobiet et al., 2014). According to Vaghefi et al. (2021), ski slopes located at more than 1800m would be sensibly more resilient to climate change while, following their evaluations and given the future projections, it would be almost impossible for low elevation resorts to survive.

### 2.2. Nevegal area

In the current work, we analyse the Nevegal hill located about 8 km from the city of Belluno, with an average elevation of 1000m. Favored by its natural beauties and the proximity to the main motorway axes, the area of Nevegal has attracted visitors, mostly from the nearby areas, becoming a popular tourism destination.

The beginning of the tourism activity dates back in the late 50s

[2] CAI website: https://www.cai.it/oltre-lindustria-della-neve/ (accessed on May, 28th 2021).

with the opening of the first ski lift and the consequent attraction of important investments, which coincided with the booming of second houses. In about a decade, Nevegal gained a huge popularity, becoming the second regional resort after Cortina D' Ampezzo. However, after the prestigious event of Universiadi in 1985, the area entered a stagnation phase, with a decrease in the number of tourists and financial instability of the ski lift operators. Behind the decline, local stakeholder points to poor marketing policies, the lack of a modern lodging segment and the shortage of investments on the ski lift, which make the destination hardly competitive with the nearby resorts. Moreover, the existing literature and empirical evidence show a change in tourists' preference, with a decline for traditional activities such as traditional skiing, an increased demand for variety where wellness centers, shopping areas, and off-piste activities, are important features for destination choice (Baush and Graber, 2020).

A at the end of 2020, the ski lift has been taken over by a group of local entrepreneurs with the aim to sell the plants to the Municipality of Belluno and invest on the enhancement of the area. According to the association webpage3, the ambition for the near future is to create a more complete offer, able to satisfy the different needs of the visitors, boost the popularity of the area and guarantee an economic and environmentally sustainable development.

Given the climatic projections pointing to a decrease in snow reliability and given the higher risk of low-lying ski slopes, it is important to start thinking about alternative strategies to adapt to climate change. Understanding the effects of climate change on vulnerable sectors is the first step to build a tourism offer that is more independent on weather conditions, and less threatened by increasing competition.

Against this framework, we offer a demo of the well-established NetSyMoD methodology, which could help destination management organizations (hereafter DMO) in designing alternative strategies, ensuring a high inclusion of local stakeholders. In fact, an active participation is, indeed, a precondition for the planning success (Bonzanigo et al., 2016).

### 2.3. Tourism activity in Belluno

The tourism sector, is undoubtedly one the main economic activities in the province of Belluno. In Figure we display the

[3] Webpage: https://nevegal2021.it/. Accessed on May, 5 2021

monthly tourism stays in Province of Belluno from 2010 to 2019[4].

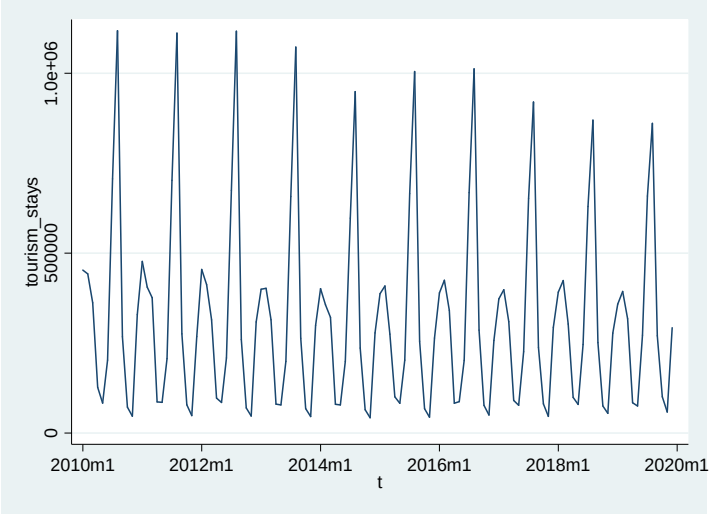



fig. 2-1
Monthly tourism stays for Belluno Province

The data show an important seasonality component, with two peaks of tourism stays registered during the year. The first peak corresponds to the winter season (on average 37% of tourism flows) and a second peak recorded in summer season (on average 50% of tourism flows). Table 1 shows the average monthly number of tourism stays in the province of Belluno.

**Table 2-1. Average tourism stays (2010-2019) in Belluno Province**

| Month | # Tourism Stays | Percentage |
|---|---|---|
| January | 408534 | 11% |
| February | 406803 | 11% |
| March | 323526 | 8% |
| April | 92873 | 2% |
| May | 81257 | 2% |
| June | 216503 | 6% |
| July | 661259 | 17% |
| August | 1003544 | 26% |

[4]Website*:* http://statistica.regione.veneto.it/banche_dati_economia_turismo_turismo1.jsp

| | | |
|---|---|---|
| September | 260395 | 7% |
| October | 75448 | 2% |
| November | 48529 | 1% |
| December | 286944 | 7% |

Looking at 2019 data in Figure 2-2, tourism seasonality appears to be smoother for international visitors (red line) than for domestic one (blue line).

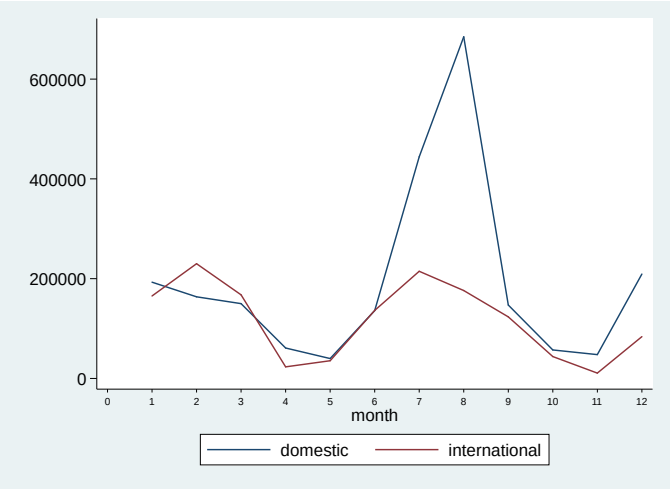



fig. 2-2
Domestic and international tourism stays in 2019 in Belluno Province

With regards to the municipality of Belluno, where Nevegal is located, Figure 2-3 shows a different picture of tourism flows, with one main peak during the summer season (on average 50% of tourism stays) and the rest of arrivals more uniformly distributed during the year.

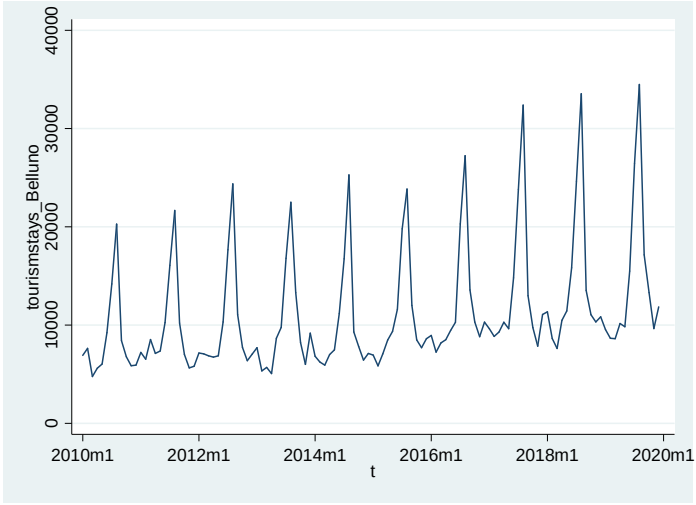



fig. 2-3
Monthly tourism stays in the municipality of Belluno

Table 2-2 shows the average monthly number of tourism stays in the municipality of Belluno.

**Table 2-2.** Average tourism stays (2010-2019) in the municipality of Belluno

| Month | # Tourism Stays | Percentage |
|---|---|---|
| January | 8225 | 6% |
| February | 7205 | 5% |
| March | 7259 | 5% |
| April | 7945 | 6% |
| May | 8612 | 6% |
| June | 11877 | 9% |
| July | 19647 | 15% |
| August | 26560 | 20% |
| September | 12155 | 9% |
| October | 9047 | 7% |
| November | 7466 | 6% |
| December | 8777 | 7% |

According to the most recent data of the regional Bureau of Statistics[5], the average length of stay in the area of Belluno (at tourism local system level) is about 2,4 days for Italian tourists and 2 days

[5] Website: http://statistica.regione.veneto.it/banche_dati_economia_turismo.jsp

for foreigners. Most of domestic tourism arrivals are from Lombardy (about 24%) and the same Veneto region (about 28%) while most of foreign visitors comes from Germany (25%) and Austria (8%).With regards to accommodation facilities, data suggest that about18% of tourists stay in high-end hotels (4 and 5 stars), about 56% stays overnight in 3 medium-end accommodation (3 stars hotel and residences) while the outstanding 26% choose low-end hotels (1 and 2 stars hotels).

### 2.4. Climate risk in the Province of Belluno

The Nevegal ski area is framed in the Province of Belluno, which was a pilot site in the research project "Introducing Climate Proofing in Investments and Spatial Planning", born from the collaboration between Venice International University (VIU) and the Euro-Mediterranean Centre on Climate Change (CMCC), with the financial support of Enel Foundation. The aim of the project was the implementation of a multi-hazard approach for Socio-Economic Regional Risk Assessment (SERRA), to map the climate risk of the most important economic sectors recognized in the Province of Belluno: summer tourism, the eyewear industry (district), electricity distribution and winter sports and events (e.g. Milano-Cortina Olympics of 2026). The SERRA approach was developed upon the methodological framework proposed by the EU Kulturisk Project (Giupponi et al., 2015). The Kulturisk integrated approach combines a spatial risk assessment with a socio-economic analysis and valuation, to estimate damages associated with potential risks of different kind and magnitude, depending on the classic risk formula:

*Risk=f(Hazard,Exposure,Vulnerability)*

where, using IPCC (2012) definitions:

- Hazard represents "the potential occurrence of a natural or human-induced physical event that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, and environmental resources";
- Exposure is defined as the presence of receptors, i.e. "people; livelihoods; environmental services and resources; infrastructure; or economic, social, or cultural assets in places that could be adversely affected" by hazard events;
- Vulnerability is given by "the propensity or predisposition

to be adversely affected" by hazard events.

In the project the SERRA methodology was applied on the basis on the following sequence of steps (revised from Mojtahed et al. 2013):

1. qualitative and quantitative mapping of climate hazards, considering rare events with a 100-year return period or average seasonal trends, multiple scenarios (RCP4.5, RCP8.5) and regional climate models (COSMO-CLM, EURO-CORDEX ensemble), in the 2036-2065 time window;
2. selection and mapping of receptors exposed directly and indirectly to climate hazards (residential buildings, industrial areas, infrastructures, ski areas, etc.);
3. identification of all spatial features affecting susceptibility, coping and adaptive capacity and mapping by means of indicators, which are subsequently aggregated through the ordered weighted average (OWA) operator into a vulnerability index, per each hazard/receptor combination;
4. spatial dislocation of hazard and vulnerability values in the case of indirect impacts (if required);
5. application of the risk formula for mapping direct and/or indirect climate risk, per each hazard/receptor combination.

The analysis of multiple risks, receptors, climatic models and scenarios resulted in a huge number of maps. Information was summarized to few representative maps, i.e. by means of simple aggregation methods such as mean or sum, taking due account of the related uncertainty deriving from the different data sources considered, such as the multiplicity of possible future scenarios.

Specifically, in the risk assessment for the winter sports and event sector, two temperature-related hazard indicators were evaluated:

- snow cover duration (SCD): number of days from November 1st to March 31st of the following year with snow depth higher than 30 cm
- snow production days (SPD): number of days from November 1st to December 31st with an average temperature less than -2.5 ° C
- temperature less than -2.5 ° C

Exposure was given by ski area boundaries, which include existing ski facilities and slopes and all other areas where new infrastructures for snow-based outdoor winter sports might be built in the future, according to the Veneto Region Snow Plan (2013).

Vulnerability for outdoor winter events was mapped depending on susceptibility to geomorphological features which may affect

temperatures gradients, hence the quality of snow at different altitudes, by considering:

- shaded reliefs identifying less susceptible areas to climate risk where the snow is not directly exposed to the sun during the hottest hours of the day;
- temperature inversion occurring in valleys/depressions which may guarantee the conditions for maintaining the snowpack, hence identifying less susceptible areas to climate risk.

Vulnerability was assumed to increase or decrease risk up to ±15%.

The risk analysis was carried out by multiplicative intersection of the hazard maps (SCD and SPD, which represent frequencies i.e. days within a reference period) and the vulnerability over exposed ski areas, in the 2036-2065 time windows. In this sector, the risk analysis focuses on the average trend of future winter seasons that stakeholders will have to face, e.g. for organizing winter sport events.

The climate risk assessment over the whole Belluno Province, returned the following results:

- 9.5% decrease in the SCD and 37.9% decrease in the number of SPDs in the 2036-2065 time window, in comparison with the reference historical period 1981-2010;
- hazard variations are locally stronger in the northern part of the Belluno Province, where most of the ski facilities are located;
- the areas of the province with the shortest SCD are also those with the smallest number of effective SPDs;
- both hazard indicators (and related risk maps) correlate with altitude and ski areas at higher elevation are typically less at risk;
- ski areas at a lower altitude and latitude (e.g. Alpe del Nevegal) are likely not to be threatened by medium term climate change (2036-2065) more than they currently are;
- future climate hazards may have significant impacts on the depth and quality of the snowpack in the northern part of the province, compromising the possibility of organizing future winter sport events and, in general, the sustainability of ski areas.

In order to frame the climate risk assessment in a broader and in-depth evaluation of financial and infrastructure planning for a

solid decision-making process in the event of deep uncertainty (DMDU), downstream to the interactions with local actors a case of interest was identified for analysing alternative decision-making solutions, i.e. the Nevegal Ski area, for demonstrating how the information resulting from the risk assessment can be used to address existing problems.

From the risk maps produced at the municipality scale, climate risk information was extracted at local scale, within the Nevegal Ski area, with the best possible spatial resolution (25 m). **Errore. L'origine riferimento non è stata trovata.** shows the estimated winter sports and events' risk in terms of snow cover duration (SCD) in the 2036-2065 time window, from November to March of the following year. **Errore. L'origine riferimento non è stata trovata.** shows the estimated winter sports and events' risk in terms of days in the 2036-2065 time window with suitable conditions for the production of artificial snow (SPD) from November to December.

We found that:

- the average future SCD will not be greater than 100 days all over the ski area (Figure 2-4), meaning that, for ensuring a suitable snowpack quality, artificial snow production will be required, although it might not be financially sustainable as even SPD are likely to shorten in the future.

geomorphological condition might locally prevent temperature increase and the snowpack exposure to the sun, which is shown in Figure 2-4 (bottom), where red colored values corresponding to a shortest SCD are found over slopes exposed to south (sun azimuth at 170°/180° in the period November to March) at a higher altitude.

Our findings suggest that, although in the future climate change might not affect the southern part of the Province of Belluno much more than the current situation, traditional winter ski tourism might not be best development strategy for the Nevegal ski area as the 100-day rule is likely not to be fulfilled and the local tourism-based economy might benefit more from the diversification of tourism products.

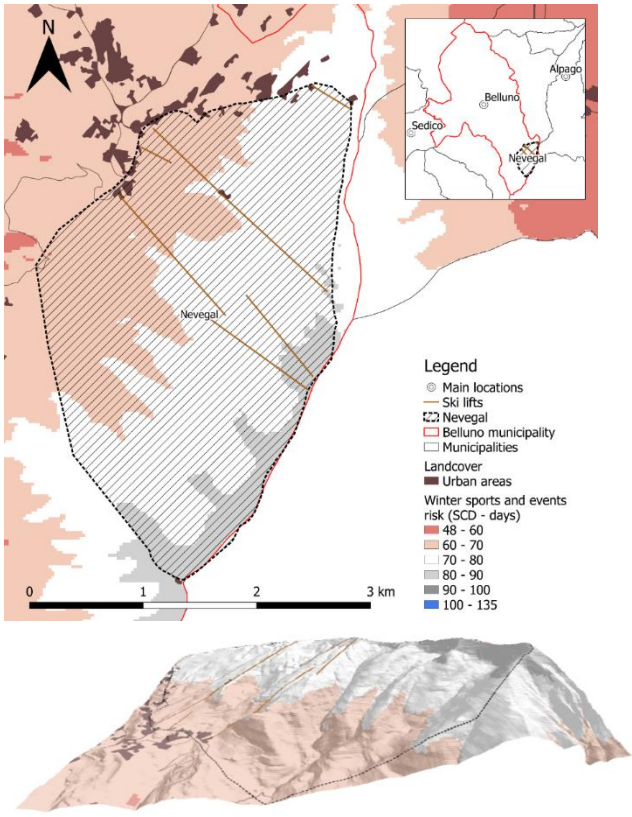



fig. 2-4
Estimated winter sports and events' risk in terms of snow cover duration (SCD) in the 2036-2065 time window, from November to March of the following year, at 25 m resolution, within the Nevegal ski area (top); risk map overlap to a 3D representation of the Nevegal ski area (bottom)

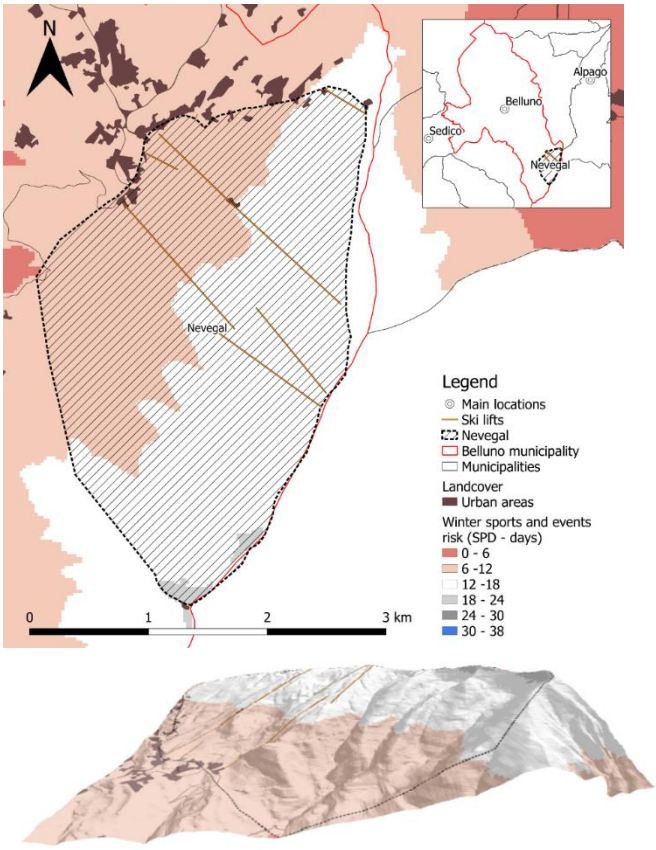



fig. 2-5
Estimated winter sports and events' risk in terms of days in the 2036-2065 time window with suitable conditions for the production of artificial snow (SPD) from November to December, at 25 m resolution, within the Nevegal ski area (top); ); risk map overlap to a 3D representation of the Nevegal ski area (bottom)

## 2.5. Methodology

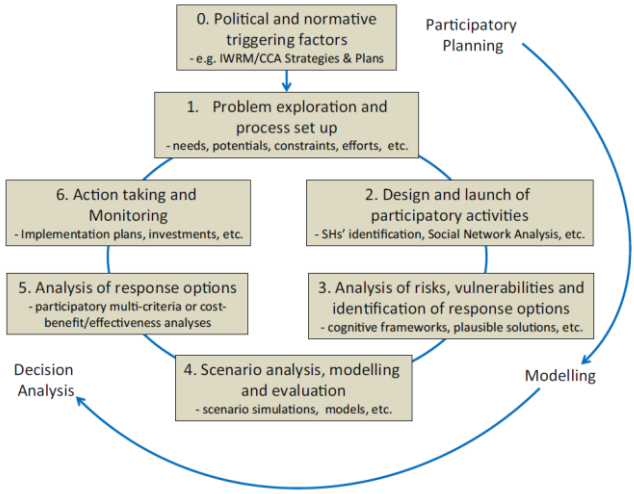
### 2.5.1. The NetSyMoD approach

The methodology proposed is named NetsyMod, where NetSyMoD stands for Network Analysis – Creative System Modelling – Decision Support, and was firstly developed by Carlo Giupponi and collaborators (Giupponi et al., 2008) in a logic to facilitate decision-making process, through the direct involvement of local stakeholders, using a bottom-up approach. NetSymod was adopted in different projects and case studies, within the many we

mention the C3-Alps6 on climate change adaptation in the Alpine Space, the ICARUS project7 on the effects of climate change on agricultural systems and the case study of Auronzo di Cadore, on the impact of climate change on tourism in the Italian Alps (Bozanigo et al., 2016).

The methodological approach consists in 6 steps (Figure 2-6), where the first three require the participation to workshops while the last two steps are performed through the use of the DSS software, ad hoc created to manage and analyze data and help in robust decision making.

fig. 2-6
Main steps of the NetSyMoD approach




Following, we provide a summary of the steps while we refer the reader to the NetSyMod wepbage[8] and related literature for a more comprehensive description of the methodology.

An initial step with the triggering factors of the whole process is aimed to identify the – case specific – institutional and normative factors determining the need to implement the process aimed at identifying preferred decision options, for example the prescriptions of a National Adaptation Plan. Step one focuses on the set up

[6] Project website: http://www.c3alps.eu/index.php/en/
[7] Project website: http://www.cmcc.it/icarus-project-project-description
[8] Tool website: http://www.netsymod.eu/index.html



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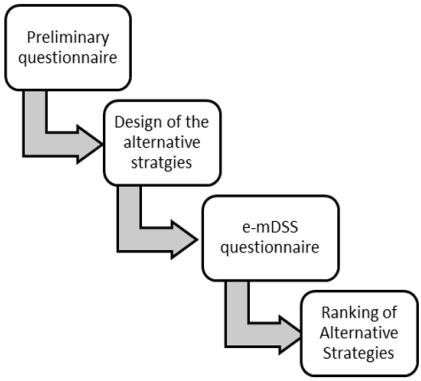
of the process and the exploration of the decision problem at hand, including the strategy for stakeholders' involvement since the earlier stages. Step two is specifically focused on the identification of the main actors to be involved (experts, policy makers, end users and stakeholders in general) and the design of methodologically sound participatory activities. The third step of the proposed approach focuses on problem analysis, i.e. the assessment of risks and vulnerabilities to climate change and the identification of the adaptation options to be considered. Once plausible solutions have been identified with a participatory approach, they must be assessed (Step 4), with the support of various activities such as scenario development and modelling. This brings to Step 5, with the application of methods synthesise the analytical work and bring to the identification of preferable solutions. Such methods could be Cost-Benefit, Cost-Effectiveness, or Multi-Criteria Analysis. Eventually, Step 6 brings to action taking (implementation) and monitoring of the effects of the solutions adopted. Internal loops are envisaged whenever the need emerged to revise intermediate results, and also subsequent iteration cycles could bring to the implementation of adaptive management.

### 2.5.2. NetSyMoD in Nevegal Area

A discussed in the introductory section, the current work is aimed at providing a demo of the NetSyMod methodology, to be applied to our pilot site, the area of Nevegal. The way in which the analysis is performed, slightly differs from the canonical step-wise procedure described in Section 2.5.1. In fact, we propose an alternative and leaner set of actions, which allow the participatory process, even when local stakeholders cannot physically meet.

To this end, we update mDSS tool (Giupponi, 2007), reducing its complexity to enable the participation of non-experts in the robust decision-making process. Figure 2-7 displays the outline of the adopted process.

fig. 2-7
Outline of leaner process




### *Preliminary Questionnaire*

The first survey helps identifying and evaluate local offer and attractions, in order to gain insight on tourism attractiveness. In a real participatory process, the heterogeneity of the participants is paramount to analyze the different perception of local stakeholders according to their socio-demographic characteristics and the role-played in the tourism destination. Moreover, the inclusion of visitors would enrich the discussion bringing to light potential incoherence between the induced images, the one resulting from destination marketing efforts (Gunn, 1988) and the tourists' perceived image (Hu and Ritchie, 1993). In this regard, a vast body of literature examine the effect of destination image on destination competitiveness. Moreover, existing literature points to a positive relationship between image and behavioral choices of sport tourists' (Hallmann et al., 2012).

The survey is structured into four parts. In the first part, we offer different elements of the destination such as hospitality, infrastructure, accessibility, climatic condition, sport and cultural offer. Respondents are asked to state if they believe each element to be a strength or a weakness of the tourism destination. In the second part, we list a set of actions aimed at developing the area from a tourist point of view. The respondent are asked to indicate the degree of importance of each action on a scale from 1 to 5, with 1 being a detrimental strategy and 5 being a crucial strategy. Part three is about the pull factors, where respondents are asked to indicate whether a given element (e.g. fresh air, relax, landscape, snow,



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price) could be considered a main motivation for tourists to visit the area. Finally, part four includes a set of open questions about the current situation and aspirations for the future.

### *Designing a set of strategies*

In light of the climatic projections and the results from the first preliminary survey, we can design a set of adaptation strategies and group them into different plausible scenarios. Being a product of stakeholders' beliefs about the current situation and potential future developments, such strategies are, to some extent, linked to the optimistic or pessimist attitude towards future. As displayed in Burki et al., (2007), different degree of fatalism, especially with respect to climate change and future snow reliability, lead to scenarios which are more-or-less distant from the current paradigm, the so called "Business as Usual Scenario" (hereafter BAU). In a similar fashion, when developing a set of strategies for another alpine tourism destination, Auronzo di Cadore, Bozanigo et al., (2016) propose three different strategies: (i) *Ski-intensive*, with a strong investment in high-tech down-hill skiing facilities; (ii) *Alternative-skiing*, where winter sports are still a key offer of the destination but shifting to new practices, more based on alternative type of skiing like free-ride skiing, Nordic skiing and snow shoes. This strategy therefore relies on lower investment in new infrastructure. (iii) *Beyond snow*, with a total change in the tourism paradigm. In this last scenario, the destination invests in alternative attractions, less snow dependent, and more devoted to the family and wellness segments.

### *e –mDSS and strategies' ranking*

This phase was launched through a second questionnaire based on the e-mDSS tool for online involvement of stakeholders. First, participants are asked to evaluate the alternative strategies, according to their expectation on their efficacy. In order to rank the scenarios, a set of *criteria* against which rate the actions' performance were defined in advance. Such criteria take into account the main dimensions of the destination sustainability like social, economic and environmental sustainability.

Second, in line with the well-known Simos procedure for criteria weighting (Figuiera and Roy, 2002), participants are asked the rate criteria on a scale from 1 to 20 with 1 being "Very important" and 20 "Least Important".

Once obtained all the relevant pieces of information, the e-mDSS tool perfoms Multi-Criteria Analysis (MCA) to evaluate the differ-

ent options (Giupponi et al., 2008). We choose this approach because of its flexibility in dealing with multitude of factors related to a local development plan. The input analysis matrix is obtained by assigning a score to each menu point in the catalogue under the proposed solutions. The MCA is initially run by using criterion scores averaged across all expert/stakeholders responses.

Subsequently, with this first benchmark result at hand, we proceed with a multi-scenario sensitivity analysis by exploring the effects on the final results of various sources of uncertainty, that are expert criterion scores and importance weights, and risk attitude of the decision maker. We use the functionality of the mDSS software that combines numerous (in this case 1800) uncertain multi-criteria decision-analysis matrices to approximate the performance of each alternative and create a range of possible outlooks. The deficiencies of each plan under different sets of scenarios are determined and, based on the above assessment, the robustness of each solution is defined, following the methodology of Rosenhead (1980). The most robust solution is the solution that is considered as preferable in most of the simulated plausible scenarios. Finally, as a sensitivity analysis that also provides intuitive visual support, we apply a CART (Classification and Regression Trees) algorithm provided by the R Package, which allows for an identification of patterns of critical score values able to overturn the final ranking of alternative strategies.

The combination of these components results in a comprehensive and intuitive decision support system that helps the decision-maker to mitigate the impacts of uncertainty and to identify the most robust plan, which is to be interpreted as the strategy that ranks best under most of the simulated alternative scenarios. In the current work, we adopt the Ordered Weights Averages (OWA) MCA method (Yager, 1988), where we sum the criterion values of every option, weighted by the vector of weights per criterion and subsequently by a second vector to express the attitude to risk of the decision makers. The second weighting round is applied to the ordered sequence of values previously weighted as in Simple Additive Weighting. Note that in this case the weights are attributed to the sequence of weighted criteria and not to each single criterion. For example, if three indicators are to be aggregated, first, their values are weighted as usual (weighted scores) and then they are sorted (sorted scores) and re-weighted with a new weight vector. This second phase allows to overcome the compensation effects of SAW and to implement the preferred degree of ANDness, with two extremes: the case of a pessimistic decision maker in

which the highest importance is given to the criterion with the lowest weighted value, and the optimistic case where only the highest values count for the final score. The case in which all ordered weights are equal reproduces the SAW case. Variations in the level of asymmetry in ordered weights produce solutions that represent different levels of risk aversion. Therefore, the balance between ANDness and ORness allows for the exploration of different risk attitudes of the decision maker.

### 2.6. Results of the first questionnaire

In this section, we discuss the results of the preliminary survey that was distributed during the last two weeks of April 2021. We collected 14 answers from local stakeholders belonging to different categories. The majority of respondents belonged to the category of owners of second houses in the area, but also visitors, members of associations and technical experts were represented. This preliminary analysis helps us defining the current strategies adopted by Nevegal, the so-called "Bussines as usual scenario" against which designing alternative tourism development strategies. Figure 5-6 displays the participants' group membership.

In first part of the survey, respondents were asked to express an opinion about a set of specific element of the tourism destination and stating if they considered it a "strength" or a "weakness". Out of 18 elements, we considered only those elements with a minimum consensus of 70% (*i.e.* at least 10 people express the same opinion). Figure 2-8 includes the list of strength and weakness with the color scale expressing the degree of stakeholder agreement.

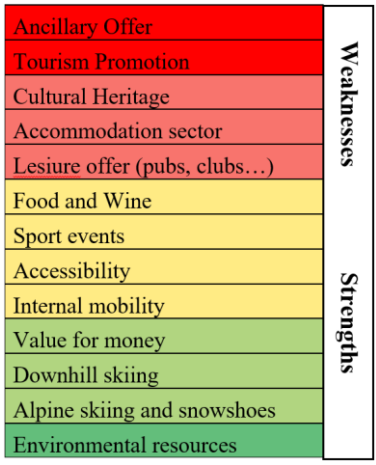



fig. 2-8
List of Weakness and Strength of Nevegal area

Looking at the data, we highlight two main areas for improvements: (i) management and marketing of the area, since data suggest the lack of an adequate tourism promotion, and (ii) the hospitality and ancillary facilities, which calls for potential investments in the lodging industry, ancillary facilities and leisure offer.

Concerning the strength of the Nevegal area, data reveal a huge consensus on the natural endowment of the destination, traditional skiing and good value for money. Moreover, despite with a relatively higher dispersion in answers, participants point to the relevance of accessibility and internal mobility as well as sport events and local enogastronomy. Moreover, in an open-ended question, the big majority of participants points to the proximity of Belluno, provincial capital, as another key strength of the destination.

In the second part of the survey, people were asked to judge a set of 17 strategies to develop the area from a tourism perspective. In Table 2-3 we display the sample descriptive statistics. Column 1 includes the score obtained by each action, where the score is the simple sum of each respondent answer. Being the answer to each line set as compulsory, the theoretical lower bound of each action is 14 (if all people answers “action not recommended”, coded as “1”) and the upper bound is 70 (if all people answers “paramount action”, coded as “5”). Column 2 shows the normalized score, according to the real upper and lower bounds (42 and 63, respec-

tively) while Column 3 includes the standard deviation, which contains info about the answers' dispersion and, therefore, the degree of stakeholders' agreement about each strategy adequacy.

**Table 2-3.** Descriptive statistics of the suggested actions

| Action | Score | Normalized | SD |
|---|---|---|---|
| Investing in facilities for the religious tourism segment | 42 | 0,00 | 0,88 |
| Strengthening the offer of the skiing school | 45 | 1,42 | 1,05 |
| Boosting leisure offer and nightlife (pubs, clubs...) | 46 | 1,91 | 1,07 |
| Expanding ski slopes | 47 | 2,38 | 1,34 |
| Investing in outdoor activities (e.g. ice rinks) | 48 | 2,86 | 1,16 |
| Investing in off-piste activities (snowshoes, ...) | 53 | 5,24 | 0,70 |
| Creating a wellness offer (spa and water parks) | 53 | 5,24 | 0,89 |
| Investing in new infrastructures for artificial snow production | 53 | 5,24 | 1,48 |
| Invest in the creation of structures for fairs and exhibitions | 54 | 5,71 | 1,1 |
| Increasing the offer for the senior segment | 55 | 6,19 | 0,73 |
| Invest in the organization of gastronomic and cultural events | 55 | 6,19 | 0,83 |
| Investing in tourism promotion | 57 | 7,14 | 0,83 |
| Designing of urban redevelopment policies | 57 | 7,14 | 1,14 |
| Increasing the offer of recreation for children and families. | 58 | 7,62 | 0,66 |
| Investing in the training of sector employees | 60 | 8,57 | 0,83 |
| Expanding of transport services | 61 | 9,05 | 0,75 |
| Renovating the accommodation offer | 63 | 10,00 | 0,86 |

We can see that, according to the participants, the less popular actions (with a score below the average value) have to do with investing in religious tourism, expanding the ski slopes, indoor activities and targeting young people (nightlife). However, we can see that such activities are also those with higher dispersions. The highest dispersions in answer is recorded for the action "investing in new infrastructure for artificial snow creation" with a SD of about 1.50. Within the top three of recommended actions, we find the investment in the lodging sector, the expansion of transport services and the training of tourism workers. Interestingly, while for the low-scored action, we have a low agreement among stakeholders, the most important actions are also those with a higher consensus. Moreover, in an open-ended question, participants

points to the importance of strengthening sport activities, like biking and downhill competitions.

In the third part of the survey, we made a list of elements and we asked participants to identify "pull factors" i.e. those factors catalyzing tourism demand. Figure 2-9 shows the list of factors and associated score.

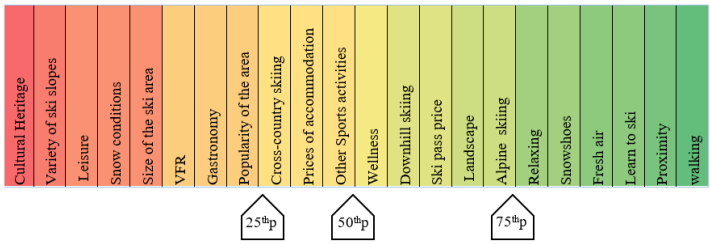



fig. 2-9
Destination's pull factors

In the 25th percentile, we find cultural heritage and leisure, which is in line with the above-mentioned results, as well as the size and variety of ski slopes and the snow cover. In the 75th percentile, we find factors linked to the natural endowment, relaxing and snow activities like snowshoes and school skiing. With lower scores but still above the median value, we find traditional skiing activities and value for money, hence confirming the results from the previous questions.

The fourth part of the survey we included two open-ended questions. The first concern seasonality and, more specifically we asked participants to suggest the best season for visiting Nevegal. The majority of the respondents agrees saying that the destination is suitable all-year round thanks to the natural endowment and the nice weather. In the second question, we asked participants to describe the most likely Nevegal situation in the next 5-10 years, given current conditions. Respondents show a unanimous concern about the next future, stressing the importance of prompt investment in the destination, especially modernizing structures and developing the shoulder season offer.

## 2.7. Identification of alternative strategies and criteria

Based on the results from the preliminary survey and building upon the existing literature (Burki et al., 2007, Bozanigo et al., 2016) we propose three adaptation strategies for the development of Nevegal area, from a tourism perspective. Two of them are alternative strategies that represents departures from the current

BAU. We also propose an enhanced BAU strategy that keeps into consideration the survey results and potentiate the current strategy adopted by the destination.

1. **FULL SPORT NEVEGAL** The first strategy takes into account the nature of the Nevegal area as a winter tourism destination and the importance of ski-sports for the attraction of new visitors. In this sense, investments should be made to enlarge current ski slopes and modernizing ski lifts infrastructures. This would help boosting the destination competitiveness and attract more expert skiers, with a higher willingness to pay for the ski services. Despite the competition of other ski resorts, an upgrade of ski facilities would offer to visitors, especially those living in the nearby, a good compromise between high quality services and proximity to the area of residence. Given the climatic projection, it is also paramount to invest in efficient snow making facilities to improve snow reliability and, in turn, visitors' experience. Strong emphasis is given to the ski schools, which would benefit from modern infrastructures. Moreover, it is important to offer tailor made programs for those family members not involved in traditional skiing activities. In this regards, this alternative requires investing in training local tourism operator and offering leisure activities for children and families. The lodging segment should also undertake refurbishments and includes leisure activities as well as beauty and spa services.

The investment in high-tech infrastructure would have positive effect also on other seasons. For instance ski-lift open all-year-round could be used for attaining heights with less effort and therefore suitable for the senior segment. Lifts would also be useful for those practicing downhill biking and could made of Nevegal the perfect venue for downhill competitions.

2. **NATURE-BASED NEVEGAL** The second strategy is still related to sport and leisure activities, but with less dependence on ski infrastructures and a strong focus on relax and environmental sustainability. In fact, in this alternative scenario Nevegal invests in promoting and expanding off-piste activities like free riding skiing, Nordic skiing and snowshoes, with a lower environmental impact. To guarantee tourism attractiveness also during other seasons, the area should organize sport events for hiking, trekking and biking as well as offering leisure activities for children and families. The eco-friendliness of the tourism activity should

also reflect in tourism transportation. By leveraging on the proximity to the provincial capital, Belluno, and the good connections with the road network, Nevegal could invest in enhancing internal and external mobility, via green-transportation solutions like electric buses. This would facilitate the access to the senior segment, as well as offering an environmental sustainable solution to those visitors looking for spending a nice day in the area, relaxing and appreciating local enogastronomy, without the stress of driving back home. To satisfy the necessity of this specific segment, Nevegal should enrich its ancillary offer (e.g. restaurants and bars) and the lodging sector should undertake refurbishments and includes leisure activities in their offer as well as beauty and spa services

3. **ENHANCED BAU** This strategy represents the status quo of Nevegal but with potential investments in ancillary services. Currently Nevegal offers traditional ski sport activities, like downhill ski, as well as alternative types of ski like Nordic skiing and free riding ski. In this scenario Nevegal does not invest in modernizing the ski infrastructure, mostly targeting amateur skiers, beginners and those attending the ski school. Despite the competition of nearby resorts, Nevegal is a good compromise between proximity, sport offer and value for money. During the spring and summers seasons, visitors can enjoy paths and cycle paths. In this sense, the low altitude represents a strength, making sport accessible for all ages. The only departure from the business as usual scenario, is the investment in wellness offer and boosting ancillary facilities (like restaurants, shops and other services). The diversification of the tourism offer and the inclusion of wellness and spa services would attract also those visitors not interested in sport but looking for nature, wellness and relax.

In Table 2-4 we include a set of indicators (i.e. social, economic, and environmental indicators) used for the evaluation of each scenario performance.

**Table 2-4.** List of criteria

| Indicator | Sustainability pillar | Description |
|---|---|---|
| Water consumption | Environmental | Consumption of water resources. |
| Land consumption | Environmental | Transformation of heathy soil for urban settlement. |
| Energy Consumption | Environmental | Energy used for the production process. |
| Job opportunity | Social-Economic | Creation of new (or better) jobs. |
| Tourism Expenditure | Social-Economic | Effect of the strategy on tourism expenditure. |
| Investment costs | Economic | Expenditure required to undertake a project. |
| Residents' quality of life | Social | Life standard of the local population. |
| Adaptation to climate change | Social-Environmental | Ability to perform efficiently, regardless weather condition. |
| Synergies with summer tourism | Social-Economic | Ability to deseasonalize tourism flows. |

## 2.8. Results of the MCA exercise

Following with the spirit of this part of the research we report here the results obtained for the analysis of the alternative strategies emerging from the online compilation of six questionnaires, collected through the ad hoc web application developed with e-mDSS (see Appendix to this chapter).

Following the NetSyMoD procedure, the values of the analysis matrix which contains the non-normalized values of the qualitative and the quantitative indicators were provided by the compilation of the second questionnaire. The analysis matrix is then transformed into the evaluation matrix by applying the chosen value functions for normalization. Here we decided to use normalization between the theoretical minum (1) and the theoretical maximum (5) value of the Likert scale adopted. Next, the importance weights assigned by respondents are applied to the normalized values.

By using the approach Ordered Weighted Averages, different level of risk aversion can be explored. After normalizing and weighing the values of the analysis matrix into the evaluation matrix, the OWA approach sorts the resulting values for each option, from the lowest (criteria that have poor performance and/or low weights) to the highest (criteria with excellent performance for the option under consideration and/or high weight). A risk-averse or

pessimistic decision-maker will tend to focus on the first indicators with the poorest performance, assigning them great importance for the final decision. On the contrary, an optimistic decision-maker, will want to highlight only the excellent performance of the best indicators. Other decision-makers can have a more risk-neutral attitude giving importance to both better and worse performances, neglecting to consider the criteria with average performance.

The results of the six questionnaires were first processed in parallel and then combined with the Group Decision Making functionality of mDSS, where the Borda Rule is applied to combine them into an overall ranking. The application of six OWA processes shows that five out of six respondent prefers the Nature-Based Nevegal (NAN) strategy, while the sixth prefers the Enhanced BAU solution (BAU). In no cases the Full-Sports Nevegal (NTS) solution is preferred and only in one case it appears as the second in the ranking. The Borda rule confirms this with the following scores: 11 (NAN); 6 (BAU) and 1 (NTS).

The approach described so far is adopted within the classic MCDA and represents what is normally done when one has to choose between alternatives considering also the trade-offs between evaluation criteria. The shortcoming of this approach is that it treats all data as certain and objective, while the divergence in the analysis matrices and in the weight vectors clearly shows the opposite.

A number of methods have been proposed for the analysis of uncertainties that generally consist in a multiplication of decision-making scenarios defined on a probabilistic (parametric or not) basis, in which case the probability of the occurrence of certain values must be known. As mentioned above, instead of identifying the optimal solution in a context of presumed certain data, we suggest to arrive at a decision that is robust, meaning that which proves to be better in most of the possible uncertain scenarios determined by the combination of all possible sources of uncertainty, from expert subjectivity, to future climate scenarios. In this work we refer to methodologies developed in contexts defined as “deep uncertainty”, as described for example in Lempert and Collins (2007). Deep uncertainty is a state in which decision-makers do not agree on the model that relates actions and consequences, the probability distribution of variables, what consequences to consider and their relative importance. To tackle this problem, we propose an intermediate solution: rather than working with a level of total un-

certainty, we focused on plausible data intervals, even without assumptions about probability distributions. In this way reasonable decision scenarios can be simulated, and it is possible to counterfactually verify whether a certain option prevails over others in many parallel "worlds".

An effective and at the same time intuitive method of robustness analysis are CART models (*Classification and Regression Tree*). These are decision tree models in which the sources of uncertainty are at the nodes and the emerging options at the final leaves.

To conduct the robustness analysis, we have to introduce some fuzziness around the MCA deterministic values to assess whether small variation of criterion scores and weights might reverse the ranking of the option. To simulate a real decision-making situation where agreements and compromises are reached through argumentation and dialogue, we sampled the matrices 100 times randomly within the observed Likert values of the questionnaires, we combined them randomly with the six weight vectors collected and with three OWA ordered weight vectors representing risk-averse, risk-taker and risk-neutral attitudes, thus obtaining 1800 parallel decision processes. The results of the robustness analysis are shown in Table 2-5 and Figure 2-10: after 1800 decision runs, NAN prevails in more than 96% of results and NTS never prevails, in which case we can safely conclude that it is dominated by the other alternatives.

**Table 2-5.** Descriptive statistics of the results of uncertainty analysis of the ranking of the three strategies examined for the Nevegal case

| | *Strategies* | | |
|---|---|---|---|
| | *BAU* | *NAN* | *NTS* |
| *Rank 1 (%)* | *3.66* | *96.34* | *0.00* |
| *Rank 2 (%)* | *81.78* | *3.33* | *14.89* |
| *Rank 3 (%)* | *13.32* | *0.11* | *86.56* |
| *Min.* | *0.0296* | *0.0346* | *0.0235* |
| *1st Qu.* | *0.0443* | *0.0536* | *0.0371* |
| *Median* | *0.0487* | *0.0591* | *0.0419* |
| *Mean* | *0.0488* | *0.0589* | *0.0421* |
| *3rd Qu.* | *0.0531* | *0.0640* | *0.0469* |
| *Max.* | *0.0702* | *0.0773* | *0.0642* |

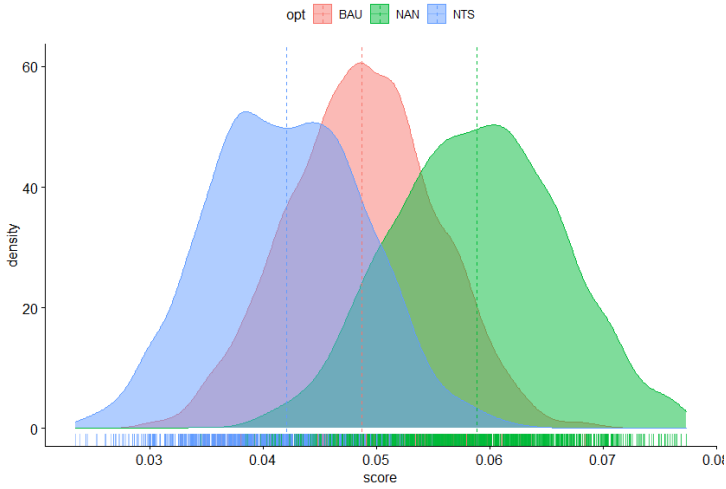



fig. 2-10
Distribution of 1800 results for the scores of the three strategies

As we can see, the robustness results in practice confirms that of the crisp classic multi-criteria analysis, since the 6 questionnaires we collected provided rather converging views about the problem, but, staying within the demonstration character of this application, the robustness analysis should be better followed by further assessments, and in particular by the sensitivity analysis of the results obtained so far.

For a sensitivity analysis, we adopt a CART algorithm provided by the R Package, which constructs a node for each indicator score that could possibly change the final choice. Below and above the limit values at the node, a reversal occurs in the ranking of the options. Figure 2-11 depicts the results of the CART analysis for the 1800 runs. This tool is useful to assess whether indicator scores should be scrutinized more in depth. For example, in this case, we can assess how with values of the seventh criterion (Synergies with summer tourism) exceeding 3.5, and criterion 6 (investment costs) lower than 2.5 the BAU strategy may become the preferable one. This combination appeared in 1% of our simulations.

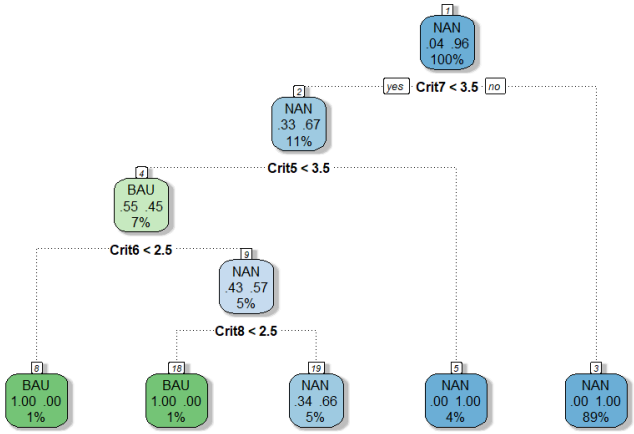



fig. 2-11
CART diagram of 1800 results for the scores of the three strategies

Once more, it is worth to repeat that the interest for this application do not lay at all in the results we obtained, but it lays instead in the demonstration of how the systematic analysis of climatic risks presented in the previous chapters could contribute later on to the climate proofing of future development or investment plans. Applications in the real world of this approach, informed by the results of sectoral risk assessments may consider the criteria we adopted here, but they may also expand them or revise them to make them more case specific. Moreover, the climatic scenarios could be used as in this demonstration case as an inspiration for the analysis of the alternates, but they may also be quantitatively integrated in the MCA and in the robustness analysis.

## Appendices

### *First questionnaire*



# Il Nevegal: situazione attuale e scenari futuri.

*Campo obbligatorio

1. Gruppo di appartenenza *

*Contrassegna solo un ovale.*

- ◯ Ristorazione/Bar
- ◯ Proprietario di case vacanza (per affitti turistici)
- ◯ Turista/Visitatore
- ◯ Agenzia immobiliare
- ◯ Gestore impianti di risalita
- ◯ Guida Turistica
- ◯ Maestro di sci/ gestore scuola di sci
- ◯ Albergatore
- ◯ Membro associazione
- ◯ Proprietario di seconda casa (per uso esclusivamente personale)
- ◯ Negoziante al dettaglio
- ◯ Altro: _____

2. Indirizzo email (facoltativo):

_____

Punti di forza e Punti di Debolezza

3. In un'ottica di sviluppo turistico indichi quali sono i principali punti di forza e debolezza dell'area Nevegal.

*Contrassegna solo un ovale per riga.*

| | Punto di Forza | Punto di Debolezza |
|---|---|---|
| Risorse naturali ed ambientali | ◯ | ◯ |
| Beni culturali ed artistici | ◯ | ◯ |
| Impianti sportivi | ◯ | ◯ |
| Prodotti enogastronomici | ◯ | ◯ |
| Strutture ricettive | ◯ | ◯ |
| Offerta accessoria (supermercati, banche, farmacie, servizi postali...) | ◯ | ◯ |
| Eventi e manifestazioni culturali | ◯ | ◯ |
| Eventi e manifestazioni sportive (sciistiche e non) | ◯ | ◯ |
| Offerta svago e vita notturna (pub, discoteche etc) | ◯ | ◯ |
| Accessibilità | ◯ | ◯ |
| Rapporto qualità/prezzo | ◯ | ◯ |
| Promozione turistica | ◯ | ◯ |
| Turismo religioso- Santuario Nostra Signora di Lourdes | ◯ | ◯ |
| Mobilità interna | ◯ | ◯ |
| Innevamento | ◯ | ◯ |
| Sci da discesa | ◯ | ◯ |
| Sci di fondo | ◯ | ◯ |
| Sci alpinismo e ciaspole | ◯ | ◯ |

4. Indichi eventuali altri punti di forza e debolezza che non sono stati menzionati e che ritiene fondamentali per lo sviluppo.

Strategie per lo sviluppo

5. Proponiamo qui di seguito una serie di azioni finalizzate allo sviluppo dell'area Nevegal in chiave turistica. Indichi il grado di importanza di ogni azione. *

*Contrassegna solo un ovale per riga.*

| | Azione sconsigliata | Poco Importante | Importante | Molto Importante | Fondamentale |
|---|---|---|---|---|---|
| Investire in impianti di creazione di neve artificiale | ◯ | ◯ | ◯ | ◯ | ◯ |
| Investire in espansione delle piste da sci | ◯ | ◯ | ◯ | ◯ | ◯ |
| Investire in attività fuori pista (ciaspole, ...) | ◯ | ◯ | ◯ | ◯ | ◯ |
| Potenziare l'offerta della scuola di sci | ◯ | ◯ | ◯ | ◯ | ◯ |
| Investire in attività indoor (es. palazzetto del ghiaccio indoor) | ◯ | ◯ | ◯ | ◯ | ◯ |
| Creazione di offerta wellness (spa e parchi acquatici) | ◯ | ◯ | ◯ | ◯ | ◯ |
| Investire nell'organizzazione di manifestazione ed eventi gastronomici e culturali | ◯ | ◯ | ◯ | ◯ | ◯ |
| Incrementare l'offerta di divertimento per i giovani (es. discoteche, pub) | ◯ | ◯ | ◯ | ◯ | ◯ |
| Aumentare la promozione turistica del territorio per | ◯ | ◯ | ◯ | ◯ | ◯ |

| | | | | | |
|---|---|---|---|---|---|
| attirare nuovi turisti (es. turisti internazionali) | | | | | |
| Incrementare l'offerta di ricreazione per i bambini e famiglie (parchi giochi, servizi di babysitting) | ☐ | ☐ | ☐ | ☐ | ☐ |
| Incrementare l'offerta per i il segmento senior | ☐ | ☐ | ☐ | ☐ | ☐ |
| Ampliare l'offerta e le strutture utili per il segmento del turismo religioso | ☐ | ☐ | ☐ | ☐ | ☐ |
| Politiche di riqualificazione urbana | ☐ | ☐ | ☐ | ☐ | ☐ |
| Ampliamento dei servizi di trasporto | ☐ | ☐ | ☐ | ☐ | ☐ |
| Adeguamento strutturale dell'offerta ricettiva | ☐ | ☐ | ☐ | ☐ | ☐ |
| Investire nella formazione degli addetti di settore | ☐ | ☐ | ☐ | ☐ | ☐ |
| Investire nella creazione di strutture per eventi comgressuali e | ☐ | ☐ | ☐ | ☐ | ☐ |

6. Indichi ulteriori strategie di sviluppo che non sono state menzionate e che ritiene importanti per lo sviluppo del Nevegal.

Fattori pull (elementi di attrattività)

7. Secondo lei, quali sono le principali motivazioni per cui i visitatori scelgono il Nevegal? (può selezionare piu elementi)

*Contrassegna solo un ovale per riga.*

| | Fattore Pull |
|---|---|
| Sci di fondo | |
| Aria buona | |
| Divertimento | |
| Prezzi strutture ricettive e servizi complementari | |
| Visita di amici e parenti | |
| Imparare a sciare | |
| Cultura | |
| Mangiare bene | |
| Passeggiare | |
| Relax | |
| Benessere | |
| Prossimità (facile da raggiungere) | |
| Svolgere attività sportiva (diversa dallo sci di fondo) | |
| Paesaggio | |
| Sci da Discesa | |
| Sci alpinismo | |
| Ciaspole | |
| Condizioni nivologiche | |
| Dimensioni del comprensorio sciistico | |
| Gamma di piste da sci | |
| Popolarità delpa destinazione Nevegal | |

Prezzo Skipass

Stagione

8. Se lei dovesse consigliare di visitare il Nevegal, quale stagione suggerirebbe? Se possibile, motivi la sua risposta. *

Nevegal 2026-2030

9. In base alle condizioni attuali, come descriverebbe la situazione più probabile del Nevegal nei prossimi 5-10 anni? *

Il Nevegal che vorrei

10. Ritiene che esista una possibilità di sviluppo migliore e diversa da quella descritta nella risposta precedete? Potrebbe descriverla brevemente? Di quali elementi dovrebbe dotarsi il Nevegal per raggiungere lo sviluppo desiderato? *

11. Se necessario, può utilizzare questo spazio per continuare la risposta alla domanda precedente.

12. Informativa per trattamento dei dati personali. *

*Seleziona tutte le voci applicabili.*

☐ Si dichiara di aver letto l'informativa ai sensi dell'art. 13 D.Lgs. 30 giugno 2003 n.196 e del GDPR (EU) 679/2016, ed esprime il consenso al trattamento ed alla comunicazione dei propri dati e dei dati qualificativi aziendali dalla citata legge nei limiti, per le finalità e per la durata del progetto "Introducing climate proofing in investments and spatial planning".





## *Second questionnaire for the ranking of alternative strategies*

*Web pages of the online questionnaire*

In seguito a precedenti indagini e discussioni con esperti e attori locali, sono emerse **tre possibili strategie di sviluppo ed investimento** (per la loro descrizione dettagliata, vedere Nevegal, situazione attuale e scenari futuri)

A. **BAU Avanzato (BAU+)**: La sigla BAU sta per Business As Usual, ossia il mantenimento della situazione attuale, ma in questo caso potenziata con investimenti nel settore della salute, accoglienza e del benessere.
B. **Nevegal a Tutto Sport (NTS)**: Questa strategia si caratterizza per investimenti nelle infrastrutture sciistiche high tech, scuola di sci, assieme al potenziamento delle strutture ricettive e del benessere.
C. **Nevegal Ambiente e Natura (NAN)** ): Questa strategia è invece caratterizzata da investimenti negli sport fuori pista e dalla sostenibilità (inclusi trasporti), sempre con il potenziamento delle strutture ricettive e del benessere

Lo scopo del questionario è quello di **raccogliere le vostre opinioni rispetto alle tre possibili strategie alternative di sviluppo che abbiamo ipotizzato**.

Questa parte della ricerca ha **scopo puramente dimostrativo, per indicare come i risultati dello studio climatico potrebbero essere utilizzati per la programmazione a scala locale**.

Con questo approccio, si possono identificare **quali strategie potrebbero essere prioritarie**, in base alle aspettative sulla loro adeguatezza ed efficacia ed analizzare le **convergenze nei giudizi** degli attori coinvolti e anche gli **aspetti di maggiore dissenso**.

Proponiamo di valutare ciascuna strategia (colonne) in base ai **nove diversi criteri** descritti di seguito (righe).

**1.Consumo di acqua**: consumi idrici derivanti dalla riorganizzazione della stazione turistica
**2.Consumo del suolo**: nuova occupazione di suolo per lo sviluppo della stazione turistica
**3.Consumo di energia**: costi diretti relativi all'approvvigionamento energetico e - indiretti - sulle emissioni
**4.Opportunità di lavoro**:impatto positivo in termini di occupazione atteso dalla strategia
**5.Spesa dei turisti**: spesa complessiva attesa da turisti di qualsiasi tipologia, richiamati dalla strategia proposta
**6.Costi di investimento**:costi relativi alla costruzione di nuove opere o ammodernamento di quelle esistenti
**7.Adattamento al cambiamento climatico**: contributo della strategia all'adattamento ed alla resilienza rispetto agli impatti attesi
**8.Sinergia con il turismo estivo**: versatilità e contributo alla destagionalizzazione da parte degli investimenti per il turismo invernale
**9.Qualità della vita dei residenti**: contributo della strategia di sviluppo turistico alla qualità della vita locale

**È necessario compilare l'intera tabella. Se incompleto, il sistema ti avviserà**.

| | |
|---|---|
| ***Compila ogni cella della matrice sottostante cliccando sul giudizio più appropriato per esprimere la validità di ciascuna strategia rispetto a ciascuno dei criteri di valutazione, secondo la scala di rating riportata a lato.*** | 1 Molto Negativo |
| | 2 Negativo |
| | 3 Neutro |
| | 4 Positivo |
| | 5 Molto Positivo |

Nell' esempio puramente indicativo qui a fianco, si ritiene che l'impatto di questa strategia sul criterio "attrazione dei turisti" sia *Negativo*

| | 0. BAU | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| Attrazione turisti | ○ | ◉ | ○ | ○ | ○ |

***MATRICE DI VALUTAZIONE***

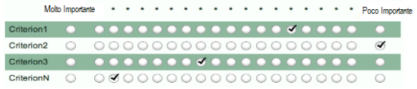
| | | ***scenari*** | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **BAU+** | | | | | **NTS** | | | | | **NAN** | | | | |
| | | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| *Criteri* | **Adattamento climatico** | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| | **Consumo di energia** | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| | **Opportunità di lavoro** | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| | **Spesa dei turisti** | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| | **Qualità della vita dei residenti** | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| | **Costi di investimento** | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| | **Sinergia con il turismo estivo** | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| | **Consumo di acqua** | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| | **Consumo di suolo** | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

Il questionario è quasi finito; nella pagina successiva dovrai attribuire pesi di relativa importanza ai criteri utilizzati sopra.

Note e commenti sulla matrice:

? | >>

In questa fase ti proponiamo di indicare l'importanza che attribuisci ad ogni criterio.
Procedura di **pesatura dei criteri**.
1. Scegli il criterio **meno importante** e seleziona il pulsante di opzione qui in basso "Poco Importante"
2. Per determinare l'importanza degli altri criteri, fare click sul pulsante che sembra esprimere meglio l'importanza relativa crescente rispetto al criterio meno importante. Ricorda che:
- devi assegnare una **valutazione a ciascun criterio**
- puoi assegnare lo **stesso livello a più criteri**
- alcuni livelli possono essere lasciati **vuoti** per esprimere la differenza di giudizio tra i vari criteri. Quindi non è necessario utilizzare tutti i livelli proposti.
Qui sotto un esempio di compilazione che mostra un caso nel quale il criterio 2 risulta essere il meno importante, mentre il criterio N è il più importante in termini relativi, con il criterio 3 e 1 ad importanza descrescente nel contribuire al giudizio finale.




| | Molto Importante | | | | | | | | | | | | | | | | | | Poco importante |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Adattamento climatico | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Consumo di energia | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Opportunità di lavoro | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Spesa dei turisti | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Qualità della vita dei residenti | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Costi di investimento | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Sinergia con il turismo estivo | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Consumo di acqua | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Consumo di suolo | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

Infine, quante volte ritieni che il criterio che hai selezionato come il più importante sia più importante di quello nella cella meno importante?:

**D1: Ci sono altri criteri che ritieni opportuno considerare? (rispondi "X" se non desideri fare ulteriori commenti):**

**D2: Ci sono altre strategie che ritieni opportuno considerare? (rispondi "X" se non desideri fare ulteriori commenti)**

**D3: Hai incontrato difficoltà nel compilare le tabelle richieste?(rispondi "X" non desideri fare ulteriori commenti)**

**Suggerimenti aggiuntivi:**

<< | ? | Invia il risultato >>

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*Final page with example of personal results*

Venice International University

## Ordinamento delle strategie secondo le tue preferenze

| Classifica : | Opzioni : | Punteggio : | % (rispetto alla prima posizione) |
|---|---|---|---|
| 1 | 0 BAU+ | 0.6467 | 100 % |
| 2 | 2 NAN | 0.513 | 79 % |
| 3 | 1 NTS | 0 | 0 % |

?

Il questionario è finito. Secondo la tua valutazione, la ***strategia* vincente** (1 or più) è quella che ha ottenuto un punteggio più alto.

I risultati del tuo questionario e di tutti gli altri interessati ce lo compileranno saranno aggregati ed analizzati e verranno comunicati via e-mail.

## Grazie per la partecipazione!

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