When the Snow Stops:
How Climate Change Impacts
Alpine Competitive Advantage and Innovation

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"Don't mistake goals for strategy. Many bad strategies are just statements of desire rather than plans for overcoming obstacles."

- Richard Rumelt

Author of Good Strategy/ Bad Strategy and Finalist at Financial Times & Goldman Sachs Business Book of the Year award for 2011

Acknowledgements

Imagine.

If someone had told me after my high school graduation eight years ago, that I would travel to over twenty countries, work and study in eight different economies and live in five vibrant places, I would not have dared to believe them. This exciting journey has culminated over the previous two years with my Double Degree Master Program at Católica Lisbon School of Business and Economics and Smith School of Business at Queen's University in Kingston. I would like to express my deepest gratitude for the opportunity to flourish at these institutions. This unique experience has made me realize once more that I can learn from every single encounter, appreciate how precious the world is, and that it is up to us to preserve it.

Personally, I have experienced some of the most valuable and fun moments with friends and family in the Alps. Thus, I hope I can contribute with my thesis to enrich the knowledge of resort executives and help them to calibrate business interests in times of global warming.

Challenge accepted.

In the past two years, I have studied at two prestigious Master Programs, worked part-time and consulted a NGO on voluntary basis – all at the same time. I was exposed to some of the smartest minds of our generation and competed with and against them. We challenged and learned from each other, but most importantly we had fun all along the way. There are certainly restrictions to what one can achieve alone, but together there seem to be no limits.

Life is a joke.

To all the people that made the past two years so valuable in their own ways, I would like to thank you all. However, there are some folks I would like to point out. First, I would like to pay my special regards to Prof. Peter Rajsingh, who has not only been a great thesis advisor, but also an entertaining, supportive and motivating companion besides. For my time in Lisbon, I am indebted to the "Tequila Crew" for all the fun nights and trips around the country. In Canada, I want to thank the "MIB Elite" for all the great times in Kingston and at the weekend cottages. Also, I would like to thank "Team Fadler", who make coming home so easy, entertaining and fun. Most importantly I would like to thank my grandparents and above all, Mama und Papa for their unconditional support.

Abstract

Title: The Ski Industry and Climate Change – How Ski Resorts Can Ensure Sustainable Competitiveness

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Every year, over 130 million people go on ski vacations worldwide. Half of them visit the biggest skiing hotspot in the world – the Alps. However, climate change now poses a significant threat to prosperity and income there, as winters are becoming shorter, infrequent and less reliable. By the end of this century, 70% less snow is projected for altitudes below 1500 m. This thesis discusses how executives assess exogenous threats, particularly the risks from climate change, and provides action plans for high and low altitude resorts to remain profitable. A quantitative survey across potential tourists and eleven semi-structured interviews with industry experts and resort executives served as primary research to enrich current knowledge.

Interviews revealed that when executives have high conviction about climate change, their product offering becomes more diversified making the resort more resilient to threats. Yet, destinations universally invest in snow production equipment. Alpine tourists, including current non-skiers, show ongoing interest in skiing activities, so this is an expedient investment. Nevertheless, climate change creates a disparate impact for ski resorts. Low altitude resorts will struggle to remain profitable as costs for technical snow production rise with every increase in temperature. Thus, they should maintain some ski alpine offerings at higher elevations and invest in novel markets with additional attractive activities for resorts at lower elevations. High altitude resorts will profit from climate change, as tourists will retreat to snow reliable resorts. Hence, these resorts should maintain sustainable competitive advantages by investing in snow reliability, accommodation capacities and infrastructure.

Key Words: Winter Tourism, Ski Tourism, Exogenous Threats, Climate Change, Strategy, Innovation, Novel Business Models, Sustaining Competitive Advantages

Sumário

Título: A Indústria do Esqui e as Alterações Climáticas - Como Podem as Estações de Esqui Garantir uma Competitividade Sustentável

Autor: Felix Michel

Anualmente, mais de 130 milhões de pessoas saem de férias de esqui em todo o mundo. No entanto, as alterações climáticas representam, agora, uma ameaça significativa à prosperidade e ao rendimento do local. Até o final deste século, as projeções apontam para uma redução de 70% da neve para altitudes abaixo de 1500 m. Esta tese examina como os executivos avaliam as ameaças exógenas, particularmente os riscos das alterações climáticas, e apresenta planos de ação para que os resorts de alta e baixa altitude permaneçam lucrativos. Uma pesquisa quantitativa com mais de 300 respostas de potenciais turistas e onze entrevistas semiestruturadas com especialistas do setor e executivos de resorts serviu como pesquisa primária.

As entrevistas revelaram que, quando os executivos têm grande convicção sobre as alterações climáticas, a sua oferta de produtos torna-se mais diversificada, tornando o resort mais resistente às ameaças. No entanto, as mudanças climáticas criam um impacto díspar para as estações de esqui. Os resorts de baixa altitude vão ter dificuldades em permanecer lucrativos, pois os custos para a produção técnica de neve aumentam a cada incremento de temperatura. Assim, eles devem manter algumas ofertas de esqui alpino em altitudes mais altas e investir em novos mercados com atividades atraentes adicionais para resorts em altitudes mais baixas. Os resorts de alta altitude vão beneficiar das alterações climáticas, pois os turistas vão retirar-se para resorts de maior fiabilidade de neve. Portanto, estes devem manter vantagens competitivas sustentáveis investindo na confiabilidade da neve, capacidade de acomodação e infra-estruturas.

Palavras-chave: Turismo de Inverno, Turismo de Esqui, Ameaças Exógenas, Alterações Climáticas, Estratégia, Inovação, Novos Modelos de Negócios, Vantagens Competitivas Sustentáveis

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List of Abbreviations

AUT	Austria
BENELUX	*Geography:* Belgium, Netherlands and Luxembourg
BN	Billion
CO2	Carbon Dioxide
C	Celsius
CM	Centimeter
DACH	*Geography:* Germany, Austria and Switzerland
°	Degree
€	*Currency:* Euro
E.g.	Exempli Gratia
GDP	Gross Domestic Product
GER	Germany
GFC	Global Financial Crisis
ITA	Italy
K	Thousand
KM	Kilometer
M	Meter
Mio	Million
%	Percent
RQ	Research Question
SARS-CoV-2	Severe Acute Respiratory Syndrome Coronavirus 2
UNWTO	United Nations World Tourism Organization
UK	United Kingdom
USP	Unique Selling Proposition
WBT	Wet Bulb Temperature

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1. Introduction

Fresh air, breathtaking scenery, a snow-covered hill and sunshine - this is the dream for over 130mio active skiers worldwide, who contribute to over 350mio ski visits every year (Vanat, 2019).

Three out of four ski vacations worldwide occur in the well-known ski resorts of Western Europe or North America. The alpine region represents the most popular ski destination of the world, capturing almost half of all ski visits[1]. This makes it a significant contributor to local GDP. As a tourist destination, the Alps generate annual revenues of over 50bn €, of which more than half comes from winter and ski tourism (Alber & Urbanc, 2011). Considering indirect effects of the winter tourism industry, the contribution to GDP can be as high as 14.8%, as it is the case in Austria (Laimer et al, 2013).

The winter tourism and ski industry are strong drivers of the economy and create employment in the alpine region. But the industry is vulnerable to exogenous shocks. Since the pre-industrial era, the mean global temperature has risen by 1.1°C. With a rise of 1.8°C, the effect was almost twice as strong in the Alps (IPCC, 2015). This rise in temperature endangers the key non-substitutable asset of the alpine region and winter tourism – sufficient snow coverage. Scholars unanimously agree that the natural snowline is moving up in altitude, specifically 150m per 1°C temperature rise (Föhn, 1990). In general terms, the winter season will shorten every year and snow coverage will continue to be less frequent and less reliable. Agrawala and the OECD (2007) conclude that natural snow reliability will differ among the northern and southern side of the Alps. They state that the northern rim will be snow reliable above 1050m, while the southern side requires a minimum altitude of 1500m to be snow reliable. Ultimately, this poses threats that have a disparate impact on ski resorts in the Alps. Low altitude resorts are stronger affected than high altitude resorts and the northern region faces less challenges than the southern region.

Most resorts have taken countermeasures to ensure sufficient snow conditions for skiing, mostly by investing in snowmaking facilities. Driven by investments with up to 20% of revenues, more than half of all ski runs are equipped with such technology in Austria alone (FSÖ, 2007; Steiger & Abegg, 2013). However, the technology is increasingly reaching its limitations. The warmer it gets, the more snow has to be produced artificially – and that at higher ambient temperatures.

[1] Ski visits relate to all alpine downhill activities, including snowboarding and telemark skiing as well.

Costs for snowmaking increase disproportionally under warmer temperatures (Abegg, Bürki & Elsasser, 2008). Scholars expect temperatures to continue to increase. Accordingly, they raise the question of the viability of the technology in the future. In addition, the winter tourism industry has reached a level of maturity, as strong cohorts quit the sport and younger generations cannot fill the vacuum (Vanat, 2019).

In conclusion, ski resorts will struggle to operate throughout an entire season, because snow becomes a scarce and unreliable asset. Technical snowmaking can counter this development successfully, but only to a limited extent (Steiger & Abegg, 2013). Hence, marginal costs for resorts will rise, while they face fierce competition over a shrinking market potential. Therefore, the winter tourism industry follows a typical S-curve pattern, described by Christensen (2008). First, they developed from a farming region to a tourist destination. By investing in cable cars and lifts, the alpine region attracted tourists. Over time, the benefits of that plateaued and new investment in artificial snowmaking and new lifts were made. These benefits start yet again to plateau and destination executives must find novel ways to innovate their offering.

Experts advise high-altitude resorts to invest in sustaining competitive advantages. These resorts will generally benefit from global warming, as tourist will move from low to high altitude destinations. Alternatively, experts suggest low-altitude destinations to diversify their offering and attract a new clientele, respectively the vast untapped market potential of non-skiers.

Skiing and winter tourism is about passion and emotions. When people care deeply about something, they are motivated to act accordingly, often basing action upon desired outcomes rather than on empirical data and facts. Consequentially, it becomes imperative to follow Rumelt's (2017) advice. To apply good strategy, destination managers must face the challenges at hand objectively and assess the likelihood of welcome and unwelcome events alike.

While Rumelt (2017) argues, that good strategy requires the consideration of all possible events, Taleb (2007) counters that this is simply not possible in all cases. According to his notion of a "black swan" or tail event, certain eventualities are thought to have very low probabilities and, consequently, are not foreseen nor prepared for based upon the historical information available. Yet, the consequences of such an event are high. The virus SARS-CoV-2, better known as COVID-19 or Corona virus, is being called a black swan event and has caused shocks for the global economy. Ski resorts in the Alps have not been spared. Some resorts even accelerated the spread of the virus, as many people coming together in a small resort area became infected

and carried the disease to their home locations (Dahlkamp et al, 2020). The 2019/ 2020 season had to stop early this year. The economic damage of this has been life threatening for many resorts. Future losses of revenues are still hard to predict, as well as the reputational damage for resorts.

This thesis aims to close an identified gap in the literature and will evaluate the sensitivity of resort management teams towards current threats, mainly global warming. It seeks to outline current measures taken and to identify possible inappropriate investments, based on semi-structured expert interviews of destination managers across the Alps. The thesis will develop short, medium and long-term action plans for winter tourism destinations, backed by a quantitative survey among winter tourists. This study encourages managers to combine business efforts based on well-known innovation and strategy scholarship with traditional destination management.

The thesis starts by summarizing current knowledge about climate change and the effects on snow reliability, as well as outlining the economic relevance and current performance indicators of the industry. The literature review concludes with a set of recommendations for high and low altitude resorts. After an explanation of the research methodology, the thesis describes the findings of the interviews and survey. The research questions will be answered before the thesis concludes by stating all findings and outlining limitations.

Temperatures in the Alps will increase by another 1, 2 or 4°C until the end of the century (Steiger & Abegg, 2013). In the worst case scenario of 4°C, only 19% of all alpine ski resorts would remain snow reliable – even with 100% coverage of snowmaking facilities. Therefore, the potential economic loss of the entire industry amounts to several billion euros. The industry has to reconsider business models and turn away from the *status quo*.

2. Literature Review

2.1. Structure

Climate change poses threats that have disparate impacts on ski resorts in the Alps. Scholars highlight the impact of global warming on the alpine region and the effects on natural snow reliability. Many resorts try to counter these effects with snowmaking technology. Over the past two decades, scholars have researched to what extent current technological solutions can be effective. As winter tourism represents a significant contribution to local GDPs, experts have gathered data to quantify the economic power of the industry. They then developed frameworks to distinguish between good and bad winters for ski destinations. Furthermore, generic recommendations for high and low altitude resorts have been collected and summarized.

2.2. Climate Change and Natural Snow Conditions in the Alpine Region

Since the 1880's, the global average temperature has risen by 1.1°C, which is mainly due to a human-caused rise in atmospheric levels of CO2. However, the impact on regions varies heavily. Global warming has severely hit the Alpine region with an increase in temperature of 1.8°C. Since the 1980s alone, average temperatures have climbed by 1°C with strong fluctuations per season. Researchers are certain mean temperatures will continue to rise until 2100 and beyond, but they cannot predict the extent given that CO2 emissions drive global warming. Climate policy will determine how far temperatures will rise (IPCC, 2015).

Back in 1990, Föhn highlighted that for every 1°C increase in temperature, the natural snowline will move up by 150m in altitude, which Haeberli and Beniston confirmed in 1998. IPCC further states that the snow season shortens at least by five days every ten years (2015). As a result, by the end of the century, 70% of the natural snow mass below an altitude of 1500m will vanish at current levels of greenhouse emissions (SLF, 2020).

However, besides a rise in temperature, other factors influence snow reliability in the Alps. One important aspect is the direction the mountainside faces. Mountains oriented north are less exposed to sunshine and therefore more snow reliable (Alber & Urbanc, 2011). In addition, climates across the main alpine divide differ. The Atlantic influences the northern regions, while the Mediterranean has an impact on the southern regions. Consequentially, the south

suffers a bigger impact from global warming and higher mean temperatures (Steiger & Stöttner, 2013).

Over the past 25 years, numerous scholars have researched snow reliability in different regions of the Alps. Abegg and Koenig (1997) stated that the Swiss mountains will see increasingly frequent delays in the first snowfall and a shortening of the snow-covered period. With current emissions, snow conditions would only reliably exist from an altitude of 1500m upwards. Later, Abegg (2011) confirmed his previous findings and extended them beyond Switzerland to the total alpine region. Agrawala (2007) et al outlined three different scenarios, in which the mean temperature in the Alps would rise by 1°C, 2°C or 4°C, depending on the level of greenhouse emissions by the end of the century. The natural snowline will therefore rise by 150m, 300m or 600m respectively.

Agrawala (2007) concludes that the northern regions of the Alps will only be snow reliable from an altitude of 1050m upwards, while the southern region will be snow reliable from 1500m upwards. Gonseth (2013) adds that the Suisse Alps will be least affected by global warming, due to their high average altitudes.

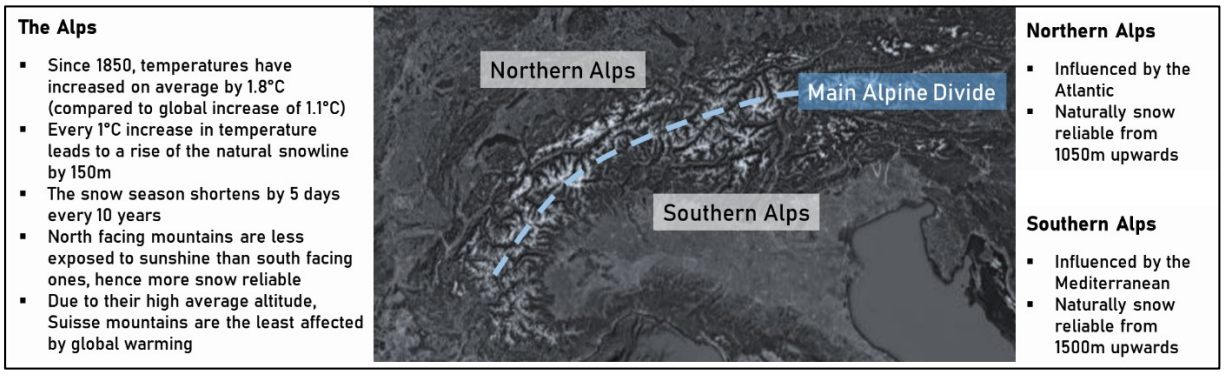

Figure 1: Overview of the Alpine region and the effects of climate change (authors own, 2020)

In summary, most scholars have limited their research to a specific alpine region. Nevertheless, they present similar findings (see Figure 1). Within this century, mean temperatures in the Alps will continue to rise, which leads to a lower natural snow reliability. In general, the winter season will shorten and snow coverage will be less frequent. Experts struggle to determine the exact extent of global warming in the Alps, as this will depend on future greenhouse emissions. Regardless, they agree that the northern region will face fewer effects than the southern alpine part. Climate change leaves stakeholders in tourist areas in a state of uncertainty and ambiguity. However, as scholars unanimously agree on future developments, stakeholders operate within a set of "discrete alternate futures" (Courtney, Kirkland &Viguerie, 1997). Meaning, the effect of global warming on the Alps is certain, but the exact consequences still require elucidation.

Hence, Courtney, Kirkland and Viguerie (1997) recommend outlining the alternate futures and assessing the likelihood of each scenario. In addition, destination managers should utilize classic decision-analysis frameworks to evaluate the risks and returns of each possible scenario and action.

2.3. The Impact of Snow Making Technology to Counter Climate Change

The natural snowline keeps moving higher in altitude due to global warming. Snowmaking technology enables ski resorts to improve snow conditions. Artificial snow production helps operators to move the snow line from a natural to a technological snowline downwards. At perfect temperatures of -5°C, snowmaking machines can produce 10cm of snow per day, spread over a ski run (Steiger & Abegg, 2013) [See Appendix I for snowmaking technology]. Resorts have made significant investments in snowmaking machines and the necessary infrastructure. This includes vast water reservoirs, as well as cables and drains across the mountains. Austria has the most sophisticated infrastructure of snowmaking technology. Approximately 70% of all slopes are covered (WKO, 2019). Austrian destinations reinvest 20% of their revenues directly into snowmaking facilities every year (Steiger & Abegg, 2013).

These investments seem to pay off. Steiger and Abegg (2013) researched the extent to which snowmaking technology can improve snow reliability in three temperature increase scenarios - 1°C, 2°C and 4°C. They developed SkiSim2.0, a simulation that compares the share of snow reliable ski resorts with and without snowmaking facilities in the Alpine region of Austria (see Figure 2). The simulation function presumes current snowmaking capacities. Under current temperatures and emissions, 69% of ski resorts are snow reliable, which rises to over 90% with snowmaking tools. In the 1°C scenario, 52% of resorts are naturally snow reliable and 81% can be technically snow reliable (see 2.4 for definition of "snow reliability"). In the 4°C scenario, the numbers

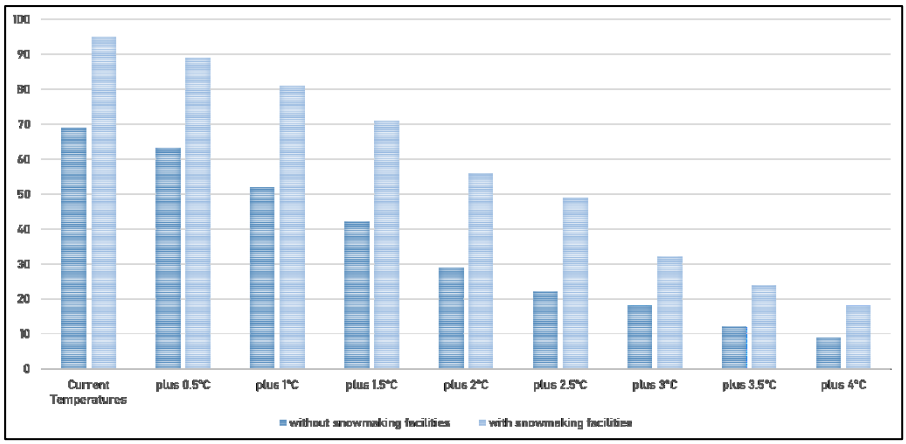

Figure 2: Share of snow reliable ski areas in Austria with and without snowmaking facilities, considering the 100-day indicator

would already drop to 9% and 19% respectively. From the 2°C scenario onwards, more than half of all resorts would have to double or triple their current snow making capacities in order remain operational, while in the 4°C scenario, more than 75% would have to increase their current capacities by more than 300%.

Referring to the necessity of ongoing investments in snowmaking technology, scholars raise the question of profitability. Scott et al (2003) question if resorts can produce snow at an acceptable cost in ecological and economical terms. Abegg, Bürki and Elsasser (2008) demonstrate that the costs of snowmaking increase disproportionally under warmer temperatures. The warmer it gets, the more snow must be produced artificially and snow production occurs at higher ambient temperatures. Teich et al (2007) state that the production of 1m³ snow at marginal temperatures costs five times as much energy as at optimal temperatures. In addition, there are significant negative externalities for the environment. Artificial snowmaking demands large amounts of water and energy. Building the necessary infrastructure of water reservoirs, cables and drains further damages nature. Finally, if temperatures rise over a certain threshold, artificial snowmaking will not be viable (Pröbstl, 2006).

Snowmaking technology has greatly helped to counter the effects of global warming. It has lowered the snowline from a natural to a lower residing technological level. The benefits of the technology have followed the typical S-Curve, which Christensen (2008) describes. Artificial snowmaking was slow to be adopted by resorts due to perceived relatively small advantages in the beginning, but it has gained momentum and is now more prevalent. However, over time, advantages plateau and the technology reaches its limitations. Applying Christensen's theory of innovation, companies offering snowmaking technology have to innovate their product to produce snow at acceptable costs for higher temperatures since artificial snow production based on snow guns and lances is less and less effective.

2.4. Economic Relevance and Indicators of the Winter Tourism Industry

Today, the Alps represent one of the biggest tourist attractions in the world. Tourists have frequented the area since the mid nineteenth century and the industry gained significant momentum since the 1950s. The alpine region has undergone a paradigm shift from a pure farming region to a tourist destination (UNWTO, 2018). Twelve per cent of global tourism occurs there, which represents a 50bn € annual industry responsible for 10-12% of employment

in the region (Keller, 2005; EEA, 2009). The Alps are especially attractive in the winter season. Of the 350mio ski visits worldwide, around 200mio visits happen in Western Europe and the vast alpine region. A little more than one third of the world's ski resorts are located there. The Alps are home to over 80% of the biggest resorts (more than 1mio skier visits per year each). This makes them by far the most economically relevant ski destination in the world (Vanat, 2019). Austria gets the biggest share of incoming tourist flows, with 51mio ski days annually. This is followed by France (48mio), Italy (29mio), Switzerland (25mio) and Germany (4mio) (Future Mountain International, 2016). Hence, given its positioning as a market leader, Austria faces the biggest potential economic impact. In that country, alpine tourism with the ski industry at the forefront represent annual revenues of more than 11bn €, which equals a direct contribution of 4.1% to Austrian GDP (Arbesser et al, 2008). Considering indirect effects of construction work or building of necessary infrastructure, the industry's contribution to GDP rises to 14.8% (Laimer et al, 2013).

Moreno-Gené et al (2018) found that the bigger the resorts, the more profitable they are due to economies of scale and a higher capacity for attracting tourists. In addition, snow reliability is the largest asset of ski resorts. Töglhöfer et al (2011) highlights a positive correlation between sufficient snow conditions and occupancy rates in ski resorts. Interestingly, resorts at high altitudes experience a negative correlation. Tourists spread themselves over the entire alpine range and visit low altitude resorts, when sufficient snow conditions exist. Nevertheless, in cases of bad snow conditions in low altitude resorts, tourists assemble at higher altitude resorts.

Scholars distinguishing between bad winters and good winters for ski resorts propose three main criteria for a successful winter season. Abegg established the 100-day rule in 1996, which remains the most important indicator for sufficient snow conditions at a ski resort. Accordingly, ski resorts are snow reliable, "if, in 7 out of 10 winters, a sufficient snow covering of at least 30–50 cm is available for ski sport on at least 100 days between December 1 and April 15". Scott and colleagues (2008) added the importance of the Christmas indicator to the equation. He considers resorts as snow reliable, if in 75% of all winters a sufficient snow coverage of at least 30cm throughout the Christmas holidays prevail. Steiger (2010) highlights the significance of this factor, as resorts generate 25 to 30 % of all revenues within that period. Steiger and Abegg (2013) also add the early season indicator to the 100-day rule. If ski resorts can open from December 8 onwards, they can stimulate season ticket sales and bookings throughout the entire winter season.

Elaborating on these indicators, Fleischhacker et al (2012) have outlined changes in consumer behavior. Responding to the question of how they would react to a series of bad winters, a large majority of those surveyed stated that they would change their behavior. In total, 14% would reduce their skiing activities significantly, while 37% would only go under good conditions or for spontaneous day trips. One quarter of skiers would change from their usual destination to a more snow reliable resort and every tenth skier would even quit the sport.

In conclusion, climate change poses a considerable threat to the prosperity of the ski and winter tourism industry. However, demographic changes pose a second significant risk. The ski market has been stagnating for years and typically strong cohorts, such as baby-boomers start to quit the sport (Vanat, 2019). Simultaneously the share of young skiers declines and leaves a vacuum for future clientele (Arbesser et al, 2008). Steiger (2012) generalizes that demographic change will pose the biggest challenge for ski resorts until midcentury and from then onwards, climate change will represent the greatest threat.

The winter tourism industry, almost entirely driven by the ski sector, has reached a phase of stagnation after a long run of strong growth. Global warming puts enormous pressure on resorts, added to the declining number of active skiers. From a market cycle perspective, the industry has reached maturity and requires innovation (Schumpeter, 2012). In order to create new markets and adapt to the changing environment, ski resorts have to go through the process of creative destruction (Schumpeter, 2008). Innovators must sequentially disrupt existing business models and create new offerings. This applies mostly to low altitude resorts, but also to those at high elevations to some extent as well.

2.5. Recommendations to Remain Sustainably Competitive for Low Altitude Resorts

Considering the 100-day rule, even low altitude ski resorts are snow reliable at least until 2030 (Steiger & Stötter, 2013). Some scholars advise ski resorts to diversify their product offerings in addition to alpine skiing in the next ten years and reduce investments in the *status quo* (Alber & Urbanc, 2011). Others state that resorts should abandon alpine skiing and try to attract currently untapped potential markets. Bausch and Unseld (2017) emphasize the importance of activating the huge market of non-skiers and trying to entice this demographic to the Alps for winter holidays. According to their findings, non-skiers reject large resorts and their lack of sustainable practices. Hence, resorts should actively market themselves to non-skiers and offer them a mix of daily activities apart from alpine skiing.

Becoming less dependent on snow, low altitude resorts in particular should consider divesting from being part of the traditional ski sector. Instead, they should invest in additional attractions and activities, which are operational throughout the entire year (Alber & Urbanc, 2011). In due course, they should position themselves as "nature pure" destinations with a variety of regional products, a unique culture and a strong environmental consciousness (Alber & Urbanc, 2011). Possible all-year activities include hiking, fitness and wellness or action sports like kayaking and climbing. Apart from that, resorts can offer alternative winter sport activities. Ski touring, cross country skiing, sledge riding or snow mobile rides require a snow cover of only 10cm, compared to 30cm for skiing and are therefore less snow dependent (Tranos & Davoudi, 2014). Some alpine regions could also become more attractive for conferences or educational events (Abegg, Bürki & Elsasser, 2008). Year-round activities will prove to be profitable as alpine regions gain attractiveness as destinations in the summer season. Tourists in the Mediterranean area claim to be considering visits to mountains instead of the sea, due to the rise in temperature. The Alps can attract tourists with a campaign emphasizing a "summer coolness" (Alber & Urbanc, 2011).

These proposed measures to diversify product offerings require a new paradigm and renouncing the *status quo*. It becomes imperative to engage in an innovative destination management and to motivate staff to find novel ways to attract untapped potential markets (Future Mountain International, 2016). To find these novel approaches, destination management will have to harness the ideas of as many people as possible. Networking becomes an important notion. The resorts should collaborate strongly from within to find a niche for the region and create strong and visible regional brands. In addition, they can network with other resorts, especially at higher altitudes. These resorts face shortages of accommodation capacity. In many cases, low altitude resorts can pick up the slack and accommodate traditional skiing tourists for them. For this, resorts must cooperate and offer convenient and fast transportation between the higher and lower altitude destinations (Alber & Urbanc, 2011).

Pressures from global warming and a declining number of active skiers, have prompted many scholars to advise ski resorts to diversify their portfolio and attract the untapped market of non-skiers. This goes hand in hand with the recommendations of Kim and Mauborgne (2004). They suggest creating new demand and markets by diversifying and offering new low-cost attractions. Pursuing this "blue ocean strategy" (Kim & Mauborgne, 2004) allows ski resorts to attract new clientele and make current competition obsolete. To achieve this, winter tourism destinations should start to diversify by investing in niche markets, operated by autonomous

business units (Christensen, 2008). Within the destination management, there must be dedicated teams, who purely work on finding and operating novel revenue streams. Niche markets encompass all potential offerings, apart from the traditional alpine ski experience. This can range from holiday setting (E.g., transportation, type of accommodation) to the holiday experience itself (E.g., winter activities and year-round activities).

2.6. Recommendations to Remain Sustainably Competitive for High Altitude Resorts

With low altitude resorts facing a critical turning point as winter tourist destinations, high altitude resorts will be winners from climate change. A majority of skiers, not willing to adapt behavior to warmer temperatures and the rising natural snowline, will wish to continue spending time on the slopes – on skis (Alber & Urbanc, 2011). As a result, high altitude resorts will need competitive advantages to capture the high numbers of skiing tourists.

Most importantly, they have to ensure technological snow reliability. Constant grooming of the slopes ensures efficient utilization of the snow (Agrawala & OECD, 2007). Ski resorts have to focus on higher altitudes and increase offerings there by merging resorts, active landscaping (E.g., planting trees for more shadow and cooler temperatures) or erecting wind protection facilities (Abegg, Bürki & Elsasser, 2008). Also, the initial results of "snow farming" have been positive whereby snow gets wrapped up in depots and covered with thick plastic sheets. This allows the snow to survive the summer and to be reused the following season (Abegg, 2011). All scholars confirm the mean rise in temperatures. In an increasing number of cases, operators will have to produce snow under higher ambient temperatures. Hence, resorts have to invest in the latest snowmaking technologies (Steiger, 2012).

Increased flows of tourists into the resorts will test infrastructure heavily. Ski destinations will have to improve their infrastructure in and out of the resorts, as well as upgrade the quantity of available beds (Steiger & Stötter, 2013).

Most existing recommendations for high altitude ski resorts are about preserving the *status quo* and achieving operational effectiveness. This might not be sufficient. As Porter (1996) points out, operational effectiveness achieves absolute improvements, but no relative advantage over competitors. High altitude ski resorts must bear in mind that the number of active skiers are declining and although they will face less competition from low altitude ski resorts in the future, competition will remain fierce. Hence, it will not be sufficient to invest in operational effectiveness, strategic positioning is also needed. Ski resorts must identify their inimitable

resources to create a unique and valuable position on the market. Table 1 effectively summarizes all existing recommendations for high and low altitude resorts alike.

Recommendations for High Altitude Resorts	Recommendations for Low Altitude Resorts
High altitude destinations should invest in sustaining competitive advantages. They need to cope with higher incoming tourist flows, origin from the vanishing low altitude resorts.	Low altitude resorts should invest in novel niche markets. They ought to attract non-skiers by diversifying their product offering and disinvest in the status quo of pure ski tourism.
▪ Provide technical snow reliability & ensure high quality of slopes ▪ Increase quantity of (high altitude) runs by potentially merging with other resorts ▪ Potentially engage in snow farming or landscaping ▪ Increase accommodation capacity	▪ Offer a wider mix of winter activities (e.g. winter hiking, snow shoeing, cross-ski, ski touring) ▪ Offer a wider mix of all-year activities (e.g. mountain biking, shopping, climbing, kayaking, wellness) ▪ Emphasize "nature pure" experience (e.g. sustainable practices, regional products)
Recommendations for High and Low Altitude Resorts	
▪ Pursue a strong and unified destination management, with a high level of agreement between all relevant stakeholders ▪ Offer fast and convenient transportation to and from, as well as within the destination	

Table 1: Summary of existing recommendations for high and low altitude resorts (authors own, 2020)

2.7. Identified Literature Gap

The literature outlines the impacts of climate change on different regions in the Alps and explains the comparative disadvantage of low altitude resorts. Existing papers and essays propose how low and high altitude resorts should deal with the effects of climate change. However, they lack clear recommendations and action plans oriented towards short, medium and long-term perspectives. This thesis seeks to close that gap and equip resort executives with an action plan. Interviews with ski resort executives will assess levels of sensitivity towards the topic. Furthermore, a quantitative survey seeks to evaluate the interest of consumers towards new tourism offerings in the alpine region.

3. Research Methodology

Many scholars have debated the effects of climate change on winter tourism in ski resorts. However, only a few have touched upon the sensitivity of destination managers towards the topic and what measures they have set in place. In addition, no academic paper has applied strategy and innovation theory to ski resorts. Consequently, the thesis seeks to close that literature gap and respond to the following research questions:

1. *How sensitive are destination managers towards current threats, mainly global warming, as well as demographic change and the Corona virus?*

In particular, it is important to identify what measures they are already taking or planning to, to counter the exogenous threats. In due course, high and low altitude resorts must pursue different strategies to remain profitable.

2. *What disruptive business models must low-altitude ski resorts adopt to remain attractive for tourists, despite their comparative disadvantage?*
3. *What strategies must high-altitude ski resorts pursue to ensure sustaining competitive advantages?*

The literature review has gathered existing knowledge on climate change, ski tourism and business innovation, based on secondary research of relevant scholars. This serves as the foundation for the methodological approach and revealed a knowledge gap. To answer the research questions, this thesis sought in-depth insights directly from destination managers and consumers.

To explore all three research questions, insights from eleven semi-structured interviews are discussed. This format allows the researcher to keep an open mind about the potential findings (Bell, Bryman & Harley, 2018). The notion of scientific objectivity is important as it is likely that resort executives may differ in their perceptions towards climate change and what mitigating measures they find effective. The author seeks to understand the rationales and motives of key stakeholders. Hence, only semi-structured interviews serve as an appropriate analytical tool (Taylor, Bogdan & DeVault, 2015).

Eight of the interviewees report from a micro-perspective, as they are representatives of their ski resorts. Interviews with executives from resorts north and south of the alpine divide, as well as from different altitudes and resort sizes, serve to assess research question 1. Appendix V offers an overview of all conducted interviews with ski resort executives. One of the interview

partners is an anomaly as the resort is not located in the Alps. Germany's second largest ski resort is located in the center of the country at an altitude of 630 to 820m. Due to its low elevation, they are experiencing stronger natural snow volatility and scarcity than their counterparts in the Alps (see Appendix VIII). Hence, their experiences can serve as a proxy for what alpine resorts have to expect in the near future. This is particularly helpful to answer research question 2. It is worth noting that the thesis distinguishes between high and low altitude resorts. By definition, a low altitude resort only have slopes below its natural snowline and high altitude resorts would have runs above the snowline. However, most resorts do operate ski runs above and beyond this critical level. However, for clarity's sake resorts labelled low altitude resorts have a majority of their runs below the natural snowline and high altitude resorts above it.

The author conducted additional interviews with executives from regional and interregional interest groups and alliances to examine the topic from a macro-perspective. This provided further insights for research questions 2 and 3. They also supplied details about technical snow production, as one of the interviewees represents the world's largest manufacturer of technical snow production facilities (see Appendices I and II).

All interviews took place between March 15 and May 28 2020. They lasted between 18 and 41 minutes and were conducted via Skype or phone calls. Cachia and Millward highlight that calls are equally as effective for qualitative research as personal encounters and that they carry with them no disadvantages. Furthermore, they assert that the medium works best when interviews take place in a semi-structured format (2011). This confirms the choice of format here. All interviewees were either senior executives or C-Suite members of their organization and therefore highly credible. All interviews took place in German. Later, the author translated them into English and analyzed them thematically. As a result, the researcher identified patterns and broader themes.

The semi-structured interviews, dealing with micro- and macro-perspectives, served to answer the research questions effectively (see table 2). This study also takes a first step towards closing an existing literature gap by contributing new knowledge about a significant topic. Further similar research can potentially confirm or extend the findings.

Name	Role	Ski Resort/ Organization, Country	Context	Date and interview length
Micro-Perspective				
Christina Demetz	Marketing & PR Executive	Val Gardena, ITA	Big Resort; Southern Alpine Divide, Altitude from 1236m – 2300m	March, 18 / 38 min
Matthias Stauch	CEO	Garmischer Zugspitzbahnen, GER	Small Resort; Northern Alpine Divide, Altitude from 740m – 2050m (GAP region); 2000m – 2940m (Zugspitze region)	March 24 / 30 min
Julian Pape	Project Management	Skikarussel Winterberg, GER	Low altitude ski resort (630 – 820m) in central Germany, serving as proxy for future developments in the alpine region.	March 31 / 33 min
Anonymous I	CEO	One of the big Tyrol ski resorts, AUT	Big Resort; Northern Alpine Divide, Altitude from 1200m – 2400m	April 14 / 28 min
Anonymous II	Head of Sales	Smaller ski resort in Carinthia, AUT	Small Resort; Southern Alpine Divide, Altitude from 1000m – 1900m	April 21 / 27 min
Bernhard Gruber	CEO	Wildkogel Arena, AUT	Small Resort; Northern Alpine Divide, Altitude from 856m – 2235m	April 22 / 18 min
Anonymous III	Marketing Executive	Medium-sized resort in Salzburg County, AUT	Medium Resort; Northern Alpine Divide, Altitude from 760 – 2000m	May 11 / 26 min
Wolfgang Quas	Head of Marketing	Saalbach Hinterglemm, AUT	Big Resort; Northern Alpine Divide, Altitude from 840m – 2069m	May 28 / 21 min
Macro-Perspective				
Karmen Mentil	Board Member	Alpine Pearls, Alpine Range (CH, AUT, FRA, ITA, GER)	Network of 21 alpine communities, marketing sustainable holidays by offering Green Mobility.	March 25 / 41 min
Diego Clara	Marketing & PR Executive	Dolomiti Superski, ITA	Association of 12 Ski resorts, making it one of the biggest interconnected ski resorts worldwide.	March 25 / 20 min
Patrizia Pircher	Head of Marketing	TechnoAlpin	TechnoAlpin is the worldwide biggest manufacturer and provider of snowmaking facilities, including machines, software and services.	March 25 / 23 min

Table 2: Interview list

In addition to the interviews, the author conducted a quantitative survey among potential customers of alpine destinations across all demographics and geographies. It consisted of nine questions, which aimed to assess the effectiveness of proposed measures for high and low altitude resorts (see Appendix XII). The survey asked skiers and non-skiers to disclose their likelihood to travel to the Alps, as well as what they would like to do there. Furthermore, it sought information about the allocation of disposable income for these activities. The survey was framed and designed in line with what has been proposed by Saunders, Lewis and Thornhill (2009). The questionnaire was kept as short while being as extensive as necessary to support answering the research questions. The author explained the purpose of the survey in a brief introduction. Apart from the close-ended questions, which identified the demographics in the beginning, all questions were on a numerical rating scale. This methodology proves to be especially efficient for collating findings. The survey was published online on April 17 and received over 300 responses up until May 10. It represents a global sample group across all generations. It is important to note, that more than half of the responses comes from Generation Y and even more than three quarters from Western Europe and the DACH region. Although

this skews the overall result in that direction, it is most valuable for the resorts and their recommendations. Generation Y and the DACH region are the most important markets for all interviewed ski resorts. Finally, 60% of the survey participants indicate themselves to be active skiers, meaning that they have either skied in three out of the six recent winters for at least three days each or have been on skiing holidays at least five times in their lives. It is noteworthy that 19 responses had to be disregarded because respondents entered contradictory data pertaining to the control questions. If subjects regarded themselves as non-active skiers, it is impossible that they are on an advanced or expert level as some stated.

4. Analysis

4.1 Sensitivity of Destination Management towards Exogenous Threats

4.1.1 Climate Change

The phenomenon of global warming has left the ski tourism industry in a state of uncertainty and ambiguity. Because scholars unanimously agree about the rising temperatures in the Alps, but they cannot predict the exact amount, stakeholders have to face a set of "discrete alternate futures" (Courtney, Kirkland &Viguerie, 1997). Temperatures are expected to rise by either 1°C, 2°C or even 4°C within this century. Although all interviewees except one agreed on the existence of climate change, none of them have prepared action plans for the three different scenarios. While the resorts only expect "some increase in temperatures", without getting precise, only one destination expects temperatures to rise by 1°C specifically, and outlined their strategy accordingly. All the others have not yet drafted plans.

This may prove to be a fatal error. Scott (2003) suggests that costs for technical snow production will grow over proportionally with the rise in temperatures. Steiger and Abegg (2013) argue that the costs for technical snow production already take up to 20% of the generated revenues under current conditions. Apart from one low altitude resort, who confirms that, the interviews showed that most investments tend to be slightly lower at 10-15%. Nevertheless, as temperatures climb profits will diminish. As a result, resorts will have to increase prices and this will put pressure on an already shrinking market. The question remains, why does a majority of resorts acknowledge the problem, but fail to construct effective counter measures? The interviews with representatives of the ski resorts have revealed four main reasons for this apparent contradiction.

Firstly, they simply are not yet experiencing severe consequences of climate change. Over the past decades, none of the resorts in the Alps has failed to meet the 100-day rule set out by Abegg (1996), which represents the main indicator for a profitable ski season. This confirms findings from Steiger and Stötter from 2013, stating that even low altitude ski resorts will be snow reliable at least until 2030. In addition, even though overall market demand is slowly declining, the market remains attractive. The survey results accords with Alber and Urbanc's (2011) who point out that active skiers continuously want to experience ski sports and that even non-skiers

are planning to engage in them. As a result, ski resort executives have become victims of a short time bias mental model (Senge, 2006). They see the opportunity for profits in the short term, but fail to put effective counter measures into place for the mid- and long-term.

The notion of short-term bias relates to the second main argument: the matter of investment horizon. Ski resorts invest heavily in infrastructure and technical snow reliability. However, depending on the size of the fixed asset, most snow guns, infrastructure projects and lifts are amortized over a time horizon of only five to eight years in the Alps, as interviews show. Only big cableway installations (15-20 years) or buildings (up to 40 years) have a longer time span. Therefore, all current investments will have paid off, before climate change really starts to harm operations.

The third aspect describes the unanimous trust of destination managers in technical snow production technology. All resorts are equipped with the latest technology and therefore achieved a tremendous increase in efficiency over the past decade. Snow guns and the surrounding infrastructure of cables, pipes and pre-cooled reservoir lakes have developed towards higher effectiveness. At ideal conditions, meaning no wind and a wet bulb temperature (ratio of temperature to humidity) below -2.5°C, one snow gun can produce up to 90m³ of snow per hour (Int: Pircher, 2020). Snow cats are equipped with digital guiding systems and snow depth measures, which can assess the snow depth on the slopes with an accuracy of up to 2cm (Int: Stauch, 2020). Most importantly, all the information bundles in a software. Paired with real-time data from the snow cats, snow guns and weather forecast, Big Data calculations can evaluate when and where artificial snow production is most efficient (Int: Pircher, 2020). Ultimately, with current snow making technology, three to five nights with perfect conditions in November or December are sufficient to ensure 90% of skiing activities for the entire season. The cost to produce 1m³ of snow is estimated at 5€ (Int: Stauch, 2020). In comparison, machines in the 1990's and early 2000's required 4 weeks of perfect conditions to achieve the same results as today (Int: Clara, 2020).

The majority of interviewees stated that they would be able to maintain the entire skiing offering as it is today, or at least a vast majority of it. However, this seems to be a false belief. As Steiger and Abegg highlight, even at the minimal expected increase of temperature by 1°C, 20% of alpine ski resorts cannot achieve the 100-day rule threshold any longer (2013), even with current snowmaking technology. Pircher confirms this and states that technical snow production has almost reached its limits, as it still relies on simple physics and outside

temperatures (2020). Even the most efficient technology cannot produce snow at a wet bulb temperature over -2.5°C.

An exception is the novel technology of a "snow factory". This snow production solution comes not as a snow gun or lance, but in a container. In simple terms, it works like a big "crushed ice machine" and can produce a certain amount of snow, regardless of the outside conditions. This helps to bring artificial snow to city events or small areas in low altitude ski resorts (Int: Pircher, 2020). However, the energy costs to operate one snow factory are as high as 25 snow guns. At the same time, one snow gun can produce 20 times more snow at ideal conditions, compared to a snow factory (Int: Pape, 2020). Hence, as of today, snow factories can help provide snow to critical ski runs, but only in a very restricted area. It is not feasible to equip entire resorts with this technology or even a single longer slope. Nevertheless, the solution is another innovation, which might follow the S-curve pattern of innovation described by Christensen (2008) and shown in Figure 3. It is a novel product, which brings fewer benefits at a higher price at the beginning. Yet, innovation and efficiencies might drive the effectiveness of the solution in the future. However, Pircher (2020) highlights, once again, the current limitations of the solution for ski alpine applications at a larger scope. Therefore, it remains questionable if innovation can surpass the benefits of conventional snowmaking technology over time. As for now, experts are inclined to predict limited potential developments.

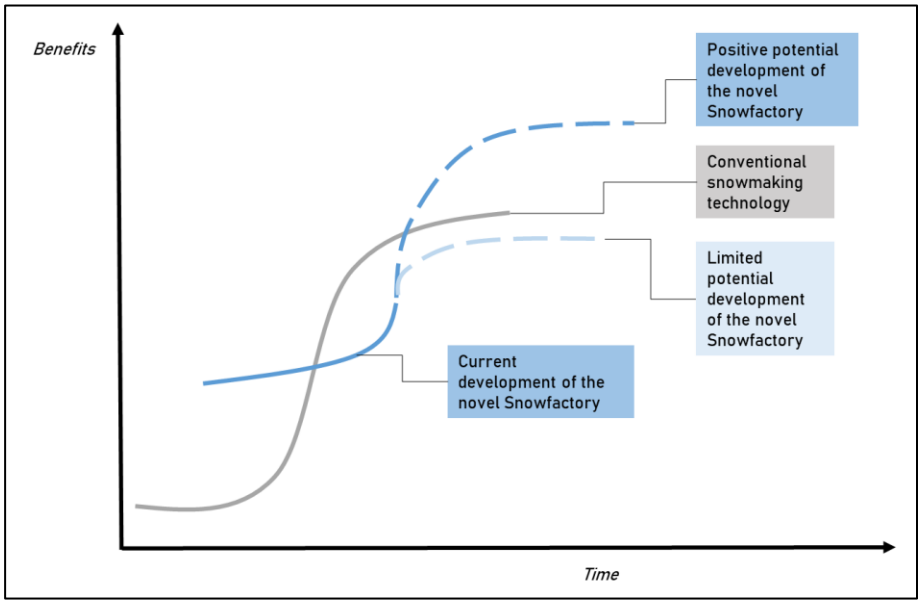

Figure 3: S-Pattern innovation of snowmaking technology, based on Christensen's Innovators Dilemma (authors own, 2020)

Furthermore, it is important to note that none of the resorts practice any other means of ensuring snow reliability apart from artificial snow production. Despite recommendations from experts to perform snow farming or landscaping (E.g., more trees for shadow and wind protection), no one engages in it.

The fourth main argument highlights that resorts strongly depend on revenue streams from traditional ski tourism. This income has brought prosperity to mountainous valleys for almost a century and transformed farming villages into global tourism hotspots. Tourism, with skiing at the frontline, is the major source of revenue for most destinations. Apart from two resorts, who have a 50/50 split of tourists in summer and winter, all other resorts have higher numbers of tourists in the winter. Despite the fact that the winter season is shorter than the summer season, revenues in winter are significantly higher. Apart from one resort, all destinations generate at least 70% of their revenues in the winter. Five of the interviewed resorts acquire more than 85% of their income in the winter season, which makes them almost entirely dependent on ski tourism. Demetz (2020) argues that the number of participating stakeholders in the winters is higher than in the summer. The resorts operate a higher number of lifts, hotels can charge high season prices for a longer period and ski schools and rentals yield additional revenue streams. Winter tourism is also responsible for the bulk of employment. Based on data from the executives interviewed, employment in the winter is between 1.7 to 5 times higher than in the summer (Int: Stauch, 2020; Int: Pape, 2020; Int: Anonymous I, 2020).

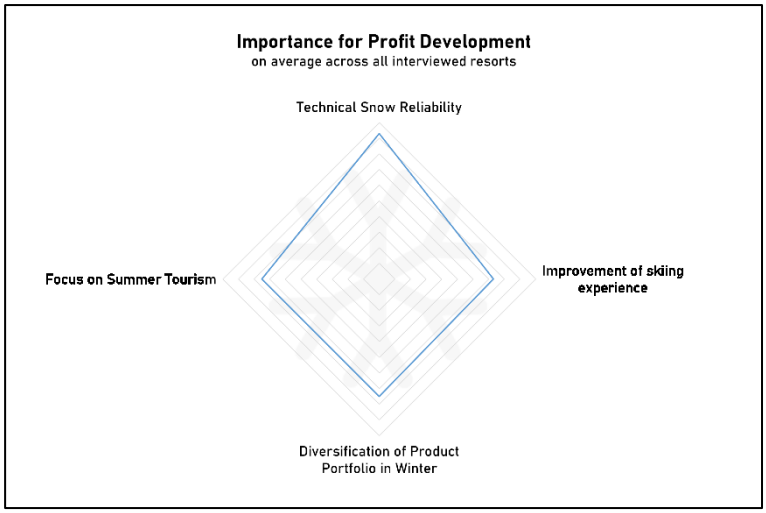

Figure 4: Criteria assessment for profit development by ski resort executives on average (authors own, 2020)

With incomplete or limitedly accurate data, executives have become victims of flawed mental models, particularly the sunk cost fallacy and confirmation biases (Senge, 2006). They continuously invest in an industry with a shrinking market and enormous exogenous threats. As the interviews showed, this is largely for one reason. The resorts fail to perceive alternatives for other equally profitable business models in the winter. Hence, they rank technical snow reliability as the sole and most important asset for future viability (see Figure 4).

Despite the way ski resorts view the impact of climate change upon their portfolio of winter activities, they all strive to be engaging more heavily in summer tourism. The resorts aim to become year-round destinations and are trying to utilize their lift infrastructure for a diverse set of summer activities as well.

In conclusion, apart from two resorts, all other ski destinations agreed that climate change will affect the way they operate their businesses in the future. On average, ski resorts rate the risk on a scale of 1 to 10 (with 10 being most severe) at 7.0. Low altitude resorts even expressed a higher risk at 8.6 on average. Nevertheless, reactions to the threat differ and are split into two camps. One group, associated with Val Gardena and Garmisch-Partenkirchen/ Zugspitze, acknowledged the threat and was willing to change their tourist offering. They claimed that the less people can ski, the more they have to offer by way of alternative activities. The other cohort partly acknowledged the threat, but they believed they could continue their operations as they stand. This group is led by two resorts, who have the highest dependence on ski tourism-related revenues. It seems that higher ski-income dependence correlated with stronger denials of the effects of global warming.

This is problematic, as can be seen in the case of Winterberg. The resort resides at a very low altitude between 630 and 820m, located 400km north of the Alps. It can serve as a proxy for what alpine regions might have to face in the future. Over the past 10 years, the resort has already failed twice to meet the 100-day rule. To conform to this threshold, they must invest heavily in artificial snow production, including two snow factories. Nevertheless, the resort can continue to operate profitably, because it has a unique selling point – they are the only comparably large high-quality resort north of the Alps. Hence, they capture the entire central German market along with nearby BENELUX countries. This justifies a substantial investment in technical snow infrastructure. Resorts in the Alps will increasingly compete and cannot absorb high costs as easily. Hence, they should carefully consider how they choose to position themselves.

In short, the notion of the boiled frog compares well to the situation of many resorts in the Alps (Senge, 2006). If one throws a living frog in boiling water, the frog jumps out. However, if the temperature increases slowly, the frog will stay in the water and die eventually. Ski resorts must pay attention that they do not become the boiled frog by not acknowledging a significant exogenous threat, which is growing steadily over time.

4.1.2 Demographic Change

In contrast to climate change and the Corona virus, the executives interviewed ranked demographic changes as the least dangerous threat for future profitability. On average, they rated it at 5.4 on a scale from 1 to 10. Apart from two resorts, which had the highest dependence on ski-related revenues, all other resorts acknowledged threats from demographic change.

Vanat (2019) discusses how global demand has been more or less stagnating for the past three decades, if not slightly decreasing. The typically strong cohort of baby-boomers has started to quit the sport and later generations have not managed to fill the vacuum. This is especially problematic for the alpine destinations. Domestic skiers represent the strongest demand for skiing in their representative markets. Considering the age structure in Europe, there are more old people (65 years and older) than young people (15 and younger) (World Bank, 2019). Even positing an equally high interest in skiing across the generations, the market is still shrinking.

One reason why executives did not rank shrinking markets as high risk relates to assumptions about capturing clientele from novel geographic markets. All executives reported that their domestic markets provide the strongest tourist inflows. Apart from one region, which almost entirely relies on the local market, the others indicated that the majority of tourists originate from the DACH region. As this traditionally strong market has started to decline due to demographic change, resorts aim to target new clientele from other geographies. Interestingly, however, they are all targeting different markets. Only three resorts believed they can remain profitable by targeting the same geographies in the future as they do today. The resort in Carinthia and Salzburg County (both Austria) want to target more customers from Eastern Europe (Int: Anonymous II & III, 2020). Val Gardena is counting on an increase inflow from Scandinavia and the UK (Int: Demetz, 2020), while Garmisch aimed to attract Asian customers (Int: Stauch, 2020). All these markets seem to be good choices. Vanat reports a resurgent interest in skiing in Scandinavia and highlights Eastern Europe and especially Asia as the biggest growing markets in the world. In absolute numbers, China is already the third largest country in terms of active skiers (Vanat, 2019). The survey conducted validates Garmisch's effort to attract Asian tourists. They report a higher probability of visiting the Alps within the next five years than the average sample group. The Asian respondents rate the likelihood to visit at 7.2 (out of 10) in the winter and rank skiing as the most desirable activity.

One thing that all resorts have in common, is that they mainly cater to families. Generations X or Y are the parents accompanied by their children. Thus, ski resorts have the feeling of capturing a growing young clientele. Realizing that family members have different vacation tastes, destinations try to offer a mix of activities for all interests. These range from skiing, to wellness, shopping or other winter pursuits (Int: Stauch, 2020). Attracting families also has the advantage that children learn to ski from a young age. Garmisch and an anonymous resort in Carinthia even operate unprofitable small lifts at a low altitude in the city region away from the actual resorts. This allows them to offer skiing classes for kindergartens and schools. Pairing

this with special discounts for families, they are trying to grow a local and loyal clientele (Int: Stauch, 2020; Int: Anonymous, 2020). This initiative relates to the notion of strategic uncertainty and may prove successful in the future. Although the commitment is not profitable today, it will be advantageous in the long run as it aligns with the notion of effective future-oriented strategic action (Raynor, 2007).

Additionally, resort executives reported general positive short-term effects of demographic change. Although a large demographic of baby-boomers has quit skiing activities, they often remain loyal customers and visit the region in the summer instead. This summer income helps resorts fund relevant infrastructure projects for hikers and mountain bikers, developing the regions towards being appealing year-round destination (Int: Anonymous, 2020). Survey respondents from the baby-boomer generation confirmed that they are more likely to visit the Alps during the summer within the next five years (rating that likelihood 8.75 out of 10) over the winter (6.25).

4.1.3 Corona Virus

SARS-CoV-2, better known as COVID-19 or the Corona virus, is a black swan event. Taleb (2007) names three conditions for such events: they must have an extremely low probability, high consequences, and retrospective distortion. Although respected personalities such as Bill Gates cautioned the public about pandemic threats, no one heeded these warnings (Gates, 2015). Hence, the Corona virus qualifies as an event with retrospective distortion, as well as perceived low probability based on historical data. With respect to the three criteria associated with black swan events, ski resorts tend to be most apprehensive about the last characteristic – high consequences. Due to dynamic developments of the pandemic and the concomitant uncertainty, executives rated the risk of the Corona virus at 6.0. Thus, they rank it between climate change and demographic aging.

Economic losses, reputational damage and uncertainty have been the main consequential phenomena from COVID-19. In most alpine destinations, the season had to end on March 15, 2020, which is at least five weeks earlier than planned. As a result, resorts lost income from the profitable Easter holiday season. Some resorts lost up to 25% of winter season revenues due to the virus (Dahlkamp et al, 2020 & Int: Anonymous I, 2020). Based on calculations of the Austrian Economic Chamber, the ski tourism industry in Austrian resorts lost 1.8bn € in revenues, as 7.4mio overnight stays had to be cancelled (dpa, 2020).

Additionally, resorts expect significantly lower revenues in the coming summer, as well as in the winter season. In recent crises (E.g., the Global Financial Crisis (=GFC) of 2008) fewer people were travelling, but businesses were not interrupted and continued to generate income. The virus has forced a complete lockdown of most countries and stopped tourism entirely. Anticipating rising tourism, the alpine region has invested heavily in growth-based projects, often with outside capital (Rainer, 2020). Loss of all income for the foreseeable future jeopardizes business survival. The UNWTO argues that precise predictions are impossible to make at the moment. It remains unclear when people will be allowed to travel again and how much of lower disposable incomes people might be willing to spend. Considering the high levels of uncertainties, UNWTO expects global tourism to decline by 20 to 30% compared to the 2019. Hence, the effects of the Corona virus are likely to be 5 to 7.5 times worse than the GFC of 2008 (UNWTO, 2020) with tourism being one of the industries hit the hardest.

Some resorts claim that they can survive a certain length of time without income, but the long-term reputational damage might be even worse (Rainer, 2020). The alpine region was an early hotspot for the pandemic and the virus spread from there across Europe. Experts criticize the world-famous ski resort Ischgl in particular. On March 1, 2020, Iceland's chief epidemiologist Gudnason stated in a press conference that all current Corona patients in Iceland had been infected in Italy or Austria while skiing. Three days later, he announced Ischgl as a high-risk area. On March 8, Norway announced that 500 of their 1200 known cases then were infected while skiing in Austria. Despite all the warnings, Ischgl did not close until March 15, together with all other alpine destinations. Consequently, up to 300k new tourists arrived and left Tyrol after the first warnings from Gudnason. Ever since, the ski resorts have had to deal with accusations from the media, stating that monetary objectives were valued over health concerns (Dahlkamp et al, 2020). The special case of Ischgl can have negative reputational spillover effects for the entire industry.

Destination managers differ in their opinions towards the Corona virus. While some argue that this might jeopardize the survival of the resorts, others see it as a setback but simultaneously as an opportunity. Some managers believed that people will travel less to cities and crowded beaches in the future, but instead will seek refuge in "pure nature destinations", such as the Alps (Int: Demetz, 2020). Heymann (2020) confirmed this and stated that the Mediterranean destinations will suffer disproportionally, due to their sole dependence on summer tourism. Thus, in the short- and medium-term, the Alps might take up the slack and accommodate tourists who usually visit beaches rather than the mountains.

4.1.4 Research Question I: Readiness Assessment

At the present time, ski resorts in the Alps are exposed to three major exogenous threats: Climate and demographic change as well as the Corona virus. Rating these risks in terms of the threats they pose to future profitability, ski resorts regard climate change as the biggest threat, followed by the Corona virus and demographic aging, as can be seen in Figure 5. Apart from two destinations each, all executives acknowledged the phenomena of climate change and demographic aging. A noteworthy point is that low altitude resorts rated the risks stronger on average, than their counterparts at high altitudes. However, regardless of this, actions being taken do not seem to differ significantly. All resorts possess the latest state of the art technical snow production facilities and all are trying to become year-round destinations. Although Steiger (2012) warns resorts that demographic aging is the biggest threat until 2050, resorts seem to be focusing on the long-term threat of climate change.

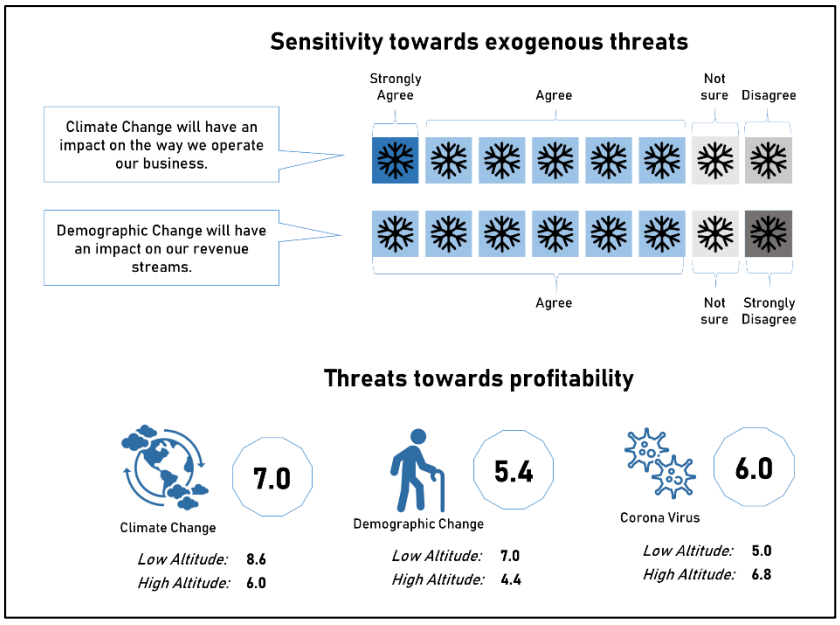

Figure 5: Ski resorts assessment about exogenous threats (authors own, 2020)

In line with Rumelt's notion of bad strategy (2017), a first step towards mitigating failure is to express challenges objectively and have action plans ready for possible future scenarios. Most resorts acknowledged the risks, but they are not instituting countermeasures to any great extent. In light of the interview results, it became apparent that those resorts that have a diversified product portfolio and a balanced split between summer and winter tourism, are less concerned than pure ski destinations. Hence, diversification and spreading of risks makes destinations more resilient against exogenous threats and black swan events.

This is most critical for the three resorts who were skeptical about demographic threats and or climate change, although they have the highest dependency on skiing related revenues (see Figure 6). It seems the more resorts rely on income from ski tourism, the harder it becomes for them to acknowledge risks and depart from the status quo. In short, they become victims of the organizational inertia problem (Hannan & Freeman, 1993). The resort is stuck on its current path without being proactive about newly evolving circumstances. The longer they refuse to acknowledge their altering environment, the harder it will be to reverse course. In conclusion, ski resorts that acknowledged exogenous threats were the ones least dependent on skiing related revenues and they feared black swan events the least.

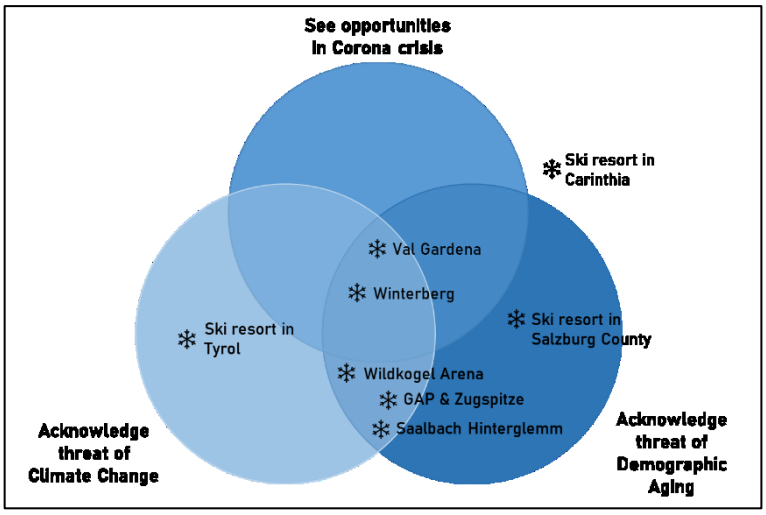

Figure 6: Venn-Diagram assessing the perception of resorts towards exogenous threats (authors own, 2020)

Garmisch-Partenkirchen/ Zugspitze can be a role model for ski resorts. Considered to be a low altitude resort, they have managed to become the least dependent resort on ski tourism. Twenty years ago, they started to diversify their product offering. This was based on the belief that the less skiing they can offer, the more alternative attractions they needed to have. This has paid off today as they have an equal split in revenues from summer and winter tourism. Thus, they are closest to mastering the core challenge for ski resorts today – the need to divide tourist flows and revenue streams between summer and winter tourists. This shows how important it is to engage in disruptive innovation. Garmisch diversified their portfolio before all other resorts and their long-term investments are working out today, as they are less dependent on winter tourism and more resilient to shocks. As Christensen (2008) outlines, disruptive innovations need five to ten years to pay off. Thus, when resorts invest in disruptive business models now, they will be able to profit from them, before climate change becomes more pronounced. Investments in disruptive models today will prevent ski resorts from losses in the future.

4.2 Recommendations for Ski Resorts

4.2.1 Research Question 2: Disruptive Business Models for Low Altitude Resorts

Low altitude ski resorts are at a distinct disadvantage. They will lack the scarce and critical resource of snow sooner and more severely than their high altitude competition. From 2030 onwards, they will increasingly struggle to reach the 100-day threshold, which will negatively affect profitability (Steiger & Stötter, 2013). Therefore, Alber and Urbanc recommend diversifying product offerings now and changing from being purely ski resorts to year-round destinations (2011). In the meantime, Bausch and Unseld recommend focusing on non-skiers, who prefer untapped winter landscapes away from the ski alpine market (2017). Scholars agree that low altitude resorts in particular have to act now and avoid being stuck in the *status quo*. However, they cannot agree on what resorts should do. Based on findings from the representative and quantitative survey, as well as the interviews conducted, ski resorts are well advised to base their new strategy on four cornerstones: an increase in winter activities offered, attracting non-skiers, a focus on year-round tourism and finding their unique selling proposition (=USP).

The survey results highlight that skiing remains the most popular choice among winter tourists (see Figure 7). On a scale from 1 to 10, people indicate their wish to ski on average at 7.6, which is by far the highest score. Taking into considerations all other activities which showed positive inclinations and a mean score (above 5), the survey suggested that resorts should widen their portfolio in terms of having a greater variety of local food offered (6.6), a vast wellness offering (6.1), a party scene (5.8) and hiking routes (5.2). Thus, other classical winter activities, such as toboggans, cross-ski or ski touring seem less interesting for the broader clientele. Winter mountain biking and winter extreme activities score even lower. The willingness to pay for these activities followed accordingly. People are inclined to pay 40% of their total holiday budget on skiing, followed by wellness (17%), party and local culinary specialties (both 14%). People are even willing to spend money on hiking (6%), although this is typically considered to be a free of charge activity. The survey results neatly confirm Stauch's claims. People continue to want to ski, but they demand a mix of different activities alongside.

Looking exclusively at the data obtained from current non-skiers, it becomes apparent that customer demands do not change drastically compared to the entire sample group. The same five activities receive positive scores with hiking, wellness, local culinary specialties and

partying scoring approximately the same, although the willingness to pay for these increases slightly. Non-Skiers are willing to spend up to 25% for wellness and 17% for local food, for instance. Nevertheless, skiing still ranks among the top four activities and has an even slightly higher willingness to pay than wellness. Hence, even non-skiers want to learn how to ski during their winter holidays, although they are not willing to spend as much on skiing and demand a variety of other activities. This suggests Bausch and Unseld (2007) are partly wrong in their claim that non-skiers seek tourism offerings away from the alpine skiing crowds.

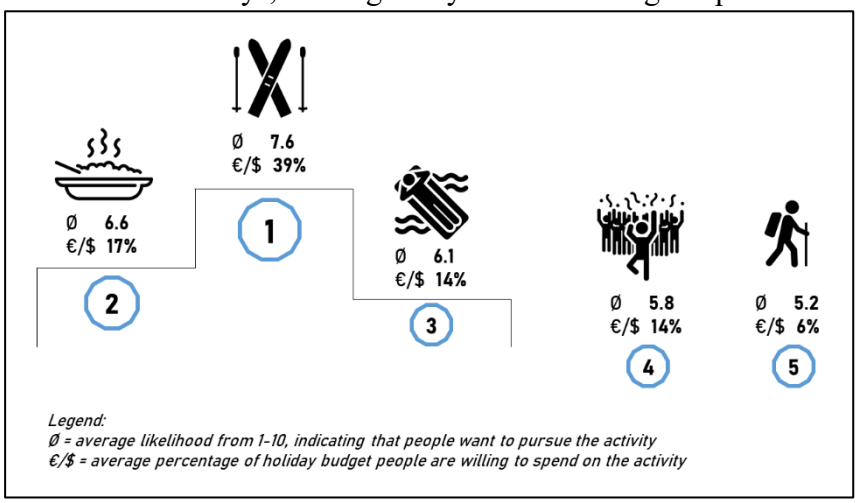

Figure 7: Survey results of activity engagement and budget allocation by tourists (authors own, 2020)

Next, the data proves that tourists are more or less equally likely to visit the Alps both in summer and winter within the next five years. Overall, winter tourism (7.0) is only slightly more favorable than summer tourism (6.3). While active skiers are almost certain to visit the alpine region again (8.6), they also express a high interest in summer tourism (6.6). Non-skiers even rate the likelihood higher of visiting the Alps in summer (5.9), rather than in the winter (4.8). Thus, it looks like summer is becoming increasingly appealing for tourists. Most importantly, people are still considering traveling to the Alps, despite their role as a Corona virus hotspot in Europe. The feared spill-over effects from Ischgl to the entire industry seem less severe than envisaged.

Finally, ski resorts should identify their USP and market it accordingly. They should follow Rumelt's notion of value denials (McKinsey, 2007) by creating demand for a product for which consumers would be willing to pay a premium that does not yet exist. For this, a plan of unified destination management across different stakeholder groups is required (Future Mountain International, 2016). As the interviews highlighted, most resorts struggle in this regard and stakeholders engage mostly in independent action.

In contrast to this, the ski resort Wildkogel Arena in Tyrol, Austria, is a good example of best practices as they appear to be executing a blue ocean strategy. Realizing their high dependency on ski-related revenues, they started to invest in a diversified product portfolio and entered niche markets. This secures incoming tourist flows distinct from the classic ski tourism, and

enlarges the clientele. In particular, they are a member of the Alpine Pearls. This tourist association promotes soft holidays in "eco-motion". Tourists arrive at the destination by public transport and can rely on emission free transportation within the valley. This includes electric cars, e-bikes or electric taxis, which are all free of charge. Additionally, tourists have a vast variety of options for activities, which are all friendly to the environment such as horse carriage rides, mountain biking, the longest toboggan run in the world or ski touring. To offer all this in one destination, a well-coordinated cooperative approach amongst all destination stakeholders was indispensable. The resort occupies a clear niche market, which had not been demanded by tourists before. And yet the business model has become profitable. Some Alpine Pearl destinations which were experiencing declining visitor numbers were able to increase occupancy rates by up to 30% (Int.: Mentil, 2020). It is interesting to note that in the survey conducted, sustainability ranked last as a decision criterion. Yet the Alpine Pearls have been successful promulgating a strategy with sustainability as a major component.

The survey also highlighted that a winter landscape, the quality of ski runs, and the overall price level are the three most important criteria for customers when choosing holiday destinations. Hence, when destinations try to identify their USP, they should consider these factors. Ultimately, success will be based on how well resorts manage to transition their USP's from a niche to a mass market. Resorts have a time horizon to test different niche markets before climate change begins to affect current operations more strongly. Eventually, crossing the "chasm" is the determinant for future success (Moore, 1999). In conclusion, ski resorts need to follow Senge's (2006) notion of becoming learning organizations and abandoning the *status quo*. As they enter new terrain, they will face new challenges. This is necessary for becoming agile and identifying changing market demands quickly. Thus, resorts will become faster at adapting to new demands and the changing environment.

In particular, executives must consider certain short-, medium- and long-term activities. Figure 8 summarizes them neatly in due course. In the short run, they should align different stakeholders (e.g. hotel owners, ski resort operators, other tourism activity providers, restaurant owners, etc.) within the destination and harness their ideas to identify their USP. In addition, they must evaluate each discrete alternate future scenario, considering the effects of exogenous threats. They should start to test novel niche markets, in accordance with the findings articulated here. In the medium term, ski resorts will be increasingly dependent on niche markets, as skiing opportunities vanish. Hence, the fewer skiing options resorts offer, the more they need other activities. They should start to abandon their low altitude tracks first, which are the costliest to

operate with technical snow compared to higher altitude slopes. In the long-run, resorts should only operate high-altitude slopes, above the critical snowline. All through the change process, resorts must follow the notion of being learning organizations, observing market demands and reacting fast to them, while keeping their USP's in mind.

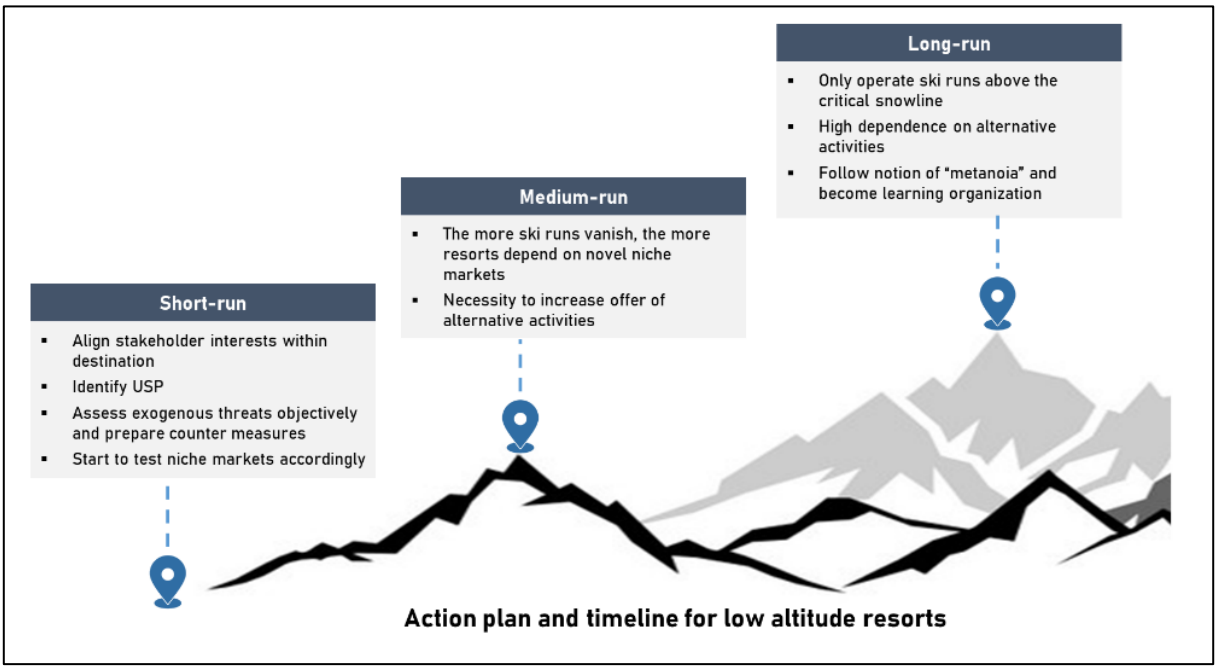

Figure 8: Action plan and timeline for low altitude resorts (authors own, 2020)

4.2.2. Research Question 3: Sustaining Competitive Advantages for High Altitude Resorts

As Töglhofer et al (2011) outline, snow conditions correlate with occupancy rates in ski resorts. Hence, the less snow tourists find at low altitude destinations, the more they will retreat to higher areas. Consequently, high altitude ski resorts will benefit from climate change and a thinning out of competition at lower elevations. Due to their ability to accommodate higher numbers of incoming tourists and through economies of scale in ski run preparations, larger resorts will profit disproportionally (Moreno-Gené et al, 2018). Applying the notion of the resource-based view, high altitude resorts have rare, valuable, inimitable and non-substitutable assets which their lower elevation counterparts do not possess – particularly sufficient amounts of snow to offer alpine skiing (Barney & Clark, 2009). To achieve a sustainable competitive advantage, these destinations need to ensure technical snow reliability, enlarge their occupancy capacities and develop their USP's.

Alber and Urbanc (2011) highlight the undisrupted demand from tourists for engaging in ski alpine activities. The survey findings here confirm their insight. Skiing ranks highest in popularity across the entire sample group. Looking at currently active skiers, alpine skiing is by far the preferred activity. On a 1 to 10 scale, active skiers rate the desire to ski at 9.1 on average. They further rank the quality of ski runs as the most important decision criterion when choosing a destination. In recent years, ski holidays have tended to be shorter, but more frequent. Tourists are also well informed and choose destinations with the best conditions (Future Mountain International, 2016). Hence, it is critical that ski resorts continue their high investments in technical snow reliability. Although the industry cannot expect disruptive products in this regard, snow gun manufacturers are driving efficiency. Clearly, using data will become mandatory and to create efficiencies in snow management (Int: Pircher, 2020).

Furthermore, high altitude ski resorts will have to deal with an increasing number of tourists. This will push hotels to their limits. In addition, resorts claimed in their interviews that traffic poses a significant challenge to their destinations. Tourists rank the quality of accommodation and the convenience of travelling to the resort as the 4th and 6th most important decision criteria, placing less weight on sustainable practices or the quality of the local cuisine. Hence, destination managers have strong motivation to solve this issue. Meanwhile, resort executives claimed that they can barely accommodate the increased need for available beds, as they are at capacity. Widening roads or parking space is mostly also not feasible, as it would harm nature or would take away valuable space from recreational activities and accommodations. Thus, ski resorts have three options. They can increase their overall prices to attract a more affluent clientele. Alternatively, they can follow the example of the Alpine Pearls and strengthen public transportation. As another option, they can cooperate with low altitude resorts. In many cases, high altitude and low altitude resorts are close to each other. Low altitude resorts could accommodate tourists and offer transport to the high altitude resort in a convenient and fast way. Both destinations would profit. This becomes especially interesting, as both the survey and interviews revealed that tourists seek a variety of activities. They could go skiing for some days on high elevation and spend the rest of their holidays at lower altitudes doing other things such as wellness, shopping or hiking. In particular, current non-skiers and Generation Z have indicated that such an offering would be interesting, considering that it would be 15-20% cheaper than spending the entire week at a high altitude resort. Facing demographic aging and an overall shrinking market, resorts should pursue the latter options. Focusing on a specific

clientele makes resorts highly dependent on one user segment whereas appealing to broader audiences minimizes their venture risks.

Although high altitude resorts will win over tourists from lower regions, the market is declining overall in the long-run. Hence, resorts must win market share from competitors. As the interviews showed, all destinations engage more or less in the same measures to ensure technical snow reliability. They aim to attain operational effectiveness, but as Porter outlines, this is easily emulated. When all competitors achieve absolute improvement in operational effectiveness, there is no relative improvement for anyone (Porter, 1996). Therefore, high altitude resorts have to identify their USP's as well. It will become inevitable that they will compete to distinguish themselves from each other. Thus, they should specialize in different areas such as some resorts focusing on expert skiers, others on families and beginners or tourists who favor partying and skiing simultaneously. Given the Corona virus situation, some resorts might also consider becoming more health conscious limiting the number of people in gondolas, for example. All destinations need to market themselves accordingly and defend their USP's by building deep moats (Buffett, 1996). In short, they have to create competitive advantages, which will protect their long-term profits.

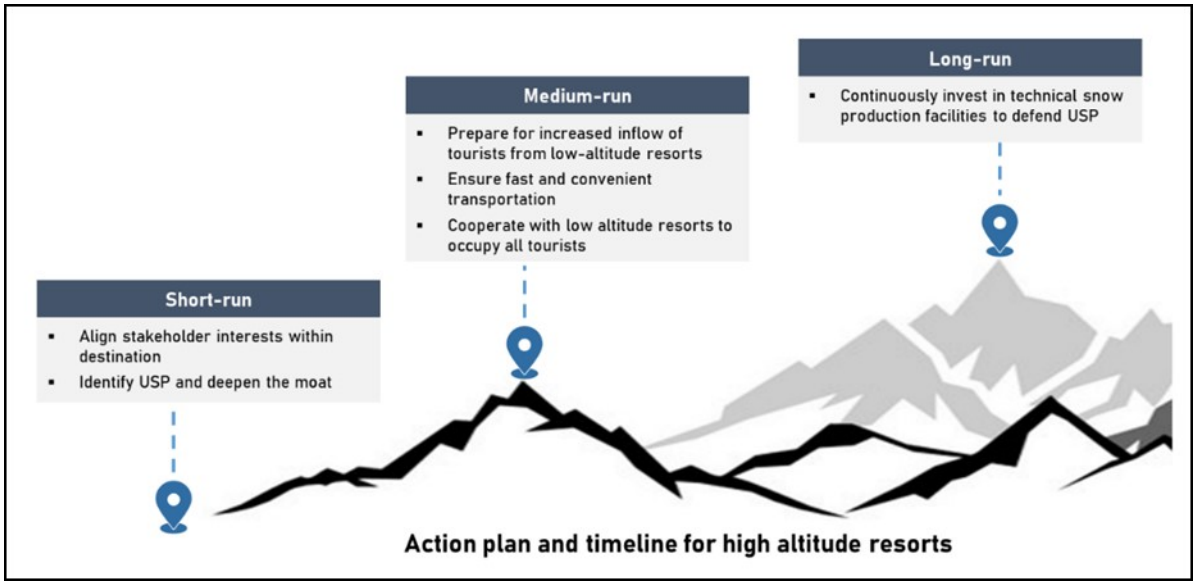

Figure 9: Action plan and timeline for high altitude resorts (authors own, 2020)

In conclusion, as is the case for low altitude resorts, high altitude destinations need to think strategically about their future competitive advantages as well and must settle upon their USP's (see Figure 9). This will help deepen their moats. From 2030 onwards, low altitude resorts will start to vanish, which will lead to an increasing inflow of tourists to high elevation areas. Destinations must prepare for this medium-term eventuality. A viable option is cooperation

with low altitude resorts. Hence, convenient and fast transportation must be established. Alternatively, resorts need to increase accessibility by convenient public transport. In the long-run, resorts committing to their USP's will pay-off, attracting loyal customers and new clientele. Over the entire time horizon, constant updates in technical snow reliability are mandatory. An essential part of deepening their moats is to defend their rare and inimitable resource – the possibility to offer fans alpine skiing.

5. Conclusion

Ski resorts across the Alps have been flourishing for decades, but have to face increasing exogenous threats. Climate change in particular jeopardizes future profitability. As the natural snowline climbs upwards, high and low elevation resorts face disparate challenges. A shrinking market caused by demographic aging exacerbates the situation. Ski resorts need to innovate their business models to remain profitable and follow Schumpeter's notion of "creative destruction" (2008).

The first step for that is to assess potential risks objectively and prepare counter measures (Rumelt, 2017). The thesis at hand is the first work, which tries to assess the readiness of ski resorts in this regard (RQ I). As climate change is not expected to endanger ski resorts critical 100-day rule until 2030, current investments are homogenous. All resorts put strong trust in technical snow production facilities. And those resorts that rate climate change to be a high level threat are the ones that have begun diversifying their product offerings. Stronger attunement to exogenous threats leads to diversifying against risks and entity more resilient.

Low and high altitude resorts need to take different measures to ensure profitability. Scholars do not agree on the right strategy for low elevation destinations. Their suggestions vary from abandoning alpine skiing to emphasizing other additional winter sport activities as well (RQ II). Primary research revealed that destinations should follow a hybrid model. They need to attract the untapped potential of non-skiers, but even this demographic is drawn to learning how to ski. In the meantime, other winter sport activities (i.e. cross ski, ski touring, tobogganing, ice climbing, etc.) do not seem to be tempting options for the mass market. Thus, low altitude resorts must diversify product offerings, but only with a selected portfolio. They should focus on alpine skiing, hiking, wellness, shopping, local culinary specialties and the possibility to party. Within this range, they need to identify their USPs and market them accordingly.

High altitude resorts on the other hand profit from climate change and can continue their strong engagement in alpine skiing (RQ III). Pressured by climate change, the lower altitude destinations will struggle to offer alpine skiing. Hence, more tourists will retreat to higher elevations. Primary research underpins the notion that the quality of ski runs and a winter landscape are the most important factors when choosing holiday destinations. Thus, resorts must continue their investments in technical snow production. To deal with a higher inflow of tourists, it becomes imperative to increase accommodation capacities and create convenient travel options to and from the resort and within the resort campus. Primary research highlights

that cooperation with neighboring low altitude destinations can be a viable option. Tourists can ski at high altitude resorts, but a price sensitive clientele can reside at lower elevations.

In conclusion, the initial secondary research, summarized in the literature review, has received confirmation and is also challenged by the primary research. Specifically, primary research confirms the findings for high altitude destinations, stating that they should continue the way they are going. However, the primary research contradicts many findings for low altitude destinations and suggests a hybrid model for them, which combines alpine skiing with a mix of other traditional winter holiday activities (i.e. hiking and wellness).

Nevertheless, one must note certain limitations of this research. The unprecedented Corona virus crisis made it hard to engage with executives from ski resorts. Appointments got cancelled or contact could not be established. Although the research encompasses eight resorts from three different countries and different altitudes, additional interviews can build upon this work and deliver more precise assessments. Furthermore, the data base relied upon by the interviewees differed. Some executives only focused on data from lift operators, while others had available data for the entire ski tourism ecosystem, including lifts, hotels, ski instructors and rentals. Hence, some executives might be biased by their skier visitors. In due course, academics might join in this research and further the conclusions drawn in this project. Once the Corona situation relaxes, other resorts could be contacted to increase the data base for RQ I. In terms of low altitude resorts (RQ II), it would be interesting to identify how destinations can align different stakeholders to occupy a niche and offer a matching mix of activities. Also, it would be useful to develop a model for generating significant revenue streams from activities such as hiking, which suffer from low willingness to pay. High altitude resorts are advised to cooperate with low altitude resorts and they need to establish collaborative connections. Resorts need to draft a joint go-to-market approach and establish an efficient infrastructure (RQ III). A set of operative recommendations would appeal to resort executives in this regard. Furthermore, all resorts rely on technical snow production. This goes hand in hand with negative externalities, such as environmental issues or high energy costs. Again, future research might identify how to tackle these issues most efficiently. Additionally, the applied research methodology can be adapted to other similar situations as well. Thus, ski resorts worldwide or equally threatened Mediterranean summer resorts can learn from these findings and apply the suggested methodology.

Exogenous threats, with climate change at the forefront, threaten the profitability and by extension the very existence of ski resorts. Yet, it is worth adapting to these changes and

investing in novel business models. Alpine skiing in the Alps is a multi-billion Euro industry, which contributes substantially to local GDP and provides employment. This thesis is the first work that has given an assessment of the current climate change readiness of alpine ski resorts and has combined scientific research with the findings of business scholars. The work provides an action plan for high and low altitude resorts alike following Christensen's (2008) notion of disruptive innovation, a strategy needed to create new business paradigms in light of the serious climate change threat.

Above all, fresh air, breathtaking scenery, snow-covered slopes and sunshine remains the dream scenario for over 130mio active skiers worldwide. Hence, ensuring the economic viability of the alpine region is worth the effort so as to preserve this priceless feeling for current and future winter ski enthusiasts.

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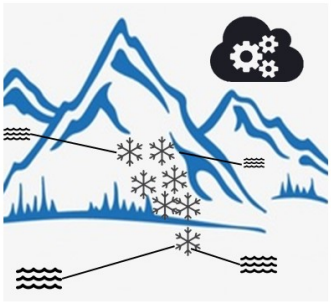
Appendices

Appendix I: Technical Snow Production – Overview

1.

Infrastructure

In order to produce technical (or artificial) snow, the many hundreds of snow guns (❄) require a certain infrastructure surrounding them. Water, which will be pumped through the guns, must be collected in vast reservoir lakes (≋) which can save up to multiple 100k m³ of water. In addition, big cables and pipes (⁓) are spread over the entire mountainside to collect the snow guns with water and electricity. Another important aspect is the software (⚙), which runs the entire infrastructure. Software collects real-live data and produces snow exactly when the conditions are perfect and where the snow will be required. It drives efficiency.

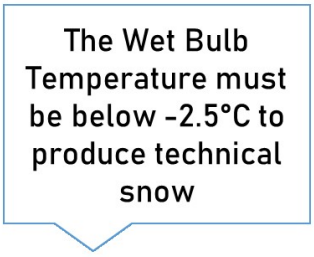


2.

Ambient Temperatures

As with natural snowfall, air temperature and air humidity need to fulfill certain requirements for technical production. Decisive for that is the wet bulb temperature (WTB), which expresses the ratio of temperature to relative air humidity. The WTB is always below the outside temperature. The damper the air, the less moisture it can absorb and the colder it must be to form snow.

Today, snow guns start producing snow from a WTB of -2.5 °C. If the atmospheric humidity is very low, this level can be reached at temperatures slightly above zero but if the air humidity is high, sub-zero temperatures are required. Temperatures around freezing point are referred to as borderline temperatures or limit temperatures.



Temperature/ Humidity = Wet Bulb Temperature

3.

Snow Guns

Technical snow consists of nothing more than water and air. Snow guns are used to simulate snowfall and the crystallization of snowflakes. Both, snow guns and snow lances can be used as snow generators. Snowmaking technology involves the use of nucleators which produce a mixture of water and compressed air which forms snow nuclei (nuclides) on entering the atmosphere. The nozzles on snow guns atomize the water into fine droplets which combine with the nuclides and freeze into small snow crystals on their way down to the ground. This fall is simulated differently by different snow generators. Fan guns are fitted with an air blower for this purpose while snow lances use the natural drop height of up to 10 meters.

Snow Gun

Snow Lance

4.

Outcome

At perfect ambient temperatures and overall outside conditions, one snow generator alone can produce 90m³ of snow in one hour. It is hard to estimate, how much energy this procedure than requires, as it depends on many individual factors. This includes temperature, location of the reservoir lakes, temperature of the water, etc. However, as a rule of thumb one can say that technical snow production requires 5 times as much energy at borderline temperatures, compared to ideal conditions.

Appendix II: Technical Snow Production – Expert Interview

Interview with Patrizia Pircher, Head of Marketing at TechnoAlpin, the world's largest manufacturer of artificial snow production facilities, about…

…the concept of technical snow production

Technical snow production follows the same principles as natural snowfall and purely relies on water, cold temperature and compressed air. Snow guns are used to simulate snowfall and the crystallization of snowflakes. Snowmaking technology involves the use of nucleators, which produce a mixture of water and compressed air, which forms snow nuclei (nuclides) when entering the atmosphere. The nozzles on snow guns atomize the water into fine droplets, which combine with the nuclides and freeze into small snow crystals on their way down to the ground. This fall is simulated differently by different snow guns. Fan guns are fitted with an air blower for this purpose while snow lances use the natural drop height of up to 10 meters. Air temperature and air humidity need to fulfill certain requirements for technical production of snow. The term used in snow-making technology is therefore the wet bulb temperature which expresses the ratio of temperature to relative air humidity. The wet bulb temperature is always below the outside temperature. The damper the air, the less moisture it can absorb and the colder it must be to form snow crystals form the fine droplets of water. Snow guns start producing snow from a wet bulb temperature of -2.5 °C. If the atmospheric humidity is very low, this level can be reached at temperatures slightly above zero but if the air humidity is high, sub-zero temperatures are required. Temperatures around freezing point are referred to as borderline temperatures or limit temperatures. The water temperature is also a key factor, especially at these limit temperatures. Cooling towers are therefore used to reach the optimum water temperature and to increase the efficiency of a snowmaking system. Snow guns are just one of the many components in a snowmaking system. Therefore, it is necessary for various components to be perfectly matched and coordinated with each other so that the snow guns will be supplied with the right amount of water at the right time and at the right pressure.

Snow making facilities are spread over the entire ski resort, either permanently installed or mobile. A strong machine pumps water from the reservoir lakes through thick pipes to the snow guns, all digitally steered by a software. The software can command the entire facility automatically. All snow guns give real live weather data to the software, which gives commands in return. Combined with the data the software receives from snowcats, it gathers all crucial data and has an overview of available snow masses on the mountain. Hence, the software knows which slopes have to be prepared in what way, when and where.

Regarding the reservoir lakes, this is an individual case for any resort. The lakes vary from 20k m³ to several 100k m³ water, often resorts can rely on natural water resources. Ideally, the lakes are high up in the resort, so that less energy has to be used to pump the water up the hill.

…future developments and innovation in technical snow production

As a novelty, TechnoAlpin has developed the Snowfactory for selected snowmaking applications. Nordic centers are most likely to be situated in areas which are too warm for conventional snowmaking systems and so the TechnoAlpin Snowfactory provides greater ability to prepare the trails. This snow gun is not intended as a substitute for conventional snow production but is more of an addition to the existing snowmaking applications and technologies. This type of snow machine is therefore mainly used on relatively low slope sections or at events in large towns. The Snowfactory produces snow by means of an innovative cooling technology. An efficient heat exchanger cools the water to its freezing point without using any chemical additives. The refrigeration circuit remains closed in the process, enabling the production of snow in any outdoor temperature. There is no complicated building work or fittings are necessary for the installation of the Snowfactory. The snowmaking system is delivered in the container on site ready for operation. It only needs to be connected to the power and water supply, then snow can be produced around the clock, regardless of the outdoor conditions or the water temperature on site. The Snowfactory is therefore also suitable for temporary installations. However, the factory demands much higher initial and operative investments. The operation is highly energy intense. The snow factory can produce 100m³ of snow per day. It is a plug-and-play solution, no infrastructure around other than water and energy connection are required.

Other than the snow factory, there will be no groundbreaking new technologies, but the current tools will achieve much higher efficiency. Software is at the forefront of that development. Software will help to produce snow in a most efficient way and also utilize it more efficiently, so that nothing of the valuable resource will be wasted. Big Data will help to combine weather forecasts with currently available snow, potential snow production capacities and data from previous years. A smart algorithm will then help to analyze when, where and at what level snow production is most efficient. TechnoAlpin has released an application this season, to predict how much snow can

be produced in the next 5 days, based on real time data. Big Data and the software will help ski resorts to identify the ideal time frame for snow production and by that minimize energy costs.

The mechanical components of snow guns will improve as well, but there are no disruptive snow gun models. Higher efficiency drives innovation.

…the costs of technical snow production

The costs to produce snow vary heavily. It is important where the reservoir lakes are and how much energy has to be used to pump water towards the snow guns. The snow guns themselves cost between 10 and 40k € each. In general, one third of the investment goes into the visible investments of guns, while two thirds go into infrastructure for pipes, drains, reservoir lakes and software.

Ideal conditions for technical snow production are dry air (ideally a humidity of 10-20%), cold temperatures between minus 10 and minus 15°C and no wind. This enables 90m³ of snow per hour and snow gun. To explain that further. The more dry the air is, the more water it can absorb and snow making would be possible even at higher and even positive temperatures of up to 2°C. If machines have to operate at ambient temperatures, hence the conditions where technical snow production is still possible, but less efficient, energy costs goes up by a factor of 5.

…TechnoAlpin markets

The resorts on the southern side of the Alps are pioneers in technical snow production, as there are higher ambient temperatures and lower natural snow reliability. Hence, the resorts adopted the technology early on and major resorts are 100% covered by snow making facilities. Driven by the importance of the skiing tourism industry, Austria has a similar history. The Suisse Alps are comparably higher and they adopted the technology later on, but also invest heavily in technical snow reliability. Technical snow production is mainly about the certainty to open the resorts at the most important dates. Therefore, even high altitude resorts utilize the technology to increase their certainty for snow reliability. There is no indicator that low altitude resorts invest more than high altitude resorts. Most investments have a horizon of 20 years, going up to 30 years in few cases.

Appendix III: Innovative Business Models in Winter Tourism – Expert Interview

The Alpine Pearls are an association of 21 tourist destinations across the Alps. Together, they offer the innovative business model of sustainable holidays in eco-motion. Karmen Mentil, CEO of Alpine Pearls, explains about…

…the history of the association and the core idea

The history of the Alpine Pearls started in 1995 in Werfenweng, a tourist destination in the Salzburg area. Destination management there entailed how they could distinguish their offering over tourism hot spots like St Johann or Flachau, which are close by. They identified the market niche of "soft mobility", whereas tourist would experience holidays without their own car. This idea received acceleration, when the national ministry for economy, environment and mobility started an initiative in this direction in 1997. Werfenweng applied for the program and received subsidies for their plans. To begin with, they started to invest in solar energy on a large scale and organized pick up from tourists for the last mile. The idea was that tourists don't need a car, arrive by train and can rely on convenient and free transportation in the destination. Furthermore, they improved their offering of hiking trails and bike paths. Over time, Werfenweng offered electric cars, e-bikes and taxis free of charge for their tourists. In a next step, the EU initiated similar programs and started a sustainable mobility movement called "AlpsMobility". Across the Alps, the EU wanted to encourage tourist destinations to engage in sustainable mobility. In due course 12 destinations across Austria, Germany, Switzerland, Italy and France received further subsidies for that purpose. AlpsMobility received positive feedback and was extended to a second round with even more participants, encouraging an internal network and best practice sharing. This was the basis for the foundation of the Alpine Pearls in 2006. The positive experience of sharing knowledge and the creation of a network across borders, languages and cultures motivated to start the Alpine Pearls with 17 tourist destinations. Ever since, the number of members is varying. It peaked with 29 destinations and has now settled at 21.

It is important to note, that the public bodies were only giving out subsidies, but did not dictate what happened to the money exactly. Ever since 1995, it is about innovative and creative individuals, who drive innovation and the sustainable movement. In Werfenweng for example, it is the local mayor, who stands for the novel approach. The progress achieved goes back to individuals in key positions in the destinations, who build a valuable local network.

The last mile of transportation has to be secured for tourists, free green transportation options have to be provided, hotel owners must jump on board and promote sustainable holidays with corresponding offers and entrepreneurs can extent the offering (E.g., horse carriage rides).

Until now, soft and green mobility has been a success story. However, Alpine Pearls has so far failed to make skiing itself more sustainable. Often, energy does not origin from local providers and lifts and snow cats are often not powered by green power, but fossil energy.

…their target market

The Alpine Pearls as a whole don't target a specific geographic or demographic. The different members have varying target markets and promote them differently. However, in order to gain momentum, the Alpine Pearls invited as many journalists as possible in the beginning of the movement, to spread the word and use them as a multiplier for their message. Nevertheless, the clientele has some features in common. Internal customer analysis has identified that most customers do not own a car. They would have the financial means to own a car, but concerning the environment and their living arrangements in the city, they decide against it. Looking at the geographic, most customers arrive from bigger cities, especially when they have a good connection to the fastest trains, like "ICE" in Germany. Customers are often enthusiastic mountain bikers or hikers. The Alpine Pearls observe that a majority of customers are families coming from Germany (40%), Northern Italy (35%), Austria (10%), France (10%) as well as Switzerland and UK. In short, Alpine Pearl members are well advised to target clientele with a total travel time by public transport with less than 6 hours. This represents a big enough target market to be successful within that niche offering.

…criteria to become an Alpine Pearl

To become an Alpine Pearl, the destinations have to fulfill certain criteria. It is mandatory to offer carless vacations for tourists. A good connection to public transport and the transfer of the last mile are critical. In addition to that, the potential pearls have to score on a variety of different aspects. They have to promote local and regional products, encourage alternate energies, protect local architecture and emphasize biodiversity.

…the co-existence as a ski resort

On the one hand, the Alpine Pearls criticize the skiing industry, as technical snow production and the lifts require a lot of energy. On the other hand, 80% of the carbon footprint of skiing holidays account to the transportation to and from the ski resorts. Hence, sustainable mobility already achieves a high impact. Therefore, the Alpine Pearls have several communities in their network, where green mobility and ski resorts co-exist. One example is Neukirchen am Großvenediger. The ski resort can easily be reached by public transport and the transfer of the last mile is excellent. Furthermore, this yields great advantages for the resort itself. There a no traffic jams in and out of the valley and big car parks make space for hotels or recreational space. The quality of living, working and spending time there increases.

…the economic impact

All destinations have their own monitoring methods and data management. It is problematic and difficult to quantify the economic impact of the Alpine Pearls as a whole. However, many destinations have transparent data, which offers valuable insights – for instance Werfenweng. In 1995, 6% of all guests arrived by public transport, the rest by car. Today more than a quarter arrives by public transport and uses the sustainable mobility offering. Every hotel pays 2 € a night per person to the tourism center. In return, all guests of Werfenweng can use a variety of transportation methods and recreation activities free of further charge. This offering includes electric cars, e-bikes, last mile transfers, taxis, sledge rides and much more. Since the introduction of that offer in 1998, overnight stays have increased by 30%. In short, the business model is profitable, despite the high investments.

…the future of the Alpine Pearls

Currently, the Alpine Pearls have 21 members with 21 different situations and methods. The organization has to optimize and synthesize systems to reach higher efficiencies and closer cooperation. Many destinations have reached their limits with sustainable mobility, as all trains, busses and horse carriages are packed. The organization has to spread the tourists over all pearls more effectively and further increase the number of members. In addition, the Pearls face challenges. Electric cars and e-bikes become mainstream and offering them for free becomes less of an unique selling point. The organization has to find innovations, which continue to attract people. Autonomous driving is a key topic now and could be the next investment. Furthermore the different stakeholders within and across the Pearls can be brought together even closer.

…their vision 2050

Switzerland is a role model for public transport with a fast, reliable and convenient network. To enable sustainable mobility across the Alps, Switzerland must become a blueprint for the entire alpine range. The Alpine Pearl movement aims to lobby politics and economy into that direction. The Alpine Pearls have reached almost the limit of what they can achieve under current circumstances, but when the infrastructure around develops, they can grow proportionally. In the end, hotel managers should care less about the mobility of people, but how to spoil them once they have arrived. The Alpine Pearls want to help to achieve that.

Appendix IV: Interview with Dolomiti Superski Association

Dolomit Superski is an association of 12 resorts in Italy's Dolomites. They are united through one ski pass, which makes the association one of the biggest resorts worldwide. Diego Clara, Head of PR & Marketing, about…

…economic data

Dolomiti Superski is an attraction in summer and winter alike, although the offering of lifts are much smaller in the summer months. Looking at the pure number of tourists, there's almost an equal 50/50 split between the two seasons, as the region is also a traditionally strong summer destination. Nevertheless, looking at the generated revenue, the winter remains much stronger with an 80/20 distribution. Dolomiti Superski runs 450 lifts in the winter and only around 100 for hikers and mountain bikers in the summer.

…climate change

Ever since the region started to adopt technical snow production, the 100-day rule was never really a problem. Yet, the destination management acknowledges climate change as a slow process. They do not expect that skiing will not be possible anymore in the near future, but fear the possibility. However, lift operators and investors do not show discouragement so far and continue their high investments in the skiing industry. Most investments have credit horizon of 15-20 years. There are no plans yet, what the region could do, when winters cease to exist. However, they highlight the possibility, that skiing will only occur on the higher altitude slopes and not in the valleys anymore.

…technical snow reliability

Currently, the region takes no other measures than technical snow production and omit snowfarming or landscaping. In the past 8 years, the region spent annually around 70 mio € in new lifts and 30 mio € in technical snow production. The latest snowmaking tools can produce a high number of snow in a very short period. First or second-generation machines become updates, along with bigger reservoir lakes and thicker pipes. As a result, the region can produce as much snow in 5 days, as the old machines could over a month, while using the same amount of power. Water gets cooled before and the jets are optimized, what reinforces efficiency. Unfortunately, there are no subsidies for the investments.

…the future of the region

The destination management sees strong growth in terms of mountain bike traffic. The world famous ski tour "Sella Ronda" has opened its doors for mountain bikers over the past 3 years. A lift brings them up and they go down on their bikes. If winter would cease to exist, the region would have to adapt to a new demand, such as hiking in the winter or fatbiking. The summer season would become longer, start in spring and end in autumn and there would be an overall focus on biking and hiking. However, concrete plans have not yet been created, as the impacts of global warming are not expected to be too severe within the next investment cycles. Based on their own market research, 99% of winter tourists visit the region for skiing and substitute activities such as snowshoeing, winter hiking or cross skiing cannot keep track with the demand and revenue streams. They acknowledge climate change, but have not yet worked on alternative offerings. It will be very hard to find an equally profitable alternative.

Dolomit Superski's biggest asset is their continuous investment in the latest technology and quality. This ensures ski tourism in the long term and offers an edge over other resorts, who invest less. For now, they will continue to invest.

Appendix V: Overview of Semi-structured Expert Interviews

Resort	Relevance of winter and summer season	Climate Change Vulnerability	Sensitivity towards climate change	Sensitivity towards demographic change	Impact of Covid-19	Sustaining competitive advantages	Novel business models	USP
Micro-Perspective								
Val Gardena, ITA	**Guests: 56/44; Revenue: 70/30**		**Agree** that climate change will impact the business and see it as biggest exogenous threat to future prosperity. **Score: 8/10**	**Agree** that it will impact the business, but yet do not regard it as threatening as other challenges. Generation X with families from DACH region is most important target market. **Score: 6/10**	Heavy economic losses in the short term, but growth opportunities in the future. Alps as climate refugee destination. **Score: 8/10**	Latest state of the art technical snow production facilities.	Become all-year destination with focus on hiking in the summer. Pronounce high quality accommodation with vast wellness offering.	Humanity, friendship and family as well as sustainability are the most important values for the destination. The nature itself remains the biggest asset.
Garmisch/ Zugspitze, GER	**Guests: 50/50; Revenue: 50/50**	Zugspitze: Garmisch:	**Agree** that climate change will impact the business and anticipate the threat to operations, including the closure of several low altitude slopes. Nevertheless, trust in technology to ensure skiing in the future. **Score: 10/10**	**Agree** that it will impact the business, especially due to the shrinking market in DACH region. Still, they focus heavily on attracting young clientele from DACH region and expand marketing to Asia, to attract new geographic. **Score: 10/10**	Strong short term cuts in revenues, while reserves dissolve. Investments must be postponed for new evaluation. **Score: 5/10**	Latest state of the art technical snow production facilities. Reinvest 10-15% of revenues annually.	Intensify position as all-year destination with a varying offering of activities for all family members.	Succeed as all-year destination, offering a diversified set of activities from culture, to shopping and sports - entertain families. Zugspitze is the highest point of Germany, which is an unrivalled USP.
Winterberg, GER	**Guests: 50/50; Revenue: Much higher in winter**		**Strongly agree** that climate change will impact the business and see it as biggest threat to future profitability with a 1°C increase in the next 20 years. Failed to meet the 100-day rule 2 times in past 10 years. Usually open only few slopes and harness artificial snow production there. **Score: 9/10**	**Agree** that it will impact the business, but yet do not regard it as threatening as other challenges. Families from Central Germany, as well as Benelux and Denmark are most important clientele. **Score: 3/10**	Halt on plans to connect resort with smaller resort by new lift. As the region is especially attractive for tourists from close by, the resort might even profit from long-term restrictions on foreign travelling. **Score: 2/10**	High density of state of the art snow production facilities. Utilization of novel snow factories. Annual investments usually account to 10% of revenues.	Strong investments to utilize entire lift infrastructure all year around with different activities from mountain biking to zip lines or summer toboggans.	Monopoly in central Germany with state of the art lift and technical snow infrastructure. Ideal resort for families and beginners.

Appendix

Resort	Relevance of winter and summer season	Climate Change Vulnerability	Sensitivity towards climate change	Sensitivity towards demographic change	Impact of Covid-19	Sustaining competitive advantages	Novel business models	USP
Micro-Perspective								
Anonymous Ski Resort in Tyrol, AUT	**Guests: n/a; Revenue: 90/10**		**Agree that climate change will impact the business, but feel well prepared for increase in temperature with investments in technical snow production. Score: 7/10**	**Uncertain about the effects. Acknowledge that market is shrinking, but so are the number of competitors. Demand and supply will remain balanced. Score: 5/10**	**25% less in revenue, due to early season ending. Referring to the uncertainty of the situation, the resort fears further absolute losses in revenue in coming summer and winter season, which might jeopardize the survival of the ski resort. Score: 10/10**	**Latest state of the art technical snow production facilities.**	**Improve offering for hiking in the winter. Position as all-year destination with a mix of activities for a wide set of interest groups – from thrill seekers to relaxation.**	**Mix of activities for all interest groups in summer and winter alike. In addition, the resort is easily accessible for huge German market.**
Anonymous Ski Resort in Carinthia, AUT	**Guests: 66/33; Revenue: 90/10**		**Disagree that climate change will impact the business. Believe in a more volatile climate with warmer and colder winters, but no general tendency towards higher temperatures. Score: 4/10**	**Strongly disagree that it will impact the business, as they try to rebalance revenue streams. Increasingly higher emphasis on young clientele (schools and kindergarten), as well as other geographies with untapped potential. Score: 2/10**	**They experienced high income losses, due to early season ending. Other than that, the consequences are impossible to predict for now. Score: n/a**	**Latest state of the art technical snow production facilities.**	**Offer soft and sustainable offerings in winter: hiking, toboggans & ski touring. Also, positioning as all-year destination with mountain biking and paragliding.**	**Natural topography of resort with a 360° panorama view over the Carinthia mountains and lakes.**
Wildkogel Arena, AUT	**Guests: 80/20; Revenue: 90/10**		**Agree that climate change will impact the business, but feel well prepared for increase in temperature with investments in technical snow production. Score: 3/10**	**Agree that it will impact the business. However, as they focus mainly on families from the DACH region, they hope to develop their future clientele from scratch and make them loyal customers. Score: 3/10**	**For now, there are severe losses in revenue for the winter, as well as summer season. We also expect lower revenue streams in the coming winter. Investment plans have come to a halt. Score: 4/10**	**Latest state of the art technical snow production facilities.**	**Offer a broad mix of activities in winter, as well as in summer. Want to entertain families with a great variety. Also, engagement in sustainable holidays (Alpine Pearls Member).**	**The mix of fun activities for the entire family in a nature pure resort.**

Appendix

Resort	Relevance of winter and summer season	Climate Change Vulnerability	Sensitivity towards climate change	Sensitivity towards demographic change	Impact of Covid-19	Sustaining competitive advantages	Novel business models	USP
Micro-Perspective								
Anonymous Ski Resort in Salzburg County, AUT	**Guests: 80/20; Revenue: 88/12**		**Uncertain that climate change will impact the business. They do not ignore the phenomenon of global warming, but believe they can control it with artificial snow production. In conclusion, they rank it the least dangerous exogenous threat. Score: 7/10**	**Agree that it will impact the business. They act accordingly and try to satisfy the various demands with a wide set of activities. They cater to families and therefore try to entertain them accordingly. Score: 8/10**	**Anticipate heavy financial losses within the next 2 years. Fewer people will travel and the resort will have to erect protective measures, which will be equally costly. Score: 8/10**	**Latest state of the art technical snow production facilities. Annually, the resort invests 10-12mio € in new lifts and technical snow (20-25% of annual revenue).**	**In order to entertain families, they invest in a wide range of activities from ski touring, hikes and wellness to yodel courses, or mountain yoga.**	**A family friendly resort, which tries to satisfy varying needs in the midst of a unique landscape. The resort enjoys a stunning mountain and lake scenery.**
Saalbach Hinterglemm, AUT	**Guests: 70/30; Revenue: 70/30**		**Agree that climate change will impact the business, but feel well prepared for increase in temperature with investments in technical snow production. Nevertheless, climate change is the biggest threat. Score: 8/10**	**Agree that it will impact the business, but note that people are also healthier in an older age. After all, they mainly attract Generation Y, X and Z with a succesful tailored marketing. Score: 6/10**	**They try to deal with the dynamic developments of the pandemic on a daily basis. It will be decisive, how the situation develops in Austria and the crucial target markets. Score: 5/10**	**Latest state of the art technical snow production facilities. Overall focus on ski activities (groomed slopes plus freeriding).**	**Apart from skiing, the resort offers other typical winter activities and offers events (e.g. ski world cup). In the summer, the offering is broader with a focus on mountain biking.**	**It is a big and high class ski resort with a state of the art infrastructure, great hotels and wellness offerings. On top, the resort offers events and a stunning scenery.**
Macro-Perspective								
Dolomiti Superski, ITA	**Guests: 50/50; Revenue: 80/20**	***Association of resorts is too big and versatile for a score.***	**Acknowledge a potential threat, but only long-term.**	**Depends on marketing of each individual resort.**	**Due to the dynamic development of the pandemic, there can be no comment made.**	**Latest state of the art technical snow production facilities. Annual investments of 130mio € in new lifts and technical snow.**	**In winter, the region remains mostly a pure skiing destination. Development of mountain biking opportunities in the summer.**	**Continuous investment in the latest technology and quality. This ensures ski tourism in the long term and offers an edge over other resorts.**

Majority of slopes are above critical snowline. Many slopes are below the critical snowline. Majority of slopes are below critical snowline.

Appendix VI: Interview with Val Gardena, ITA

Christina Demetz, Head of PR and Marketing about…

…economic data

Val Gardena accommodates 56% of their guests in the winter, compared to 44% in the summer. However, the tourist destination generates 70% of their revenue in the winter and 30% in the summer. A higher number of stakeholders profits from the winter season. Hotels can apply their high season prices for a longer period and ski rentals, ski schools and ski lifts can only operate in the wintertime. Overall, skiing holidays are more expansive than summer holidays and this brings revenue to the region. On the other side, operative costs are higher in the winter. The ski lift operators have to prepare the slopes for tourists and produce technical snow. This goes along with a higher employment rate in the winter. The winter seasons lasts around four months from early December to late March usually, while the summer season starts in mid-May and ends in October. The most lucrative period of the whole year are the Christmas holidays, although these are only ten days. The strongest month is February, when many European countries have winter school breaks. In the summer season, August represents the most profitable month.

…technical snow production

Because Val Gardena resides on the southern side of the Alps, the region anticipated a potential shortage of natural snow very early on. Hence, Val Gardena are pioneers in technical snow production and the first region in the world to adopt such technology in the 1980s. However, snowmaking facilities are the only tool the region adopts for that purpose. There are no other measures such as landscaping. Due to the fact that the Dolomites are an UNESCO world heritage, the region is rather limited in that regard anyways and restricted in their movements. For instance, there is only one artificial reservoir lake in the skiing area. Winter tourism is an important economic foundation for the region, but stakeholders value the nature and their uniqueness over economic profit.

…natural snow reliability and the impact on the future of the ski resort

Val Gardena is well aware that due to climate change, skiing could no longer be possible there. There is hope that technology develops and snow can be produced under higher ambient temperatures above 0°C. Nevertheless, the destination needs to prepare an alternative offer for tourists apart from skiing. Val Gardena wants to become an all-year destination with a stronger offering for hiking for example. But, the destination management doesn't expect a drastic shortage of snow in the next 30 years. Only if there is a succession of several winters with no snow and no possibility to produce it technically, the resort will change their image away from a skiing hotspot. Stakeholders are aware that if tourists cannot ski anymore in the area, this will be a huge economic damage. In that case, the area has to reinvent. Some lifts could vanish and make space for hiking routes. Besides planning on an extensive offering for hiking, the destination managers count on the vast offering of high-class hotels with their spa areas. Val Gardena wants to remain a destination for recreation.

But as of today, Val Gardena stands for skiing and the area has reached their limits. They cannot build any new lifts or connect to other resorts. All they can do is renew existing infrastructure, which they do every single year heavily. The resort aims to have the latest technology and highest quality with their lift infrastructure. Right now, there are strong investments in the ski resort, rather than divestments and a focus on other activities. They do not see a successive shortage of snow and low temperatures, but rather a stronger variation of good and bad winters.

…geographic and demographic target markets

The generation of baby-boomers was the strongest demographic for a long time, but they have changed travel habits. They mostly stopped coming in the winter and rather spend their summers in the mountains now. The most important demographic are Generation X and their families. The resort advertises their high quality and demands a higher price, hence the target group is relatively wealthy. The resort does not focus on party and après ski, therefore the demographic is rather old. However, the resort starts to attract Generation Y now and wants to make them their future main clientele. The strongest geographic is the domestic market of Italians, who represent one third of all customers. Germany follows close by with almost equal numbers. Dutch, Brits, Russians and Scandinavians contribute to the rest of the main customers.

…the impact of the Corona virus

As of now, the Corona crisis has a very severe negative impact on revenue streams. Especially as long as borders are closed, tourists from the main markets in the DACH region, cannot access the valley. However, in the future we rather see it as a growth opportunity, as people might favor nature based holidays over crowded beaches or city

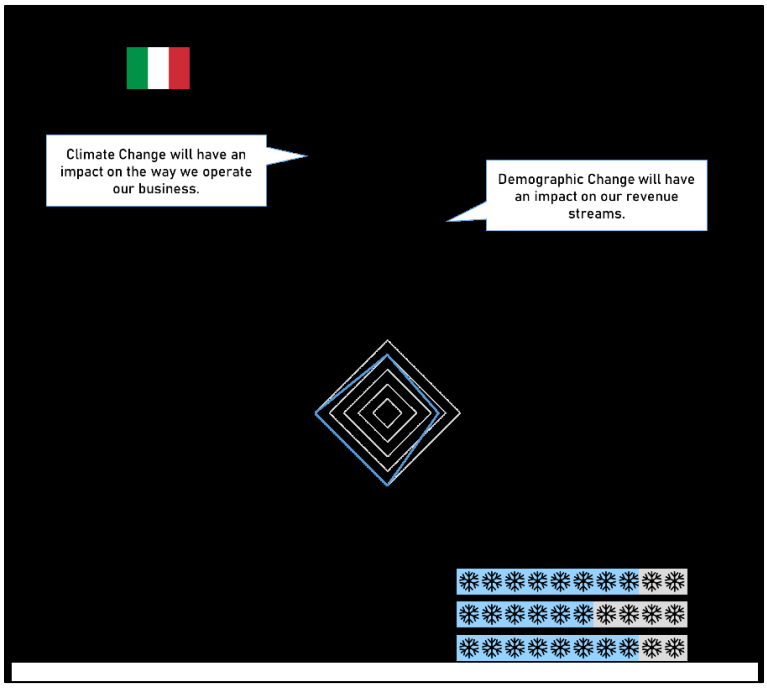
trips. The chance for infection will seem lower in the mountains than elsewhere. However, we will have to change the way we transport tourists in busses and lifts. New concepts will have to be made.

…regional and interregional alliances

Val Gardena is part of the world famous Dolomiti Superski area, an alliance of 12 resorts, who are combined through one ski pass. Apart from that, cooperation within the tourist destination and across regions is rather difficult. Some partnerships were initiated, such as Dolomiti Super Summer or Leading Mountain Resorts, but the results were weak and the cooperation were abandoned soon. Every destination continues to work more or less individually.

…the future of the resort

Val Gardena wants to promote quality and continuity. Humanity, friendship and family as well as sustainability are the most important values for the destination. The nature remains the biggest asset of the region and has to be protected at all cost. Therefore, all lifts are operated by electricity from South Tyrol. One of the biggest challenges will be to reduce heavy traffic in and out of the resort.



Appendix VII: Interview with Zugspitzbahnen, GER

Matthias Stauch, CEO, about…

…economic data

The region around Garmisch-Partenkirchen, including Germany's tallest mountain Zugspitze, accommodates 1.3 million guests per year. There are two ski resorts: Garmisch Classic, which resides between 740 and 2050 m and Zugspitze, which lays between 2000 and 3000m. The tourists are split 50/50 between winter and summer; hence, Garmisch is an all-year destination. The most lucrative period are the Christmas holidays. Similar to the number of tourists, revenue is also split 50/50 between summer and winter, although the summer is more profitable, as costs are lower. There are the same amount of tourists, but less lifts have to be operated with a significant lower number of personnel. 500 people operate the lifts in the winter, while the summer operations require 100 people less.

Since the early 2000s, Garmisch has started to promote the area as an all-year destination, which seems to pay off, as it also attracts non-skiers in the winter and makes the resort less reliant on skiing-tourism. Zugspitze welcomes already 70% of their visitors in the winter as non-skiers, thanks to their unique selling point of being the tallest mountain in Germany. To react to that trend, the region has opened a new lift with investment costs of 60mio € in 2018 to transport more people faster to the top of the mountain. Garmisch Classic also welcomes more non-skiers. The region observes that families demand a mix in activities, away from entire skiing holidays. They travel

together, but while some want to ski, others want to go hiking, go to the spa or go shopping. As Garmsich offers all that, they see that as a strong asset compared to their Austrian competition.

…technical snow production

Thanks to the high altitude, Zugspitze is still highly snow reliable, even without technical snow production. However, technology is essential for Garmisch Classic and without it; skiing tourism would not be possible anymore. In addition to that, the quality standard and tourists expectations have risen. Today, tourists expect perfectly prepared slopes every single day, regardless of the natural conditions.

The resort has invested in the latest version of snowcats. All of them are equipped with digital guiding systems and snow depth measurements, which evaluates the snow depth with an accuracy of +/- 2cm. This increases the efficiency significantly, as the snowcat drivers know exactly, where they have to put the scarce resource of snow. As 1m³ of snow costs roughly 5€, this technology is a game changer for the resort. To run the whole ski resort, they need 500k m³ of snow. To ensure technical snow reliability, the resort invests 1,85mio € annually. Combined with the investment costs of the new Zugbspitzbahn, the investments in technical snow reliability and new lifts accumulated to 90mio € in the past 9 years. The annual revenue is around 50mio €. Therefore, the resort reinvests 10-15% every single year. Most investments are made over a horizon of 5-8 years and amortize in that period.

Garmisch acknowledges that technical snow production will become more expansive, as temperatures rise. However, they hope that scientists will be proven correctly and that there will still be cold periods, although they might be shorter and less frequent. It will be essential to produce as much snow as needed in these short intervals. The latest technology enables, that 3 days of perfect conditions can be sufficient to ensure that 90% of the season are technically snow reliable. They hope that these 3 days occur before Christmas, so that the 100-day rule can be realized. Regardless of technical snow production, Garmisch must anticipate restrictions in their offering. Especially the four slopes, which go down to the valley, will be most at risk. Garmisch has to offer alternatives for tourists, such as hiking or sledge riding, so that the loss in piste offerings is less painful. As the area invests a lot in infrastructure and snow reliability, the ticket prices have to increase proportionally. There are no public subsidies for the skiing tourism sector, so the tourists have to cover the rising costs of piste making. However, so far the ticket prices have increased in harmony with the average rise in salary and wages. As a result, it will not be the biggest challenge for ski resorts to remain skiing as a sport for the broader public, but to attract younger clientele and awake their interest.

…geographic and demographic target markets

Garmisch aims to attract families and advertises themselves as an all year around tourist destination. Hence, most important is an offering of mixed activities including skiing, hiking, shopping, spa and family entertainment. To attract families and younger clientele, the ski resort has invested over 2mio € alone to update the “kids-land” three years ago. This attracts families from the Munich area and schools and kindergartens from the region. Destination management has not decided yet, which geographic will prove to be most profitable for the resort, but the domestic and local market looks promising so far. In addition to that, Garmisch anticipates the opening of a new market from Asia and China. So far, Asian visitors mainly just stopped by for half a day, went up Zugspitze and left again. Now they start to spend more time and diversify their activities from “Pictures only” to skiing. Hence, the resort has started to hire Chinese ski instructors.

…regional and interregional alliances

The ski resort is more or less fighting on their own and tries to dictate the direction in which the region is heading. There are no alliances or cooperation, which leads to a low level of coordination. Many stakeholders try to engage in all-year destination practices, but the region fails to synthesize activities.

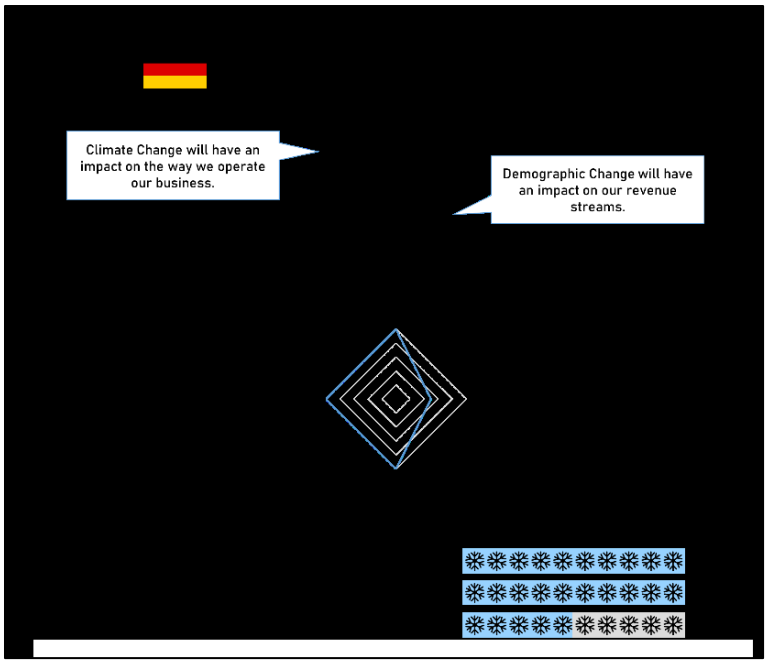
…the impact of the Corona virus

For now, we have to face severe cuts in revenue and cannot really anticipate, when this situation will relax again. The longer the crisis endures like that, the more capital reserves we will have to dissolve. That is very painful, as they are the foundation for future investments. All investment plans have come to an halt at the moment and will be reevaluated later.

…the future of the resort

Garmisch wants to continue to succeed with their all-year destination offering and the diversified set of activities. From Culture, to Shopping and Sports, they want to entertain families. Zugspitze is the highest point of Germany, which is an unrivalled unique selling point.

Appendix



Appendix VIII: Interview with Skikarussel Winterberg, GER

Julian Pape, Project Manager, about…

…economic data

The winter season is between 3 and 4 months long and therefore shorter than the summer season. Yet, numbers of winter and summer tourists are equally split. Revenue per winter season accumulates to 140 mio € per year (including indirect revenue streams, E.g., ski schools, ski rental). Revenue in the summer is much lower. Also, the winter season enables a higher employment rate in the region. Including ski rental, ski schools and huts for food and beverage, the winter season employs 700 people. The number in the summer is significantly lower. Looking at the 100-day rule, Winterberg has failed 2 times in the past 10 years to meet the goal. Usually they do meet the target even in bad winters, by offering at least some few slopes, while a majority of the resort stays closed.

…technical snow reliability

The ski resort has around 400 snow guns, which is a high density considering the relatively small area of slopes. Three slopes are even equipped with the latest technology of snowfactories, which enables technical snow production at high ambient temperatures at high electricity costs. In the last winter, which was warm and had not much natural snow, the snowfactories helped to keep the resort alive. However, it comes to a high price. The energy costs of one snowfactory are as high as 25 snow guns, of which one could produce almost 20 times as much snow in the same time at perfect conditions. Usually, the resort only needs 4-5 very cold nights in December, to secure technical snow reliability for the entire season. However, these cold nights did not come and therefore they had to rely on the snow factories. Other than that, Winterberg works with the same state of the art technical snow production facilities as most alpine resorts. This includes the latest snow guns, software, snow depth measure with GPS and cooling towers.

…Investments

Winterberg demands roughly 25% less for a day ticket than their counterparts in the Alps, because they have lower costs for technical snow production in total. The total area of slopes is much smaller. Yet, the costs to invest and operate the facilities are the same. But, the ski resort has a monopoly in central Germany. While alpine resorts are in fierce competition, Winterberg is the only comparably big ski resort north of the Alps. Tourists from the Netherlands, Belgium, Cenral German regions such as Cologne, Frankfurt or Dortmund drive two hours and can start skiing. Going to the Alps would take them at least 5 more hours. To attract this clientele, the resort has to invest in snow reliability. Over the past 20 years, every two years, the resort invests in new or updated lifts, with costs of 6 mio € per lift. Total investments per year varied between 10 and 15 mio €. The investments are planned over a time horizon of 10 to 12 years, before they amortize. Further investment plans to connect Winterberg with smaller resorts around by lift are anticipated, but came to a halt, due to Corona and mild winters recently. The situation has to be re-evaluated. However, if this investment takes place, Winterberg would become Germany's

largest ski resort in terms of total area. This would attract more tourists and would justify an increase in prices. In addition, it would help to solve a traffic problem, as tourists would spread over a wider region.

…climate change

The ski resort plans investments in 20-year cycles. Within that period, they expect mean temperatures to rise by 1°C. Considering the expected development in snow making technology, skiing would still be possible and profitable, as snow guns could produce snow more efficiently and at lower costs.

…diversification of activities offering

In recent years, Winterberg invested heavily in the summer season. Some lifts continue to operate throughout the entire year and transfer mountain bikers instead of skiers in the summer. They have built a bike park, two summer toboggan runs and have started construction on a zipline. It is their goal to use all lifts in the summer as well with a different attraction each for tourists. This decreases their dependency on winter tourism. Other offers, such as spa areas in hotels, indoor climbing or swimming pools shall increase the attractiveness in the region.

…cooperation of regional stakeholders

Compared to alpine destinations, Winterberg has one problem. Stakeholders in the region are not entirely aligned, when it comes to the direction the destination wants to head in. They are not pushing with all their combined force in one direction, as there are several interest groups to consider, ranging from tourism to industry or culture. All these forces are usually more aligned in the alpine destinations, as they concentrate entirely on the skiing tourism sector, E.g., Serfaus.

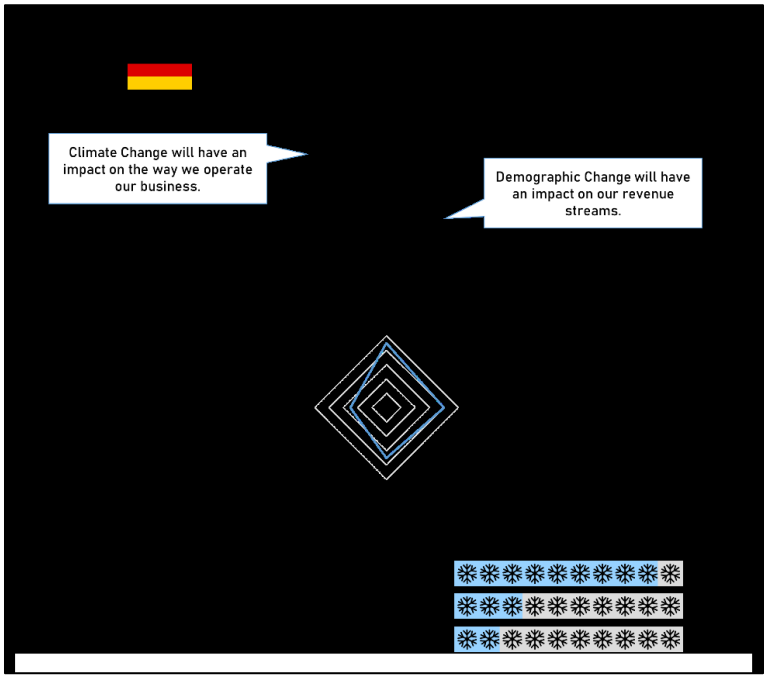
…the impact of the Corona virus

We are rather lucky, as the resort targets mainly tourists from very close by. Hence, especially in the short to medium term we will win more of this clientele against alpine competition. As soon as travelling for leisure will be allowed again, we will be the first to profit locally. Other than that, we experienced strong losses in revenue streams this winter, due to a lack of natural snow and the Corona virus at last. Therefore, we have postponed high investment decisions for now and will reevaluate the situation in another season.

…target markets

The most important geographic target groups are the Ruhr Valley, Holland, Belgium, Rhine Main Valley, Northern Germany and Denmark. Although guests from all demographics arrive in Winterberg, they try to target families with children. The resort has easy slopes and is perfect to practice skiing. In the summer, they attract a more sportive clientele, with easy to difficult tracks for mountain bikers.

Note: Skikarussel Winterberg is an anomaly in the sample of interviewees, as they are not located in the Alps. However, they operate entirely below the critical natural snowline and serve as a proxy for low altitude resorts in the Alps.



Appendix IX: Interview with a Ski Resort in Tyrol, AUT

The CEO (Anonymous I) of one of the biggest ski resorts in Austria, who wants to remain anonymous about…

…economic data

The ski resort strongly depends on the revenues from the winter season, with a 90/10 split between winter and summer. As a result, the winter season proofs much more profitable. While the winter counts a workforce of 220, the summer gives employment to 130 people. The classic periods in the winter, like Christmas, February (including carnival) and Eastern are the most important dates.

…snow reliability

Technical snow production is absolutely necessary to offer ski tourism over the entire season. Hence, all technologies are up to date and constantly renewed. Snow Farming or Landscaping has not been undertaken and does not yield viable options. Currently, the resort invests in a new infrastructure around the crucial snow guns. For that, new reservoir lakes are being built. All these investments in technical snow reliability usually have an investment horizon of 7 years. Although the resort expects some increase in temperature, they are well prepared with the available technology.

…target markets

Skiing has always been a sport for the rather wealthy clientele. This is not going to change in the future and will rather continue in this direction. Smaller resorts will vanish over time and with that supply for skiing will decrease. As a result, the remaining resorts will and have to increase prices. A rise in energy costs plays another key role. On the other side, the market is shrinking slightly, so overall, supply and demand will stay balanced. Especially the European market for skiing will shrink, due to the demographic development. On the other side will this be beneficial for the summer season. Older people visit the region in the summer instead. Europe will remain the target market for the resort, as the Asian market requires a focused marketing approach, which does not seem to be necessary yet.

…their product portfolio

The winter offers many attractions, such as snow board parks or fun parks. Hiking in the winter gains on popularity and the resort will increase the offering. The incoming tourists in the summer have a wide variety in age and demand. From families and pensioners to singles, a great variety is represented. Hence, the resort needs to offer an equally great variety in terms of product offerings.

…destination management

The ski resort itself seems very united to the outside world and agrees on targeting the same markets and offering an identical product portfolio. However, once the tourists are in the valley, there is fierce rivalry from within.

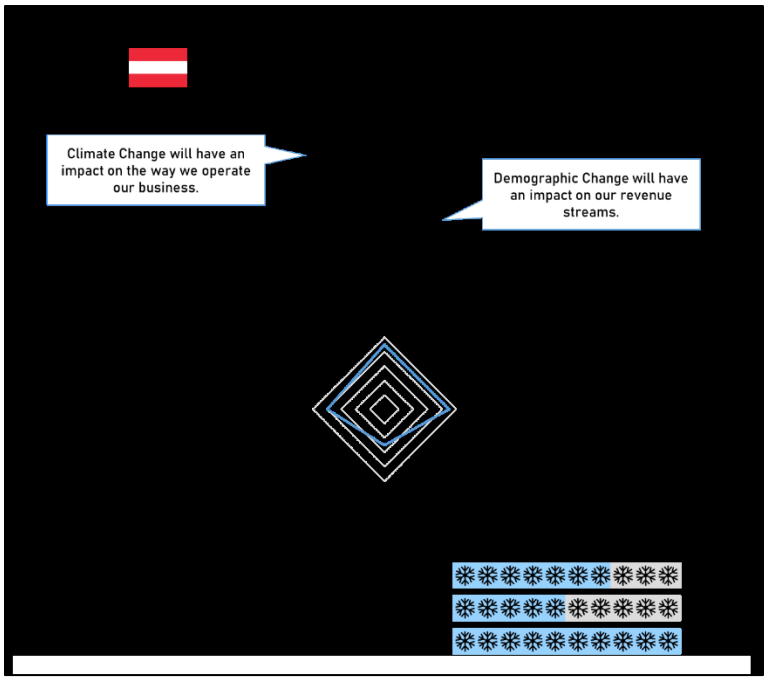
…the Corona virus

The virus has stopped the season on March 15th, 5 weeks before the intended season closing and before the profitable easter holidays. Hence, the overall winter season has been cut short by 25% of the expected income. The summer season will also be negatively affected. This is painful, but the resort can survive it. However, in case the next winter has significant losses as well, the whole resort might be in jeopardy. There are many uncertainties right now: Will the borders open again, will tourists have enough disposable income to travel, will they have the willingness to travel?

…competitiveness

The ski resorts claims to be the most active valley of the world, as it offers such a great variety in winter and summer alike. As it is also easily accessible, especially for the vast number of German tourists, it will remain one of the big players in the alpine circus.

Appendix



Appendix X: Interview with a Ski Resort in Carinthia, AUT

The Head of Sales (Anonymous II) of a relatively small ski resort in Carinthia, who wants to remain anonymous about…

…economic data

The resort welcomes roughly 2/3 of the guests in the winter and the rest in the summer, however the revenue is split 90/10 in favor of the winter. Revenue streams are much smaller in the winter. We can only afford to operate in the summer season, if winter has been good. In the summer, tourists spend much less. The main revenue stream in the summer is the "Kaernten Card". By purchasing that card, tourists can do a lot of activities in the entire Carinthia area. Nevertheless, only a little fraction of the "Kaernten Card" revenue really makes it into our pocket.

…demographic and geographic target markets

Most tourists come from Austria and Germany. Especially in the summer, there are also more tourists from the Netherlands as well, while in the winter, we see an increasing tourist inflow from Eastern Europe, due to the geographic proximity. The resort mostly targets families. The topography of the resort is ideal for families and beginners. On top of that, we attract many day-tourists, again especially families, with special price offerings. At last, we target specifically pensioners with cheaper season tickets. From that clientele, we capture more skiers, in comparison to other resorts in Carinthia. In the future, we will promote increasingly the growing market in Eastern Europe. In order to attract young skiers and promote skiing in general, we operate one single hill on low altitude (500m) in the city region. All schools and kindergarten bring their classes there, to learn skiing. Although operating the hill is not profitable, we can grow future clientele. Paired with attractive prices for families in the big resort, we develop future clientele.

…technical snow reliability

To ensure technical snow reliability, we trust the common artificial snow making facilities. This includes the latest snow guns and lances, digital guidance systems, digital snow depth measuring and well placed reservoir lakes. We try to construct the water ponds as high up as possible, to cool the water naturally. Once temperatures are ideal for technical snow production, we start the infrastructure.

In general, we do not support the notion of climate change. Based on our own research, we experience warmer and colder winters. In general, temperatures are becoming more volatile, but there is no tendency to observe, that temperatures are increasing permanently.

…investments

As a private company, we reinvest almost all of our profits from a season to remain competitive. However, the investments per year vary strongly. Usually, we save as much equity capital as possible and once we've saved

enough we reinvest. This year it will be a new lift. If you want to buy a new lift, you have to have at least 50% of that investment sum as equity capital. This is Austrian Law for ski resorts. In short, we keep dividends low and savings high. The investment horizon varies between the different types of investments. Buildings and are often paid over a 40 year timeframe. Reservoir lakes or snow guns are invested over a 5-8 year horizon.

…diversification of winter activities

We offer a rather big variety of soft tourism. This is typical for Carinthia, as we promote soft and sustainable tourism as a region. In due course, we have a diverse offering of winter hiking routes, rent toboggans and have special ski touring routes. That's the ideal offering for the families we attract.

…development towards an all-year destination

The resort is still concentrating rather on winter tourism, simply because revenue streams are much higher. Nevertheless, we offer a variety of activities as well in the summer. The hiking offering increases, and we have a downhill buggy course. Currently, we build a new mountain bike downhill park. All year around, the mountain is a hot spot for paragliding.

…destination management

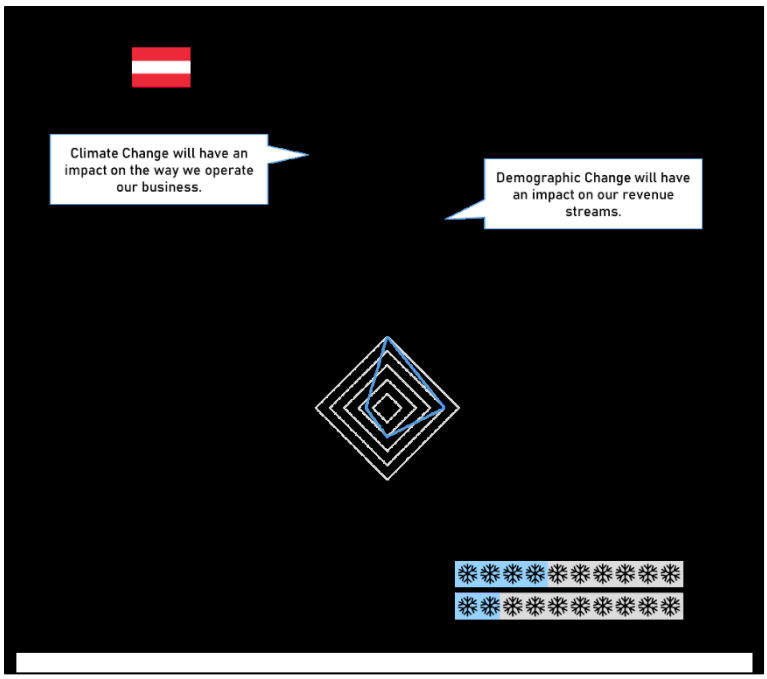
There is a relatively high unity among all stakeholders, when it comes to the destination management. The ownership structure on the mountain is ideal for that. All land owners operate some kind of business on the mountain (hotels, restaurants, lifts), what makes them reliant on the tourism flows. We all agree to a high extent on the general direction we are heading into: soft tourism and a focus on winter and skiing tourism.

…the impact of the Corona virus

The effects are highly uncertain. There is no vaccine, no broader immunity; borders to our most important markets are closed. In general, the longer we have to close our operations, the higher the negative economic impact will be. Right now, it is impossible to predict the exact effects.

…competitiveness

The resort has an unique mountain and lake combination. When you ski, you ski while looking at the many lakes of the region. In the summer, you can be active on the mountain and later swim in the lakes. Natures has given us a great gift here. On top, we have a great 360° panorama view.



Appendix XI: Interview with Wildkogel-Arena Neukirchen & Bramberg, AUT

Bernhard Gruber, CEO, about…

…economic data

Although we have a nice mix of activities in the summer and winter season alike, we are still more of a classic winter destination. Around 80% of our guests arrive in winter, however we see a shift towards a more balanced split. Nevertheless, our revenue streams still strongly depend on the winter seasons with 90% and more.

…demographic and geographic target markets

We welcome most tourists, just like most our competitors, from the DACH region. Austria and Germany are the biggest clientele. With our broad offering and a great mix of activities, we specifically try to target families. Furthermore, we promote sustainable holidays, as a member of the Alpine Pearl association. Hence, all our guests can comfortably arrive without unnecessary emissions by train. This restricts the target market to origins in a train ride range of maximum 7 hours.

…technical snow reliability

We experience an increase in temperature over the years and trust experts in that area. However, we strongly believe that we can counter these effects for the near future with the artificial snow production facilities we have set in place. We can rely on a state of the art infrastructure including the latest snow guns, software and sufficient reservoir lakes. However, lower altitude ski runs will be endangered first. We anticipate the possibility that we cannot ensure runs in the valley, but only skiing on the mountain itself.

…investments

As investments vary from year to year, it is hard to generalize, how much of the revenues we reinvest each and every year. However, we try to reinvest revenues to a very high extent, to remain competitive. Besides investing in technical snow reliability, we have increasingly invested in a great mix of activities for tourists. In the winter we offer a great skiing experience with 85% of the pistes being red or blue slopes (easy and medium difficulty). This makes it a great resort for families and beginners. Additionally, we have the longest toboggan run of the world, a great variety of winter hiking paths, opportunities for paragliding, skitouring and cross-ski. As a special we offer horse carriage rides and horseback riding in the winter.

In the summer, we offer an equally varying activity mix. Just as in winter, we offer a great mix for hikers, horse back riding and horse carriages. Mountain bikers will find great opportunities and we have a fun mountaincart track. Moreover, the resort is member of the Alpine Pearls, who promote sustainable tourism. Specifically, tourists can arrive without their car and will get free electric cars or e-bikes for their transportation.

…destination management

We have rather united approach within the community. Again, as Alpine Pearl member, we try to promote sustainable tourism for families. All stakeholders more or less agree with that and we can harmonize our marketing in that regard.

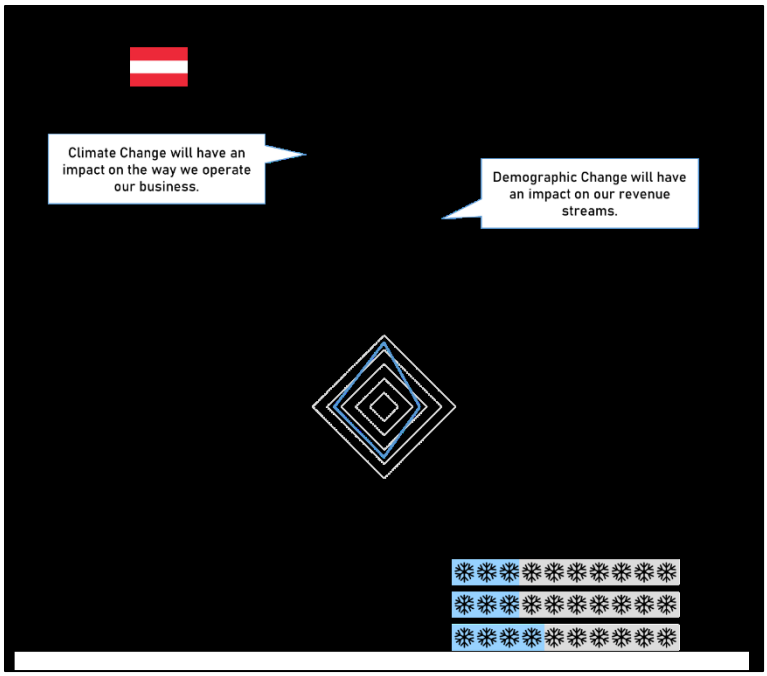
…the impact of the Corona virus

We are facing grave losses in revenue in the winter and summer season 2020. We hope that we can go “back to normal” in the winter 2021 season, but also expect losses there. In general, we have to deal with a great amount of uncertainty. All we can do is hope for a vaccine and a quick opening of the borders. As for now, we have stopped current investment plans and will reassess them after the crisis.

…competitiveness

Our biggest strength is the great mix of activities we can offer, both in winter and in summer. This makes us over proportionally attractive for families. Furthermore, as an Alpine Pearls member we can foster our position as a sustainable and innovative holiday destination.

Appendix



Appendix XII: Interview with a Ski Resort in Salzburg County, AUT

The Marketing Executive (Anonymous III) of a medium-sized ski resort in Salzburg County, who wants to remain anonymous about…

…economic data

In the 2017/2018 winter season we recorded almost 1mio visitors in the winter, while we welcomed over 200k guests in the summer of 2018. So, usually we accommodate 80% of our guests in the winter. In this season, we generated almost 88% of our revenues in the winter season. The winter season is far more profitable and important for us. We also see that we can offer higher employment in the winter. Most of our employees work in the winter, while we only require a fraction of them in the summer. The ratio is roughly 65/35.

…demographic and geographic target markets

Looking at the demographics, the Generation X is our most important clientele, but Generation Y comes close behind. In recent years we lost the generation of baby-boomers as our top customers. Domestic travelers and the DACH represent our main tourist inflows, but the UK, the Netherlands and most recently Eastern Europe emerge as substantial new geographies.

…technical snow reliability

As discussed earlier, ski tourism is our most crucial revenue stream, thus artificial snow production is critical for our operations. For us, achieving the 100-day rule and having an early start to the season is the determinant of a successful season. Unfortunately, snowfall is unpredictable. This is why we constantly invest in the latest state of the art snow production facilities and infrastructure. In the past 10 years we spent 10-12mio € on average per season, which represents 20-25% of our revenues. With that, we think we are well prepared for any potential increase in temperatures, due to global warming.

…investments

In the past, all family members coming to us would like to ski. Skiing remains a core activity, this is why we constantly invest in a varying skiing offer for all skill and interest levels. However, tourist demands diversify stronger than in the past. Some want to ski, while some others want to pursue other activities in the meantime. Therefore we reacted accordingly and created a vast set of alternate activities for our guests. This ranges from rather common activities such as ski touring, snow shoeing, guided hikes or toboggan runs to rather unorthodox ones like yodeling and mountain yoga. We also believe that gamification schemes, which will be transferred to social media from the tourists, will become vital. This increases the engagement between tourists and the region and is a great advertisement tool for us.

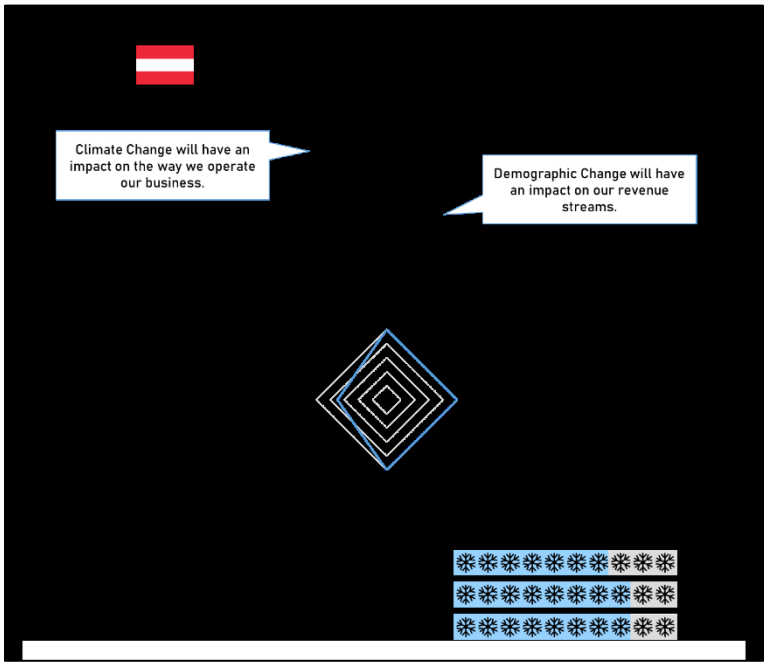
We also see that summer tourism becomes more important, as tourists seek the alpine summer freshness. We cannot offer a core activity liking skiing this season, so we need an even bigger and more diverse set of activities to offer then. However, we are a skiing hotspot and focus on that.

…the impact of the Corona virus

We expect severe losses in revenue in the coming two years. Until a vaccine is found, tourists will have legal and intrinsic objections to travel. At the same time, the resort has to put protective measures into place, which might change the travel and activity experiences as we know it. This as well, will be costly.

…competitiveness

We believe that we have strong arguments on our side, as we satisfy a wide range of interests for all family members. At the same time, we have a unique landscape around us with a beautiful mountain and lake combination. After all, we are the ideal ski resorts for families.



Appendix XIII: Interview with Saalbach Hinterglemm, AUT

Wolfgang Quas, Head of Marketing, about…

…economic relevance

We have a quite balanced split of winter and summer tourism. 70% of our guests arrive in winter. Accordingly, our revenues generated in the winter season have roughly the same percentage. However, we can employ more people in the winter. The split is around 80% in the winter and 20% in the summer.

…demographic and geographic target markets

Our most important clientele is between 14 and 49 years old. Hence, the generation Y represents the biggest junk of our customers, followed by the generation X and the new incoming tourist flows from generation Z. Our target market is relatively young. Most tourists come from the traditional DACH region, with a vast majority from Germany and Austria itself. But we also see a strong inflow from Scandinavia, the UK and most recently Eastern Europe. Traditionally, Dutch tourists have always come in high numbers.

…technical snow reliability

Technical snow reliability is a key asset for us and secures the recurrent high numbers of incoming tourists. Investments in that are absolutely mandatory in order to offer our guests the ski experience they expect and demand. Therefore, our technology is state of the art. Artificial snow plays a crucial role for the high quality of the ski offering and the respective infrastructure.

…investments

We have one of the biggest and most diverse ski resorts in Europe and want to maintain our high standards. This is what we focus on. Apart from the groomed slopes, we try to offer an equally attractive freeriding experience. After all, we observe a continuous interest in skiing. However, in recent years, we have a diversified our tourist offering quite a lot. Guests can go skiing, hiking, cross-skiing, tobogganing, ice skating or enjoy a great wellness offering. There are also many tourist attractions, such as professional ski races to attend or music festivals. In the summer, we are a great hot spot for mountain biking.

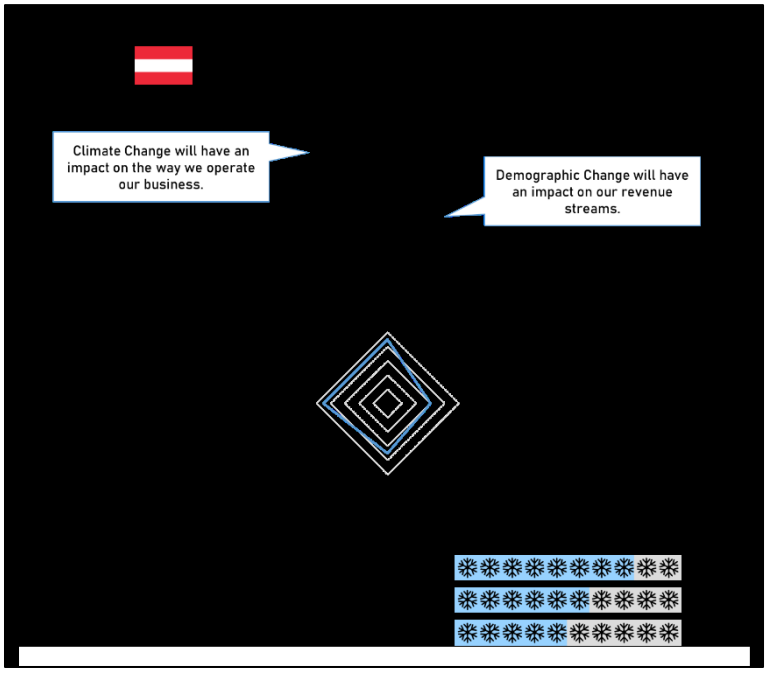
Nevertheless, we only want to extend our tourist offer so a certain level. The mountains are a precious resource and we want to remain a nature pure destination for tourists. We believe that especially the summer season yields potential for more incoming tourists, who seek refuge from the warmer climate at the sea. The summer also offers a really interesting mix of activities and we anticipate a growth there. The season is longer and people usually relax more in the summer holidays.

…the impact of the Corona virus

As of today, it is almost impossible to evaluate the consequences of the crisis. The situation changes almost on a daily basis. In essence, we try to deal with the new situation every single day. It will be decisive, how the pandemic develops in our closest markets in Austria, Germany and the Netherlands, as they represent the biggest source of income.

…competitiveness

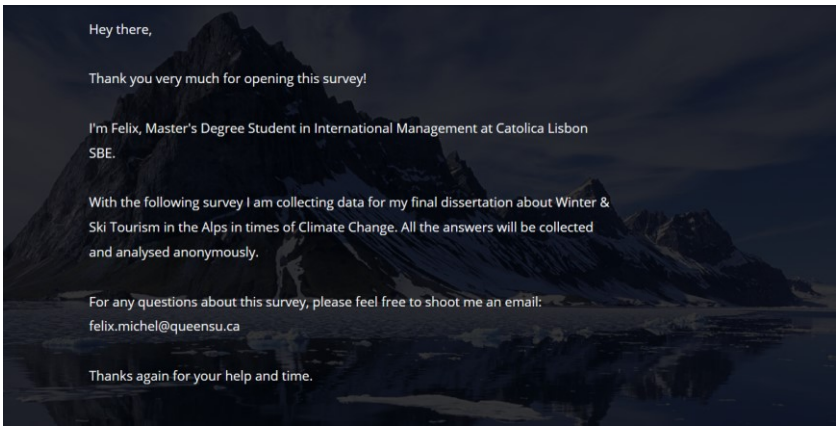
We are one of the biggest resorts in the Alps with high quality slopes and infrastructure, a smart and innovative piste guiding system and 60 restaurants on the mountains alone. The resort has a great hotel and wellness offering and we can attract appealing events to our destination, like the ski world cup. Most importantly, we can offer a great nature experience with a stunning scenery.



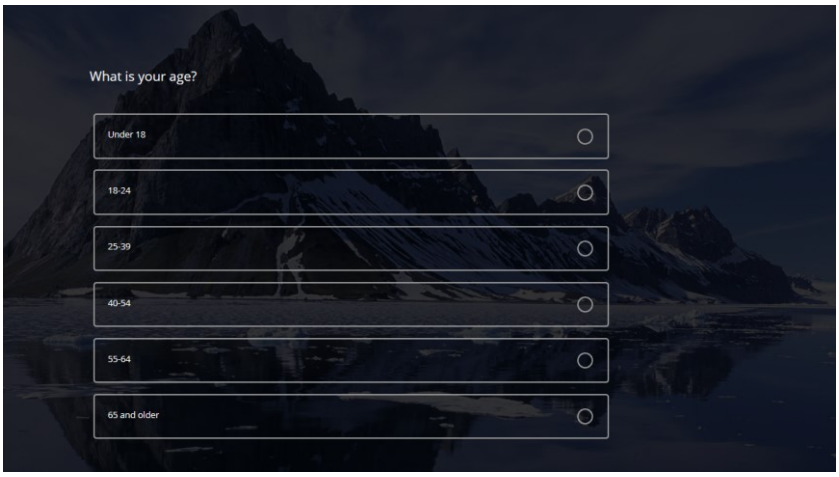
Appendix XIV: Survey Framework

The following screenshots show all steps and questions the survey respondents went through.

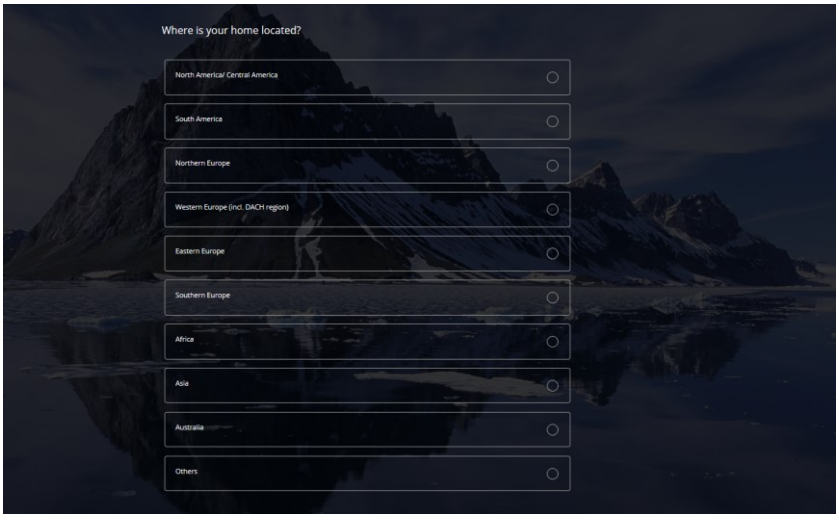
Intro Screen



Demographic question: age

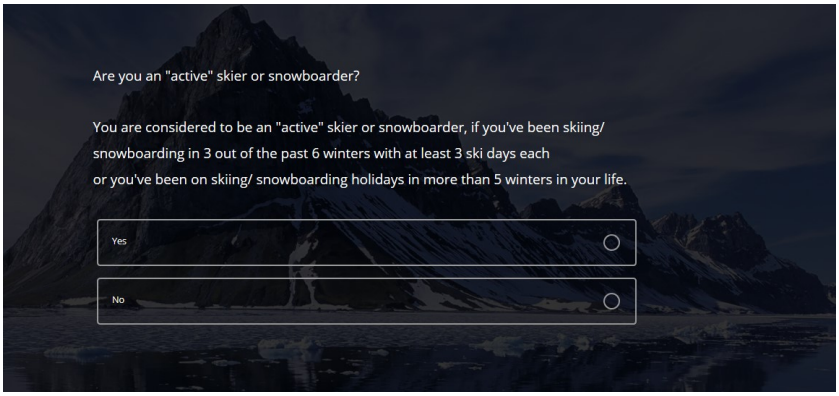


Demographic question: geography

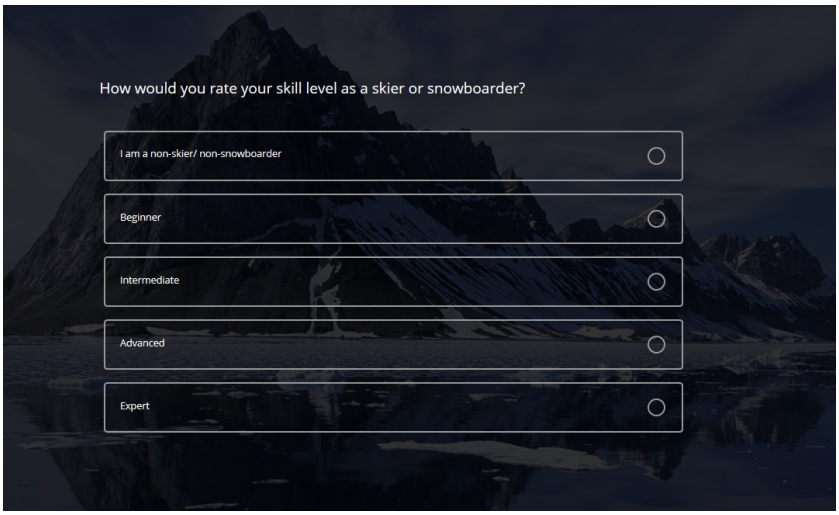


Appendix

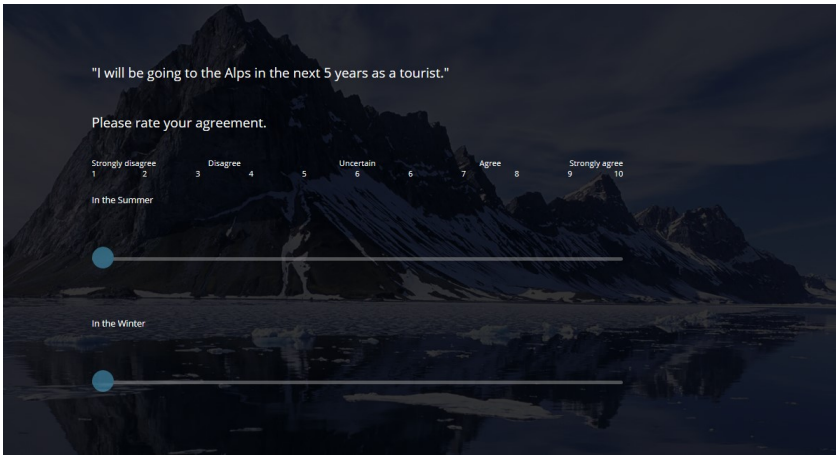
Demographic question: ski skills I



Demographic question: ski skills II

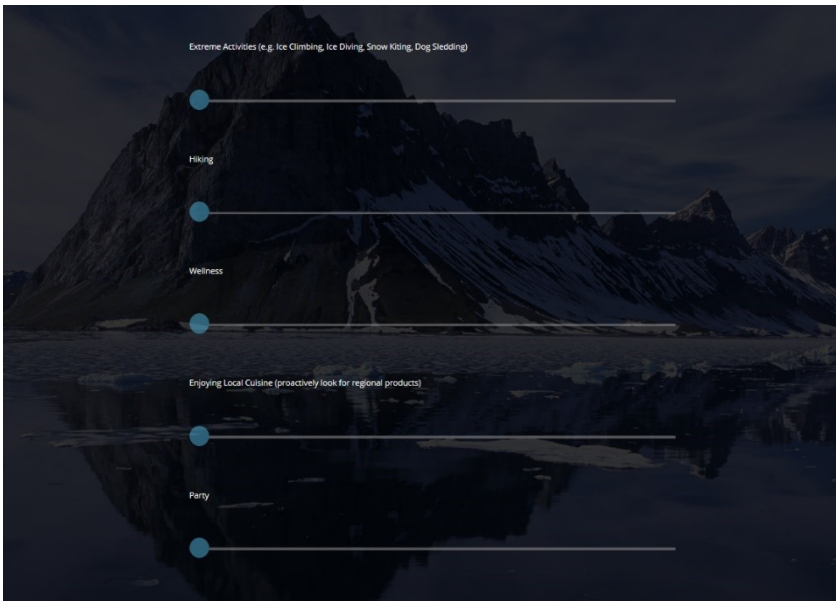


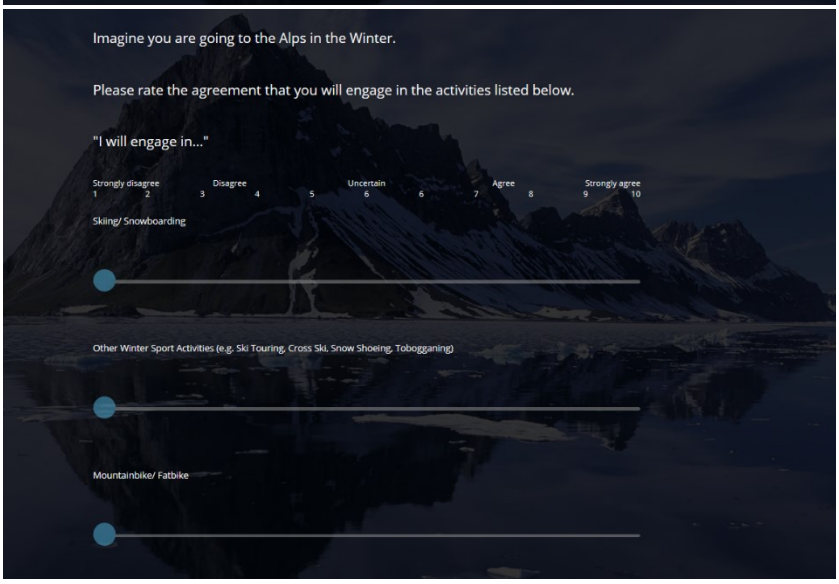
Research question: travel willingness



Appendix

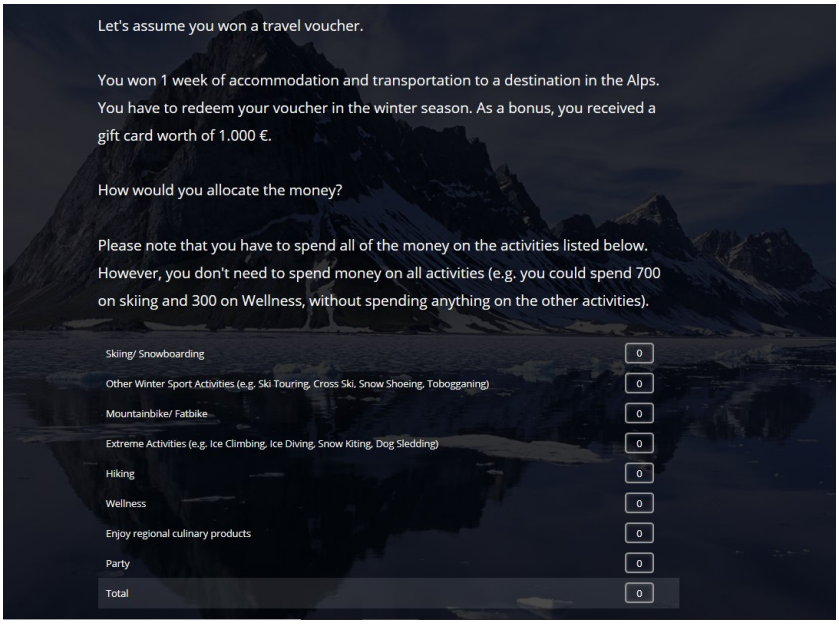
Research question: activity engagement



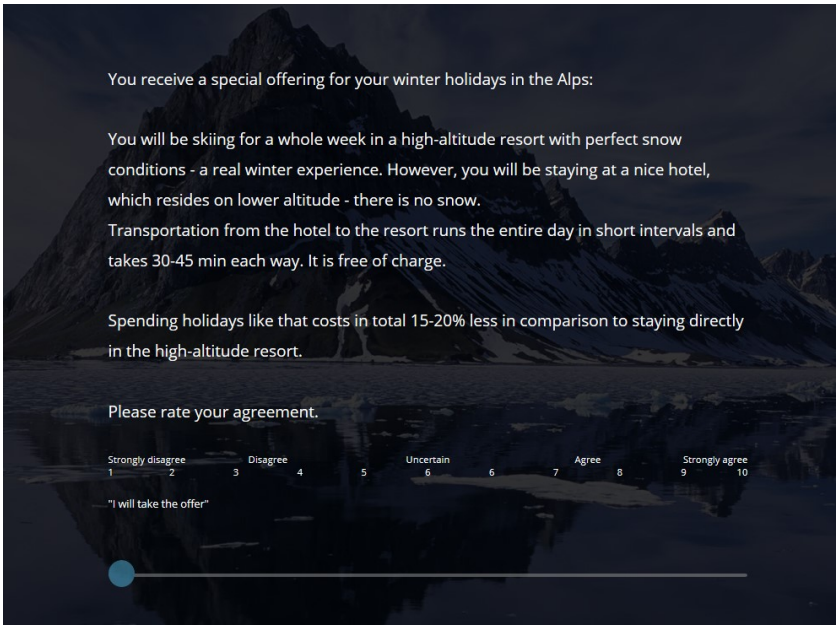


Appendix

Research question: budget allocation

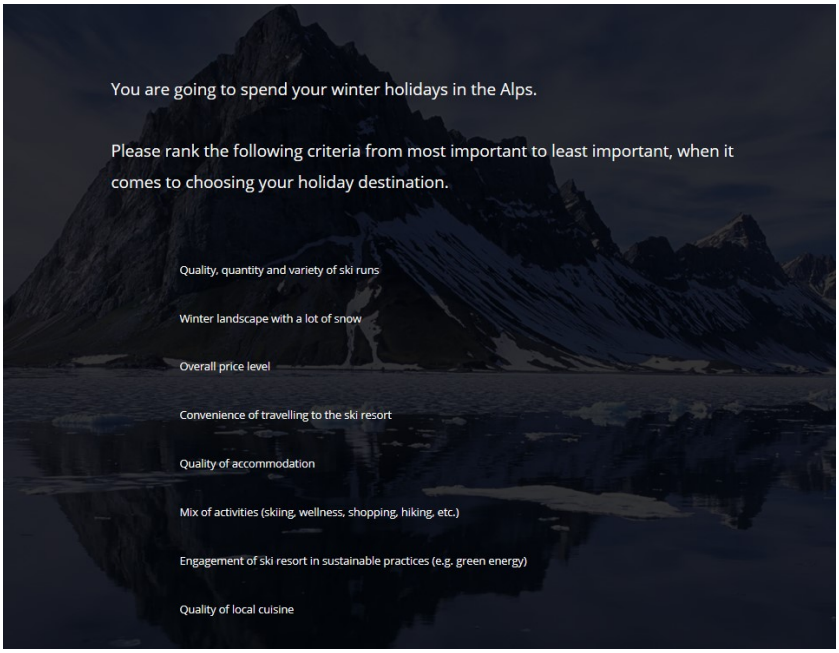


Research question: special offer

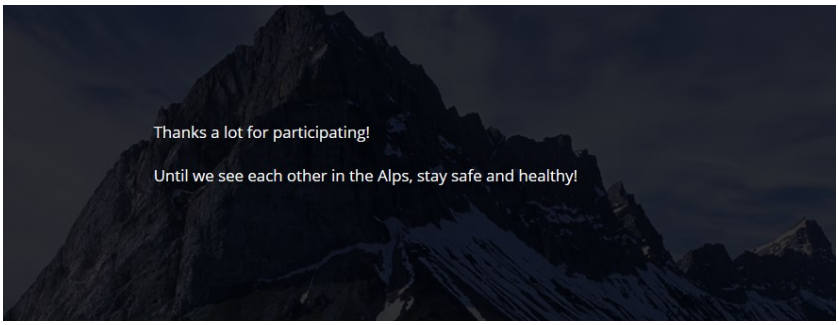


Appendix

Research question: decision criteria



Outro



Appendix XV: Survey Results of the Entire Sample

Quantitative Survey - Info

URL https://survey.smith.queensu.ca/jfe/form/SV_4YoOTnmJwFw6sSN

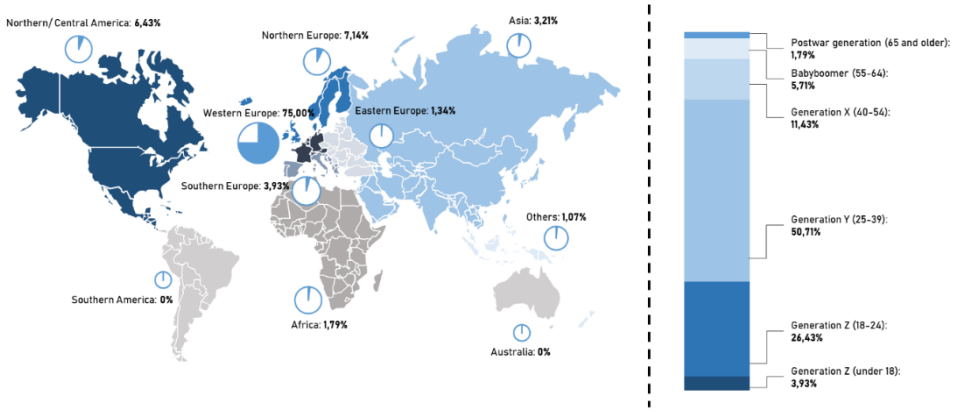
Published on April 17, 2020

Closed on May 12, 2020

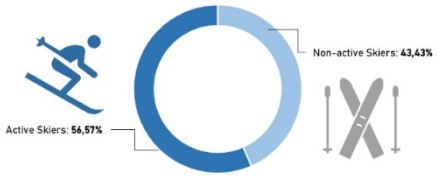
9 Questions

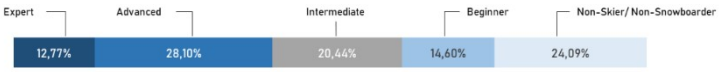
301 Responses

Demographics – Age and Home located



Demographics – Ski Skills

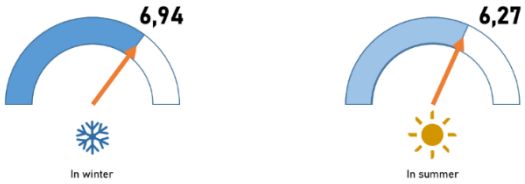




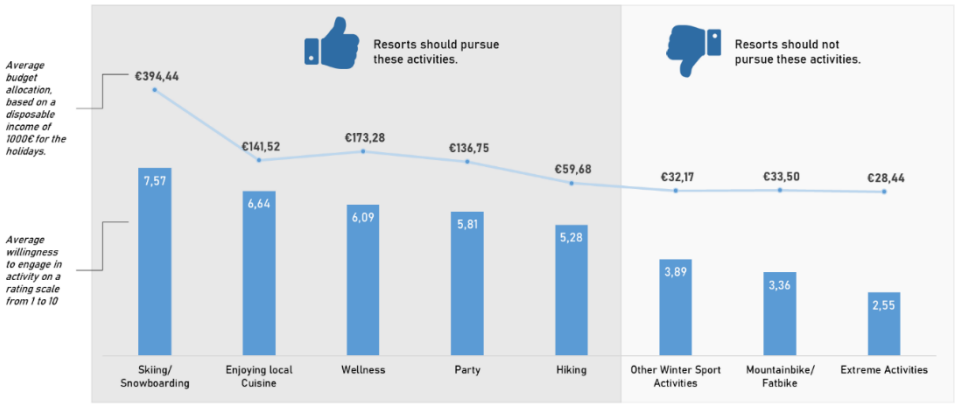
Research – Travel Willingness to the Alps

I will be going to the Alps in the next 5 years as a tourist.

On a rating scale from 1 to 10

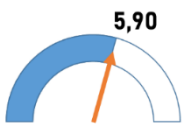


Research – Activity engagement and budget allocation



Research – Cooperation high and low altitude

I will take the offer and save 15-20% of my budget!



Research – Decision Criteria

Respondents rank each criteria from most important (1) to least important (8) as following (Choices per criteria per rank, showing the highest and lowest manifestation):

	1	2	3	4	5	6	7	8	Ø
Winter landscape with a lot of snow	57							3	2,9
Quality, quantity and variety of ski runs	85				8				3,2
Overall price level		36		36				10	3,73
Quality of accommodation					52			9	4,14
Mix of activities (skiing, wellness, shopping, hiking, etc.)	15						39		5,15
Convenience of travelling to the ski resort	5			45					5,33
Quality of local cuisine	7							44	5,34
Engagement of ski resort in sustainable practices	2							68	6,4

Appendix XVI: Survey Results Filtered by Certain Demographics

The sample group has been filtered by certain demographics. This was to answer parts of the research questions in greater detail. All subsequent filters applied can be seen in grid table format.

Research								
#5: "I will be going to the Alps in the next 5 years as a tourist."	Mean Value of...							
	Entire sample group	Active Skiers	Non-active Skiers	Generation Z	Generation Y & X	Postwar generation	Western Europe	Asia
In the Summer	6,27	6,59	5,86	5,79	6,41	8,6	6,49	7,5
In the Winter	6,94	8,59	4,79	7,45	6,78	5,4	7,06	7,17
#6: "I will engage in..."	Mean Value of...							
	Entire sample group	Active Skiers	Non-active Skiers	Generation Z	Generation Y & X	Postwar generation	Western Europe	Asia
Skiing/ Snowboarding	7,57	9,08	5,6	8,29	7,42	3	7,55	7,67
Other Winter Sport Activities	3,89	3,92	3,86	4,37	3,69	1,8	3,63	7,5
Mountainbike/ Fatbike	3,36	3,13	3,65	3,66	3,23	2,2	3,3	5,67
Extreme Activities	2,55	2,34	2,82	3,04	2,44	1	2,27	2,67
Hiking	5,28	5,20	5,39	5,41	5,23	5,2	5,18	6,17
Wellness	6,09	5,64	6,68	5,89	6,16	4,4	6,07	7
Enjoying Local Cuisine	6,64	6,44	6,91	6,53	6,77	6,8	6,5	7,17
Party	5,81	5,88	5,71	6,59	5,7	4,4	5,62	6,5
#7: Holiday Budget allocation	Mean Value of...							
	Entire sample group	Active Skiers	Non-active Skiers	Generation Z	Generation Y & X	Postwar generation	Western Europe	Asia
Skiing/ Snowboarding	394,44	489,25	258,85	418,66	381,59	0	413,72	260
Other Winter Sport Activities	32,17	26,32	40,54	42,39	28,11	17,5	21,57	90
Mountainbike/ Fatbike	33,5	28,87	40,13	42,39	31,3	75	27,64	200
Extreme Activities	28,44	24,25	34,44	40,3	26,56	0	25,91	0
Hiking	59,68	45,62	79,78	55,9	60,12	132,5	52,76	170
Wellness	173,28	123,71	244,18	141,04	188,3	237,5	178,03	120
Enjoying Local Cuisine	141,52	116,32	177,56	121,94	140,45	487,5	137,62	130
Party	136,75	145,3	124,52	137,39	143,21	50	142,46	30
#8: Special Offer of low altitude accommodation and high altitude ski experience	Mean Value of...							
	Entire sample group	Active Skiers	Non-active Skiers	Generation Z	Generation Y & X	Postwar generation	Western Europe	Asia
"I will take the offer"	5,9	5,68	6,22	6,57	5,7	6,75	5,69	7,2
#9: Decision Criteria when choosing the winter holiday destination	Mean Value of...							
	Entire sample group	Active Skiers	Non-active Skiers	Generation Z	Generation Y & X	Postwar generation	Western Europe	Asia
Quality, quantity and variety of ski runs	3,2	2,08	4,77	2,86	3,23	6,75	3,01	4,4
Winter landscape with a lot of snow	2,9	2,62	3,3	2,94	2,93	2,25	2,73	4
Overall price level	3,73	3,91	3,49	3,49	3,7	5	3,77	4,6
Convenience of travelling to the ski resort	5,33	5,05	5,74	5,09	5,48	4,25	5,4	4,4
Quality of accommodation	4,14	4,6	3,5	4,32	4,08	2,5	4,24	3,2
Mix of activities	5,15	5,74	4,34	5,42	5,12	6	5,35	3,8
Engagement of ski resort in sustainable practices	6,4	6,45	6,34	6,57	6,31	6,75	6,43	5,4
Quality of local cuisine	5,34	5,92	4,52	5,54	5,36	2,5	5,31	6,2

Appendix XVII: Impressions – Climate Change in Ski Resorts

Twenty snow guns stand poised to go into action on a sunny alpine day
(Credit: Felix Michel, 2020).

The ski lift passes tracts of green and brown land on its ascent. This picture was taken at 1000m on the southern side of the Alps in February, 2020
(Credit: Felix Michel, 2020).

“As long as skiing is enjoyable, I’m going to continue to do it.”

– Bode Miller

World Champion, Olympic Champion and Ski Alpine Legend