

Overcoming social barriers in managing vulnerability of alpine tourism to environmental change

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- *working paper* -

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Abstract

Tourism as a major service industry is threatened by global environmental change. Alpine tourism with its economic backbone of alpine skiing is highly dependent on snow while climate change is leading to a shortening of the snow season. Adaptation has been focusing on maintaining a status quo of alpine (ski) tourism, resulting in technical adaptation such as snow making and expansion of lifts and slopes to higher elevations. Such business-as-usual strategies feed back negatively to environmental change and proofed to be not sustainable, neither ecologically nor economically. More sustainable kinds of vulnerability management include behavioral ways of adaptation, such as diversification strategies, and mitigation efforts. Both have been neglected by the supply side of tourism stakeholders because of the fear of high investments into alternative products and services that would not meet customer demand.

A vulnerability analysis in thirty tourism destinations in the four main alpine countries after an analogue winter for future (climate) change proofed that vulnerability is more complex than currently understood. Climate change is one major threat, but socio-economic developments have been neglected and underestimated in their potential consequences. Commonly focused on vulnerability factors such as climate change and snow making capacity retain their relevance, but socio-economic changes and the inadequacy of policies adressing these are understood as being of higher importance. Further social causes such as a lack of participation in supply side social networks, personal barriers, weaknesses in destination governance models and a lack of interaction and partnering with the demand side increase vulnerability of alpine tourism to environmental change, the current focus on climate change adaptation cannot cope with.

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1. Global change effects on winter tourism

Tourism in the mountainous regions of the Alpine countries is of great importance for their local economic development. About 13.6 million people live in the Alps. The total number of tourists in the Alps per year estimated to be from about 60-80 million people (OECD, 2007) up to 100 million (CIPRA, 2006a). About half of the revenue in Alpine tourism is gained in winter, half in summer. Ski areas generate the major share of sales in winter tourism only exceeded by lodgement and gastronomy. Inside ski areas, the ropeways are by far the most important economic forces. In some Alpine regions, valleys or destinations, winter tourism may well exceed an economic importance in direct and indirect sales and employment of more than 80% (Müller et al., 2007). The Alps are a highly inhomogeneous unit with huge regional and local differences (CIPRA, 2007b).

Winter tourism in ski areas mainly means lift accessed alpine skiing. A ski area relies on cold temperatures and snow as the main *product* or *service*. Rising temperatures and changing precipitation patterns alter the climate. Climate change is considered to be the major threat for winter tourism destinations, already affecting the European Alps (OECD, 2007, Schneider & Schönbein, 2006, Seiler, 2006, Zemp et al., 2006).

The world's mean temperature has risen about 0.8°C within the last 30 years. In the Alps, this change happened with 1.6°C two times faster (OECD, 2007). Climate models show that the world average temperature will rise about 2 - 4 degrees Celsius more until the end of this Century, whereas the mean temperature in the Alps will rise another 2°C already within the next 30 years. Precipitation patterns are changing with less precipitation in early and midwinter and more precipitation in spring and summer. The total amount of precipitation will most not change significantly, though. Extreme weather events, such as storms, floods, draughts or heavy snow falls will become more frequent (IPCC, 2007, OECD, 2007, Rolland, 2006, Schneider & Schönbein, 2006, Seiler, 2006).

The current number of 666 ski areas in the Alps will drop to 404 under a 2°C warming of climate measured by their sheer elevation and their natural snow reliability according to the OECD report. However, technical snow making is not taken into account in this calculation.

Ski areas will not be able to offer the same services as they used to and as customers were used to buy. Tourists as consumers will face heavy changes in the winter tourism product as the reliability of snow is vanishing, which will affect their satisfaction (Elsasser & Bürki, 2003). The modelled and forecasted rises in temperature would result in significant reductions in snow pack and glacier mass within decades. The influence of any changes in precipitation on overall snow cover is small and will not affect the general trend resulting from temperature rises. By 2050, about 75% of the glaciers in the Swiss Alps are likely to have disappeared. Glacier retreat will increase slope instability and permafrost thawing will lead to more rockfall activity (Zemp et al., 2006). Climate change will lead to more extreme events and natural hazards in the Alps too (IPCC, 2007, OECD, 2007).

In response to this ski areas are challenged to adapt. Adaptation to climate change is of vital importance for ski tourism (OECD, 2007).

Rising temperatures will lead to a decrease in natural snow cover. Different criteria have been discussed as to what natural snow reliability means. Witmer (1986) first

mentioned the so-called 100-day rule that summarizes the discussion. It means that in order to operate a ski area successfully, a snow cover sufficient to operate should at least last for 100 days a season. The sufficiency of a snow cover differs from 30 cm to 1m, depending on the slope and the underground (Witmer, 1986). It should be seen not as a strict rule, but as a rule of thumb for ski area management (Abegg, 1996).

The natural snow line varies across the Alpine regions. Many aspects influence this line, particularly the continentality of the climate. The OECD report on vulnerability of ski areas bases its assumptions on this 100-day rule and on the natural snow reliability. However, more aspects need to be taken into account to analyze the snow reliability of a single ski area. *Foehn* influences, local cold air down streams, inversion valleys, slope aspects and others can have severe impacts and even change this general understanding of natural snow reliability, such as Schneider et al. showed for German mid mountain range ski areas (Schneider et al., 2006). Technical snow making potential of course, is not included in the view of natural snow guarantee.

The impacts of climate change on ski areas have led to a discussion of *winners* and *losers*, both in terms of regions and of ski areas themselves (OECD, 2007). It states that the ski areas in higher elevations will benefit from changes, such as profiting from the potential lower number of ski areas, if those in lower altitudes, the losers, disappeared. This winners and losers discussion is mainly based on the altitude of ski areas and thus their natural snow reliability.

1.1 Global change is more than climate change

Apart from climate change there are other changes in the social environment that can affect ski tourism. The demographic development in the example of the German market is leading to more people with the age of 50 and older, and to fewer people of younger ages below 30 years. Already in a very short term till 2015 the age class of 60+ will grow with 10% to about 30% of the population. The usual pyramid is growing to a mushroom shape showing the future majority of older people in the population by an increased heterogeneity of people with migrative backgrounds (Bundesinstitut für Bevölkerungsforschung, 2008).

The question is how an older population will affect consumer behaviour? Results of Lohmann (2007) show that the elderly will stick to their preferred destination more than the younger. Their decisions are made after about two thirds of their life span and merely change after. Seniors are a huge market potential if “caught” early enough so they can find their preferred destination. Schröder comes to similar results and recommend a special “senior” marketing of destinations (Schröder et al., 2007).

The economic development is leading to a higher percentage of lower income classes and of higher income classes, thereby dropping the mid incomes (Statistisches Bundesamt Deutschland, 2008). The general economic development can influence the willingness to spend money for tourism – if the economy is shrinking, tourism turnovers will drop as previously experienced for example by the Austrian tourism industry (MCI, 2006).

Higher costs of energy, water scarcity, new competing tourism markets worldwide are some more examples. The market of ski tourists is changing, diverse and affected by

demographic, socio-economic and socio-graphic developments that in addition affect ski tourism in the Alps. The growing number of customers from the emerging tourism markets of China and of Eastern Europe leads to such a socio-graphic change. However, there is little literature on the outcomes of other than climate change factors on ski tourism. The scientific and the public discussions so far are centred on climate change impacts.

2. Reactions of the winter tourism industry

2.1 The focus on technical adaptation

Ski areas already are adapting in expectation and in experience of climate change. The kinds of adaptation can be split in behavioural and in technical adaptations. Technical adaptations such as technical snow making, glacier skiing, an expansion to higher altitudes and on north facing slopes as well as landscaping and ski slope changes are the main discussed and applied means of adaptation (OECD, 2007). The major kind of technical adaptation today is the production of machine made snow. Many different kinds of technology have been developed, and a discussion of them would go beyond the scope of this study.

Technology is improving quickly, still for efficient snow making in terms of cost-use ratio temperatures below freezing are needed. Nature is setting the limit for snow making, but with ice making machines and vacuum technology it already is possible to produce snow in small amounts in warm summer temperatures – not for the amounts needed in ski areas though. Technical adaptation can cope with the direct outcomes of climate change, such as rising temperatures. It cannot address other aspects of global change. More information on the technology of technical snow making can be found in Teich (Teich et al., 2007).

2.2 Behavioral adaptation

Behavioural adaptations change or decrease the dependency on the status quo of lift accessed Alpine skiing to other activities. Examples for such diversification strategies are operational practices that change the way of ski area operations (four season tourism activities), financial instruments (snow insurances), financial support or subsidies from local authorities, co-operations and mergers with other ski areas or marketing partners, winter revenue diversification, all year tourism and finally withdrawal from ski tourism and a closure of the ski area.

2.3 Mitigation - avoiding environmental problems caused by ski tourism

The discussion how ski areas could react has been focusing on adaptation. Mitigation or avoidance strategies are understood as avoiding an even faster climate change by increasing the efficiency and by lowering the amount of greenhouse gases being emitted (OECD, 2007). Ski tourism is causing environmental problems. From a climate change discussion point of view the emissions of the greenhouse gas CO₂ by winter tourism activities have come up rather recently. The main source of greenhouse gases is individual traffic to ski areas with more than 70%, followed by lodgement and housing infrastructure in ski destinations with about 25%. The ski area itself is responsible for about 3% of the emissions, lifts and technical snow making for each about one percent. These numbers origin from a recent study of ADEME (Agence de l'Environnement et de

la Maîtrise de l'Energie) and The Mountain Rider Foundation in the French ski resorts of Les Menuires and Val Thorens (Mountain Riders, 2007).

Other environmental impacts include land uses for slopes, lifts and parking space, water usage for snow making and others, ecological disturbances of habitats from wildlife and plants, noise and light pollution, earth and rock movements, erosions and others (see for example pro natura-pro ski, 2003). Snow making as the main kind of technical adaptation has various negative effects on the natural environment. The use of resources such as energy and water and the direct or indirect impacts on plants, wildlife and soil are described in Teich (Teich et al., 2007). Ski tourism has negative impacts on the environment and on our climate, thus organizations such as the CIPRA and the WWF demand for more avoidance activities that lower the impact instead of investing all available resources into adaptation that addresses the impacts of changes, not their sources (for example in CIPRA, 2007). Examples of avoidance strategies are less energy and water consumption, more efficiency in operations and use of resources, soft forms of mobility as well as compensation of CO₂ emissions (CIPRA, 2007b, Mueller & Weber, 2008).

Mitigation in a broader understanding may involve social aspects too. The socio-economic impacts of global change on tourism have been discussed before. Ski tourism stakeholders do have opportunities to avoid some social changes too, such as the problem of losing the tradition of families teaching their children to ski. Special support programs for children and a family-friendly price policy are examples of social mitigation that cross the border to behavioral adaptation.

2.4 Adapting in a sustainable way?

Ski areas depend on landscape and nature as resources; infrastructure is built and has to be maintained; landscape is transformed, and ecosystems are affected as energy is used. The direct dependency on natural resources makes ski areas responsible to manage these public goods in a sustainable way. Global change impacts influence and alter ski tourism. Common ski area service consumers were used to buy are changing, being it snow reliability, the occurrence of extreme weather events, safety issues or faster rising costs of transportation.

The current kind of adaptation is attempting to maintain services as they were. Strategies of adaptation that focus on technical means, such as expansion or snow making, require the use of even more resources to maintain the common ski tourism product, which feeds back and even accelerates the cycle of human influences on climate change (see figure xy). There are natural and economical limits of technical adaptation, being the availability of water or the increasing costs of energy for snow making. The sheer number of existing ski areas in the Alps and their expected disappearance due to climate change indicate the technical limits of adaptation (CIPRA, 2006b, OECD, 2007). Ski areas cannot rely only on technical adaptation alone – it is not sustainable, not from an ecological nor an economical point of view (CIPRA, 2006b).

Behavioral adaptation and mitigation instead would change the services offered by ski areas. They could be successful if they met customer demand, if the customer was satisfied with altering services in ski areas and adapted his or her consumer behavior accordingly – buying different services that could be provided with less technical efforts,

such as less snow making or fewer changes in the landscape. Adaption from a demand side is a new facet that if we hypothesize, could help create a market for the supply side to increase mitigation and behavioral adaptation. The ski tourist is questioned to change his or her demand to more sustainable services that require less resource intensive technical adaptation from a supply side. The question is whether he or she is willing to adapt his or her demand accordingly.

All discussed types of adaptation focus on maintaining ski tourism. Withdrawal from ski tourism would be another strategy where alternatives must be found. Tourism, though, is a growing industry that is the main economic driver in many Alpine regions, and in some less developed regions it is the only industry that cannot be substituted by any other kind of industry so far (Elsasser, 1995). Withdrawal from ski tourism would thus, in general, not be sustainable from an economic perspective, and maintaining ski tourism should be the first approach. If, however, the ecological and socio-economic aspects speak against maintaining ski tourism, then the system should be open to withdrawals and the search for alternatives.

3. Vulnerability of winter tourism to environmental change

Vulnerability can be described as a function of three overlapping objectives: exposure, sensitivity and adaptive capacity or resilience (Turner et al., 2003a).

Vulnerability of ski tourism to global change is the likelihood that the coupled human-environment system, ski tourism, may experience harm from exposure to stresses associated with changes in the natural and social environment. The expression human-environment system refers to the interrelations between humans and environment, being part of a holistic system (Turner et al., 2003b). Hazards for the system arise from influences outside and inside the system and place. The human-environment conditions determine its sensitivity to any set of exposures. The social and environmental mechanisms influence and inform each other. Responses in one system can influence the resilience and the ability to cope with the other. Mitigative aspects are understood as taking advantage of opportunities and thus being part of adaptive elements.

Turner (Turner et al., 2003a) provides a general framework of vulnerability analysis that ideally considers the totality of the system. Turner states that this ideal, of course, is unrealistic because of real world data, uncertainty and other constraints, such as complexity and connection and multiple spatiotemporal scales. Turner provides a template suitable for *reduced-form* analysis, yet inclusive of the larger systematic character of the problem (figure xy).

Turner's framework is not explanatory *but provides the broad class of components and linkages that comprise a coupled system's vulnerability to hazards* (Turner et al. 2003a). The elements shown are interactive and scale dependent, linking place to region to world. The hazards for the system arise from influences outside and inside the system. The human-environment conditions of the system determine the sensitivity to exposures. The social and environmental or biophysical mechanisms influence each other and feed back into the system. Adaptive responses determine the ability to cope with both the social and biophysical subsystem.

In this research we seek to address elements of the general framework of Turner to the specific example of ski tourism vulnerability to global change.

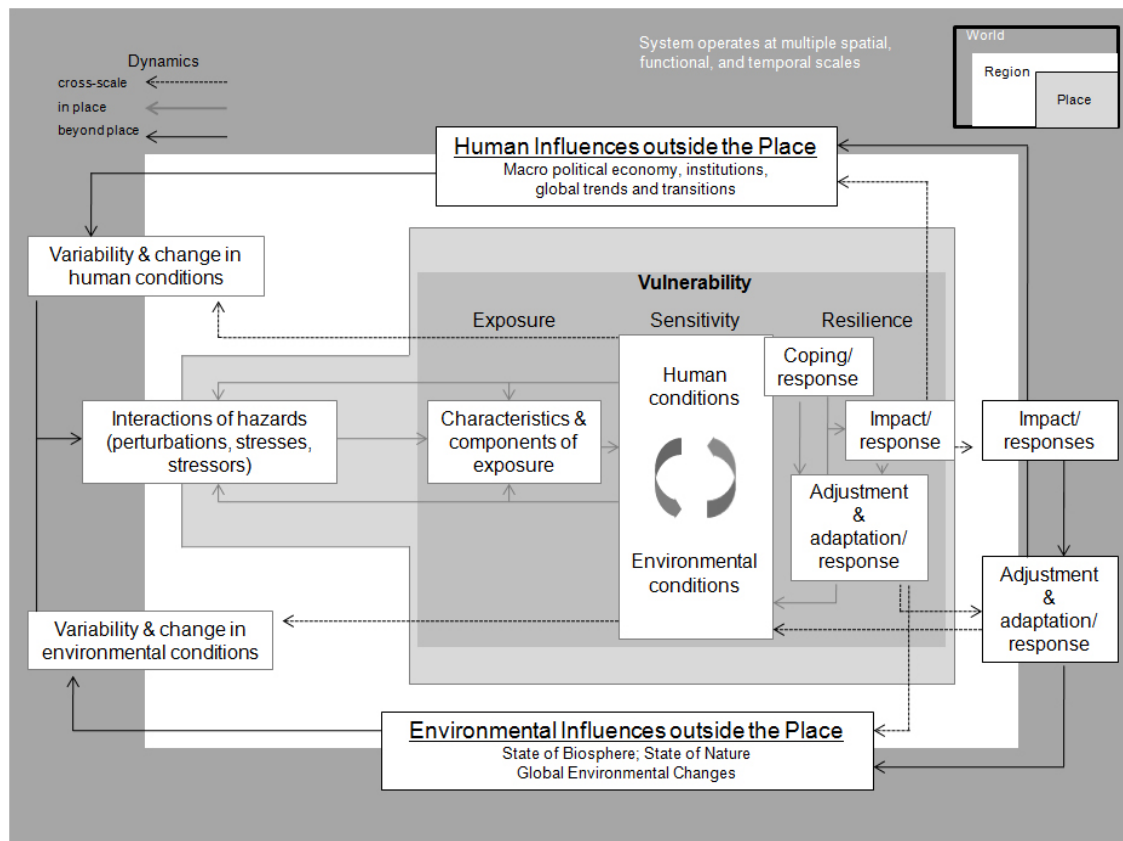


Figure 1 Vulnerability framework
(Turner et al., 2003a)

3.1 Vulnerability perception by the tourism industry

From a supply side point of view, there have been a number of qualitative and quantitative studies surveying strategies of tourism stakeholders regarding their perceptions of vulnerability to environmental change.

Examples of supply side surveys are found in Abegg (1996), König (1998), Bürki (2000), Behringer (Behringer et al., 2000). More recent quantitative surveys have been done with the cableways in Switzerland by Abegg (Abegg et al., 2007) and with the German cableways (Roth et al., 2008). In France Sfez (Sfez & Cauquelin, 2005) surveyed attitudes in French ski stations. Rolland (2006) assessed success factors of ski stations in France and in French Canada. Tettenborn (2007) looked at success factors of French ski stations.

The studies found out that tourism stakeholders are aware of climatic changes and recognize the ongoing and future impacts on winter tourism as relevant to their industry. In stakeholders' opinions the media exaggerates climate change and even seeks to publish bad news. Even science and politics exaggerate the topic, which is understood as being of minor importance. The behavior of stakeholders reveals ambivalence in downplaying climate change and still legitimate unpopular expansions and constructions, such as technical snow making and new lifts or widening of slopes.

In one of the latest studies Wolfsegger (Wolfsegger et al., 2008) found out that a majority of managers from lower ski areas in Austria expects some substantial changes from climate change in ski areas. Still, one-fourth believes the climate to remain stable. Extreme weather events are expected to have the most severe impacts. 39% could

imagine the ski season to become shorter, not meaning that fewer tourists would then visit the ski areas. In general, the vast majority believes that they are able to adapt to climate change and therefore do not see it as a substantial threat. The most important adaptation strategies in a technical approach were snow making, expanding to higher elevations and avoiding southern exposures. For behavioral actions, “sharing the cost of snow making with the accommodation sector” was most named, then partnering and becoming members of agglomerations, diversification in winter, diversification in four seasons and “reviewing environmental regulations”. Mitigation, though, was seen as only moderately important (OECD, 2007, Wolfsegger et al., 2008).

Huttner (2008) recently focused on the social construct in ski destinations, investigating three destinations in the Bavarian Alps. Local stakeholders were interviewed about their perception and strategies on climate change. Results proved the lack of communication between stakeholders in the same destination with often opposing goals and different stages of information and knowledge. The public media coverage has the greatest influence on stakeholders’ knowledge and perception. Still, climate change as a fact is not questioned. The trust in further technological development of snow making is high, and along with expected legal and financial support of local and regional authorities, adaptation is seen as possible. New target groups and more marketing are understood as further strategies of adaptation.

A representative survey of Swiss ropeways companies was conducted in 2007 by Abegg (Abegg et al., 2007). Bigger companies believe to be better informed on climate change than smaller ones. Scientific publications and congresses are important sources of information for the larger companies. In the future, 80% will incorporate climate change in their strategic planning, so far only 50% did. They expect a decrease in snow reliable winters of 20%, and 58% expect a decrease in snow reliability. For adaptation, the bigger ventures increasingly plan to organize events in winter on-mountain. In the summer, the construction of mountain bike trails and downhill parks is a main strategy. Financial aspects and behavioral strategies will gain in importance. The bigger and higher ventures will market snow guarantee and snow making, while the smaller and lower offer sustainable tourism. Mitigation, with increased efficiency and the use of energy from renewable resources, will be applied, especially by the bigger ventures in the future. Bigger companies, rather than smaller ones, are looking more positively into the future regarding their adaptation possibilities.

A representative survey of German ropeways companies carried out by Roth (Roth et al., 2008) and based on the questionnaire developed by Abegg, highlighted the circumstances of the smaller German ski lift operators. Roth also implemented global change impacts into the questionnaire. The vast majority is insecure about future climate change developments and impacts; only one-seventh is secure enough to plan strategically ahead. The majority believes in a decrease of snow reliability, followed by a shorter snow season and a decrease in customer demand. 29% expect a decreasing demand as moderately probable, 29% as probable and 5.6% as very probable.

Still, about one-third does not believe in a decrease in customer demand in the future. 65% see economic development as the biggest threat of the future, followed by demographic developments (23%) and climate change with only 5.5%. 61% do not see socio-graphic developments as a threat; 45.8% do not see climate change as a threat, followed by 13.9% demography and only 5.5% economic development.

From an adaptive point of view, about 30% see technical snow making as the main strategy so far, with 21% grading of the slopes to reduce the necessary snow pack height

and 13% better physical snow management. In the future, snow farming, snow management and ground-free lifts are of growing importance. To secure the winter season, snow hiking trails, events and new trend sports are seen as the strategies of the future. In the summer, theme parks and water parks are becoming of most importance compared to today.

From a financial perspective the support by local authorities as well as by the accommodation sector and the increase of ticket prices are seen as the most important strategies. In marketing, sustainable tourism is of highest priority in the future. Mitigation, especially energy efficiency and the use of alternative energy is of increased importance in the future. Teich (Teich et al., 2007) asked experts in the Swiss ski destinations Davos, Scuol and Graubünden about their experiences after the winter 06/07 and found out that higher elevations and snow making were the main adaptive elements securing that season, but that snow guarantee alone is not enough to adapt in the future.

Other authors have looked at ski tourism stakeholders from an organizational aspect of adaptation. Beritelli (Beritelli et al., 2007) discuss models of governance in destinations and find that the corporate-based model leads to advantages in adaptive management. Busch (Busch & Hoffmann, 2006) as well as Hoffmann (Hoffmann & Trautmann, 2006) discuss uncertainty management and the need for models of governance that fit to managing uncertainty. They see more need for research in this case. Breuer (Breuer & Pawlowski, 2007) discusses econometric models of price evaluation in winter sports with the goal to evaluate and benchmark ski ticket prices by their individual attributes. Bieger (Bieger et al., 2006) also discusses new pricing models to increase added value in the ropeways industry.

3.2 Research questions addressing the complexity of vulnerability

Alpine tourism destinations have been responding to climate change mostly by technical adaptation with the goal of maintaining services as they were. This practice is economically and ecologically not sustainable (CIPRA, 2006). More behavioral and mitigative forms of adaptation are needed. Furthermore, we hypothesize that vulnerability to environmental change is more complex and diverse, and that technical adaptation as well as the simple distribution of losers and winners given the size, elevation and snow making capacity of ski areas cannot sufficiently reflect the reality.

The system of global change, of ski tourists and of ski areas is complex, many variables are uncertain and result in risks for the governance of Alpine destinations. The ropeways companies as the main stakeholders on supply side in winter tourism as well as the main threatened party from global change impacts are challenged to find a more sustainable tourism business model that is less vulnerable to environmental change.

Furthermore, the successful implementation of alternative sustainable tourism models requires the adaption of customer demand to changing services. In order to be successful, the satisfaction of the customer and its involvement in the services designing process are integral parts of destination governance. Consumer demand and the role of information in winter tourism are beyond the scope of this supply side study and have been looked at in Luthe and Schläpfer, 2010.

In order to develop and implement alternative, more resilient tourism practices this study seeks to display an outlook into the future development of environmental change impacts and vulnerability from a supply side perspective, spanning the whole scope of

Alpine ski destinations in the major countries of the Alpine arch. The impacts and experiences of the analogue winter 2006/07, the warmest winter in the Alps on records to date (Beniston, 2007), can be used as an outlook on future developments of both direct and indirect impacts in a changing climate. This study aims to assess and discuss the experiences of that extremely warm winter to help better understand the complexity of vulnerability and how it can be decreased, focusing on five main questions:

- How do ski areas perceive the various facets of global change after their experiences of an analogue winter for future developments?
- How vulnerable do they think to be and which are the main sensitivity factors?
- How do they estimate their adaptive capacity and what are their adaptation strategies?
- What is their willingness for mitigation?
- Where do ski areas see the need for action, and where do they see chances resulting from global change?
- What is their willingness for behavioural adaptation and mitigation, and would ski areas believe and invest in alternative, more sustainable tourism models?

Knowing that a tourism destination is a system of various supply side actors providing the tourism service chain this research focuses on the ski areas and the ropeways companies since these are economically the main driving forces in destinations and simultaneously the main threatened stakeholders due to their dependency on snow. We seek to address ski areas being representative of the various kinds of existing ski areas in the main Alpine countries.

3. Methodology

The research objectives ask for a qualitative approach with the advantages of receiving more individual and in-depth information than it would have been possible with a quantitative survey. The goal here was not to get representative results of the ski areas in the Alps. The goal was to discuss the experiences of the analogue winter 06/07 in more depth and to include the personal insights and visions of the ski area managers. The intent was to include experts representative of ski areas for the Alps and to picture the variety and the scope that exists as explained later in this chapter. In such a discussion it is possible to inductively adapt and develop the topics according to the personal experiences and visions of the interview partner, and to discover topics or issues the scientist might not have thought about in advance (Bogner, 2005). A qualitative method opens up more space for exploring and does not limit the possibilities in advance.

Referring to the research questions the exploration should, of course, not leave the main topics and address the questions in mind. Therefore, the qualitative experiment aims to achieve two things: while being exploratory, it still follows a well-defined procedure trying to prevent accidental outcomes and results (Diekmann, 2003, Häder, 2006). Qualitative interviews can be structured or unstructured (Bogner, 2005, Lamnek, 2005).

In order to include advantages of both structured and unstructured interviews we chose to follow semi-structured interview plans in personal, qualitative interviews that were

created by a lined-up set of topics and questions to allow for enough space for extending into one topic or another. We thus were able to be available for the individual experiences and situations of the interviewed partner and still were able to come to comparable results that would be structured enough to be analyzed and compared with each other.

The guiding topics for the interviews were developed in accordance with the research questions focusing on the experiences of the winter 06/07 and the resulting view of vulnerability and adaptive capacity. Hereby we took results of earlier interviews and focus group discussions from other researchers into account (for example Bürki, 2000). After the first interviews the structure of the guidelines was slightly adopted to better fit the flow of the discussion and the given time frame of about one hour. Each interview partner responded differently, though, and the order of questions posed needed constant adjustments. The guiding structure of the interviews is shown in Appendix A.

3.1 Selection of ski areas and interview partners

The ski areas were selected in order to find an even distribution in the four main Alpine countries: Austria, Switzerland, France and Italy. Furthermore, there are five categories we chose to represent an average of ski areas in the Alps and to cover the main existing kinds of ski areas. The selection criteria were based on elevation, size, access, if glacier skiing is offered and the image of the destination as follows:

- Elevation low or high
- Size big or rather small
- With a glacier and without
- Distance to source markets – direct easy access or remote and difficult access
- World known leading destination
- Destination of local or regional importance

We draw the line between a low and a high ski area with the major part of the lift equipped, and available terrain being below or above 2000m asl. A big ski area in this understanding has more than one million skier days per year. The elevations and the skier days are shown in table one. The reach ability within two hours of time from towns of fifty thousand people to one million, as well as the direct train access and the distance to the next public airport, were further criteria in our selection. The travel times are based on available online route planners (www.map24.de) and indicate the reach ability for day tourists.

We combined these factors to five ski area categories of selection:

- Low and small
- Low and big
- High and rather small
- High and big
- Glacier skiing (high and big)

We matched these categories with the two classes of a world leading destination (12 ski areas) and a destination of local or regional importance (8 ski areas) within the four countries. The reputation, whether a destination is of world reputation or not, is subjective to a certain degree. We picked seven ski areas from the group *Best of the Alps*

(<http://www.bestofthealps.com>) as having a world reputation and added Gstaad, Les Arcs, Val d'Isere, Arosa and Verbier because of their international reputation as ski areas. Within the high areas with world reputation we include five areas with glacier skiing. The easiness of access and the distance to source markets is about evenly distributed between the selected ski areas. Table two shows the selected ski areas and the included categories and classes.

Table xy Elevation and skier days of the selected ski areas

	Elevation min	Elevation max	Skiers days
Arosa	1750 m	2653 m	578.000
Davos	1194 m	2844 m	1.110.000
Diedamskopf	655 m	2050 m	220.000
Dolomiti Super Ski	12 areas	12 areas	10.000.000
Flumserberg	1200 m	2222 m	<1.000.000
Gstaad	948 m	2156 m	1.000.000
Kitzbühel	789 m	2000 m	1.550.000
Les Arcs	1200 m	3226 m	1.618.905
Morzine/Les Gets	900 m	2000 m	750.000
Orcieres	1850 m	2725 m	<1.000.000
Planai & Hochwurzen	752 m	2000 m	1.000.000
Scoul	1250 m	2783 m	400.000
Sölden im Ötztal	1377 m	3249 m	1.430.000
St. Anton am Arlberg	1304 m	2811 m	1.250.000
St. Moritz	1856 m	3057 m	1.300.000
Toggenburg	900 m	2262 m	350.000
Val d'Isere	1850 m	ca.3300 m	1.240.000
Verbier	821 m	3330 m	>1.000.000
Wilder Kaiser/Brixental	650 m	1892 m	>1.000.000
Zermatt	1524 m	3899 m	1.368.000

From the management of these ski areas we selected interview partners from leading positions, usually the CEO, who in some cases were also part of the tourism management of the destination in general (table three).

The selected ski areas were called by phone and asked for an interview partner for the topic of this study. There was only one ski area that was not willing to schedule an appointment for an interview because of too many requests for interviews from the media and from students and others alike. In two cases the interview partner needed to be convinced to schedule an interview – not because of a lack of interest but because of too many requests of such a kind. With the remaining eighteen partners an appointment was easy to plan as they were very interested in environmental change topics.

The interviews were held at the end of the ski season 2006/07 from May through September, 2007. The timing proved to be right because the experiences of the last winter were still fresh, but the economic data of that season had already been analyzed. The summer is the time of the year when the ski area personnel has the lowest work volume and thus is more likely to have the time for interviews.

In the interviews we introduced the research group, the goal and the scope of the research project. We asked to record the interviews with voice recorders (Olympus VN-

3100PC) for later transcriptions. It was obvious that the position and the educational background of the interviewed partner led to different kinds of responding. Someone with a technical background usually waited for the whole question to be asked, and then responded clearly and directly to the stated question in a rather short and structured time. Someone with a marketing background responded differently, often starting right away with talking before the questions were asked and digressing while answering a question. Such interviews required more re-structuring by the interviewer. It showed that interview partners in marketing positions often did not have sufficient insight in key business strategies, which negatively influenced the scope of responses given.

Table xy Categories and classes of the selected ski areas

	small + low	big + low	small + high	big + high	glacier	world known/ leading destinations	less known/ local importance
Short indicator for citations	sl	bl	sh	bh	g	w	l
Arosa			x			x	
Davos				x		x	
Diedamskopf	x						x
Dolomiti Super Ski				x		x	
Flumserberg	x						x
Gstaad		x				x	
Kitzbühel		x				x	
Les Arcs					x	x	
Morzine/Les Gets	x						x
Orcieres			x				x
Planai & Hochwurzen		x					x
Scoul			x				x
Sölden im Ötztal					x	x	
St. Anton am Arlberg				x		x	
St. Moritz				x		x	
Toggenburg	x						x
Val d'Isere					x	x	
Verbier					x	x	
Wilder Kaiser/Brixental		x					x
Zermatt				x	x	x	

3.2 Introducing the question on sustainable tourism

One of the main goals of *this research* is to explore opportunities of sustainable adaptation to environmental change. Behavioral adaptation and mitigation on the supply side as well as adaption of consumer behavior are possible steps to follow in developing sustainable tourism. On supply side we intended to discuss the feasibility and the acceptance of establishing such sustainable ski tourism. The concept of sustainable development is complex and might not be clear to everyone, the same with sustainable tourism. In order to secure that the interview partner knew about this concept and its underlying contents in order to respond honestly, we first asked how he understood the expression sustainable development and the concept of sustainable tourism. We then provided definitions of sustainable development, sustainable tourism and sustainable tourism development to each interview partner:

Sustainable development implies "meeting the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development, 1987).

Sustainable tourism is, "Tourism that meets the needs of present tourists and host regions while protecting and enhancing opportunities for the future" (World Watch Institute, 2005).

"Sustainable tourism development requires the informed participation of all relevant stakeholders, as well as strong political leadership to ensure wide participation and consensus building. Achieving sustainable tourism ... requires constant monitoring of impacts, introducing the necessary preventive and/or corrective measures whenever necessary. Sustainable tourism should ... ensure a meaningful experience to the tourists, raising their awareness about sustainability issues and promoting sustainable tourism practices amongst them" (WTO, 2004).

This way we made sure that all responses to the following questions on their acceptance, willingness and feasibility for establishing sustainable ski tourism were trustful and based on their own knowledge and opinions.

3.3 Qualitative content data analysis

The qualitative content analysis described is a set of techniques for analyzing texts that were developed in the nineteen eighties in the context of a large psychological study on unemployment (Mayring, 2000). The main goal of the qualitative content analysis is to combine the advantages of quantitative content analysis developed in communication sciences with qualitative-interpretive steps (Brosius & Koschel, 2001). Qualitative content analysis is appropriate to work with any kind of fixed communicational material, being it written texts, videos or transcripts. The method embeds material into a communicational model to make specific inferences from text to other states of properties of its source. In a qualitative content analysis the data is reduced to extract the relevant aspects of the content (Mayring, 2000, 2002, 2003).

The four categories of quantitative content analysis (fitting the material into a communication model, rules of analysis, category centred, criteria of reliability and validity) will be preserved to be the fundament for qualitative oriented procedure of text interpretation. In the procedures of qualitative content analysis, there are two central kinds of category development: inductive and deductive application. In the inductive approach the categories as aspects of interpretation are developed as close as possible to the material, formulating them, while the analysis is in progress. The material is worked through and categories are tentative and step by step deduced, revised and eventually reduced to main categories (Brosius & Koschel, 2001).

In the deductive approach aspects are formulated prior to analysis, connecting them with the text. The qualitative step of analysis consists in a methodological controlled assignment of the categories to the text passages. Within the last years, several computer programs have been developed to assist the process of interpretation to handle the texts and the coded passages.

We were using content analysis software MAXqda2 for the coding and the handling of the transcriptions and text bits. The categories are the core of any content analysis. Categories should be disjunctive, complete and precise. Categories of one variable should not be overlapping. Each unit of analyzed text is referred to a category and can be referred to other categories at the same time (Mayring, 2003).

3.3.1 Definition of units to analyze and category building

Starting from the research question and the hypotheses the units to be analyzed and the system of categories were set. The units of analysis were the twenty ski areas interviewed. The categories were deductively developed according to experiences of earlier research in the field of climate impacts on ski tourism and according to our research goals and questions. Still, they were open for inductive changes throughout the analysis. The seven main categories were further divided into 26 sub categories, again addressing our research goals and questions. The seven main categories of this analysis are:

1. Description of facts about the ski area
2. Experiences of global change after the analogue winter 06/07
3. Estimation of general vulnerability
4. Sensitivity elements
5. Adaptive capacity
6. Strategies and action to cope with global change impacts
7. Outlook on the future of the ski area and of ski tourism in general

Further divisions in up to three sub categories were made in some cases.

3.3.2 Transcription

The complete recorded interviews were transcribed using Dragon Naturally Speaking software 9.0. The seventeen hours of interviews resulted in 167 pages A4 of transcribed texts.

3.3.3 Paraphrasing and generalization

The transcribed texts were mostly (16 out of 20) in the German language and not translated into English to keep the original spelling of the material. The two French transcriptions were translated into German while the two English texts remained in English, again to keep the original spelling where possible. The texts were paraphrased and generalized, dropping irrelevant text bits and bringing it into a similar grammar and expression. Because of the scope of languages and dialects of the four visited countries, this step required major work.

3.3.4 Coding by category system

Before coding was started key words were defined that addressed the research questions and described the sub categories. On the basis of the preliminary system of categories, we referred the text bits (codings) to categories and sub categories with help the defined key words, using content analysis software MAXqda2 for the coding and the handling of the transcriptions and text bits. In total 1908 codings were made (table xy).

3.3.5 Review of category system

Throughout the coding process we inductively refined and extended the categories and sub categories where necessary, meaning where the existing sub categories could not be matched with new codings found.

3.3.6 Sorting and structuring

The high number of key words, categories and sub categories made a re-structuring and a sorting for relevance necessary. The order of the system was matched with the relevance for addressing the research questions. The total content needed multiple steps of structuring and sorting. We extracted the contents several times to bring them down to a readable length, filtering the main contents and codings that addressed the research questions to become as dense as possible. In total 215 codings (citations) were then displayed. Codings were selected that provided new information responding to the research questions and the category system. All stated opinions are included in the displayed citations with at least one display per opinion. This sorting process led to the final structure of the results presentation.

3.3.7 Summarizing and interpretation

The contents of the text bits were summarized as the basis for later interpretation within each category and sub category. Again, several loops of summarizing were necessary to reduce and compact the amount of data to a relevant and manageable depth that addressed the research questions sufficiently, without repetitions. Because all stated different opinions are included in each sub category, a measure was needed of how to come to general interpretations of results. In this case a general opinion was interpreted as such if at least half of the twenty interviewed persons stated to be of that opinion. Table xy presents the number of codings for the sub categories, and table xy shows the number of relevant citations selected and displayed from each interview.

3.3.8 Plausibility check

The interpreted results were checked for plausibility with results of other studies (described in the literature review) and with consistency of the theoretical concept of the method and of the research goals.

3.3.9 Validation with original material

Already in the process of sorting and structuring, the results were validated consistently with the original material. Some of the interview bits were repeatedly listened to, to validate the meanings and the personal expression of the interviewed person. In this last step, and after interpretation, we anonymized the codings in the final text by eliminating the original name of the interviewed ski area. Instead we added a short indicator to the end of the codings that consists of an internal reference number for the ski area from one to twenty and a combination of letters, describing the class of the ski area as shown in table xy.

For example, *S1shw* stands for the ski area with the internal number one that is of small size, high and world known. *S2bhw* with internal number two is big, high and world known. *S9sll* is small, low and of local importance. *S17gw* has a glacier and is world known. *S19bll* is big, low and of local importance. The short indicators are listed as well in table six. With this short indicator one can see from what class of ski areas the citation is derived from and thus value it in the right context. The internal reference number also guarantees a quick reference back to the original interview data.

4. Results

This chapter presents the results of the qualitative content analysis in eight headlined chapters matching the initial six supply side research questions and addressing the seven categories defined for the content analysis, as shown in table xy. The eight headlined chapters of presentation match key words included in the research questions for direct reference.

Table xy Research questions, categories and presentation headlines

Shown are the six initial research questions, matched by seven categories in the content analysis, and presented in eight headlines.

No.	Research questions	No.	Categories of content analysis	No.	Presentation headlines of results
1	How do ski areas perceive global change after their experiences of an analogue winter for future developments?	1	Description of facts about the ski area	1	Perceptions of global change after the analogue winter 06/07
		2	Experiences of global change after the analogue winter 06/07		
2	How vulnerable do they think they are, and which are sensitivity elements?	3	Estimation of general vulnerability	2	Estimation of general vulnerability
		4	Sensitivity elements	3	Sensitivity elements
3	How do they estimate their adaptive capacity, and what are their adaptation strategies?	5	Adaptive capacity	4	Adaptive capacity
4	What is the willingness for mitigation?	6	Strategies and action to cope with global change impacts	5	Strategies and action
5	Would ski areas believe and invest in sustainable ski tourism?			6	Willingness for mitigation
		7	Chances and sustainable tourism		
6	Where do ski areas see the need for action, and where do they see opportunities in global change?	7	Outlook on the future of the ski area and of ski tourism in general	8	Outlook and external support

Within each of the eight main headlined chapters, sub headlines are defined according to the finalized structure that came up during step six of the content analysis as described earlier, slightly differing from the initial set of sub categories. The sub headlines are formulated to summarize the main contents of these sections. Within these sub chapters the results are presented in altering segments of original codings of the interviews in *italic* letters – being citations – and our interpretive summaries of the citations. At the end of each main category we provide a summary in **bold** letters.

4.1 Perceptions of global change after the winter 06/07

How do ski areas perceive global change after their experiences of an analogue winter for future developments?

Climate change has been the focus of threatening ski tourism most. The unusually warm winter of 2006/07 proved that vulnerability means more than elevation, size of the ski area and snow making capacity. The customer did not know that skiing conditions were good in higher elevations – and the day guest stayed home. The media's commentary on this topic only worsened the situation. Climate change is not only directly affecting the snow conditions on the mountain, but also indirectly in a social way. Demographic, socio-graphic and socio-economic developments are interrelated problems and need to be taken into account more.

The reported losses of the winter 06/07 are especially high when compared with the winter before (05/06) because 05/06 was a record high in the last century in terms of sales and visitor numbers as stated by the interviewed ski areas. The comparison with a ten year average reveals a result of 06/07 of total sales that is about average.

In the winter 06/07 the higher ski areas clearly had the fewest losses if not even gains compared to the year before. The colder temperatures and sufficient equipment with snow making technique helped those high areas over the season. Still, losses were reported resulting from day visitors staying away because they did not know about the good conditions higher up. The lower ski areas had high losses and could not produce enough snow – either because of the warm temperatures or because there was not enough snow making equipment. Diversification in gastronomy helped to buffer the losses from missing skiers.

Perception of climate change

Climate change is not doubted any more. The scale of changes is unclear, though, for many of those interviewed. For lower ski areas the direct effects of climate change are among the biggest problems, especially because the costs for technical adaptation are getting too high. The higher ski areas come along with snow making so far, but understand the link to the indirect effects on losing customers in the source markets, something technical adaptation on-site cannot cope with.

Perception of demographic, socio-graphic and socio-economic changes

Indirect effects of climate change, such as demographic, socio-economic and socio-graphic aspects are seen as threats of higher importance than direct climate change impacts in the long term. People in the source markets lose interest in skiing, children are not taught skiing anymore by school camps or by their parents. Emerging markets are generally seen as a chance to equalize losses in the common markets. A fewer number of ski areas could lead to over-demand in the remaining ski areas.

4.2 Estimation of general vulnerability

How vulnerable do they think they are, and which are sensitivity elements?

Snow making proved to be the most valuable technical adaptation most invested in and centred on. Technical snow making is a must for conventional ski areas, and no such ski area can afford not having it. This kind of technical adaptation is limited in its potential, though, and will not prevent even the highest and biggest ski areas from further problems that actually may well become of even greater significance in the future. Higher ski areas foresee demographic and socio-economic changes already as a greater threat than the direct outcomes of climate change.

Vulnerability is perceived with big differences. On a scale of one (not vulnerable to global change) to ten (most vulnerable) ski areas estimated their vulnerability. The overview shows surprising differences where high and big areas, like St. Moritz or Sölden, guess their vulnerability with 5 and 7.5 out of 10 as higher than small and low areas like Toggenburg with 2.5 or Diedamskopf and Flumserberg with 3 out of 10 as shown in the table. The reported losses of the season show differences with the self-estimation of the ski areas. Eleven out of twenty ski areas or 55% estimate their vulnerability correctly compared with the actual losses of that year. Four ski areas or 20% overestimate their vulnerability; the losses of that season were less or even gains. Instead, they more so pointed out the demographic and indirect aspects as threatening most. Five or 25% underestimate their vulnerability; losses here were very high. These ski areas all guessed themselves at about three out of ten on that scale, but had losses between 20% and 40% (table xy).

Table xy Self-estimation of vulnerability and real losses in 06/07

Also shown are elevation, skier days and day guest percentage of interviewed ski areas.

	Self estimation of vulnerability to global change (1 low to 10 high)	Loss in 06/07 to 05/06 %	Estimation quality	Elevation min	Elevation max	Skiers days	% day guests*
Arosa	2,5	0,10%	about right	1750 m	2653 m	578.000	<10%
Davos	7,5	plus 4% (50%)	over (about right)	1194 m	2844 m	1.110.000	middle
Diedamskopf	3	40%	under	655 m	2050 m	220.000	high
Dolomiti Super Ski	5	0%	over	12 areas	12 areas	10.000.000	7%
Flumserberg	3	10%	about right	1200 m	2222 m	<1.000.000	high
Gstaad	6	24%	about right	948 m	2156 m	1.000.000	50%
Kitzbühel	4	21%	under	789 m	2000 m	1.550.000	20%
Les Arcs	3	2,50%	about right	1200 m	3226 m	1.618.905	low
Morzine/Les Gets	4,5	33,70%	under	900 m	2000 m	750.000	high
Orcieres	2,5	plus 0% (40%)	about right	1850 m	2725 m	<1.000.000	high
Planai & Hochwurzen	3,5	1,20%	about right	752 m	2000 m	1.000.000	15%
Scoul	3	8%	about right	1250 m	2783 m	400.000	low
Sölden im Ötztal	5	1%	over	1377 m	3249 m	1.430.000	5%
St. Anton am Arlberg	2,5	2%	about right	1304 m	2811 m	1.250.000	6%
St. Moritz	7,5	2,60%	over	1856 m	3057 m	1.300.000	low
Toggenburg/Wildhaus	2,5	35%	under	900 m	2262 m	350.000	65%
Val d'Isere	3,5	1%	about right	1850 m	3300 m	1.240.000	low
Verbier	1	plus 3%	about right	821 m	3330 m	> 1.000.000	middle
Wildes Kaiser/Brixental	3	20%	under	650 m	1892 m	> 1.000.000	20-25%
Zermatt	1	plus 10%	about right	1524 m	3899 m	1.368.000	low

* low, middle, or high % of day guests: exact numbers were not retrieved but estimated by the interviewed stakeholders

When we look at the correlation with the elevation, then the highest ski areas had the best results of that season, the lowest the highest losses. Surprisingly the underestimating areas are the lowest, smallest and have the highest dependency on day guests, thus objectively the highest vulnerability. Orcieres, owned by the investment group Remy Loisirs, is a ski area in high elevation that finished the winter with a small plus in sales. The other ski stations from Remy Loisirs are in lower elevations and report losses around 35% (table xy).

Ski areas in the lower elevations perceive the direct effects of climate change as the main threat. The lower the elevation, the more important is climate change. The losses of the last winter were highest there – despite of better knowledge these ski areas totally underestimate their vulnerability when asked. One must wonder if that is part of a strategy to deny the reality. The higher the elevation, the less climate change is perceived as a threat in its direct outcomes. Higher and bigger areas that might not suffer that much from climate change more so believe in demographic and socio-economic changes to be the main future challenges. The dependency on day guests proved to be a big problem, even for a ski area in a high elevation. Still, uncertainty of local differences is high.

Sensitivity elements

The interview partners named a number of elements affecting the sensibility of ski areas to global change in addition to general exposure by their elevation. Among the most important were aspects such as the dependency on the day guest, accessibility, competing sea tourism in winter and from new ski areas in emerging markets, water availability for snow making, costs of inflation and operations such as for energy, local communication and governance of the destination and the ski area, regulations, media and outreach to customers, the ratio of cold to warm to hot beds and the history of summer use in the destination.

4.4 Adaptive capacity

How do they estimate their adaptive capacity, and what are their adaptation strategies?

Major aspects of increasing adaptive capacity are more diversity of operations and in seasons, pro-active communication with the customer and the media, as well as strategic partnerships inside and outside the destination. Hereby, thorough market research and benchmarking of quality and services need to be improved. More data on the customer and more data on the outcomes of global change should help to decrease the uncertainty that makes adaptation even more difficult.

A *Model Europe* of ski destination and ski area governance is being described and shall be of strong future interest. The North American resort structure can serve as an example that needs to be adapted to the European conditions. We found the model of Dolomiti Super Ski as a good illustration in a more open direction of strategic partnerships on a regional scale that needs to be filled with solutions on a local and individual level. More diversification of the ski area operations and ownerships, and more partnering with the destination will be of key intrigue. A shrinking number of ski areas will result from a massive concentration process.

The international scope of this qualitative study reveals very little differences in countries. The Germanic speaking countries are very close and equal in their perceptions, opinions and strategies, as the interviewed ones in the Italian Dolomites are. In France, there are more varied opinions and more classic and conservative views on vulnerability and adaptation strategies. Classic alpine skiing remains the main focus. The French system of governance of ski areas by single companies with centralized steering as it is now may not be the model that copes best with the challenges.

The model of governance and local regulations affect the adaptive capacity of a ski area most. A *Model Europe* is needed in governing ski destinations successfully and sustainable into the future. The differences in the countries seem to reflect the market demand fairly well. Ski areas believe in the Germanic speaking guest to be more affinitive for sustainability and information or direct involvement while the Southern and Eastern European guests are much less affinitive. The French, Italian, Swiss and Austrian ski areas are noting these differences.

Technical adaptation

Snow making is the main kind of technical adaptation, applied in all interviewed areas with the goal of opening the ski area after 70 hours of snow making, independently from

natural snow occurrence. Water already is and will be even more the limiting factor for snow making, the construction of new water reservoirs part of the strategy. Landscaping is seen as an important cosmetic tool for optimizing the slopes.

Expanding is not only understood to move to higher elevations with cooler temperatures, but to gain in sheer size. Smaller areas might connect to bigger ones without the bigger ones necessarily supporting it financially if a sufficient size has been reached.

Behavioral adaptation

Behavioral adaptation opens up a whole set of different opportunities. Diversification is among the most important ones. Decreasing the dependency on the day guest, increasing the variety of activities in winter, increasing sales in summer and increasing the variety of operations and investments are strategies of choice.

The envisioned *Model Europe* of governance needs to support diversification and provide higher added value from tourists' expenses. Ticket costs will increase, communication and outreach have to be improved. Specific target group addressment, diversification and others cannot replace classic Alpine skiing. Subsidies and investors are needed to increase the capital on stock.

4.5 Mitigation

What is the willingness for mitigation?

Mitigation strategies help to buffer the speed and the strength of climatic change, lessen the ecological impacts and build up environmental awareness with customers. A social aspect of mitigation was mentioned in the interviews too.

The protection of the environment is valued as very important for customer satisfaction, for the success of the ski area and for Alpine tourism in general. Sound environmental management is seen as mandatory. Those who have no Environmental Management System in place, about two thirds, are planning or willing to implement one. Mitigation in the understanding of avoiding climate change was not stated by the ski areas, but rather in the avoidance of negative impacts on the local environment the customer could recognize. Contents of mitigation are understood differently. Most cannot imagine the tourist paying more for mitigation. Still, a fourth of the ski areas believe in or even have positive experiences with customers valuing mitigative efforts.

4.6 Chances and sustainable tourism

Would ski areas believe and invest in sustainable ski tourism?

The extended view on vulnerability and adaptive capacity opens up prospects too, such as developing new market niches and new partnerships. One example is the growing market of sustainable consumption, of going green. For a ski area this could open up new ways of operations, costs savings, efficiency, *soft* adaptation, of mitigation and new partnerships with the customer.

Sustainable tourism is a way of sustainable adaptation and a market of the future which ski areas will address. It is seen as a niche though for smaller ski areas and a complementary aspect for bigger areas on top of the basic services such as snow reliability, modern lifts and high quality ski runs. Sustainability as a strategic approach is

expected to become mandatory for ski tourism. The market potential for sustainable winter tourism offers at least in the German speaking outbound tourism market is existing (Luthe and Schläpfer, 2010).

Changes always inhabit chances, not only threats. Global change indeed opens up chances for ski areas. With hotter and drier summers the majority of ski destinations see chances for fostering summer tourism in the mountains. The lower areas might have more chances in summer because the green and sound landscape might attract more people than the harsh alpine zone. Ski stations in higher elevations see a chance for them in winter when the lower areas have to shut down, and the demand concentrates on a fewer number of higher areas. New technology, diversification and new target groups can be opportunities.

New markets in the East, more specific target group addressment – such as seniors – and summer tourism are examples. Summer tourism is expected to increase with lower ski areas having advantages here. Famous mountain scenery, prestige and image of the destination brand are important success factors. Sustainability is seen as a complementary market niche now, which will become mandatory for any destination in the future. In general, size, high elevation and diversification are seen as main factors of success, and, of course, technical snow making. The model of governance and local regulations need to support diversification and investments.

The quality of the natural environment is understood as important for customer satisfaction and thus for the strategy of a ski area. It is seen as a growing topic being worthwhile investing in. No one named sustainability or being green as a destinations' Unique Selling Proposition (USP) though. Asked more concretely, the majority agreed that sustainability can be a USP of a ski destination – maybe not the only one, but still a complementary part.

In sum the answer to the potential of sustainability as a USP is yes. All interviewed ski areas apart from one could imagine to actively participate in a club of sustainable ski destinations that develops and markets the topic of sustainable ski tourism. The content must be clearly worked out and communicated. One objective would be to learn from each other and bundle forces in research and marketing while developing individual profiles.

Those who inform themselves and who do their own market surveys agree with the potential of sustainability as a market. Even the biggest ski area aggregation Dolomiti Super Ski, would include these topics into its active marketing. The understanding of sustainability is mostly reduced to the ecological aspects though, and the social facets need to be developed. Economical topics are more understood as internal and not to be communicated.

Summary of results

The winter 2006/07 as the warmest in records so far (Beniston, 2007a) has shown that ski areas high in elevation and with sufficient snow making equipment can cope with the direct impacts of climate change quite well. Lower and smaller ski areas with less natural snow reliability and warmer temperatures preventing snow making in combination with less investment power suffer much more from direct climate change impacts. Losses in the lower areas range around 15% to 40%, in the higher from zero percent to three percent. Some of the high and big areas even had positive results with a gain of up to 10% relative to the season 05/06.

The main problem for the lower ski areas was the temperature – snow making often was not possible. The higher areas took advantage from spontaneous skiers who stayed

away from the lower ski areas. All ski areas believe in the advancements of technical snow making to cope with warmer temperatures as long as they can stem the investments – something that will be possible only for bigger ski areas and such with investors. In general, higher and bigger ski areas can be seen as less vulnerable to the direct impacts of climate change than lower and smaller ones. Losses of one to three percent in the higher areas still result in a lower cash flow of some million Swiss Francs or Euros. This cash flow is the guaranty for making new investments that are necessary for operations or for increasing the diversity.

Climate change impacts vary from place to place. Some lower ski areas might have completely reverse circumstances than generally expected.

Global change impacts, though, are much more interrelated, diverse, complicated and different in every locality. The factors making a ski area sensitive to changes are much more diverse than currently discussed. Higher ski areas expect the indirect and social aspects of global change to become a problem of greater importance in the future. The investigated season has shown a first taste of indirect impacts of climate change in the source markets and towns. The lack of snow or winter atmosphere where people live makes them forget about the existence and the beauty of skiing in the Alpine destinations.

Decreasing numbers of skiers cannot be tackled with technical adaptation. The limits of snow making have been experienced in the higher ski areas despite the overall good results. Water shortages are another limiting factor. Fewer skier numbers are expected in the future, due to a break in traditions of skiing and kids education in skiing, a lack of snow in the source markets, rising prices and many alternative competing activities. The influence of media and communication on the customer proved to be very important. The negative reporting of the press in the winter 06/07 led to a decline in day guests. Ski areas with high dependencies on day guests are thus more vulnerable than others.

Behavioral adaptations focus on diversification in many aspects. A targeted increase of overnight guest ratio demands for more bed capacity. Demographic and socio-economic developments lead to an increase in secondary homes or cold beds, to rising land prices and together with topographic constraints limit the bed capacity. Diversification in summer activities and in snow independent ones cannot replace the revenue of Alpine skiing. Events seem the only real option to generate the needed volume of clients. Concentration processes will carry on; small and low ski areas are expected to diminish. Partnering and aggregating is more important than ever.

However, opportunities are seen in specific target groups like seniors, in emerging markets, such as from Eastern Europe, and in summer tourism. Lower ski areas are expected to benefit more in summer. General key success factors for high adaptive capacity are the elevation, the size and the development space for accommodation. The model of local governance and regulations set the frame for any developments in the future, being it expansion plans, diversification or just the construction of water reservoirs.

A governance *Model Europe* is demanded that opens up new opportunities in investments and governance while sleeking the chain of added value from tourism spending – analogue to the North American resort model. The barriers in social networks within and beyond destinations are amongst the most important sensitivity elements determining the adaptive capacity; better partnering and participation of all stakeholders is a major task to decrease vulnerability and cope with environmental change.

Environmental performance is seen as a key success factor, sustainable tourism as a growing market that could become a niche for smaller ski areas, a complementation for big and high areas, and even mandatory for any ski area in the long term.

Vulnerability of ski areas to global change is more complicated and diverse than just the elevation, the size and the snow making capacity. The uncertainty in the knowledge and in forecasts of developments is high, as well as local and regional differences, and the many possible feedback loops affecting and changing the system. Every ski area is unique in its exposure, its sensitivity and its adaptive capacity.

5. Discussion

5.1 Perception and vulnerability

The perception of global change is high within all interviewed ski areas. Because the interviews of *this study* were held after an analogue winter for future developments (Beniston, 2007), the reactions and perceptions of ski areas probably were stronger and different in general, as opposed to interviews held after a rather *normal* winter in terms of snow cover and average temperatures. This circumstance leads to a high quality of the results for forecasting future developments, but the circumstances of this winter have to be kept in mind for making interpretations and conclusions.

Climate change is understood as the main threat, but the outcomes and the local and regional differences are often unclear. Abegg (Abegg et al., 2007) discovered that 70% of the ski areas in Switzerland feel well informed about climate change. Smaller ski areas are rather insecure with the outcomes of climate change, although Wolfsegger showed that a clear majority of managers from lower ski areas in Austria expects at least some substantial changes from climate change (Wolfsegger et al., 2008). Here, still one-fourth believes the climate to remain stable with a majority expecting more extreme weather events, which was reported in our interviews too. The high insecurity of especially lower ski areas is confirmed by Roth (Roth et al., 2008). Here only about fifteen percent feel secure enough about future global change developments to plan strategically ahead.

A minority of the higher and bigger ski areas interviewed understand climate change as the main threat. Demographic and socio-economic changes as another facet of global change are seen as even more important by the higher areas who proved to outcome direct climatic problems with technical snow making in the winter 2006/07. In Roth (Roth et al., 2008), economic and demographic problems are seen as the main threat of the future followed by climate change.

The indirect outcomes of climate change on the sensibility of the guest in relation to his preferences and demand could just have been guessed in their future potential with more severe winters like 06/07. The guest did not have a sense of winter because of the lack of snow in the source markets, in the low lands and close to the cities. More than ten years ago, Abegg (Abegg, 1996) found out that about 60% of tourism officials in the Swiss region, Bünden, believed that three winters with little snow lead to more sensitivity in this topic. Abegg discovered that technical snow is limited in its adaptation potential to the ski area itself and cannot help in the source markets and in the minds of potential customers. People have to know about it; they have to be reached with this message. These quantitative results confirm our findings.

The dependency on the day guest who reacts spontaneously and is most affected by the media is understood as a sensitivity factor, related to the ease of access. This leads to the

goal of more overnight guests and more warm beds. The development in many destinations is opposing that because an increasing number of secondary homes are being built. They count as cold beds and increase land prices for local inhabitants. They cannot afford living in the destination anymore, and in off-season and summer the destination is rather *dead* – being contra-productive for summer tourism. Diversity is a key vulnerability factor seen by the ski areas. The goal is to increase summer sales and decrease winter dependency. In summer the unique ideas are absent, looking for offers to the customer that no one else has. Wolfsegger (2008) found out too that diversification is among the most important kinds of behavioral adaptation in Austrian ski areas, as well as in German ski areas (Roth et al., 2008).

The added value in the ski tourism service chain is low for the ropeways companies compared to the high one for gastronomy and hotels. The less diverse the operations of a ski area are, the higher the vulnerability becomes. The winter 06/07 showed that the gastronomy could benefit from the milder weather when visitors skied less but instead spent more money for food and for going out. This saved some ski areas in Davos, Arosa or Orcieres from more substantial losses.

The vulnerability of ski destinations is complex and interrelated. We have to take many more variables into account when guessing which destination will suffer and which one will profit from global change, not only from climate change.

5.2 Adaptive capacity

Ski areas mainly believe in technical snow making as the most effective kind of adaptation to climate change, and thus think that climate change inside the ski area is manageable to a certain rise of temperature as confirmed by results from Roth (2008), Abegg (2007) and Wolfsegger (2008), also Huttner (2008). Only water availability and energy prices will become the main limitations of snow making. If the temperature rose even further, then society would face other more important problems than not being able to technically adapt anymore.

In addition to this classic technical adaptation, ski areas try to invest more in co-operations, in diversity of activities in winter and in summer, as well as in diversity of operations. Some classic ski stations in France still focus mainly on the classic market of Alpine skiing, although a tendency toward more diversity was observed. Ski areas can significantly increase their added value if they own gastronomy. Partnering within the destination and with other ski areas is becoming more important. The Swiss ski areas are reacting in this manner (Abegg et al., 2007), and in Italy and Austria we found a similar attitude. Wolfsegger (2008) reports similar results from Austria, Roth from Germany (2008).

Higher ski areas see themselves in a winning position, benefiting from climate change, which is expected to weaken the lower ski areas and decrease their numbers. A similar result is reported by Abegg (2007). The lower ones also see their chances as rather positive because of technical adaptation. Still, some higher areas could imagine too much demand becoming a problem if the reputation of snow guarantee and a smaller number of ski areas in total focused and channelled the crowds into these higher areas. A significant decrease in customer demand is not expected by Austrian and German ski areas (Roth et al., 2008, Wolfsegger et al., 2008).

Adaptive capacity is not only or mainly made by the elevation and the size of the ski area, although these are and remain two very important aspects. But the system of adaptive capacity is quite complex, and the high number of vulnerability factors indicates how many responses there are.

Summer tourism is seen as an opportunity, especially for the lower ski areas that have a mellow and a greener surrounding than the harsh, high Alpine environment of the higher ski areas, thus being more attractive in summer. It proves to be illusionary to increase sales in summer in the ski area to regain the losses from winter or to become an alternative to winter. One should try to imagine a ski area in summer with about 30'000 hikers and bikers on a single mountain who all take at least ten ascents and descents. Events, though, are an alternative to reaching higher numbers of customers any time of the year. Events in their potential variety also work to target very specific clients and to form a reputation. Abegg (2007) reports the same importance of events in the diversification process of ski areas.

The natural limits of the natural environment just make the same revenue from a summer guest not possible, not even taken the discrepancy in the carrying capacity of the mountain environment into account. It is thus only possible to see the destination as a whole in four seasons – so better partnering is the key.

The dependency of the destination from the ski area in winter and the need of support for the ski area by the destination in summer is a given relation that needs equalizing. We therefore see partnering in the destination as one key to increase the overall adaptive capacity. The Swiss and the Austrian ski areas understand partnering and aggregating as very important means of adaptation (Abegg et al., 2007, Wolfsegger et al., 2008).

5.3 Strategies and management

We discussed snow making as the main adaptation strategy with its limits in finances, water supplies and from a mental and legal perspective. Climate change is not the only threat ski tourism has to face. The public discussion focuses on snow making adaptation to climate change, but ski areas need to do more to cope with all aspects of global change. The Swiss ski areas expect behavioral strategies to become more important (Abegg et al., 2007) as well as the German ropeways companies who as well see mitigation to be of more future importance (Roth et al., 2008). Mitigation and efficiency measures so far had not been in the focus of ski tourism. Rising energy costs and public awareness, as well as lack of alternatives, especially for the lower and more suffering ski areas is now leading to an increasing interest of stakeholders in mitigation. Mitigation will be applied more by the Swiss ski areas too (Abegg et al., 2007). Still, the small share of the ski area emitting the greenhouse gas CO₂ (about 3%) on the total emissions of an average weekly ski vacation, make it clear that effective mitigation is only possible when all stakeholders partner and work together. Transportation and travel make up about 70%, lodging and gastronomy about 25% (Mountain Riders, 2007).

The aspects of involving the customer more, of investing more into customer relationship management and partnering better with the customer are among the planned options.

5.4 Communication and media

The losses of the season 2006/07 were highest in the low resorts because of little snow making equipment and too warm temperatures. Some higher resorts still had losses, and despite good skiing conditions, the customer did not know about it. The media informed the public about climate change and the catastrophic winter in a narrow focus. They even looked for bad stories of closed ski areas. This kind of reporting was the biggest problem for ski areas in that winter.

Similar perceptions are reported from German tourism stakeholders (Huttner, 2008). Ski areas plan to invest more resources in the future into media work and marketing.

More advertisements will be planned for as well as an *emergency plan* if conditions demand for it. Ski areas agree that the negative publicity of that winter 06/07 must not happen again. Kitzbühel started to actively advertise with snow guarantee by technical means the winter after, in 2007/08. Ski destinations will have to enlarge their marketing budgets and communicate more actively, not letting the media control the message alone.

The bigger Swiss ski areas will market snow guarantee and snow making in the future (Abegg et al., 2007). More control and a direct connection to the customer are essential. Costs of advertisements are high, though, and ski areas will have to partner with the destination and with other ski areas and destinations to generate the marketing power needed. It seems that the model of Dolomiti Super Ski, where the destinations remain individual but the marketing and the communication are done jointly, works well in these aspects. Still, the uncertainty in the interplay of media and public awareness has to be taken into account as discussed in chapter two.

5.5 Partnering with the customer

Ski areas describe their customers as becoming more demanding in quality, service, safety and more information. The day guest is very spontaneous, deciding where to go and what to do. The overnight guest shows a tendency of this behavior too. He used to buy a multiple day ski pass for the time being in the destination. Increasingly, the overnight guest now decides daily what he does, if he buys a ski ticket or not. This has a positive side and a negative one. It is positive when the customer remains in the destination if there is no snow or bad conditions to participate in alternative activities. It is negative when he does not buy the multiple day pass in advance anymore but rather single day tickets for more flexibility.

Offering more flexible ski passes that are transferable to summer and remain valid for the whole winter could be one option to give the customer the feeling that it makes sense to buy a pass for the full stay because on a bad day it is not lost. Ski areas believe in this as being a possibility in marketing because only a minority would then actually come back and use the passes that are left. Once the cash is in the company the goal is reached.

So addressing the right kind of customer in the proper manner is key. Offering more flexibility, more quality and service in general, are goals stated by the ski areas. More marketing is a main strategy of Austrian ski areas too (Wolfsegger et al., 2008). In-house training is another key issue. Ski areas admit that, for example, in the topic of ski area management reactions to global change, the staff would not be in best position to answer customers' questions. That of course would be helpful in case of customers demanding this information. Constant market research and staff training are necessary. In the interviews we examined the need for more data on the customer and a lack of data, of experiences and tools in benchmarking and evaluation.

5.6 Sustainable tourism

The quality of the environment is understood as a key performance and success factor of ski areas, more so in the summer than in winter. The majority sees a chance in marketing a higher environmental performance. Only one French company owning six resorts believes it to be more of a temporary fashion. The majority would be interested in developing a better environmental performance and also in marketing it, thus becoming part of a possible sustainable ski area aggregation.

Ski areas understand sustainability as a general improvement in quality and service, as well as environmental. Some would even go so far as to see ecotourism as a possibility

for a niche market of small ski areas. Ecotourism does not fit for the larger ones needing the masses of people. Most believe that a USP in sustainability would work, but only as complementary to others, not the main or sole one. Smaller ski areas could develop it as a niche market; for bigger ones it would be a mandatory issue they had to include anyway. Abegg and Roth report that Swiss ski areas, especially the smaller ones, as well as German ski areas, will market sustainable tourism more in the future (Abegg et al., 2007, Roth et al., 2008).

We should wonder now what the market actually demands in terms of sustainable consumption. What is the demand of skiers for ski areas that find a more sustainable way of adaptation to global change? Does it match the expectations of the tourist stakeholders? The market of sustainable consumption, in general, is growing rapidly as discussed in chapter two. If this were the case in ski tourism too, then the willingness of ski areas to target this market more should reflect it. In chapter five we will test the actual market demand for sustainable ski tourism.

5.7 Uncertainty – global change and the future customer

The uncertainty of future developments is reflected in the interviews. The outcomes of global change are anticipated, but how strong and how fast, and in what varieties they will hit the ski destinations is unclear. The smaller ski areas in Switzerland, Austria and Germany show a higher uncertainty (Abegg et al., 2007, Roth et al., 2008, Wolfsegger et al., 2008). The demand of the customer is hard to predict, but a general trend toward more spontaneity is felt, which even makes it more difficult to foresee the specificity of the customer.

Greater knowledge of the market, of the unpredictability of society and certain target groups could be better understood to help manage uncertain changes. In terms of climate change, there is uncertainty about the various studies published, the vast variety of information, and especially local differences in forecasts. Though managers often do not have time, more detailed, local climate studies and informative support with difficult scientific questions, could help to decrease uncertainty, also reported from Huttner (2008).

5.8 The European Model of governance - the destination and the ski area

The destination as such cannot be seen separately anymore from the ski area, nor the ropeways company, and will have to grow together much more. Combining small ski areas with bigger one has advantages in operations, in management, in marketing and also in customer demand. During the interviews we learned that communication inside the destination and especially between the ski area and the rest of the destination, in most cases is problematic. Often goals, target groups and USP differ like the strategies do.

Huttner (2008) describes the same problem. The ski areas seek to address masses of people all paying the same price for a ticket – the kind of customer is of secondary interest. The hotels and the gastronomy rather seek the well-paying guest in a lower volume, the added value then being higher. Controversial goals are problematic. Partnering inside the destination with the ski area is a key performance factor. If, for example, a ski area seeks to target a higher standard of quality and services, but the destination cannot keep the same standard the ski area does and vice versa, then it will be difficult to reach such a standard. Wolfsegger reports partnering and becoming a member of agglomerations as a main strategy of Austrian ski areas (Wolfsegger et al., 2008). Diversification and investments are followed easier if the gastronomy sector and

the hotel sector become involved more in the ski area and the costs of adaptation and mitigation – reported from Wolfsegger and named the *Model Europe* in our interviews. Partnering is crucial and more communication and participation are necessary. The social construct of the destination is prone to preferences of individuals.

If people cannot work together on a personal level this may affect partnership opportunities. The majority of interviewed areas would welcome a model of governance that is close to the North American resort system, where one company owns the ski resort, ski schools, sports shops, gastronomy and hotels. That would be the most adaptable model to cope with changes. Because of traditional developments and the structure in the Alps, such a model will most likely not be possible in Europe. But some elements of it can be applied, and ski areas already walk the path in that direction.

Dolomiti Super Ski seems to be a well working example of a *Model Europe*, just as some called the model the Alps needed and could obtain. Each destination keeps its individualism, its identity and its freedom to act locally and close with the customer. The strength in communication and strategies on a larger, regional, national and international scale are achieved jointly in the marketing aggregation of Dolomiti Super Ski. This group functions as a mediator, a communicator between all the different destinations sharing at least one common goal and USP: the Dolomites.

Still, on a smaller scale, the individual destinations need to work out ways to incorporate the many different stakeholders and the patchwork of landowners and ski lift operators

There are many examples of the necessities for a model of governance that is meant to partner. Customer Relationship Management bonus card systems, for example, only work if all stakeholders partner. The management of day and overnight guests is strongly interrelated between the ski area and the village.

Despite the different existing models of governance, there is a trend of becoming a member in many different marketing groups or other aggregations of ski areas and destinations for diverse reasons. Partnering is understood as important and will become of even greater future importance.

6. Conclusion

The results of this large qualitative survey of experiences and strategies from tourism managements in 20 destinations accounting for 35 ski areas in four Alpine countries show the complexity, variety and uncertainty in understanding vulnerability and responding to environmental change. They open up new questions that have to be looked at in more detail. The current focus on climate change and technical adaptation needs to be extended to socio-economic changes and behavioural adaptation, as well as mitigation.

In the discussion of *losers* and *winners* the highest ski areas – seen as *winners* – will suffer and lose in the long term from socio-economic and demographic developments as well as from indirect climate change impacts. Other vulnerability issues are, for example, the changing topography from glacier and permafrost melt with rock movements and a changing pitch resulting in more concave shapes of slopes. This would then require changes in topography of the whole ski area. More research should centre on this topic.

The management of uncertainty and an according model of governance, as well as a closer look into the emerging Eastern European and Asian markets, are proposed areas of future research.

We need to take a closer look into the social construction and the social networks inside tourism destinations and beyond to better understand the patterns of power sharing, and to find the linkages to change the system. Partnering of stakeholders is crucial to develop new governance models that allow for higher resilience to changes.

A focus should be more on the demand side too. Assumptions are often made based on what the product is and how it can be sold best. Tourism stakeholders should start again looking at the demand side more, understanding what is required, and then design the tourism service product accordingly. Maybe the customer is much more willing to adapt his preferences to changing services by becoming more involved and being part of the outcome of global change? In that case, much less effort in terms of costly technical adaptation would be necessary that seclude many smaller and lower ski areas. Adapting to changes could imply to mitigate and partner with the customer better who then adapts his behavior to changing services – which would then be a win-win situation.

Given the complexity and uncertainty of developments and the diversity of possible adaptations, the interviewed ski areas communicate a very clear demand for external support, be it more in general to not becoming *blind* for the own organization or because specific knowledge or manpower is missing internally. This demand confirms and reflects the problems ski areas have and the general market development. Specific aggregations for that purpose could help addressing these needs. In general each destination and each ski area is very different and unique. There are many strategic aspects that can count for in general, but solutions will have to be found on an individual basis. This situation opens up new fields for research, consulting and development support.

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