Hochschule Harz

Bachelorarbeit

EVALUATION OF THE BAVARIAN CABLECAR SUBSIDIES DIRECTIVE

ASSESSING ITS ECOLOGICAL AND ECONOMIC IMPACTS USING A UTILITY VALUE ANALYSIS

angefertigt an der
Hochschule Harz

Fachbereich Wirtschaftswissenschaften

Studiengang: International Tourism Studies

vorgelegt von:
Caroline Ringler
Matr.-Nr.: 26933
Bonauweg 4
83026 Rosenheim
u34515@hs-harz.de

angefertigt bei:
Erstbetreuer
Prof. Dr. Harald Zeiss
Zweitbetreuerin
Prof. Dr. Inga Dehmel

Eingereicht am: 22.09.2023

Table of Contents

List of Figures....IV

List of Tables....V

List of Abbreviations....VI

1 Introduction 1

1.1 Identification of the Research Problem 1

1.2 Aims and Objectives 2

1.3 Thesis Structure Overview.... 2

2 The Alps.... 3

2.1 Natural, Social and Economic Environment.... 3

2.2 Climate Change 3

3 Alpine Ski Tourism 6

3.1 Economic Significance of Ski Tourism.... 6

3.2 Bavarian Ski Tourism.... 7

3.3 Climate Change and Ski Tourism 9

3.3.1 Declining Snow Reliability and Resulting Development of Artificial Snowmaking.... 9

3.3.2 Limitations of Snowmaking Systems 11

3.3.3 Economic Implications and Resulting Need for Adaptation Strategies.... 13

4 Bavarian Cable Car Subsidies Directive 15

4.1 Purpose and Content.... 15

4.2 Investments from 2009 to 2022 17

4.3 Public and Political Debate 18

5 Methodology 20

5.1 Research Questions 20
5.2 Selection of Research and Analyzing Methods 20
5.3 Conducting the Literature Review 22
5.4 Conducting the Utility Value Analysis 23
6 Results 29
6.1 Impacts of the Directive 29
6.1.1 Cable Cars and Surface Lifts 29
6.1.2 Snowmaking Facilities and Reservoir Ponds 33
6.1.3 Others 38
6.1.4 Parking Areas 40
6.1.5 Synthesis 41
6.2 Results of the Utility Value Analysis 44
7 Discussion 47
7.1 Summary 47
7.2 Limitations 49
7.2.1 Literature Review 49
7.2.2 Utility Value Analysis 49
7.3 Recommendations 50
8 Conclusion 53
Appendix 55
Bibliography VII
Eidesstattliche Erklärung XX

List of Figures

Figure 1: Glacier Argentière in 1890 and 2015 5
Figure 2: Number of Ski Areas by Country, 2007 7
Figure 3: Mean Altitude Ranges of Alpine Ski Areas at Regional Level 8
Figure 5: Development of SM Area and SM System Numbers in Bavarian Ski Resorts, 2011-2022 11
Figure 6: Absolute Funding Amounts per Investment Category 17
Figure 7: Chosen Decision Alternatives for the UVA 23
Figure 8: Assessment of Average Environmental Impacts per Funding Category 26
Figure 9: Calculation of Environmental Impacts' Weights 26
Figure 10: Employed Seven-point Scale and Corresponding Transformation Rule for the Example of the CCSL Construction Criteria 28
Figure 11: Cable Car Stations on Wendelstein (left) and Zugspitze (middle), Chairlift on Unternberg, Ruhpolding (right) 30
Figure 12: Construction of SM Pipelines 36
Figure 13: Construction Process of a RP in Garmisch, Kreuzwank 36
Figure 14: Estimated Average Degree of Impacts per Funding Category (2009-2022) 43
Figure 15: Overview of Utility Scores in Ecological and Economic Categories 46

List of Tables

Table 1: Average Increase in Snowmaking Efforts across Bavarian Ski Resorts 11
Table 2: Evaluation Criteria for the Selected BCCSD Alternatives............... 25
Table 3: Weighting of Criteria.. 27
Table 4: Funding Amounts of CCSLs from 2009 to 2020............................. 31
Table 5: Energy and Water Consumption of SM Systems per Scenario 34
Table 6: Funding Amounts of SM Systems and RPs from 2009 to 2022 37
Table 7: Funding Amounts of Other Investment Objects/Activities from 2009 To 2020.. 40
Table 8: Funding Amounts of PAs from 2009 to 2020.................................. 41
Table 9: Calculation of Estimated Average Devree of Impact for each Funding Category 43
Table 10: Overview of Funding Data and Impacts per Funding Category.... 44
Table 11: Ranking Result of the Utility Value Analysis................................. 44
Table 12: Overview of Results for Each Alternative 45

List of Abbreviations

A1 .... *Alternative 1*
A2 .... *Alternative 2*
A3 .... *Alternative 3*
BAFU .... *Federal Department of Environment*
BAV .... *Federal Department of Transport*
BCCSD .... *Bavarian Cable Car Subsidies Directive*
CCSL .... *cable car and surface lift*
LfU .... *Bavarian State Office for the Environment*
PA .... *parking area*
PTIC .... *Potential Total Investment Costs*
RP .... *reservoir pond*
SM .... *snowmaking*
UVA .... *Utility Value Analysis*

1 Introduction

1.1 Identification of the Research Problem

Climate change has a pronounced impact on the Alps, where temperatures have risen from 1901 to 2008 nearly twice as much as the global average.[1] Projections indicate further increases.[2] These increases and the resulting decrease in snow reliability will affect the availability of snow-sure ski resorts and lead to a higher demand for snowmaking facilities.[3] Lower-altitude ski resorts are particularly affected by this. In winter, ski resorts below 1,500 meters can no longer be operated profitably in the long term, as snow reliability is lacking.[4] Bavarian tourism, with a gross revenue of 34.2 billion Euros from tourists in 2019, holds significant economic importance.[5] Ski tourism plays a substantial role at the local level, shaping the tourism landscape.[6] The growing popularity of winter sports tourism has increased the significance of cable car and lift infrastructure.[7] To improve infrastructure standards, the Bavarian government introduced the Bavarian Cablecar Subsidies Directive (BCCSD), promoting investments in the technical renewal and modernization of cable cars, including other facilities and activities such as slope grading and grooming, ticket and access systems, snowmaking systems, floodlight systems and maintenance workshops.[8] It has been regularly extended since its introduction, to the end of 2025.[9] The extension of the directive was criticized by conservation representatives who pointed out the projected warming and the associated investment risk, the climate effects of the facilities, and the questionable economic and

[1] cf. Federal Ministry for the Environment, Nature Conservation and Nuclear Safety 2008, 12
[2] cf. LfU 2021, 18,21
[3] cf. Steiger and Abegg 2014, 8
[4] cf. Menn and Putzing 2014, 535
[5] cf. Bavarian State Ministry of Economic Affairs, Energy and Technology, 3
[6] cf. Jülg 1999 as cited in Mayer and Steiger 2013, 165-166
[7] cf. dwif Consulting GmbH 2022, 6
[8] cf. Bavarian State Ministry 2023, 1
[9] cf. Ibid., 4

ecologic sustainability of snowmaking systems in the face of rising temperatures in the Alps.[10] For this reason, environmental advocates are calling for a reorientation of the directive, placing greater emphasis on incorporating ecological aspects.[11]

1.2 Aims and Objectives

This bachelor's thesis aims to identify both economic and ecological influencing factors and effects of the Bavarian Cablecar Subsidies Directive by looking at the associated subsidized operational facilities and subsequently comparing these factors. In addition, recommendations for adapting and reorientating this directive as well as a decision support system will be developed and provided using a Utility Value Analysis (UVA). Based on these objectives, the following research questions were derived:

- What recommendations for changes to the directive can be derived?
- Sub question: What are the ecological and economic impacts of the Bavarian Cablecar Subsidies Directive?

1.3 Thesis Structure Overview

After the introduction, the thesis consists of seven parts, with most of them containing subchapters. Chapter two and three provide the thesis' theoretical framework by providing information on the Alps and Alpine ski tourism. In part four, current contents and purposes of the BCCSD as well as the public and political debate behind it are described. After an overview of the chosen research methodology in the form of a semi-systematic literature review and UVA, chapter six presents the research's results. Based on them, recommendations for adapting the directive and involving relevant stakeholders are presented. Finally, the limitations of this thesis are highlighted and the conclusion summarises the work.

[10] cf. BUND et al. 2021
[11] cf. Ibid.

2 The Alps

The following section provides an overview of the Alpine region's natural and economic environment, followed by an examination of the effects of climate change on the Alps.

2.1 Natural, Social and Economic Environment

The European Alps form a mountain range that extends over approximately 1,200 kilometers from Nice to Vienna. This range is categorized into the shorter and higher Western and the Eastern Alps, with the Rhine and the Splügen Pass in eastern Switzerland serving as the natural boundary between them.[12] Germany holds a portion of approximately six percent within the Alpine region.[13] Moreover, the Alps are considered one of Europe's top spots for biodiversity, with over 30,000 animal and 13,000 plant species.[14] Agrawala calls the Alps Europe's primary "water tower", as they are providing the source for three major rivers: the Rhine, Rhône, and the Po.[15] Spanning an area of around 190,000 square kilometers, the Alpine region accommodates a population of more than 14 million individuals,[16] the majority of which are concentrated within the lower, often very densely populated valleys.[17]

2.2 Climate Change

In their report from 2021, the IPCC state that human activities have indisputably led to warming in the atmosphere, ocean, and land, causing significant changes across various natural systems. The increase in greenhouse gas concentrations since 1750 is attributed to human actions. Each of the last four decades has been consistently warmer than the ones since 1850. Human influence is evident in the retreat of glaciers, reduction of Arctic Sea ice, changes in precipitation patterns, decline in spring snow cover, warming of the upper

[12] cf. Agrawala 2007, 18
[13] cf. Bausch 2019, 92
[14] cf. Agrawala 2007, 18
[15] cf. Ibid., 18
[16] cf. Elmi and Streifeneder 2018, 12
[17] cf. Agrawala 2007, 18

ocean, and the rise in global mean sea level.[18] Furthermore, the Alps demonstrate a higher-than-average level of sensitivity to climate changes. From 1901 to 2008, the global annual average temperature increased by 0.9 °C. In contrast, the temperature in the Alps rose nearly twice as much, reaching 1.5 °C.[19] According to the Bavarian State Office for the Environment (LfU), depending on the scenario considered (RCP2.6: global temperature limited to 2 °C vs. RCP8.5: no climate mitigation measures), the projected temperatures range from 0.8 °C to 1.5 °C (for near: 2021-2050, medium: 2041-2070, and distant future: 2071-2100 compared to 1971-2000) to 1 °C to 2.3 °C (near), 1.9 °C to 3.4 °C (medium), and 3.4 °C to 5.1 °C (far future).[20]

In 2007, Agrawala projected that these circumstances would result in a notable decrease in snow cover (see section 3.3.1) and glacier mass in the Alpine region.[21] The projected rising temperatures will result in the decrease of snowfall and a corresponding increase of rainfall.[22] In terms of glacial cover, Zemp et al. estimate that the glaciers in the Alps have been diminishing at an average rate of one percent of their volume annually since 1975. Collectively, the glaciers in the European Alps underwent a reduction in area of nearly 50 % between 1850 and 2000.[23] Figure 1 depicts the Argentière Glacier near Mont Blanc in the years 1890 and 2015. It is evident that the glacier has significantly receded during this timeframe. If temperatures were to rise by 5 °C, the Alps would experience a near-complete absence of ice cover. In contrast, Germany would face the loss of all its glaciers with a temperature rise of even 2°C.[24]

---

[18] cf. IPCC 2021, 4–5
[19] cf. BMU 2008, 12
[20] cf. LfU 2021, 18, 21
[21] cf. Agrawala 2007, 21
[22] cf. Kotlarski et al. 2023, 77
[23] cf. Zemp et al. 2006, 3–4
[24] cf. Ibid., 1, 3

Figure 1: Glacier Argentière in 1890 and 2015[25]

The European Environment Agency has identified key vulnerability aspects for the Alps, relying on findings from Beniston, 2004, UBA 2004, and BMU, 2004:

- "Increasing risks of economic losses in winter tourism due to warmer winter and less snowcover, especially in lower altitudes (e.g. less than 1 500 m). (…)
- Increasing vulnerability of settlements and infrastructure to natural hazards, such as flash-floods, avalanches, land-slides, rock fall and mudflows (…) due to heavy rain- and snowfalls and the upward shift of the permafrost line (UBA, 2004) (…)
- Changes in biodiversity and stability of ecosystems (…)
- Changes in water balance (…)
- Increasing vulnerability of human health and tourism due to heat waves (…), flash floods (…) and to higher air pollution from traffic and energy consumption"[26]

[25] left Amis du Vieux Chamonix (1890), right researchers at CREA Mont-Blanc (2015), accessed from CREA Mont-Blanc, n.d.
[26] Beniston 2004; Federal Environment Agency 2004; BMUV 2004 as cited in European Environment Agency 2005, 60–61

3 Alpine Ski Tourism

Section 3 focuses on Alpine Ski Tourism, highlighting its economic significance and specific relevance to Bavaria. It explores the impacts of climate change on skiing, including declining snow reliability and the rise of artificial snowmaking. Economic implications and the need for adaptation strategies are also discussed.

3.1 Economic Significance of Ski Tourism

Skiing in the Alps underwent a transformation from an elite sport to a mass activity during the 20th century.[27] This shift was influenced by improved mobility, infrastructural development, and innovations in uphill transport.[28] The introduction of surface lifts in the 1930s made skiing more accessible, leading to a post-World War II ski boom. However, surface lifts were later replaced by more advanced lift types.[29]

Today, the ski and snowboarding sectors play a crucial economic role, because they are remarkably cost-intensive activities while being enjoyed by a large proportion of the population.[30] In their work, An der Heiden et al. state that skiing is by far the most economically significant sport in Germany and holds high value in terms of national economy: The costs for winter sports infrastructure in Germany amount to only 1.8 % of the overall sports infrastructure expenses of 22.6 billion euros per year. At the same time, winter sports make up a share of 20 % of all consumer spending. For skiing, individuals spend 915 € on average per year. When it comes to vacations, almost twice as much is spent on skiing holidays compared to other sports.[31] In their study, Preuß, Alfs and Ahlert state that with a total expenditure of approximately 11,800 million Euros per year, skiing ranks first for individuals older than 16

[27] cf. dwif Consulting GmbH 2022, 6; Krautzer and Klug 2009, 211
[28] cf. Krautzer and Klug 2009, 211; Mayer 2019, 342
[29] cf. Mayer 2019, 344
[30] cf. An der Heiden et al. 2013, 3
[31] cf. Ibid., 5, 9

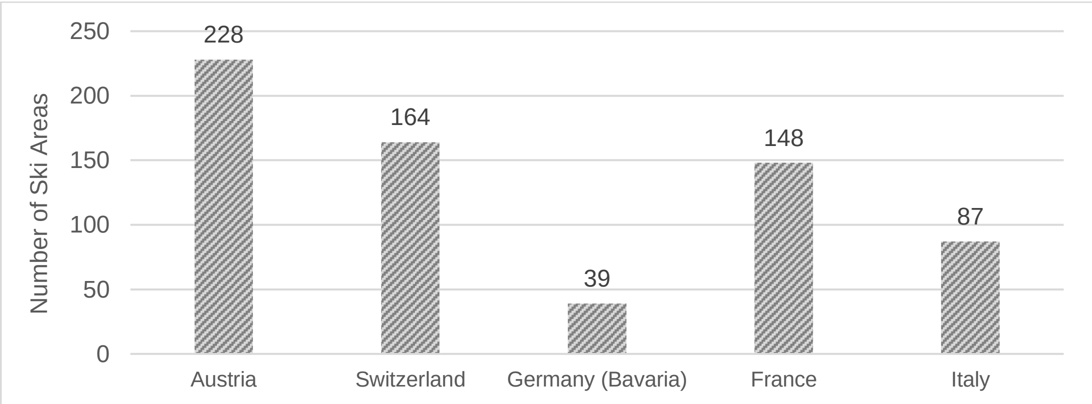
actively participating in the sport out of all examined sports.[32] Reasons for the high expenditures for skiing are the high costs associated with lift passes, outdoor equipment and services like ski schools.[33]

Abegg states that for most Alpine ski areas, the operating season covers a time span of 120+ days, usually starting in the first half of December and ending, depending on snow conditions, around Easter/mid-April. The most crucial periods during the season are Christmas/New Year, early spring school holidays and Easter due to the high demand and therefore high revenues generated in relatively short time spans.[34]

3.2 Bavarian Ski Tourism

There are about 500 ski areas in Germany, nearly half of them consisting of only one lift. Most main resorts are located along the southern border of the Black Forest and in the Bavarian Alps.[35] Figure 2 shows the number of Alpine ski areas by country in 2007. Due to the large amount of small ski areas, only ski areas with at least three transport facilities, at least five kilometers of ski runs and permanent winter operations are considered in this figure. Out of all 666 ski areas, Germany/Bavaria has the smallest share with 5,9 %.

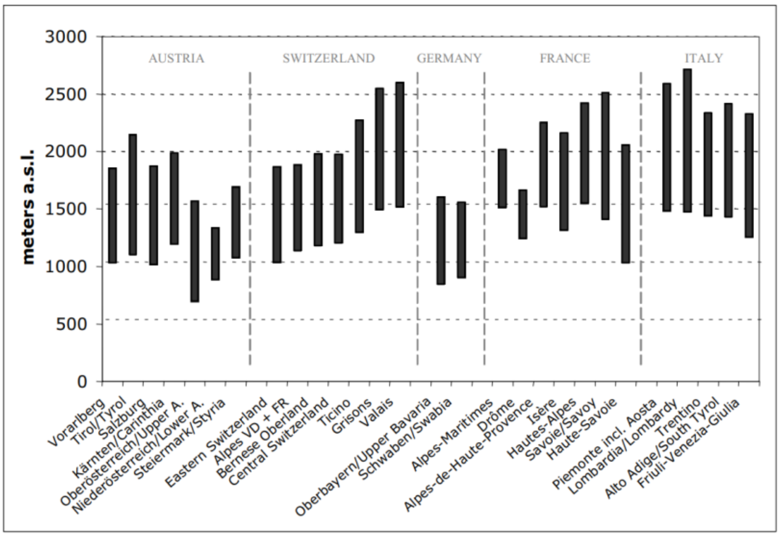
Figure 2: Number of Ski Areas by Country, 2007[36]



[32] cf. Preuß, Alfs, and Ahlert 2012, 128
[33] cf. Mayer and Kraus 2019, 112
[34] cf. Abegg et al. 2007, 29
[35] cf. Vanat 2021
[36] cf. Abegg et al. 2007, 28

In terms of topography, Bavarian ski areas lay much lower than most of the other countries, as can be seen in Figure 3. They are situated at elevations ranging from 580 to 2,840 meters, with an average altitude of 1,325 meters. Half of the ski slope areas are located below 1,295 meters.[37]

Figure 3: Mean Altitude Ranges of Alpine Ski Areas at Regional Level[38]



Due to the highly competitive environment of Alpine tourism, low-altitude skiing regions are facing economic challenges.[39] Nevertheless, Bavarian skiing areas are attractive for both day trippers and short stay guests. This is due to the large metropolitan area of Munich with 2.5 million inhabitants only being away 100 – 150 km from most skiing areas of Bavaria.[40]

Generally, winter tourism plays an important economic role in Bavaria, with rising overnight stays before the Covid19 pandemic (from 32.2 million in the season of 2013/14 to 39.4 million in 2018/19). In 2022/23, the winter tourism industry almost fully recovered from the pandemic with a number of overnight stays of 37.2 million.[41] In a survey conducted by FeWo-Direkt, 26 % of the surveyed German families stated that they ski on half of their vacation days,

---

[37] cf. Dietmann and Kohler 2006, 44
[38] Abegg et al. 2007, 30
[39] cf. Pröbstl-Haider 2019, 66
[40] cf. Bausch 2019, 92
[41] cf. Bayern Tourismus Marketing GmbH 2023

17 % occasionally try other activities, and 12 % ski every day.[42] This illustrates the importance of skiing during winter vacations in Bavaria.

3.3 Climate Change and Ski Tourism

Alpine winter and ski tourism are considered particularly sensitive to climate. In no other tourism sector are the connections to the climate as close as they are in ski tourism.[43] This section provides a closer look at these connections.

3.3.1 Declining Snow Reliability and Resulting Development of Artificial Snowmaking

"No snow – no ski tourism: This simple statement conveys the climate sensitivity of this important tourism sector. [author's translation]"[44] Snow is a fundamental requirement and can be produced technically, but cannot be fully substituted.[45] Guests in German ski resorts expect a snow-covered landscape with a real winter atmosphere for their holidays.[46] In a warmer climate, projections suggest that the snowline and the level of natural snow reliability will rise by 150 meters for every 1 °C temperature increase.[47] "On this basis, climate change could result in a 150, 300 and 600 meter increase in the altitude of the natural snow-reliability line for 1 °C, 2 °C and 4 °C of warming."[48]

In literature, the 100-day rule for snow reliability has become widely accepted.[49] According to this rule, a ski resort is considered snow reliable if it achieves 100 operational days on half of the ski slope area in seven out of ten winters.[50] To be operational, it requires a minimum snow cover of 30 centimeters.[51]

---

[42] cf. FeWo-direkt 2021, 16
[43] cf. Abegg 2012, 30
[44] „Ohne Schnee – kein Skitourismus: Diese simple Aussage bringt die Klimasensitivität dieses wichtigen Tourismuszweiges zum Ausdruck."; Abegg 2012, 29
[45] cf. Ibid., 30
[46] cf. Bausch 2019, 93
[47] cf. Föhn, 1990 and Haeberli and Beniston, 1998 as cited in Abegg et al. 2007, 31
[48] Abegg et al. 2007, 31
[49] cf. Abegg 2012, 29
[50] cf. Steiger, 2013, 12
[51] cf. Hartl and Fischer 2015, 65

Due to their low elevations, Bavarian ski resorts are expected to be particularly affected by declining snow cover.[52] All seven examined Bavarian ski resorts (Oberstdorf, Garmisch-Partenkirchen, Mittenwald, Bad Reichenhall, Wendelstein, Zugspitze and Reit im Winkl) show a negative snow depth trendline for the period 1961 to 2014.[53] In 2014, 30 to 50 % of Bavarian ski resorts were considered snow-reliable.[54] According to Abegg, without the use of technical snowmaking (SM), roughly 30 % examined Bavarian ski resorts will stay snow reliable with a +1 °C increase, while only one (Zugspitze) is expected to do so in case of a +4 °C warming.[55] To counteract this declining natural snow reliability, the implementation of SM systems has been promoted in the Alps since the late 1980s.[56] Reasons for this are ensuring skiing operations and maintaining the duration of the season by blurring natural constraints imposed by weather and climate.[57]

Artificial snow is usually made with snow guns. They disperse water into tiny droplets that freeze in the cold air before landing, producing the effect of a layer of artificial snow.[58] Most Bavarian ski resorts engage in SM between mid-November and beginning of March.[59] Steiger and Abegg state in their study from 2015 examining 310 Austrian, Bavarian and South Tyrolian ski resorts, that to ensure a snow reliable operation (100 day rule) for coming decades, all ski resorts have to increase their SM capacities.[60] Table 1 illustrates the average increase of SM efforts of Bavarian ski resorts depending on the warming scenario. They state that a 31 % (+1 °C), 93/94 % (+2 °C), 193/194 % (+3 °C) and 323/328 % (+ 4°C) increase is required for ski resorts to stay snow reliable.

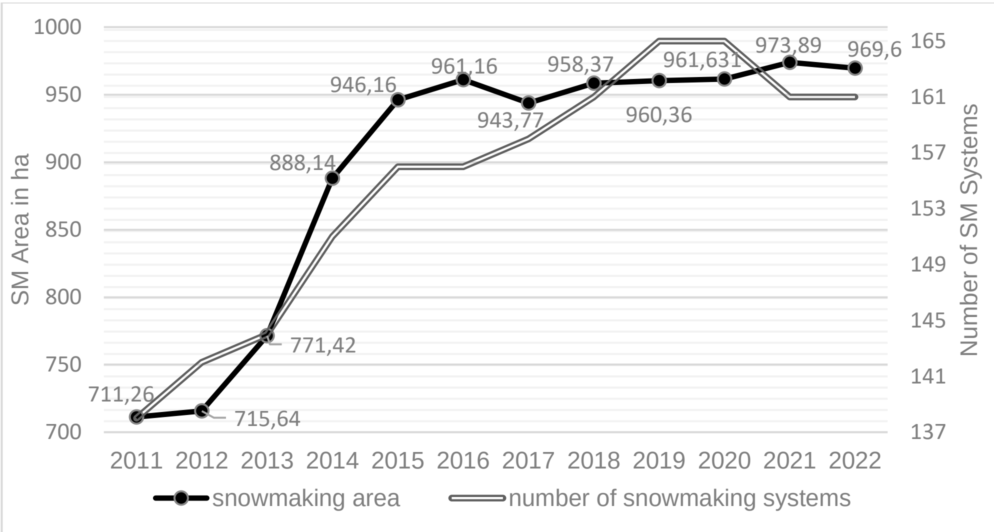
[52] cf. Kotlarski et al. 2023, 83
[53] cf. BR Data, n.d.
[54] cf. Menn and Putzing 2014, 535
[55] cf. Abegg et al. 2007, 32
[56] cf. Hahn 2004, 2
[57] cf. Abegg 2011, 9
[58] cf. Caravello et al. 2006, 31
[59] cf. Bavarian State Parliament 2020b, 8
[60] cf. Steiger and Abegg 2014, 6

Table 1: Average Increase in Snowmaking Efforts across Bavarian Ski Resorts[61]

Region	Scenarios			
	+1 °C	+ 2 °C	+ 3 °C	+4 °C
Upper Bavaria	31 %	93 %	193 %	323 %
Allgäu	31 %	94 %	194 %	328 %

Figure 4 shows the development of SM areas and SM system numbers in Bavaria from 2011 to 2022. The total artificial snow-covered area has increased by almost 37 % during this period.

Figure 4: Development of SM Area and SM System Numbers in Bavarian Ski Resorts, 2011-2022[62]



In the case of a 31 %, 93.5 %, 193.5 %, and 325.5 % increase in SM efforts (average increase for Upper Bavaria and Allgäu, see Table 1), the snow-covered area in Bavaria would expand to 1,163.5, 1,723, 2,611.1, and 3,779 ha for each warming scenario, respectively.

3.3.2 Limitations of Snowmaking Systems

As illustrated in the previous section, insufficient natural snow conditions can be partially compensated using SM systems, thus ensuring skiing operations.

[61] cf. Steiger and Abegg, 2014, 6

[62] Own figure based on Bavarian State Parliament 2022, 4, 5

To do so in times of climate warming, more snow needs to be produced in a shorter amount of time.[63]

However, there are both physical and economic limits to the extent to which these systems can be employed. For instance, in his background report for CIPRA in 2011, Abegg says that the climatic conditions for the operation of SM systems are projected to deteriorate over time. He assumes that the snow production potential[64] would still be sufficient until around 2030. However, beyond that timeframe, especially at lower and mid-altitudes, the situation is anticipated to become critical.[65] Key factors for the use of technical snow production include local wind patterns, atmospheric stratification within the valley and solar radiation conditions.[66] Additionally, a wet-bulb temperature below -2 °C is necessary for the operation.[67]

Based on these factors, Hartl and Fischer conducted a climatological study in which they assessed climatic conditions for snow production at 17 Austrian and 11 German locations. For the Bavarian ski resort located at the Zugspitze, the probability of when SM can be applied has decreased from 93 % (for the period 1974/75 to 1993/94) to 77 % (1994/95 to 2013/14).[68] Furthermore, their calculations indicate that the relative frequency of a wet-bulb temperature of over -2 °C will increase in all examined six Bavarian ski resorts compared to the period 1993-2014, assuming a warming of 1 °C (by 2030) and 2 °C (by 2050).[69] Hence, the technical potential of SM systems will decrease due to increasing wet-bulb temperatures.

Furthermore, there are economic limits to future SM. According to Abegg, in a warmer future, technical production of snow is expected to increase not only in quantity but likely with reduced efficiency. Additionally, there could be an

---

[63] cf. Abegg 2011, 12
[64] measured in SM hours/SM days
[65] cf. Abegg 2011, 12-13
[66] cf. Hartl and Fischer 2015, 33
[67] cf. Ibid., 23
[68] cf. Ibid., 608
[69] cf. Ibid. 2015, 634, 674, 833, 958, 996, 1024

increased use of more energy-intensive technologies such as refrigeration technology and cryotechnology. Lastly, the required energy for water supply, especially the pumping of water from the valley to the reservoir ponds (RP) or onto the slopes, is continuously increasing. This implies that the electricity consumption for SM could significantly rise.[70] Since it is assumed that the costs per unit of energy and water will increase in the face of climate change (due to rising electricity prices and increasing water scarcity), operational costs of SM systems are expected to rise significantly.[71]

Given the presented climatic and economic limitations of snow production systems, the required increase in SM efforts to ensure operations in Bavarian ski resorts (Table 1Figure 4) is unlikely to be realized. This can lead to economic challenges and the need for adaptation strategies, which will be looked into in the following section.

3.3.3 Economic Implications and Resulting Need for Adaptation Strategies

Abegg states that in regions where ski resorts disappear due to climate change, a decline in revenue must be anticipated. This primarily affects cable car operators depending on skiers and snowboarders.[72] However, even before the full shut-down of a ski resort, the deterioration of snow conditions leads to a serious negative effect on demand since good snow conditions generating a winter atmosphere is an important factor for destination choice of guests.[73] In a warmer climate characterized by more frequent periods of low snowfall, the appeal of skiing is likely to diminish for many individuals.[74] Damm et al.'s findings suggest that with changing climate conditions, there is a projected de-

[70] cf. Abegg 2012, 32-33
[71] cf. Abegg 2011, 15
[72] cf. Ibid., 19
[73] cf. Steiger et al. 2022, 11–13
[74] cf. Krautzer and Klug 2009, 230

crease in the ski area's seasonal visitor numbers by 6 % to 28 % when factoring in artificial SM. However, when considering only natural snow, this decline is estimated to range from 22 % to 64 %.[75]

In order to stay or re-establish themselves as competitive, many Alpine regions are forced to develop technical adaptation strategies like landscaping and slope development, moving to higher altitudes or slopes facing north, glacier skiing and, as explained in section 3.3.1, the widespread use of artificial SM.[76] While such strategies, especially the use of snow production systems, might provide temporary solutions, they cannot fully compensate for the lack of natural snow in the long run. For this reason, climate change is likely to render low-lying resorts like those in Bavaria economically unviable, whereas higher-altitude regions with big ski conglomerates could potentially benefit from this development.[77] This is why Abegg et al. state that "(…) government and public policy might play a role (..) in providing an adequate safety net to those at the "losing" side of the adaptation equation."[78] Such a safety net for small ski resorts was introduced in Bavaria in 2009, which will be examined in more detail in the next chapter.

[75] cf. Damm, Köberl, and Prettenthaler 2014, 16
[76] cf. Bausch 2019, 100; Abegg et al. 2007, 37, 42
[77] cf. Krautzer and Klug 2009, 230
[78] Abegg et al. 2007, 59

4 Bavarian Cable Car Subsidies Directive

To support and relieve small and medium-sized ski operation companies in financing necessary technical adjustments and investment and thereby helping the Bavarian ski tourism industry, the BCCSD was introduced by the Bavarian Government in 2009.[79] The directive promotes investments in the technical renewal and modernization of cable cars and surface lifts (CCSL), including operationally necessary facilities.[80] It has been regularly extended since its introduction, most recently from January 1st 2023 to December 31st 2025.[81]

4.1 Purpose and Content

"The purpose of this promotion is to provide an incentive for investments in technical standards, comfort, and quality of cable cars, thereby ensuring the sustainable preservation of Bavarian cable car installations. These installations serve as significant economic factors for the region as infrastructure facilities, while also guiding visitor flow. [author's transl.]"[82]

Financial support is provided for the technical renewal and modernization of cable cars, including operationally necessary ancillary facilities as well as for investments in additional services which are closely related to skiing or summer activities.[83] In practice, the following facilities have been supported:

- CCSLs
- SM systems and RPs,
- Parking areas (PA),

[79] cf. dwif Consulting GmbH 2022, 5
[80] cf. Bavarian State Ministry 2023, 1
[81] cf. Ibid., 4
[82] „Zweck der Förderung ist es, einen Anreiz für Investitionen in technische Standards, Komfort und Qualität von Seilbahnen zu bieten und so die nachhaltige Sicherung des Bestands der bayerischen Seilbahnanlagen, die sowohl als Infrastrukturanlagen einen erheblichen Wirtschaftsfaktor für die Region darstellen, als auch besucherstromlenkend wirken, zu gewährleisten."; Bavarian State Ministry 2023, 1
[83] cf. Ibid., 1–2

- Others: Slope grading and grooming measures plus its equipment/machinery, ticketing and access control systems, floodlight installations, operational workshops.[84]

The recipients of funding are commercial and municipal enterprises.[85] Areas eligible for funding are ski resorts with

- A maximum of three slopes, total length of slopes being less than three kilometers *or*
- The municipality in which the enterprise is located has a maximum hotel room capacity of 2,000, and the number of weekly ski passes sold is less than 15 % of the total number of ski passes sold (last three years' average).[86]

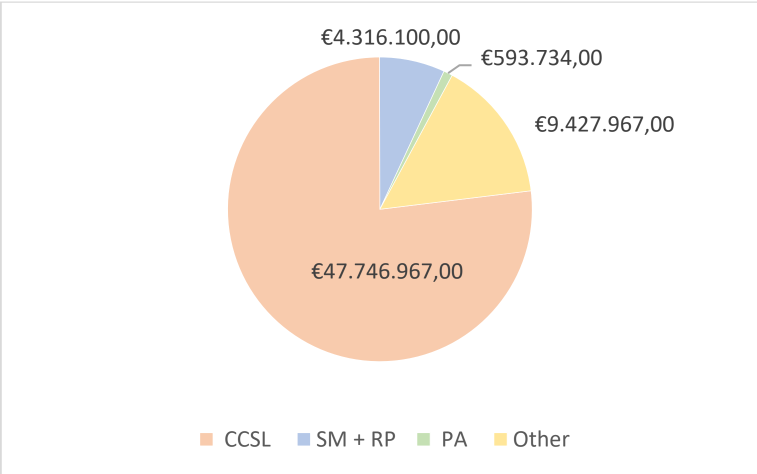
Funding amounts to up to 35 % for small businesses, up to 25 % for medium-sized businesses, and up to 35 % for solely municipally supported enterprises.[87] There are numerous funding requirements, the most important being: (1) The possibility for year-round usage of the facilities must be linked to the investment project. When applying, a concept for year-round usage must be provided. (2) Obligation to assess options for connections to public transportation. (3) The investment amount must be at least 500,000 Euros or the project must be capable of directly and significantly increasing the overall income in the respective economic area immediately and permanently. (4) Only investment projects without legal obstacles and aligning with environmental conservation and spatial planning considerations are eligible for support.[88] All contents and details of the BCCSD can be further reviewed in Appendix 1.1.

[84] cf. dwif Consulting GmbH 2022, 12; Bavarian State Parliament 2022, 19
[85] cf. Bavarian State Ministry 2023, 2
[86] cf. Ibid., 2
[87] cf. Ibid., 3
[88] cf. Ibid., 2–3

4.2 Investments from 2009 to 2022

Until 2022, a total of 42 applications have been received since the introduction of the directive. Five of them are currently under review, one application has been withdrawn, and two are on hold. From 2009 until the end of 2019, the Bavarian government has approved a total funding amount of 62,084,768 €, of which 77 % went into the expansion or modernization and new or replacement constructions of CCSL facilities. Seven percent were invested in the expansion of SM systems and RPs. Another 15 % went into other investment objects and one percent into the modernization or extension of PAs. The absolute funding amounts are shown in Figure 5.

Figure 5: Absolute Funding Amounts per Investment Category



The average funding rate[89] for all approved applications from 2009 to 2020 is 28.43 %. From 2019 to 2022, additional 26,683,544 € were approved. [90]

Out of the 34 approved applications, a total of 63 investments were supported, with 43 % allocated to CCSLs, 25 % to SM systems and RPs, 25 % to other investments and 6 % to PAs. The detailed breakdown of all investment projects can be found in Appendix 1.2.[91]

[89] approved investment amount/planned investment amount
[90] cf. Bavarian State Parliament 2023, 5; Bavarian State Parliament 2022, 19, 20
[91] cf. Bavarian State Parliament 2022, 19,20; Bavarian State Parliament 2023, 4,5

4.3 Public and Political Debate

Past extensions of the directive have been repeatedly criticized by conservation representatives.[92] Especially the continued funding of SM facilities has been heavily condemned: Environmental organizations are pointing out the projected warming and the associated investment risk, the climate effects of the facilities, and the questionable economic and ecologic sustainability of these systems in the face of rising temperatures in the Alps.[93] This led to a widespread public and political debate centered on the directive's effectiveness in economic and ecological aspects.[94]

The German Alpine Club demands the stop of public funding for SM facilities, highlighting their impacts on the delicate Alpine landscape associated with the construction of required technical infrastructure as well as the high water and energy consumption. Instead, the club calls for long-term tourism concepts that do not solely rely on the expansion of ski resorts.[95] Furthermore, representatives of various environmental organizations doubt the economic and ecological sustainability of the directive, as they believe it creates disincentives and leads to a significant and uncontrolled increase in the environmental impact on the Alps. They also criticized the non-transparent continuation of the directive without involving civil society or political groups. Altogether, they called for a public debate and a realignment of the BCCSD, stressing the need to put more emphasis on ecological criteria during the application process.[96]

The Bavarian Minister of Economic Affairs Hubert Aiwanger, on the other hand, defends the promotion of SM systems and calls the reduction or complete discontinuation of such fundings a "(…) colossal mistake [author's

---

[92] cf. German Alpine Club 2013, 2; Axel Doering 2019, 1
[93] cf. BUND et al. 2021
[94] cf. Bündnis 90 2023; Bavarian State Ministry 2022; Roth 2022; Schmidtutz, January 23, 2023; Stoffels, December 17, 2019.
[95] cf. German Alpine Club 2013, 2
[96] cf. Axel Doering 2019, 1; German Alpine Club 2013, 2

transl.]".[97] The government of Bavaria justifies the directive's renewed extension with the associated strengthening of Bavarian tourism and, therefore, the Bavarian economy, basing their arguments on a study by dwif Consulting GmbH.[98] According to the study, the BCCSD has primarily led to increased guest satisfaction, improved quality of offerings and comfort, enhanced destination image, and heightened demand for the facilities, thus contributing to an overall increase in the tourist value chain.[99] However, only economic questions were taken into account in the study, while environmental aspects were left out in the evaluation process.[100]

---

[97] „(…) kolossaler Fehler"; BR television 2022
[98] cf. dwif Consulting GmbH 2022
[99] cf. Ibid., 17, 24
[100] cf. Ibid., 5

5 Methodology

This chapter provides an overview of the study's research methodology as well as its thorough application in practice.

5.1 Research Questions

The following research question and sub question were formulated based on the research problem.

What recommendations for changes to the directive can be derived?

This question takes precedence over the other research question as it illuminates the core theme of this thesis. Due to current climate developments and projections, the BCSSD has faced heavy criticism concerning its ecological sustainability. Therefore, this research question aims to identify a potential realignment and improvement suggestions for the directive.

Sub question: What are the ecological and economic impacts of the Bavarian Cable Car Subsidies Directive?

It is of paramount importance to understand the specific impacts of each funding object under the directive to develop potential recommendations for improvement. For this reason, the purpose of this question is to identify and summarize both ecological and economic impacts of cable cars and surface lifts, snowmaking systems and reservoir ponds, other activities and investments and parking areas, ultimately providing an overview for all objects.

5.2 Selection of Research and Analyzing Methods

To answer the formulated research questions, a semi-systematic literature review was carried out first to provide the theoretical foundation for conducting the subsequent UVA. According to Snyder, the semi-systematic review method is useful when studying topics that have been looked at from different angles by different groups of researchers in various fields. It aims to gather and understand all the important research approaches related to the topic, and then combine them to provide a clearer picture of complex areas. When using the semi-systematic review approach, it's important to stay transparent and have a planned research strategy.[101]

According to Kühnapfel, a UVA is particularly useful when dealing with complex decision-making situations. There are three main scenarios where it can be applied: (1) Choice Decisions: comparing multiple alternatives to identify the most beneficial one. (2) Rankings: evaluating subjects or objects to determine which one best achieves a set objective. (3) Object and Subject Evaluations: rating entities by comparing them with predefined benchmarks.[102] In this thesis, the first scenario applied, as three alternative scenarios of the BCCSD were compared in terms of their ecological and economic aspects. The UVA quantifies and makes all aspects of a decision measurable, including those that normally wouldn't be countable, measurable, or weighable. During the analysis, these aspects are evaluated through a transformation process, and subsequently, a score is determined for each decision alternative - the utility value.[103]

However, there are limitations to the reliability and validity of a UVA's result, as conducting a UVA involves subjectivity. The method relies on assumptions or, ideally, real-world experience. Criteria may not always be entirely distinct, and personal preferences can impact how they're weighted. The aim is to reduce these uncertainties through methods like fragmentation, but scoring models are never flawless. Especially when making predictions about the future, relying solely on a single method for crucial decisions could be risky.[104] The goal of this thesis is not to develop specific action guidelines for the directive. Instead, it aims to illustrate the complexity of ski tourism and its associated economic and ecological impacts, providing decision support with the NWA and developing potential options for change. For this reason, the limitations highlighted within the scope of this thesis are acceptable.

[101] cf. Snyder 2019, 335
[102] cf. Kühnapfel 2021, 7–8
[103] cf. Ibid., 6
[104] cf. Ibid., 14

5.3 Conducting the Literature Review

This section is based on Snyder's recommendations for conducting a semi-systematic literature review.[105] To conduct this literature review, a search strategy was developed first. To find literature covering ecological and economic impacts of each funding object category of the BCCSD, a specific set of search terms and phrases in combination with the object categories were selected (Appendix 2.1). During the research process, the following databases were used: UNWTO library, OECD, Google Scholar as well as the online catalogue of the Harz University of Applied Sciences' library. Moreover, reference lists of already selected articles were scanned to identify other relevant articles and sources. Due to time and scope limitations, it was predetermined to examine 60 sources per category for relevant data and information, which amounted to a total number of 240 skimmed literature. Criteria that led to the exclusion of literature included non-relevance to the research question, non-alpine geographic location of the study area, literature in a language other than German or English, literature published after 2000, and papers that couldn't be accessed. In addition to the literature identified through the described search strategy, official statements from the Bavarian State Government in response to written inquiries from political representatives were included to extract specific and concrete data related to Bavarian ski resorts. Overall, a total number of 50 sources were identified which addressed the economic and/or ecological impacts of either one or up to all four object categories. During the final step, the literature analysis, the selected literature was thoroughly examined and relevant information regarding effects and impacts of the object categories abstracted.

The following two sections provide information about the steps conducted during the literature review and the UVA.

[105] cf. Snyder 2019, 335-337

5.4 Conducting the Utility Value Analysis

This section is based on Kühnapfel's book "Scoring und Nutzwertanalysen – Ein Leitfaden für die Praxis" (p. 20-87). His recommended steps for the implementation of a UVA were followed and will be described in this section. Firstly, the goal was formulated, which helps to better understand the underlying decision problem.[106] In the case of this thesis, the following goal was determined: Which decision alternative provides the greatest benefit in both economic and ecological aspects? The next step involves the selection and description of decision alternatives for which the utility value is to be determined.[107] Figure 6 shows the chosen decision alternatives. Since the directive has been in effect for 13 years, and therefore many of the collected data are based on this time frame, the alternatives and the subsequent associated impacts and developments were projected for an additional 13 years.

Figure 6: Chosen Decision Alternatives for the UVA

Alternative 1: Complete discontinuation of the directive
Funding objects: None Funding requirements: None Assumptions for coming 13 years: CCSL: 80 % fewer investment projects → 5 SM+RP: 60 % fewer investment projects → 8 PA: 100 % fewer investment projects → 0 Other: 80 % fewer investment projects → 3
Alternative 2: Continuation of the directive for another 13 years without adjustment for ecological impact factors
Funding objects - CCSLs, - SM systems & RP, - Parking areas, - Others (Slope construction measures, ticketing and access control systems, floodlight installations, piste grooming equipment, operational workshops) Funding requirements (1) The possibility for year-round usage of the facilities must be linked to the investment project. When applying, a concept for year-round usage must be provided. (2) Obligation to assess options for connections to public transportation. (3) The investment amount must be at least 500,000 euros, or the project must be capable of directly and significantly increasing the overall income in the respective economic area immediately and permanently. (4) Only investment projects without legal obstacles and aligning with environmental conservation and spatial planning considerations are eligible for support. Assumptions for coming 13 years:

[106] cf. Kühnapfel 2021, 23
[107] cf. Ibid, 24, 28

Numbers of investment projects for CCSL, SM + RP, PA and Other will stay the same (27, 16, 6, 16)
Alternative 3: Continuation of the directive for another 13 years with consideration of ecological impact factors
<u>Funding objects</u> - CCSLs, - SM systems & RP, - Parking areas, - Other (slope construction measures, ticketing and access control systems, flood-light installations, piste grooming equipment, operational workshops) <u>General funding requirements</u> (1) Assessing the capacities of the ski resort/summer operation + natural environment to prevent overload tendencies. (2) Year-round usage of the facilities must be linked to the investment project. When applying, a concept for year-round usage must be provided. (3) Planned operation appears reasonable in the medium term based on comprehensible scientific criteria. (4) Obligation to ensure connections with public transportation. (5) Only investment projects without legal obstacles and aligning with environmental conservation and spatial planning considerations are eligible for support. Additionally, a success monitoring is carried out during the investment project: A project is considered completed and officially approved by the authorities only when it is proven that all requirements have been met and the set goals have been achieved. <u>Funding restrictments for</u>: (1) <u>Snowmaking systems, reservoir ponds and parking areas, other</u>: Only maintenance of existing facilities, no expansion or renewal, no new piste grading measures (2) <u>CCSLs</u>: ▪ Replacement or new construction only after examination of ecological benefits compared to modernization/maintenance of existing facility. ▪ Area capacity is not already fully utilized by non-cable car-dependent use. ▪ Investment is not linked to capacity increases. ▪ Investment does not lead to other consequential interventions. <u>Assumptions for coming 13 years:</u> - CCSL: 40 % fewer investment projects → 16 - SM+RP: 100 % fewer investment projects → 0 - PA: 100 % fewer investment projects → 0 - Other: 50 % fewer investment projects → 8

The following step involves identifying criteria that sufficiently describe the utility of an alternative within the framework of the NWA.[108] Here, as many criteria as possible were collected through brainstorming (for the brainstorming list see Appendix 3.1) and then pre-selected, sorted, and limited to a final list, which are the four steps Kühnapfel recommends.[109] Due to the complexity of the presented decision alternatives, the focus was limited to direct influencing criteria. Indirect factors were not considered in this UVA. Furthermore, the final criteria were grouped into categories, which helps prevent bias effects.[110] In the following Table 2, the evaluation criteria are listed. These criteria are categorized

[108] cf. Kühnapfel 2021, 28
[109] cf. Ibid., 34-35
[110] cf. Ibid., 33–34

into ecological and economic assessment criteria. The purpose of this table is to enhance understanding and provide explanations for each individual criterion.

Table 2: Evaluation Criteria for the Selected BCCSD Alternatives[111]

Criterion	Background question
	Ecological
	CCSL
Constructed	How many construction processes can be expected?
Operated	To what extent does the number of operated objects change?
	SM + RP
Constructed	How many construction processes can be expected?
Operated	To what extent does the number of operated objects change?
	PA
Constructed	How many construction processes can be expected?
Operated	To what extent does the number of operated objects change?
	Other
Constructed	How many construction processes can be expected?
Operated	To what extent does the number of operated objects change?
	Economic
	Service quality
Waiting time	To what extent does the waiting time during peak hours change?
Snow reliability	To what extent does the snow reliability change in the ski resorts?
Access with public transport	To what extent does the accessibility of Bavarian ski resorts wit public transport change?
Visual attractiveness: disturbance of alpine landscape	To what extent does the construction of facilities affect the perceived attractiveness of the alpine landscape?
Visual attractiveness: snowy landscape	To what extent does the perceived attractiveness of a snowy landscape change?
Security standards: slope	To what extent does the slope security change?
Security standards: infrastructure	To what extent does the infrastructural security change?
	Operation
Infrastructural capacity	To what extent does the capacity of ski resort infrastructure change?
Year-round operability	To what extent does the probability of year-round operation of the facilities change?
Midterm operability	To what extent does the probability of medium-term (next 13 years) ski resort operation change?
Operating costs	To what extent can changes in operating costs be expected?
Generated revenues	To what extent can changes in generated revenues be expected?
Administrative efforts	To what extent can changes in administrative efforts be expected?

[111] Own representation

Regional economy	
Job security	To what extent can changes in the job security in the ski destinations be expected?
Room occupancy	To what extent can changes in the destinations' room occupancy be expected?
Follow-up investments	To what extent can changes in the destinations' amount of follow-up investments be expected?

Moving on, following Kühnapfel's fifth step, the criteria were weighted.[112] The criteria "Ecological Impacts" and "Economic Impacts" were equally weighted (0.5) to simulate and ensure equal consideration of both dimensions. The weighting of environmental impacts for each funding category was based on the average impact assessments conducted by the Federal Department of Environment (BAFU) and by the Federal Department of Transport (BAV), as shown in Figure 7 and Figure 8.

Figure 7: Assessment of Average Environmental Impacts per Funding Category[113]

		air		noise		groundwater		systems		soil		forest		FFH		LS				per ob/act		per obj. category	
		con	**op**	**con**	**op**	**con**	**op**	**con**	**op**	**con**	**op**	**con**	**op**	**con**	**op**	**con**	**op**	**sum (con)**	**sum (op)**	**con**	**op**	**con**	**op**
CCSL	CCSL	1	0	2	2	2	1	2	1	2	1	3	2	3	2	3	2	**18**	**11**	2,25	1,375	**2,250**	**1,375**
SM + RP	SM	1	0	1	2	2	1	2	3	2	2	2	1	2	2	2	2	**14**	**13**	1,75	1,625	**1,750**	**1,625**
	RP	1	0	1	2	2	1	2	3	2	2	2	1	2	2	2	2	**14**	**13**	1,75	1,625		
PA	PA	2	1	2	2	2	2	2	2	2	0	2	1	2	2	3	3	**17**	**13**	2,13	1,625	**2,125**	**1,625**
Other	piste grading	2	0	2	0	2	2	2	2	3	3	2	2	3	2	3	3	**19**	**14**	2,38	1,75	**1,208**	**1,042**
	snowfarming	1	0	1	2	1	1	1	0	1	1			1	1	1	1	**7**	**6**	0,88	0,75		
	floodlight	0	0	0	0	0	0	0	0	0	0	0	0	2	3	1	2	**3**	**5**	0,38	0,625		
	total sum	**8**	**1**	**9**	**10**	**11**	**8**	**11**	**11**	**12**	**9**	**11**	**7**	**15**	**14**	**15**	**15**						
	rel. Sum	**0,8**	**0,1**	**0,9**	**1,0**	**1,1**	**0,8**	**1,1**	**1,1**	**1,2**	**0,9**	**1,1**	**0,7**	**1,5**	**1,4**	**1,5**	**1,5**						
		FFH = Fauna, Flora, Habitation						con = impacts from construction															
		LS = Landscape						op = impacts from operation															

Figure 8: Calculation of Environmental Impacts' Weights[114]

Impacts of Objects: Absolute Numbers				Impacts of Objects: Relative Numbers		
	con	op	sum	con	op	Total (final weight)
ccsl	2.250	1.375	3.625	0.621	0.379	0.279
pm	1.750	1.625	3.375	0.483	0.448	0.260
pa	2.125	1.625	3.750	0.586	0.448	0.288
other	1.208	1.042	2.250	0.333	0.287	0.173
			13.000			

112 cf. Kühnapfel 2021, 38-56
113 cf. BAFU and BAV 2013, 48-49; 0 = no impact to 3 = strong impact
114 Own Calculation based on Ibid., 48-49

The remaining criteria were weighted using the cascading weighting method, which combines intuitive weighting and categorization of criteria. The idea of this method is that only the weights of a manageable number of criteria are intuitively weighted.[115] Kühnapfel's three conditions for intuitive weighting were all met:[116]

- Expertise through knowledge or experience: In this case, the author's expertise is based on the theoretical background and the conducted literature review.
- Limited number of criteria: maximum number of six criteria per category.
- No personal interests: The author of the thesis had no personal interests in the matter.

The following Table 3 shows the final weighting of all criteria.

Table 3: Weighting of Criteria[117]

Criterion	Weight	Criterion	Weight
Ecological	0.5	**Economic**	0.5
CCSL	0.28	**Service quality**	0.3
Constructed	0.62	*Waiting time*	0.1
Operated	0.38	*Snow reliability*	0.3
SM + RP	0.26	*Access with public transport*	0.25
Constructed	0.52	*Visual attractiveness*	0.15
Operated	0.48	Disturbance of alpine landscape	0.7
PA	0.29	Snowy landscape	0.3
Constructed	0.55	*Security standards*	0.2
Operated	0.45	Slope	0.5
Other	0.17	Infrastructure	0.5
Constructed	0.51	**Operation**	0.3
Operated	0.49	*Infrastructural capacity*	0.1
		Year-round operability	0.25
		Midterm operability	0.3
		Operating costs	0.15
		Generated revenues	0.15
		Administrative efforts	0.05
		Regional economy	0.4
		Job security	0.33
		Room occupancy	0.33
		Follow-up investments	0.33

[115] cf. Kühnapfel 2021, 42, 46
[116] cf. Ibid., 42
[117] Own representation

Once criteria are selected and weighted, they need to be evaluated. For this, scales and corresponding transformation rules need to be provided.[118] In this thesis, a seven-point scale was employed, as the example in Figure 10 shows. The top row describes the scale steps, while the bottom row describes the corresponding transformation rule.

Figure 9: Employed Seven-point Scale and Corresponding Transformation Rule for the Example of the CCSL Construction Criteria[119]

		0,00	**1,17**	**2,33**	**3,50**	**4,67**	**5,83**	**7,00**
CCSL	construction	26-30	21-25	16-20	11-15	6-10	1-5	0

For the transformation rules for each criterion, refer to Appendix 3.2. The next step involved evaluating the criteria,[120] which were assessed based on the gathered expertise and subject knowledge acquired through the conducted literature review and the theoretical background. Due to a lack of reliable data, this step only allowed speculative assumptions regarding the behaviour of each criterion in the event of applying the respective alternative. The reasons and explanations for all assumptions made for each criterion can be found in Appendix 3.3. During the second to last step, the utility scores were calculated using Excel (see Appendix 3.4).[121] Finally, the sensitivity analysis was carried out in four analysis steps:

1. Balancing the criteria weights
2. Leveling existing weight peaks
3. Diversifying weight distribution
4. Variating criteria ratings[122]

The detailed description of each sensitivity analysis step can be found in Appendix 3.5.

[118] cf. Kühnapfel 2021, 56
[119] Own representation
[120] cf. Kühnapfel 2021, 76-79
[121] Ibid., 79-81
[122] Ibid., 81-86

6 Results

This section presents the results of both the literature review (impacts of the directive) and UVA.

6.1 Impacts of the Directive

Out of the 240 skimmed sources, the final literature list included 50 sources, most of them studying more than one category. The ecological and economic impacts identified and extracted from this selection will be presented and summarized in the following section, starting with ecological factors followed by economic factors. The categories are presented in the order of how often they were funded (see section 4.2). Many of the impacts presented are of a general nature and are based on studies and sources that have examined regions other than the Bavarian Alps. Concrete figures for Bavarian ski resorts could only be determined for specific impacts.

6.1.1 Cable Cars and Surface Lifts

In the examined literature, there was little information available on ecological impacts of CCSLs. Most examined literature focus on the economic side of CCSLs. Regarding energy consumption, no information could be found.

Impacts on fauna during constructing and operating phases of CCSLs can be significant.[123] Often, forest clearings are necessary for the construction of CCSLs, which can cause fragmentation of forests and other natural habitats and changes the mountains' natural composition, leading to further ecosystem damage.[124] The total deforestation[125] since 1970 in Bavarian ski resorts amounted to a retraceable area of 47,982 ha, with real numbers likely being higher due to untraceable records.[126] Furthermore, aerial cables can pose a

---

[123] cf. BAFU and BAV 2013, 56–57
[124] cf. Bavarian State Parliament 2020a, 31; Curcic et al. 2019, 248; Ruth-Balaganskaya and Myllynen-Malinen, 2000 as cited in MacIntosh, Apostolis, and Walker 2013, 102
[125] Deforestation resulting from constructions of CCSLs, SM systems and RPs and general constructions for ski resorts in 33 examined Bavarian ski resorts
[126] Bavarian State Parliament 2020a, 31

lethal threat to avifauna.[127] Moreover, noise pollution during the construction phase can be significant, the main sources of noise being explosions, construction machinery, transport vehicles or material transportation by helicopters. In older facilities, deteriorated components like loose parts, imbalances or cabins can become sources of noise emissions. Other sources can be electronically amplified music or announcements during events or as background music.[128]

Surface water bodies and aquatic ecosystems located nearby can be altered through channelization or damming and impacted through contamination from fuel or construction runoff during construction activities. Similar issues can also arise during the operational phase, especially during maintenance work.[129]

The visual impacts on the Alpine landscape of CCSL infrastructures and their linear alignment through the forest are substantial. Mountain stations on ridges and peaks are clearly visible from a distance and disrupt the natural alpine landscape, as can be seen in Figure 10.

Figure 10: Cable Car Stations on Wendelstein (left) and Zugspitze (middle), Chairlift on Unternberg, Ruhpolding (right)[130]

While some landscape impacts might gradually fade over time, severe disruptions can persist throughout the entire operational phase.[131]

[127] cf. BAFU and BAV 2013, 56–57
[128] cf. Ibid., 51
[129] cf. Ibid., 52
[130] Wendelstein GmbH, n.d.; Bayerische Zugspitzbahn Bergbahn AG; Peter H., 2017
[131] cf. BAFU and BAV 2013, 57–58

To quantify the overall environmental impacts, the data from BAFU and BAV are used. They have assessed the potential impacts of ski resort projects, assigning a value from zero (no impact) to three (very strong impact) to investment objects in ski resorts for both construction and operational phases. The provided impact ratings for air, noise, groundwater, water systems, soil, forests, fauna, flora, habitats, and landscape aesthetics result in average values of 2.25 (construction) and 1.375 (operation) for CCSLs.[132] The overview of all average value calculations for each investment category can be found in Appendix 2.2.

Investment costs for CCSL structures can be extensive. From 2009 to 2020, funding for the expansion of CCSL facilities ranged from 24,600 € to 10,378,139 €, as shown in Table 4. Considering the average funding rate of 28.43 %, potential total investment costs (PTIC) range from 86,528 € to 36,504,182 €.

Table 4: Funding Amounts of CCSLs from 2009 to 2020[133]

year	investment funding amount	PTIC (funding rate: 28.43%)
2019	10,378,139 €	36,504,182 €
2016	4,798,360 €	16,877,805 €
2015	4,626,000 €	16,271,544 €
2012	4,294,200 €	15,104,467 €
2018	3,200,000 €	11,255,716 €
2019	3,000,000 €	10,552,234 €
2017	2,398,900 €	8,437,918 €
2015	2,361,700 €	8,307,070 €
2013	2,142,700 €	7,536,757 €
2019	1,835,000 €	6,454,450 €
2019	1,724,500 €	6,065,776 €
2014	1,622,800 €	5,708,055 €
2011	1,571,600 €	5,527,963 €
2019	1,471,000 €	5,174,112 €
2012	985,000 €	3,464,650 €
2012	599,000 €	2,106,929 €

[132] Own calculations based on BAFU and BAV 2013, 48-49
[133] Own representation based on Bavarian State Parliament 2023, 5 and Bavarian State Parliament 2022, 19-20

2013	266,000 €	935,631 €
2015	159,000 €	559,268 €
2011	129,760 €	456,447 €
2011	78,000 €	274,358 €
2012	46,600 €	163,911 €
2012	34,100 €	119,944 €
2011	24,600 €	86,528 €
Total	**47,746,967 €**	**167,945,716 €**

According to the evaluation by the dwif, the implementation of the BCCSD has, in many cases, led to an increase in the maximum capacity of transportable individuals per trip through modernized, expanded, or newly constructed cable car infrastructure. This increase was achieved, for example, through larger gondolas or chairs.[134] Moreover, safety standards have been maximized through the installation of modern protective devices.[135] Providing an innovative CCSL system which meets customer expectations in terms of transportation comfort, speed, and minimal waiting times, typically correlates with tourist success for a destination. Mayer and Steiger state that this can be measured through high numbers of overnight stays during the winter season. Conversely, destinations with outdated facilities are unable to achieve these values.[136] In the case of Bavaria, the realized modernization and renovation measures were able to ultimately ensure the continued operation in specific areas.[137]

Cable car enterprises play a crucial role in strengthening the local economy. A study conducted by Schröder in Tyrol indicates that the industry shows a relatively weak, whereas retail, trade, and artisan sectors a relatively strong dependency on the success of cable car companies. Accommodation businesses exhibit a very high degree of dependence.[138] According to a study by dwif e.V, a total gross revenue of 739.8 million Euros was generated through the operation of CCSLs during the winter of 2012/13 and the summer of 2014 in Germany. Out of this, 20.4 % were spent on CCSLs, while 32.4 % went towards

[134] cf. dwif Consulting GmbH 2022, 23
[135] cf. Ibid., 54
[136] cf. Mayer 2008, Mayer 2009 as cited in Mayer and Steiger 2013, 169–170
[137] cf. dwif Consulting GmbH 2022, 31
[138] cf. Schröder 2017, 468

accommodation, 21.7 % towards gastronomy, 11.2 % towards retail, and 14.3 % towards services such as wellness or entertainment.[139] The calculation of the value-added ratio[140] for cable cars resulted in 37 %.[141] Furthermore, the income multiplier was calculated to be 5.1.[142] This means that a total of 1,000 € in salaries and profits from cable car companies leads to an overall income of 5,100 € in the region.[143]

Lastly, cable cars play a crucial role, particularly in regions with limited economic infrastructure, by providing secure and sustainable jobs that cannot be relocated abroad. This helps mitigate population outflows and the need for long-distance commuting.[144]

6.1.2 Snowmaking Facilities and Reservoir Ponds

The energy and water consumption of a SM system depends on the location, weather conditions, and type of equipment.[145] Teich et al. state that one cubic meter of artificial snow consumes 1.5 to 9 kWh. This means that to cover one hectare of slope with 30 cm, 5,000 to 27,000 kWh of electricity are required. In terms of water consumption, Teich et al. provide a range of 600 to 1,500 m³ of water while Marnezy talks about 3,000 m³.[146] For the calculations in this thesis, Teich's values (average energy and water consumptions of 16,000 kWh and 1,050 m^3) are used. Considering the projected rising SM areas for the specific warming scenario discussed in section 3.3.1, the energy consumption would rise by 3.1, 12.1, 26.3 and 45 million kWh for each scenario respectively, along with an additional water usage of approximately 0.2, 0.8, 1.7, and 2.9 million m^3 per hectare of Bavarian slope area. The specific numbers are detailed in Table 5.

---

[139] cf. dwif e.V. 2015, 5
[140] (personnel costs + profit) / total revenue
[141] cf. dwif e.V. 2015, 7
[142] cf. Ibid., 10
[143] cf. Stirnweis 2010, 54
[144] cf. Verband Deutscher Seilbahnen und Schlepplifte e.V. 2015, 2
[145] cf. Abegg 2011, 14
[146] cf. Mayer et al. 2007, Professional Association of Austrian Cable Cars 2006, Hahn 2004, Lutz 2001, Meerkamp van Embden 1999 as cited in Teich et al. 2007, 94; Marnezy 2008

Table 5: Energy and Water Consumption of SM Systems per Scenario[147]

	2022	+1 °C	+2 °C	+3 °C	+4 °C
(Projected) SM area in ha	969.6	1,163.5	1,723	2,611.1	3,779
Energy consumption in million kWh	15.5	18.6	27.6	41.8	60.5
Water consumption in million m^3	1	1.2	1.8	2.7	4

The high water consumption leads to impacts on the water cycle, occurring both during water extraction and through increased runoff during snowmelt.[148] "Melt from artificial snow has significant impacts on the local water cycle both at the seasonal and diurnal scale. The impacts on discharge can be strong several weeks after natural snow melt during the summer months as well as for high frequency, low magnitude flood events."[149]

In terms of impacts in fauna, flora and habitats, the following information was extracted during the review. The construction of facilities, especially the installation of pipelines and reservoirs, can lead to the destruction of natural habitats or the disruption of wildlife habitats.[150] Moreover, the water used for making artificial snow has a different chemical composition than natural snow and usually contains more nutrients and minerals. Due to the increased nutrient input, certain sensitive habitats can be affected.[151] Wipf et al.'s findings suggest a strong impact on nutrition and species composition. "The longer artificial snow had been used on ski pistes (2–15 years), the higher the moisture and nutrient indicator values. Longer use also affected species composition by increasing the abundance of woody plants, snowbed species and late-flowering species, and decreasing wind-edge species. The impacts of artificial snow increase with the period of time since it was first applied to ski piste vegetation."[152] In the

[147] Own representation based on Teich et al., 2007 and 94 Steiger and Abegg 2014, 6
[148] cf. Hahn 2004, 13
[149] Jong and Barth 2008, 7
[150] cf. BAFU and BAV 2013, 74
[151] cf. Ibid., 74
[152] Wipf et al. 2005, 306

study area of Davos, artificial snowmelt water contained four times more minerals and nutrients than natural snowmelt water. Subsequently, indicator species for higher nutrient and water supply increased.[153] With the continuing production of SM, further changes should be expected since the responses of the vegetation are increasingly pronounced the longer artificial snow is applied.[154]

Another factor disturbing fauna is the noise level of SM systems, which can range from 60 to 115 dB depending on the type of machine.[155] Hahn provides a comparison of noise levels: a passenger car (70 dB), heavy road traffic (80 dB), and trucks (90 dB). He states that a SM system with 115 dB is louder than a jackhammer. Pumps and cooling units can be additional sources of noise.[156]

Potential natural hazards triggered by the construction or operation of SM systems and RP are debris flows, landslides, and deep gully erosion.[157] They can be caused by the deposition of construction materials for reservoirs or defective underground water pipelines for SM.[158]

Construction of underground piping systems like the one presented in Figure 11 leave long-lasting scars on soil and vegetation and remain visible for a very long time.[159] Moreover, the above-ground, permanently installed components of SM systems such as taps and pump stations and the construction of reservoirs necessary for water supply leave traces in the alpine landscape, shown in Figure 12.[160]

---

[153] cf. SLF 2002 as cited in Krautzer and Klug 2009, 212
[154] cf. Wipf et al. 2005, 306
[155] cf. Rakytova and Tomcikova 2017, 20–21; Hahn 2004, 14
[156] cf. Hahn 2004, 14
[157] cf. Jong, Previtali, and Carletti 2015, 5
[158] cf. Jong 2020, 37
[159] cf. Hahn 2004, 13
[160] cf. Abegg 2012, 32; Hahn 2004, 13

Figure 11: Construction of SM Pipelines[161]

Figure 12: Construction Process of a RP in Garmisch, Kreuzwank[162]

Overall, the calculated average values for the examined impacts from BAFU/BAV for SM systems and RP are 1.75 (construction) and 1.625 (operation).[163]

From 2009 to 2020, funding for the expansion of SM and RP facilities ranged from 29,851 € to 3,470,015 €, shown in Table 6**.** Considering the average funding rate of 28.43 %, potential total investment costs range from 104,998 € to 12,205,471 €.[164]

---

[161] Grossenbacher 2023
[162] Collection Society for Ecological Research / Sylvia Hamberger, n.d.
[163] Own calculations based on BAFU/BAV 2013, 48, 49
[164] Own calculations based on Bavarian State Parliament 2022; Bavarian State Parliament 2023

Table 6: Funding Amounts of SM Systems and RPs from 2009 to 2022[165]

year	investment funding amount	PTIC (funding rate: 28.43 %)
2019	3,470,015 €	12,205,471 €
2015	2,884,208 €	10,144,944 €
2014	2,158,918 €	7,593,801 €
2011	1,228,933 €	4,322,664 €
2013	1,208,528 €	4,250,890 €
2011	999,727 €	3,516,452 €
2019	501,160 €	1,762,786 €
2014	401,392 €	1,411,863 €
2014	200,123 €	703,913 €
2012	154,880 €	544,777 €
2014	70,000 €	246,219 €
2012	62,800 €	220,893 €
2012	29,851 €	104,998 €
Total	**13,370,534 €**	**47,029,672 €**

An estimation of the annual SM operating costs is 10,000 to 30,000 €/ha.[166] Using the average of 20,000 €/ha means that in 2022, to cover the SM area of 969.6 ha, this cost around 19.4 million Euros. Considering the additional SM areas for the specific warming scenario (see section 3.3.1), the energy costs would rise to 23.3 (+1 °C), 34.5 (+2 °C), 52.2 (+3 °C), and 75.6 million euros (+4 °C). In addition to the required additional SM effort, rising costs per unit of energy and water will lead to a substantial increase in these operating expenses.[167]

When natural snow is scarce, artificial snow helps provide the snow depth required for slope grooming, guarantee operation and safety as well as generally provide an enjoyable experience.[168] The primary immediate economic benefits of SM come from the additional revenues of ski ticket sales thanks to additional

[165] Own representation based on Bavarian State Parliament 2023, 5; Bavarian State Parliament 2022, 19, 20
[166] cf. Breiling et al. 2008 as cited in Damm, Köberl, and Prettenthaler 2014, 9
[167] cf. Abegg 2011, 15
[168] cf. Marty 2013, 31

skiable days made possible by the production of artificial snow. In a study conducted by Damm, Köberl, and Prettenthaler, it was determined that considering artificial snowmaking, an anticipated decline in seasonal visitor numbers for the ski area ranges from 6 % to 28 % under future climate conditions. This decline increases to 22 % to 64 % when factoring in only natural snow.[169] Pütz et al.'s study suggests that the introduction of SM during winters with poor snow conditions in Davos, Switzerland could potentially avert income losses of up to 10% for the regional economy.[170]

6.1.3 Others

In the examined literature, no information could be found on the effects of operational workshops or ticketing and access control systems. In the following section, the impacts of floodlight systems, snow grooming and machine grading are highlighted.

The artificial light from floodlight installations alters the attraction of animals to a specific environment and their navigational abilities. Long term, this leads to impacts on the movement, feeding, reproduction and communication behaviors.[171] Furthermore, artificial lighting disrupts the natural nighttime landscape.[172]

During the winter season, ski slopes in resorts require regular maintenance for downhill skiing, achieved through daily snow grooming and farming. The use of heavy snow grooming vehicles can lead to mechanical harm to vegetation and compaction of the soil beneath by frequently driving over the terrain,[173] particularly when the snow cover is thin.[174]

Leveled slopes can be more easily and efficiently covered with artificial snow, which is why the expansion of SM facilities often leads to further slope grading

---

[169] cf. Damm, Köberl, and Prettenthaler 2014, 16
[170] cf. Pütz et al. 2011, 360
[171] cf. BAFU 2021, 60
[172] cf. BAFU and BAV 2013, 102
[173] cf. Wipf et al. 2005, 307
[174] cf. Rixen et al. 2003 as cited in Meijer zu Schlochtern et al. 2014, 585

measures.[175] “Machine-grading during summer exerts the most drastic disturbance on ski pistes.”[176] Heavy machinery is used to remove soil and vegetation, creating a levelled surface. This surface enables snow grooming at the beginning of the winter when snow cover is limited. Restoration efforts after this process may not always be effective or might be neglected.[177] The study by Wipf et al. demonstrates higher indicator values for nutrients and light, and lower levels of vegetation cover, productivity (reduction by more than 75 % compared with ungraded slopes) and species diversity on machine-graded ski slopes.[178] In 2005, it was determined that 63% of all erosion damages in Bavarian ski resorts occurred on modified sections of slopes (equivalent to 27 % of the total Bavarian ski slope area).[179]

Overall, the calculated average values for the examined impacts from BAFU/BAV for other investments (piste grading, snow farming and floodlight systems) are 1.208 (construction) and 1.042 (operation). The lower values of snow farming (0.77/0.75) and floodlight systems (0.38/0.625) offset the high values of piste grading (2.38/1,75) in this case.[180]

Table 7 shows all other funding investments from 2009 to 2020. Funding ranged from 11,400 € to 5,018,640 €. Considering the average funding rate of 28.43 %, possible total investment costs range from 250,580 € to 989,946 €.[181]

---

[175] cf. Doering and Hamberger 2007, 19; Pröbstl-Haider 2019, 66
[176] Rixen 2013, 70
[177] cf. Titus and Tsuyuzaki 1999; Bayfield et al. 1984; Urbanska 1995; Fattorini, 2001 as cited in Rixen 2013, 70
[178] cf. Wipf et al. 2005, 306; Meijer zu Schlochtern et al. 2014, 585
[179] cf. Dietmann, Kohler, and Lutz 2005; Abegg 2011, 16
[180] Own calculations based on BAFU and BAV 2013, 48-49
[181] Own calculations based on Bavarian State Parliament 2023, 5 and Bavarian State Parliament 2022, 19-20

Table 7: Funding Amounts of Other Investment Objects/Activities from 2009 To 2020[182]

year	investment funding amount	PTIC (funding rate: 28.43 %)
2016	5,018,640 €	17,652,620 €
2015	1,842,500 €	6,480,830 €
2019	621,861 €	2,187,341 €
2012	492,000 €	1,730,566 €
2011	314,200 €	1,105,171 €
2014	299,766 €	1,054,400 €
2012	205,800 €	723,883 €
2014	182,200 €	640,872 €
2019	164,500 €	578,614 €
2013	112,000 €	393,950 €
2019	80,000 €	281,393 €
2012	63,100 €	221,949 €
2014	20,000 €	70,348 €
2013	11,400 €	40,098 €
Total	**9,427,967 €**	**33,162,037 €**

6.1.4 Parking Areas

There is a scarcity of literature concerning the effects of parking facilities in the Alpine region.

During the construction of parking infrastructure, there is a risk of altering water bodies and aquatic ecosystems, as well as contaminating them with fuel or construction site runoff. The resulting traffic also poses a pollution risk.[183] Furthermore, noise pollution can be significant due to excavation work and transportation traffic during the construction phase. Here, blasting and material transport generate substantial noise. Additionally, traffic volume during the operational phase can create noise, thereby affecting the local fauna.[184] According to Leung et al., new infrastructure increases the number of visitors, leading to a greater demand for further paved areas, resulting in more environmental

[182] Own representation based on Bavarian State Parliament 2023, 5 and Bavarian State Parliament 2022, 19-20
[183] cf. BAFU and BAV 2013, 88
[184] cf. Ibid., 86

impacts.[185] In certain regions of Bavaria, parking lots have become over-crowded during peak times, resulting in traffic congestion on access roads.[186] The construction of parking lots also leads to loss of soil. Today's soils are the result of a century or even millennia long process.[187] In addition to their biological functions, soils provide protection against erosion. In high-altitude regions, due to the topography, thin soil layers, and extreme climatic conditions, the risk of erosion is particularly high. Concentrated runoff over impenetrable surfaces can also contribute to erosion.[188] In summary, the calculated average values for the examined impacts from BAFU/BAV for PAs are 2.13 (construction) and 1.625 (operation).[189]

From 2009 to 2020, funding for the expansion of PAs ranged from 80,000 € to 989,946 €, as illustrated in Table 8. Considering the average funding rate of 28.43 %, possible total investment costs range from 250,580 € to 989,946 €.[190]

Table 8: Funding Amounts of PAs from 2009 to 2020[191]

year	investment funding amount	PTIC (funding rate: 28.43 %)
2014	293,834 €	989,946 €
2014	219,900 €	803,150 €
2019	80,000 €	250,580 €
Total	593,734 €	2,043,676 €

6.1.5 Synthesis

Overall, the implementation of the BCCSD led to a measurable strengthening of the regional economy. The evaluation study by dwif states that 44 % of the projects were able to generate additional winter opening days, averaging be-

185 cf. Leung et al. 2018, 23
186 cf. dwif Consulting GmbH 2022, 49
187 cf. BAFU and BAV 2013, 153
188 cf. Ibid., 89
189 Own calculations based on BAFU and BAV 2013, 48-49
190 Own calculations based on Bavarian State Parliament 2023, 5 and Bavarian State Parliament 2022, 19-20
191 Own representation based on Ibid.

tween 10 and 30 days, with 4 % extending their opening days during the summer season. Among 76 % of the investment projects, the positive effects could be quantified and were expressed in various ways, including:

- Increased guest numbers and heightened demand (up to 35%)
- Higher revenues and more season passes sold
- Reduced wait times at the facility and increased transportation capacity
- Enhanced guest satisfaction and positive feedback
- Additional operating days due to weather independence
- Decreased energy costs
- Higher room occupancy in the accommodation establishments in the immediate vicinity[192]

[192] cf. dwif Consulting GmbH 2022, 17

Figure 13 displays the estimated average degree of impacts per category. The values are calculated by multiplying the number of realized investments with the average degree of impact for construction and operation (see Table 9).

Figure 13: Estimated Average Degree of Impacts per Funding Category (2009-2022)[193]

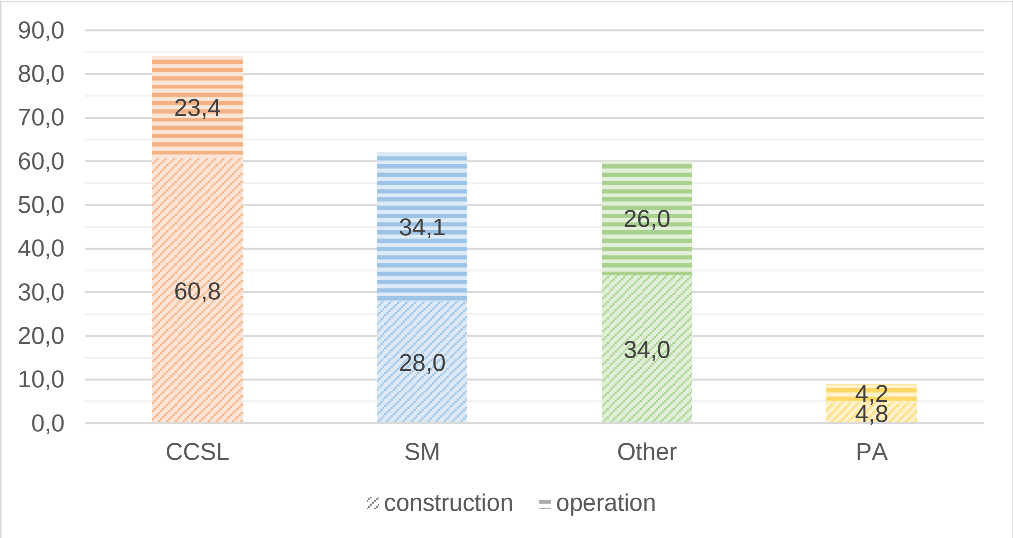


Table 9: Calculation of Estimated Average Degree of Impact for each Funding Category[194]

Funding Category	Number of investments (2009-2022)	Average Degree of Impact: con/op	Estimated Average Degree of Impact: con/op
CCSL	27	2.250/1.375	60.8/23.4
SM	16	1.750/1.625	28/34.1
Other	16	1.208/1.042	34/26
PA	4	2.125/1.625	4.8/4.2

Overall, the potential harm caused by cable cars, as well as park facilities and other investment activities during this period, is not insignificant. A reorientation of the directive could primarily address the damage caused during the construction of new facilities and reduce it for the coming 13 years.

[193] Own representation based on BAFU and BAV, 2013, Bavarian State Parliament 2023, 5 and Bavarian State Parliament 2022, 19-20
[194] Own representation based on Ibid.

Table 10 summarises the information and data extracted from the literature review in a brief overview of all funding categories. Overall, the many ecological impacts are accompanied by numerous economic benefits. Measurement is a challenge due to the varying types of criteria and was aimed for through the UVA.

Table 10: Overview of Funding Data and Impacts per Funding Category[195]

	CCSL	SM + RP	Other	PA	Total
Supported Investments: 2009-2022/2009/2020	27/23	16/14	16/14	4/3	63/54
Share in %: 2009-2022/2009-2020 (rounding differences)	43/43	25/26	25/26	6/6	100
Total Funding Amount: 2009-2020	47,746,967 €	4,316,100 €	9,427,967 €	593,734 €	62,084,768 €
Rel. Funding Amount in %: 2009-2020	77	7	15	1	100
Ecological Impacts	- Forest clearings - Noise pollution - Fragmentation of habitats - Alteration + contamination of aquatic systems - Disruption of alpine landscape	- Rising energy & water consumption - Noise pollution - Impacts on water cycle - Impact on nutrition and species composition - Risk of erosion & natural hazards - Disruption of alpine landscape	- Light pollution - Harm to vegetation - Risk of erosion - Loss of soil - Vegetation clearings	- Alteration + contamination of aquatic systems - Noise pollution - Loss of soil - Risk of erosion	
Economic Impacts	- PTIC: 167,945,700 € - Capacity increase - Strengthening of local economy - Job security	- PTIC: 47,029,700 € - Operation costs 2022: 19,400,000 € - Additional skiing days: additional revenues	- PTIC: 33,162,000€	- PTIC: 2,043,700 € - Visitor number increase	- PTIC: 250,181,400 € - Ensurance of operation - Increased revenue - Higher service and product quality
Average Degree of Impact: impact from construction/impact from operation	60.8/23.4	28/34.1	34/26	4.8/4.2	
Number of Examined Literature per Category	42/50	18/50	25/50	7/50	

6.2 Results of the Utility Value Analysis

The implementation of the UVA yielded the following ranking of alternatives. As Table 11 shows, none of the examined alternatives were able to achieve the maximum attainable utility value of seven. Table 12 provides a detailed overview of the results.

Table 11: Ranking Result of the Utility Value Analysis

Alternative	Utility Value Score
Maximum	7
1. A3	4.44
2. A2	4.02
3. A1	3.82

195 Own representation based on findings in sections 6.1.1-6.1.4

Table 12: Overview of Results for Each Alternative

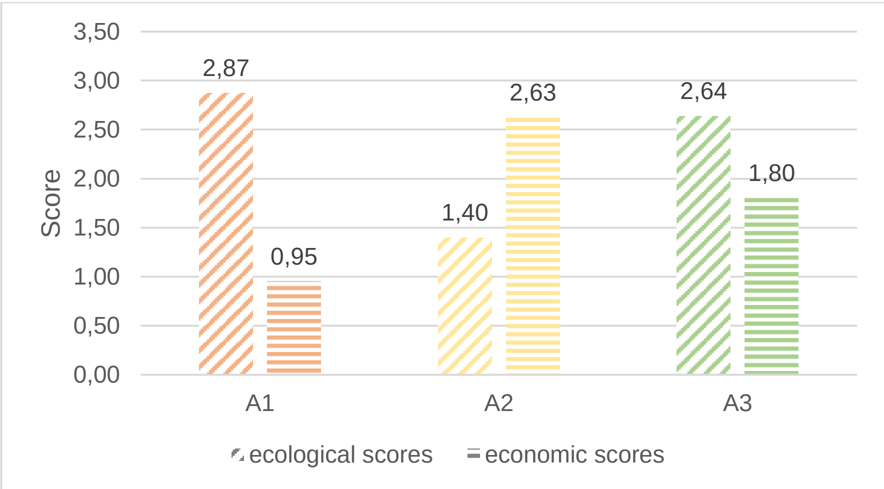
	Maximum points	A1		A2		A3	
CCSL	0,98	0,88	90 %	0,25	25 %	0,51	52 %
SM + RP	0,91	0,61	67 %	0,23	25 %	0,84	92 %
PA	1,015	0,94	93 %	0,77	76 %	0,94	93 %
Other	0,595	0,45	75 %	0,15	25 %	0,35	59 %
Ecological Impacts	**3,5**	**2,87**	**82 %**	**1,40**	**40 %**	**2,64**	**75 %**
Service	1,05	0,39	37 %	0,75	71 %	0,57	54 %
Operation	1,05	0,41	39 %	0,71	68 %	0,53	51 %
Regional economy	1,4	0,16	11 %	1,17	83 %	0,70	50 %
Economic Impacts	**3,5**	**0,95**	**27 %**	**2,63**	**75 %**	**1,80**	**52 %**
Sum	**7**	**3,82**	**55 %**	**4,02**	**57 %**	**4,44**	**63 %**

The lowest score was received by Alternative 1 (A1) with 3.82 points. This alternative suggests the immediate termination of all financial subsidies for Bavarian ski resorts. The analysis revealed that A1 and the associated potential changes could indeed have a high potential for reducing ecological impacts on the environment: In three out of four ecological categories, namely CCSL (0.88), PA (0.94), and Other (0.94), A1 achieved the highest scores. Overall, A1 scored 2.87 points, which is a share of 82 % of maximum points in the ecological impact category. However, this potential cannot be complemented by the determined low economic potential (service quality: 0.39, operation: 0.41, and regional economy: 0.16), which equals a share of 27 %.

Alternative 2 (A2), which proposes the continuation of the BCCSD as it is with no changes, secured the second rank. Although A2 obtained the lowest scores in all ecological categories (CCSL: 0.25, SM + RP: 0.23; PA: 0.77, and Other: 0.15) totalling only 40 % of the maximum attainable score, these values could be balanced out by achieving the highest scores in all economic categories (overall 75 %). Especially in the "regional economy" category, A2 achieved a high score of 1.17, which corresponds to 83 % of the maximum attainable points in this category, as Table 12 shows.

Alternative 3 (A3), which envisions the continuation of the directive while considering ecological factors, claimed the first rank. A3 received an ecological score of 2.64. In the CCSL category (0.51) as well as Other (0.35), the obtained scores were between those of A1 and A2. A3 also received scores in all economic categories that fall between those of A1 and A2. Overall, within the framework of this UVA, A3 presents the most balanced score profile in terms of both economic and ecological criteria, as shown in Figure 14.

Figure 14: Overview of Utility Scores in Ecological and Economic Categories[196]



Finally, the conducted sensitivity analysis resulted in a robust outcome of the NWA. None of the carried-out parameter changes resulted in a change in the ranking of the alternatives. According to Kühnapfel, this makes the result robust and reliable.[197]

[196] Own representation
[197] cf. Kühnapfel 2021, 56

7 Discussion

This section first provides a summary and interpretation of the results, followed by an examination of the limitations of the methodology and the issuance of recommendations.

7.1 Summary

CCSLs accounted for 43 % of supported investments between 2009 and 2022, totaling 47,746,967 € in funding. These projects have significant ecological impacts, including forest clearings, noise pollution, habitat fragmentation, alterations, and contamination of aquatic systems, as well as the disruption of alpine landscapes. On the economic side, they brought potential total investment costs of 167,945,700 €. Overall, investments led to capacity increases, strengthening of the local economy, and ensuring job security. The average degree of impact for all realized projects from construction was 60.8, while the impact from operation was 23.4.

SM and RP investments made up 25 % of the supported investments from 2009 to 2022, amounting to 4,316,100 € in funding. In literature, SM systems are associated with ecological impacts such as increased energy and water consumption, noise pollution, effects on the water cycle, changes in nutrition and species composition, the risk of erosion and natural hazards, and disruptions to the alpine landscape. In economic terms, they resulted in potential total investment costs of 47,029,700 € and estimated operation costs of 19,400,000 € in 2022. Economic benefits include additional revenues from extended skiing days. The average degree of impact from construction was 28, while the impact from operation amounted to 34.1. Overall, the ecological and economic impacts of SM systems are complex, and their sustainability should be carefully considered in future planning and development.

Other investment objects and activities accounted for 25 % of supported investments from 2009 to 2022, totaling 9,427,967 € in funding. Slope grading, snow grooming and the use of floodlight systems is associated with ecological impacts such as light pollution, harm to vegetation, erosion risks, soil loss, and vegetation clearings. From an economic perspective, they resulted in potential total investment costs of 33,162,000 €. The average degree of impact from construction was 34, while the impact from operation was 26.

Finally, there were 6 % of supported PA investments from 2009 to 2022, totaling 593,734 €. PAs are associated with ecological impacts like alteration and contamination of aquatic systems, noise pollution, loss of soil, and risk of erosion. From an economic perspective, they resulted in potential total investment costs of 2,043,700 €. The average degree of impact from construction was 4.8, while the impact from operation was 4.2.

Overall, investment in CCSLs and SM/RP projects had significant ecological and economic implications. CCSLs were associated with higher ecological impacts but substantial economic benefits, while SM/RP investments had moderate ecological impacts and significant economic costs. Other activities had moderate ecological impacts but contributed to the functionality of ski resorts. PA investments had relatively low ecological and economic impacts. This data highlights the complex trade-offs between ecological and economic considerations in ski resort development. While some investments contribute to economic growth, they also have significant ecological impacts that need to be carefully managed and mitigated. Harmonizing these factors is essential for sustainable ski resort planning and development.

The conducted UVA aimed at balancing these factors and comparing the selected decision alternatives for the BCCSD. A3 emerged as the top choice due to its balanced ecological and economic impact criteria. A2 performed well economically but lagged in ecological aspects, while A1 showed strong ecological performance but had lower economic utility. Overall, the conducted UVA emphasizes the importance of a balanced approach to sustainability and economic viability.

7.2 Limitations

The following section outlines the limitations of the conducted literature review and UVA.

7.2.1 Literature Review

The literature review examined sources studying ski resorts across the entire Alpine region, not specifically limited to the Bavarian Alps. Consequently, the impacts discussed are often of a more general nature rather than being specific to the Bavarian Alpine region.

It should be noted that access to many sources was restricted, preventing the possibility of conducting an all-encompassing literature review that represents the entire body of literature on the subject. While there is an abundance of sources addressing the impacts of snowmaking systems, there is considerably less research available for other measures. As a result, the impacts of certain measures, such as park facilities in the Alpine region, could not be extensively explored within this thesis.

The impacts associated with the studied facilities span across numerous thematic and disciplinary domains. Therefore, due to time and scope constraints, it was not feasible to comprehensively review all sources for each impact category. Consequently, this study focused solely on direct impacts and did not delve into indirect ones.

7.2.2 Utility Value Analysis

Firstly, the final list of criteria for this UVA resulted from a brainstorming process by a single individual, namely the author. It could not be guaranteed that all relevant criteria were collected in this manner. Other individuals involved in the brainstorming process may have identified different criteria. Therefore, it cannot be ruled out that potentially other important criteria were not considered in the process.

Moreover, the presented Alternatives 1 and 3 do not represent concrete, real-world alternatives. Especially A3 was independently formulated based on statements from conservation representatives. There are no specific data available regarding the future economic and ecological developments resulting from the various policy alternatives. Therefore, assumptions had to be made to conduct the UVA. Additionally, it was challenging to find suitable data for evaluating the alternatives and criteria. The basis for the UVA was the competence gained through the prior literature review. The results serve as tendencies and approximation since precise measurement of the significance weights is not achievable within the scope of a UVA.[198] Lastly, this UVA is based on general assumptions for all Bavarian ski resorts. However, it's evident that the Zugspitze ski resort would fare better under A1 than one of the lower-lying ski resorts.

Summing up, it must be noted that since the extent of available data for evaluating individual criteria was overestimated initially, this resulted in most criteria being of a speculative nature. In such cases, according to Kühnapfel, a UVA can be unsuitable and other methods should be considered.[199]

7.3 Recommendations

The following recommendations can be derived from the conducted research. Estimated ecological harm associated with each funded project is significant. Therefore, the Bavarian government should consider all sustainability dimensions and not justify the directive based solely on economic success factors. Key recommendations from the highest-scoring alternative in the conducted UVA include:

1. Assess ski resort capacities and their impact on the environment to prevent overload and promote responsible tourism.
2. Tie investment projects to year-round facility usage and ensure easy access via public transportation.

[198] cf. Kühnapfel 2021, 38
[199] Ibid., 15

3. Restrict funding for snowmaking, reservoirs, and parking to maintenance, discouraging expansion.
4. Evaluate the ecological benefits before replacing or constructing new cable car systems.
5. Fund projects only if capacity isn't fully utilized by non-cable car-dependent use and avoid interventions harming the environment.

The UVA is a helpful tool for breaking down complex topics and guiding strategic discussions. It assists in focusing on what truly matters by dissecting complex subjects into smaller, manageable parts. This method is versatile and can be applied to various purposes, including strategy development. Additionally, it encourages the identification of factors influencing goal achievement, which is crucial for constructing a strategic plan. Based on Kühnapfel's experience, utilizing a moderated UVA in a workshop with managers proves to be an effective approach for addressing these aspects.[200]

This thesis should serve as an incentive to conduct such a UVA or other participatory decision support approaches on a larger scale, involving a great number of stakeholders and experts from business, tourism, conservation, and politics. This could take the form of a workshop, providing a concrete decision support tool for both economically and ecologically sustainable changes to the BCCSD. Such an endeavor can help dissect the complexity of the underlying issue into its components,[201] offering all stakeholders a better understanding of the intricate system of ski tourism and its environmental compatibility. Moreover, it can serve as an effective instrument for fostering comprehension of the connection between tourism and sustainable development, a topic consistently linked with discussions concerning vulnerability to climate change.[202]

[200] cf. Kühnapfel 2021, 253-254
[201] cf. Ibid., 7
[202] cf. Bonzanigo, Giupponi, and Balbi 2016, 649

In practice, there have been projects that focused on conducting such a participatory workshop.[203] In the Dolomites, Italy, one approach was carried out with the support of information and communication technologies, including simulation models and decision support systems. A significant outcome was stakeholders recognizing the need for an innovative brand for the destination and emphasizing environmental indicators alongside economic factors. Participation was active, with stakeholders considering long-term sustainability and climate change risks. They creatively devised strategies to benefit the local community and expressed readiness to adapt established practices. This participatory approach encouraged a broader, forward-looking dialogue, though it was exploratory and didn't lead to immediate implementation plans.[204]

As an addition, conducting a scenario analysis could be valuable. So far, such an analysis has been conducted for the entire Bavarian tourism sector but not specifically skiing tourism.[205]

[203] cf. Ibid.; Loibl and Walz 2010
[204] cf. Bonzanigo, Giupponi, and Balbi 2016, 648
[205] cf. Bauer et al. 2021

8 Conclusion

Since 2009, Bavarian ski resorts have received financial support from the Free State of Bavaria. This support includes funding for cable cars and lift systems, snowmaking facilities and ponds, park facilities, as well as other necessary investment objects and activities (from floodlight systems, ticketing systems to piste grading). The extension of this directive has faced strong criticism from environmental conservation groups, particularly regarding the funding of snowmaking facilities at a time of rising temperatures. Comprehensive studies and evaluations on the impacts of the directive are lacking in the literature. The Bavarian State Government justifies the extension of the directive based on the economic success factors identified by dwif in 2022. However, this evaluation ignores social and ecological impacts of the supported investment objects. The aim of this bachelor thesis was to evaluate the Bavarian Cable Car Subsidies Directive in terms of its ecological and economic impacts, to provide a decision support system and derive recommendations for its future orientation. A semi-systematic literature review was conducted to establish the necessary insights and foundation for the subsequent UVA.

The results of the literature review provided a broad overview of the potential impacts of the directive's funding objects. It primarily identified effects on fauna, flora (aquatic) habitats and ecosystems, energy and water consumption, increased risk of natural hazards and erosion, as well as the costs and economic benefits of these objects.

The conducted UVA identified a decision alternative with the highest utility value, namely the adjustment of the directive with consideration of ecological impact factors. This alternative suggests modifying the directive to prioritize responsible tourism, year-round facility usage, careful funding allocation, and ecological impact assessment in ski resort development. However, the results of the literature analysis were less revealing and specific than initially anticipated. This led to the criteria mainly having to be evaluated based on assumptions, which is why the results of the UVA are considered unreliable. Nonetheless, this thesis can serve as a stimulus and a starting point for conducting a more extensive analysis involving appropriate methodolgy, experts and stakeholders.

Appendix

List of Appendices

Appendix 1: General ... 57

Appendix 1.1: Detailed Content of Bavarian Cable Car Subsidies Directive ... 57

Appendix 1.2: Overview of Funding Objects and Amounts ... 62

Appendix 2: Literature Review ... 63

Appendix 2.1: Search Terms and Phrases ... 63

Appendix 2.2: Overview of Average Impact Assessment for each Funding Object ... 64

Appendix 3: Utility Value Analysis ... 64

Appendix 3.1: Criteria Brainstorming ... 64

Appendix 3.2: Transformation Rules ... 66

Appendix 3.3: Assumptions for Evaluation ... 67

Appendix 3.4: Utility Value Analysis Excel Sheet ... 72

Appendix 3.5: Detailed Sensitivity Analysis Process ... 74

Appendix 1: General

Appendix 1.1: Detailed Content of Bavarian Cable Car Subsidies Directive[206]

Bayerisches Ministerialblatt

BayMBl. 2023 Nr. 56 8. Februar 2023

7072.2-W

Richtlinien zur Förderung von Seilbahnen und Nebenanlagen in kleinen Skigebieten

Bekanntmachung des Bayerischen Staatsministeriums für Wirtschaft, Landesentwicklung und Energie

vom 19. Januar 2023, Az. 73-4884-4/2/15

[1]Der Freistaat Bayern gewährt nach den allgemeinen Bestimmungen – insbesondere Art. 23 und 44 der Bayerischen Haushaltsordnung, Art. 48, 49 und 49a des Bayerischen Verwaltungsverfahrensgesetzes und der Allgemeinen Verwaltungsvorschriften für die Gewährung von Zuwendungen an die gewerbliche Wirtschaft (AVG) in der jeweils geltenden Fassung – sowie nach Maßgabe dieser Richtlinien Zuwendungen für Investitionen in Seilbahnen einschließlich betriebsnotwendiger Nebenanlagen. [2]Die Europäische Kommission sieht in einer staatlichen finanziellen Unterstützung von Seilbahnanlagen, die tendenziell eher einen lokalen Einzugsbereich haben und in Orten mit nur wenigen Einrichtungen für den Wintersport bzw. beschränkten Kapazitäten zur Aufnahme von Touristen liegen („kleine Skigebiete"), keine Beihilfe im Sinn von Art. 107 Abs. 1 AEUV[1]. [3]Die wesentlichen Maßstäbe hat die Kommission zuletzt in der Mitteilung zum Beihilfebegriff zusammengefasst[2]. [4]Gefördert wird nur, wenn die Seilbahn in einem Gebiet liegt, das diesen Anforderungen entspricht. [5]Die Förderung erfolgt ohne Rechtsanspruch im Rahmen der verfügbaren Haushaltsmittel.

I. Allgemeine Beschreibung des Förderbereichs

1. Zweck der Zuwendung

Zweck der Förderung ist es, einen Anreiz für Investitionen in technische Standards, Komfort und Qualität von Seilbahnen zu bieten und so die nachhaltige Sicherung des Bestands der bayerischen Seilbahnanlagen, die sowohl als Infrastrukturanlagen einen erheblichen Wirtschaftsfaktor für die Region darstellen, als auch besucherstromlenkend wirken, zu gewährleisten.

2. Gegenstand der Förderung

2.1 [1]Gefördert werden die technische Erneuerung und die Modernisierung von Seilbahnen einschließlich betriebsnotwendiger Nebenanlagen. [2]Soweit zusätzliche, in unmittelbarem Zusammenhang stehende Leistungen angeboten werden, die für den Skisport bzw. die Sommernutzung ebenso wichtig sind, werden diese Investitionen ebenfalls gefördert. [3]Eine Förderung scheidet aus, soweit Investitionen mit der grundlegenden Dienstleistung nicht unmittelbar zusammenhängen (z. B. Leihskiausrüstung, Zusatzeinrichtungen für Skischulen, Mountainbikeverleih).

1 Entscheidungen der Kommission vom 9. April 2002 (2003/521/EG) und vom 27. Februar 2008 (N 731/2007).

2 Vgl. Rz. 197 h) der Bekanntmachung der Kommission zum Begriff der staatlichen Beihilfe im Sinne des Artikels 107 Absatz 1 des Vertrags über die Arbeitsweise der Europäischen Union (ABL C 262, 19.7.2016, S. 1).

Seite 1 von 5

2.2 [1]Die geförderten Wirtschaftsgüter müssen mindestens 10 Jahre nach Abschluss des Investitionsvorhabens in der geförderten Betriebsstätte verbleiben, es sei denn, sie werden durch gleich- oder höherwertige Wirtschaftsgüter ersetzt. [2]Das ersetzende Wirtschaftsgut ist nicht erneut förderfähig.

2.3 Die Zuwendungen werden grundsätzlich nur für ein Investitionsvorhaben gewährt, das innerhalb von 36 Monaten durchgeführt wird.

3. Zuwendungsempfänger

3.1 [1]Die Zuwendungen werden gewerblichen und kommunalen Unternehmen gewährt.

3.2 [1]Antragsberechtigt ist, wer die betrieblichen Investitionen vornimmt, die betrieblichen Maßnahmen durchführt oder der Betreiber der zu fördernden Maßnahme. [2]Sind Investor und Betreiber einer geplanten Investition nicht identisch, kann eine Förderung nur erfolgen, wenn zwischen Investor und Betreiber eine steuerlich anerkannte Betriebsaufspaltung, Mitunternehmerschaft im Sinn des § 15 EStG, ein Leasingverhältnis oder ein gewerbliches Pachtverhältnis vorliegt. [3]Investor und Betreiber haften für die Zuwendung gesamtschuldnerisch.

4. Fördergebiet

[1]Förderfähig sind nur Vorhaben in Gebieten, die den EU-Anforderungen an kleine Skigebiete entsprechen. [2]Diese müssen eine der folgenden Voraussetzungen erfüllen:

– Das Skigebiet verfügt über maximal drei Pisten und die Gesamtlänge der Pisten beträgt weniger als 3 km.

oder

– Die Gemeinde, in der das Seilbahnunternehmen liegt, verfügt über eine maximale Hotelzimmerkapazität von 2 000 und die Anzahl der verkauften Wochenskipässe beträgt weniger als 15 % der Gesamtzahl der verkauften Skipässe (Mittelwert der letzten drei Jahre).

[3]Ergänzend sind die Vorgaben aus Rz. 197 h) der Bekanntmachung der Kommission zum Begriff der staatlichen Beihilfe im Sinne des Artikels 107 Absatz 1 des Vertrags über die Arbeitsweise der Europäischen Union (ABL C 262, 19.7.2016, S. 1) zu beachten.

5. Zuwendungsvoraussetzungen

5.1 [1]Die Mittel des Programms sind stets zusätzliche Hilfen. [2]Der Antragsteller hat entsprechend seiner Vermögens-, Liquiditäts- und Ertragslage für die Finanzierung in angemessenem Umfang Eigenmittel oder sonstige Fremdmittel einzusetzen, die nicht durch öffentliche Finanzierungshilfen zinsverbilligt sind.

5.2 [1]Mit dem Vorhaben muss die Möglichkeit für eine ganzjährige Nutzung der Anlagen verbunden sein, das heißt die Maßnahme muss auch auf den Sommertourismus ausgerichtet sein. [2]Daher werden grundsätzlich nur Vorhaben gefördert, bei denen im entsprechenden Ski- bzw. Wandergebiet ein ganzjähriges Angebot mit der oder den Seilbahnanlagen besteht oder vorgesehen ist. [3]Hierzu ist mit der Antragstellung ein Konzept für die Ganzjahresnutzung im entsprechenden Ski- bzw. Wandergebiet vorzulegen.

5.3 Der Vorhabenträger ist verpflichtet, gemeinsam mit dem örtlichen ÖPNV-Träger die Schaffung eines Verkehrskonzepts und Möglichkeiten einer Anbindung der Seilbahn an den ÖPNV zu prüfen.

5.4 Eine Förderung kann nur gewährt werden, wenn der Investitionsbetrag mindestens 500 000 Euro beträgt oder das Vorhaben zumindest geeignet ist, das Gesamteinkommen in dem jeweiligen Wirtschaftsraum unmittelbar und dauerhaft nicht unwesentlich zu erhöhen (sog. Primäreffekt).

5.5 [1]Für die Förderung kommen nur Investitionen in Betracht, die eine besondere Anstrengung des Betriebs erfordern. [2]Investitionsvorhaben sind nur förderfähig, wenn der Investitionsbetrag bezogen auf ein Jahr die Summe der in den letzten drei Jahren durchschnittlich verdienten Abschreibungen ohne Berücksichtigung von Sonderabschreibungen und des durchschnittlichen Gewinns der letzten drei Jahre überschreitet.

5.6 Förderfähig sind nur Investitionsvorhaben, denen keine öffentlich-rechtlichen Hindernisse entgegenstehen und die mit den Belangen des Umweltschutzes sowie der Raumordnung, insbesondere dem Alpenplan und dem Regionalplan in Einklang stehen.

5.7 Die Gewährung von Mitteln zur Ablösung von Krediten (Umschuldung) und zur Sanierung ist ausgeschlossen.

5.8 Für ein Vorhaben, dessen Antragsteller einer Rückforderungsanordnung aufgrund einer Entscheidung der Europäischen Kommission über die Rückzahlung einer Beihilfe nicht Folge geleistet hat, kann eine Förderung erst gewährt werden, wenn der Rückforderungsbetrag zurückgezahlt worden ist.

6. Art und Höhe der Zuwendung

6.1 [1]Die Förderung wird auf Antrag gewährt. [2]Sie kann dem Zuwendungsempfänger als Investitionszuschuss oder als Zinszuschuss zur Verbilligung eines von der LfA gewährten Darlehens gewährt werden, das zur Mitfinanzierung des antragsgegenständlichen Vorhabens verwendet wird. [3]Eine Kombination von Investitionszuschüssen und zinsgünstigen Darlehen ist im Rahmen der nach Nr. 6.2. zulässigen Förderhöchstsätze grundsätzlich möglich.

6.2 [1]Förderfähig sind die Ausgabe für Anschaffung bzw. Herstellung der zum Investitionsvorhaben zählenden Wirtschaftsgüter des aktivierten Sachanlagevermögens sowie unter bestimmten Voraussetzungen auch für die Anschaffung von immateriellen, geleasten, gemieteten oder gepachteten Wirtschaftsgütern. [2]Zu den förderfähigen Aufwendungen gehören nicht Investitionen, die der Ersatzbeschaffung dienen.

6.3 [1]Die Förderung beträgt:

- Bis zu 35 % bei kleinen Unternehmen,
- bis zu 25 % bei mittleren Unternehmen,
- bis zu 35 % bei ausschließlich kommunal getragenen Unternehmen.

[2]Großunternehmen werden nicht gefördert. [3]Die Unternehmensgröße wird nach der Empfehlung der Kommission vom 6. Mai 2003 betreffend die Definition von Kleinstunternehmen sowie der kleinen und mittleren Unternehmen 2003/361/EG, ABl. Nr. L 124/36 vom 20. Mai 2003 bestimmt. [4]Wenn ein Unternehmen nur aufgrund einer Beteiligung kommunaler Gebietskörperschaften als Großunternehmen definiert wird, bleibt dies bei der Ermittlung der Unternehmensgröße unberücksichtigt.

II. Verfahren

7. Antragsverfahren

7.1 [1]Für Anträge sind die entsprechenden Formblätter zu verwenden. [2]Die Formblätter sind bei den Regierungen, den Hausbanken, der LfA Förderbank Bayern, den Industrie- und Handelskammern, den Handwerkskammern sowie im Internet erhältlich.

7.2 [1]Anträge sind vom Antragsteller samt Anlagen bei der Regierung einzureichen, in deren Bezirk das Vorhaben durchgeführt werden soll. [2]Dem Antrag ist eine Bestätigung beizufügen, dass die Gesamtfinanzierung des Vorhabens bei Gewährung der Förderung unter wirtschaftlichen Gesichtspunkten gesichert ist. [3]Die Bestätigung kann durch die Hausbank oder einen Wirtschaftsprüfer, bei konzerninterner Finanzierung auch durch die Muttergesellschaft erfolgen.

7.3 [1]Zu den Anträgen holen – soweit erforderlich – die Regierungen möglichst gleichzeitig Äußerungen der zur Begutachtung bestimmten Stellen ein. [2]Der örtlich zuständige regionale Planungsverband ist am Verfahren zu beteiligen. [3]Die Regierungen können für die Abgabe der Äußerung eine angemessene Frist setzen, nach deren Ablauf sie davon ausgehen können, dass keine Einwendungen gegen das Vorhaben und seine Förderung erhoben werden.

7.4 [1]Unvollständig ausgefüllte Anträge sowie Anträge, denen die erforderlichen Unterlagen nicht vollzählig beigelegt sind, werden von der Regierung in der Regel zurückgegeben, sofern der Antragsteller sie trotz Aufforderung nicht innerhalb einer angemessenen Frist nach Antragseingang bei der Regierung vervollständigt. [2]Sie gelten dann als nicht gestellt.

7.5 [1]Über die Anträge entscheiden die Regierungen in eigener Zuständigkeit, sofern nicht wegen Art und Bedeutung eine Einschaltung des Bayerischen Staatsministeriums für Wirtschaft, Landesentwicklung und Energie geboten ist oder das Bayerische Staatsministerium für Wirtschaft, Landesentwicklung und Energie eine andere Behandlung vorgibt. [2]Die Entscheidung über den Antrag wird dem Antragsteller durch Bescheid der für die Antragsbearbeitung zuständigen Regierung bekannt gegeben.

8. Auszahlungsverfahren und Nebenbestimmungen

8.1 [1]Die Auszahlungsanträge sind bei den Regierungen einzureichen. [2]Die Auszahlung erfolgt über die Regierungen, diese überwachen die ordnungsgemäße, insbesondere zweckentsprechende Verwendung der Zuwendung. [3]Zuwendungsbescheide können widerrufen und bereits gewährte Fördermittel können ganz oder teilweise zurückgefordert werden, insbesondere dann, wenn die der Bewilligung zugrundeliegenden Fördervoraussetzungen nach Abschluss des Investitionsvorhabens nicht erfüllt sind bzw. der Zuwendungszweck nicht erreicht wird.

8.2 In den Nebenbestimmungen zum Bescheid ist insbesondere festzulegen:

8.2.1 Die Förderung soll nach Möglichkeit mit der Auflage zur Realisierung höherer Energieeffizienz, Arbeitsplatzqualität und/oder Barrierefreiheit verbunden werden.

8.2.2 Der Zuwendungsempfänger ist verpflichtet, an künftigen Evaluationen des StMWi oder seiner Beauftragten mitzuwirken und die entsprechenden Auskünfte zu erteilen.

8.2.3 Der Zuwendungsempfänger ist verpflichtet, mindestens dreimal innerhalb von zehn Jahren nach Abschluss der Maßnahme einen Bericht über die Zielerreichung der Maßnahme anhand der im Antrag genannten Evaluationsindikatoren zu übermitteln.

9. Evaluierung

Um eine nachträgliche Evaluierung der Fördermaßnahme möglich zu machen, sind vom Antragsteller bereits im Rahmen der Antragstellung konkrete Angaben zu machen, welche Ziele er mit der Maßnahme verfolgt und anhand welcher Indikatoren die Zielerreichung zu bemessen ist.

III. Hinweis

10. Die Angaben im Antrag sowie in den dazu eingereichten ergänzenden Unterlagen sind subventionserheblich im Sinn des § 264 StGB in Verbindung mit § 2 des Subventionsgesetzes vom 29. Juli 1976 (BGBl. I S. 2037) und Art. 1 des Bayerischen Subventionsgesetzes (BayRS 453-1-W).

IV. Inkrafttreten

11. Diese Bekanntmachung tritt mit Wirkung vom 1. Januar 2023 in Kraft und mit Ablauf des 31. Dezember 2025 außer Kraft. Die Bekanntmachung des Bayerischen Staatsministeriums für Wirtschaft, Landesentwicklung und Energie über die Richtlinien zur Förderung von Seilbahnen und Nebenanlagen in kleinen Skigebieten vom 29. November 2019 (BayMBl. 2019 Nr. 535) bleibt auf Vorhaben anwendbar, für die vor dem 31. Dezember 2022 ein prüffähiger Antrag oder die Zustimmung zum vorzeitigen Maßnahmenbeginn vorliegt, und sich die Rechtslage durch diese Regelung zu Ungunsten des Antragstellers geändert hat.

Dr. Ulrike W o l f
Ministerialdirektorin

Impressum
Herausgeber:
Bayerische Staatskanzlei, Franz-Josef-Strauß-Ring 1, 80539 München
Postanschrift: Postfach 220011, 80535 München
Telefon: +49 (0)89 2165-0, E-Mail: direkt@bayern.de
Technische Umsetzung:
Bayerische Staatsbibliothek, Ludwigstraße 16, 80539 München
Druck:
Justizvollzugsanstalt Landsberg am Lech, Hindenburgring 12, 86899 Landsberg am Lech
Telefon: +49 (0)8191 126-725, Telefax: +49 (0)8191 126-855, E-Mail: druckerei.ll@jv.bayern.de
ISSN 2627-3411
Erscheinungshinweis / Bezugsbedingungen:
Das Bayerische Ministerialblatt (BayMBl.) erscheint nach Bedarf, regelmäßiger Tag der Veröffentlichung ist Mittwoch. Es wird im Internet auf der Verkündungsplattform Bayern www.verkuendung.bayern.de veröffentlicht. Das dort eingestellte elektronische PDF/A-Dokument ist die amtlich verkündete Fassung. Die Verkündungsplattform Bayern ist für jedermann kostenfrei verfügbar.
Ein Ausdruck der verkündeten Amtsblätter kann bei der Justizvollzugsanstalt Landsberg am Lech gegen Entgelt bestellt werden. Nähere Angaben zu den Bezugsbedingungen können der Verkündungsplattform Bayern entnommen werden.

Appendix 1.2: Overview of Funding Objects and Amounts[207]

	district	year of application	year of approval	planned investment amount	approved investment amount	average funding rate	CCSL	type of inv.	SM facilities	type of inv.	reservoir ponds	type of inv.	parking areas	type of inv.	others
1	Upper Allgäu	2022	2022	2.870.500,00 €	850.000,00 €	29,61%		Mod.							
2	Freyung-Grafenau	2021	2021	20.000.000,00 €	5.766.000,00 €	28,83%		Renewal		Exp.		Exp.		Exp.	
3	Garmisch-Patenkirchen	2021	2021	4.857.400,00 €	1.700.000,00 €	35,00%		Repl./NC							
4	Bayreuth	2020	2021	20.098.200,00 €	6.544.797,00 €	32,56%		Mod.							unspecified
5	Bayreuth	2020	2021	12.010.000,00 €	4.052.747,00 €	33,74%		Mod.							unspecified
6	Upper Allgäu	2019	2019	6.750.000,00 €	2.155.000,00 €	31,93%	1.835.000,00 €	Renewal	160.000,00 €	Exp.			80.000,00 €	Exp.	80.000,00 €
7	Regen	2019	2019	8.600.000,00 €	3.000.000,00 €	34,88%	3.000.000,00 €	Renewal							
8	Upper Allgäu	2019	2019	5.631.860,00 €	1.889.000,00 €	33,54%	1.724.500,00 €	Renewal							164.500,00 €
9	Passau	2019	under review	200.000,00 €											
10	Upper Allgäu	2018	2019	7.928.000,00 €	2.616.000,00 €	33,00%	1.471.000,00 €	Renewal	1.145.000,00 €	Exp.					
11	Upper Allgäu	2018	2019	48.265.000,00 €	11.000.000,00 €	22,79%	10.378.139,00 €	Mod.							621.861,00 €
12	Samerberg	2018	withdrawn	2.500.000,00 €											
13	Upper Allgäu	2018	2020	23.775.430,00 €	7.770.000,00 €	32,68%									
14	Upper Allgäu	2018	under review	4.016.000,00 €											
15	Upper Allgäu	2018	under review	9.654.000,00 €											
16	Upper Allgäu	2018	under review	22.190.000,00 €											
17	Garmisch-Patenkirchen	2017	2018	9.405.000,00 €	3.200.000,00 €	34,02%	3.200.000,00 €	Repl./NC							
18	Rosenheim	2016	under review	26.000.000,00 €											
19	Berchtesgadener Land	2015	2016	38.186.866,00 €	9.817.000,00 €	25,71%	4.798.360,00 €	Repl./NC							5.018.640,00 €
20	Miesbach/Rosenheim	2015	2017	6.877.500,00 €	2.398.900,00 €	34,88%	2.398.900,00 €	Repl./NC							
21	Cham	2015	2015	455.000,00 €	159.000,00 €	34,95%	159.000,00 €	Mod.							
22	Upper Allgäu	2014	2015	23.130.000,00 €	7.390.000,00 €	31,95%	4.626.000,00 €	Repl./NC	921.500,00 €	Exp.					1.842.500,00 €
23	Upper Allgäu	2014	2014	7.127.000,00 €	2.328.000,00 €	32,66%	1.622.800,00 €	Repl./NC	705.200,00 €	Exp.					
24	Cham	2014	2014	140.000,00 €	40.000,00 €	28,57%			20.000,00 €	Exp.					20.000,00 €
25	Upper Allgäu	2013	2013	8.190.000,00 €	2.645.000,00 €	32,30%	2.142.700,00 €	Repl./NC	390.300,00 €	Exp.					112.000,00 €
26	Upper Allgäu	2013	2014	1.870.000,00 €	512.000,00 €	27,38%			109.900,00 €	Exp.			219.900,00 €	Mod.	182.200,00 €
27	Upper Allgäu	2013	2014	2.200.000,00 €	653.000,00 €	29,68%			59.400,00 €	Exp.			293.834,00 €	Mod./Exp.	299.766,00 €
28	Miesbach/Rosenheim	2013	2015	15.675.000,00 €	2.361.700,00 €	15,07%	2.361.700,00 €	Repl./NC							
29	Upper Allgäu	2013	on hold	5.025.000,00 €											
30	Upper Allgäu	2013	on hold	9.300.000,00 €											
31	Garmisch-Patenkirchen	2012	2012	346.000,00 €	51.000,00 €	14,74%	46.600,00 €	Repl./NC	4.400,00 €	Exp.					
32	Upper Allgäu	2012	2012	15.000.000,00 €	4.500.000,00 €	30,00%	4.294.200,00 €	Repl./NC							205.800,00 €
33	Traunstein	2012	2012	6.639.400,00 €	985.000,00 €	14,84%	985.000,00 €	Repl./NC							
34	Traunstein	2012	2013	770.000,00 €	266.000,00 €	34,55%	266.000,00 €	Mod.							
35	Deggendorf	2012	2013	34.000,00 €	11.400,00 €	33,53%									11.400,00 €
36	Garmisch-Patenkirchen	2011	2012	3.925.000,00 €	500.000,00 €	12,74%			8.000,00 €	Exp.					492.000,00 €
37	Upper Allgäu	2010	2011	7.000.000,00 €	2.200.000,00 €	31,43%	1.571.600,00 €	Repl./NC	314.200,00 €	Exp.					314.200,00 €
38	Straubing-Bogen	2010	2011	1.300.000,00 €	450.000,00 €	34,62%	24.600,00 €	Exp.	320.500,00 €	Exp.	104.900,00 €	NC			
39	Rosenheim	2010	2012	440.000,00 €	150.000,00 €	34,09%	34.100,00 €	Repl./NC	52.800,00 €	Exp.					63.100,00 €
40	Traunstein	2010	2011	397.389,00 €	129.768,00 €	32,66%	129.768,00 €	Mod.							
41	Garmisch-Patenkirchen	2011	2011	537.000,00 €	78.000,00 €	14,53%	78.000,00 €								
42	Berchtesgadener Land	-	2012	-	599.000,00 €		599.000,00 €	Repl./NC							
	Sum			**389.316.545,00 €**	**88.169.312,00 €**		**47.746.967,00 €**		**4.211.200,00 €**		**104.900,00 €**		**593.734,00 €**		**9.427.967,00 €**
					62.084.768,00 €		76,91%		6,78%		0,17%		0,96%		15,19%
	Repl. = Replacement	Exp.=Expansion									Investment amount until 2019:				62.084.768,00 €
	NC = New Construction	Mod.=Modernization									Investment amount from 2019:				26.084.544,00 €
											Average funding rate:				28,43%

[207] Own table based on Bavarian State Parliament 2022; Bavarian State Parliament 2023

Appendix 2: Literature Review

Appendix 2.1: Search Terms and Phrases

CCSL	English: sustainability, ecological impacts, erosion, fauna and flora, economic impacts, climate change, Alps, mountain regions, ski tourism, winter tourism, touristic value creation, energy consumption, energy balance, costs German: Nachhaltigkeit, ökologische Auswirkungen, Erosion, Wasser, Energie, Fauna und Flora, ökonomische Auswirkungen, Klimawandel, Alpen, Bergregionen, Skitourismus, Wintertourismus, touristische Wertschöpfung, Energieverbrauch, Energiebilanz, Kosten
SM systems and RP	English: sustainability, ecological impacts, economic impacts, climate change, Alps, mountain regions, ski tourism, winter tourism, touristic value creation, energy consumption, energy balance, costs German: Nachhaltigkeit, ökologische Auswirkungen, ökonomische Auswirkungen, Klimawandel, Alpen, Bergregionen, Skitourismus, Wintertourismus, touristische Wertschöpfung, Energieverbrauch, Energiebilanz, Kosten
Parking areas	English: sustainability, ecological impacts, economic impacts, climate change, Alps, mountain regions, ski tourism, winter tourism, tourist value creation, costs German: Nachhaltigkeit, ökologische Auswirkungen, ökonomische Auswirkungen, Klimawandel, Alpen, Bergregionen, Skitourismus, Wintertourismus, touristische Wertschöpfung, Kosten
Other (slope grooming/construction measures & equipment, ticketing and access control systems, floodlight installations, operational workshops)	English: sustainability, ecological impacts, erosion, fauna and flora, economic impacts, climate change, Alps, mountain regions, ski tourism, winter tourism, tourist value creation German: Nachhaltigkeit, ökologische Auswirkungen, ökonomische Auswirkungen, Klimawandel, Alpen, Bergregionen, Skitourismus, Wintertourismus, touristische Wertschöpfung, Energieverbrauch, Energiebilanz, Kosten

Appendix 2.2: Overview of Average Impact Assessment for each Funding Object[208]

		air		noise		groundwater		water		soil		forest		FFH		LS				per ob/act		per obj. category	
		con	op	con	op	con	op	con	op	con	op	con	op	con	op	con	op	sum (con)	sum (op)	con	op	con	op
CCSL	CCSL	1	0	2	2	2	1	2	1	2	1	3	2	3	2	3	2	**18**	**11**	2,25	1,375	**2,250**	**1,375**
SM + RP	SM	1	0	1	2	2	1	2	3	2	2	2	1	2	2	2	2	**14**	**13**	1,75	1,625	**1,750**	**1,625**
	RP	1	0	1	2	2	1	2	3	2	2	2	1	2	2	2	2	**14**	**13**	1,75	1,625		
PA	PA	2	1	2	2	2	2	2	2	2	0	2	1	2	2	3	3	**17**	**13**	2,13	1,625	**2,125**	**1,625**
Other	piste grading	2	0	2	0	2	2	2	2	3	3	2	2	3	2	3	3	**19**	**14**	2,38	1,75	**1,208**	**1,042**
	snowfarming	1	0	1	2	1	1	1	0	1	1			1	1	1	1	**7**	**6**	0,88	0,75		
	floodlight	0	0	0	0	0	0	0	0	0	0	0	0	2	3	1	2	**3**	**5**	0,38	0,625		
	total sum	**8**	**1**	**9**	**10**	**11**	**8**	**11**	**11**	**12**	**9**	**11**	**7**	**15**	**14**	**15**	**15**						
	rel. Sum	**0,8**	**0,1**	**0,9**	**1,0**	**1,1**	**0,8**	**1,1**	**1,1**	**1,2**	**0,9**	**1,1**	**0,7**	**1,5**	**1,4**	**1,5**	**1,5**						
		FFH = Fauna, Flora, Habitation						con = impacts from construction															
		LS = Landscape						op = impacts from operation															

Appendix 3: Utility Value Analysis

Appendix 3.1: Criteria Brainstorming

Ökonomisch

Angebotsqualität
- Komfort
  - Parkplätze
  - Wartezeiten
  - ÖPNV Anbindung
  - Funparks/Eventisierung
- Betriebszeit durch Wetterunabhängigkeit
- ÖPNV Anbindung/Mobilitätskonzept
- Funparks
- Sicherheit der Pistennutzung (zu wenig Schnee → gefährlich)
- Optische Auswirkungen (nur Piste ist weiß, Rest ist braun)
- Ganzjahresbetrieb
  - Nebennutzung der Speicherseen (Wakeboarding)
  - Nutzung der Schlepplifte für Mountainbiker

Nachfrage
- Klimasensitivität der Gäste
  - Bedingung Naturschnee
  - Schneeunabhängige Zusatzangebote?
  - (Verluste über 50% am Alpenrand)
  - Verschiebung der Nachfrage auf höhergelegene Skigebiete

Ökologisch

- Naturraumüberlastung
- Mittelfristig nachhaltige Nutzung der Investitionen
  - Entwicklung der Schneegrenze
  - Demographischer Wandel → Auswirkung auf Nachfrage
- Schneesicherheit
- Ganzjahresbetrieb
- Wasserverbrauch
- Energieverbrauch (veraltete Anlagen,
- CO2-Ausstoß
  - durch An- und Abreise
    - Verlagerung auf weit entfernte Skigebiete, wenn lokale nicht mehr betriebsfähig wären
    - ÖPNV
  - Beherbergung, Gastronomie
  - Skiaktivitäten/Betrieb
- Bau von Speicherbecken
- Grundwasserspeichernutzung, wenn Speicherseen nicht mehr reichen?
- Veraltete Anlagen → höherer Energieverbrauch

[208] Own table based on BAFU and BAV, 2013

○ Attraktivität des Skigebiets (Verschneite Winterlandschaft vs. Patchy Pisten und Loipen) Wirtschaftlich - Umsatz der Skibetriebe - Zimmerauslastung - Folgeinvestitionen - Energiekosten - Wettbewerbsfähigkeit - Investitionskosten, die sich amortisieren müssen - Perspektive der Amortisation - Entwicklung der Kosten im Anbetracht der Klimasituation - Zahlungsbereitschaft Sommer-/Wintergäste - Aufwand (je mehr Erfolgskontrolle zB. Bei Ganzjahresnutzung etc. desto höher der verwalterische Aufwand → Kosten	- Gästelenkung - Lichtbelastung durch Beleuchtung der Pisten - Lärmemission - Abfallproduktion ○ Gäste ○ Betriebe - Nutzung der umgebauten Hänge und Landschaften nach Ende des Skibetriebs

Appendix 3.2: Transformation Rules

			0,00	1,17	2,33	3,50	4,67	5,83	7,00
	CCSL	construction	26-30	21-25	16-20	11-15	6-10	1-5	0
		operation	very strong increase	strong increase	moderate increase	weak increase	very weak increase	stable	decline
	SM + RP	construction	26-30	21-25	16-20	11-15	6-10	1-5	0
		operation	very strong increase	strong increase	moderate increase	weak increase	very weak increase	stable	decline
	PA	construction	26-30	21-25	16-20	11-15	6-10	1-5	0
		operation	very strong increase	strong increase	moderate increase	weak increase	very weak increase	stable	decline
	Other	construction	26-30	21-25	16-20	11-15	6-10	1-5	0
		operation	very strong increase	strong increase	moderate increase	weak increase	very weak increase	stable	decline

			0,00	1,17	2,33	3,50	4,67	5,83	7,00
service quality	waiting time	waiting time during visitor peaks	stable	very weak decrease	weak decrease	moderately weak decrease	moderately strong decrease	strong decrease	very strong decrease
	snow reliability	snow reliability	very strong decrease	strong decrease	moderate decrease	weak decrease	very weak decrease	stable	increase
	access with PT	access with PT	decrease	stable	very weak increase	weak increase	moderate increase	strong increase	very strong increase
	visual attractiveness	disturbance of alpine landscape	very strong increase	strong increase	moderate increase	weak increase	very weak increase	stable	decline
		snowy landscape	very strong decrease	strong decrease	moderate decrease	weak decrease	very weak decrease	stable	increase
operation	security standards	slope	very strong decrease	strong decrease	moderate decrease	weak decrease	very weak decrease	stable	increase
		infrastructure	decrease	stable	very weak increase	weak increase	moderate increase	strong increase	very strong increase
	infrastructural capacity	infrastructural capacity	strong decrease	moderate decrease	weak decrease	stable	weak increase	moderate increase	strong increase
	year round operability	year round operability	strong decrease	moderate decrease	weak decrease	stable	weak increase	moderate increase	strong increase
	midterm operability	midterm operability	very strong decrease	strong decrease	moderate decrease	weak decrease	very weak decrease	stable	increase
	operating costs	operating costs	strong increase	moderate increase	weak increase	stable	weak decrease	moderate decrease	strong decrease
	generated revenues	generated revenues	strong decrease	moderate decrease	weak decrease	stable	weak increase	moderate increase	strong increase
	administrative efforts	administrative efforts	strong increase	moderate increase	weak increase	stable	weak decrease	moderate decrease	strong decrease
regional economy	job security	job security	very strong decrease	strong decrease	moderate decrease	weak decrease	very weak decrease	stable	increase
	room occupancy	room occupancy	strong decrease	moderate decrease	weak decrease	stable	weak increase	moderate increase	strong increase
	follow-up investments	follow-up investments	decrease	stable	very weak increase	weak increase	moderate increase	strong increase	very strong increase

Appendix 3.3: Assumptions for Evaluation

	A1	A2	A3	A1	A2	A3
CCSL con	5	27	16	High investment costs for CCSL & → very strong decline by 80 %: 5	Numbers of investment projects for ccsls will stay the same → 27	CCSL investments are still being supported, but only after thorough examination, leading to a moderate decline in new constructions → decline by 40 %: 16
CCSL op	Decline	Very weak increase	Stable	If at all, only renewal/modernization, no new facilities; also assuming that few facilities will have to cease operations --> decline	1/27 was an expansion of the facilities, while 26/27 were simply renewals/modernizations/replacements of existing CCSL facilities. → construction will lead to very weak growth of operated system numbers	Only the maintenance/modernization/replacement of existing facilities is allowed, leading to a stable number of operated systems.
SM + RP con	8	16	0	To continue operating existing ski resorts and facilities in the short term, some ski resorts will continue to invest in snowmaking (which is cheaper compared to CCSL investments) → decline by 60 %: 8	Numbers of investment projects for SM systems + rps will stay the same → 16	No fundings for new SM facilities → decline by 100 %: 0
SM + RP op	Very weak increase	Strong increase	Stable	Few ski resorts will continue to invest in snowmaking facilities, leading to very weak growth.	Some ski resorts will continue to invest in snowmaking to maintain skiing operations for as long as possible, leading to strong growth of operated systems	No new constructions/expansions are permitted, but existing facilities continue to operate, leading to a stable number of operated systems
PA con	0	4	0	Due to uncertain predictions regarding the future operability of the ski resort, investments in park facilities are considered economically futile → decline by 100%: 0	Numbers of investment projects for CCSL, SM + RP, PA and Other will stay the same → 4	No fundings for new PA facilities → decline by 100%: 0
PA op	Stable	Very weak increase	Stable	No new constructions, existing facilities will continue to be operated --> stable	Four investment projects in the past 13 years → operated pas will inly weakly increase	No new constructions, existing facilities will continue to be operated → stable

Other con	3	16	8	Due to uncertain predictions regarding the future operability of the ski resort, investments in slope expansions and other expansions are considered economically impractical, only in a few ski resort → decline by 80 %: 3	Numbers of investment projects for CCSL, SM + RP, PA and Other will stay the same → 16	No new piste grading; Due to the nonspecific breakdown of shares of other measures in this category, an assumption of a moderate decline overall is made → decline by 50 %: 8
Other op	Stable	Strong increase	Very weak increase	No new piste grading etc., but current activities like snow grooming will continue --> stable	In order to keep ski operations going, other activities/investments will continue to grow and operate in a strong manner --> strong growth	Few new investments of floodlight systems/snow grooming --> very weak growth in operated systems
Waiting time	Very weak decrease	Very strong decrease	Moderately strong decrease	The waiting time during peak hours depends on the number of CCSL construction projects in the alternative. (see Evaluation calculation for waiting time)	So far: achieved reduction of waiting and ride times (dwif 2022, 24). For coming years: The waiting time during peak hours depends on the number of CCSL construction projects in the alternative (see Evaluation calculation for waiting time)	The waiting time during peak hours depends on the number of CCSL construction projects in the alternative. (see Evaluation calculation for waiting time)
Snow reliability	Weak decrease	Stable	Moderate decrease	Current systems will be operated, few expansions to offset rising temperatures --> weak decrease of snow reliability	Expansion of sm systems will allow sr to remain stable	Only current systems will be operated, no expansion to offset temperature increases --> snow reliability will suffer and decrease moderately
Access with PT	Stable	Weak increase	Strong increase	No incentives for new access potential, status quo will remain stable	Weak increase: some will be able to realise access, but since directive only requires a mobility concept but puts responsibility in hands of communes (bavarian state parliament 2021), only weak increase	Requirement of ensuring access with pt --> strong increase (not very strong since some will face challenges in realising this
Untouched nature	Very weak growth	Moderate growth	Very weak growth	Average number of assumed construction projects: 3,35 --> very weak increase	Average number of assumed construction projects: moderate increase 15,75	Average number of assumed construction projects: 4,55 --> very weak increase
Snowy landscape	Weak decrease	Stable	Moderate decrease	Assumed change to the same extent as in the "snow reliability" criterion.	Assumed change to the same extent as in the "snow reliability" criterion.	Assumed change to the same extent as in the "snow reliability" criterion.

Piste	Weak decrease	Stable	Moderate decrease	Assumed change to the same extent as in the "snow reliability" criterion.	Assumed change to the same extent as in the "snow reliability" criterion.	Assumed change to the same extent as in the "snow reliability" criterion.
Infrastructure	Stable	Strong increase	Weak increase	Only very few assumed modernizations/renewal projects compared to A2, with the simultaneous assumption of a decline in maintenance measures, resulting in stability.	So far: Increased safety standards by installing modern safety devices (dwif 2022, 46) → for coming years: many modernization/renewal projects that increase the safety of the facilities, leading to a strong increase.	Fewer modernization/renewal projects that increase the safety of the facilities compared to A2, leading to a weak increase.
Infrastructural capacity	Stable	Moderate	Stable	There is a weak increase in capacity in ski resorts that can still be operated effectively and afford investments, while there is a decrease in capacity in economically underperforming ski resorts, resulting in stability.	Investments meant to strengthen demand and capacities --> moderate increase; So far: modernised, extended or newly built ropeway infrastructure has increased the basic maximum capacity of passengers per ride (dwif 2022, 23, 24)	Requirement to avoid capacity increases --> stable
Year round operability	Moderate decrease	Weak increase	Moderate increase	Incentives to provide year round incentives stop with discontinuation of funding → moderate decrease	Requirement of year round concept → weak increase	Requirement for year round operation + success control → moderate increase
Propability midterm operability	Strong decrease	Stable	Weak decrease	Midterm skiing operations dependent on snow reliability --> change to the same extent as snow reliability	Midterm skiing operations dependent on snow reliability --> change to the same extent as snow reliability; in some places it was only possible to ensure the continued operation of railways that are important for the regions through the modernization measures (dwif 2022, 31)	Midterm skiing operations dependent on snow reliability --> change to the same extent as snow reliability
Operating costs	Stable	Moderate increase	Stable	Assumed change to the same extent as average change of all operated funding objects (see Evaluation calculation for operating costs)	Assumed change to the same extent average change of all operated funding objects (see Evaluation calculation for operating costs)	Assumed change to the same extent average change of all operated funding objects (see Evaluation calculation for operating costs)
Generated revenues	Moderate decrease	Weak increase	Stable	Intuitive allocation	Intuitive allocation	Intuitive allocation

Administrative efforts	Strong decrease	Stable	Strong increase	Discontinuation of directive means discontinuation of all administrative efforts for funding	Continuation of current version of the BCSSD means that administrative efforts will remain stable	The many additional requirements will result in a very strong increase of administrative efforts
Number of guaranteed jobs	Moderate decrease	Stable	Stable	Many resorts will eventually shut down operations, resulting in a strong decrease	Funding helps secure jobs (verband deutscher seilbahnen und schlepplifte e.v. 2015, 2), therefore resulting in a stable situation	While job security during winter operations might suffer, summer operations can help offset this trend, resulting in a stable situation
Room occupancy	Moderate decrease	Moderate increase	Stable	Intuitive allocation	Increase in the number of guests and visitors. This has made a significant contribution to increasing the occupancy rate and expanding the season in terms of year-round tourism (dwif, 2022, 24)	Directive should not lead to rising number increases → stable situation
Follow-up investments	Decrease	Strong increase	Stable	Intuitive allocation	Achieved external and internal follow-up investments through BCCSD: To this end, the financial support has also opened up the necessary financial scope for own follow-up investments. (dwif, 2022, 25)	Intuitive allocation

Evaluation calculation for operating costs:

Change of operated	A1	A2	A3	A1	A2	A3
CCSLs	decline	very weak increase	stable	7	5	6
SMs + RPs	very weak increase	strong increase	stable	5	2	6
PAs	stable	very weak increase	stable	6	5	6
Other investments/activities	stable	strong increase	very weak increase	6	2	5
Average				6	3,5	5,8
Evaluation of operating costs				**=6: stable**	**=4: weak increase**	**=6: stable**

1	2	3	4	5	6	7
very strong increase	strong increase	moderate increase	weak increase	very weak increase	stable	decline

Evaluation calculation for waiting time:

Change of constructed CCSLs	**A1**	**A2**	**A3**
Number of constructions of CCSLs	1-5	26-30	16-20
Evaluation of waiting time	**very weak decrease**	**very strong decrease**	**moderately strong decrease**

0	1-5	6-10	11-15	16-20	21-25	26-30
stable	very weak decrease	weak decrease	moderately weak decrease	moderately strong decrease	strong decrease	very strong decrease

Appendix 3.4: Utility Value Analysis Excel Sheet

											A1		A2		A3	
crit. Layer 1	weight	crit. Layer 2	weight	int. weight	crit. Layer 3	weight	int. weight	crit. Layer 4	weight	final weight	points	score	points	score	points	score
ecological	0,50	CCSL	0,28	0,14	constructed	0,62	0,09			0,09	5,83	0,51	0,00	0,00	2,33	0,20
				0,14	operated	0,38	0,05			0,05	7,00	0,37	4,67	0,25	5,83	0,31
		SM + RP	0,26	0,13	constructed	0,52	0,07			0,07	4,67	0,32	2,33	0,16	7,00	0,47
				0,13	operated	0,48	0,06			0,06	4,67	0,29	1,17	0,07	5,83	0,36
		PA	0,29	0,15	constructed	0,55	0,08			0,08	7,00	0,56	5,83	0,47	7,00	0,56
				0,15	operated	0,45	0,07			0,07	5,83	0,38	4,67	0,30	5,83	0,38
		Other	0,17	0,09	constructed	0,51	0,04			0,04	5,83	0,25	2,33	0,10	4,67	0,20
				0,09	operated	0,49	0,04			0,04	4,67	0,19	1,17	0,05	3,50	0,15
economic	0,50	service quality	0,30	0,15	waiting time	0,10	0,02			0,02	1,17	0,02	7,00	0,11	4,67	0,07
					snow reliability	0,30	0,05			0,05	3,50	0,16	5,83	0,26	2,33	0,11
					access with PT	0,25	0,04			0,04	1,17	0,04	3,50	0,13	5,83	0,22
					visual attractiveness	0,15	0,02	disturbance of a	0,7	0,02	4,67	0,07	2,33	0,04	4,67	0,07
							0,02	snowy landscap	0,3	0,01	3,50	0,02	5,83	0,04	2,33	0,02
					security standards	0,20	0,03	slope	0,5	0,02	3,50	0,05	5,83	0,09	2,33	0,04
								infrastructure	0,5	0,02	1,17	0,02	5,83	0,09	3,50	0,05
		operation	0,30	0,15	infrastructural capacity	0,10	0,02			0,02	3,50	0,05	5,83	0,09	3,50	0,05
					year round operability	0,25	0,04			0,04	1,17	0,04	4,67	0,18	5,83	0,22
					midterm operability	0,30	0,05			0,05	3,50	0,16	5,83	0,26	2,33	0,11
					operating costs	0,15	0,02			0,02	3,50	0,08	1,17	0,03	3,50	0,08
					generated revenues	0,15	0,02			0,02	1,17	0,03	5,83	0,13	3,50	0,08
					administrative efforts	0,05	0,01			0,01	7,00	0,05	3,50	0,03	0,00	0,00
		regional economy	0,40	0,20	job security	0,33	0,07			0,07	1,17	0,08	5,83	0,39	5,83	0,39
					room occupancy	0,33	0,07			0,07	1,17	0,08	5,83	0,39	3,50	0,23
					follow-up investments	0,33	0,07			0,07	0,00	0,00	5,83	0,39	1,17	0,08
sum	1,00									1,00		**3,82**		**4,02**		**4,44**

		0,00	**1,17**	**2,33**	**3,50**	**4,67**	**5,83**	**7,00**
CCSL	construction	26-30	21-25	16-20	11-15	6-10	1-5	0
	operation	very strong increase	strong increase	moderate increase	weak increase	very weak increase	stable	decline
SM + RP	construction	26-30	21-25	16-20	11-15	6-10	1-5	0
	operation	very strong increase	strong increase	moderate increase	weak increase	very weak increase	stable	decline
PA	construction	26-30	21-25	16-20	11-15	6-10	1-5	0
	operation	very strong increase	strong increase	moderate increase	weak increase	very weak increase	stable	decline
Other	construction	26-30	21-25	16-20	11-15	6-10	1-5	0
	operation	very strong increase	strong increase	moderate increase	weak increase	very weak increase	stable	decline

ecological impacts	**A1**	**A2**	**A3**
CCSL	1-5	26-30	16-20
	decline	very weak increase	stable
SM + RP	6-10	16-20	0
	very weak increase	strong increase	stable
PA	0	1-5	0
	stable	very weak increase	stable
Other	1-5	16-20	6-10
	very weak increase	strong increase	weak increase

			0,00	1,17	2,33	3,50	4,67	5,83	7,00
service quality	waiting time	waiting time during visitor peaks	stable	very weak decrease	weak decrease	moderately weak decrease	moderately strong decrease	strong decrease	very strong decrease
	snow reliability	snow reliability	very strong decrease	strong decrease	moderate decrease	weak decrease	very weak decrease	stable	increase
	access with PT	access with PT	decrease	stable	very weak increase	weak increase	moderate increase	strong increase	very strong increase
	visual attractiveness	disturbance of alpine landscape	very strong increase	strong increase	moderate increase	weak increase	very weak increase	stable	decline
		snowy landscape	very strong decrease	strong decrease	moderate decrease	weak decrease	very weak decrease	stable	increase
operation	security standards	slope	very strong decrease	strong decrease	moderate decrease	weak decrease	very weak decrease	stable	increase
		infrastructure	decrease	stable	very weak increase	weak increase	moderate increase	strong increase	very strong increase
	infrastructural capacity	infrastructural capacity	strong decrease	moderate decrease	weak decrease	stable	weak increase	moderate increase	strong increase
	year round operability	year round operability	strong decrease	moderate decrease	weak decrease	stable	weak increase	moderate increase	strong increase
	midterm operability	midterm operability	very strong decrease	strong decrease	moderate decrease	weak decrease	very weak decrease	stable	increase
	operating costs	operating costs	strong increase	moderate increase	weak increase	stable	weak decrease	moderate decrease	strong decrease
	generated revenues	generated revenues	strong decrease	moderate decrease	weak decrease	stable	weak increase	moderate increase	strong increase
	administrative efforts	administrative efforts	strong increase	moderate increase	weak increase	stable	weak decrease	moderate decrease	strong decrease
regional economy	job security	job security	very strong decrease	strong decrease	moderate decrease	weak decrease	very weak decrease	stable	increase
	room occupancy	room occupancy	strong decrease	moderate decrease	weak decrease	stable	weak increase	moderate increase	strong increase
	follow-up investments	follow-up investments	decrease	stable	very weak increase	weak increase	moderate increase	strong increase	very strong increase

economic impacts	**A1**	**A2**	**A3**
waiting time	very weak decrease	very strong decrease	oderately strong decrea
snow reliability	weak decrease	stable	moderate decrease
access with PT	stable	weak increase	strong increase
disturbance of alpine landscape	very weak increase	moderate increase	very weak increase
snowy landscape	weak decrease	stable	moderate decrease
slope	weak decrease	stable	moderate decrease
infrastructure	stable	strong increase	weak increase
infrastructural capacity	stable	moderate increase	stable
year round operability	moderate decrease	weak increase	moderate increase
midterm operability	weak decrease	stable	moderate decrease
operating costs	stable	moderate increase	stable
generated revenues	moderate decrease	moderate increase	stable
administrative efforts	strong decrease	stable	strong increase
number of guaranteed jobs	strong decrease	stable	stable
room occupancy	moderate decrease	moderate increase	stable
follow-up investments	decrease	strong increase	stable

Appendix 3.5: Detailed Sensitivity Analysis Process

Step 1: **Balancing the criteria weights**

Layer 1:

1. Ecological/economic (already equally weighted)

Layer 2:

2. CCSL/SM+RP/PA/Other (0,25): same result
3. Service quality/oepration/regional economy (0,333): same result

Layer 3:

4. CCSL con/op (0,5): same result
5. SM + RP con/op (0,5): same result
6. PA+AR con/op (0,5):
7. Other con/op (0,5):
8. Service quality (0,2): same result
9. Operation (0,17): same result
10. Regional economy (already equally weighted)

Layer 4:

11. Visual attractiveness (disturbance of…/snowy landscape) (0,5): same result

Step 2: Leveling existing weight peaks

12. CCSL & SM+RP: 0,285; PA+AR & Other: 0,215: same result
13. Snow reliability & access with PT: 0,275; rest: 0,15: same result
14. Probability of yr operation & midterm operability: 0,275; rest: 0,13333: same result

Step 3: Diversifying weight distribution

In this step, the weights of approximately 20 % highest weighted criteria are increased by 25 %. The weights of all other criteria are reduced pro rata.

Layer 2:

15. PA: 0,29 → 0,3625; CCSL: 0.28 → 0.2515; SM+RP: 0.26 → 0.2335; Other: 0.17 → 0.1526: same result
16. Regional economy: 0.4 → 0.5: service quality & operation: 0.3 → 0.25: same result

Layer 3:

17. CCSL: con: 0.62 → 0.775; CCSL op: 0.38 → 0.225
18. SM + RP: con: 0.52 → 0.65; op: 0.48 → 0.35
19. PA: con: 0.55 → 0.6875; 0.45 → 0.3125
20. Other: con: 0.51 → 0.6375; op: 0.49 → 0.3625
21. Snow reliability: 0.3 → 0.375; waiting, visual, security: 0.15 → 0.1339; access: 0,25 → 0,2232: same result
22. Midterm: 0.3 → 0.375: infrastructural capacity: 0.1 → 0.089; prop. Of yr operability: 0.25 → 0.223; operating costs: 0.15 → 0.134; generated revenues: 0.15 → 0.134; administrative efforts: 0.05 → 0.045: same result
23. Regional economy: no peaks

Layer 4

24. Disturbance: 0.7 → 0.88; snowy: 0.3 → 0.13: same result

Step 4: Variating criteria ratings

In this step, the highest values were increased (highlighted in green) by one level, while the lowest values were decreased by one level (highlighted in red). Thus, a more polarizing effect could be simulated.

	A1	A2	A3
CCSL con	1-5 → 0	26-30	16-20
CCSL op	Decline	Very weak increase → weak increase	Stable
SM+RP con	6-10	16-20 → 21-25	0

SM+RP op	Very weak increase	Strong increase → very strong increase	Stable → decline
PA con	0	1-5 → 6-10	0
PA op	Stable → decline	Very weak increase → weak increase	Stable → decline
Other con	1-5 → 0	16-20 → 21-25	1-5 → 0
Other op	Very weak increase → stable	Strong increase → very strong increase	Very weak increase → stable
Waiting time	Very weak decrease → stable	Very strong decrease	Moderately strong decrease
Snow reliability	Weak decrease	Stable → increase	Moderate decrease → strong decrease
Access with PT	Stable → decline	Weak increase	Strong increase → very strong increase
Disturbance	Very weak increase → stable	Moderate increase → strong increase	Very weak increase → stable
Snowy landscape	Weak decrease	Stable → increase	Moderate decrease → strong decrease
Piste security	Weak decrease	Stable → increase	Moderate decrease → strong decrease
Infrastructural security	Stable → decrease	Strong increase → very strong increase	Weak increase
Infrastructural capacity	Stable → weak decrease	Moderate increase → strong increase	Stable → weak decrease
Probability of year round operability	Moderate decrease → strong decrease	Weak increase	Moderate increase → strong increase
Midterm operability of skiing services	Weak decrease	Stable → increase	Moderate decrease → strong decrease
Operating costs	Stable → weak decrease	Moderate increase → strong increase	Stable → weak decrease
Generated revenues	Moderate decrease → strong decrease	Moderate increase → strong increase	Stable
Administrative efforts	Strong decrease	Stable → increase	Strong increase → increase
Number of guaranteed jobs	Strong decrease → very strong decrease	Stable → increase	Stable → increase

Room occupancy	Moderate decrease → strong decrease	Moderate increase → strong increase	Stable
Follow-up investments	Decrease	Strong increase → very strong increase	Stable

Bibliography

Abegg, Bruno. 2011. “Tourismus im Klimawandel: Ein Hintergrundbericht der CIPRA.” Accessed July 03, 2023. https://www.cipra.org/de/publikationen/4606.

Abegg, Bruno. 2012. “Natürliche und technische Schneesicherheit in einer wärmeren Zukunft.” *Forum für Wissen*, 29–35. Accessed July 04, 2023. https://www.dora.lib4ri.ch/wsl/islandora/object/wsl%3A13971/datastream/PDF/download/Abegg-2012-Nat%C3%BCrliche_und_technische_Schneesicherheit_in-%28published_version%29.pdf.

Abegg, Bruno, Shardul Agrawala, Florence Crick, and Anne de Montfalcon. 2007. “Climate change impacts and adaptation in winter tourism.” In OECD 2007, 25-60.

Agrawala, Shardul. 2007. “The European Alps: Location, Economy and Climate.” In OECD 2007, 17-23.

“Aiwanger: "Die Seilbahnförderung wirkt".” 2022. News release. November 9, 2022. Accessed July 23, 2023. https://www.stmwi.bayern.de/presse/pressemeldungen/pressemeldung/530-2022/.

Axel Doering. 2019. “Alpin- und Umweltverbände fordern öffentliche Debatte über die Zukunft der bayerischen Seilbahnförderrichtlinie.” News release. December 6, 2019. Accessed July 14, 2023. https://www.vzsb.de/media/docs/PM_CIPRA_D_Seilbahnfoerderung_in_Bayern.pdf.

Bauer, Alfred, Marco Gardini, Guido Sommer, and Alexander Fink. 2021. “Szenarien für den Tourismus in BAyern im Jahr 2040: Impulse für die touristische Zukunft.” Accessed September 01, 2023. https://www.stmwi.bayern.de/fileadmin/user_upload/stmwi/publikationen/pdf/2021-05-27_Szenarien_f%C3%BCr_den_Tourismus_in_Bayern_2040__04_2021_.pdf.

Bausch, Thomas. 2019. “Climate Change Adaptation – A New Strategy for a Tourism Community: A Case from the Bavarian Alps.” In Pröbstl, Richins, and Türk 2019, 92–102.

Richtlinien Zur Förderung Von Seilbahnen Und Nebenanlagen in Kleinen Skigebieten. BayMBI. 2023 Nr. 56. Bavarian State Ministry. February 8, 2023. Accessed July 10, 2023. https://www.verkuendung-bayern.de/files/baymbl/2023/56/baymbl-2023-56.pdf.

Bavarian State Ministry of Economic Affairs, Energy and Technology. “Wichtige Daten zum Bayerntourismus 2022.” Unpublished manuscript, last modified June 22, 2022. https://www.stmwi.bayern.de/fileadmin/user_upload/stmwi/Wirtschaft/Tourismus/Tourismusbilanz_2022/23_02_09_Themenblatt_Wichtige_Zahlen_zum_Bayerntourismus_2022_final.pdf.

Bavarian State Office for the Environment (LfU). 2021. “Klima-Faktenblätter Bayern und Alpen: Klima der Vergangenheit und Zukunft.” Accessed July 21, 2023. https://www.bestellen.bayern.de/application/eshop_app000001?SID=1040724042&ACTIONxSETVAL(artdtl.htm,AARTxNR:lfu_klima_00186,USERxZUORDARTIKEL:artdtl.htm,USERxAPGNODE:1325,USERxAARTNR:lfu_klima_00171)=Z.

Bavarian State Parliament. 2020a. “Drs. 18/11061 Schriftliche Anfrage der Abgeordneten Christian Hierneis, Patrick Friedl, Ludwig Hartmann BÜNDNIS 90/DIE GRÜNEN: Skigebiete in Bayern.” Drs. 18/11061. Accessed July 20, 2023. https://www1.bayern.landtag.de/www/ElanTextAblage_WP18/Drucksachen/Schriftliche%20Anfragen/18_0011061.pdf.

Bavarian State Parliament. 2020b. “Drs. 18/5306 Schriftliche Anfrage der Abgeordneten Christian Zwanziger, Ludwig Hartmann, Maximillian Deisenhofer, Christian Hierneis, Patrick Friedl BÜNDNIS 90/DIE GRÜNEN: Seilbahnförderung und künstliche Beschneiung in Bayern.” Drs. 18/5306. Accessed July 20, 2023. https://www1.bayern.landtag.de/www/ElanTextAblage_WP18/Drucksachen/Schriftliche%20Anfragen/18_0005306.pdf.

Bavarian State Parliament. 2022. “Drs. 18/19511 Schriftliche Anfrage der Abgeordneten Christian Zwanziger, Ludwig Hartmann, Maximilian Deisenhofer, Patrick Friedl, Christian Hierneis BÜNDNIS 90/DIE GRÜNEN: Seilbahnförderung und Förderung künstlicher Beschneiung in Bayern – Stand 2021.” Drs. 18/19511. Accessed July 20, 2023. https://www1.bayern.landtag.de/www/ElanTextAblage_WP18/Drucksachen/Schriftliche%20Anfragen/18_0019511.pdf.

Bavarian State Parliament. 2023. “Drs. 18/26237 Schriftliche Anfrage des Abgeordneten Christian Zwanziger BÜNDNIS 90/DIE GRÜNEN: Seilbahnförderung und Förderung künstlicher Beschneiung in Bayern - Stand 2023.” Drs. 18/26237. Accessed July 03, 2023. https://www1.bayern.landtag.de/www/ElanTextAblage_WP18/Drucksachen/Schriftliche%20Anfragen/18_0026237.pdf.

Bavarian Zugspitze Mountain Railway AG. 2023. “Faszination Bergbahn.” Accessed September 03, 2023. https://zugspitze.de/de/Unsere-Bergwelten/Die-Gebiete/Faszination-Bergbahn.

Bayern Tourismus Marketing GmbH. 2023. “Statistiken und Studien zum Tourismus in Bayern.” Accessed August 08, 2023. https://tourismus.bayern/statistiken-und-studien/.

Bonzanigo, Laura, Carlo Giupponi, and Stefano Balbi. 2016. “Sustainable tourism planning and climate change adaptation in the Alps: a case study of winter tourism in mountain communities in the Dolomites.” *Journal of Sustainable Tourism* 24 (4): 637–52. Accessed July 05, 2023. https://doi.org/10.1080/09669582.2015.1122013.

BR Data. 2022. “Schnee von morgen.” Accessed August 14, 2023. https://interaktiv.br.de/schnee-von-morgen/daten/index.html.

BUND, CIPRA, DAV, LBV, Nature Friends, and Association for the Protection of Mountain Environments. 2021. “Vorschläge für eine notwendige Neuausrichtung der Seilbahnförderrichtlinie: Umwelt- und Alpinverbände fordern gezielte Steuerung bei der Förderung von

Seilbahnen in Bayern." Accessed July 23, 2023. https://www.cipra.org/de/news/verbaende-fordern-eine-oekologische-neuausrichtung-der-bayerischen-seilbahnfoerderrichtlinie.

Caravello, Gianumberto, Elena Crescini, Serena Tarocco, and Fabio Palmeri. 2006. "Environmental modifications induced by the practice of "Artificial snow-making" in the Obereggen/Val D'Ega Area (Italy)." *Journal of Mediterranean Ecology* (7): 31–39. Accessed August 21, 2023. http://www.jmecology.com/wp-content/uploads/2014/03/caravello31-39.pdf.

Collection Society for Ecological Research / Sylvia Hamberger. 2023. "Garmisch, Kreuzwankl, Beschneiteich, 5.7.2006, 30.5.2007, 26.7.2 – Gletscherarchiv." Accessed August 24, 2023. https://www.gletscherarchiv.de/die_folgen/garmisch-kreuzwankl-beschneiteich-5-7-2006-30-5-2007-26-7-2/.

CREA Mont-Blanc. 1/1/0001. "Climate change and its impacts in the Alps | CREA Mont-Blanc." Accessed July 07, 2023. https://creamontblanc.org/en/climate-change-and-its-impacts-alps/.

Damm, Andrea, Judith Köberl, and Franz Prettenthaler. 2014. "Does artificial snow production pay under future climate conditions? – A case study for a vulnerable ski area in Austria." *Tourism Management* 43 (1): 8–21. Accessed August 21, 2023. https://doi.org/10.1016/j.tourman.2014.01.009.

der Heiden, Iris an, Frank Meyrahn, Holger Preuß, and Gerd Ahlert. 2013. "Wirtschaftsfaktor Wintersport: Aktuelle Daten zur Sportwirtschaft." Accessed July 22, 2023. https://www.bmwk.de/Redaktion/DE/Publikationen/Wirtschaft/wirtschaftsfaktor-wintersport.pdf?__blob=publicationFile&v=7.

"Die Grenzen der Beschneiung sind bald erreicht." 2013. News release. April 18, 2013. Accessed July 14, 2023.

Dietmann, Thomas, and Ulrich Kohler. 2006. *Skipistenuntersuchung Bayern: Landschaftsökologische Untersuchungen in den bayerischen Skigebieten ; Endauswertung.*

Augsburg: Bayerisches Landesamt für Umwelt. Accessed August 25, 2023. https://www.bestellen.bayern.de/application/applstarter?APPL=eshop&DIR=eshop&ACTIONxSETVAL(artdtl.htm,APGxNODENR:34,AARTxNR:lfu_nat_00102,AARTxNODENR:12433,USERxBODYURL:artdtl.htm,KATALOG:StMUG,AKATxNAME:StMUG,ALLE:x)=X.

Dietmann, Thomas, Ulrich Kohler, and Gernot Lutz. 2005. “Die Skigebiete in den bayerischen Alpen. Ökologischer Zustand, Konfliktbereiche, Lösungsmöglichkeiten: eine Schlussauswertung der Skipistenuntersuchung Bayern.” Accessed August 25, 2023. https://www.zobodat.at/pdf/Jb-Verein-Schutz-Bergwelt_70_2005_0045-0060.pdf.

Doering, Axel, and Sylvia Hamberger. 2007. “Der künstliche Winter: Mit Schneekanonen gegen den Klimawandel: Salto Mortale in die Vergangenheit.” Accessed July 10, 2023. https://rosenheim.bund-naturschutz.de/fileadmin/kreisgruppen/rosenheim/downloads/Kreisgruppe/bn_schneekanonen_0702.pdf.

dwif Consulting GmbH. 2022. “Evaluierung der Förderung von Seilbahnen und Nebenanlagen in kleinen Skigebieten.” Accessed July 15, 2023. https://www.stmwi.bayern.de/fileadmin/user_upload/stmwi/Foerderungen/Tourismusfoerderung/2022-11-04_dwif-Abschlussbericht_Evaluierung_Seilbahn-F%C3%B6rderung.pdf.

dwif e.V. 2015. “Wirtschaftliche Effekte durch Seilbahnen im Winter in Deutschland.” Accessed August 23, 2023. https://www.seilbahnen.de/wp-content/uploads/dwif-Wifa-Seilbahnen-GesamtjahrWinter-12-13-und-Sommer-14-in-Deutschland1.pdf.

Elmi, Marianna, and Thomas Streifeneder, eds. 2018. *The Alps in 25 maps.* Innsbruck: Permanent Secretariat of the Alpine Convention. Accessed August 08, 2023. https://www.alpconv.org/en/home/news-publications/publications-multimedia/detail/the-alps-in-25-maps/.

European Environment Agency. 2005. “Vulnerability and adaptation to climate change in Europe.” Accessed July 13, 2023. https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwiroL

j6pYuAAxUpRKQEHfg_AvwQFnoECAoQAQ&url=https%3A%2F%2Fwww.eea.europa.eu%2Fpublications%2Ftechnical_report_2005_1207_144937%2Fdownload&usg=AOvVaw0JCBt7KhrMcXQWjutMAtUL&opi=89978449.

Federal Department of Environment. 2021. "Empfehlungen zur Vermeidung von Lichtemissionen." Accessed August 01, 2023. https://www.bafu.admin.ch/bafu/de/home/themen/elektrosmog/publikationen-studien/publikationen/empfehlungen-zur-vermeidung-von-lichtemissionen.html.

Federal Department of Environment, and Federal Department of Transport. 2013. "Umwelt und Raumplanung bei Seilbahnvorhaben: Vollzugshilfe für Entscheidbehörden und Fachstellen, Seilbahnunternehmungen und Umweltfachleute." Accessed July 31, 2023. https://www.bafu.admin.ch/bafu/de/home/themen/uvp/publikationen/publikationen/umwelt-und-raumplanung-bei-seilbahnvorhaben.html.

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety. 2008. "Klimawandel in den Alpen: Fakten - Folgen - Anpassung." Accessed August 10, 2021. https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwjTvdWC8_yAAxXMSPED-HfpXBIcQFnoECA0QAQ&url=https%3A%2F%2Fwww.cipra.org%2Fde%2Fpdfs%2F796&usg=AOvVaw1oPQLE2o-6pCFlzJDIf2Ba&opi=89978449.

FeWo-direkt. 2021. "Winter-Kompass 2021." Accessed August 11, 2023. https://assets.ctfassets.net/gxwgulxyxxy1/5hJzy7QOE08Rgi9psXrmq5/e77cd8be007f94d285db0ad8bb7af651/FeWo-direkt_Winter-Kompass_2021.pdf.

Grossenbacher, Alain. 2023. "Leistungen - Leitungsbau - Alain Grossenbacher." Alain Grossenbacher. Accessed August 24, 2023. https://www.alain-grossenbacher.ch/leistungen/leitungsbau.

H., Peter. 2017. “Die Schneise der Seilbahn zum Unternberg. – Bild von Unternberg Sesselbahn, Ruhpolding - Tripadvisor.” Accessed September 19, 2023. https://www.tripadvisor.de/LocationPhotoDirectLink-g198554-d10751584-i245223014-Unternberg_Sesselbahn-Ruhpolding_Upper_Bavaria_Bavaria.html.

Hahn, Felix. 2004. “Künstliche Beschneiung im Alpenraum: Ein Hintergrundbericht.” CIPRA. Accessed July 23, 2023. https://www.cipra.org/de/dossiers/11/dateien/454_de/@@download/file/Dossier_Kunstschnee_D.pdf?inline=true.

Hartl, Lea, and Andrea Fischer. 2015. “Beschneiungsklimatologie: Endbericht.” Accessed July 10, 2023. https://epic.awi.de/id/eprint/37875/1/Endbericht_Beschneiungsklimatologie_2015.pdf.

IPCC. 2021. “Summary for Policymakers.” In *Climate Change 2021: The Physical Science Basis*. Accessed August 10, 2023. https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_SPM_final.pdf.

Jong, Carmen de. 2020. “Umweltauswirkungen der Kunstschneeproduktion in den Skigebieten der Alpen.” *Geographische Rundschau* 6: 34–39. Accessed August 21, 2023. https://www.researchgate.net/publication/342305335_Umweltauswirkungen_der_Kunstschneeproduktion_in_den_Skigebieten_der_Alpen/citation/download.

Jong, Carmen de, and Thierry Barth. 2008. “Challenges in Hydrology of Mountain Ski Resorts under Changing Climatic and Human Pressures.” Accessed August 21, 2023. https://www.academia.edu/80016716/Challenges_in_hydrology_of_mountain_ski_resorts_under_changing_climatic_and_human_pressures.

Jong, Carmen de, Franco Previtali, and Gloria Carletti. 2015. “Challenges in Assessing and Managing Geo-hydrological Risk Related to Natural and Anthropogenic Pressures in Alpine Ski Resorts.” In *Engineering Geology for Society and Territory - Volume 5*. Vol. 90, edited by Giorgio Lollino, Andrea Manconi, Fausto Guzzetti, Martin Culshaw, Peter Bobrowsky, and Fabio Luino, 781–85. Cham: Springer International Publishing. Accessed

August 21, 2023. https://www.researchgate.net/profile/Franco-Previtali/publication/285602708_Challenges_in_Assessing_and_Managing_Geo-hydrological_Risk_Related_to_Natural_and_Anthropogenic_Pressures_in_Alpine_Ski_Resorts/links/575176a708ae6807faf96949/Challenges-in-Assessing-and-Managing-Geo-hydrological-Risk-Related-to-Natural-and-Anthropogenic-Pressures-in-Alpine-Ski-Resorts.pdf.

Kotlarski, Sven, Andreas Gobiet, Samuel Morin, Marc Olefs, Jan Rajczak, and Raphaëlle Samacoïts. 2023. “21st Century alpine climate change.” *Clim Dyn* 60 (1-2): 65–86. Accessed July 10, 2023. https://doi.org/10.1007/s00382-022-06303-3.

Krautzer, B., and Brigitte Klug. 2009. “Renaturierung von subalpinen und alpinen Ökosystemen.” In *Renaturierung Von Ökosystemen in Mitteleuropa*. Vol. 12, edited by Stefan Zerbe and Gerhard Wiegleb, 209–34. Heidelberg: Spektrum Akademischer Verlag. Accessed July 11, 2023. https://link.springer.com/chapter/10.1007/978-3-8274-2161-6_8#chapter-info.

Kühnapfel, Jörg B. 2021. *Scoring und Nutzwertanalysen: Ein Leitfaden für die Praxis.* 1st ed. Wiesbaden: Springer Fachmedien Wiesbaden. Accessed July 27, 2023. https://link.springer.com/book/10.1007/978-3-658-34810-6.

Leung, Yu-Fai, Anna Spenceley, Glen Hvenegaard, and Ralf Buckley. 2018. *Tourism and visitor management in protected areas : guidelines for sustainability:* IUCN, International Union for Conservation of Nature. https://portals.iucn.org/library/sites/library/files/documents/PAG-027-De.pdf.

Loibl, Wolfgang, and Ariane Walz. 2010. “Generic Regional Development Strategies from Local Stakeholders' Scenarios - an Alpine Village Experience.” *E&S* 15 (3). Accessed July 17, 2023. https://doi.org/10.5751/ES-03387-150303.

Marty, Christoph. 2013. “Climate Change and Snow Cover in the European Alps.” In Rixen and Rolando 2013, 30–44.

Mayer, Marius. 2019. “The role of cable cars and ski lifts as key innovations in the evolution of winter tourism.” In Pröbstl, Richins, and Türk 2019, 339–53.

Mayer, Marius, and Felix Kraus. 2019. “Economic Relevance of Different Winter Sport Activities Based on Expenditure Behaviour.” In Pröbstl, Richins, and Türk 2019, 103-115.

Mayer, Marius, and Robert Steiger. 2013. “Skitourismus in den Bayerischen Alpen - Entwicklung und Zukunftsperspektiven.” In *Tourismus und Regionalentwicklung in Bayern*, edited by Hubert Job and Marius Mayer, 164–212. Arbeitsberichte der ARL 9. Hannover: Akademie für Raumforschung und Landesplanung. Accessed August 01, 2023. https://www.ssoar.info/ssoar/handle/document/37303.

Meijer zu Schlochtern, Melanie P., Christian Rixen, Sonja Wipf, and Johannes H. C. Cornelissen. 2014. “Management, winter climate and plant–soil feedbacks on ski slopes: a synthesis.” *Ecol Res* 29 (4): 583–92. Accessed August 21, 2023. https://doi.org/10.1007/s11284-014-1141-6.

Menn, Arne, and Fabian Putzing. 2014. “Klimapioniere - Nachhaltigkeitsinitiativen im Wintersport.” In *CSR Und Sportmanagement*, edited by Alexandra Hildebrandt, 533–46. Berlin, Heidelberg: Springer Berlin Heidelberg.

OECD, ed. 2007. *Climate Change in the European Alps: Adapting Winter Tourism and Natural Hazards Management.* Paris: OECD publishing. Accessed July 06, 2023. https://ebookcentral.proquest.com/lib/kxp/detail.action?docID=299337.

Preuß, Holger, Christian Alfs, and Gerd Ahlert. 2012. *Sport als Wirtschaftsbranche.* Wiesbaden: Springer Fachmedien Wiesbaden. Accessed July 19, 2023. https://link.springer.com/book/10.1007/978-3-658-00733-1.

Pröbstl, Ulrike, Harold Richins, and Stefan Türk, eds. 2019. *Winter tourism: Trends and challenges.* CABI series in tourism management research. Wallingford, Boston, MA: CABI. Accessed July 03, 2023. https://www.cabidigitallibrary.org/doi/book/10.1079/9781786395207.0000.

Pröbstl-Haider, Ulrike. 2019. “Winter Tourism in the Alps and the Implications of Climate Change.” In Pröbstl, Richins, and Türk 2019, 64–72.

Pütz, Marco, David Gallati, Susanne Kytzia, Hans Elsasser, Corina Lardelli, Michaela Teich, Fabian Waltert, and Christian Rixen. 2011. “Winter Tourism, Climate Change, and Snow-making in the Swiss Alps: Tourists' Attitudes and Regional Economic Impacts.” *Mountain Research and Development* 31 (4): 357–62. Accessed August 23, 2023. https://doi.org/10.1659/MRD-JOURNAL-D-11-00039.1.

Rakytova, Iveta, and Ivana Tomcikova. 2017. “Assessing Sustainability in Mountain Tourism of Demanovska Valley, Slovakia.” *European Journal of Geography* (8): 6–23. Accessed August 21, 2023. https://eurogeojournal.eu/index.php/egj/article/view/287/236.

Rixen, Christian. 2013. “Skiing and Vegetation.” In Rixen and Rolando 2013, 65–78.

Rixen, Christian, and Antonio Rolando, eds. 2013. *The impacts of skiing and related winter recreational activities on mountain environments.* Saif Zone, Sharjah, U.A.E: Bentham Science Publishers. Accessed August 21, 2023. https://d1wqtxts1xzle7.cloudfront.net/42053702/Ground-Dwelling_Arthropods_and_Ski-Piste20160204-3118-ba4o5d-libre.pdf?1454601486=&response-content-disposition=inline%3B+filename%3DGround_Dwelling_Arthropods_and_Ski_Piste.pdf&Expires=1692622116&Signature=HLjBrwuTnLwoxvoiGCNR9~3L9QoKAsP2m85n29cFMfaONv1DuSY419dE6R2F-O9-mD3KokJIqoJ~8V4HiR4CTjVtKtBhHM~09yaSJRGk22gM-lZhlui-okucwf7wjwCIqdXhJVnc7bYcNvcyP8ptOY95sKparaTqyjwAthwk5o4ma2rd7-P0QePZi5zb2AlQ1Txcx5LyoHi9UobVju1Om-FULX7jTkOv6syy32A9wtzYpo3~vSfWR20QZQHunyC24E4fXj4ua2WDtEtVn99XcGG0viO-To88se2q1fcOtmHpMn7pj89644sRjcUH1KjbmjZI1qBVhIXscQ9XqQDjvNWg__&Key-Pair-Id=APKAJLOHF5GGSLRBV4ZA#page=45.

Steiger, Robert. 2013. “Auswirkungen des Klimawandels auf Skigebiete im bayerischen Alpenraum: Studie im Auftrag des Deutschen Alpenvereins.” German Alpine Club. Accessed July 23, 2023. https://bit.ly/45vYbA9.

Roth, Uwe. 2022. “Scheinargumente und Milchmädchenrechnungen in Debatte um bayerische Seilbahnförderung — CIPRA (d).” CIPRA Germany e.V. Accessed July 23, 2023. https://www.cipra.org/de/news/scheinargumente-und-milchmaedchenrechnungen-in-debatte-um-bayerische-seilbahnfoerderung.

Schmidtutz, Thomas. 2023. “Kein Giftmüll“: Aiwanger verteidigt Hilfen für Beschneiungsanlagen - und attackiert Grünen-Wähler .” *merkur*, January 23, 2023. Accessed July 23, 2023. https://www.merkur.de/wirtschaft/hubert-aiwanger-schneekanonen-kunstschnee-kritik-gruene-waehler-minister-giftmuell-bayern-news-92022846.html.

Schröder, Verena. 2017. “Verantwortung für die Region? Das Beispiel der Seilbahnunternehmen in Tirol vor dem Hintergrund einer Corporate Regional Responsibility.” In *CSR Und Tourismus*, edited by Dagmar Lund-Durlacher, Matthias S. Fifka, and Dirk Reiser, 467–74. Management-Reihe Corporate Social Responsibility. Berlin, Heidelberg: Springer Berlin Heidelberg. Accessed August 22, 2023. https://d1wqtxts1xzle7.cloudfront.net/57715081/Schroeder_V.2017_Verantwortung_fur_die_Region-libre.pdf?1541626164=&response-content-disposition=inline%3B+filename%3DVerantwortung_fur_die_Region_Das_Beispie.pdf&Expires=1692695547&Signature=RK7QPWqD~q9ZQkD7Dj9O~YxwnycI~nr6~28xH01WORPI8swk9CPq00Odc91UaQY2Uv-nxoGeUavvikcO~Zs0cPdZ-YLineffe-sGTymR2tgTisbRa-1Ku-a0mNkCX200xsoE76C51MSHVkQ2kGlseQmcW~5UriSQpHH3126-MtLgRYQAPCQ2BLf2zV2qbg~8mnGumhDrk8xPc-f0ocVfaYZH-KnGeU2AwgwhR5IzHG7lbRIxR38B5z-vrR0Itg9H8CpUBPZzT2D5ALb778yJ49Bojc8WMJ0bSsXfIt-NGUEbGq9Aoq7sIM4VXeBXJI5TTu~HvvxFmGTz4qY0cF-qoDwQ__&Key-Pair-Id=APKA-JLOHF5GGSLRBV4ZA.

jetzt red i, “Skifahren Trotz Klimawandel Und Energiekrise - Pistengaudi Um Jeden Preis? .” Aired December 7, 2022, on BR television. https://www.ardmediathek.de/video/Y3JpZDovL2JyLmRlL3ZpZGVvLzA1ODdiMjYwLTJlNzQtNDZjNC1hYTJmLWUxZTdkZDViMmRhYg.

Snyder, Hannah. 2019. “Literature review as a research methodology: An overview and guidelines.” *Journal of Business Research* 104 (5): 333–39. https://doi.org/10.1016/j.jbusres.2019.07.039.

Steiger, Robert, and Bruno Abegg. 2014. “Klimawandel und Skigebiete im Ostalpenraum.” Accessed July 16, 2023. https://www.researchgate.net/publication/290441495_Klimawandel_und_Skigebiete_im_Ostalpenraum.

Steiger, Robert, Eva Posch, Gottfried Tappeiner, and Janette Walde. 2022. “Seasonality matters: simulating the impacts of climate change on winter tourism demand.” *Current Issues in Tourism*, 1–17. Accessed July 17, 2023. https://doi.org/10.1080/13683500.2022.2097861.

Stirnweis, Jan. 2010. “Wertschöpfung durch Bergbahnen im Winter in Österreich.” Accessed August 26, 2023. https://www.gw-unterricht.at/images/pdf/gwu_118_047_056_stirnweis_wertschoepfung.pdf.

Stoffels, Arno. 2019. “"Subventionierter Irrsinn": Kritik an bayerischen Seilbahn-Millionen.” *Nordbayern.de*, December 17, 2019. Accessed July 23, 2023. https://www.nordbayern.de/region/subventionierter-irrsinn-kritik-an-bayerischen-seilbahn-millionen-1.9643503.

Teich, Michaela, Cprina Lardelli, Bebi, David Gallati, Susanne Kytzia, Mandy Pohl, Marco Pütz, and Christian Rixen. 2007. “Klimawandel und Wintertourismus: Ökonomische und ökologische Auswirkungen von technischer Beschneiung.” Accessed July 22, 2023. https://www.seco.admin.ch/dam/seco/fr/dokumente/Standortfoerderung/Tourismus/Strategische%20Themen/Klimawandel/Klimawandel_Wintertourismus_WSL_2007.pdf.download.pdf/Klimawandel%20und%20Wintertourismus%20-%20%C3%96ko-logische%20und%20%C3%B6konomische%20Auswirkungen%20von%20tech-nischer%20Beschneiung.pdf.

Vanat, Laurent. 2021. “2021 International Report on Snow & Mountain Tourism: Overview of the key industry figures for ski resorts.” 13th ed. Unpublished manuscript, last modified August 20, 2023. https://www.vanat.ch/RM-world-report-2021.pdf.

Verband Deutscher Seilbahnen und Schlepplifte e.V. 2015. “Seilbahnen: Motor der Region.” Wirtschaftliche Effekte durch Seilbahnen in Deutschland. Accessed August 20, 2023. https://www.seilbahnen.de/wp-content/uploads/Wertsch%C3%B6pfung2015-Flyer_Web-5.pdf.

Wendelstein GmbH. 2021. “Die Wendelstein-Seilbahn.” Accessed September 03, 2023. https://www.wendelsteinbahn.de/die-wendelstein-seilbahn.

Wipf, Sonja, Christian Rixen, Markus Fischer, Bernhard Schmid, and Veronika Stoeckli. 2005. “Effects of ski piste preparation on alpine vegetation.” *Journal of Applied Ecology* 42 (2): 306–16. Accessed August 21, 2023. https://doi.org/10.1111/j.1365-2664.2005.01011.x.

Zemp, Michael, Wilfried Haeberli, Martin Hoelzle, and Frank Paul. 2006. “Alpine glaciers to disappear within decades?” *Geophys. Res. Lett.* 33 (13). Accessed August 05, 2023. https://doi.org/10.1029/2006GL026319.

“Zwanziger: „Schneekanonen aus der Förderung streichen, nicht nur verstecken!“.” 2023. News release. February 8, 2023. Accessed July 23, 2023. https://www.gruene-fraktion-bayern.de/themen/landesentwicklung-und-tourismus/2023/zwanziger-schneekanonen-aus-der-foerderung-streichen-nicht-nur-verstecken/?L=0.

Eidesstattliche Erklärung

Hiermit versichere ich, dass ich die vorliegende Arbeit bisher bei keiner anderen Prüfungsbehörde eingereicht, sie selbstständig verfasst und keine anderen als die angegebenen Quellen und Hilfsmittel benutzt sowie Zitate kenntlich gemacht habe.

Rosenheim, 22.09.2023

Ort, Datum

Eigenhändige Unterschrift

Anzahl der Zeichen: 78.969

Anzahl der Wörter: 12.208