Forschungsarbeiten von Ausbildungseinrichtungen mit Tourismusschwerpunkt zum Thema Tourismus und Nachhaltigkeit

Name: Verena Knoll

Persönliche Kontaktdaten[1]: Tel. +43 664 2488642, Mail: verena.knoll27@gmail.com

Titel der Arbeit: The Adaptability of the G.H. Betriebs GmbH to the Effects of Climate Warming

Name Betreuer: Prof. (FH) Mag. Mag. Dr. Harald Friedl

Name der **Ausbildungseinrichtung**: FH JOANNEUM Ges.mbH, Institut für Gesundheit und Tourismus Management

Kontaktdaten Institut: Kaiser-Franz-Josef-Straße 24, 8344 Bad Gleichenberg, gtm@fh-joanneum.at, +43-316/5453-6700

SDG-Kategorie[2]:

☐ **SDG 1**:	**Armut** in all ihren Formen und überall beenden
☐ **SDG 2**:	Den **Hunger** beenden, **Ernährungssicherheit** und eine bessere **Ernährung** erreichen und eine nachhaltige **Landwirtschaft** fördern
☐ **SDG 3:**	Ein **gesundes Leben** für alle Menschen jeden Alters gewährleisten und ihr Wohlergehen fördern
☐ **SDG 4:**	Inklusive, gleichberechtigte und hochwertige **Bildung** gewährleisten und Möglichkeiten **lebenslangen Lernens** für alle fördern
☐ **SDG 5:**	**Geschlechtergerechtigkeit** erreichen und alle Frauen und Mädchen zur Selbstbestimmung befähigen
☐ **SDG 6:**	Verfügbarkeit und nachhaltige Bewirtschaftung von **Wasser und Sanitärversorgung für alle** gewährleisten
☐ **SDG 7:**	Zugang zu bezahlbarer, verlässlicher, nachhaltiger und moderner **Energie** für alle sichern
☐ **SDG 8:**	Dauerhaftes, breitenwirksames und nachhaltiges **Wirtschaftswachstum**, produktive **Vollbeschäftigung** und **menschenwürdige Arbeit** für alle fördern
☐ **SDG 9:**	Eine widerstandsfähige **Infrastruktur** aufbauen, breitenwirksame und nachhaltige **Industrialisierung** fördern und Innovationen unterstützen
☐ **SDG 10:**	**Ungleichheit** in und zwischen Ländern **verringern**
☐ **SDG 11:**	**Städte und Siedlungen** inklusiv, sicher, widerstandsfähig und nachhaltig gestalten
☒ **SDG 12:**	Nachhaltige **Konsum- und Produktionsmuster** sicherstellen
☒ **SDG 13:**	Umgehend Maßnahmen zur **Bekämpfung des Klimawandels** und seiner Auswirkungen ergreifen
☐ **SDG 14:**	**Ozeane, Meere und Meeresressourcen** im Sinne nachhaltiger Entwicklung erhalten und nachhaltig nutzen
☐ **SDG 15:**	**Landökosysteme** schützen, wiederherstellen und ihre nachhaltige Nutzung fördern, **Wälder** nachhaltig bewirtschaften, Wüstenbildung bekämpfen, Bodendegradation beenden und umkehren und dem Verlust der **biologischen Vielfalt** ein Ende setzen
☐ **SDG 16:**	**Friedliche und inklusive Gesellschaften** für eine nachhaltige Entwicklung fördern, allen Menschen **Zugang zur Justiz** ermöglichen und leistungsfähige, rechenschaftspflichtige und inklusive **Institutionen** auf allen Ebenen aufbauen
☒ **SDG 17:**	**Umsetzungsmittel stärken** und die Globale Partnerschaft für nachhaltige Entwicklung mit neuem Leben erfüllen

Haupt-SDG der Arbeit: SDG 13

3-5 Keywords[3]: Anpassung, Klimaerwärmung, Wintertourismus, Tirol, Alpenraum

[1] Die Angabe dieser Information steht Ihnen frei. Sie ermöglicht dem Interessenten mit Ihnen in Kontakt zu treten.
[2] Welchem der 17 SDG's kann diese Arbeit zugeordnet werden? Bitte kreuzen Sie alle Ziele an, zu denen Ihre Arbeit einen wesentlichen Bezug herstellt und geben Sie darüber hinaus jenes SDG an, das von der Arbeit am meisten betroffen ist.
[3] Zentrale Begriffe zur inhaltlichen Erfassung der wesentlichen behandelten Aspekte.

FH | JOANNEUM
Health Management in Tourism

FH JOANNEUM Gesellschaft GmbH

The Adaptability of the G.H. Betriebs GmbH to the Effects of Climate Warming

---

Bachelorarbeit

zur Erlangung des akademischen Grades einer Bachelor of Arts in Business

eingereicht am

Fachhochschul-Studiengang Gesundheitsmanagement im Tourismus

Betreuer: Prof. (FH) Mag. Mag. Dr. Harald Friedl

eingereicht von: Verena Knoll

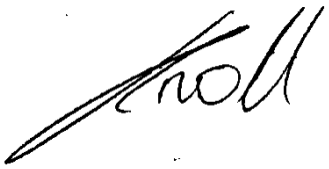
Personenkennzahl: 1710369031

Gesamtzeichenanzahl: 69 237

November 2019

Eidesstaatliche Erklärung

Ich erkläre Eides statt, dass ich die vorliegende Bachelorarbeit selbstständig und ohne Benutzung anderer als der angegebenen Hilfsmittel angefertigt habe. Die aus fremden Quellen direkt oder indirekt übernommenen Gedanken sind als solche kenntlich gemacht. Die Arbeit wurde bisher in gleicher oder ähnlicher Form keiner anderen Prüfungskommission vorgelegt und auch nicht veröffentlicht.



Kopenhagen, 15. November 2019 Unterschrift

Abstract

This thesis deals with the effects of global warming on the winter tourism industry in the Austrian province of Tyrol, more specifically on the G.H. Betriebs GmbH. Climate warming has affected the area of Tyrol over the last decades. From the lack of snow to a change of season, businesses in the region have had to cope with perceptible effects of global warming. This means that the area is also becoming more and more exposed to ski tourism and financial support from stakeholders. As an adaption strategy, many areas produce artificial snow in order to supply enough snow for the winter season. However, this strategy is often the only one that is implemented as many stakeholders and especially managers of ski resorts do not perceive climate warming as a real risk. Therefore, the aim of this thesis is to find out what strategies businesses can implement in order to properly adapt to the effects of climate warming.

The theoretical part is mainly based on literature from online databases, such as Sciencedirect or Emeralds. Moreover, the thesis draws on scientific magazines, studies and internet sources, which serve as the base for the empirical part.

In order to analyze a concrete example of a business in a case study, the dissertation focuses on the G.H. Betriebs GmbH. In the case study, two different forms of online CO2-calculators were used, which determine the CO2 footprint of the company. The respective results are then compared in order to draw conclusions and make further suggestions for strategies that could be implemented in the future.

Results show that the amount of emissions produced by the G.H. Betriebs GmbH are little below average, which indicates that only few adaption strategies have been implemented so far. Therefore, it can be concluded that there is a lot of room for improvement. The hotel could implement further strategies such as obtaining electricity from renewable energy, which would enable the business to be more eco-friendly and sustainable in the long term.

Key words:

Climate warming, climate change, winter tourism, Tyrol, Austria, adaptability, ski tourism, strategies, effects

Abstract

Diese Bakkalaureatsarbeit behandelt die Auswirkung der globalen Erwärmung auf den Wintertourismus in Tirol anhand des Beispiels der G.H. Betriebs GmbH. In den letzten Jahren wurden immer mehr Folgen der Klimaerwärmung in der Region Tirol spürbar. Betriebe haben mit Konsequenzen wie weniger Schnee oder einer kürzeren Wintersaison zu kämpfen. Um genug Schnee für die Wintersaison zu gewinnen, setzen viele Skigebiete auf die Produktion von Kunstschnee als Hauptanpassungsstrategie. Dieses Prozedere ist jedoch meist die einzige Strategie, die Betriebe implementieren, da viele Stakeholder und besonders viele Manager von Skigebieten die Klimaerwärmung nicht als direktes Risiko für ihren Betrieb und die Region wahrnehmen. Aus diesem Grund behandelt diese Arbeit die Frage, welche Strategien ein Business implementieren kann, um sich nachhaltig und langfristig den Auswirkungen des Klimawandels stellen zu können.

Als Methode für den theoretischen Teil der Arbeit wurde hauptsächlich Literatur aus Online-Datenbanken wie Sciencedirect oder Emeralds verwendet. Zudem wurden wissenschaftliche Magazine, Studien und Internetseiten benutzt, welche die Basis für den empirischen Teil der Arbeit bilden.

Um einen konkreten Betrieb in einer Fallstudie zu analysieren, wurde die G.H. Betriebs GmbH als Fallbeispiel verwendet. In dieser Fallstudie wurden zwei verschiedene Online-CO2-Rechner verwendet, welche den CO2-Fußabdruck des Betriebes berechnen. Die Ergebnisse wurden dann verglichen, um Schlussfolgerungen zu ziehen und zudem Empfehlungen für Anpassungsstrategien, die für den Betrieb passend wären, auszusprechen.

Die Ergebnisse zeigen, dass die produzierten Emissionen des Betriebes nur knapp unter dem Durchschnitt liegen, was darauf hindeutet, dass bisher wenige bis keine Anpassungsstrategien implementiert wurden. Aus diesem Grund kann man zusammenfassen, dass es noch viele Möglichkeiten zur Verbesserung gibt. Als Empfehlung könnte der Betrieb beispielsweise auf erneuerbare Energien umsteigen, was eine langfristige Möglichkeit wäre, umweltfreundlicher zu agieren.

Schlüsselworte:

Anpassung, Klimaerwärmung, Wintertourismus, Tirol, Alpenraum

Table of Content

1. Introduction

1.1. Problem statement

During the winter season of 2017/2018, the Austrian tourism industry brought approximately 14 billion Euro value and 72 million overnight stays (Österreich Werbung, 2018). Nevertheless, with public investments, such as the production of artificial snow, Austria is becoming more exposed to ski tourism, subsidies and the effects of climate change (BMWFW, 2012).
This is especially true for businesses such as the G.H. Betriebs GmbH, with its Alpine Lifestyle Resort “das Kronthaler” and the “Skischule Achensee”. Climate warming, which is a critical phenomenon for the tourism industry, has led to much less snow and a change of seasons. This directly affects businesses as they have to deal with the complexity of economic and ecological changes. Consequently, businesses have to cope with, and eventually overcome, new challenges. Thus, they have to work in a way that is as climate-friendly as possible, handle political and legal obstacles and, most importantly, meet customers’ demands. Therefore, it is important for them to develop new concepts for winter holidays which are sustainable, attractive to tourists and profitable for the industry.

1.2. Aim and limitation of the research

This bachelor thesis is aimed at demonstrating the big urge to change the attitude of the behavior of the winter tourism industry towards the environment. By analyzing different adaptability strategies, this thesis shows what a business like the G.H. Betriebs GmbH can do in order to maintain profit and, on the other hand, not harm the environment. Therefore, it serves as a summary of ideas and possibilities as to what can be done in the future in the field of climate protection.
Moreover, it analyzes scenarios regarding the impact of stakeholders, such as public administration, on the adaptability of businesses and associations to the effects of climate warming. By using their power, they can create laws or innovative cooperation, provide financial resources and, in this way, support businesses to implement strategies. This makes it easier for owners and employers in the winter tourism industry to act more consciously about leading their business in an eco-friendly way. If a business is supported financially, it has more possibilities to make further eco-friendly investments. This can later lead to a greater variety of offers for tourists and, therefore, also help the industry maintain profit. The overall goal is to

encourage businesses to consider climate-neutral strategies while also customizing them to suit their own company.
This dissertation, however, does not deal with the effects of increasing electricity prices or the availability of fuels on the price of snowmaking as this would go beyond the scope of this paper. Moreover, the dissertation solely focuses on the area of Tyrol. However, it also includes some studies and articles that deal with the whole region of Austria, as the research conducted in Tyrol is only limited.

1.3. Research question

What strategies can the G.H. Betriebs GmbH implement in order to properly adapt to the effects of climate warming?

1.4. Subquestions

- Which economic risks will the business eventually have to conquer in the future when considering the current predictions for climate warming?
- What strategies can the company use in order to meet the interests of customers and be economically and ecologically successful on the long run?
- Which alternative products can the company realistically implement in order to adapt to both climate warming and postmodern winter tourists?
- How can politics and tourism associations use their role in order to support a business such as the G.H. Betriebs GmbH?

1.5. Hypothesis

If stakeholders do not implement new adaption strategies, low-elevation ski areas in Tyrol are likely to close due to low productivity.
Businesses have to find new, alternative products and receive financial support from the government in order to stay sustainable in the long term.
The G.H. Betriebs GmbH has not yet implemented sustainable strategies. Nevertheless, the business does have reasonable opportunities for alternative products in the Achensee region.

2. Research method

2.1. Desktop research

This bachelor thesis is mainly based on literature research, which was done using the Austrian Library Network for literature. Dealing with the topics environment, adaptability and tourism, the network offers a great variety of monographies, studies and dissertations. Scientific articles from databases, such as ScienceDirect and Emerals, form the base of this thesis. On these websites, articles with a great variety of different approaches to topics are published. Moreover, they are also easily accessible on the internet and free. Internet sources were used mostly for definitions or information on companies. Webpages that provide a great collection of statistics, for instance Tirol Tourism Research, were also part of the literature. Those statistics specified on the region of Tyrol and Austria help to underpin arguments from articles. During the research process, languages used were German and English. The main focus was put on English as this is the language in which the dissertation is written and in which many articles about climate warming in general could be found. German was especially useful for region-specific articles about Tyrol and Austria. Hotel websites and statistics were mostly found in German.

English search terms for research were “climate warming”, “climate change”, “winter tourism”, “Tyrol”, “Austria”, “effects”, “strategies”, “adaptability” and “ski tourism”. As for German terms, “Anpassung”, “Klimaerwärmung”, “Wintertourismus”, “Tirol” and “Alpenraum” were utilized. On scientific databases, Boolean operators facilitated the literature research. “AND” was used to limit the results, which turned out to be very useful when looking for literature on climate warming. The operator “OR” was helpful when searching for terms such as “climate warming” OR “climate change”, as those were often used differently and showed more results by using the operator. Concerning combinations, the following search protocol illustrates the combinations of keywords used on databases during research.

Search Terms	**Limitation**	**Results**	**Articles used**
Science Direct			
Winter tourism AND Austria	Advance search, Limited the search to: 2008 and 2019, within: all articles	96	8

	types, all publication titles		
Ski Tourism OR Winter Tourism AND Austria	Advance search, Limited the search to: 2008 and 2019, within: all articles types, all publication titles	39	4
Anpassung UND Klimaerwärmung UND Wintertourismus	Advance search, Limited the search to: 2008 and 2019, within: all articles types, all publication titles	3	1
Emeralds			
Winter Tourism AND Austria	Advance search, Limited the search to: 2008 and 2019, within: all articles	13	2
Climate change OR climate warming AND adaptability AND strategies	Advance search, Limited the search to: 2008 and 2019, within: all articles	42	0
Climate change OR climate warming AND adaptability AND Austria	Advance search, Limited the search to: 2008 and 2019, within: all articles	5	0
Researchgate			
Winter tourism AND Austria AND Adaptability	Advance search, Search in Publications: Articles	3	1
Climate Change AND Tyrol	Advance search, Search in Publications: Articles	27	2
Climate Warming AND Winter Tourism	Advance search, Search in Publications: Articles	53	1
Climate Warming OR Climate change AND effects	Advance search, Search in Publications: Articles	87	1

The literature used should not have been published before 2008 as new studies, especially dealing with the topic of climate warming, are published every year and show different and more recent outcomes. The literature used should include a clearly

formulated research question and reasonable arguments. References must be included as well to enable a proper examination of statements. Articles must have at least a short abstract in order to have a better overview, which facilitated the research. The studies used should have a suitable design and methodology, for instance meta-analysis. This method combines data from different studies and evaluates evidence, which makes it a valuable source. Moreover, the studies included should also focus on the region of Tyrol and Austria as this is the main focus of the thesis. Although some studies used focus on the Alps and Europe, they were relevant when drawing general conclusions, which is also mentioned in the chapters concerned.
In this dissertation, no monographies were used, as there is very little research done specifically on the region Tyrol. It is hard to access the few books that exist on the subject, which is why mainly literature from scientific articles from databases is used.

2.2. Case study

A case study, which analyzes the company's impact on the environment, was carried out. The theoretical base provided by the dissertation was used for the reflection and the evaluation of the results of the case study. This showed how the theoretical part lays the foundation for the empirical one. The method of a case study was chosen because it specifically focuses on one business, which allows for a realistic and practical analysis.
In this case study, two online CO2-calculator tools, which use two different concepts for their calculations, were utilized. The aim was to not only discover the amount of emissions produced in the G.H. Betriebs GmbH, but also to compare the online tools. Firstly, research on Google on common online CO2-calculators for businesses in English and German was done. There was a great variety of tools offered, hence several criteria for the selection process had to be defined. A major aspect is that the tools used were free of charge as this makes them accessible for every business. Furthermore, tools must have been launched before 2008 in order to be relevant. The calculators used should be targeted towards small to medium businesses. Moreover, programs that delivered immediate results were used. Another aspect was that the data required was as basic as possible, as other forms of calculations would go beyond the scope of this thesis. However, the amount of minimum data required should include at least the amount of electricity and heating used, the number of employees in the company and information concerning the number of overnight stays per year. This should allow for reasonable results and help to draw conclusions for

the business analyzed. Despite the various criteria used, the task of finding a suitable calculator for the purpose of this case study proved to be rather difficult. Many tools were only available for companies in the form of a subscription. The following two calculators were chosen due to their fulfilment of all the criteria defined and mainly because of their reputation and price:

The first online calculator is the MyClimate business calculator. The calculations are based on the Greenhouse Gas Protocol, which includes direct as well as indirect emissions produced by using electricity and heat. Additionally, the consumption of raw materials or provided meals are also taken into consideration (Myclimate, 2014, p. 4).

The other tool used is the CO2-calculator of the Flächenagentur Brandburg, which is a project that was developed in cooperation with the ifeu institution in Heidelberg, Germany. The calculation takes into account CO2 and other greenhouse gases such as methane or nitrous oxide (Flächenagentur Brandenburg GmbH, n.d.).

For the case study, these two different calculators were purposely chosen in order to provide a better comparison of the results and also prove the quality of the calculators. The two online tools calculated the carbon footprint of the company and determined the amount of emissions caused by the G.H. Betriebs GmbH.
The carbon footprint is defined as the following:

> **"**Carbon footprint, amount of carbon dioxide (CO2) emissions associated with all the activities of a person or other entity. It includes direct emissions, such as those that result from fossil-fuel combustion in manufacturing, heating, and transportation, as well as emissions required to produce the electricity associated with goods and services consumed. In addition, the carbon footprint concept also often includes the emissions of other greenhouse gases, such as methane, nitrous oxide, or chlorofluorocarbons" (Encyclopædia Britannica, 2013).

As explained in the definition, the carbon footprint is a measurement tool of the emissions caused. In this case, the carbon footprint of the G.H. Betriebs GmbH was calculated. By determining the footprint, one could draw conclusions concerning the current impact of the business on the environment.

3. Theoretical foundations

3.1. Definitions

3.1.1. Climate

Climate is described as “the total experience of weather and atmospheric behavior over a number of years (…) It should include not only the average values of the climate elements that prevail at different times but also their extreme ranges and variability and the frequency of various occurrences” (Encyclopædia Britannica, 2019).
Since extreme weather conditions are also part of this definition of climate, this thesis also deals with the possible effects of such weather conditions on businesses in the area of Tyrol.

3.1.2. Climate change

In a convention of the United Nations Framework from 1992 targeting climate warming, climate change was defined as “a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere” (United Nations, 1992, p.7).
Even almost 30 years ago, this definition focused on the role of mankind influencing climate change. As described in the definition, the population has had a huge impact on the climate crisis ever since. Nevertheless, today’s generation must seek solutions that build a proper foundation for the future. By taking measures, for instance by predicting consequences that could become reality in the future, stakeholders can better prepare for the impact of climate change. This is elaborated in the following chapter.

3.1.3. Prediction

Predictions for the future concerning the climate are utterly important for businesses, policy and administration in general. These predictions are necessary in order to implement or even invent new strategies that prepare businesses and laws to be sustainable in the future. In the context of climate change, prediction means “an attempt to produce an estimate of the actual evolution of the natural climate in the future, for example, at seasonal, inter-annual or long-term time scales” (Unitar, 2015, p. 4).

It can be claimed that by predicting future effects of climate change, the actions and the behavior of the population can be properly adapted in order to avoid further harm to the planet. In the next chapters, we will discuss how former predictions have come true and what the current forecasts for the next decades for the province of Tyrol are.

3.1.4. Snow reliability

In order to define the term snow reliability, the so-called 100-days-rule is used. According to this rule, there is sufficient snow in a ski resort if it is possible to ski on a minimum of 100 days between the months of December and April with at least 30cm of natural snow on the ground. If this rule can be successfully applied to a resort, the area is regarded as snow reliable (Elsasser et al., 2011).
Many effects that come with climate change can impact snow reliability of winter tourism areas, which will be further discussed in the next chapters.

3.2. The effects of climate warming in the area of Tyrol

The Austrian province of Tyrol plays an utterly important role in the Austrian tourism industry and, therefore, is indispensable for the economy. In the winter season of 2018/19, Tyrol brought 27.5 million overnight stays and 3 billion Euro value (Tirol Tourism Research, n.d.).
Due to the sensitivity of winter tourism to changes in weather, Tyrol is inevitably affected by the consequences of climate warming. As the province is mostly appreciated for its winter landscape and the amount of winter sport activities offered, the area is becoming more and more affected by climate change. This poses the question of how businesses in the province can develop strategies that enable them to keep profits, but also develop a sustainable system for the future. Before inventing and implementing strategies, a closer look must be taken on the effects the area perceives and the challenges it has to face in the future. The present effects as well as predictions for the next years are therefore elaborated in the following chapter.

3.2.1. Present perceptible effects

The actions of humankind have impacted climate change in Austria since the period of industrialization. Therefore, global warming has had tremendous effects on the country: shorter winter seasons, less permafrost, a bigger amount of warmer days or an increasing duration of vegetation (BMNT, 2017, p. 35).

One of the most noticeable effects of climate warming in Austria is the melting of glaciers. According to the glacier report of the Austrian Alpenverein, in the glacier year of 2017/18, an average 17.6 meters of melting was noticed in 89 of the total 93 Austrian glaciers. This means that 95.7 percent of the glaciers were melting due to warmer summers, which can be traced back to climate warming (Lieb & Kellerer-Pirklbauer, 2018, p. 21).

The examples mentioned above are only a few of the effects that climate change have caused and that have already affected Austria. The current impact of climate change should not only act as a warning sign for how much damage climate warming can cause, but it should also build a base for the development of adaption strategies for the future.

3.2.2. Temperature

The rise of temperature is another perceptible effect caused by climate change over the last years. Since the year 1880, the average air temperature in Austria has increased by 2°C by 2014. Globally, the air temperature has risen by 0.9°C in total. This change occurred rather rapidly: the warming of 1°C in the average air temperature only took 25 years. Furthermore, the average number of summer days, which are days on which a temperature with a minimum of 25°C is measured, nearly doubled. The amount of heat days, with temperatures over 30°C, has tripled in comparison to 40 years ago (BMNT, 2017, p.35).
The increase in temperature has happened quickly over the last decades, which leads to the assumption that temperatures will continue to rise if no measures are taken. Therefore, there is a big urge for businesses to take the presumable increase of temperatures into consideration for future planning.

3.2.3. Snow conditions

Over the last years, the dependency on natural snow fall has decreased, as most ski resorts additionally use artificial snowmaking. Nevertheless, in the western area of Austria, where Tyrol is located, safe snow cover is mostly guaranteed at an elevation above 1,300 meters. This relatively high snow line is due to masses of warm air from the Mediterranean Sea and the Atlantic Ocean area that are responsible for winter precipitation. This further explains why ski resorts in the area of Tyrol located above

the natural snow line struggle less with a lack of snow or a shorter season (BMWFW, 2012, p. 6-7).
As a result, areas located beneath the natural line are confronted with more difficulties that they need to overcome. For instance, less natural snow means that they are obliged to produce more artificial snow, which is accompanied by higher electricity costs. In the long run, this could cause excessive costs which small ski resorts may not be able to bear.

3.2.4. Current economic impacts

Winter tourism in Tyrol plays a crucial role for the Austrian economy. In the winter season of 2018/19, the province with its 6.2 million visitors generated a gross value of 3 billion Euros. Moreover, 80 percent of guests use skiing facilities during their holidays (Presse Tirol, 2019).
As mentioned in the last chapter, the probability of having less snow in the future is quite high. This fact puts pressure on managers of ski resorts, forcing them to provide as much snow as possible in order to maintain the current revenue.
Therefore, in 2011, Austrian cableway enterprises spent approximately 500 million Euros in snow-making infrastructure. 102 million Euros therefrom were allocated to different forms of artificial snowmaking. According to experts, the costs for producing snow are estimated to be around 10,000-30,000 Euros per ha. The impact of artificial snow-making is further illustrated in a case study, in which a small Austrian ski resort in 1320 meters altitude and its snow-making facility are analyzed. In the winter seasons of 2008/09 to 2010/11, the operating cash capacity of the ski lift was 6,964,000€. The average seasonal costs of snow guns amounted to 3,554,000€. This means that more than half of the cash flow was invested in the production of snow. These costs are very likely to rise in the future as especially electricity prices could increase (Damm, Köberl & Prettenthaler, 2014, p. 9).
This fact sheds light on ski resorts and cable car companies in low-elevation ski areas, as they have to cope with high costs due to less natural snowfall. The case study mentioned is only one example in which a cost-revenue analysis was carried out. Naturally, the amount of money spent on adaption strategies also depends on the financial department of the business and on their way of spending profit. However, it is safe to say that there is a big urge for small ski resorts to rethink their own concept and develop new strategies. The next chapter elaborates on how businesses have already tried to deal with the impacts of climate change.

3.2.5. Current adaption approaches

In 2017, the Federal Ministry for Sustainability and Tourism published a paper naming strategies for the adaption to the effects of climate warming. It claims that “the potential consequences of climate change have to be taken into account in all relevant future planning and decision-making processes from the national to the local levels” (BMNT, 2017, p. 6).

Even though a paper was published listing numerous measures to be taken, no real strategy has been implemented so far. As explained in the previous chapter, a considerable amount of money is invested in artificial snow-making in order for areas that rely on winter tourism to make profit. However, it seems that this is the only strategy that is used at the moment. Therefore, one can assume that strategies such as artificial snowmaking or official papers are currently implemented as a short-term fix, but there is a big need to find a long-term solution. Thus, stakeholders should search for long-term solutions and distribute responsibilities so that impacts can be kept as agreeable as possible. These solutions have to be adapted to predictions for the future in order for the regions concerned to be prepared to meet future challenges in the best way possible. In the following chapter, current predictions are therefore examined.

3.3. Current predictions for the future

As chapter 3.2. relates to the present situation in the province of Tyrol, this chapter deals with weather and financial predictions for the next decades in Tyrol.

3.3.1. Temperature

It is safe to say that an increase in temperature in the upcoming decades is inevitable. In Austria, it is predicted that temperatures will rise by an additional one or two degree Celsius until the midst of the century. It is quite hard, however, to make any predictions for the second half of the century as the extent of climate warming depends on the actions taken by mankind. A future increase in temperature in Austria can vary from 3°C up to 7°C according to the Austrian Federal Ministry of Education, Science and Research (BMWFW, 2012, p. 4).

As especially winter and ski tourism are highly weather-sensitive sectors, a rise in temperature is expected to cause many problems in this field.

In a 2017 study, scientists conducted research on winter tourism demand in Europe under the condition of a temperature rise of 2°C. As a result, Austria was determined to have the highest vulnerability risk. It is very likely that Austria could lose up to 2.5 million overnight stays due to a rise in temperature of 2°C (Damm, Greuell, Landgren & Prettenthaler, 2017, pp. 37-39).

Another study analyzed the snow reliability of over 600 ski resorts in the five dominating European countries in winter tourism under different temperature conditions. Nowadays, 91% of those businesses have enough snow. Only with an increase of 1°C, 16% thereof would suffer from a lack in snow reliability. Under the condition of a temperature rise of 2°C, there will only be 61% snow reliability, and with an increase of 4°C, the percentage of ski resorts with enough snow would drop to 30% (Damm et al., 2014, p. 9).

The rise of temperatures can have a tremendous impact on the amount of snow in a winter tourism area. Nonetheless, it has to be mentioned that the sources used only define scenarios that exclude measurements taken by the population. This means that it is rather difficult to draw conclusions if it is still unclear what climate-protection strategies will be implemented in the next decades to moderate the rise in temperature. It is safe to say that the risk is omnipresent, which is why there is a big need for action to be taken by stakeholders. This aspect will be further elaborated in this bachelor thesis.

3.3.2. Snow conditions

A rise in temperature is strongly connected to future snow conditions. The Austrian tourism industry is therefore dependent on the amount and quality of snow as most guests consume winter sports activities during their stay.

Experts predict that with a rise in temperature of 1°C, the natural snow line would increase by 150m. Especially low-elevation ski areas are therefore endangered and ski tourism would mainly take place in ski areas situated at 1800-2000 meters above sea level (Mayer & Steiger, 2008, p. 292).

As Tyrolean ski resorts are mostly located in higher altitudes, the whole winter tourism industry in Austria would be affected by the consequences of the rise of the natural snow line.

The BMWFW claims that out of 128 municipalities engaged in the winter tourism sector, only 65.6% would have enough natural snow cover in the very probable scenario of an increase in average tempeterature of 1°C (BMWFW, 2012, p. 8).
It is safe to say that many low-altitude ski areas will be affected due to less snow reliability. However, it has to be mentioned that the sources do not consider wealthy ski areas in Tyrol, as for instance Kitzbühel, which will have difficulties, but also enough capital to afford more artificial snow-production regardless. Nonetheless, it is safe to say that low snow reliability will cause difficulties in many areas, which are also connected to economic challenges for those businesses.

3.3.3. Economic impact

With the tremendous consequences illustrated in the previous chapters, the Austrian economy will also have to suffer from the effects of climate change.
Although most Austrian ski areas have the ability and the necessary financial resources to produce artificial snow nowadays, the future of snow-making is to be questioned.
Pickering and Buckley suggest that in case of a warming of 1°C, ski areas in Australia at an elevation of 1,340 to 1,720 meters will have to anticipate an average 1.7 additional snow guns to the already existing number of snow guns used in a ski resort in order to produce artificial snow. Further, this will lead up to additional investments of 95.2 million USD as a regular snow gun costs 131,000 USD (Damm et al., 2014, p. 9).
Although this study investigated possible scenarios for Australia, one can make comparisons to Austria as well: the natural snow line will rise, hence ski areas at a low-elevation are at risk.
In the unusually warm winter season of 2006/07, municipalities located under 100 meters of the natural snow cover line experienced a 50% loss of overnight stays compared to naturally snow-reliable areas (BMWFW, 2014, p.8).
This proves that winter tourism areas at low altitudes will eventually be suffering from low rentability. It can be claimed that only wealthy areas in Tyrol, such as Kitzbühel or Bad Ischgl, have the financial resources to bear the costs of snow-making. Except for these areas, tourism will eventually be focused in high-altitude areas, where snow-reliability will still be given.

4. Adaptability strategies according to present research

In 2017, the Federal Ministry for Sustainability and Tourism defined 10 main principles for adaption to climate change. A great variety of adaption processes should be examined, such as sharing knowledge or promoting cooperation. Moreover, "the entire potential portfolio of technological, behavioral, informative, organizational, ecosystem-based, and socio-economic adaptation measures, both sector-specific and cross-cutting, should be considered" (BMNT, 2017, p. 63).

When considering the adaption strategies currently used in Austria, it can be said that there is still room left for further improvements. In order to give a brief summary, some present adaption approaches are pointed out in this chapter.

4.1. Technical strategies

As for the technical segment of adaption strategies, winter tourism regions mainly use snow-making in order to ensure a sufficient amount of snow. The production of artificial snow should guarantee longer ski seasons and also provide enough snow throughout the whole period. Most ski resorts nowadays have some sort of snow-making system, mostly in the form of snow guns. Besides a great number of investments made for pumps, hydrants or the snow guns themselves, snowmaking also requires a considerable amount of water and electricity. In addition, snow-guns can only be used when the temperature as well as the humidity reach certain values. With the effects of climate warming, as already experienced in the record-warm winter season of 2006/07, especially low-elevation areas could suffer from a lack of snow – and therefore, low rentability (Hanzer, Marke & Strasser, 2014, p. 113). According to Steiger and Mayer, snowmaking can be considered a reasonable adaption strategy for small- to medium-sized ski resorts in high-elevation regions and financially strong areas. It is likely that ski seasons will become shorter in the future, which can be traced back to the probable rise of electricity prices and, therefore, the chance of unprofitability. This requires multiplex snow-making models and more innovation in the field of snowmaking (Mayer & Steiger, 2008, p. 298).

More technical strategies that have already been implemented are "grooming of ski slopes, moving ski areas to higher altitudes and glaciers, protecting against glacier melt with white plastic sheets" (OECD, 2007, p. 2).

Grooming of ski pists can add 10 to 20 cm of snow that is needed in order for ski areas to be able to operate. However, it is not feasible to compensate a significant

decrease or even the absolute absence of snow. As for the use of plastic sheets on glaciers, this measure can by no means prevent the melting of glaciers if temperatures rise to a certain level (OECD, 2007, p.2).

This proves that many adaption strategies in the technical field are already used; however, it is uncertain if they will continue to be effective in the light of possible future scenarios. For instance, we cannot predict how electricity prices will really change in the future. Moreover, the source only includes the most common strategies implemented in Austria. There is currently a lot of research done concerning new strategies; however, only few are already used.

4.2. Economic strategies

The WKO states that in the winter season of 2017/18, a total of 582 million Euros were invested in Austrian ski resorts, whereof 107 million Euros were spent on the production of artificial snow (WKO, 2018).

Moreover, subsidies in the amount of 100,000 Euros were distributed to small to medium-sized cable car businesses in the province Vorarlberg. However, the guidelines of the WKO state these subsidies aim to “improve the economy (…) and grant children and young adults the access to winter sport activities … near their hometowns” (WKO, 2018).

Although cable car companies can receive subsidies, the adaption to climate warming is not mentioned as a reason in the guidelines whatsoever.

Many ski areas nowadays also insure themselves against a complete absence of snow. This possibility is a short-term solution for winters that bring less snow; however, insurance is not able to compensate for an increasing number of winter seasons with much less snow (OECD, 2007, p.2).

Even though the WKO mentions the amount of subsidies granted, they provide no information on how businesses that receive support are selected. Therefore, the selection process and the amount of companies that are supported is unclear. As it is intransparent, it is uncertain if small, low-elevation businesses or the already wealthy ones are supported – and under which circumstances. Therefore, it is difficult to draw conclusions as to how the money is distributed. However, it is very important to support small businesses so that they are able to afford adaption strategies in the future.

4.3. Managerial strategies

Currently, a great amount of official papers and reports are published, dealing inter alia with managerial and organizational strategies. For instance, the BMWFW published the following strategies for management adaption:

- implementing and improving risk management
- clear allocation of tasks between municipalities and tourism associations
- creating evacuation and communication concepts (BMWFW, 2012, p. 22).

Trawöger conducted a study, interviewing 24 CEOs of tourism associations or Austrian cable car companies. The study showed that most CEOs do not perceive climate warming as a threat. Therefore, implementing risk management as an adaption strategy is not necessary, neither at the moment nor over the course of the next decades. Trawöger finds it crucial to minimize fear and maximize trust so that change and innovation in those areas can be implemented. She states that "particular attention should be given to new forms of management that allow people to tackle complex problems like climate change successfully" (Trawöger, 2014, pp. 344-349).

This example demonstrates that not only innovative ideas should be published, but a proper implementation of these organizational strategies is essential. Additionally, it is important that not only businesses, but also customers change their behavior, which will be further discussed in the next chapter.

4.4. Individual strategies

An online survey amongst Austrian travelers concerning their own travel behavior was conducted. The focus was laid on the impact that the effects of climate warming have on tourists' travel attitude. The results show that most tourists are aware of the impact of climate warming on their chosen destination. Nonetheless, only a small number of participants are ready to adapt their behavior to an eco-friendlier way of travelling (BMWFW, 2014, p. 5).

Nonetheless, some businesses in Austria also offer some climate-neutral alternatives for winter holidays. For instance, an organization called Alpine Pearls offers eco-friendly summer and winter holidays for tourists. These include climate-neutral mobility - tourists can use public shuttle-busses, e-bikes or e-cars. Moreover, tourists stay in special climate-neutral hotels that offer regional food and are eco-friendly (Alpine Pearls, n.d.).

Nevertheless, it depends very much on the own perception of the tourist and their willingness to spend more money on special, eco-friendly offers. As the whole winter tourism industry cannot rely on the tourists themselves to change their behavior, all stakeholders have to take action. This aspect is elaborated in the following chapter.

5. The role of stakeholders with regard to the adaptability to climate warming

This chapter examines the role of different stakeholders in the field of adaption processes. It shortly describes their current approach and further elaborates potential risks, while also suggesting ways to deal with the repercussions of climate warming in the future.

5.1. Politics

A study by Gössling et al. found that out of the 18 most important tourism countries in Europe, most governments have neither had their potential risks regarding climate change analyzed, nor do they have a plan for possible adaption strategies in the tourism sector (Gössling, Hall & Scott, 2012).

Although Austria has implemented some regulations concerning snow-making or subsidies for small businesses, those laws depend on the province in which the business is located. In the meantime, Austrian regional municipalities and the national government tend to stick to maintaining the current status for the longest period possible, even though this entails a variety of negative impacts. Therefore, it is essential that politicians make decisions for the future while confronting some risks. For the Austrian government, it is crucial to get an overview in order to investigate that market forces will probably conduct an autonomous adaption process. Moreover, the government has to find a way to weigh up the benefits and drawbacks of some adaption strategies, including ecological and social side effects. For instance, fostering snow production uses up large amounts of water and electricity. Another example would be that focusing on ski resorts in higher elevations, for example on glaciers, could negatively impact their fragile nature. Therefore, the key is to find a balance concerning adaption processes. It is questionable if, in the future, decisionmakers will rely on the influence of the market or properly support businesses with subsidies (OECD, 2007, p.3.).

This proves that there is still room for improvement with regard to political measures as many obstacles have yet to be overcome. Thus, it is very important that some laws are made, measures are taken and subsidies are fairly distributed.

5.2. Interest groups

5.2.1. Tourism associations

Tourism associations have a high reputation in Austria and are a crucial part of the tourism sector. These associations are described as “public corporations that develop tourism strategies and conduct marketing activities for their region” (Trawöger, 2014, p. 343).

Trawöger conducted a study on risk perception concerning the effects of climate warming. In the interviews conducted in the study, one third of the Tyrolean tourism organizations, together with regional cable car companies, were questioned. As a result, Trawöger states that most stakeholders do not retrace the impact global warming has on Tyrol and do not identify climate warming as a threat. The majority of stakeholders does not regard climate change as a regional problem, but as more of a global issue that has little to no influence on their own businesses (Trawöger, 2014, p. 347).

Therefore, it is of high importance to make a change in people’s perceptions.

One suggestion would be to use climate services, which aim to support organizations and businesses to alleviate the effects of climate warming and properly adapt to climate warming (Alonso, Damm, Harjanne, Köberl & Stegmaier, 2019).

As the use of climate services is also a matter of capital, a special focus needs to be put on the costs for individual businesses. Despite the high costs, it is safe to say that it would be reasonable to take those services into consideration. Moreover, the most relevant opportunity for tourism associations would be to use specific marketing strategies as an instrument for raising awareness amongst the population and stakeholders. These marketing strategies should be clearly positioned and in the long term, are likely to draw tourists’ attention to more sustainable ways of spending their holidays. In order to create more opportunities for associations to take action, cooperation with other stakeholders, for instance public administration, would be vital.

5.2.2. Public administration

When talking about climate change, people often seem rather skeptical and generally know only little about the impacts it has on the tourism industry. According to a member of the Styrian Chamber of Commerce, who was interviewed concerning perceptions of tourism stakeholders, describes the situation as follows:
“We try to communicate the climatic trends to our members. However, the interest in climate change topics is very low. There is a kind of resistance to advice. [...] Nevertheless, we try to point out that climate change should be considered in investment decisions” (Interview partner from the Chamber of Commerce, department of ‘Tourism and Leisureindustry’, as cited in Alonso et al., 2019, p. 5).

Thus, it can be concluded that, often, even members of the public administration do not regard climate warming as an omnipresent threat in the context of winter tourism in Austria, hence only few strategies are implemented.

In order to improve the situation in the future, the Austrian public administration could create more information material concerning climate change, for instance in the form of online support platforms. It is also important to hand these materials to ski areas, as it has be shown that they have little to no interest in the topic.

A further crucial factor is that public administration should allocate responsibilities to stakeholders that have an impact on the industry.

Naturally, different stakeholders do not feel responsible for certain tasks and tend to rely on others even though they are actually responsible. Therefore, an idea would be to create an agenda for a specific region that names precisely formulated goals and strategies together with the responsible association. This would help to avoid misunderstandings and would also give every stakeholder the chance to contribute their part. Even if interest groups and politics create a proper base for adaption, a lot still depends on the customers themselves and their behavior as they are the ones who are responsible for the demand. The role of tourists is therefore elaborated in the next chapter.

5.2.3. Tourists

Tourists will play a crucial role in the development of the winter tourism industry in the next decades as they are the ones who determine the demand. Nevertheless, it is rather difficult to make predictions for the future as it is unknown how much tourists

are, for instance, willing to pay more money for more eco-friendly holidays. It is clear, however, that tourists are responsible for sustainable development, for example through the way they travel, their choice of accommodation or their consumer habits during their stay.

An example of an eco-friendly accommodation in Tyrol is the Hotel Kristiana in Lech am Arlberg. The hotel analyzes its carbon footprint by taking factors such as mobility of employees, paper consumption or energy and water consumption into consideration. As a result, they determine what can be improved to reduce emissions. Emissions that cannot be avoided are compensated by the hotel's purchasing special certificates that support climate-protection projects (BMWFW, 2012, p. 27).

By switching to climate-neutral hotels such as the Hotel Kristiania tourists can improve their own travel behavior in the long run. What CEOs and managers can actually do to create more sustainable businesses such as the Hotel Kristiania, is examined in the following.

5.2.4. CEOs and hotel managers

Another one of the most important stakeholders with regard to winter tourism are hotel managers and CEOs of cable car companies. They are the ones who depend on winter tourism and have to adapt their offers to the consequences of climate warming.

5.2.4.1. Risk perception and present approach

The risk perception of stakeholders in the context of climate warming is a highly important factor in minimizing the vulnerability to climate warming. The more aware stakeholder such as CEOs are, the more is done to devise effective methods of adaption. Risk perception is influenced by many different factors: it depends whether or not a phenomenon has been there for a long time, is a short- or long-term problem, or whether it is prompt or delayed. Moreover, different social and cultural aspects also have an impact on the stakeholders' risk perception. For instance, people who have dealt with science-based data tend to perceive a higher risk than the general public. Generally, according to a survey conducted in 2014, 83% of stakeholders interviewed believe that climate change has an impact on the planet; nonetheless, 79% do not perceive it as a risk for their business at the moment and for the following decades (Trawöger, 2014, pp. 339-346).

This proves that raising awareness among CEOs and managers is a crucial step in the process of adaption. If they are more aware of the problem and actually recognize climate warming as a risk, the chance that they make a change increases. The question of what instruments could be used in order to make that change is dealt with in the following.

5.2.5. Possible instruments to react

Taking this survey into consideration, it is safe to say that something has to be changed. In the following, strategies that could be implemented by managers and CEOs are discussed.

5.2.5.1.1. Generating one's carbon footprint

As already mentioned in 5.2.3., hotels that generate their carbon emissions are already on the market. They calculate their own carbon footprint and often offer the guest the possibility of compensating for the emissions caused by their stay (BMWFW, 2012, p. 27).

It is safe to say that it is a crucial step for companies and business to become aware of their own emissions. What is more, projects aimed at protecting the environment are also supported by the money they receive from businesses who compensate for their emissions.

5.2.5.1.2. Communicating climate neutral tourism

CEOs and managers are in the position to decide in which direction their marketing strategy is going. Therefore, they have the opportunity to clearly communicate climate-neutral ways of travelling to customers. The key is to focus on alternative and innovative types of holiday and benefit from this niche market. This will also lead to an improvement in the perception of tourists and the general public in the long run. Nevertheless, before being able to change their marketing strategy, businesses must ensure that they are able to keep their promises. It follows that the marketing strategy, for example the use of eco-friendly forms of electricity, can only be changed after other strategies have already been implemented.

5.2.5.1.3. Expansion to other forms of tourism

The adaption strategy of the BMWFW suggests focusing on summer tourism in the Alps in order to protect the infrastructure in the winter time and rather expand on summer tourism possibilities. Moreover, it also proposes fostering urban tourism in order to cultivate stable year-round offers (BMWFW, 2017, p. 121).

While these are very common approaches to adaption in many winter tourism areas, it has to be considered that they could have repercussions on the environment as well. For instance, ecosystems could be threatened by mass tourism. Moreover, wild animals may lose their natural habitat due to this measure. Nevertheless, if structured management strategies are implemented and sustainable routes, for instance hiking trails in forests, are created, the focus on year-round tourism can act as a reasonable alternative for winter regions. A more detailed analysis of what can be done in a Tyrolean business will be provided by analyzing a case study conducted for this thesis in the following chapters.

6. The G.H. Betriebs GmbH

In this thesis, the G.H. Betriebs GmbH, located in the province of Tyrol, will be presented as an example for the consequences of climate warming on winter tourism.

6.1. The Alpine Lifestyle Hotel “das Kronthaler“

The hotel „das Kronthaler“ is a business located in Achenkirch, Tyrol, amidst the Karwendel and Rofan mountains. Its atmosphere is appreciated by many guests, especially in winter. The hotel promotes active, but also relaxing holidays with possibilities such as skiing, winter hiking or cross-country skiing (Das Kronthaler, n.d.).

The region Achensee could profit from 155,653 arrivals and 617,667 overnight stays during the winter season of 2018/2019. This represents an increase of 3,9% for arrivals and 2,9% for overnight stays compared to the winter season of 2017/2018 (Tirol Tourism Research, n.d.).

The hotel and the whole Achensee region are gaining in popularity, hence it is crucial to consider the effects of climate warming in the region and to analyze the strategies of the hotel for sustainable adaptions.

6.1.1. Significance for a „ski in – ski out“ hotel

What makes a great number of tourists appreciate the hotel is its proximity to the ski resort Christlum Achenkirch. Therefore, the “ski-in – ski-out” concept is promoted, which enables guests to ski right next to the hotel. This simultaneously causes a high dependency on ski tourism as many tourists primarily spend their holiday engaging in winter sport activities such as skiing. As the hotel profits from its location next to a ski resort, it is essential to consider different adaption strategies. The area could suffer from a lack of snow in the future due to the effects of global warming. Therefore, it is important to find alternatives in order to provide a sustainable offer for the future.

6.1.2. Possibility for alternative products

Even though tourism is very strong in the wintertime, the area also benefits from concepts for year-round tourism. As the hotel is located next to the lake Achensee, summer activities such as hiking, water sports, kite surfing or stand-up paddling are offered. Hiking is very popular amongst tourists as the Achensee region has 500 kilometers of marked hiking trails (Achensee Tourismus, n.d.).
Moreover, spa facilities are an important factor. With its 2500 m^2 spa and beauty area, the hotel promotes different offers for relaxation. Additionally, yoga retreats and detox programs are offered (das Kronthaler, n.d.).
As the cities of Innsbruck, Kufstein or Hall in Tirol also attract tourists throughout the year, there is a chance of providing city tours for guests in the future as well. Nonetheless, the main focus of the hotel is currently still on winter tourism.

6.2. Ski school Achensee

Another branch of the G.H. Betriebs GmbH is the ski school Achensee, which is mainly based in the ski area Christlum Lift next to the hotel. With its 25 employees, national and international, they provide many tourists with private ski trainings and group units (C.Gross, Assistant to the general manager, Email, August 30, 2019). As it is based in a rather low-elevation ski area, the business obviously depends on snow conditions and, therefore, on the impact of climate warming in the area.

6.2.1. Ski area Christlum Lifte

The ski resort Hochalmlifte Christlum Achenkirch offers 27 kilometers of pists, whereof 100% are equipped with artificial snow-making facilities. It is the biggest ski area in the Achensee region and profits from its proximity to cities such as Innsbruck and Munich. The ski resort is located at a low altitude, with its lowest point at 950 meters and its peak at 1,800 meters (Achensee Tourismus, n.d.).
As the ski area is situated at a rather low elevation, the ski resort is highly exposed to global warming. There is no official data concerning the question of whether or not adaption strategies are implemented . Nevertheless, it can be speculated that due to the fact that all pists dispose of snow guns, artificial snow production is the main short-term adaption strategy.
The introduction to this business proves that, even though it could offer alternative products, winter tourism still constitutes an important part of the profits and customers' appreciation of the company. The hotel as well as the ski area are located at a rather low altitude, which is why they will eventually have to face challenges due to the effects of climate change in the next decades. In order to properly adapt to those effects, it is essential for the business to develop strategies and to implement them. In the following chapter, a case study regarding the company's ecological impact is analyzed. It will be further examined if the G.H. Betriebs GmbH has already implemented adaption strategies and what opportunities it has to become more eco-friendly and sustainable in the future.

7. Case Study: possibilities for adaptability of the G.H. Betriebs GmbH

7.1. Approach

As I served my internship in the hotel "das Kronthaler" from February to July 2019, I have noticed that the area is already affected by global warming. Temperatures were high in February, and winter returned in the beginning of May. A business such as the G.H. Betriebs GmbH, which mainly attracts tourists during the winter season, is dependent on consequences of climate change, such as changes of season and different weather conditions. Therefore, the hotel is also responsible for properly adapting to these changes. This case study examines the current situation of the business and looks at the emissions currently produced by the company.

Furthermore, it provides suggestions for improvements for a more climate-friendly future in the business.

7.2. Method

As the research conducted for the case study is further elaborated in chapter 2.2., this chapter examines the empirical application of the method. The aim was to not only calculate the amount of emissions produced in the G.H. Betriebs GmbH but also to compare the online tools used. Therefore, the next step after the research was to collect the necessary data for the calculations. The data required for both the MyClimate calculator as well as the calculator of the Flächenagentur Brandenburg were the following: type of electricity used, amount of electricity used per year, type of heating, size of heated surface, number of company cars, total number of overnight stays and number of employees. For the MyClimate calculator, aspects such as the amount of business flights per year were also taken into consideration. The Flächenagentur Brandenburg calculator, however, additionally considers the type of fuel used for cars as well as meals provided for employees.
The data required for the calculations, such as the amount of electricity used, was provided by the hotel itself. The collection of data was conducted in 2018 and includes all the types of data required (C.Gross, Assistant to the general manager, Email, August 30, 2019).
By adding the data necessary, the online tools calculated the produced emissions online and delivered immediate results. The end results were used to draw conclusions about the current carbon footprint of the business. In the next step, suggestions concerning possible improvements were made. It was examined what could be done better and what advantages a reduction in emissions could have on the business. The results as well as the recommendations are elaborated in the following chapters.

7.3. Results

When comparing their results, it can be maintained that the online tools both calculated approximately the same results.

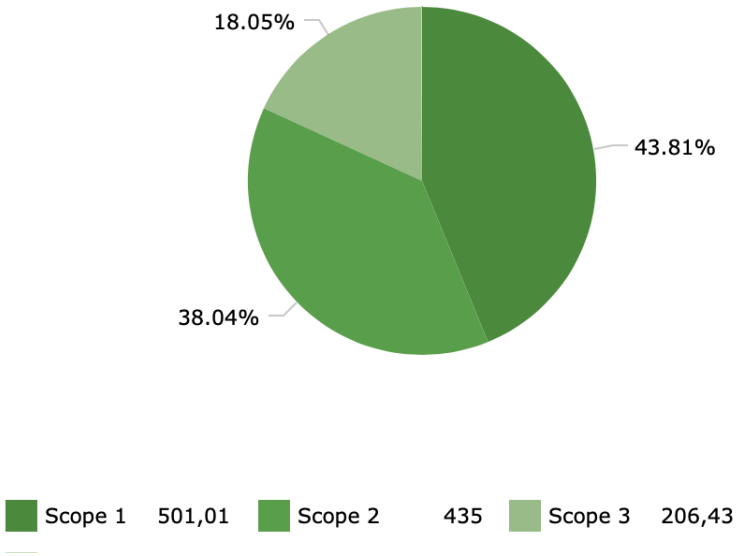
The first tool, the myclimate calculator, came to the following conclusion:

- Energy: 1,057.2 t CO_2e

- Mobility: 0.001 t CO2e
- Meals provided: 27.4 t CO2e
- Consumption items such as waste: 56.5 t CO2e

It follows that the G.H. Betriebs GmbH produces **1,141.1 tons of CO2e emissions** per year. It has to be mentioned that the impact of the field mobility is significantly low. That is because the G.H. Betriebs GmbH has one company car that is only used for a distance of approximately 8,000 kilometers per year. Therefore, emissions in that field are relatively low.

The second tool, namely the CO2-calculator of the Flächenagentur Brandenburg GmbH, illustrates the results in a graph:



From Flächenagentur Brandenburg GmbH. (n.d.). *Verteilung der THG-Emissionen in Geltungsbereiche.* Retrieved September 1, 2019 from https://flaechenagentur-priv.co2-rechner.de/de_DE

The calculation results in a total of **1,142.45 tons CO2e** in the year 2018. The emissions were divided into three main scopes, which are further described. Of the total sum of emissions, direct emissions, such as the combustion of fossil fuels, account for 43.81%. In Scope 2, 38.04% indirect emissions are illustrated. Indirect emissions stem, for instance, from the production of electricity or heat. Scope 3 shows 18.05% of other indirect emissions that come from the value chain such as the mobility of employees or the paper consumption.

When comparing the two results, it becomes evident that the tools came to approximately the same conclusions. However, the second tool gives a more detailed overview of how the calculation was made. By dividing the results into scopes, the main fields are illustrated including the percentage and the detailed numbers. In comparison to the myclimate calculator, the main areas are divided differently. While the first tool only names “energy” as an aspect, the second tool divides the result into direct and indirect emissions. For practical use, the demonstration of results as done by the second tool is more suitable as the business can differentiate between direct or indirect emissions. The first tool divides the other parts of the results into mobility, material consumption and meals provided. It has to be mentioned that, since the hotel only owns one vehicle, the mobility field is of low importance for the overall emissions. The other fields clearly demonstrate the CO2e produced. The second tool names a percentage for scope three that describes the indirect emissions from the daily consumption – so to speak - for instance through the use of raw materials or the employee’s mobility. However, what has to be added is that both calculators miss important factors that should be considered for the calculation of the CO2 emissions. For instance, neither of the tools includes emissions that are produced due to the guests’ choice of means of transport. Moreover, indirect emissions caused by the production of the equipment of the guests are also neglected. This indicates that the calculators give somewhat of an overview of the emissions produced, but only include a small number of factors for the calculations.

In the case of the G.H. Betriebs GmbH, the CO2 calculator of the Flächenagentur Brandenburg GmbH offers a better-arranged design and delivers more detailed results. It is more suitable for this kind of business as it focuses on the direct and indirect emissions, which are the main contributors to CO2 emissions in the hotel industry, and names additional factors in its third category.

Finally, the aim of the study was to investigate the impact of the businesses on the environment and draw conclusions for improvements. Hence, when the results are compared to average measurements, the hotel ranks below average .

Even though there are no official figures regarding the Austrian hotel industry, a study states that the average hotel produces between 29.53 kg and 33.38kg CO2 per guest and night. The first value targets average hotels that have up to four stars whereas the second value is defined for upscale hotels (Chen, Legrand & Sloan, 2013).

For the sake of comparison, those values are applied to the example of the hotel das Kronthaler. When taking into consideration the total overnight stays in 2018 of 44,000 guests, the CO2 emissions would be between 1,299.32 tons to 1,468.72 tons CO2 per year. If the results of the CO2 calculators are now compared to the average value, it shows that the results are a little below average.

In order to demonstrate the improvements that can be achieved by implementing more adaption strategies, the results are also compared to good-practice examples in Austria.

The Bio-Hotel Stanglwirt is a five-star resort located in Going in Tyrol, which offers winter tourism and wellness activities. The aim of the hotel is to act in a way that is as climate-neutral as possible, integrating many strategies in order to enable their guests a more eco-friendly stay. For instance, they obtain 100% of their electricity from renewable energy sources and use the water from their own spring to heat and cool down the whole hotel area. Moreover, they support a project aimed at protecting the environment in Costa Rica in order to compensate for their remaining CO2-emissions (Stanglwirt, 2019).

It has to be taken into consideration that the Bio-Hotel Stanglwirt has a larger budget due to a higher number of annual visits compared to the G.H. Betriebs GmbH and explicitly claims to be an organic hotel. However, it is safe to say that some strategies they use could possibly be implemented in the Hotel das Kronthaler, such as the use of renewable energy or the compensation for emissions. Furthermore if they implemented at least some of the strategies from the examples given, the Hotel das Kronthaler could improve their sustainability and be more environmentally-friendly in the future.

To sum up, the G.H. Betriebs GmbH ranges just below the average emission values in nowadays' hotel industry. As there is no average value for comparison in Austria, it is difficult to draw specific conclusions for the Austrian hotel industry. Nevertheless, if the business is compared to another good-practice example in the region of Tyrol, it is safe to say that there is a big need for implementing further adaption strategies. Examples of how to adapt to climate change would be using solar or other forms of green electricity, a focus on offering only regional and organic products or the possibility for guests to compensate for the emissions produced by their stay.

8. Discussion

From the literature research, it can be concluded that there is a lot of room for improvement when it comes to adaption to climate warming in the Tyrolean winter tourism industry. Snow-making is often the main strategy used. Even though this is a short-term fix for the next few years, it is not an adequate solution for the long term. Effects of climate warming are becoming more and more perceptible, which is why political bodies publish several papers, claiming how important it is to start acting now. Nevertheless, if one considers the perception of CEOs and businesses, it does not seem like politicians are taking the issue seriously. The only possibility for a medium-term abatement of consequences of climate change is to finally change our way of thinking and to start acting. As demonstrated in the case study, businesses such as the G.H. Betriebs GmbH have apparently not yet taken any further steps to reduce the amount of emissions produced. This shows that even though the profits of the business and the region in which it is located are highly dependent on winter seasons, stakeholders have not yet understood the importance of a change in habits.

But what can be done concretely in order to avoid a worst-case scenario? Personally, I believe that especially the government has to alter their way of thinking and create concrete regulations. It is essential that they compose agendas that formulate precise goals for the future and, more importantly, work on implementing them properly. In addition, politicians are the ones that can allocate responsibility to other stakeholders so that everyone knows what to do and when to start acting. Moreover, tourism associations and businesses can work together to analyze the possible effects climate change could have on their region. In doing so, implementation strategies or offers for alternative products could be elaborated for the future.

Moreover, a crucial part is to raise awareness amongst all stakeholders. Nothing will change if global warming is not considered a real risk for a region. It is not a phenomenon that may only impact our region in a few hundred years – but it has already influenced our region in more ways than we think. Therefore, politicians, associations, businesses and especially the population have to change their way of thinking and start acting now.

9. Conclusion

9.1. Answers to subquestions and the research question

- *Which economic risks will the business eventually have to conquer in the future when considering the current predictions for climate warming?*
  As elaborated in chapter 4, the main adaption strategy in most Tyrolean ski resorts is the production of artificial snow. As a result, economic risks will eventually occur. Electricity prices are likely to rise, which could cause financial problems, especially for small ski areas. Moreover, the natural snow line will rise and precipitation will decrease in low-elevation areas. This results in the need for more artificial snow. In the long run, this could lead to low rentability and, therefore, to the bankruptcy of small ski areas. It is very likely that only wealthy areas such as Kitzbühel or Bad Ischgl will be able to overcome those risks.

  If stakeholders do not implement new adaption strategies, low-elevation ski areas in Tyrol are highly endangered to close due to less rentability.
  As demonstrated in chapter 4.1, most of the literature used claims that the production of artificial snow is only a short- to midterm strategy. Nonetheless, snow-making is the main adaption strategy used in the area of Tyrol. It also has to be taken into consideration that the natural snow line as well as the prices for electricity are very likely to rise in the next decades. Therefore, the hypothesis could be proven.

- *What strategies can the company use in order to meet the interests of customers and be economically and ecologically successful in the long run?*
  As chapter 5 shows, it is crucial that stakeholders take action and responsibility in order to create a reasonable agenda with strategies that are actually implemented. For instance, politicians can decide to financially support smaller regions that struggle with rentability. What is more, tourism associations could examine the climatic hazard of their region by using climate services. This allows them to get an overview of what the actual risks for their area are and implement strategies that specifically counteract those. The most important aspect, however, is raising awareness amongst stakeholders and providing information that illustrates the urge to take action now.

- *Which alternative products can the company realistically implement in order to fit to both climate warming and postmodern winter tourists?*
  As examined in chapter 6.1.2., the possibility to offer alternative products depends very much on the region in which the business is situated. In the case of the G.H. Betriebs GmbH, an expansion to city tourism would be an option. Moreover, the focus can be laid on wellness facilities. Another popular aspect is the expansion on summer tourism.

  Businesses have to find new alternative products and receive financial support from politics in order to stay sustainable in the long term.
  This hypothesis can be confirmed partly as the possibility of offering alternative products very much depends on the region in which the business is located. If the proximity to cities or, for instance, hiking trails is given, the business could promote those as alternative activities. This means that some businesses can make use of already existing facilities in their region. As illustrated in chapter 5.1., it can be stated that through the help of subsidies, the adaption process could be simplified. If businesses are financially supported, they can invest in more complex, but sustainable strategies for long-term security.

- *How can politics and tourism associations use their role in order to support a business like the G.H. Betriebs GmbH?*
  A crucial aspect for a proper adaption is raising awareness among stakeholders such as tourists, managers and CEOs. Political bodies and tourism associations have the power to reach not only the general population, but specifically endangered regions, as chapter 5.1 and 5.2 illustrate. By providing information and a proper strategy for adaption, they can improve the chance for adaption. Moreover, they can use their financial power to support businesses at risk. This way, smaller companies also have the opportunity to make sustainable investments that are profitable for the future.

- *What strategies can the G.H. Betriebs GmbH implement in order to properly adapt to the effects of climate warming?*
  As the results of the case study conducted in chapter 7.3 show, the G.H. Betriebs GmbH could implement strategies such as the use of green electricity or the focus on regional products. Another opportunity for the business would be to offer tourists the

possibility of compensating for the emissions caused by their stay. This way, other environmental projects can profit from the donations.
The business could thus follow good-practice strategies that are already used in the Austrian hotel industry.

The G.H. Betriebs GmbH has not yet implemented sustainable strategies for the long term. Nevertheless, the business does have reasonable opportunities for alternative products in the Achensee region.
This hypothesis can be partly disproved. As the case study in chapter 7 examined, the hotel ranks a little below the average concerning hotel emissions. This indicates that the hotel might already have implemented some strategies. Nevertheless, there is quite some room for improvements when comparing the results to Tyrolean good-practice examples.
The business, however, has reasonable opportunities for offering alternative products, as elaborated in chapter 6.2.1. The hotel could profit from the proximity to the lake Achensee and surrounding cities such as Innsbruck. This way, the business will not be totally exposed to the consequences of climate warming in the future.

This bachelor thesis aims to illustrate adaption strategies and to point out suggestions for improvements. The literature used is only limited, however, due to the topicality of the topic, many articles are likely to be published in the near future. Thus, there is plenty of room for further research. The following questions could build the base for more in-depth research on this topic:

- What specific effects does the use of climate services have on endangered regions?
- How do the effects of climate warming influence the demand for winter sport activities?
- What marketing strategies can be used in order to make climate-neutral tourism palatable for winter tourism guests?

Moreover, the case study could be further elaborated in the form of interviews with the manager and CEOs in the region Achensee in order to investigate their perceptions. This would again have gone beyond the scope of this paper.

9.2. Practical recommendations

As the case study illustrates, there is room for improvement when it comes to the strategies implemented in the G.H. Betriebs GmbH. Therefore, suggestions are pointed out that especially focus on the company, enabling them to have a sustainable, profitable system in the long run.

Firstly, a starting point could be conducting a more detailed analysis of the ecological footprint of the company. There are many services on the market that offer a structured investigation of a business and its region, pointing out risks and opportunities. As shown by the case study mentioned above, the management of the company could use those services in order to gather more in-depth data and also have the business checked on a regular basis to track improvements and results. Moreover, a suggestion that can be implemented is paying more attention to the quality of products. Vegetables and fruit should be seasonal and regional; meat should only be bought from organic farmers in the region and there should be a broader offer of vegetarian and vegan options in order to reduce meat consumption. Furthermore, cleaning products should be biodegradable and towels could be switched to organic cotton that is sustainably produced.
What is more, the use of renewable energies should be promoted. This factor accounts for a big part of the ecological footprint, which should be reduced in the future. For instance, instead of using crude oil or coal for heating, the business could switch to biofuel such as pellets which are obtained from regional companies. Even though this change is associated with relatively high costs, it is worth the investment as it is more sustainable in the long run.
Another strategy that has already been mentioned in chapter 5.2.3. is giving guests the possibility to compensate for their stay. As more and more people aim for a more sustainable lifestyle, it would be reasonable to enable them to reduce their own ecological footprint while being on holiday. What is more, there are many possibilities that would allow the hotel itself to compensate for some of its CO2 emissions by, for example, supporting climate-protection projects. This is not only an opportunity for interesting collaborations but can also help boost the reputation of the business. After having implemented some of the suggested strategies, the business should also focus on being more transparent when it comes to sustainability. This means that they should sensitize customers concerning their consumption and also raise more awareness about where their products come from. Moreover, the business could create supporting information material on what it is doing in order to be sustainable.

This material could be placed in every room or be illustrated on the website. In that sense, it could then also be used as a marketing strategy.
In general, a focus should also be put on cooperation with tourism associations, regional politicians and other businesses in the area. If all stakeholders work together and focus on relevant external factors, more initiatives can be created and more far-reaching strategies can be implemented in the whole region.

9.3. Methodological reflections

In this section, both theoretical and empirical methods are reviewed.

9.3.1. Methodological weaknesses

Concerning the literature research, it turned out to be rather difficult to find articles that were published only three to five years ago, which was my initial aim. Therefore, it has to be considered that some literature used was published before 2010. As illustrated in the search protocol in chapter 2.1, only one suffix for terms such as adaption was used in databases. The search field could have been broadened if “adapt*” had been utilized, which would have included all suffix options and could have shown more results. Even though this thesis focuses on the province of Tyrol, some articles used target the whole region of Austria or the Alps in general. Nevertheless, most of the literature can be considered as reliable sources that reflect the situation with a critical point of view.

The online tools used in the empirical part of this dissertation turned out to be rather challenging. Even though they are easy to handle, there were some points that hindered a smooth process of analyzing the results. Many conversions regarding the data and their units had to be made as only one specific unit could be used for the purpose of the calculation. Moreover, the fact that, for most data, there was the option of using average data from other businesses, made the tool seem rather unprofessional. Therefore, in order to make a more precise and in-depth calculation for businesses, I would recommend more complex tools. Nevertheless, for the use of this paper, the online tools used delivered adequate and sufficient results.

9.3.2. Practicability of the practical outcomes

Especially the outcomes of the theoretical part of this bachelor thesis can serve as ideas for further adaption strategies. They shed light on the current situation in the province of Tyrol and underline the urge for stakeholders to cooperate in order to improve the current situation. Recommendations in chapter 9.2, however, mainly focus on the G.H. Betriebs GmbH and the results of the case study. The company could implement these suggestions and, therefore, reduce their overall ecological footprint. For instance, the business could focus on more regional, seasonal products. In order to implement this strategy, regional farmers who are able to produce the amount of products required must be found. Moreover, the management of the hotel should analyze what impact the costs of regional food have on room prices. The focus on regional products is a reasonable strategy that the company can implement as it also improves the overall quality of the food. Additionally, guests are likely to appreciate the products offered, because they can retrace the origin of the products. What is more, switching to renewable energy is a considerable factor for the business. Admittedly, changing their source of energy is associated with high costs and a considerable amount of planning. However, it is a valuable and sustainable investment for the future as it considerably reduces the carbon footprint of the hotel. Another suggestion is to cooperate with other stakeholders to create sustainable initiatives. The G.H. Betriebs GmbH can easily implement this strategy, because it is already cooperating with the local tourism organization. If they expand this cooperation and encourage other businesses as well as the regional government to work together, they can focus on setting a sustainable framework for the future. Overall, it is certain that the business could implement most recommendations even though some might cause higher costs. However, it is safe to say that they would be worth the investment in the long run.

9.4. Last words

I would like to thank the G.H. Betriebs GmbH, representative Mr. Günther Hlebaina and Christiane Gross, for providing the data required for the case study.

Literature List

Achensee Tourismus. (n.d.). *Zahlen & Fakten*. Retrieved 28, 2019 from https://www.achensee.com/service/reiseinfos/zahlen-fakten/

Alpine Pearls. (n.d.). *Sanft mobiler Urlaub in Werfenweng*. Retrieved August 28, 2019 from https://www.alpine-pearls.com/urlaub/oesterreich/werfenweng/

BMNT. (2017). *The Austrian Strategy for Adaption to Climate Change*. Retrieved August 28, 2019 from https://www.bmnt.gv.at/service/publikationen/umwelt/austrian-strategy-adaption-to-climate-change.html

BMWFW. (2012). *Klimawandel und Tourismus in Österreich 2030*. Retrieved August 28, 2019 from https://www.bmnt.gv.at/tourismus/tourismuspolitische-themen/nachhaltige-entwicklung/klimawandel.html

BMWFW. (2014). *Klimawandel und Tourismus in Österreich*. Retrieved August 28, 2019 from https://www.bmnt.gv.at/tourismus/tourismuspolitische-themen/nachhaltige-entwicklung/klimawandel.html

Carbon Footprint. (2013). In *Encyclopædia Britannica*. Retrieved September 1, 2019 from https://www.britannica.com/science/carbon-footprint

Climate. (2019). In *Encyclopædia Britannica*. Retrieved August 28, 2019 from https://www.britannica.com/science/climate-meteorology

Chen, J., Legrand, W., & Sloan, P. (2013). *Sustainability in the Hospitality Industry.* Oxon: Routledge. Retrieved September 2, 2019 from https://books.google.dk/books?id=Tm1xvG0GAMUC&pg=PT27&lpg=PT27&dq=average+co2+produced+hotel&source=bl&ots=TaGKf57wlI&sig=ACfU3U2RZrxEsLcvefJbpALnKGW4enV1cA&hl=de&sa=X&ved=2ahUKEwjn5Pf57K_kAhWJbFAKHTvzAPUQ6AEwCHoECAgQAQ#v=onepage&q=average%20co2%20produced%20hotel&f=false

Alonso, E., Damm, A., Harjanne, A., Köberl, J., & Stegmaier, P. (2019). The market for climate services in the tourism sector. An analysis of Austrian stakeholders' perceptions. *Climate services.* doi: https://doi.org/10.1016/j.cliser.2019.02.001. Retrieved August 25, 2019 from https://www.sciencedirect.com/science/article/pii/S2405880718300931?via%3Dihub

Damm, A., Greuell, W., Landgren, O., & Prettenthaler, F. (2017). Impacts of +2°C global warming on winter tourism demand in Europe. *Climate Services, 7,* 31-46. doi: http://dx.doi.org/10.1016/j.cliser.2016.07.003. Retrieved August 25, 2019 from https://www.sciencedirect.com/science/article/pii/S2405880715300297?via%3Dihub

Damm, A., Köberl, J., & Prettenthaler, F. (2014). Does artificial snow production pay under future climate conditions?. A case study for a vulnerable ski area in Austria. *Tourism Management, 43*, 8-21. doi: https://doi.org/10.1016/j.tourman.2014.01.009. Retrieved August 25, 2019 from https://www.sciencedirect.com/science/article/pii/S0261517714000107?via%3Dihub

Das Kronthaler. (n.d.). Winteraktiv mit all seinen Facetten. Retrieved August 28, 2019 from https://www.daskronthaler.com

Elsasser, H., Gallati, D., Kytzig, S., Lardelli, C., Pütz, M., Rixen, C., Teich, M., & Waltert, F. (2011). Winter tourism, climate change, and snowmaking in the

Swiss alps: Tourists' attitudes and regional economic impacts. Mountain Research and Development, 31(4), 357-362. doi: https://doi.org/10.1659/MRD-JOURNAL-D-11-00039.1. Retrieved October 28, 2019 from https://bioone.org/journals/mountain-research-and-development/volume-31/issue-4/MRD-JOURNAL-D-11-00039.1/Winter-Tourism-Climate-Change-and-Snowmaking-in-the-Swiss-Alps/10.1659/MRD-JOURNAL-D-11-00039.1.full?tab=ArticleLink

Falk, M. (2013). A survival analysis of ski lift companies. *Tourism Management, 36,* 377-390. doi: https://doi.org/10.1016/j.tourman.2012.10.005. Retrieved August 25, 2019 from https://www.sciencedirect.com/science/article/pii/S0261517712001859?via%3Dihub

Flächenagentur Brandenburg GmbH. (n.d.). *CO2-Rechner*. Retrieved September 1, 2019 from https://flaechenagentur-priv.co2-rechner.de/de_DE

Flächenagentur Brandenburg GmbH. (n.d.). *Verteilung der THG-Emissionen in Geltungsbereiche*. Retrieved September 1, 2019 from https://flaechenagentur-priv.co2-rechner.de/de_DE

Gössling, S., Hall, M. & Scott, D. (2012). International Tourism and Climate Change. Wiley interdisciplinary reviews: *Climate change, 3*(3), 213-232. doi: 10.1002/wcc.165. Retrieved August 25, 2019 from https://www.researchgate.net/publication/236018302_International_Tourism_and_Climate_Change

Hanzer, F., Marke, T., & Strasser, U. (2014). Distributed, explicit modeling of technical snow production for a ski area in the Schladming region. *Cold Regions Science and Technology, 108*, 113-124. doi: https://doi.org/10.1016/j.coldregions.2014.08.003. Retrieved August 25, 2019 from https://www.sciencedirect.com/science/article/pii/S0165232X14001360?via%3Dihub

https://www.austriatourism.com/tourismusforschung/tourismus-in-zahlen/

Lieb, G., & Kellerer-Pirklbauer, A. (2018). Gletscherbericht 2017/2018. *Bergauf 2, 73*(143), 20-29. Retrieved August 28, 2019 from https://www.alpenverein.at/portal_wAssets/img/news/2019/gletscherbericht/Gletscherbericht-2019-Bergauf_2_19.pdf

Mayer, M., & Steiger, R. (2008). Snowmaking and Climate Change. Future options for snow production in Tyrolean ski resorts. *Mountain research and development, 28*(3), 292-298. doi: 10.2307/25578206. Retrieved August 25, 2019 from https://www.researchgate.net/publication/260465409_Snowmaking_and_Climate_Change_Future_Options_for_Snow_Production_in_Tyrolean_Ski_Resorts

Myclimate. (2014). *Myclimate Label Richtlinien*. Retrieved September 1, 2019 from https://www.myclimate.org/fileadmin/user_upload/myclimate_-_home/01_Information/01_About_myclimate/09_Calculation_principles/Documents/myclimate-Label-Richtlinien-Berechnungsgrundlagen.pdf

OECD. (2007). *Climate Change in the European Alps: Adapting Winter Tourism and Natural Hazards Management. Summary in English*. Retrieved August 28, 2019 from https://www.oecd.org/env/cc/climatechangeintheeuropeanalpsadaptingwintertourismandnaturalhazardsmanagement.htm

Österreich Werbung (2018). *Tourismus in Zahlen*. Retrieved June 18, 2019 from https://www.austriatourism.com/tourismusforschung/tourismus-in-zahlen/

Presse.Tirol. (2019). *Tirols Tourismus meistert winterliche Herausforderung und blickt zuversichtlich Richtung Sommer*. Retrieved August 28, 2019 from https://presse.tirol.at/de/tirols-tourismus-meistert-winterliche-herausforderung-und-blickt-zuversichtlich-richtung-sommer/pr1200335

Stanglwirt. (2019). *Bio-Fakten*. Retrieved October 28, 2019 from https://www.stanglwirt.com/de/ueber-uns/bio-fakten.html

Tirol Tourism Research. (n.d.). *Die Wintersaison 2018/19*. Retrieved August 28, 2019 from https://www.ttr.tirol/statistik/statistik/wintersaison-201819

Trawöger, L. (2014). Convinced, ambivalent or annoyed: Tyrolean ski tourism stakeholders and their perception of climate change. *Tourism Management, 40,* 338-351. doi: https://doi.org/10.1016/j.tourman.2013.07.010. Retrieved August 25, 2019 from https://www.sciencedirect.com/science/article/pii/S0261517713001428?via%3Dihub

UNITAR. (2015). *Predicting and Projecting Climate Change*. Retrieved August 28, 2019 from https://www.uncclearn.org/sites/default/files/guide_predicting_and_projecting.pdf

United Nations. (1992). *United Nations Framework Convention on Climate Change*. Retrieved August 28, 2019 from https://unfccc.int/files/essential_background/background_publications_htmlpdf/application/pdf/conveng.pdf

WKO. (2018). *Schigebiete in Österreich: Winter am Berg*. Retrieved August 28, 2019 from https://www.wko.at/branchen/transport-verkehr/seilbahnen/schigebiete-oesterreich.html