Evaluation of Regional Ski Resorts in Austria from the Perspective of Specific Groups of Skiers

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Article

Evaluation of Regional Ski Resorts in Austria from the Perspective of Specific Groups of Skiers

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Abstract: This paper focuses on the data-driven evaluation of 40 regional ski resorts in Austria, employing the attractiveness index. Unlike similar studies, this research concentrates on smaller resorts essential for local economies. Input data acquired through meta-analysis offers insights into skier preferences, combining information from various sources, including volunteered geographic information (VGI). Employing a geographic information system (GIS), the study addresses pertinent questions regarding over-tourism, regional resort ratings, and spatial patterns, providing a foundation for sustainable development in alpine regions.

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Introduction

According to the report The Most Surprising Skiing Industry Statistics And Trends in 2023 (Castillo, 2023), there will be over 400 million skier visits worldwide. Ski tourism generates around $70 billion in revenue. The facts mentioned above emphasise the importance of ski tourism. This economic sector generates significant revenue and plays a crucial role in the jobs market, especially in marginal mountain regions (Dornier & Mauri, 2018; Moreno-Gené et al., 2018). Studies (Pechlaner & Tschurtschenthaler, 2003; Lasanta et al., 2007; Moreno-Gené et al., 2018) show an increasing number of workers in the tertiary sector in regions with ski resorts in comparison with the number of employees in the primary sector (including agriculture and forestry).

Austria is crucial in global ski tourism because the mountains cover 60% of Austria. Austria has a strong ski culture (Milman et al., 2017; Moreno-Gené et al., 2018). In 2019, approximately 1,520 ski lifts were operating in Austria (Castillo, 2023). There are hundreds of ski resorts. The respected Bergfex.com website offers 394 ski resorts throughout Austria. The article by Moreno-Gené et al. (2018) lists 254 resorts with an average of 51,7 million visitors per year. At Austrian ski resorts, 66% of skiers come from abroad (Moreno-Gené et al., 2018).

The aim of this paper is **a data-driven evaluation of 40 regional (smaller) ski resorts in Austria from the perspective of specific groups of skiers, such as families with children, advanced skiers (sporty skiers) and seniors**. The assessment primarily uses the attractiveness index (Cerba et al., 2021). The attractiveness index represents an implementation of statistical methods and data mining procedures on spatial data. The results will be visualised mainly through tables and thematic maps.

This study differs from other similar studies (see the chapter Literature review) in several details:

- The research focuses on regional ski resorts, essential in the local economy and landscape management.
- While the authors of similar publications collected input data through questionnaires and surveys, this study obtained input information on the target groups' preferences through meta-analysis - by evaluating, analysing and summarising the studies conducted.
- Input was obtained from several sources (e.g., ski resort websites, tourism data aggregation products) as well as data provided voluntarily by individuals (Volunteered geographic information, VGI).
- The data were processed and analysed using a geographic information system (GIS).

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The data-driven evaluation of regional ski resorts used in this study can help answer the following research questions related to alpine ski resort problems: over-tourism in popular ski resorts and depopulation of peripheral areas (see Materials and methods, case study section). The critical questions of this research are:

1. Do the results found in this study correspond to existing evaluations?
2. Are the regional resorts significantly worse rated than the best Austrian ski resorts?
3. Do the ratings of ski resorts differ for the different target groups?
4. Are resorts near major cities (e.g. Innsbruck or Salzburg) better rated?
5. Are resorts near large ski resorts (e.g. KitzSki or Ski Arlberg) less well-rated?
6. What are other spatial patterns regarding the ranking of regional ski resorts in Austria?

The answers (see chapters Results and Discussion) to the above questions should stimulate further development of Alpine ski resorts, their focus on specific target groups, and cooperation. Measures responding to this research will undeniably positively impact landscape and environmental protection and population development in endangered (peripheral, mountain and rural) areas.

Based on the results of our research, it will be possible to (a) identify problems and opportunities in local and regional tourism; (b) reduce over-tourism through effective destination management and marketing activities and thus reduce the environmental burden in large international ski resorts; (c) use the proposed methodology to replicate the study in another geographical area or for other target groups or forms of tourism.

The document is structured as follows. The introduction describes state-of-the-art and topical problems of ski resorts generally. After that, the part focused on existing research studies (Literature review) follows. The chapter Materials and Methods summarises the information about the research case study and methodology proposed for ski resort evaluation. The next part contains the results of the research (values of the index of attractiveness and maps visualising the attractiveness of particular resorts). The results are discussed in the section Discussion. The last part of the article (Conclusions) summarises findings and results.

Literature review

The study focused on evaluating regional ski resorts follows a detailed literature review of publications assessing ski resorts or the specifics of particular groups of skiers (e.g., women, university students, or expert skiers). This chapter will only briefly overview the expert sources and their focus. Individual articles and other publications will be described in more detail in the Materials and Methods chapter, especially in the sections devoted to describing the target groups and how ski resorts are evaluated.

Many articles and other publications in the literature focus on alpine skiing from the perspective of evaluating how different types of skiers choose ski resorts. Already in the 1970s, publications dealing with the characteristics of ski resorts (Kulka, 1975) or the characteristics of skiers (Leuschner & Herrington, 1971) were produced. Each author's research differs in the areas evaluated, the target groups included in this research, and the methods used to evaluate the data.

In terms of various geographical regions, we can find studies that treat the ski areas of Greece (Siomkos et al., 2006; Alexandris et al., 2007), Korea (Won & Hwang, 2009), Canada (Williams & Fidgeon, 2000; Joppe et al., 2013), selected parts of the USA (Leuschner & Herrington, 1971; Won et al., 2008; Mirehie & Gibson, 2020), Scandinavia (Steen Jacobsen et al., 2008) and alpine ski resorts (Hudson & Shephard, 1998).

Most of the studies work with specific groups of skiers, such as average skiers (Steen Jacobsen et al., 2008; Won et al., 2008), advanced skiers (Steen Jacobsen et al., 2008; Won et al., 2008), college skiers (Won et al., 2008; Won & Hwang, 2009), women (Mirehie & Gibson, 2020), skiers preferring overnight stays (Leuschner & Herrington, 1971; Won et al., 2008), and skiers focused on multi-day stays (Leuschner & Herrington, 1971; Won et al., 2008). Joppe et al. (2013) divide skiers into groups based on behavioural characteristics. Siomkos et al. (2006) work with target groups defined by gender, age, occupation, level of education or income.

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Data processing methods also vary from relatively simple preference ranking (Leuschner & Herrington, 1971) to complex Principal Component Analysis (PCA) with varimax rotation (Konu et al., 2011; Joppe et al., 2013), clustering (Konu et al., 2011) or conjoint analysis (Siomkos et al., 2006; Won et al., 2008). Hudson & Shephard (1998) use the Importance-Performance Analysis (IPA) method, which shows the relative importance of various attributes and the destination's performance.

Materials and Methods

This chapter is composed of two sections. The first part describes the case study (evaluating regional ski resorts in Austria). This text describes and justifies the limitations of this study, in particular, the limitations of the choice of target groups, geographical location and type of ski resorts. The second part discusses the general methodology used to evaluate the ski resorts.

Case study

As described in the introduction, the aim of the research is a data-driven evaluation of 40 regional (smaller) ski resorts in Austria from the perspective of specific target groups. First, the primary limitations of the research need to be justified. From a geographical perspective, the study focuses on Austria as one of the countries with a developed tourism industry focused on alpine skiing (a more detailed justification is given in the introduction of the paper).

Ski resort size perspective

The study evaluates ski resorts, which we refer to as regional. To select them, we use a normative perspective based on transport performance (Francois et al., 2014; Spandre et al., 2016; Berard-Chenu et al., 2021). Ski resorts are divided into the following groups based on ski-lift power data: small (S) - below 2500 persons km/h, medium (M) - between 2500 and 5000 persons km/h, large (L) - between 5000 and 15,000 persons km/h and very large (XL) - above 15,000 persons km/h. A similar classification based on vertical transportation feet per hour is also used by the National Ski Areas Association (Jacek et al., 2021). Since ski-lift power data is unavailable for Austrian ski resorts, we used a similar classification based on lift capacity (persons/h). We divided the resorts according to data from the web page ski-resort-stats.com into four groups (Table 1) similar to the above scale.

Table 1. Ski resort size based on lift capacity.

Ski resort size	Lift capacity
S (small)	<500
M (medium)	500-8000
L (large)	8000-57000
XL (extra large)	>57000

A total of 17 resorts in M categories were evaluated (S category resorts represent local resorts). The 23 smallest L resorts were added to make the data sample wider. Thus, 40 Austrian resorts of regional importance were processed (see Figure 1 and Annex A for a list of resorts).

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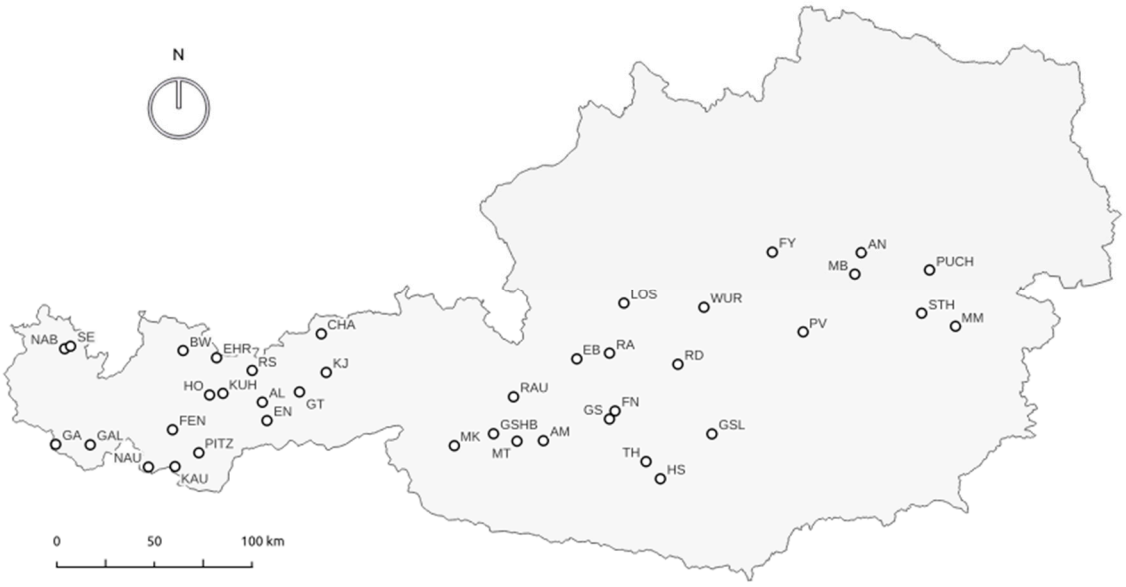

Figure 1. Map of studied ski resorts (acronyms are explained in Annex A).

Regional ski resorts are chosen for two main reasons: (1) environmental protection and (2) support of the local economy and rural life. Large international ski resorts suffer from a massive influx of visitors (called overtourism) (Pikkemaat et al., 2020). The consequences of overtourism (light and noise pollution, traffic emissions, erosion, and production of large amounts of waste) are critical for protecting nature and people's lives (Capocchi et al., 2019; Dodds & Butler, 2019). Therefore, there is pressure to move tourism to local (globally less important) centres. Promoting rural life and the related development of the local economy, including tourism (Clark & Chabrel, 2007), are effective measures to counteract the depopulation of rural areas, including the disappearance of local cultural specificities. According to Linchpin SEO Team (2023), "Consumers who become more aware of environmental issues demand environmentally friendly products". This trend interconnects both reasons mentioned above.

Target group perspective

The general evaluation of ski resorts is problematic because we cannot say there is a "universal skier". Segmentation of tourism participants can be implemented from several perspectives (Konu et al., 2011). We chose groups created based on demographics (e.g. age), psychographics (e.g. consumer lifestyles or personality criteria (Zografos & Allcroft, 2007)), and social factors (e.g. social roles). We select three socio-demographic groups that represent three significant categories of skiers. We select the target groups based on a priori segmentation. This type of segmentation "is applied when the variable used as a criterion is known in advance. Such criteria include gender, age or other pre-defined variable" (Konu et al., 2011). In our case, we will work with the following target groups (types of skiers): families with children, advanced skiers (sporty skiers) and seniors. Especially the first two categories are mentioned in the literature. For example, Fuller & Matzler (2008) mention Family and Sporty/life-conscious categories, which correspond to our target groups. Similar user segments are also treated in Baloglu & Uysal (1996), Park & Yoon (2009) and Matzler et al. (2004). We chose the senior category as a specific target group (Huber, 2019) due to the significant demographic trend of an ageing population.

Evaluation Methodology

The design of the process of data-driven evaluation of ski resorts follows the calculation of the general index of attractiveness (Cerba et al., 2021), Importance-Performance Analysis as published in

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Hudson & Shephard (1998) and the framework published in Formica (2000). According to Kulka (1975), this so-called site-variable approach uses skiers' spatial and environmental preferences and perceptions for evaluation. The following symbolic formula characterises the evaluation process: $A(T,R) = f(P(R),P(T))$where

- R - region (area)
- T - target group
- $P(R)$ - set of properties of the area R (external inputs according to Konu et al., (2011))
- $P(T)$ - set of properties, preferences, requirements and priorities of the target group T (individual constraints according to Konu et al., (2011))
- $A(T,R)$ - the attractiveness of territory R focused on the target group T

The following flowchart (Figure 2) shows the complete evaluation process, including its relation to the previous formula. White nodes represent the state at the beginning or end of each process. Yellow nodes are sub-processes, which are described below.

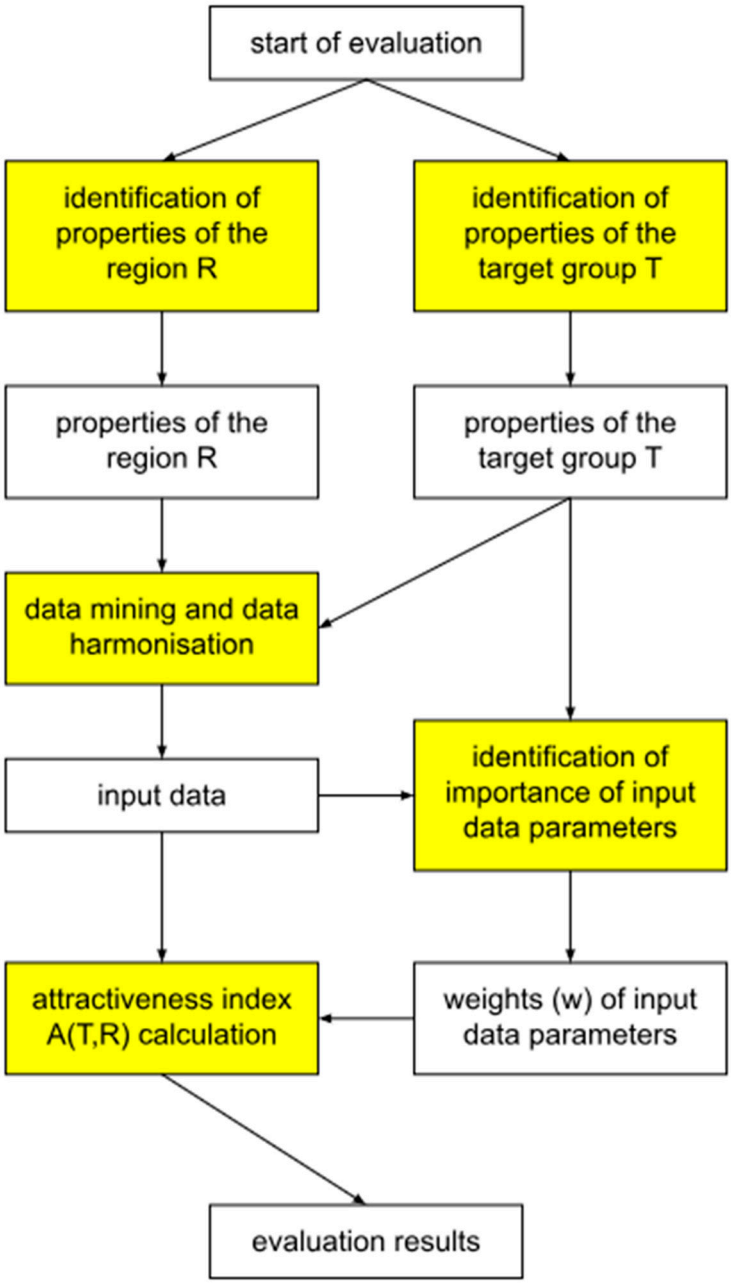

Figure 2. Evaluation process workflow.

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Territory properties $P(R)$ are determined by selecting geographic objects that will be processed in the territory assessment. These properties influence the research mainly in data mining (data availability, data sources for individual ski centres). In the case of this research, there are 40 Austrian ski resorts (see Appendix A) that have a regional character. The reason for focusing the study on Austrian regional resorts is described in the Introduction section. The Materials and Methods chapter explains the data sample selection method (section Case study - Ski resort size perspective). The map in Figure 1 shows the geographical localisation of the resorts. Based on an evaluation of the literature (Leuschner & Herrington, 1971; Kulka, 1975; Hudson & Shephard, 1998; Siomkos et al., 2006; Steen Jacobsen et al., 2008; Won et al., 2008; Won & Hwang, 2009; Joppe et al., 2013; Mirehie & Gibson, 2020), **identification of suitable properties** $P(R)$ of the area R was carried out. Fifteen characteristics describing ski resorts were selected (Table 2) to evaluate ski resorts within this research. Initially, there were sixteen properties, but eco-responsibility data is unavailable. Data were primarily collected from each resort's website. If a resort did not provide the required information, a suitable source was used, such as Bergfex.com, ski-resort-stats.com or OpenStreetMap.

Table 2. Overview of data and data resources for modelling ski resort properties.

Ski resort property	Data describing property	Data source
Amenities	Number of restaurants, bars, pubs and ski huts in the resort	Bergfex.com
Crowding	Capacity of lifts, chairlifts, cable cars and similar facilities	resort web pages, ski-resorts-stats.info
Difficult slopes	Length of black slopes	resort web pages, Bergfex.com
Discount	Discounts for families or seniors	resort web pages
Length of slopes	Total length of all slopes in the resort	resort web pages, Bergfex.com
Lift quality	The ratio of the number of chairlifts, cable cars and similar facilities to the number of lifts	resort web pages, Bergfex.com
Resort quality	Resort rating on the Bergfex website	Bergfex.com
Sightseeing	The number of galleries, museums and other sights within 10 km of the resort	OpenStreetMap
Ski pass price	Offline ski pass prices in the main season	resort web pages
Slopes for beginners	Length of blue slopes	resort web pages, Bergfex.com
Snow conditions	The average altitude of the resort	resort web pages, Bergfex.com
Snowparks and similar facilities	The existence of a snowpark or similar facility	resort web pages, Bergfex.com
Surroundings resorts	The number of ski resorts within 10 km of the resort	OpenStreetMap
Terrain	Difference between the maximum and minimum altitude of the resort	resort web pages, Bergfex.com
Variety of slopes	The standard deviation of the length of the different types of slopes	resort web pages, Bergfex.com

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Knowledge of the target group's needs is essential for an effective and fair evaluation. In this research, **identifying the characteristics of the target group** $P(T)$ consists of finding the priorities, requirements and preferences that the selected target groups (T_{FAM} - families with children, T_{ADV} - advanced skiers and T_{SEN} - seniors) have associated with the choice of ski resort. Information about the target groups will determine the selection of input data, but most importantly, the determination of weights (importance) for calculating the resort ranking. This information can be obtained from technical articles, popular science articles, our own experience, and various rankings or artificial intelligence. Most existing research (Hudson & Shephard, 1998; Siomkos et al., 2006; and Mirehie & Gibson, 2020) perform this step using a survey or questionnaire. In this research, the authors decided to analyse nine existing studies related to alpine skiing that were conducted between 1971 and 2020 ((Leuschner & Herrington, 1971; Kulka, 1975; Hudson & Shephard, 1998; Siomkos et al., 2006; Steen Jacobsen et al., 2008; Won et al., 2008; Won & Hwang, 2009; Joppe et al., 2013; Mirehie & Gibson, 2020). Based on this research, Table 2 was created, listing the 15 needs of each group (in terms of desired characteristics of ski resorts). Since the requirements of the target groups are used to evaluate a large number of ski resorts, this information must be available for all evaluated locations. Another condition for including the attribute in the list was the possibility to model the required attribute using the available data. Therefore, any user requests that could be described as subjective (e.g. distance of the resort from the place of residence, scenery or information regarding the cost of ski equipment or behaviour on the slopes) were excluded. Subsequently, an attribute was assigned to a model record with high semantic similarity or congruence. The list of required attributes of ski resorts is the same for all target groups. The weights of each attribute define the specific requirements of each target group.

The first step in this study's **data mining and harmonisation** phase is to find appropriate data to model the characteristics of ski resorts that the target groups desire. Table 2 provides an overview of the features, datasets and sources from where the data was collected. The data was collected in the second half of November 2023. QGIS software was used to process the spatial data. The data harmonisation was based on the 5-step harmonisation framework (Janecka et al., 2013). The primary operations of data harmonisation were filtering (selection) and normalisation of the obtained values (min-max normalisation). The following list shows selected data mining and harmonisation issues:

- Eco-responsibility - this ski resort attribute had to be dropped from the list of attributes due to a lack of suitable data. Eco-responsibility has a minimal influence on the decision-making of each target group. It ranks 12-13th out of 16 items in the ranking of considered ski resort attributes.
- Ski pass prices - ski pass prices refer to the 2023/24 ski season. For the resort evaluation, we worked with two-day (weekend) ski passes purchased at the ticket office during the high season, as it is impossible to trace target group preferences in the literature regarding the length of ski stay or how ski passes are purchased. Prices for sport skiers refer to one adult. For a senior citizen, it is either a specific ski pass for seniors or an adult ski pass. The amount for a family was obtained by adding the prices of ski passes for two adults and two children or a family ski pass (family package) with an equivalent number of people.
- Discounts - discounts were calculated on the difference between the price of a regular adult ski pass and a senior ski pass. In the case of families, this was the difference in price for a ski pass for four adults and a family as above. Sport skiers were not included in the discount as there are no specific discounts for this target group.
- Five rated ski resorts were also changed from the original list in the data mining and harmonisation phase. The reasons for replacing were missing data, resort closure in winter 2023/24 or the inclusion of a larger resort.

From the same sources as the list of requirements, the research authors then **identified and derived weights for each ski resort characteristic** for families - w_{FAM}, sport skiers - w_{ADV}, and seniors - w_{SEN} (Table 3). The overall relative weights were generated by averaging the importance of each attribute across the studies. This importance was expressed in three primary ways: ranking (e.g., Leuschner & Herrington, 1971), scoring, or percentage (e.g., Hudson & Shephard, 1998; Joppe et al.,

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2013; Mirehie & Gibson, 2020), or only a list of attributes was available without specifying importance (e.g., Kulka, 1975). With no ranking, all attributes were given an average weight. Individual values were normalised (min-max normalisation) before calculating overall weights for the sub-target groups.

Table 3. Properties of ski resort (ordered by importance for families).

Ski resort property	w_{FAM}	w_{ADV}	w_{SEN}
Resort quality	0,94	0,91	0,88
Ski pass price	0,90	0,92	0,82
Snow conditions	0,86	0,88	1,00
Crowding	0,78	0,81	0,93
Variety of slopes	0,74	0,76	0,64
Amenities	0,49	0,62	0,66
Terrain	0,45	0,49	0,35
Length of slopes	0,33	0,36	0,40
Lift quality	0,30	0,34	0,39
Discount	0,18	0,17	0,20
Slopes for beginners	0,14	0,09	0,18
Difficult slopes	0,10	0,15	0,10
Sightseeing	0,06	0,06	0,07
Snowparks and similar facilities	0,06	0,06	0,07
Surrounding resorts	0,06	0,06	0,07

The data-driven assessment of ski resorts was conducted using the attractiveness index (Cerba et al., 2021). Similar approaches are applied in other research, such as Zhang (2009) or Huang et al. (2020). For each target group, based on the characteristics of this group $P(T)$, a vector quantifying the importance of each parameter w_T (Table 3) was created to represent the preferences of each target group when choosing a ski resort. Suppose a given target group does not consider a particular feature in the selection process. In that case, a value 0 is inserted into the vector (for example, in the case of the perception of a senior discount by a group of advanced skiers). The importance vector (weights) is multiplied by the vector $P(R)$, which contains the quantified characteristics of each ski resort. The **attraction index is calculated** as the dot product of the normalised data vectors - $A(T,R) = w_T \cdot P(R)$.

Results

The results of evaluating local and regional ski resorts in Austria are shown in Table 4, which presents the five most and five least attractive resorts for each target group. The complete results are in Appendices B, C and D, which contain the attractiveness index values for each resort and target group.

Table 4. Ski resorts evaluation results.

	Family	Advanced skier	Senior
1.	Nauders	Nauders	Nauders
2.	Kühtai	Kühtai	Kühtai
3.	Kaunertal	Kaunertal	Mölltal
4.	Pitztal	Pitztal	Kaunertal
5.	Hochoetz-Oetz	Galtür	Galtür
…			
36.	Glungezer-Tulfes	Eben	Eben
37.	Grebenzen	Grebenzen	Annaberg
38.	Annaberg	Forsteralm	Grebenzen

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39.	Forsteralm	Annaberg	Forsteralm
40.	Mönichkirchen	Mönichkirchen	Mönichkirchen

The data visualisations (map cuts) in Figure 3 show the distribution of centres in space and their rankings. The individual resorts are expressed using coloured circles, where red represents strongly unattractive resorts, orange represents unattractive resorts, yellow resorts are neutrally rated, and light green represents rather attractive resorts. Dark green represents beautiful resorts for a given target group. The resorts are sorted into groups using the equal intervals method. The complete maps are published in Appendices E, F and G. The following spatial patterns are evident from the maps in Figure 3 (in response to question 6 formulated in the Introduction chapter):

- The spatial patterns for the three groups of skiers studied are very similar.
- Resorts that stand alone (are more isolated) generally have worse ratings.
- Positively rated resorts are found in two areas: on the border of Tyrol and Vorarlberg and the border of Salzburg, East Tyrol, and partly Carinthia.
- There are two areas with poor evaluation results for all target groups studied: resorts in the eastern part of the Alps and resorts along the A12 motorway (Kufstein - Innsbruck).

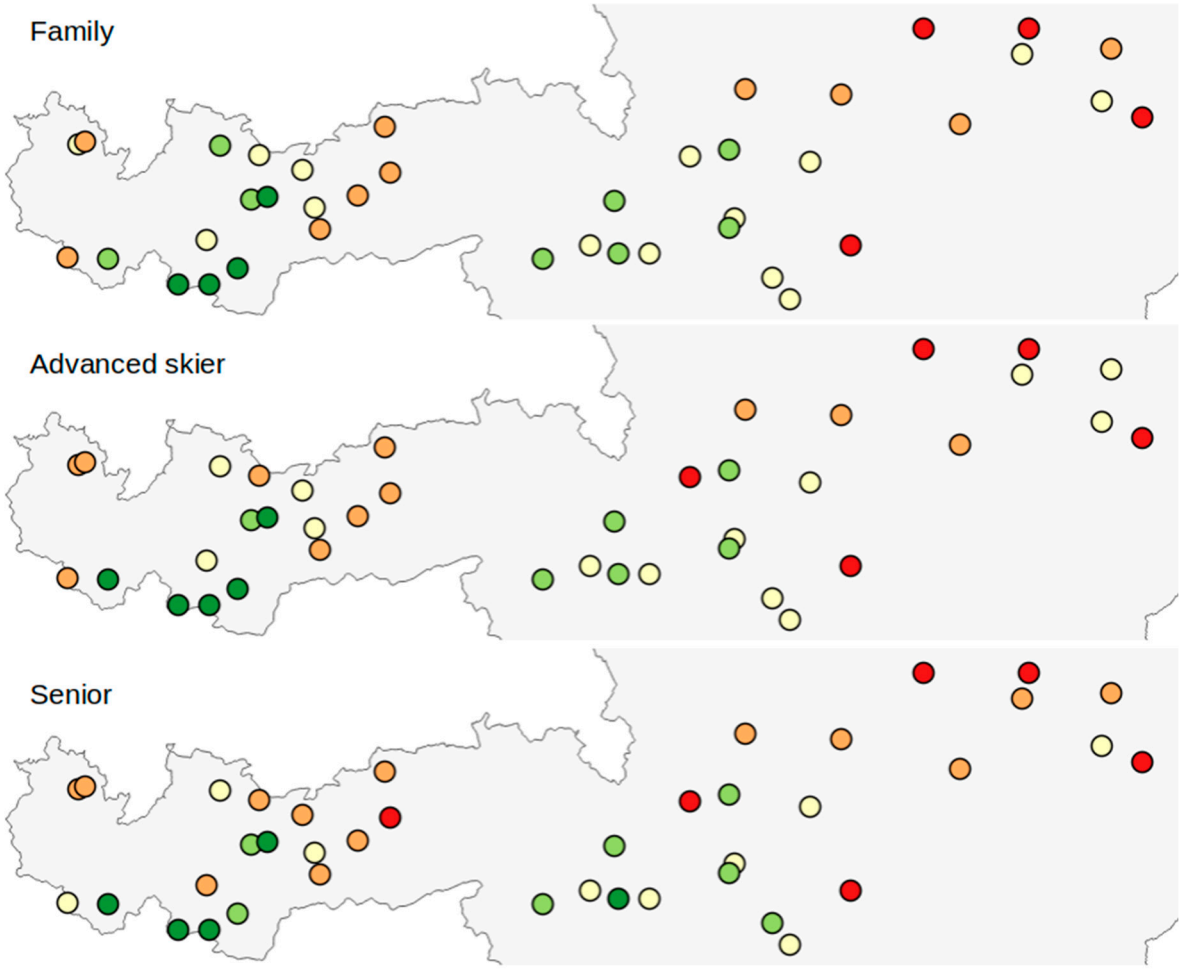

Figure 3. Regional ski resorts in Austria and their ratings.

Discussion

The introduction mentions six research questions to which this research should provide answers. The following paragraphs interpret the results published in the previous section of the paper in the context of each research question.

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Ad1. The results were compared with existing popularity rankings for target groups published on skiresort.info. In ranking the attractiveness of a ski resort for families, 52 Austrian resorts are in the first place. According to the information published on skiresort.info, the ranking is mainly limited to infrastructure for families, especially for children (playgrounds, ski parks, resort mascots, etc.). In the 52 best resorts group, 11 resorts are studied in this research (the other 41 resorts belong to the L and XL categories). If we divide the results of our evaluation (see table in Annex B) into quartiles, the highest ranking for families in the ranking skiresort.info is given to 5 resorts from the first quartile (Nuaders, Matrei-Kals, Hochoetz-Oetz, Galtür and Ramsau), four resorts from the second quartile, one resort from the third quartile and one ski centre from the fourth quartile. The website skiresort.info also offers a similar ranking for sports skiers. In the group of 22 ski resorts in the first place, four resorts from our research appear - Kaunertal (ranked in this study as the third best resort for sports skiers), Matrei (8), Axamer (14), and Grossglockner (22). The resorts that ranked first and second in this research regarding sports skiing (Nauders, Kühtai) are in the second-best group in the ranking skiresort.info. A suitable benchmark for the senior group could not be found. The lack of suitable sources for benchmarking (especially data for small and medium resorts) shows the uniqueness of the research conducted.

Ad2. The five largest Austrian ski areas (Ski Welt, Ski Arlberg, Skicircus, Kitzski and Zillertal Arena) were selected for comparison. The criteria described in Materials and Methods - Case study - Ski resort size perspective were used. The hypothesis that these globally known resorts would be better rated than regional resorts was confirmed in 4 out of 5 cases. The exception was Ski Welt, which ranked 10th, 18th and 12th in each category. This is mainly due to the limited infrastructure level, the small number of slopes for inexperienced skiers and the low altitude. The differences between the least attractive large resorts and the top regional centres were minimal (units of percentage points).

Ad3. The resorts' ranking from the perspective of the different target groups was compared by comparing quartile borders of normalised values (from 0 to 100) of the attractiveness index (Table 5).

Table 5, as well as the summary tables in Appendices (B, C and D), the maps in Figure 3 and Appendices E, F and G show that the centres preferred by each target group show a high degree of similarity in terms of ranking, descriptive statistics and geographical distribution. The most specific ski resorts include Eben, Niedere-Andelsbuch-Bezau (especially suitable for families with children), Großglockner/Heiligenblut, and Gargellen (most suitable for seniors).

Table 5. Quartiles of ski resort rating results.

Quartile borders	Family	Advanced skier	Senior
First	33	30	27
Second	49	47	46
Third	66	63	61

Ad4. Figure 3 and Appendices E, F and G show that resorts near big cities do not show higher attractiveness than other resorts. The original assumption was based on the assumption of minimising commuting distance. The author expected that metropolitan areas generating many skiers would have many quality smaller ski resorts nearby to appease skiers preferring to commute during weekends.

Ad5. The original assumption was based on minimising competition, i.e. there should be fewer ski resorts of regional importance around major ski areas (e.g. KitzSki or Ski Arlberg), but they should be better quality (more attractive) places. The research findings show that the presence of L and especially XL-size ski resorts positively impacts the quality of smaller resorts but does not negatively impact their frequency. It shows that regional and local ski resorts successfully function as an alternative to large ski centres.

Ad6. Comments on this issue are provided in the Results section.

The research on the attractiveness of ski resorts presented in this paper will be further refined and deepened. The following steps will be directed towards the processing of new input data and information (e.g., adding behavioural and geographical factors for individual target groups or

modelling resort characteristics using more input data), evaluation of input data quality, formal semantic analysis of input information, optimisation of the computational model, use of machine learning and artificial intelligence technologies and principles, evaluation of changes over time (including comparison of different types of seasons) or cartographic presentation of attractiveness assessment results (including visualisation of clusters). Finally, similar studies will be conducted for other locations and target groups.

Conclusions

The aim of this paper is a data-driven evaluation of 40 regional ski resorts in Austria from the perspective of specific groups of skiers, such as families with children, advanced skiers (sporty skiers) and seniors. The selection of the characteristics of ski resorts and their importance was carried out as a meta-study, where publications focused on evaluating ski centres and areas were compiled. A total of 15 parameters relating to ski pass prices, infrastructure, or conditions for alpine skiing were used. The result is three attractiveness index values for each ski resort studied, which reflect attractiveness from the target's perspective as mentioned earlier groups. The results are presented using tables (Table 4 and Appendices B, C and D) and thematic maps (Figure 3 and Appendices E, F and G). The paper aims to determine if smaller and medium-sized resorts are suitable for specific types of skiers, which, among other things, could be used in travel management and marketing activities. The evaluation of individual resorts shows gaps and opportunities in regional tourism and will contribute to a more even distribution of tourism. The developed methodology (see chapter Materials and Methods, section Evaluation methodology) is transferable to evaluating other areas and treating other target groups.

A total of 6 research questions were asked in the introduction and answered in the Results and Discussion sections based on the data and information collected. The questions were formulated concerning the case study described in this paper to cover the problems addressed in the Austrian Alps region (over-tourism in popular tourism centres connected to environmental risks and economic and demographic difficulties of marginal peripheral areas). The results show the importance and potential of regional ski centres. These can work in symbiosis with large XL-sized resorts and offer complementary services. As the authors Moreno-Gené et al. (2018) point out, smaller resorts are more vulnerable to economic shocks, but on the other hand, small businesses are more innovative. Sharing some capacities (including know-how, ski passes and some technologies) seems to be an effective solution for small resorts.

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