The Sustainable Tourism Observatory of South Tyrol (STOST)

Annual Progress Report – 2022 edition

eurac research

UNWTO INSTO World Tourism Organization International Network of Sustainable Tourism Observatories

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Foreword

After two pandemic years, the tourism sector has finally started its recovery. In this phase, sustainable tourism observatories are transforming their role again, turning into instruments to monitor the resilience of the tourism sector and the permanent transformation driven by crises such as climate, demographic or economic crises, and especially driven by the Covid-19 crisis. Questions to be answered in this phase relate to the correlation between demand recovery and job (re)creation, but they also refer to local acceptance towards tourism and destination competitiveness after a critical phase. In this transformative scenario, observatories were putting sustainability at the top of the recovery agenda, following the claim #buildbackbetter of the UNWTO.

The Italian Autonomous Province of Bozen/Bolzano (South Tyrol) understood the pandemic as an opportunity to reshape the tourism culture and to check if the development principles used so far fit the expectations of the local population. More than ever, local inhabitants' voices have become an important factor in the discussion and definition surrounding maximum growth limits of tourism. Both regional and local surveys were organized with local partners to investigate their expectations. Further, the local government – after a long planning and political negotiation process – was able to establish a moratorium for tourism accommodation facilities. This means a substantial reduction of developmental speed and slowdown of quantitative growth as an important additional parameter for sustainable development in South Tyrol. Setting limits to growth and identifying 2019 as the peak year was an important milestone for local tourism and at the same time it was a good marketing tool to promote sustainable tourism in the region. STOST provided the most important insights in the planning of this political decision, using its indicators, as well as their historical development as a compass to guide decision making processes. The usefulness of monitoring procedures was evident for local decision makers and local stakeholders, who expressed their willingness and commitment to further expand on monitoring activities. In the near future we expect a need to measure specific processes of transformation, with special consideration of participatory approaches.

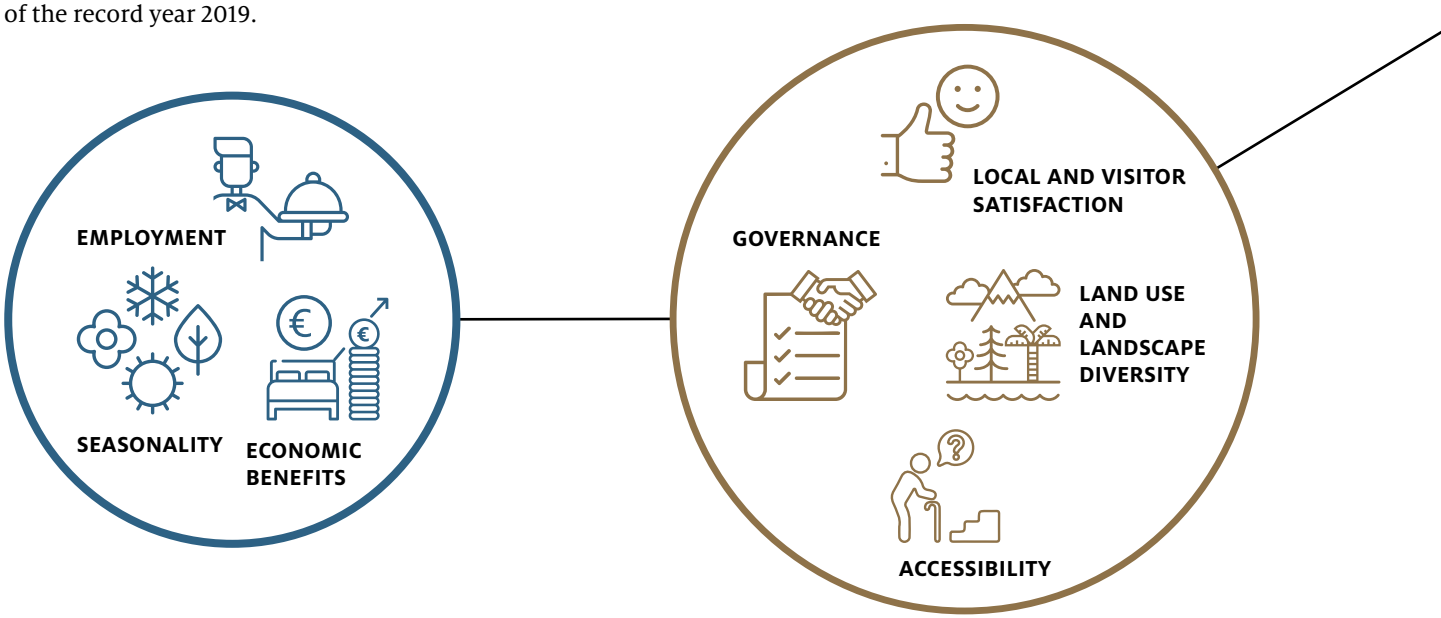
New horizons are expanding for the future of tourism and evidence-based decision making will pave the way.

Harald Pechlaner – Head, Center for Advanced Studies, Eurac Research

Executive Summary

Sustainable tourism "takes full account of its current and future economic, social and environmental impacts, addressing the needs of visitors, the industry, the environment and host communities" (UNEP & UNWTO, 2005). STOST – the Sustainable Tourism Observatory of South Tyrol - monitors, evaluates, and communicates tourism developments in the Autonomous Province of Bolzano/Bozen (Italy). It examines social, ecological and economic benefits and costs of tourism for South Tyrol and provides recommendations and guidelines for policy makers to support sustainable tourism management.

In 2021, 5.4 million tourist arrivals and 23.8 million overnight stays were registered in South Tyrol. This implies an increase of 16.1% in arrivals and of 9.4% in stays compared to 2020. Yet, the numbers were still significantly below those of 2019 (-30.3% for arrivals and -29.4% for overnight stays). This is due to the negative effects of the Covid-19 pandemic, which still has a strong impact on the tourism industry – in particular between January and April 2021, where virtually no tourists visited South Tyrol. At the same time, however, between July and October 2021, both arrivals and overnight stays were able to fully recover, reaching new monthly all-time highs that exceeded those of the record year 2019.



1 Seasonality

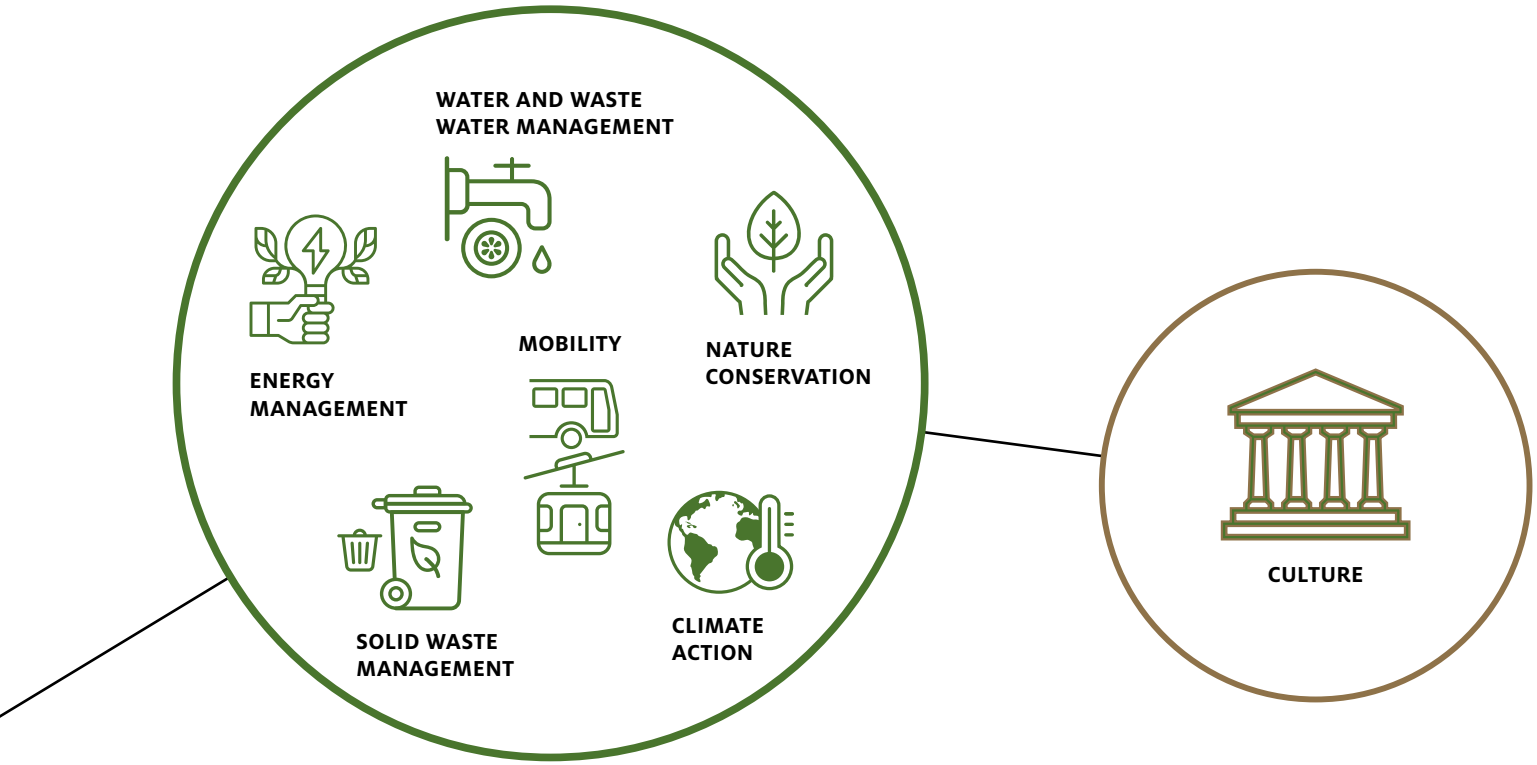
Prior to the Covid-19 pandemic, tourist arrivals in South Tyrol followed a clear seasonal pattern which had remained relatively stable over the last 10 years. It was characterized by two high seasons, one in the summer and one in the winter. Yet, due to the travelling restrictions put in place in 2020 and 2021, this pattern has changed: while, in 2021, in some months almost no guests arrived in South Tyrol (between January and March), in other months (between July and October) new monthly record numbers were achieved. This has obviously increased the seasonality, with monthly and weekly peaks in almost all municipalities being registered in August. In total, more than a quarter (26.9%) of all overnight stays in 2021 were registered in August (compared to an average of 18.0% in the 10-year-period prior to the pandemic).

2 Employment

Between 2017 and 2019 employees in the accommodation and food service sector made up 13.7% of total employment in South Tyrol. As the tourism industry was one of the most affected by the Covid-19 pandemic, also the employment numbers diminished considerably to an average of 11.1%, even though a slight recovery can be observed within the second half of 2021.

3 Economic benefits

In terms of value added, the accommodation and food service sector provides a substantial share of the overall GDP (11.4% in 2019). Including induced and indirect effects, tourism contributes even more to the overall economy. The contribution of tourism to South Tyrolean GVA (Gross Value Added) has been rather constant over the last two



decades. Although GVA data for 2020 and 2021 are not yet available, it is to be expected that, after a decrease in 2020, the industry will have partly recovered in 2021.

4 Governance

In 2021, the number of certified municipalities has slightly increased. This recovery compensates the negative trend registered in 2020 due to the effects of the Covid-19 pandemic. The number of certified accommodation facilities has remained quite stable and represents 0,76 % of the total accommodations available in South Tyrol, while the demands for local products ("Red Rooster") and the share of organic milk sold to accommodation facilities have slightly risen.

5 Local and visitor satisfaction

The Covid-19 pandemic has caused the trend of a rising tourism intensity to stop, leading to a fall from 17.3 (2019) to 12.2 (2021) average daily overnight stays per 100 inhabitants in South Tyrol (-29.8%). Minimum rent prices in town centers in touristic municipalities are 3.04 € per square meter higher than for comparable rents in non-touristic municipalities. The overall level of satisfaction of tourists with their holiday in the destination is extremely high (99%), even in the pandemic year. Surveys with local inhabitants have been conducted in 2021 to evaluate the degree of local satisfaction. The results thereof will be presented in next year's report.

6 Energy management

According to our estimation, in 2021, at least 197.1 GWh of electrical energy were consumed in accommodation facilities. This is still 29.0% less than prior to the pandemic, reflecting the negative trend in tourism intensity. Adding up the values for electricity consumption in accommodation facilities (277.7 GWh) and of cable cars and snow cannons (127.1 GWh) for the year 2019 – the last year when data for both are available – shows that around 12.7% of electricity consumption in South Tyrol can be directly linked to the tourism industry – keeping in mind, however, that also locals use cable cars and ski slopes.

7 Water management & 8 Waste water management

Tourism activities are directly and indirectly linked to water consumption. In the last two decades, the estimated minimum water usage in accommodation facilities has continued to increase, reaching a maximum value of 7.7 million cubic meters in 2019. Followed by a steep decline in 2020 attributable to the Covid-19 pandemic, the general increase in overnight stays in South Tyrol in 2021 has caused the estimated minimum water consumption in accommodation facilities to rise again. Water used for artificial snow production has also increased steadily over the last decades. During the winter season 2020/2021, the pandemic caused the water used by snow canons to decline by roughly 25.9% with respect to the water consumed during the pre-pandemic winter ski season of 2018/2019. Used fresh water also needs to be treated. Currently however, there are no available data to accurately measure how much waste water is attributable to tourism.

9 Solid waste management

Tourism generates a considerable amount of waste in the destination. As it is difficult to directly observe waste production, we estimate it for accommodation facilities based on existing parameters and using overnight stays. Overall, an estimated 47,081 tonnes of waste were generated in accommodation facilities in 2021. Although waste generation in accommodation establishments has thus decreased by 29.2% compared to the pre-pandemic year of 2019, an upward trend can be observed from 2020 to 2021, exemplified by the percentage increase of 9.4% in waste generation in accommodation facilities.

10 Mobility

In contrast to 2020, when visitors' mobility was heavily restricted by the pandemic, in 2021 guests could move (more or less) freely around the destination. Now, with almost no restrictions left, transport behaviour looks similar to pre-pandemic habits again, with only few exceptions. The 916,618 activated mobilcards in 2021 represent the lowest value since 2015. However, the number of uses of these cards rose again to over 4 million. In the winter of 2019, the closure of lifts had led to a drop of 12.1% in uses compared to the previous year. In the summer of the same year, the number of uses increased to an all-time high of almost 11 million. Also, electric mobility continued to gain importance: in 2021, 384 locations for loading stations for e-mobility were counted, 207 being in hotels and 177 in public spaces.

11 Land use and landscape diversity

South Tyrol has little more than 5% of area of permanent settlement. Given these spatial constraints, the allocation of new accommodation facilities, beds or tourist facilities should be carefully thought out and soil consumption should possibly be minimized. In the period from 2013 to 2021, the areas for tourist facilities have increased in 83 of the 116 municipalities of South Tyrol, while only 15 municipalities have not yet designated areas for tourist facilities. Overall, 41.6% of beds are located in residential areas (areas A, B, C), 36.8% in agricultural areas, 11.9% in areas for tourist facilities and 9.7% in other land use zones. The spread of accommodation facilities in rural environments and outside residential areas might represent a problem in the long run, as it is related to a sub-optimal use of land.

12 Nature conservation

The extent to which natural areas are protected and where potential impacts of tourism can be expected can be shown by a cartographic overlap of protected areas and tourist facilities by number of beds. The proximity of communities with intensive tourism to protected areas highlights the importance of managing tourism flows to prevent overloading and potential damage to these ecosystems, especially around the city of Meran/Merano and in the Dolomites.

13 Culture

The relation between tourism and culture is mostly perceived as harmonious and mutually beneficial when considering the traditional practice of transhumance (qualitative case study with stakeholders from agriculture, culture and tourism in 2020). Nevertheless, possible negative effects of increasing visitor numbers can be countered by a so-called code of conduct. Another aspect of the interface between tourism and culture concerns museums, which are an essential part of the tourism sector in South Tyrol and despite the sharp decline in visitor numbers due to the Covid-19 pandemic, there is nevertheless a trend towards the use of combined tourism products such as the areas of mobility and museum admissions. 1,417,557 museum visitors (66.0% of all visitors) in 2019 and 517,670 visitors (78.9% of all visitors) in 2020 were tourists.

14 Climate Action

As the transport sector constitutes the largest emitter of CO_2 emissions in South Tyrol, in this first year of this new issue area we wanted to provide a solid and up-to-date estimation of transport-related touristic emissions. In 2021, car-related CO_2 emissions attributable to inbound tourism in South Tyrol amounted to 68.9 kilotonnes CO_2 equivalents. This equals 5.7% of all traffic-related emissions produced in South Tyrol in that year. While touristic car-related emissions rose by almost 40% between 2010 and 2019, they fell again between 2019 and 2021 (-32.7%). In order to reduce touristic car-related emissions in the long term, various measures are necessary, the most important of which is the promotion of alternatives to individualised, fossil-fuel-based traffic (e.g., public transport, e-mobility), both for the arrival/departure of guests and their movement within the destination.

15 Accessibility

Globally, around 15% of the population has either temporary or permanent disabilities (WHO, 2022). Yet, having equal access to all parts of life, thus also to travelling, is a fundamental human right (Ibid.). Over the last decades, the tourism sector has started to adapt to the needs of people with disabilities (PwD) in order to ensure inclusive travel experiences. In South Tyrol, in 2021 362 accommodation facilities and 170 gastronomy facilities were labeled accessible by the local social association *independent L*. Furthermore, guests have access to 244 barrier free cultural facilities and free time activities (including museums, sports venues, pools etc.) as labelled by *independent L*.

South Tyrol in brief

South Tyrol is an Italian Autonomous Province and constitutes, together with the Autonomous Province of Trento, the region Trentino-South Tyrol, located in the northern part of the Italian Alps and bordering with Austria and Switzerland. The province has an area of 7,400 square kilometres and a total population of over 530,000. Its capital is the city of Bozen/Bolzano, with about 100,000 inhabitants, but it also has a few other small towns with more than 20,000 inhabitants (Meran/ Merano, Brixen/Bressanone and Bruneck/Brunico).

South Tyrol is officially a trilingual region, with German, Italian and Ladin speakers and three official languages. The statute of autonomy came into force in 1972 and contains concrete measures to protect the German- and Ladin-speaking minorities, such as German and Ladin schools, minority-language radio and television broadcasts and administrative and law-making rights.

The territorial morphology is characterized by mountains and valleys. South Tyrol is known for its mountain areas and natural landscapes covering approximately 90% of the territory. One fourth of the South Tyrolean surface consists of protected areas (Morello & Oggiano, 2015). This includes those protected areas, which form part of the core of the renowned Dolomites natural heritage site, declared a UNESCO World Natural Heritage (WHS) site in 2009 for its value in landscape aesthetics and its geologic and geomorphologic importance in science.

THE ROLE OF TOURISM IN SOUTH TYROL'S ECONOMY

Tourism plays a major role for South Tyrol's economy, contributing to 11.4% of the local GDP in 2019 with direct effects only (ISTAT, 2022). In the same year, more than 7.7 million tourist arrivals and 33.7 million overnight stays were registered in South Tyrol (see **Figure 1**). Compared to 2000, this implies an increase of 87.3% in arrivals and 42.4% in overnight stays. This massive growth over the last 20 years came to an abrupt halt in 2020, when travelling restrictions were put in place as a reaction to the Covid-19 pandemic. Consequently, the numbers fell dramatically to 4.6 million arrivals (-40.0%) and 21.7 million stays (-35.5%), levels similar to those of 20 years ago. Also, the year 2021 was shaped by restrictions leading to virtually no tourism activity between January and April. However, between July and October 2021, both arrivals and overnight stays were able to fully recover, reaching new monthly record levels that exceeded those of the record year 2019. Under the condition that in the upcoming winter months of 2022/2023 the pandemic will be largely under control in Europe, it is possible that a full recovery to pre-pandemic levels of tourism activity could be achieved. If so, and given the pressures the tourism industry puts on social and natural resources, an emerging challenge for sustainable tourism management in South Tyrol could be to keep growth rates within reasonable limits, or even to refrain from pursuing further quantitative growth entirely, while redistributing the existing demand both geographically and between seasons (see **1 Tourism seasonality**). Indeed, to keep control of the rising numbers in the tourism economy, there has been an initiative to introduce a *moratorium* to limit the number of new beds built for tourism purposes in the next years. The imposition of this limit to growth is currently being discussed by the tourism stakeholders and the provincial government.

The average length of stay of guests in South Tyrol, which had been steadily decreasing between 2000 and 2019 (from 5.7 to 4.4 days), rose in 2020 (4.7 days) and returned to pre-pandemic levels (4.4 days) in 2021. This might be explained by the fact that in 2020, the bulk of tourism activity

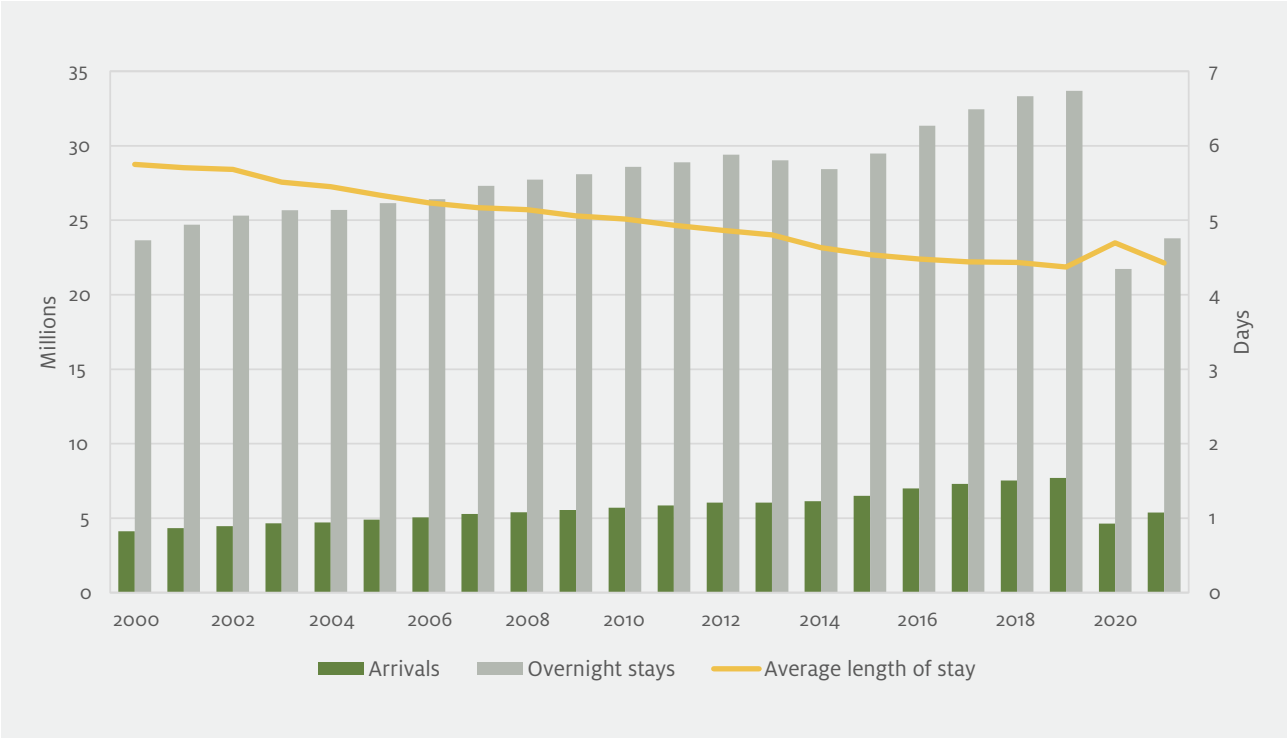


Figure 1: Tourist arrivals and overnight stays (left scale) and average length of stay (right scale) in all accommodation facilities, South Tyrol 2000-2021. Yearly data in millions. Source: ASTAT, own elaboration.

was concentrated in the summer months, when guest usually stay longer than in the winter months. In addition, almost all winter guests visited the destination in January or February, while in 2021 most winter guests arrived in December, when stays are typically shorter than in January and February.

The number of hotels and similar accommodation facilities has decreased over the last two decades, from 4,521 in 2000 to 3,940 in 2021 (-12.8%). By contrast, the number of beds available in these facilities rose by 1.5% over the same period (from 149,705 to 151,963), implying an increasing average bed capacity per accommodation (from 33.1 to 38.6), i.e. bigger facilities. Among other things, this trend might be connected to a shift in the quality of accommodation facilities. Indeed, as displayed in **Figure 2**, we can observe a continuous reduction of 1- and 2-star hotels (-59.8%) and a rise in 3-star (+24.8%) as well as 4- and 5-star hotels (+149.1%).

The number of other accommodation services, such as campsites, private accommodations and agritourism ventures, when compared to hotels and similar establishments, have experienced an opposite trend, increasing from 5,521 in 2000 to 6,770 in 2020 (+22.6%). Similarly, the number of beds in other accommodation services has increased by 18.36% (from 65,274 to 77,261). These numbers highlight the rising importance of such services outside of traditional hotel structures. As of 2021, they make up 63.2% of all accommodation facilities and provide 33.7% of all beds, with an upward trend.

The tourism hospitality sector is spread over all South Tyrolean valleys, with a particularly high concentration of beds in the South-Eastern part of the province (see **Figure 3**). "Red Rooster" branded agritourism ventures exist in almost all touristic areas, with only few exceptions, mostly in mountainous areas at higher altitudes, which are inadequate for farming activities.

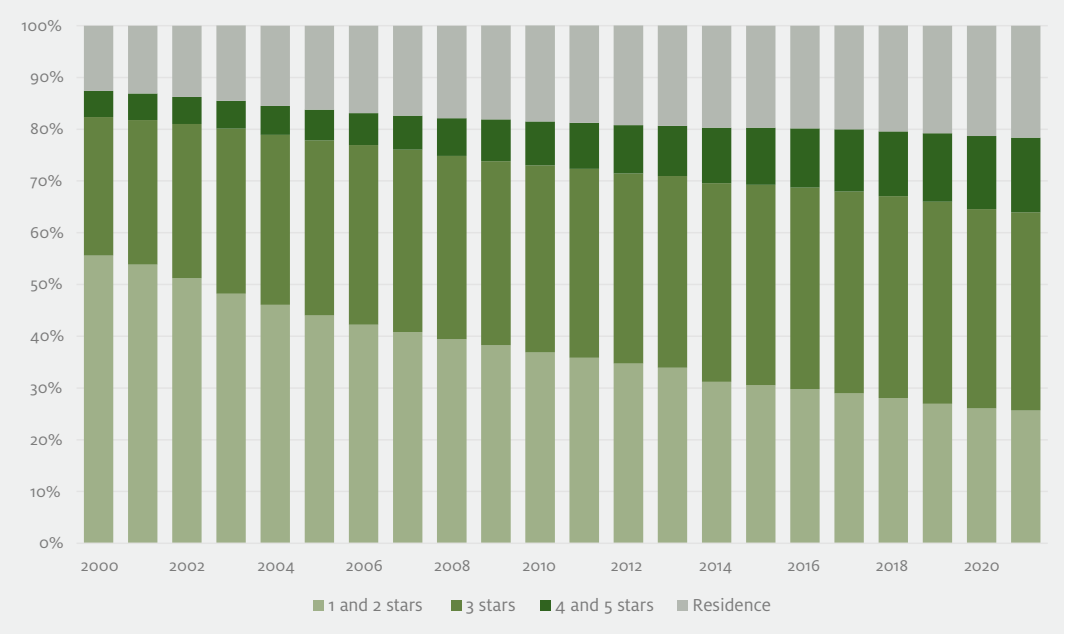


Figure 2: Hotels and similar establishments by accommodation category, South Tyrol 2000-2021. Percentage values. Source: ASTAT, online database, own elaboration.

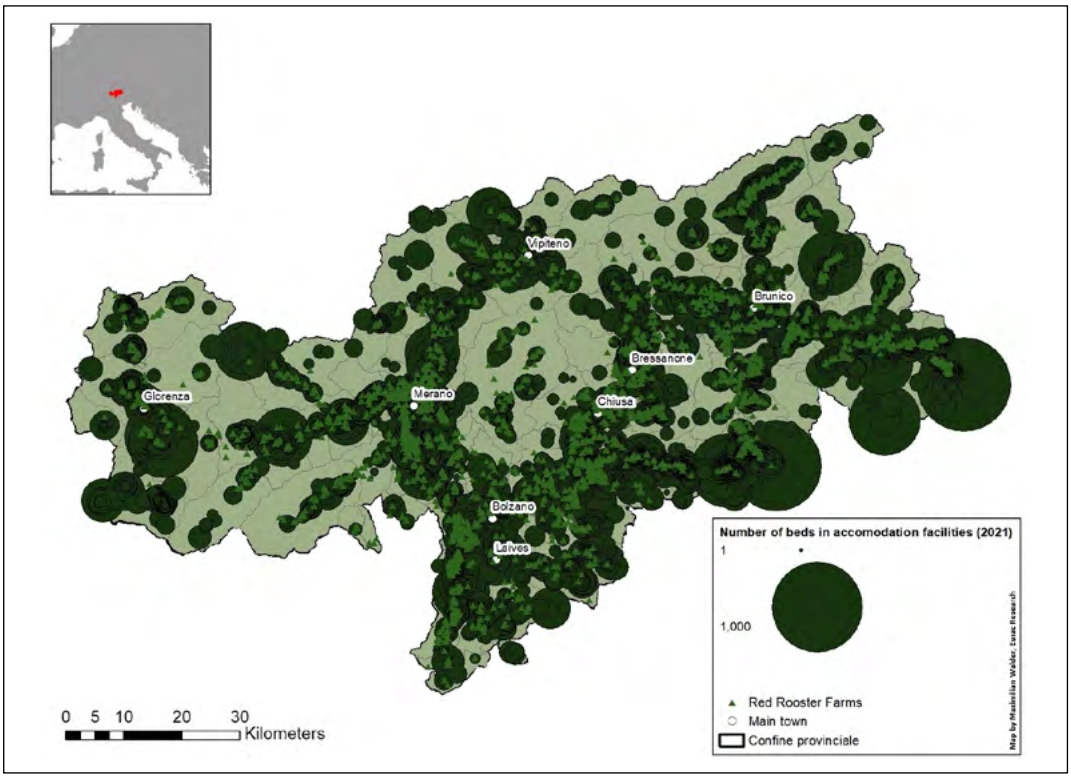


Figure 3: Location of "Red Rooster" branded agritourism ventures and beds of accommodation facilities. Source: Open Data Hub Südtirol/Alto Adige Online Database.

Concerning the origin of guests, proximity markets clearly prevail over long-distance markets. The main tourist markets for South Tyrol are the so called DACHI countries (a German abbreviation for Germany, Austria, Switzerland and Italy). For 2021 we can observe a slow convergence towards the pre-pandemic market distribution, except for those countries which were subsumed under the category "Other countries" in **Figure 4** (i.e., long-distance markets), whose share has continued to decrease. In the past two decades, German tourists had consistently made up around 50% of all overnight stays. This share decreased to 41.7% in 2020 due to the Covid-19 pandemic. But also, international tourism in general suffered a lot in 2020, with overnight stays of international guests from all countries declining substantially. This loss of international tourism was in part compensated by Italian guests, whose numbers didn't fall as strongly. Consequently, their share among all overnight stays rose by 10 percentage points between 2019 and 2020 (from 30.0% to 40.7%).

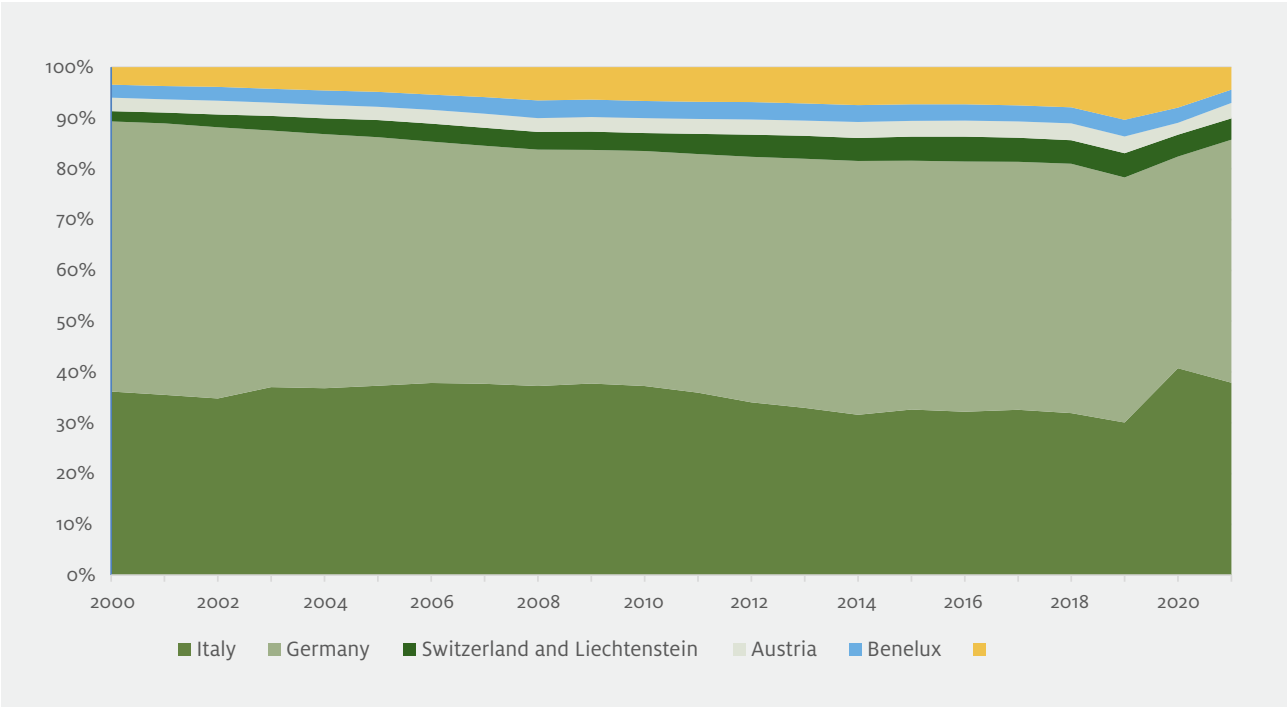


Figure 4: Overnight stays in all accommodation facilities by market of origin, South Tyrol 2000-2021. Source: ASTAT, own elaboration.

STOST: A Tourism Intelligence tool

The Sustainable Tourism Observatory of South Tyrol (hereafter STOST) was launched in 2018. It belongs to the United Nations World Tourism Organization's (UNWTO) International Network of Sustainable Tourism Observatories (INSTO), a network of organizations monitoring the economic, environmental and social impact of tourism at the regional level. The initiative is based on the UNWTO's long-standing commitment to the sustainable and resilient growth of the sector through measurement and monitoring, supporting an evidence-based management of tourism (see **http://insto.unwto.org**).

The observatory strives to achieve a series of objectives in line with the following vision and mission:

Vision

Through intersectoral and destination-wide cooperation as well as new monitoring and communication models, STOST seeks to contribute to the creation of a liveable socio-environmental habitat for South Tyrol's future generations and their guests.

Mission

STOST monitors, evaluates and communicates tourism developments in South Tyrol. STOST examines benefits and costs of tourism for South Tyrol and provides recommendations and guidelines for policy makers to support sustainable tourism management. The enabling of a transformation of the tourism sector based on awareness, learning and evidence-based decision making for different target groups of South Tyrol's society lies at its very core.

Objectives

Striving towards the achievement of the vision and the implementation of the mission, various short-, medium- and long-term objectives for the observatory were elaborated based on a synthesis of expert interviews conducted during the preliminary phase of the STOST settlement. They can be divided into five overarching goals: (1) be in the loop of developments and regularly inform about and communicate them; (2) serve as a think tank promoting sustainability in tourism; (3) raise awareness and enable learning processes; (4) provide evidence for decision makers; (5) build trusts between stakeholders and enable communication, cooperation and networking.

Find out more on our website!

Governance of STOST

The governance of STOST is shaped by many different actors within and outside the destination. The observatory has been installed by the Center for Advanced Studies at Eurac Research in cooperation with the local destination management organization IDM South Tyrol (abbreviation for Innovation, Development, Marketing) and the provincial government of South Tyrol. The two institutions keep up-to date thanks to regular monthly online meetings.

The stakeholder working group actively contributes to the development of the observatory by supporting Eurac Research and IDM in the design of monitoring issues, in data management and feedback processes, as well as in the validation of results. The stakeholder working group includes a) data providers, among which are, e.g., the Provincial Statistical Office, the Chamber of Commerce and Industry, the local Environmental Agencies; b) support providers, such as, e.g., the Free University of Bozen/Bolzano, the Hotel and Gastronomy Association (HGV), the Fair of Bozen/Bolzano and other local research institutions and trade associations. A complete list of the organizations participating in the Working Group Workshops is listed in the Annex of this report. Finally, additional organizations such as UNWTO, the National Ministry for Agriculture and the Ministry of Tourism, the provincial administration and international treaties such as the Alpine Convention support the advancement of the observatory by sharing their expertise and bringing in best practices. These entities are crucial because they offer benchmarking opportunities and access to a supra-regional knowledge network.

The last official stakeholder meeting was held online on the 6th of December 2021. In occasion of the International Mountain Day on the 11.12.2021, it was organised in cooperation with the Global Mountain Safeguard Research (GLOMOS) Programme of the United Nations University (UNU-EHS). Around 40 participants from different public and private organisations attended the event. In total, three presentations were held by external speakers: Joerg Szarzynski, head of GLOMOS Bonn Office, talked about climate risks and their implications for tourism; Tobias Luthe of ETH Zurich explained how to help shape complex processes of change in mountain areas; and Jana Varesco of the Fair of Bozen/Bolzano presented the Sustainability Award of the Fair, with a short input by one of the recipients of the award. In addition, the meeting was used to provide to interested stakeholders both a look back and ahead at past and potential future activities of STOST. Furthermore, three concrete projects within the issue areas of STOST were presented, revolving around 1) landscape use, 2) new accommodation forms such as AirBnb and 3) a survey carried out on the topic of culture and tourism.

Furthermore, in the last year, an example of working with local stakeholders on sustainable tourism governance was given in IA 13: Based on a previous study on the influence of tourism on transhumance in Schnals/Senales and Wolkenstein/Selva di Val Gardena (more on this on our website), we started the process of creating a code of conduct for the transhumance in Schnals/Senales. The return of the cattle to the valley is traditionally celebrated by people and over time grew more and more to be a touristic attraction. In order to manage, educate and advise visitors of this event, a code of conduct was drafted for local stakeholders. To promote a collaborative design of the code of conduct, STOST organized two workshops with stakeholders from the agricultural, tourism and cultural sectors from the Schnals/Senales valley and currently structure

the gathered data for the final outcome. For a deeper understanding of the features of a code of conduct and to know more about the STOST process, see **13 Culture**.

While providing support to policy makers and tourism businesses to make evidence-based decisions, STOST also aims to build a local culture for sustainable development among local communities. For this concrete goal, the main target groups of the observatory are policy makers, the private sector and the general public. To address this last target group, a short video with the highlights of the 2021 STOST report was created and shared on social media (**https://www.youtube.com/watch?v=GN6ev_FHg_I**).

Find out more on our website!

Methodological strategy: how to measure and understand?

In this report we refer to sustainable tourism according to the UNWTO definition, as a form of tourism that ***"takes full account of its current and future economic, social and environmental impacts, addressing the needs of visitors, the industry, the environment and host communities"*** (UNEP & UNWTO, 2005). Following this definition, "sustainability principles refer to the environmental, economic and socio-cultural aspects of tourism development", implying that a "suitable balance must be established between these three dimensions to guarantee its long-term sustainability" (ibid.).

The UNWTO guidelines for INSTO observatories propose eleven mandatory issue areas to monitor sustainability in tourism. These are: tourism seasonality, employment, economic benefits, governance, local satisfaction, energy management, water management, waste water management, solid waste management, climate action and accessibility. The last two are introduced in the annual progress report of the STOST for the first time this year. Further monitoring topics are welcomed by the UNWTO to assess context-specific topics and issues. Based on 29 qualitative interviews undertaken with local and international tourism experts during the preliminary phase, the STOST research team defined three additional issue areas: mobility, nature conservation, land use and landscape diversity (see **Figure 5**). In the year 2020, an additional issue area on culture was added with the goal to measure the reciprocal effects of culture and tourism. Thus, currently, STOST is monitoring 15 issue areas.

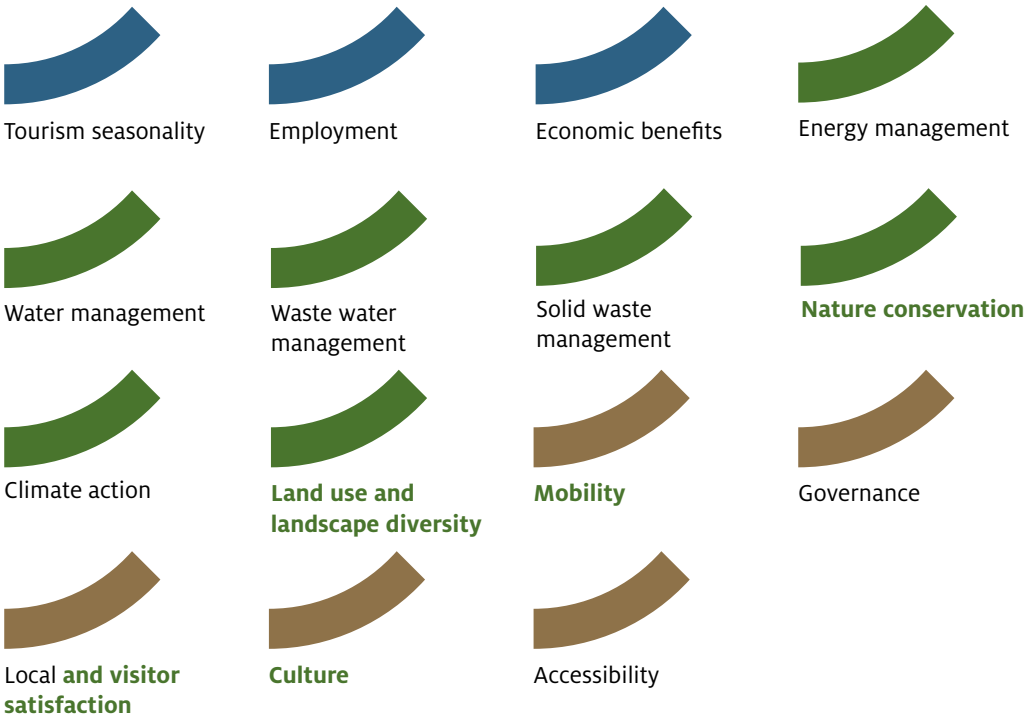


Figure 5: Mandatory (in black) and additional (in green) issue areas.
Source: own elaboration.

For each of these issue areas, indicators were selected with reference to international standards (e.g., European Tourism Indicators System for sustainable destination management - ETIS, Global Sustainable Council Tourism Criteria for Destinations - GSTC-D). This was done in collaboration with different administrative and private stakeholders. Some indicators were revised and improved over the years, based on the feedback of stakeholders gathered during so-called think tanks. These think tanks are viewed as opportunities – usually during a working group workshop for a specific issue area – to discuss emergent or innovative aspects in the respective fields, for which quantitative data are often not available yet.

In view of the subsequent creation of a general indicator for sustainability (e.g., using the standard by Pulido Fernández & Sánchez Rivero, 2009), indicators were classified according to the DPSIR framework (an acronym that stands for Driving forces, Pressures, States, Impacts, Responses) (Burkhard & Müller, 2008). This framework enables the classification of indicators based on their typology as: a) driving forces of an impact (DF); b) indicators of pressure on the environment (P); c) indicators of the state of the environment (S); d) indicators of impact measured on the environment (I) and finally d) indicators of response typically undertaken by civil society to minimize impacts (R). Below is a table illustrating the indicators and their classification. Beside each indicator, a circular symbol helps the reader to identify the DPSIR typology, as well as the dimension it refers to: a blue circle indicates the economic, a brown one the social-cultural and a green one the environmental dimension. In addition, a reference to the Sustainable Development Goals (SDGs) linked to each issue area is provided.

ISSUE AREA	INDI-CATOR	DESCRIPTION	DIMENSIONS	TYPOLOGY (DPSIR)	SDGS
1 **Seasonality** 	1.1	Tourist arrivals by month and market	Economic	Driving force DF	
	1.2	Overnight stays by month and period	Economic	Driving force DF	
	1.3	Tourist arrivals in peak weeks by municipality	Economic	Driving force DF	
2 **Employment** 	2.1	Employees in the accommodation and food service sector	Economic/ Social-cultural	Driving force DF	
	2.2	Female enterprises in the accommodation and food service sector	Economic/ Social-cultural	State S	
	2.3	Employees in the accommodation and food service sector by citizenship	Economic/ Social-cultural	State S	
3 **Economic benefits** 	3.1	Value added by industries	Economic	Driving force DF	
	3.2	Earnings situation for the accommodation and food service sector	Economic	State S	
	3.3	Gross occupancy rates of bed places by municipality and tourism exposure	Economic	Driving force DF	
4 **Governance** 	4.1	Municipalities, accommodation facilities and events involved in voluntary certification schemes for sustainability	Environmental/ Social-cultural	Response R	
	4.2	"Red Rooster" branded agritourism ventures producing and selling regional products	Environmental/ Social-cultural	Response R	
	4.3	Organic milk sold to the members of the main local buying syndicate	Environmental/ Social-cultural	Response R	
5 **Local and visitor satisfaction** 	5.1	Tourism intensity index	Environmental	Pressure P	
	5.2	Rent prices by municipality and tourism exposure	Social-cultural	Pressure/ State P S	

ISSUE AREA	INDI-CATOR	DESCRIPTION	DIMENSIONS	TYPOLOGY (DPSIR)	SDGS
6 **Energy management**	6.1	Estimated minimum electricity consumption in accommodation facilities	Environmental	Pressure P	
	6.2	Electricity consumption of cable cars and snow guns	Environmental	Pressure P	
7 8 **Water management** **Waste water management**	7.1	Estimated minimum water consumption in accommodation facilities	Environmental	Pressure P	
	7.2	Water use by snow guns	Environmental	Pressure P	
9 **Solid waste management**	9.1	Estimated waste production in accommodation facilities	Environmental	Pressure P	
10 **Mobility**	10.1	Mobilcards, bikemobil Cards, museumobil Cards and guest tickets	Environmental	Response R	
	10.2	Ski-lift and cable car users by season	Environmental/ Economic	Driving force DF	
	10.3	Charging stations for e-mobility	Environmental	Response R	
11 **Land use and landscape diversity**	11.1	Beds per land use zone and category	Environmental/ Social-cultural	Pressure P	
	11.2	Areas for tourist facilities	Environmental	Driving force DF	
	11.3	Bed density in residential zones	Environmental/ Social-cultural	Pressure P	
12 **Nature conservation**	12.1	Natural and protected areas intersecting tourism accommodation facilities	Environmental/ Social-cultural	State/ Response S R	
13 **Culture and tourism**	13.1	Museums by type and tourism exposure	Cultural	State S	
	13.2	Museum visitors	Cultural	State S	

ISSUE AREA	INDICATOR	DESCRIPTION	DIMENSIONS	TYPOLOGY (DPSIR)	SDGS
14 Climate action 	14.1	Car-related CO_2 equivalent emissions from inbound tourism	Environmental	Pressure (P)	
15 Accessibility 	15.1	Accessible gastronomy and accommodation facilities	Social-cultural	State/ Response (S, R)	
	15.2	Accessible cultural facilities and free time activities	Social-cultural	State/ Response (S, R)	

Table 1: List of indicators and their classification. Source: own elaboration.

As different regions in South Tyrol are affected by and exposed to tourism activity to varying degrees, throughout this report, we use the so-called tourism exposure – an index composed by the tourism intensity and the number of beds per surface – as a variable to group municipalities into three categories (high, average, low). This helps to analyse and better understand whether the exposure to tourism influences the indicators we measure in the issue areas to follow (for a detailed description of how the tourism exposure is calculated see **Annex 2**).

Additionally, to better compare trends throughout the fields of monitoring, this report includes summarising tables for each issue area and each indicator. They help to provide an overview about the trends before the pandemic (2010-2019 variations), during the pandemic (2019-2021 variations) and across topics.

INDICATOR		VALUES (ABSOLUTE/%)		CHANGE (%/PP)	
1.1	**Indicator name**	**2019**	**2021**	**2010-2019**	**2019-2021**
		Value 1	Value 2	Change 1	Change 2

Table 2: Structure of the summarising tables used in this report.
Source: own elaboration.

Issue areas

1.

Tourism seasonality

1 Tourism seasonality

Felix Windegger

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Seasonal fluctuations are one of the distinctive features of the global tourism industry. It implies the concentration of tourist flows in relatively short periods of the year. While a certain degree of seasonality might be considered unproblematic and even unavoidable (e.g., due to external drivers like mandatory holidays), higher degrees can contribute to various problems such as overcrowding, high prices, a lack of services and job opportunities in shoulder seasons, inadequate infrastructure in peak seasons or oversized infrastructure to meet demand during peak seasons. In order to mitigate these negative effects and the entailed burden on physical resources as well as the local population, a good understanding of seasonal patterns in the destination is fundamental. Monitoring the share of tourist arrivals by month and week can thus help to identify lows and peaks and anticipate and tackle issues connected to both periods in a timely manner. It also provides the foundation for efforts to effectively manage visitor flows and balance out systemic demand fluctuations. Concrete goals that might be pursued in South Tyrol in this context are the reduction of demand in peak seasons, a shift of demand from peak seasons to low and shoulder seasons and a geographical redistribution of demand (i.e., from destinations with high tourism exposure to those with low or average exposure).

INDICATOR		VALUES (ABSOLUTE/%)		CHANGE (%/PP)	
1.1	Tourist arrivals by month and market (Reported value: Gini index[1])	2019	2021	2010-2019	2019-2021
		0.277 (Germany)	0.584 (Germany)	+15.7% (Germany)	+110.5% (Germany)
		0.350 (Italy)	0.570 (Italy)	-8.9% (Italy)	+62.6% (Italy)
1.2	Overnight stays by month and period	2019	2021	2010-2019	2019-2021
		17.1% (August)	26.9% (August)	-1.2 pp	+9.8 pp
1.3	Tourist arrivals in peak weeks by municipality	2019	2021	2010-2019	2019-2021
		4.8% (Abtei/ Badia, week 52)	7.0% (Abtei/ Badia, week 34)	-0.1 pp	+2.2 pp
		3.3% (Meran/ Merano, week 33)	4.7% (Meran/ Merano, week 34)	-0.2 pp	+1.4 pp
		2.8% (Bozen/ Bolzano, week 33)	4.4% (Bozen/ Bolzano, week 34)	+0.1 pp	+1.6 pp

Table 3: Indicators for seasonality. Source: own calculation based on data from ASTAT (1.1, 1.2, 1.3).

1 The Gini Index ranges from 0 (even distribution of arrivals across months) to 1 (all arrivals concentrated in one month).

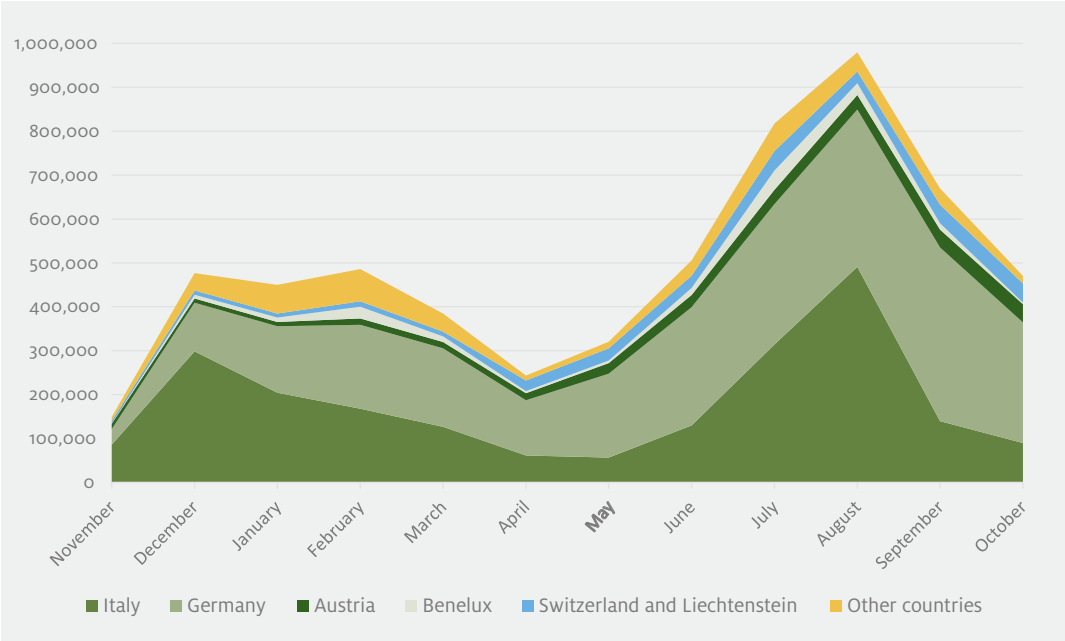

Figure 6: Tourist arrivals by month and market, South Tyrol 2012-2021. Monthly average values. Source: ASTAT, own elaboration.

1.1 TOURIST ARRIVALS BY MONTH AND MARKET

Figure 6 shows the mean values per month of tourism arrivals in South Tyrol between 2012 and 2021, distinguished by market of origin. One can clearly identify a seasonal pattern characterized by a winter and a summer season. This can be explained by climatic and weather-related conditions, which make these periods ideal for outdoor activities (e.g., hiking, mountain biking and skiing). In addition, mandatory holidays and cultural and religious events or festivities such as Christmas and the popular Christmas markets also contribute to the seasonal peaks. Regarding the countries of origin, proximity markets (particularly the domestic Italian and the German market) clearly prevail over long-distance markets. The various countries of origin display different seasonal patterns: while domestic tourists arrive predominantly in August (22.7%), July (14.5%) and December (13.8%), the arrivals of German guests are more evenly distributed across the year (with a peak of 15.2% in September). Tourists from the Benelux countries display a particularly high concentration in July (25.1%), whereas guests from other countries (i.e., long-distance markets) tend to visit South Tyrol in the wintertime (16.3% in February and 14.6% in January).

Calculating the Gini index, which is usually used to measure the degree of inequality of a distribution, helps classifying different tourist markets according to their degree of seasonality. The index takes the value of 0 if tourist arrivals from one country are uniformly distributed across all months of a year and assumes a value of 1 in the case that all guests of one nationality arrive in one single month. Comparing the Gini index for the 10-year-period between 2012 and 2021 for the most important markets of origin shows that the arrivals of German guests are the most uniformly distributed across the year, with a Gini value of 0.320. Austria (0.329), Switzerland and Liechtenstein (0.367) and Italy (0.398) follow. Tourist arrivals from the Benelux countries, few in absolute numbers, are more unevenly distributed (0.484).

DF

1.2 OVERNIGHT STAYS BY MONTH AND PERIOD

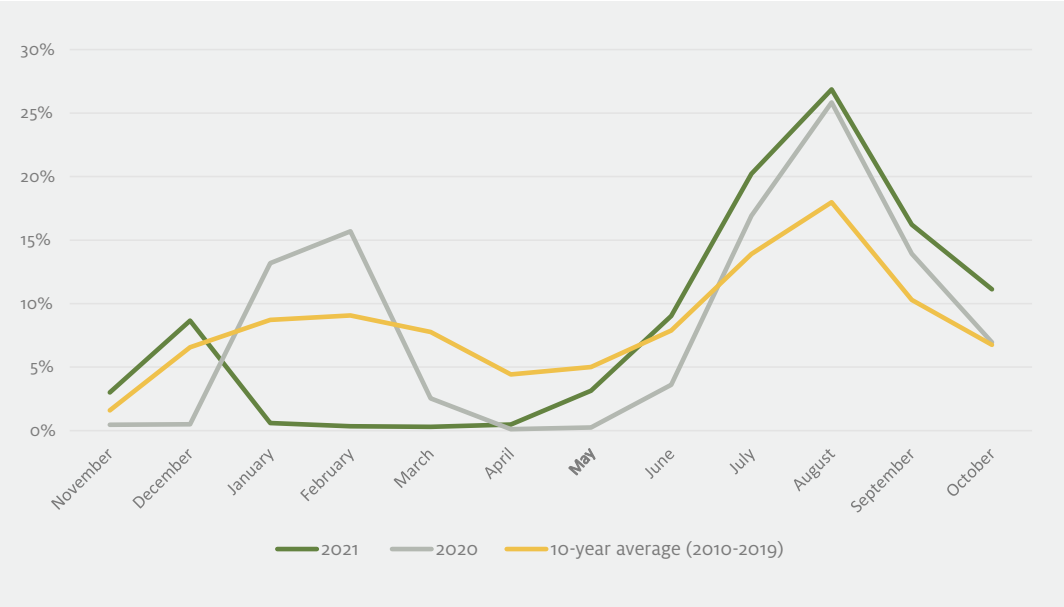

Figure 7: Overnight stays by month, South Tyrol 2010-2021. Percentages values. Source: own calculation based on data from ASTAT, own elaboration.

When looking at the monthly distribution of overnight stays, we get a very similar picture. The 10-year average reveals a high concentration of stays in the summer months, particularly in August (18.0%) and July (13.9%). **Figure 7** also reveals the impact of the Covid-19 pandemic, which brought the entire tourism industry to a halt in specific months of 2020 (April and May, November and December) and 2021 (January until April). This has obviously increased seasonal fluctuations, with more than a quarter of overnight stays being registered in August alone, in both years. The pandemic-driven concentration of stays in already crowded summer months is a relevant phenomenon to consider, as it might affect locals' perception of overtourism and, thus, eventually also the acceptance of tourism by the local population.

1.3 TOURIST ARRIVALS IN PEAK WEEKS BY MUNICIPALITY

DF

Looking at the number of arrivals at the municipal level over the last ten years (2012-2021) further confirms their concentration in the summer months. For 112 of the 116 South Tyrolean municipalities, the week with the highest share of arrivals lies in August. More specifically, 59.4% of municipalities registered their peak in the calendar week 33, 19.8% in week 34 and 17.2% in week 32. These weeks constitute the moments of the year with the highest demands to tourist attractions and infrastructures (e.g., roads and railways). Interestingly, municipalities with a low and average tourism exposure tend to show a higher concentration of arrivals, with the highest share of arrivals in one week in Laurein/Lauregno (11.6% of yearly arrivals), followed by Proveis/Proves (7.8%) and Waidbruck/Ponte Gardena (6.7%). Among the municipalities with high tourism exposure, weekly peaks range between a minimum of 3.1% (Hafling/Avelengo) and a maximum of 5.0% (Stilfs/Stelvio).

Tourism seasonality

WHAT COULD BE DONE?

- ➔ Reduce touristic demand in peak seasons
- ➔ Shift touristic demand from peak seasons to low seasons
- ➔ Redistribute touristic demand geographically (from destinations with high tourism exposure to those with low or average exposure)

2.

Employment

2 Employment

Philipp Corradini
Linda Ghirardello

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Tourism employment is a crucial field to monitor, as it impacts both the quality of life of the local population as well as tourists' experience and satisfaction. Monitoring the share of employees in the tourism sector and comparing it to other sectors is a good proxy for the economic impact of tourism. Considering additional employment aspects can help to understand the socioeconomic effects of tourism on destinations and regions to an even better extent. For example, indicators related to gender equality provide indications regarding the quality of employment. The gender composition of the workforce is a crucial aspect in this context, as it is widely acknowledged (see, for instance, Baum, 2013) that the labour market is characterized by horizontal and vertical gender segregation, especially within the tourism sector. Women and men typically perform different jobs (horizontal segregation), with women working mostly as waitresses and cleaners and men as maintenance and construction workers, gardeners etc. Moreover, occupations at the lower level with few career developments are usually dominated by women, while men are more likely to hold managerial positions (vertical segregation) (see Campos-Soria et al., 2011).

Considering the high importance of the accommodation and food service sector for the South Tyrolean economy (see ***3 Economic benefits at the destination level****), concrete goals that must be pursued in South Tyrol in the context of employment, encompass strengthening the tourism industry as a continuous and valuable employer, decreasing the tourism work disparity between male and female employees and improving the working conditions for domestic and foreign tourism employees.*

	INDICATOR	VALUES (ABSOLUTE/%)		CHANGES (%/PP)	
2.1	**Employees in the accommodation and food service sector**	**2019**	**2021**	**2010-2019**	**2019-2021**
		30,354 (yearly avg.)	24,069 (yearly avg.)	+44.1%	-20.7%
2.2	**Female enterprises in the accommodation and food service sector**	**2019**	**2021**	**2014*-2019**	**2019-2021**
		36.6%	36.7%	+1.7pp	+0.1pp
2.3	**Employees in the accommodation and food service sector by citizenship**	**2019**	**2021**	**2010-2019**	**2019-2021**
		64.6% (domestic) 35.4% (foreign)	68.3% (domestic) 31.7% (foreign)	+4.4 pp (domestic) -4.4 pp (foreign)	+3.7 pp (domestic) -3.7 pp (foreign)

Table 4: Indicators for employment. Source: own calculation based on data from AMB (2.1 & 2.3) and WIFO (2.2). * No data available for 2010.

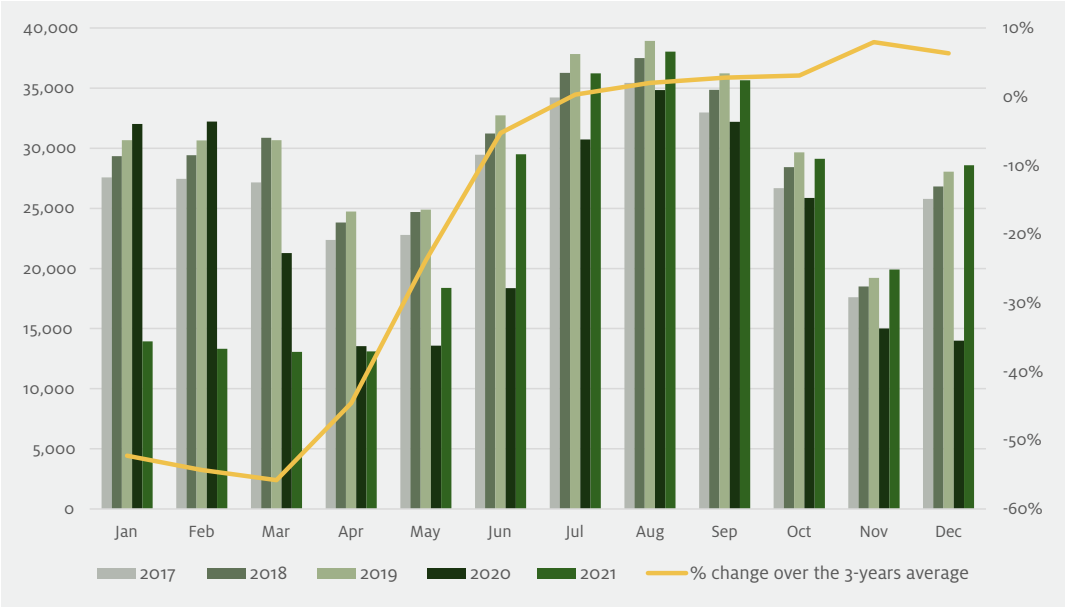

Figure 8: Employees in the accommodation and food service sector by month, South Tyrol 2017-2021 (left axis) and percentage change of 2021 in relation to the years' 2017, 2018 and 2019 average (right axis). Source: AMB, own elaboration.

2.1 EMPLOYEES IN THE ACCOMMODATION AND FOOD SERVICE SECTOR

On average the accommodation and food service sector encompassed 13.7% of the overall workforce of South Tyrol between the years 2017 and 2019. During 2020 and 2021 this share fell to 11.1%, due to the pandemic-related drop in touristic demand.

With the exception of the first months of 2021, during which Covid-19-restrictions where still in place (see **1 Tourism seasonality**), tourism employment numbers steadily increased from May 2021, starting to gradually converge to the pre-Covid status, reaching an all-time high for the months of November (19,909 employees) and December (28,582 employees) and exceeding the 3-year average of the pre-Covid years (2017, 2018 and 2019). In **Figure 8** this development is represented by the relation between the absolute numbers of 2021 and the average values from the three years pre-Covid, with a positive increase of employment starting in the month of July.

It is important to mention that the data displayed in **Figure 8** refer to employees and do not include the self-employed. They also exclude all other tourism-related economic activities (e.g., museums, natural parks, commercial activities). Thus, the total share of workers (employees and self-employed) in the tourism sector who were not employed might be higher. Employment in the tourism sector is highly seasonal with differences between accommodation and food service employees. Despite this variation between the workforce, in 2020 and 2021 the accommodation employees represented approx. 60% of the overall number of employees of the tourism sector. In pre-Covid years this share reached 65%.

2.2 FEMALE ENTERPRISES IN THE ACCOMMODATION AND FOOD SERVICE SECTOR

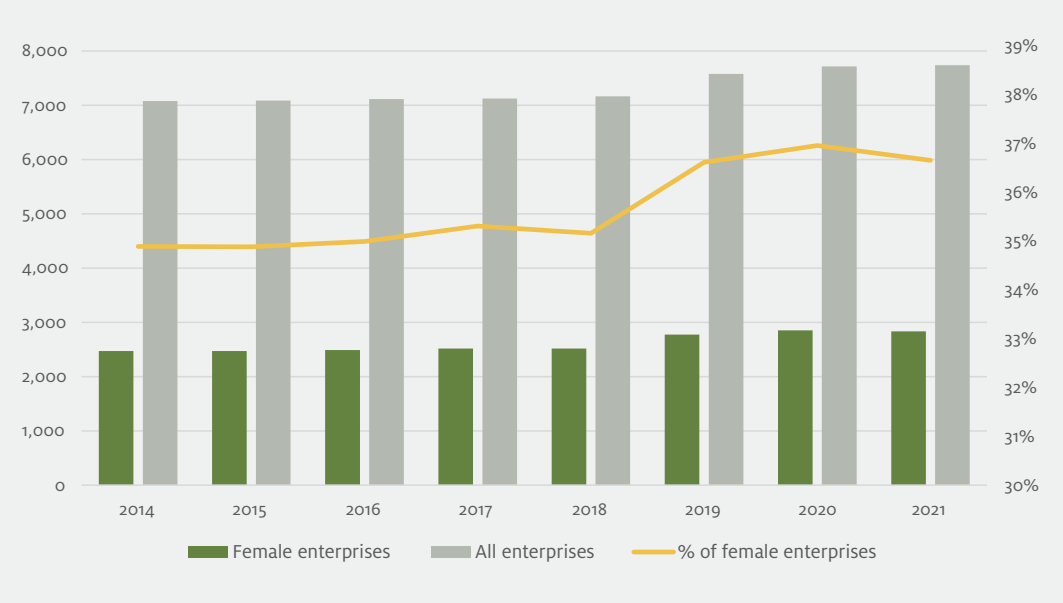

Figure 9: Female enterprises in the accommodation and food service sector in comparison to the overall number of enterprises in absolute numbers (left axis) and percentage (right axis). Source: WIFO, own elaboration.

Among the 7,738 enterprises active in the accommodation and food service sector in 2021, 2,836 (36.7%) were defined as female enterprises according to the definition provided by the Institut für Wirtschaftsforschung (Institute of Economic Research, hereinafter WIFO) of the Chamber of Commerce of Bozen/Bolzano[2]. The share of female tourism enterprises saw a steady increase from 34.9% in 2014 (2,470 enterprises) to 37% in 2020 (2,851 enterprises) and represents a positive trend towards female leadership development and gender equality.

2 Data are based on Stockview (Infocamere). Infocamere is the digital innovation company for the Italian Chambers of Commerce, which manages the data coming from the Companies Registers in Italy.

2.3 EMPLOYEES IN THE ACCOMMODATION AND FOOD SERVICE SECTOR BY CITIZENSHIP

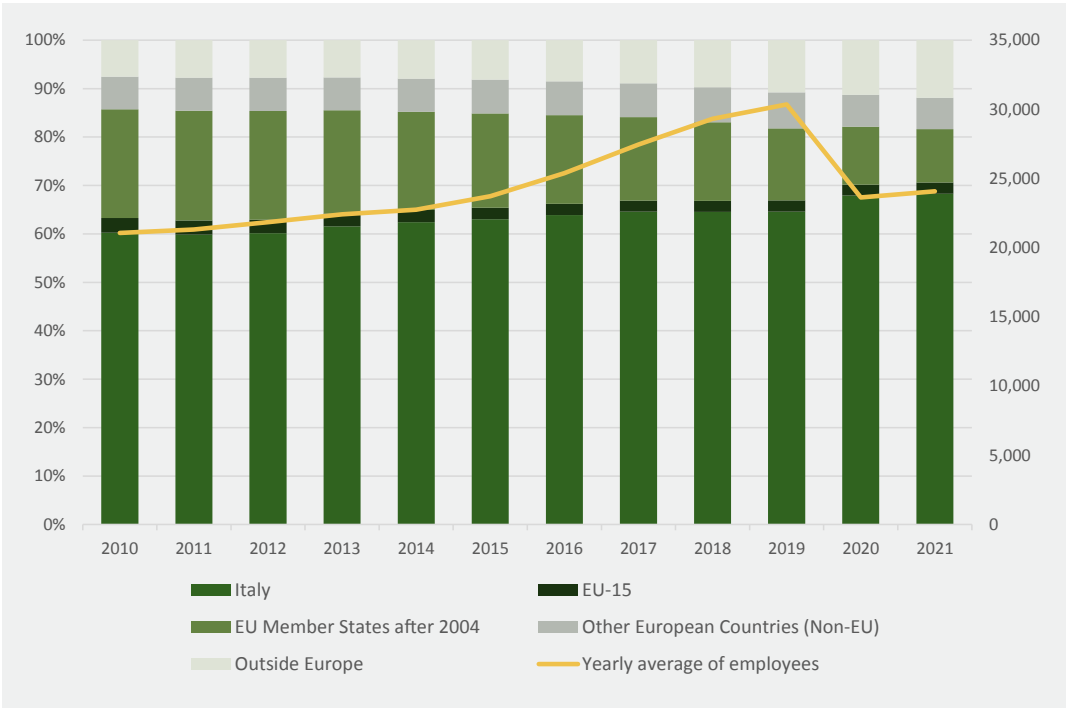

Figure 10: Employees in the accommodation and food service sector by citizenship, South Tyrol 2010-2021. Values in percentage (left axis) and average values (right axis). Source: AMB, own elaboration.

The percentage distribution of the employees' different nationalities between the years 2008 and 2012 has only seen slight changes, with Italian nationals representing most of the workforce (approx. 60%), followed by citizens of EU member states after 2004 with approx. 22%. Within the same timeframe non-European citizens, as well as citizens of other European (non-EU) countries represented both approx. 7% of the workforce. Lastly, citizens of the EU-15 states represented approx. 3% of the overall tourism workforce. From 2013 to 2019 the distribution of the employees' citizenship underwent slight changes, with an increase of Italian citizens to 64.6%, a decrease of citizens of EU member states after 2004 to 14.8%, an increment to 10.8% of non-European citizens, a slight increment to 7.5% of citizens of other European countries (non-EU) and a slight diminishment to 2.3% of citizens of the EU-15 states. As illustrated in **Figure 10** with the linear trend, the overall decrease of the tourism workforce during 2020 and 2021 is clear. Additionally, there is a distinct increase of Italian employees to 67.9% in 2020 and 68.3% in 2021 and a slight decrease of citizens of EU member states after 2004 to 12% (2020) and 11.1% (2021), as well as citizens of other European countries (non-EU) to 6.6% (2020) and 6.5% (2021), while the share of

non-European citizens slightly increased to 11.3% (2020) and 11.9% (2021). **Figure 11** illustrates the monthly distribution of the tourism employees' citizenships for the years 2020 and 2021, as well as the reference year 2019. A possible interpretation of the increase of domestic employees might relate to the mobility restrictions during the Covid-19 pandemic. Non-Italian seasonal workers may have been prohibited from entering or reluctant to apply for seasonal employment. The difficulty to access local and national social safety-nets may have furthermore diminished the inclination of non-Italian citizens to enter the seasonal tourism workforce and entrepreneurs might have chosen domestic workers instead.

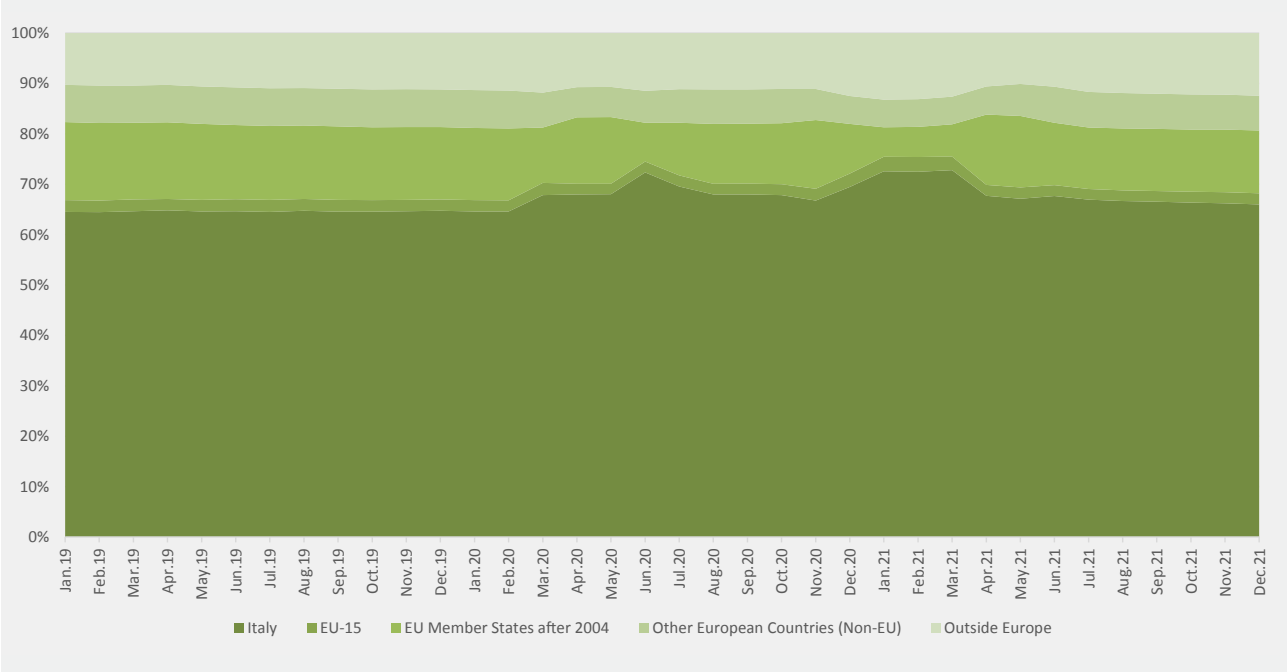

Figure 11: Monthly distribution of the tourism employees' citizenships, South Tyrol 2019-2021. Source: AMB, own elaboration.

Employment

WHAT COULD BE DONE?

- ➜ Strengthen the tourism industry as a continuous and valuable employer
- ➜ Decrease gender-related disparities in tourism work
- ➜ Improve working conditions for domestic and foreign employees

BOX 1: INCOME SATISFACTION IN 2020 IN THE TOURISM SECTOR – THE EFFECTS OF COVID-19

A representative study (7,750 sample size, 2,222 respondents) was conducted in 2021 on the effects of Covid-19 on individuals and families in South Tyrol. Further analyses regarded the sectoral distribution of perceived income satisfaction with earnings from the year 2020. As **Figure 12** shows, the differences in income satisfaction vary significantly between the tourism sector and the other aggregate sectors. In fact, in the tourism sector, income satisfaction seems to be substantially lower. Respondents amounted to N= 139 for the tourism sector and N= 1,413 for the other sectors.

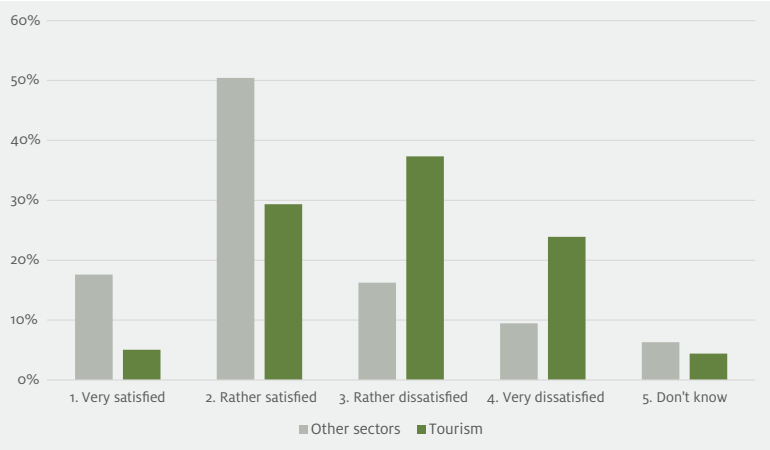

Figure 12: Income satisfaction in South Tyrol per sector, 2020. Percentage values, weighted per gender and age. Source: Family-Covid Study, Eurac Research, 2021, own elaboration.

Looking at gender differences among income satisfaction per sector from 2020, it can be observed that both men and women in the tourism sector tend to be dissatisfied, with women reporting even higher levels of strong dissatisfaction (see **Figure 13**). With N=716 (other sectors) and N=88 (tourism), women are slightly overrepresented in the sample respectively to men who amount to N= 697 (other sectors) and N= 51 (tourism). The same analysis with data from 2021 will further investigate long-term changes in income satisfaction in the tourism sector.

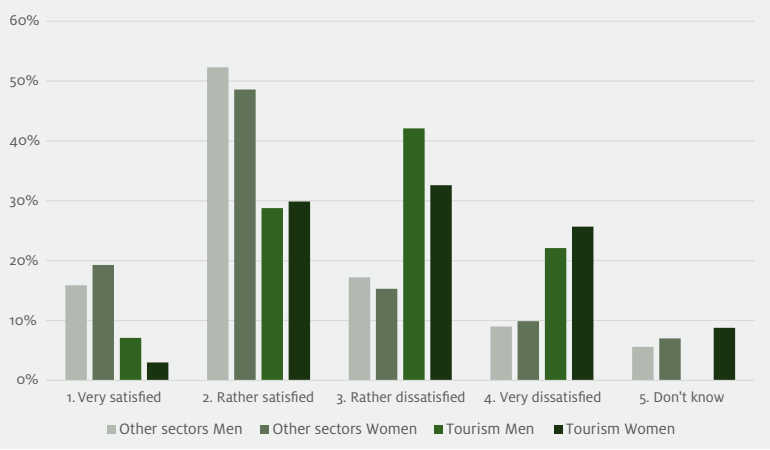

Figure 13: Income satisfaction in South Tyrol per sector and gender, 2020. Source: Family-Covid Study, Eurac Research, 2021, own elaboration.

3.

Economic benefits at the destination level

3 Economic benefits at the destination level

Philipp Corradini

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Tourism brings economic growth and prosperity to regions (Brida & Risso, 2009). It creates jobs, fosters private investment and increases public spending in infrastructure. Although being a quite volatile industry as well as potentially suffering from negative spill-over effects, especially in respect to disruptions (see Becken, et al., 2014) such as the pandemic, tourism systems can recover in a timely manner if adequately managed (see Sharma et al., 2021)

In South Tyrol, tourism plays a central role for the local economy. Besides employing more than 30,000 people, the tourism industry also contributes a significant share to the local gross domestic product. The monitoring of the Gross Value Added (hereinafter GVA) of the accommodation and food service sector over time is a good proxy for the relative contribution of tourism to the overall economy, since the last tourism satellite account of South Tyrol refers to the year 2008. Further indicators to assess the economic benefit of tourism at the local level are reports by entrepreneurs on their profit situation and the occupancy rate of accommodation facilities by tourism exposure. Combining objective indicators (value added and occupancy rate) with a subjective assessment of the profit situation and also with the issue area **2 Employment** *provides a well-structured image of the local benefits related to tourism.*

In terms of concrete goals to pursue regarding this issue area, the first two goals encompass a more precise assessment of the economic impacts of tourism at the destination level. These comprise the inclusion of indirect effects of tourism within the assessment of its overall contribution to the GVA and the consideration of the resource consumption patterns associated to positive economic impacts of the tourism sector. The third goal is connected to tourism seasonality and aims at a more balanced distribution of the occupancy rate throughout the year. From a local perspective, municipalities with low tourism exposure should try to extend the season and those with high exposure should aim to redistribute flows to shoulder seasons.

	INDICATOR	VALUES (ABSOLUTE/%)		CHANGES (PP)	
3.1	**Value added by industries**	**2019**	**2021**	**2010-2019**	**2019-2021**
		2,635.5 Mio € (11.4% of GVA)	no data	+0.9 pp	no data
3.2	**Earnings situation for the accommodation and food service sector**	**2019**	**2021**	**2010-2019**	**2019-2021**
		92.8%	68.6%	+4.1 pp	-24.2 pp
3.3	**Gross occupancy rates of bed places**	**2019**	**2021**	**2010-2019**	**2019-2021**
		36.6%	26.4%	+4.2 pp	-10.2 pp

Table 5: Indicators for economic benefits. Source: own calculation based on data from ISTAT (3.1), WIFO (3.2) and ASTAT (3.3).

3.1 VALUE ADDED BY INDUSTRIES

Table 6 depicts the relative contribution of single European NACE Rev2 categories (EUROSTAT, 2008) to the total value added (economic output) of South Tyrol for 2019[3]. The accommodation and food service sector is highlighted in bold. In 1995, the tourism industry produced goods and services corresponding to a nominal worth of 1,345.8 million EUR, 12.7% of the total output. In 2019, the sum of all goods and services produced by the tourism sector amounted to 2,635.5 million EUR, which corresponds to 11.4% of the total output. Although the sector's contribution has doubled between 1995 and 2019 in absolute values, its relative importance has seen a slight decrease.

3 Unfortunately, at the time of writing, more recent data were not available

NACE INDUSTRIES		CONTRIBUTION TO THE TOTAL GVA (2019)
A	Agriculture, forestry and fishing	4.8%
B	Mining and quarrying	0.1%
C	Manufacturing	11.8%
D	Electricity, gas, steam and air conditioning supply	4.8%
E	Water supply; sewerage, waste management and remediation activities	0.3%
F	Construction	5.8%
G	Wholesale and retail trade; repair of motor vehicles and motorcycles	12.1%
H	Transportation and storage	3.7%
I	**Accommodation and food service activities**	**11.4%**
J	Information and communication	1.8%
K	Financial and insurance activities	5.5%
L	Real estate activities	10.0%
M	Professional, scientific and technical activities	4.9%
N	Administrative and support service activities	1.9%
O	Public administration and defense; compulsory social security	8.0%
P	Education	4.5%
Q	Human health and social work activities	5.6%
R	Arts, entertainment and recreation	0.9%
S	S Other service activities	1.4%
T	Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use	0.7%

Table 6: Sectoral share of value added in South Tyrol, 2019, Source: ISTAT, data available online, own elaboration.

In 2019, the accommodation and food service sector was the third-highest driving force of the South Tyrolean economy. Historically this position has been held consistently by the sector since 1995, with just a few years of exception. The turmoil caused by the financial crisis in 2008 for example, influenced the sector to slide to position four in 2008, while in 2009, also with reference to the previous remark regarding its timely recovery capacity in relation to disruptions, the sector represented the largest economic driving force in terms of the South Tyrolean GVA.

It must be underlined that the national account data consider only the direct effects produced by this sector, while the indirect and induced economic activities produced by tourism, i.e., how

much the output of other sectors depends on demand from the tourism sector itself, are not considered. Referring, for example, to the input-output tables released by ASTAT in 2019 for the year 2015 (ASTAT, 2019), 44.8% of the intermediate consumption of the sector CA - Manufacture of food products, beverages and tobacco products is directed to the accommodation and food service sector. On the other hand, outside the official statistics, a more accurate estimate is difficult to provide given the incidence of other influencing factors. A very insightful result comes from the Tourism Satellite Account provided by ASTAT (2012) for the economic year 2008. It showed how considering the induced effects (i.e., the effects resulting from the reuse of income) increases the tourism industry's share of the GVA from 11.2% to 16.2%.

3.2 EARNINGS SITUATION FOR THE ACCOMMODATION AND FOOD SERVICE SECTOR

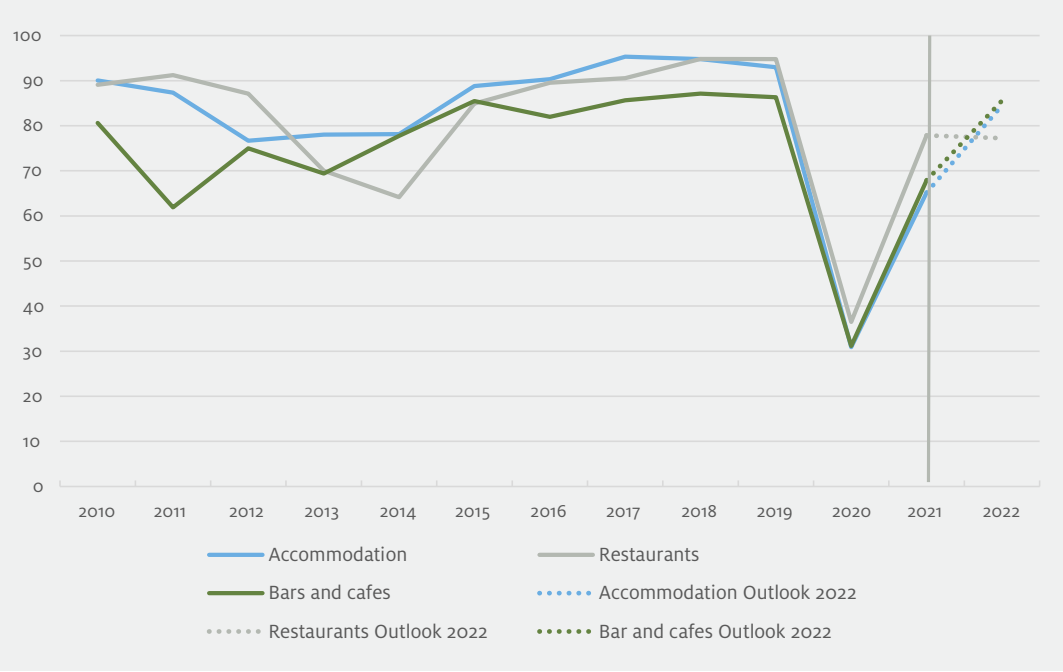

Figure 14: Earnings situation in the accommodation and food service sector, South Tyrol 2003 - 2021, Index and expectations for 2022. Source: WIFO, own elaboration.

Figure 14 illustrates the earnings situation for accommodations, restaurants as well as bars and cafes in South Tyrol. The indicator is based on business tendency surveys conducted by WIFO among a large panel of firms. At the beginning of each year, WIFO asks firms to assess their profit of the previous year. Therefore, we report the reference year and not the survey year. The graph

reports the share of enterprises for each subsector of the tourism industry who have reported either a good or at least satisfactory profitability in the reference year.

Between 2003 and 2016 the average of the declared good or satisfactory profitability of the tourism enterprises fluctuated between 72.5% (lowest value – year 2013) and 89.1% (highest value – year 2006). In 2017 an average of 90.5% was reached for the first time since the introduction of this measurement. The subsequent years continuously saw values over 90% until 2019, driven mostly by the accommodation and restaurant subsectors, before dropping to 32.9% due to the pandemic in 2020. After a recovery to 70.3% in 2021, driven mostly by the restaurant subsector (77.9%), the outlook for the year 2022 in terms of good/satisfactory profitability expectation comprises on average 82.4% for the tourism sector. These figures suggest that the recovery phase is ongoing and expected.

3.3 GROSS OCCUPANCY RATES OF BED PLACES BY MUNICIPALITY AND TOURISM EXPOSURE

Next to the indicator on firms' earning situation, the assessment of accommodation structures' occupancy rates represents an additional indicator of the economic benefits of tourism. A higher occupancy rate implies a better capacity utilization, which translates into higher margins, especially regarding the positive development of the contribution margin, if not achieved solely through price reductions.

From 2010 to 2019, the overall occupancy rates increased by 4.2%, from an average occupancy rate of 35.8% in 2010 to 41.0% in 2019. Due to the Covid-19 pandemic in 2020, the average occupancy rate decreased significantly to 26.2%, while in 2021 it increased again to 28.4%.

Figure 15 depicts the gross occupancy rates in percent of the overall bed places of the South Tyrolean municipalities. The figure reveals a clear difference in gross occupancy rates between municipalities with high, average and low tourism exposure throughout the pre-pandemic years as well as in the years 2020 and 2021. For more details about the calculation of the tourism exposure index, please refer to Annex 2. While the aggregated municipalities with low tourism exposure experienced a slightly less steep decline from 2019 to 2020, the recovery in terms of percentage point increase of the occupancy rate of the aggregated municipalities within the three tourism exposure categories from the year 2020 to 2021, is almost identical (high 3.3 pps, average 3.9 pps and low 3.3 pps).

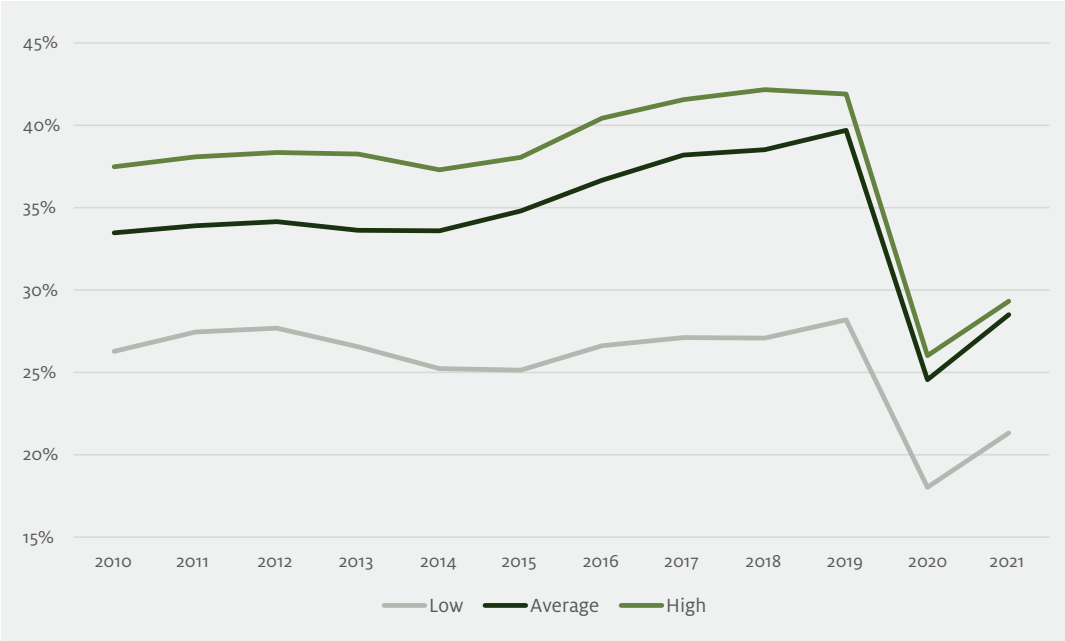

Figure 15: Gross occupancy rates of bed places by municipality and tourism exposure, South Tyrol 2010-2021. Source: ASTAT, own elaboration.

Economic benefits

WHAT COULD BE DONE?

- ➔ Include the indirect effects of the tourism sector within the assessment of its contribution to the GVA
- ➔ Include resource consumption within the profitability assessment of the tourism sector
- ➔ Increase the occupancy rates in the low season and the overall occupancy rate in destinations with low tourism exposure

4.

Governance

4 Governance

Greta Erschbamer
Giulia Garzon

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Monitoring different steering approaches regarding sustainability is key to understanding local decision-making capacities, observe the presence of a common vision and strategy and track the coherence of local and cross-sectoral policies. When investigating and collecting data on governance, some key objectives should be established. In order to achieve a good governance of sustainability in tourism, concerted efforts and stronger networks among stakeholders should be sought. The strengthening of bottom-up initiatives (i.e., led by the private sector or civil society) and their integration with top-down initiatives (e.g., planning, subsidies, taxes; usually initiated by institutions) are crucial to the goal. In fact, collaborative approaches have proved particularly effective in mountain destinations that adopted sustainable growth models (Gill & Williams, 2011). In addition, certification schemes should be further leveraged to strengthen intersectoral governance. Certifications should not be used as a mere marketing tool, but most importantly they should contribute to serve environmental and social objectives (Farsari, 2021). Lastly, measures should be taken both by public and business actors to overcome the gender gap in tourism, especially regarding salary and unpaid work (UNWTO, 2019, p. 20). The following section shows sustainable certification schemes and labels that are relevant to the tourism sector. In the box below, a future research project on the understanding of tourism governance is presented.

	INDICATOR	VALUES (ABSOLUTE/%)		CHANGES (%/PP)	
4.1	**Municipalities, accommodation facilities and events involved in voluntary certification schemes for sustainability**	**2019**	**2021**	**2010-2019**	**2019-2021**
		150	99*	+1,053%	- 34%
4.2	**"Red Rooster" branded products**	**2019**	**2021**	**2010-2019**	**2019-2021**
		687	777	+387%	+13%
4.3	**Organic milk sold to the members of the main local buying syndicate**	**2019**	**2021**	**2010-2019**	**2019-2021**
		23%	25%	no data	+2%

Table 7: Indicators for governance. Source: own calculation based on data from Bio Hotels, KlimaHaus, ISPRA, Provincial department for waste management (4.1), Red Rooster (4.2) and Hogast (4.3). * The negative trend mainly refers to the decrease in events during this period.

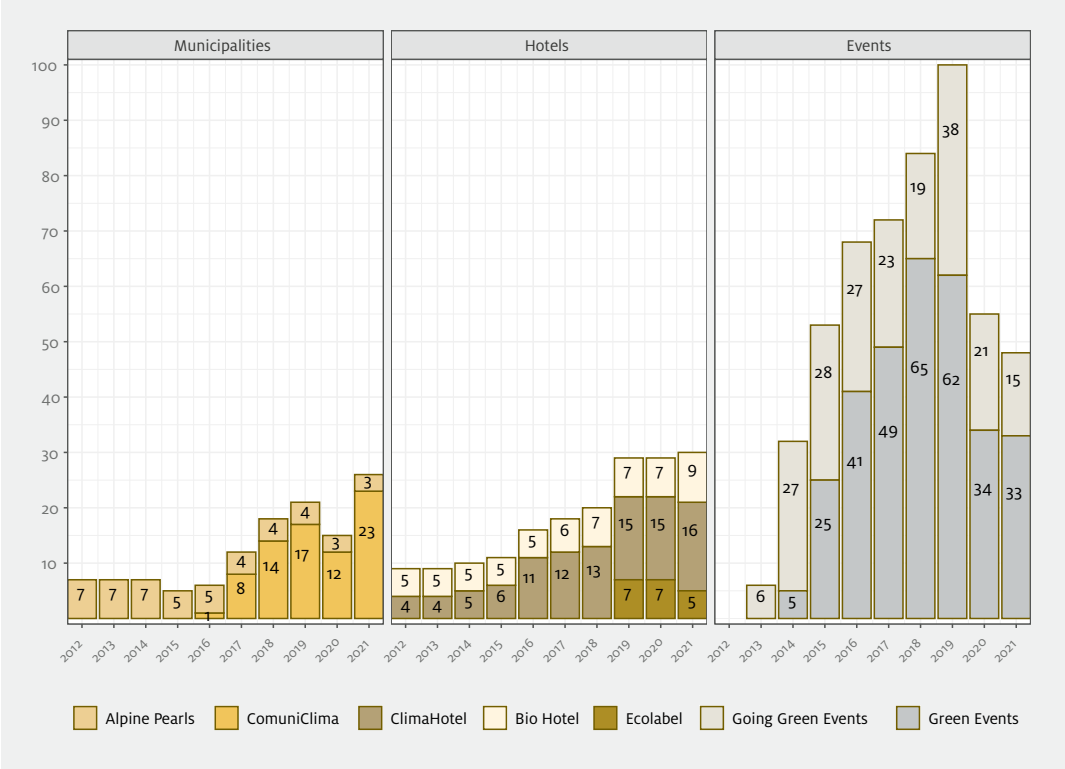

Figure 16: Sustainability certifications for accommodation facilities, municipalities and events, 2012–2021. Source: Bio Hotels, KlimaHaus, ISPRA, Provincial department for waste management, own elaboration.

4.1 MUNICIPALITIES, ACCOMMODATION FACILITIES AND EVENTS INVOLVED IN VOLUNTARY CERTIFICATION SCHEMES FOR SUSTAINABILITY

R

Monitoring voluntary certification programs implemented by tourism stakeholders is one starting point for understanding local steering mechanisms at the destination level. In South Tyrol, these include "Green" or "Going Green" events, as well as certification programs developed by municipalities (ComuniClima and Alpine Pearls) and by the accommodation sector (Bio Hotels, ClimaHotels and Ecolabel). Additional certification schemes (e.g., Tourcert, GSTC, etc.) have not been considered due to a lack in data accessibility.

Figure 16 depicts the progression of stakeholder engagement through certification over time. It is evident that since 2012, sustainability programs have greatly expanded to municipalities, accommodations and events. After a steady increase up until 2019, the overall number of awarded certifications has experienced a considerable drop in 2020, due to the Covid-19 pandemic. This decline most notably concerned "Green" and "Going Green" events, as almost all events were cancelled, rescheduled or held online. The data for 2021 confirm this trend. On the other hand, the number of certifications awarded to municipalities has slightly grown, driven by the increase in ComuniClima, exceeding 2019's total. The overall number of sustainability certificates in the accommodation sector has also slightly grown in 2021 compared to previous years. This could be due to the steady importance of environmentally friendly tourism in general, as well as to more exigent and conscious tourist preferences in times of a global pandemic.

4.2 "RED ROOSTER" BRANDED AGRITOURISM VENTURES PRODUCING AND SELLING REGIONAL PRODUCTS

Similarly, the number of certified products of the South Tyrolean quality label for agritourism "Red Rooster" has further increased. In addition to wine, honey, cereals, fruit and vegetables, as well as meat and dairy products, cyder and mushrooms were introduced in 2021. "Red Rooster" products are all regionally produced and can thus have an additional positive impact on the local agricultural sector. In total, 82 "Red Rooster" branded agritourism ventures comprehensively sold 777 "Red Rooster" labelled products in 2021 – a number that represents a continuous increase in the supply of regional products since the establishment of the "Red Rooster" label in 2005.

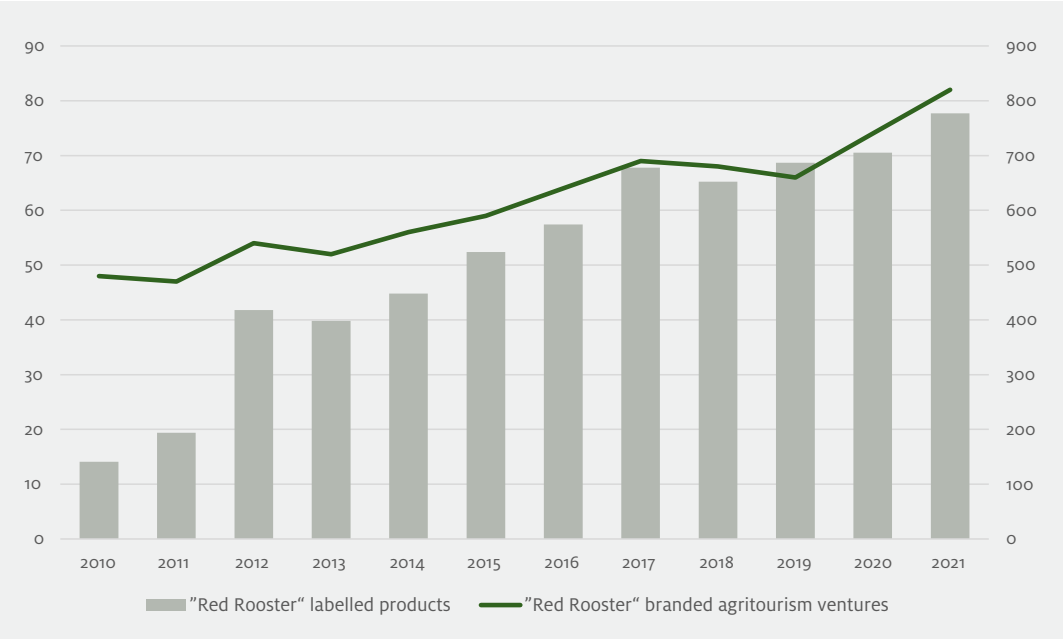

Figure 17: "Red Rooster" labelled products (right scale) and "Red Rooster" branded agritourism ventures (left scale), 2010-2021.
Source: Red Rooster, own elaboration.

4.3 ORGANIC MILK SOLD TO THE MEMBERS OF THE MAIN LOCAL BUYING SYNDICATE

The demand for organic products – and particularly organic milk – in the food and accommodation service sector is on the rise. In fact, the share of organic compared to the non-organic milk sold has jumped from 0.6% in 2016 to 25% in 2021, for a total of 658 certified members. Compared to 2019, organic milk demand has risen by 2pp, showing that the interest and awareness of local stakeholders and tourists for high-quality, locally produced and certified regional products persists.

BOX 2: LOCAL SUSTAINABILITY GOVERNANCE – HOW SHOULD IT LOOK?

As argued in the introduction, hard management tools are often not the most effective way to promote sustainability in tourism destinations, unless developed together with local actors (Ruhanen, 2013). Consequently, mapping the roles stakeholders have in steering sustainability not only top-down, but also bottom-up becomes paramount for the sustainability governance of South Tyrolean tourism destinations. The aim of this year's research is precisely to present, discuss and describe the current and ideally future governance of tourism sustainability in South Tyrol. This will be done by means of an explorative study using qualitative interviews. Our targets are representatives from the sectors of agriculture, trade and handicraft, local politics, civil society und culture. The research assumption is that on top of conventional stakeholders, other societal actors should also be engaged in the decision making process in tourism destinations in order to achieve sustainability (Bramwell & Lane, 2012). A series of interviews will be conducted with the aim of sketching out the current and potential governance structures in tourism, with a particular focus on certification schemes, as a successful example of a governance tool for sustainable tourism destinations. Indeed, sustainability indicator schemes have attracted scholars' attention given their ability to act as catalysts for generating a process of dialogue and continuous learning, building stronger networks among stakeholders, attracting funding opportunities and shaping tourism narratives (Crabolu, 2021; UNWTO, 2017). The research will deal with three issues. First, stakeholders will be asked to provide their views on what the actual governance of sustainability in South Tyrol looks like, how it could develop in the future and which instruments or approaches should be used according to them to make it more collaborative and participative. In this respect, interviewees' perceptions of governance mechanisms (money, knowledge, power and trust) in relation to sustainable tourism will be explored. Secondly, the effectiveness of certification schemes will be investigated. Interviewees will be asked if they are employing certification schemes or if they plan to join them in the future, and to what extent certifications serve social, economic and environmental objectives. In conclusion, the last set of questions will address the gender gap issue in tourism. The research will be carried out in 2022 and results will be reported in the 2023 edition of the STOST report. Drawing from the results of this study, following research will more systematically collect quantitative data on businesses' certification schemes/sustainability strategies and will develop further relevant indicators.

Governance

WHAT COULD BE DONE?

- ➔ Achieve concerted action of stakeholders towards sustainability, also through bottom-up initiatives
- ➔ Leverage certification schemes to strengthen intersectoral governance
- ➔ Overcome the gender gap in the tourism sector

5.

Local and visitor satisfaction

5 Local and visitor satisfaction

Maximilian Walder
Zoe Krueger Weisel

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Sustainable tourism implies considering both the positive and negative effects of tourism on the local population and on visitors, trying to promote the former, while avoiding or minimizing the latter (UNWTO, 2004). Tourism in South Tyrol plays a vital role in the province's economic structure contributing 11.4% to the total GVA (2019) (see 3 Economic benefits at the destination level). Many residents either work directly in the food and accommodations sector or profit indirectly from it, while many others only passively experience the negative impacts of tourism, without perceiving any concrete advantage from it. Therefore, monitoring local satisfaction is key to long-term sustainable development. Not only residents should be satisfied, but also guests, as the tourism sector needs to maintain a high level of attractiveness to guarantee destination competitiveness. This balance between locals and visitors requires a continuous effort in monitoring and policy intervention. In doing so, concerns, potential problems and conflicts can be detected in due time and addressed immediately, even before they can have a negative impact on the guest-host relationship. In the following, we present various indicators which aim to measure tourism pressure on the local population, as well as the satisfaction of visitors in the destination. Concrete goals for South Tyrol in this context are the increase of quality standards in tourism offers instead of focusing on increasing tourism flows quantitatively, to include the needs and concerns of the local population in the destination management (e.g., by applying a tourism sensitivity index as proposed in the new tourism development concept of South Tyrol (Pechlaner et al., 2022) and to secure affordable living costs for the local population.

	INDICATOR	VALUES (ABSOLUTE)		CHANGES (%)	
5.1	Tourism intensity index	2019	2021	2010-2019	2019-2021
		17.3	12.2	+12.2%	-29.8%
5.2	Rent prices by municipality and tourism exposure	2019	2021	2010-2019	2019-2021
		3.07 €/m2	3.06 €/m2	+10.9%	-0.4%

Table 8: Indicators for local and visitor satisfaction. Sources: ASTAT (5.1), own calculation based on data from Agenzia del Territorio (5.2).

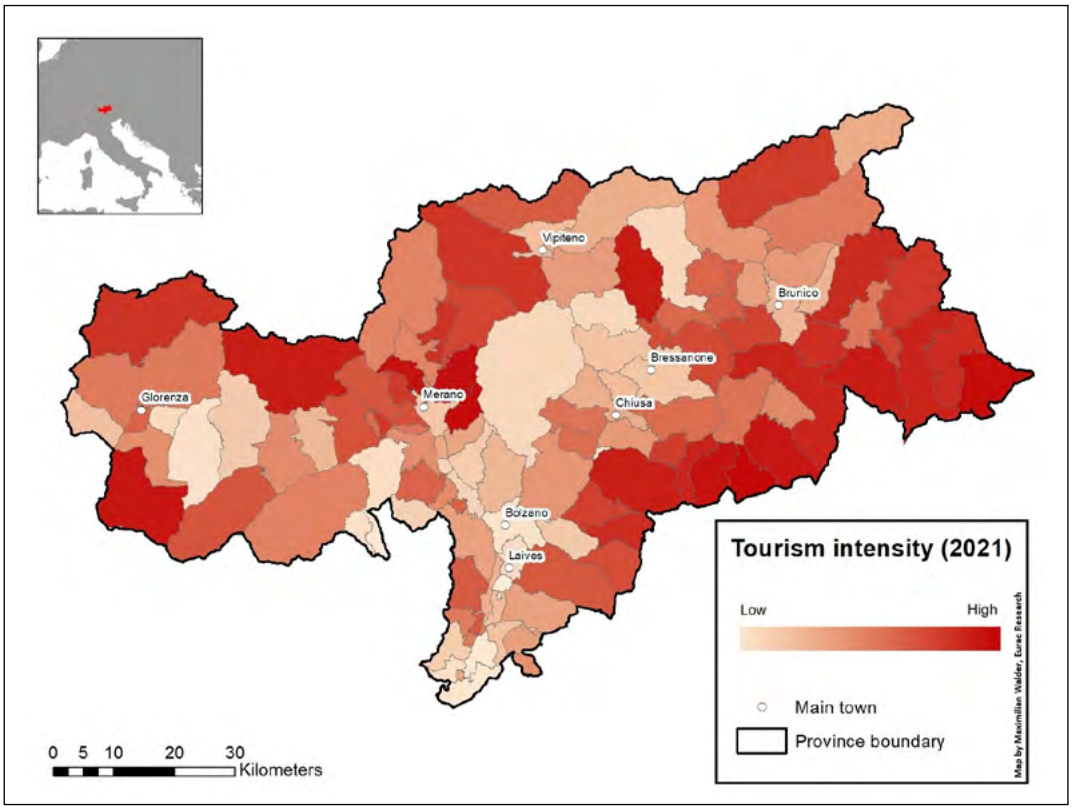

Figure 18: Tourism intensity, South Tyrol 2021. Sources: ASTAT and office of Regional Planning and Cartography, Province Bolzano-South Tyrol, own elaboration.

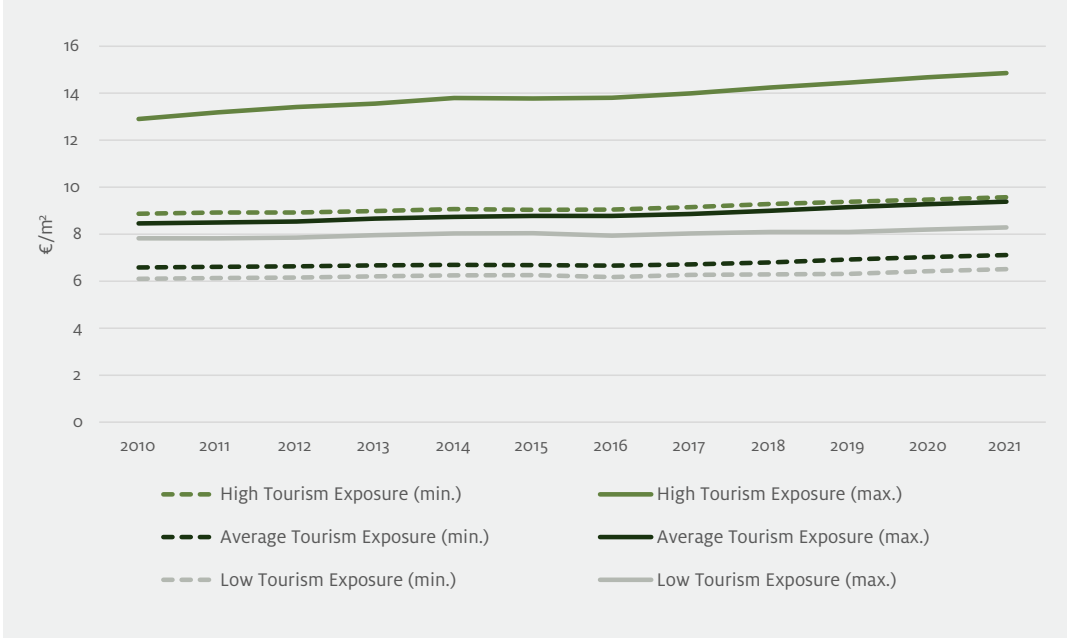

Figure 19: Average rent prices in municipalities by tourism exposure, South Tyrol 2010-2021. Source: own calculation based on data from Agenzia del Territorio, own elaboration.

S

5.1 TOURISM INTENSITY INDEX

Tourism intensity describes the ratio of the average daily overnight stays in tourist accommodation establishments relative to the total permanent resident population of the area (see **Annex 2**). Between 2014 and 2019, the tourism intensity has continuously increased (from 15 to 17.3), implying a rising proportion of tourists compared to inhabitants, driven in turn by the steady increase in overnight stays in this period. Although the value dropped to 11.1 in 2020 due to the general sharp decline in overnight stays caused by the Covid-19 pandemic, it has risen back to 12.2 in 2021 (see **Table 8**), clearly indicating an upward trend and the possibility of a return to the pre-pandemic situation. It is important to note the high variance of this indicator across the provincial territory (see online: **https://sustainabletourism.eurac.edu/issue-area/local-and-visitor-satisfaction/**). As in previous years, in 2021 some municipalities experienced a much higher tourism intensity than the provincial average, such as Corvara/Corvara in Badia (107.7) and Hafling/Avelengo (86.8). **Figure 17** shows that overall, territories in the east (i.e., in the Dolomites area) are more touristic compared to the rest of the region.

PS

5.2 RENT PRICES BY MUNICIPALITY AND TOURISM EXPOSURE

High touristic intensity is likely to drive up inflation on goods, prices and accommodation. Especially in the housing sector, more and more (wealthy) investors are buying properties in South Tyrol, which they use as holiday homes for only a few weeks a year. These properties are left empty during the rest of the year and are hence not available to the local population. At the same time, this phenomenon might influence rent prices in South Tyrolean municipalities. It might not be the only factor raising the minimum and maximum price per square meter in the province but as shown by **Figure 19**, it indeed seems to affect the local housing market. We can observe that both the minimum and the maximum prices are slowly but steadily rising in all three municipality categories. The difference between prices per square meter in municipalities with high and low tourism exposure is hereby also increasing, i.e., the gap is widening. From the year 2020 to the year 2021, the difference increased by only 0.4%, but in municipalities with high tourism exposure, one pays on average 3.1 €/m2 more than in municipalities with low tourism exposure. The gap between touristic and non-touristic municipalities has increased by 10% since 2010. The average prices in municipalities with average and low tourism exposure on the other hand are quite similar.

S

5.3 VISITOR SATISFACTION

In the year 2021 no individual survey to measure visitors' satisfaction in the destination was conducted. The most recent data therefore refer to the year 2020, where we found that in terms of overall evaluation of their holiday, 98.9% of guests in South Tyrol reported high levels of satisfaction. In comparison to a similar visitors' survey in the year 2013, overall satisfaction stayed stable (98.3%) (De Rachewiltz, 2021). Regarding the overall satisfaction with prices in the destination, we could observe a decline from 95.4% satisfaction in 2013 to 76.8% satisfaction in 2020 (idem).

BOX 3: IMPACT OF TOURISM ON SUBJECTIVE PERCEPTION OF QUALITY OF LIFE

The UNWTO definition of sustainable tourism makes explicit reference to social impacts in host communities of destinations (UNEP & UNWTO, 2005). Thus, taking a closer look at the subjective perception of any type of impact of tourism on the daily life of locals is needed to create a complete picture in the context of sustainable tourism. From a scientific perspective, measuring perceptions of tourism impacts is complex. On the one hand, perceived problems can have a variety of causes, but residents might overestimate the effect tourism has on them. E.g., during summer months traffic problems occur frequently in touristic places – and tourism is perceived as the only reason and not as a contributor to a complex traffic flow problem. On the other hand, temporary problems might be distorted by the communication in media, e.g., traffic jams may be perceived as permanent and not timely concentrated.
The study, conducted in cooperation between Eurac Research and the Free University of Bolzano, therefore chose the measurement of quality of life and satisfaction with living conditions in the place of residence as a starting point, without addressing tourism. Quality of life questions and scales were taken from OECD guidelines on Measuring Subjective Well-being. Questions about living conditions were split into eight subsections: local community, economy, public services, nature and environment, daily supply, mobility and traffic, leisure activities and settlement and housing. In a second step the perceived effects of tourism on each of these eight areas were studied in terms of how absent or permanent and how positive or negative they felt to/were perceived by the local population.
Approximately 17,000 households were contacted for this survey. An even distribution by municipality, age and gender was ensured by selecting people from the population register. An online questionnaire in German and Italian was used as the survey method.
In total, more than 2,000 people participated in the study by the end of July 2022. For the data analysis, which is still pending, spatial disparities will be investigated. The extent to which different ratings in quality of life emerge in communities with high tourism intensity compared to communities with low tourism intensity is of particular interest. Further positive or negative perceived factors will be compared concerning spatial distribution and socio-demographic parameters. Finally, the findings will provide direct indications for the development of measures to reduce negative impacts of tourism on the subjective perception of quality of life, as well as a basis for a future sustainable tourism development strategy.

Author: **Thomas Bausch**, Competence Centre Tourism and Mobility, Free University of Bozen/Bolzano

Local and visitor satisfaction

WHAT COULD BE DONE?

- ➔ Increase the quality of touristic experiences for guests and the quality of life for inhabitants
- ➔ Include the needs and concerns of the local population in the tourism management
- ➔ Secure affordable living costs for the local population

6.

Energy management

6 Energy management

Felix Windegger

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Energy consumption is an important indicator of resource use and environmental impact, linked to rising levels of CO_2 emissions and human induced climate change. In order to reduce the negative impact of energy consumption, three main strategies are commonly referred to: the reduction of consumption levels (e.g., through energy saving measures), the increase of energy efficiency (e.g., by promoting and supporting insulation) and the abandonment of fossil fuels and their replacement with renewable energies. The tourism industry requires vast amounts of energy to produce and provide its products, services and visitor experiences. More specifically, the energy consumption can be allocated to either mobile assets (mostly vehicles, but also cable cars, ski lifts and snow guns) or fixed assets (such as accommodation facilities, restaurants and other buildings). Measuring the energy consumption of the tourism sector is a challenging task, as beyond the energy directly attributable to guests (e.g., in accommodation facilities), there is also indirect energy consumption, which is very difficult to capture. Due to a lack of data on total energy consumption, in the following we focus on electrical energy only. For a more complete picture, it would be necessary to include also other forms of energy, used for instance for transportation or heating (and cooling) systems. In order to help close this gap, enterprises should actively be encouraged (e.g., by destinations and political authorities) to measure and monitor (and eventually reduce) their energy consumption.

	INDICATOR	VALUES (ABSOLUTE)		CHANGE (%)	
6.1	**Estimated minimum electricity consumption in accommodation facilities**	**2019**	**2021**	**2010-2019**	**2019-2021**
		277.7 GWh	197.1 GWh	+20.4%	-29.0%
6.2	**Electricity consumption of cable cars and snow guns**	**2019**	**2021**	**2010-2019**	**2019-2021**
		127.1 GWh	no data	+21.1%	no data

Table 9: Indicators for energy management. Sources: own calculation based on data from ASTAT (6.1) and ASTAT (6.2).

6.1 ESTIMATED MINIMUM ELECTRICITY CONSUMPTION IN ACCOMMODATION FACILITIES

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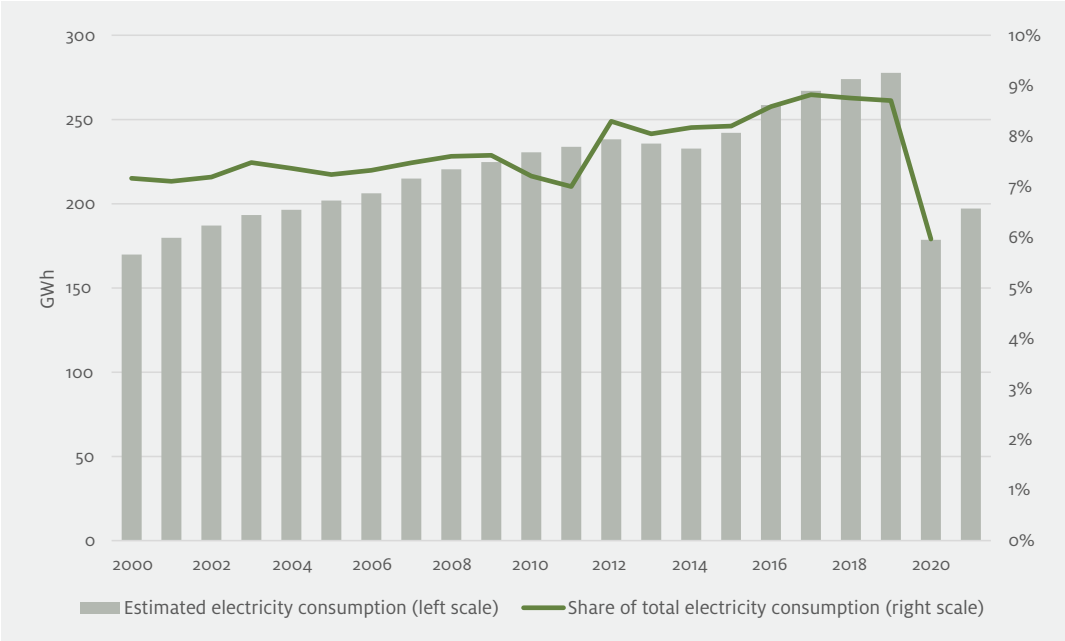

Figure 20: Estimated minimum electricity consumption in accommodation facilities, South Tyrol 2000-2021. In GWh. Source: own calculation based on data from ASTAT, own elaboration.

We have estimated the amount of electricity consumed by tourists based on overnight stays and coefficients for electricity consumption per accommodation category (Bundesministerium für Wirtschaft, Familie und Jugend, Wirtschaftskammer Österreich, Fachverband Hotellerie, Fachverband Gastronomie, Österreichische Hoteliervereinigung, 2015). These coefficients represent a proxy for the energy consumption of an energy-efficient accommodation facility in South Tyrol. Hence, the estimate is to be interpreted as a lower bound. Yet, since we apply the consumption coefficients to all overnight stays in a specific hotel category, changes in individual consumption patterns cannot be accounted for (for more detailed information on the calculation procedure see **Annex 2**). **Figure 20** shows that between 2000 and 2019, the estimated minimum electricity consumption has steadily increased, reaching 277.7 GWh in 2019. This amounts to 8.7% of South Tyrol's total electricity consumption in that year (equal to 3,188 GWh, Terna Spa, as cited in ASTAT, 2022[4]). However, due to the Covid-19 pandemic and the restrictions on travelling put in place, in 2020, the value fell by 35.7% to 178.6 GWh (6.0% of the total electricity consumption),

4 https://astat.provinz.bz.it/de/raum-umwelt-energie.asp

rising again slightly in 2021 to 197.1 GWh (for which data on total electricity consumption were not yet available).

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6.2 ELECTRICITY CONSUMPTION OF CABLE CARS AND SNOW GUNS

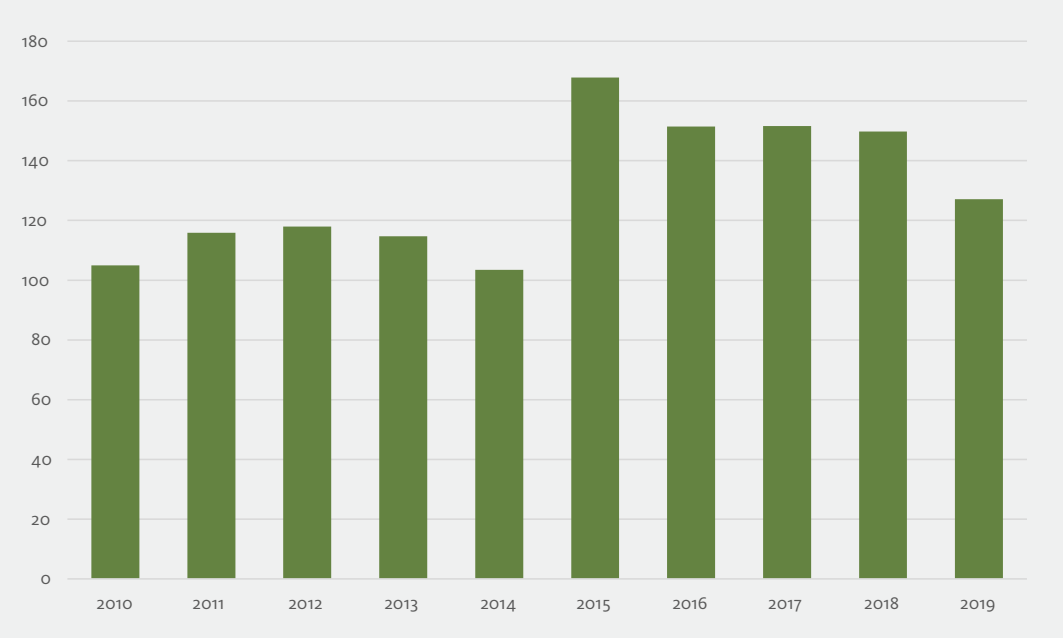

Figure 21: Electricity consumption of cable cars and snow guns, South Tyrol 2010-2019. In GWh. Source: ASTAT, 2022, own elaboration.

Being surrounded by mountains, skiing and snowboarding represent important tourist activities in South Tyrol. However, due to increasing temperatures (+0.8 °C in winter since the 1960s in South Tyrol) and the trend towards less snowfall – two phenomena related to human induced climate change (Zebisch et al., 2018) – winter sports increasingly depend on artificial snow production. In 2019, a total of 4,324 (+4.6% compared to 2018) snow guns operated in South Tyrol to ensure snow quality standards, extend the ski seasons and counterbalance the scarcity of natural snowfall (ASTAT, 2021). In addition, in 2020 there were 357 cable cars in South Tyrol (three less than in the previous year), which play a central role for winter sports and tourism more broadly. Combined, the electricity consumed by artificial snowmaking systems and cable cars rose from 105.0 GWh in 2010 to 149.7 GWh in 2018, implying an increase of 21.1%. In 2019, the last year for which data are available, the electricity consumption amounted to 127.1 GWh (-15.1% compared to the previous year).

Adding up the values for electricity consumption in accommodation facilities and of cable cars and snow cannons for the year 2019 shows that around 12.7% of electricity consumption in South Tyrol can be linked to the tourism industry – keeping in mind, however, that locals also use cable cars and ski slopes. Nonetheless, this highlights the crucial role tourism plays for South Tyrol when it comes to reaching climate neutrality (see also **14 Climate action**).

Energy management

WHAT COULD BE DONE?

- ➔ Reduce the energy demand in the tourism industry
- ➔ Increase the energy efficiency in accommodation facilities, restaurants and touristic attractions
- ➔ Increase the share of renewables for touristic services and infrastructures

7. & 8.

Water and Waste water management

7 & 8 Water and Waste water management

Zoe Krueger Weisel
Valentin Wallnöfer

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Water is a central resource for tourism. Tourists consume fresh water directly by drinking it, via use for hygiene purposes, but also contribute to water use indirectly, e.g., water used for watering gardens, filling swimming pools, supplying wellness and spa facilities, cleaning rooms, washing bed and table linen. Additionally, water is used for touristic leisure activities, such as swimming, golf and skiing (Gössling, 2015). Thereby, tourism affects not only water use, but also waste water treatment. The discharge of untreated waste water negatively affects the quality of groundwater and can therefore damage natural ecosystems. Since tourism leads to a strong incline in water use, the discharge of waste water is growing as well. Accommodation facilities discharge for example high amounts of chlorinated swimming pool water and chemicals, which are used for cleaning purposes (UNEP & UNWTO, 2012).

In South Tyrol, almost all accommodation facilities and even some mountain huts are connected to sewage plants, leading to a better water quality of lakes, streams and rivers. However, within the last years, water use in general has grown consistently and many sewage plants reached their limit, which poses new threats to water quality and ecosystems. According to the local department for water protection and the sewage plant operator, the strong growth of tourism is believed to be one of the main reasons for the increasing amount of waste water production in South Tyrol (Rai Tagesschau, 2022; Autonome Provinz Bozen 2022). Right now, there are no available data to measure how much waste water is attributable to tourism. However, a comparison of water quality and tourism exposure over time could give new insights on their interrelationship and could therefore be used as an indicator in the near future (see **BOX 4: Contested yes, pristine rarely: water courses, their quality and their relationship to tourism**).

To better understand the link between water and tourism, STOST monitors the water consumed and plans to monitor the waste water generated by tourism in South Tyrol. Due to climate change, which causes reduced snowfall and a greater evapotranspiration, water is an increasingly scarce resource in South Tyrol (Zebisch et al., 2018), and in the future there may be cross-sectoral conflicts for its use, e.g., between tourism and agriculture in rural areas. Monitoring water consumption is therefore essential to foresee and warn local stakeholders against potential water shortages and stresses. Concrete goals of this issue area present themselves in reducing water consumption and increasing water use efficiency in accommodation facilities as well as reducing water use indirectly caused by tourism. Concerning waste water management, decreasing waste water generation, increasing and securing waste water treatment, as well as water re-use are crucial goals.

INDICATOR		VALUES (ABSOLUTE)		CHANGES (%)	
7.1	Estimated minimum water consumption in accommodation facilities	2019	2021	2010-2019	2019-2021
		7.7 million m³	5.5 million m³	+18.7%	-29.2%
7.2	Water used by snow guns	2018/19	2020/21	2009/10-2018/19	2018/19-2020/21
		8.2 million m³	7.4 million m³	+89.9%	-25.9%

Table 10: Indicators for water and waste water management.
Sources: own calculation based on data from ASTAT (7.1); APAC (7.2).

P

7.1 ESTIMATED MINIMUM WATER CONSUMPTION IN ACCOMMODATION FACILITIES

Direct data on tourism-related water use are only partly available. Therefore, we estimated the minimum water use in accommodation facilities using literature-driven coefficients specific for each hotel category and combining them with the number of overnight stays in South Tyrol (see **Annex 2**). The results show that the estimated minimum water usage has continued to increase over the last two decades, reaching a maximum value of 7.7 million cubic meters in 2019. This trend is attributable to the general increase of overnight stays in accommodation facilities, but also to the changing structure of the hotel sector in South Tyrol consisting of more and more high-class hotels with a respectively higher level of water use per capita (or per night) (see **Figure 2**). Although the Coronavirus-pandemic caused a steep decline in water consumption in accommodation facilities in 2020 compared to previous years, the following graph shows that the consumption is on the rise again in 2021.

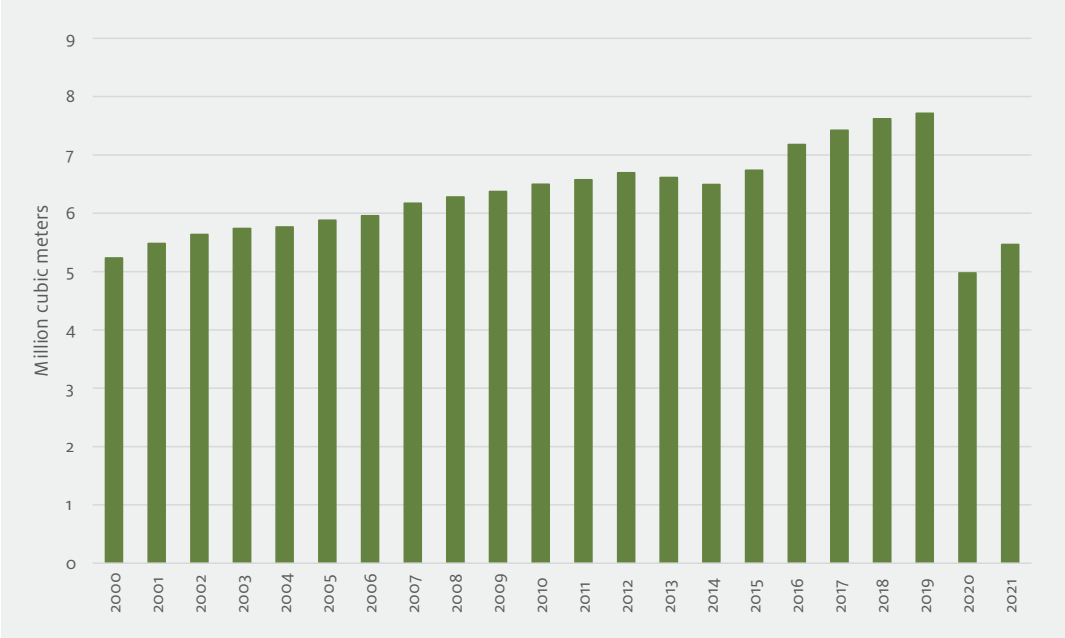

Figure 22: Estimated minimum water consumption in accommodation facilities by year, South Tyrol 2000-2021. In million cubic meters.
Source: own calculation based on data from ASTAT, own elaboration.

P

7.2 WATER USED BY SNOW GUNS

To measure the indirect effect tourism can have on water use, we included available data for water consumption by snow guns as an indicator for this issue area. In the ski-tourism sector, water used for artificial snow production has increased steadily over the last decades. However, during the winter season 2020/2021, the water used by snow canons declined by roughly 25.9% with respect to the pre-Covid winter season of 2018/2019, which may be attributed to the Covid-19 related restrictions and closures of ski resorts.

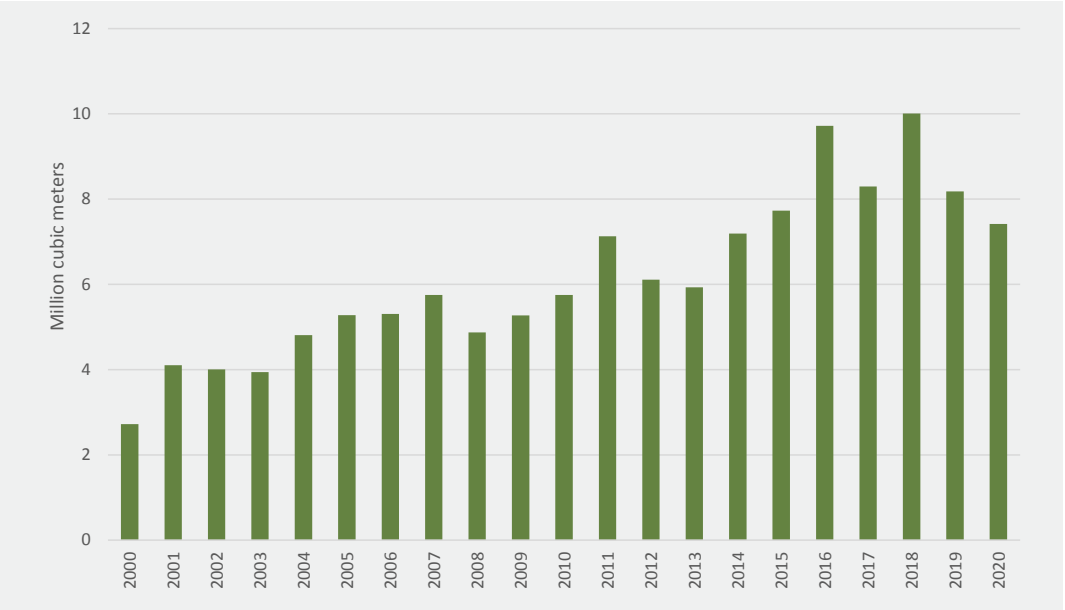

Figure 23: Water used by snow guns, South Tyrol 2000-2021. In million cubic meters. Source: APAC, own elaboration.

Water management

Waste water management

WHAT COULD BE DONE?

- ➔ Reduce the water consumption in accommodation facilities
- ➔ Increase the efficiency of water use in accommodation facilities
- ➔ Reduce the water use indirectly caused by tourism
- ➔ Decrease the waste water generation in accommodation facilities
- ➔ Increase/secure waste water treatment
- ➔ Increase water re-use in the tourism sector

BOX 4: CONTESTED YES, PRISTINE RARELY: WATER COURSES, THEIR QUALITY AND THEIR RELATIONSHIP TO TOURISM

The largest water supplies on the planet are found in mountainous areas. Water courses are like the arteries of our land and were recognized as true ecosystems only in the 1980s. They are living environments, fascinating elements of the landscape, and are of fundamental importance to the territories through which they flow. But they are also very sensitive environments and subject to various anthropogenic impacts. Many of our daily activities depend on water, an irreplaceable resource that enables the survival and growth of every organism.

The large presence of tourists in South Tyrol results in an additional demand for water resources due to increased population pressure on the territory. Can one also find indicators that assess differences in water quality attributable to tourism peaks?

Much depends on the proper functioning of waste water treatment plants. If overloaded, they are not able to dispose of pollutants that affect the health of water courses into which they flow. Given the high resilience of water courses, the touristic peak does not result in an immediate impact on the biological water quality, but (if it persists), it will disrupt the quality of water over time. In addition to findings from biological indicators and indices that are often difficult to associate distinctly with tourism, two so-called “emerging” pollutants that are of increasing concern to researchers and the public must be considered: hormone substances and microplastics. The concentration of hormones detected in running waters usually rises with increasing population pressure. They mostly derive from birth control pills, are excreted in urine, and only partially retained by sewage treatment plants. These substances are active even in very small doses. In some animal species, these substances can lead to sex alterations and infertility and enter the food chain.

Similarly, microplastics are now widespread in all environments, from oceans to mountains. They can be released directly into the environment in the form of particles, for example, from washing synthetic garments, use of personal care products, and tire abrasions while driving, or they can be produced by the breakdown of larger plastic objects, such as plastic bags or bottles. It is immediately apparent that in areas subject to high tourist pressure, concentrations of microplastics in surface waters will also tend to increase. The development of new filtration techniques in the tertiary treatment section of sewage treatment plants is rapidly evolving and could/should reduce the concentration of microplastics in waste water and consequently in the environment. Due to their small size, microplastics are easily absorbed into the digestive systems of animals that underlie food chains. These emerging substances, being directly related to population pressure, can also increasingly be used in terms of quality indicators related to tourism.

Obviously, to optimally protect and manage such a contested resource, the importance of scientific study and monitoring of water courses and its watersheds becomes evident. Therefore, it is imperative that the management of the water resource be integrated at both the socioeconomic and policy levels. Moreover, it is desirable that the currently prevailing sectoral approach in the study of aquatic systems is transformed into a cross-sectoral approach, considering water the medium that connects all sectors (environment, society, agriculture, energy, tourism, health, etc.). Thus, the concept “thinking outside of the water box” was born, which sums up this approach and should stimulate and involve stakeholders more to veer in the right direction where necessary.

Author: **Roberta Bottarin**, Institute for Alpine Environment, Eurac Research

9.

Solid waste management

9 Solid waste management

Zoe Krueger Weisel
Valentin Wallnöfer

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Solid waste is generated through nearly all human activity. Academic literature shows that tourism-related activities produce amounts of waste well above the domestic average (Hamele & Eckardt, 2006). It seems, tourists often expect higher standards of hygiene and a wider range of choice in food and other services, which translates into more waste. Additionally, people tend to use more disposable products on vacation than they would at home, a habit that also increases waste volume. To mitigate the impacts of these phenomena, a good waste management system and well thought out information policies for guests and staff members can help. To sensitize guests and staff members to waste reduction mechanisms, a solid background of knowledge on the waste volumes produced, and the management processes implemented is needed (UNWTO, 2004). Strategies to minimize waste include reduction, reuse, recycling, residual treatment, and residual disposal of waste: the adoption of said measures should be considered at destination level and particularly within accommodation facilities to ultimately reach the goal of reducing waste generation in tourist accommodations. An efficient waste management might also represent a source of cost saving for businesses in the tourism industry, whose entities also depend on the business location and the local waste management regulations (Pirani & Arafat, 2014).

INDICATOR		VALUES (ABSOLUTE)		CHANGES (%)	
9.1	Estimated waste production in accommodation facilities	2019	2021	2010-2019	2019-2021
		66,695 tonnes	47,081 tonnes	+17.9%	-29.4%

Table 11: Indicator for waste management. Source: own calculation based on data from ASTAT (9.1).

P

9.1 ESTIMATED WASTE PRODUCTION IN ACCOMMODATION FACILITIES

Although waste management is becoming increasingly relevant for the tourism sector, the literature on the topic is limited. Thus, it is difficult to pin down the impact of tourism on waste production. To circumvent this problem, like for energy and water management, the decision was made to estimate the production of waste in accommodation facilities using a coefficient retrieved from Hamele & Eckardt (2006) on the production of waste per overnight stay. The following graph shows the output of this estimation. Following the 2020 decline in waste genera-

tion attributable to the Covid-19 pandemic, waste production in accommodation facilities has slowly but steeply started to increase again in 2021, with an estimated value of 47,081 tonnes of waste produced in accommodation facilities. This comes as no surprise considering the increase in overnight stays in accommodation facilities. As in the issue areas related to energy and water management, an additional effort is necessary in the future to produce more place-specific estimations or to proceed with an accurate and more precise measurement of real waste production levels.

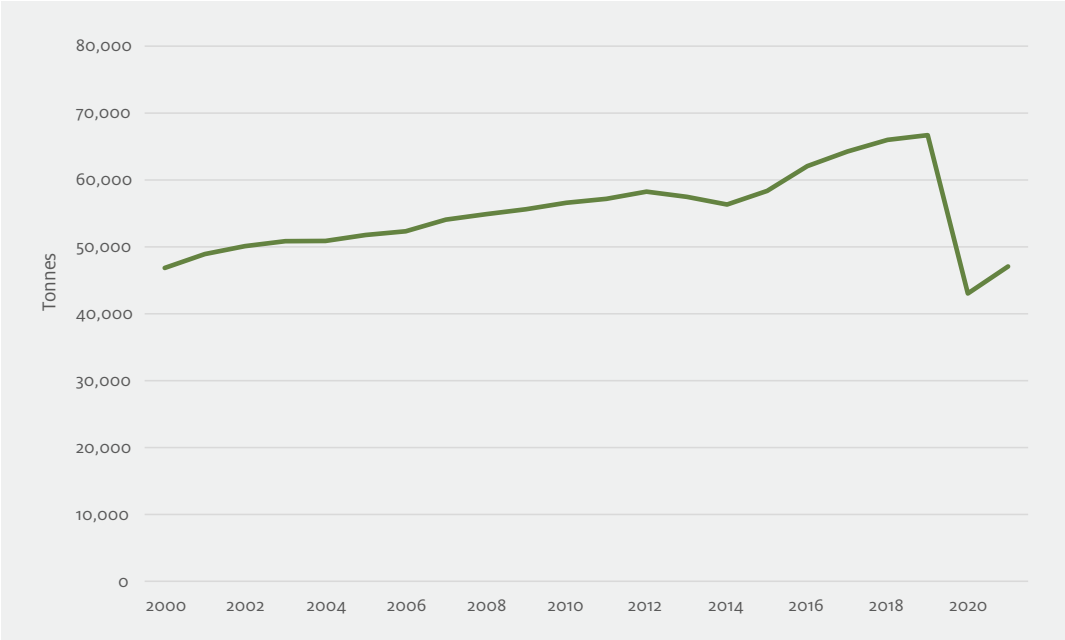

Figure 24: Waste production estimated for accommodation facilities by year, South Tyrol 1990-2021. In tonnes. Source: own calculation based on data from ASTAT, own elaboration.

Waste management

WHAT COULD BE DONE?

- ➔ Reduce waste generation in accomodation facilities, restaurants and touristic attractions
- ➔ Increase the efficiency of waste management in tourism enterprises

10.

Mobility

10 **Mobility**

Maximilian Walder

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De-carbonising tourist mobility is key to achieve sustainable tourism globally and on site, as tourism without transportation is inconceivable. However, carbon emissions are not the only negative effects of tourist transport: and spatial use, energy consumption, air and noise pollution are just as relevant, particularly for remote and rural regions. Therefore, monitoring possible modal shifts towards more sustainable forms of transport is crucial in this issue area. These include public transport, but also shared transport, e.g., car sharing. As far as mobility on site is concerned, notwithstanding the energy use (see indicator 6.2) and the potential negative impact on the landscape, the use of cable cars in Alpine contexts can generally be interpreted as an encouraging sign, as it can substitute less sustainable means of transport via private cars or motorcycles for example, especially in summer and in combination with traffic regulations and road closures (see, e.g., Scuttari et al., 2016).

In South Tyrol, previous statistics showed that 90.4% of incoming tourists entered the region by private transport and 70.3% used this means to travel around during their holiday (De Rachewiltz, 2021). Indicators in this issue area were selected to show the actions taken to tackle this problem and shift modal choices towards public transport or shared use of vehicles, rather than to estimate the magnitude of impacts.

The table below offers a summarized overview of the magnitude and change of each indicator over the last year of data collection. Concrete goals that might be pursued in South Tyrol in this context are to incentivize guests to use public transport, to increase the number of locations of charging stations for e-mobility both in accommodation facilities and in public areas and to manage visitor streams during peak tourism months.

INDICATOR			VALUES (ABSOLUTE)		CHANGE (%)	
10.1	Mobilcards, bikemobil Cards, museumobil Cards and guest tickets	Activation	**2019**	**2021**	**2012*-2019**	**2019-2021**
			1,658,620	916,618	+258.5%	-44.7%
		Uses	**2019**	**2021**	**2012*-2019**	**2019-2021**
			6,924,310	4,075,548	+282.2%	-41.1%
10.2	Ski-lift and cable car users by season	Summer	**2019**	**2021**	**2010-2019**	**2019-2021**
			10,817,425	no data	+38.8%	no data
		Winter	**2019**	**2021**	**2010-2019**	**2019-2021**
			118,094,699	no data	-7.5%	no data
10.3	Charging stations for e-mobility	In hotels	**2019**	**2021**		**2019-2021**
			209	207		-1.0%
		Public	**2019**	**2021**		**2019-2021**
			110	177		+60.9%

Table 12: Indicators for mobility. Sources: STA - Südtiroler Transportstrukturen AG (10.1); ASTAT (10.2); Neogy and Tesla (10.3). * No data available for 2010 and 2011.

10.1 MOBILCARDS, BIKEMOBIL CARDS, MUSEUMOBIL CARDS AND GUEST TICKETS

The most recent survey on tourist mobility has shown that the preferred mode of transport in South Tyrol is the car, followed by public transport (De Rachewiltz, 2021). To incentivise this further, so called Mobilcards can be purchased in hotels, tourist offices, train stations and local vendors. These Mobilcards are valid for either one or three days or for a whole week and allow guests to travel with all means of public transport. Furthermore, some special forms of Mobilcards include additional benefits: bikemobil Cards allow tourists to rent bikes and to bring them on public transport, museumobil Cards are simultaneously travel tickets for public transport and admission tickets to around 80 museums in South Tyrol. Due to the Covid-19 pandemic, the upwards trend in activation and the use of Mobilcards[5] since its introduction came to a halt in the year 2020 and the effect was still felt in the year 2021. With 916,618 activations, we have a 22.4% decline in comparison to the previous year. Interestingly, the cards were used much more often in 2021 than in 2020 (4.45 times per Mobilcard). This means that fewer cards were distributed, largely due to the absence of tourists in the destination, but the cards that were distributed were used to a greater extent (+ 37.9%).

5 Each card can be initially activated (activation) and then used repeatedly in the according time limit (uses).

S

10.2 SKI-LIFT AND CABLE CAR USERS BY SEASON

Cable cars and ski-lifts offer additional transportation possibilities for guests in the mountains and sometimes reduce the use of cars, hence minimizing traffic and CO2 emissions. The most recent data on the use of cable cars and ski-lifts refer to the year 2019, which means that we can observe an unprecedented "Covid-19 effect" in this indicator. For the first time in recent years, the total number of uses was lower than 130 million. The last time this happened was in 2013 and 2014. The pandemic was particularly felt in the winter season where there was a decline of 12.1% compared to 2018. In the summer of 2019, we can even observe a new all-time high of cable car and ski lift uses with almost 11 million (+6.8% since last year). This might spark some solace, but the summer use only represents a small market for the lift operators, almost a side hustle, because 91.6% of all uses still happen in the cold months of the year. In recent years the gap between winter and summer uses closed slightly, 2019 being the most balanced year since data recording started. This obviously also has to do with the closure of numerous cable cars and ski lifts due to the imposed restrictions. In summer, with a reduced circulation of the virus, these restrictions were weakened and South Tyrolean guests once again had the opportunity to use this mode of transport.

R

10.3 CHARGING STATIONS FOR E-MOBILITY

Figure 25 shows the location of all current charging stations for e-mobility in South Tyrol, some of which offer more than one charger. The many yellow dots represent new stations in the destination. The 58 new stations in 2021 raise the total number of charging stations to 384, indicating a trend towards more e-mobility in the area – or at least a continuing trend to promote e-mobility. Tourism establishments play a crucial role in this, as 207 out of 384 (almost 54%) charging stations can be found in accommodation facilities. The situation in accommodation facilities remained basically the same, as four new charging stations were activated in 2022, three were dropped. On the other hand, charging stations in public areas increased by 27. This might indicate a general increase of interest in e-mobility. When we look at the distribution of the locations, we can see that most charging possibilities can be found in the cities and in the more touristic areas in the East and South. Stations in upper Vinschgau/Val Venosta and in the Northern parts of South Tyrol are scarce. It is to say that some locations offer more than one charger.

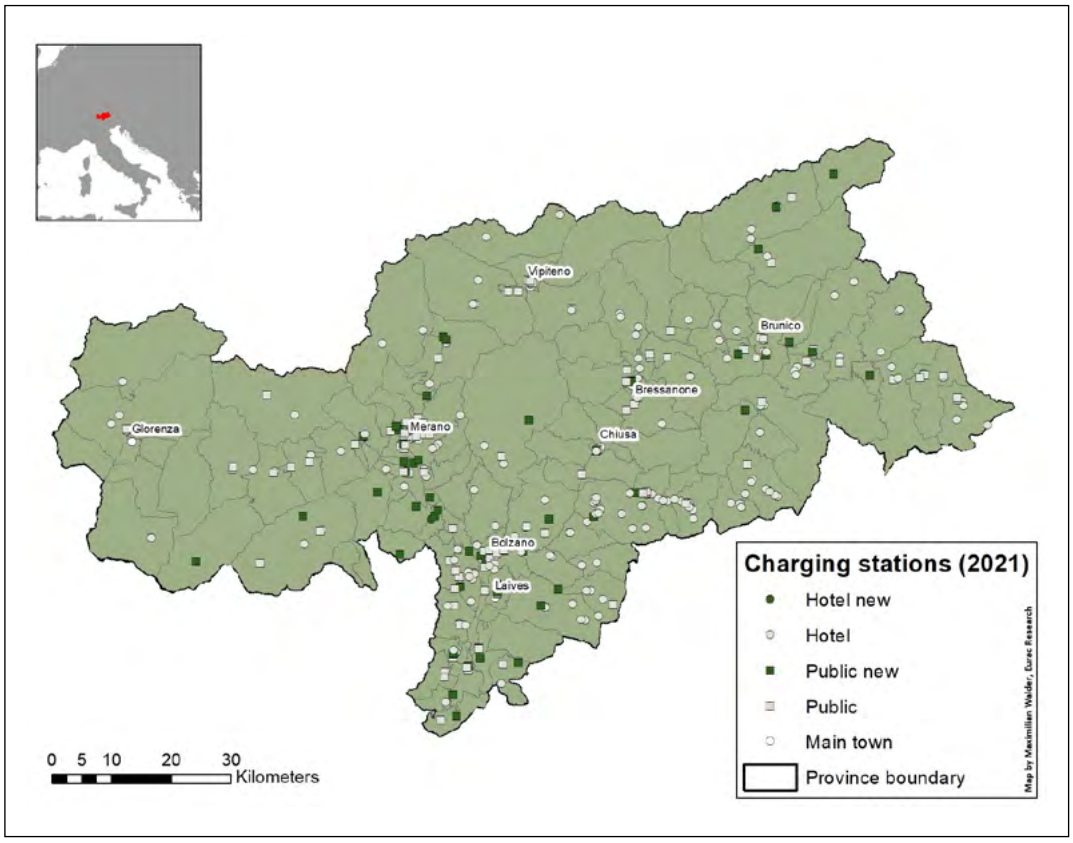

Figure 25: Charging stations for e-mobility in hotels and in public areas, South Tyrol 2021. Sources: Neogy and Tesla, own elaboration.

Mobility

WHAT COULD BE DONE?

- ➜ Strenghten the public transport infrastructure and incentivise its usage by guests
- ➜ Increase the number of charging stations for e-mobility both in accommodation facilities and in public areas
- ➜ Limit the touristic traffic in sensitive areas during peak seasons

11.

Land use and landscape diversity

11 Land use and landscape diversity

Maximilian Walder
Daria Habicher

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A permanently environmentally friendly land use should contribute to the preservation of natural ecosystems, guarantee the supply of mankind with natural resources and thus not endanger the basis of life and economy of present, as well as future generations. In the Agenda 21 formulated in 1992 the United Nations referred to the urgency and relevance of sustainable settlement development (Chapter 7) and to integrated, sustainable planning and management of land resources (Chapter 10) (United Nations, 1992). Similarly, reference to this topic was also made by the United Nations in 2015 in the 17 Sustainable Development Goals developed as well as in its adaptation by the UNWTO for tourism, particularly in goals 11, 13 and 15 (United Nations, 2015; UNWTO, 2022). Especially for an alpine region like South Tyrol, characterized by a lot of natural landscape and little more than 5% of area of permanent settlement, a well-founded discussion about the finite resource land is central (ASTAT, 2013).

Humans are the main factor influencing land use and landscape through their consumption and lifestyle habits, as well as through economic activities. Beside other economic sectors, such as agriculture or industry, tourism also shapes the natural landscape and the land use of South Tyrol. At the same time, an intact nature, a well-kept and attractive natural as well as cultural landscape are the basis for the functioning and success of tourism in South Tyrol. Against this backdrop, an analysis of the influence of tourism on landscape diversity and land use is particularly important. Concrete goals that might be pursued in South Tyrol in this context are a limitation of the quantity of new accommodation and food services facilities (e.g., by using vacant buildings or shared buildings) and the limitation of the construction of tourist facilities in non-residential areas.

INDICATOR		VALUES (ABSOLUTE)	CHANGE (%)
11.1	**Beds per land use zone and category (Reported value: Most prevalent area)**	**2021**	**2020*-2021**
		Residential areas (41.6%)	Residential areas (40.8%)
11.2	**Areas for tourist facilities (Reported value: Average size of the area for tourist facilities)**	**2021**	**2020*-2021**
		3.7 hectare	-0.09%
11.3	**Bed density in residential zones (Average bed density in residential zones)**	**2021**	**2020*-2021**
		21.4 beds per hectare	-0.014%

Table 13: Indicators for land use and landscape diversity. Sources: Office of Regional Planning and Cartography, Province Bolzano-South Tyrol and LTS. *Data prior to 2020 not available.

P

11.1 BEDS PER LAND USE ZONE AND CATEGORY

Land use zones, such as for example residential or agricultural areas, are areas with specific provisions and building regulations. In South Tyrol, 41.6% of beds are located in residential areas (areas A, B, C), 36.8% in agricultural areas, 11.9% in areas for tourist facilities and 9.7% in other land use zones. Concerning the accommodation category, the majority of the "star establishments" (hotels) are also located in residential areas (44.2%), agricultural areas (30.9%) and areas for tourist facilities (15.7%). The majority of the "flower establishments" (farm residences), namely 82.4%, are located in the agricultural areas, followed by the residential areas (10.5%) and the forest areas (3.59%). Around 58% of the "sun establishments" (private room rental facilities) are located in the residential areas, followed by the agricultural areas (34.3%) and the forest (1.9%).

R

11.2 AREAS FOR TOURIST FACILITIES

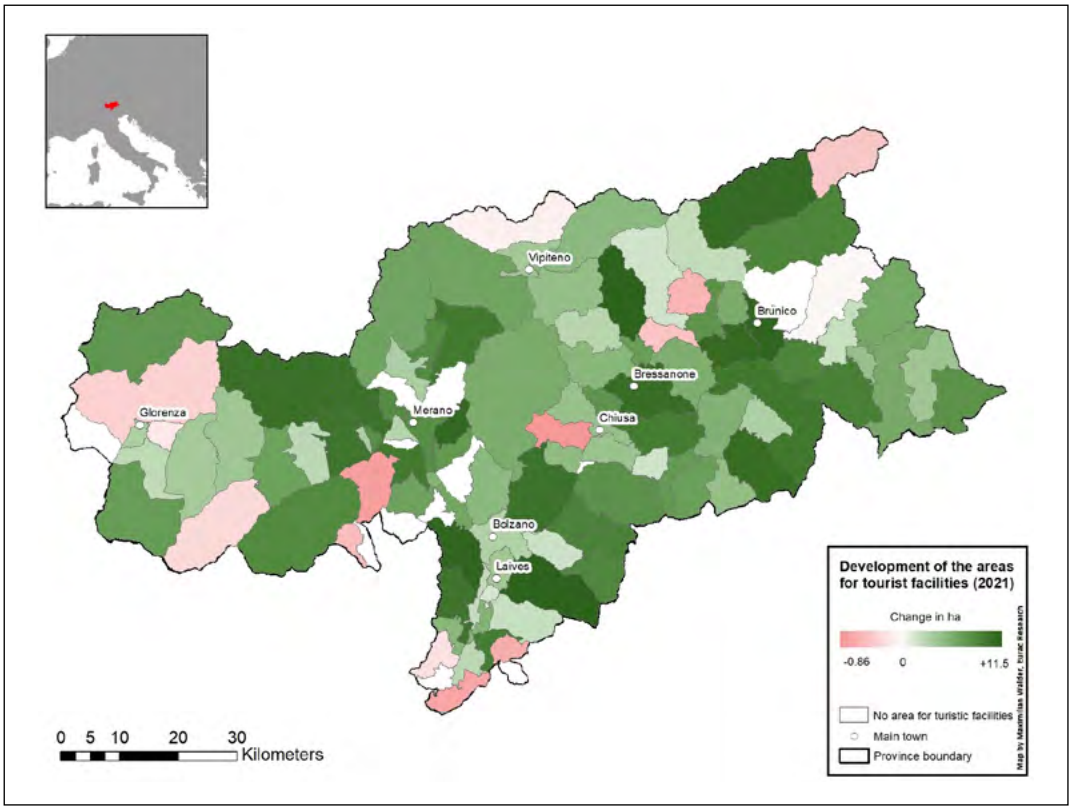

Figure 26: Development of the areas for tourist facilities at municipality level, South Tyrol 2016-2021. Yearly data on municipality level. Source: Office of Regional Planning and Cartography, Province Bolzano-South Tyrol, own elaboration.

Since 2007/2008, municipalities have had the possibility to designate areas specifically for tourist facilities. In general, in the period between 2013 and 2021, areas for tourist facilities increased in most South Tyrolean municipalities (in 83), in 7 municipalities the area did not change[6] and in 10 municipalities the areas decreased slightly[7]. All of the latter are municipalities with low or average tourism exposure. Until 2021, only 15 municipalities did not assign special areas for tourist facilities[8], with Riffian/Rifiano, Pfatten/Vadena and Kastelbell-Tschars/Castelbello-Ciardes being the municipalities assigning areas only in the last year. The municipality with the biggest surface for tourist facilities in 2021 is Brixen/Bressanone with 18.6 ha. It should be noted that the increases and decreases are minimal in some cases.

P

11.3 BED DENSITY IN RESIDENTIAL ZONES

The stronger the colour, the higher the bed density in residential zones in the respective municipality (for information on how the bed density is calculated see **Annex 2**). In **Figure 27** we can see that the bed density in the residential zones of South Tyrol's east, especially in the Dolomites area, is higher than the one in the South. The average density in South Tyrol is 22.1 beds per hectare. The three municipalities with the lowest bed density in residential areas are Neumarkt/Egna, Laas/Lasa and Gargazon/Gargazzone. The highest density is to be found in Corvara, Wolkenstein and Schenna, all very touristic municipalities. Two municipalities, Pfatten/Vadena and Laurein/Lauregno, do not have any beds in residential zones. In general, regions with a higher bed density in residential areas than in rural areas might be better from an ecological point of view but might have a negative impact on the local population's attitude towards tourism, especially if these areas include tourism hotspots.

6 Terenten/Terento, Truden/Trodena, Salurn/Salorno, St. Pankraz/San Pancrazio, Villanders/Villandro

7 Unsere Liebe Frau im Walde/Senale-San Felice, Rasen-Antholz/Rasun-Anterselva, Brenner/o, Schluderns/Sluderno, Kurtatsch/Cortaccia, Martell/Martello, Mals/Malles, Prettau/Predoi, Rodeneck/Rodengo, Proveis/Proves

8 Altrei/Anterivo, Andrian/Andriano, Gais/Gais, Kuens/Caines, Kurtinig/Cortina, Laurein/Lauregno, Margreid/Magrè, Mölten/Meltina, Nals/Nalles, Percha/Perca, Schenna/Scena, Taufers/Tubre, Tirol/Tirolo, Tscherms/Cermes, Waidbruck/Ponte Gardena

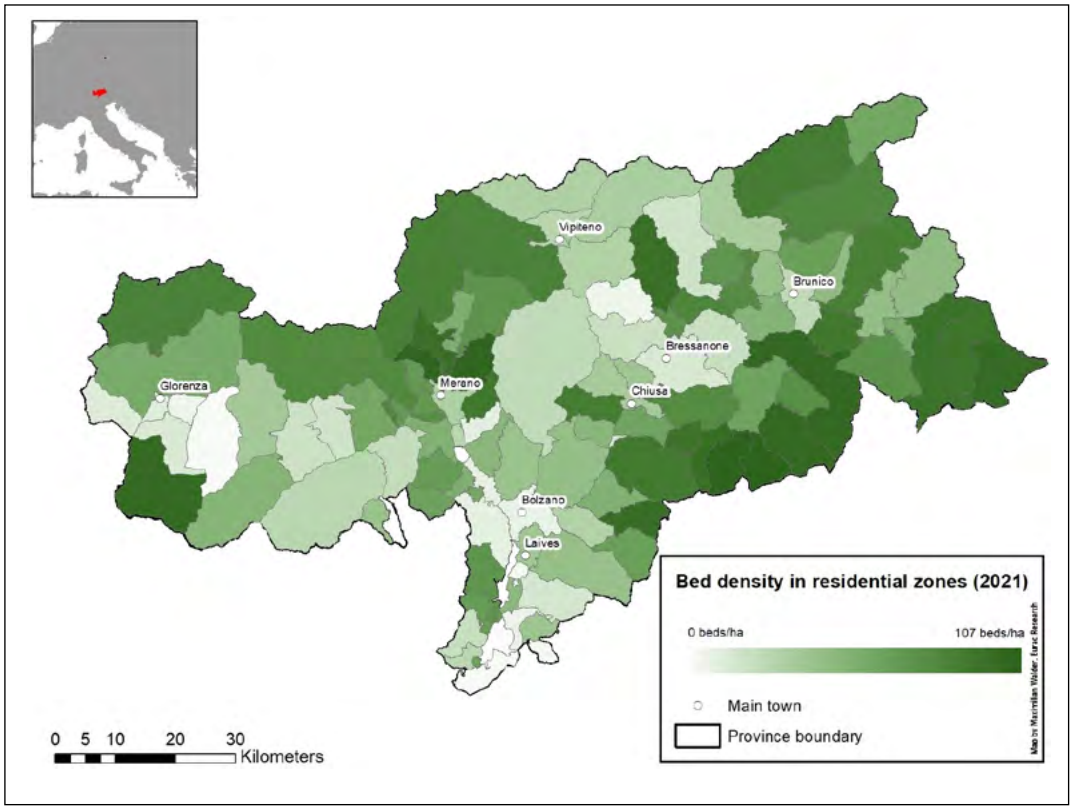

Figure 27: Bed density in residential zones at municipality level, South Tyrol 2021. Source: Office of Regional Planning and Cartography, Province Bolzano-South Tyrol and LTS, own elaboration.

Land use

WHAT COULD BE DONE?

- ➔ Limit the construction of tourist facilities outside city centres
- ➔ Limit the quantity of new accommodation and food services facilities

12.

Nature conservation

12 Nature conservation

Michael de Rachewiltz

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Nature-based tourism in destinations such as South Tyrol relies heavily on recreational opportunities provided by the environment and in turn also contributes to the attractiveness and quality of destinations (see also Scuttari et al., 2019). In this context, tourism, depending on the intensity, concentration and behaviour of visitors on site, can either endanger the environment or constitute an impulse for positive change. In fact, as it is based on the enjoyment of the natural and cultural surroundings, tourism can be a driving force for nature protection, play a positive role in raising awareness and consumer education through its vast channels of communication and provide an economic incentive to protect habitat that might otherwise be converted to less environmentally friendly purposes (UNWTO, 2004). On the other hand, it might also become a source of stress for certain fragile environments. It is therefore quite essential for a sustainable development in tourism to reduce the negative human impact on nature and the environment in tourism destinations and to protect biodiversity through concrete measures.

RS

12.1 NATURAL AND PROTECTED AREAS AT THE INTERFACE TO TOURISM

In order to link tourism and nature conservation and identify those areas where a balance between conservation and enhancement is pursued, we show the extent to which natural areas are protected. The effects of human activities on nature conservation are multifold and, among these activities, it is not always easy to define the weight of tourism. We attempt to exemplify the impact of tourism activity on the ecosystem by using a cartographic overlap of the geolocated accommodation facilities and the number of beds with the nature reserves, natural monuments and biotopes (see **Figure 28**). This map illustrates how close tourism is to ecologically valuable and often particularly vulnerable areas in South Tyrol. Especially some highly touristic communities in the Dolomites and around the city of Meran/Merano show the proximity to these ecologically sensitive zones.

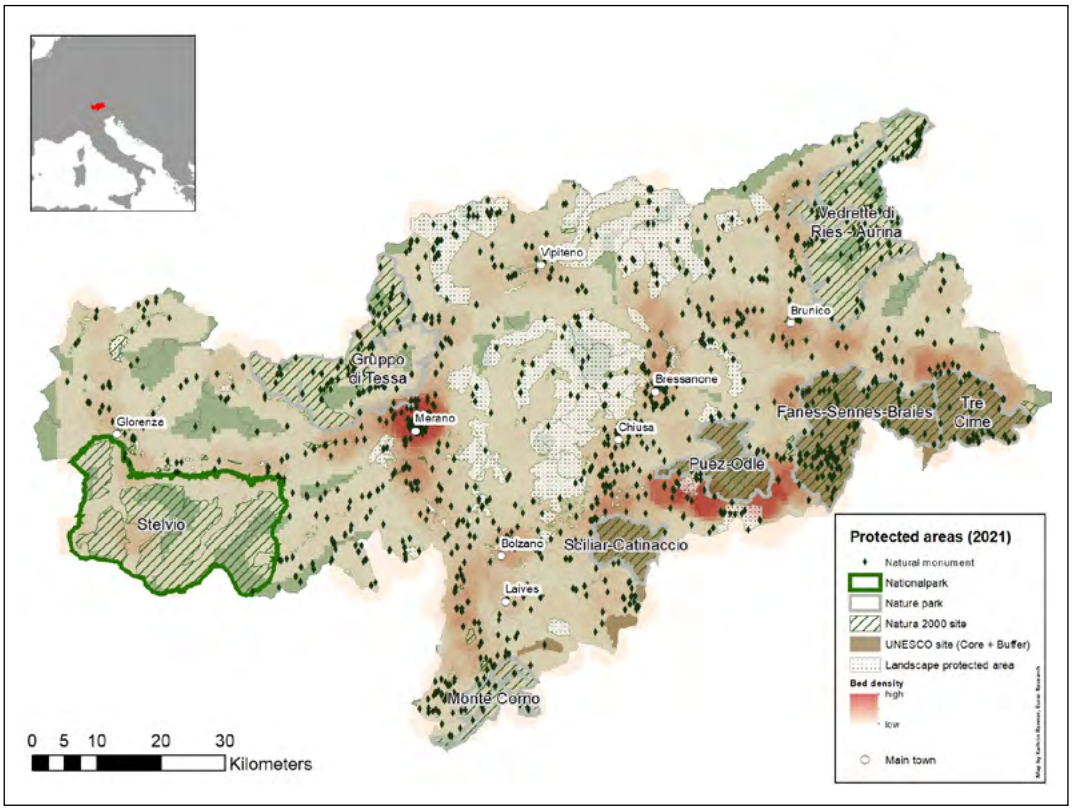

Figure 28: Natural and protected areas at the interface to tourism - cartographic overlap. Source: Office of Regional Planning and Cartography, Province Bolzano-South Tyrol and LTS, own elaboration.

Nature Conservation

WHAT COULD BE DONE?

- ➔ Promote the awareness of existing nature reserves
- ➔ Reduce negative human impact on the natural environment in tourism destinations
- ➔ Protect biodiversity through concrete measures

13.

Culture

13 Culture

Greta Erschbamer
Michael de Rachewiltz
Maximilian Walder

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South Tyrol is a popular holiday destination for culturally interested tourists due to its many cultural treasures and its rich history. Over the last 150 years, tourism has had a great impact on the most diverse forms of culture worldwide. In material terms, this influence on culture has existed and continues to exist directly in the form of hotel facilities, infrastructure etc., but also indirectly through the prosperity fostered by tourism in the region. The influence of tourism on immaterial cultural assets is more difficult to assess and is underexplored in tourism research, but tourism stakeholders report that it clearly exists. To close this knowledge gap, qualitative interviews and workshops with different stakeholders were held in order to investigate the relation between culture and tourism with the specific reference to the practice of transhumance. Moreover, the development of a code of conduct for the cultural tradition of transhumance was initiated with the participation of local experts of the valley of Schnals/Senales in South Tyrol. In addition, quantitative data on museum visitors were collected to better explore the relation between culture and tourism and quantify the relevance of cultural tourism for South Tyrolean guests.

When investigating and collecting data on culture and tourism, some key objectives need to be established and pursued in order to continually develop the issue area. First of all, establishing the issue area of culture and tourism has shown that raising awareness of the importance of tangible and intangible culture for the region is a key element for sustainable development. Second, culture should be preserved and promoted as a living heritage for future generations. The socio-cultural effects of tourism need to be considered to harness the positive aspects on the quality of life of the inhabitants. The transformative experiences of the tourists and the contribution to intercultural understanding is important for this development, while at the same time negative aspects such as the commodification and homogenization of culture, cultural appropriation or the loss of identity need to be monitored and reduced. Third, the mediation role of the hosts is crucial to communicate and transfer the principles of cultural sustainability to its guests. This role should be acknowledged, further developed and expanded. Moreover, the development of this role needs to be guided and supported by political entities.

INDICATOR		VALUES (ABSOLUTE)		CHANGE (%)	
13.1	Museums by type and tourism exposure (Reported value: Total numbers of museums)	2010	2021	2010-2019	2019-2021
		83	no data	+33.7%	no data
13.2	Museum visitors	2010	2021	2010-2019	2019-2021
		1,474,414	no data	+45.6%	no data

Table 14: Indicators of Culture. Source: ASTAT (13.1, 13.2) and Lorima (13.2).

BOX 5: THE DEVELOPMENT OF A CODE OF CONDUCT FOR THE PRESERVATION OF IMMATERIAL CULTURAL HERITAGE

In the last edition of the report, the impact of culture and tourism was studied using the example of the tradition of transhumance, an ancient form of pastoralism where livestock is moved from one mountain region to another. One of the central findings was the importance of raising awareness among visitors and local stakeholders about the knowledge on tangible and intangible heritage related to the transhumance, as well as some challenges of the annual local event in connection with the transhumance (Ghirardello et al., 2022). This initial starting point related to the proposition of the increasingly important role of culture as a factor in the development of a sustainable future, has led to this year's research project exploring the possibilities of establishing a code of conduct for the tradition of transhumance in the Schnals/Senales valley. The elaborated code of conduct should not be seen as a traditional binding set of rules, but the possibility to narrate various topics related to the ancient tradition of the transhumance, for a respectful approach to nature and culture, in order to strengthen and safeguard the passion, the sense of connection and the knowledge surrounding this tradition for future generations. The research aims to contribute to the current discussion on how to further develop and strengthen the social and cultural dimension of sustainability.

Based on extensive literature, research on the development of a code of conduct and the results of a workshop with local stakeholders (representatives from sectors such as agriculture, tourism, forestry, local government and culture) about the importance and challenges of the transhumance, a first draft of the code of conduct will be elaborated. Examples of existing codes of conduct and current literature show that successfully adopted codes of conduct should be developed by and for all parties involved in the tourism sector, in particular local authorities. Besides, codes are more likely to be successful if they are positively stated, action oriented and avoid prohibitive language (WWF, 2001). In the past, critiques towards normative codes included the lack of providing sufficient motivations for why visitors should adopt the guidelines (Malloy and Fennell, 1998). It has been shown that voluntary codes are more likely to be adopted by those affected when they have had the opportunity to participate in the drafting of the guidelines (Garrod and Fennell, 2004).
For these reasons, this edition's research project wants to focus on how the process of developing a code of conduct, where both, potential visitors and local stakeholders could participate in the process, can be implemented. The reasons for the guidelines will be explained with a positive wording in order to increase the effectiveness of the code. Furthermore, we are interested in how such a code of conduct can address the current challenges of the transhumance and what future generations can learn from this ancient form of pastoralism.

Methodologically, workshops will be conducted with the various stakeholders in homogeneous and heterogeneous groups using design methods in an interdisciplinary process to explore the activities, groups of people, hotspots, infrastructures and potential problem areas and challenges during the transhumance. With the gained inputs and results, a code of conduct will be elaborated and presented to the stakeholders. Ultimately, the final version of the code of conduct will be presented and discussed at an international conference and included in next year's edition of the report.

S

13.1 MUSEUMS BY TYPE AND TOURISM EXPOSURE

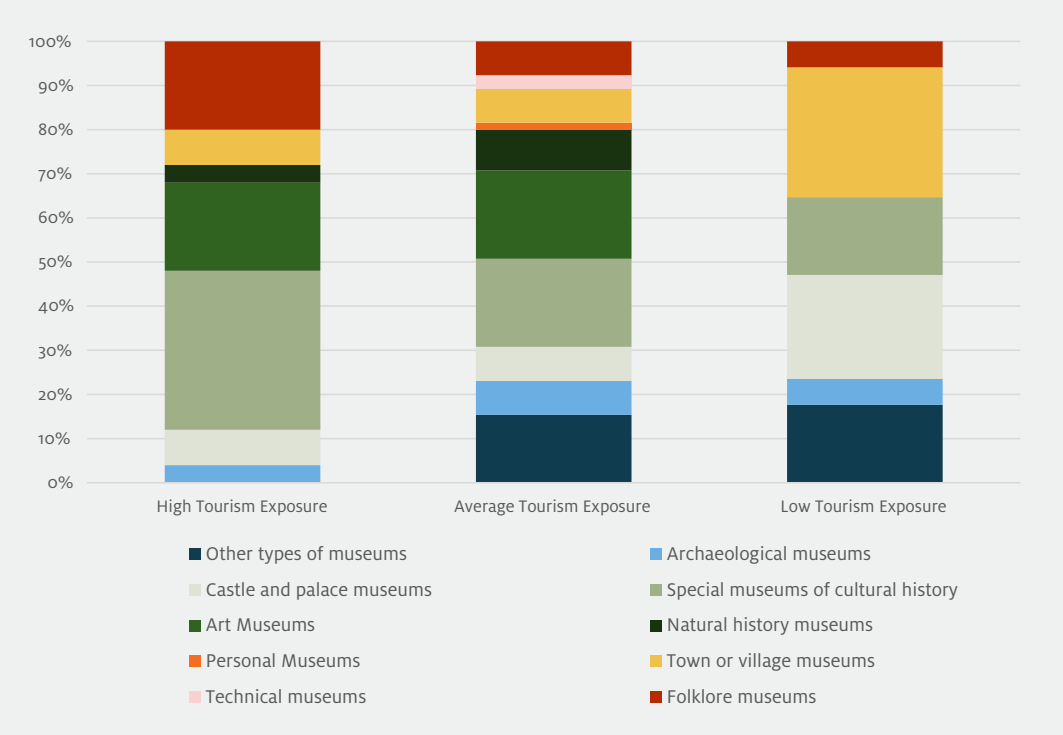

Figure 29: Museums by type and tourism exposure, South Tyrol 2020. In percentage values. Source: ASTAT, own elaboration.

Museums play an important part in showcasing local culture and heritage. This has educational value for tourists as well as marketing value to the destination itself. In South Tyrol, since the nineties[9] museums started to open all around the province and with a steady increase. The number of museums peaked in 2019 with 111 single facilities and decreased slightly in 2020 to 107 (official) museums. **Figure 29** shows the variety of museums and their distribution in the single municipality categories. Most museums (65) can be found in municipalities with average tourism exposure, obviously as it is the group of municipalities with the most units. Comparing municipalities with high and low tourism exposure, we can observe that more touristic towns offer more museums than less touristic municipalities, although each of these two categories entails 25% of the South Tyrolean municipalities, i.e., 29 units. This might indicate an effect the presence of tourists might have also on the museum offer and cultural sector in more general terms. Additionally, municipalities with low tourism exposure have a larger number of town or

9 29 museums opened between the years 1991 and 2000, 25 between 2001 and 2010 and 22 after 2011.

village museums and castle and palace museums, whereas municipalities with high tourism exposure offer cultural historical museums, art museums and folklore museums. This might be connected to characteristics of the individual towns themself and their local specificities.

13.2 **MUSEUM VISITORS**

To gain further insights into cultural tourism in South Tyrol, quantitative data on museum visits were collected and analyzed. Overall, tourists constitute a large part of museum visitors in South Tyrol. In fact, official estimates calculate that tourists made up 79.4% of the total museum visits in 2017, 66.4% in 2018, 66% in 2019 and 78.9% in 2020 , which in 2019 results in a number of 1,417,557 and for 2020 in a number of 517,670 tourist visitors to South Tyrolean museums. (ASTAT, 2021).

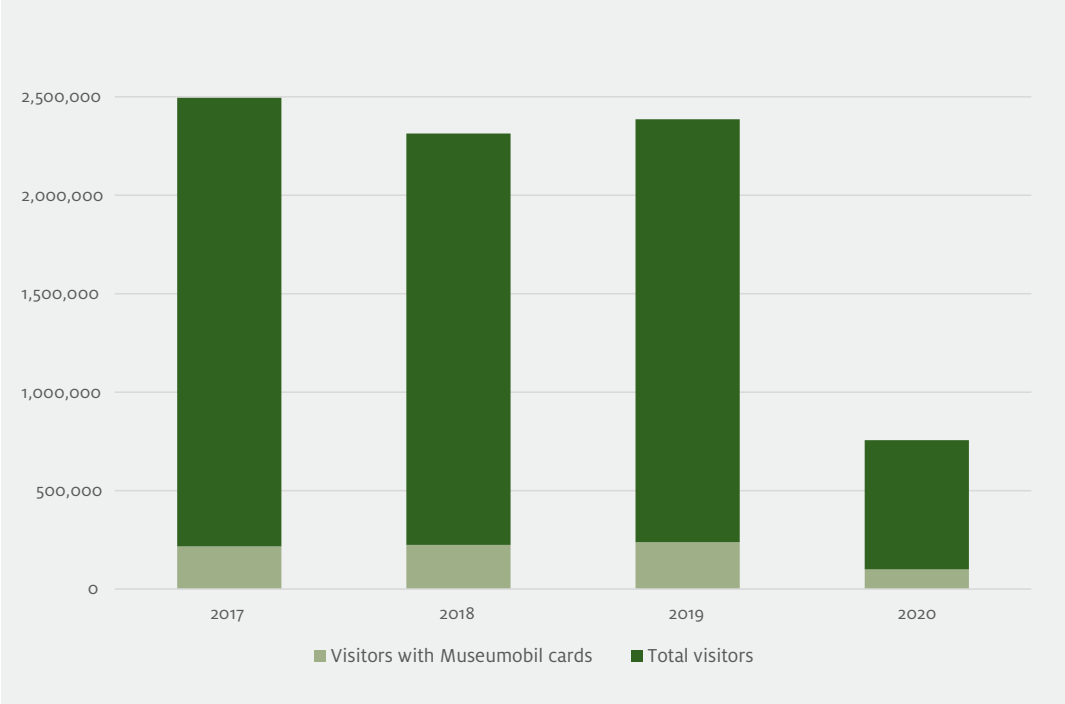

Figure 30: Total visitors and visitors with museumobil cards, South Tyrol 2017-2020. Source: ASTAT and Lorima, own elaboration.

Moreover, several types of mobility cards offered to tourists in South Tyrol allow free access to museums and cultural venues (See also **10 Mobility**). **Figure 30** shows the total number of museum visitors from 2017 to 2020 and the proportion of the so called museumobil cards used

(for 2021, the total number of museum visitors is not yet available). Despite the sharp decline in visitor numbers due to the Covid-19 pandemic, there is nevertheless a trend towards the use of combined tourism products, such as the areas of mobility and museum admissions.

As far as the distribution of museumobil cards over the year 2021 is concerned, due to the pandemic restrictions, the usual visitor numbers were not reached again until the summer. The months of July, August and October are the three months with the highest amount of visitors (see **Figure 31**). In 2021, up to the month of April museums were not allowed to welcome any visitors due to restriction measurements against the Covid-19 pandemic.

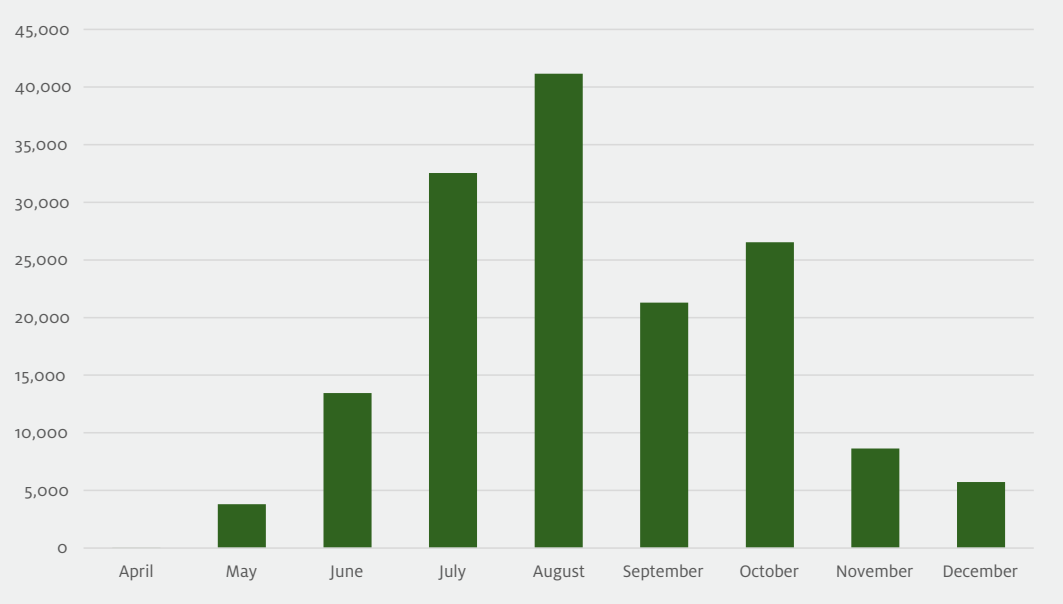

Figure 31: Total visitors with museumobil cards by month, South Tyrol 2021. Source: Lorima, own elaboration.

Culture

WHAT COULD BE DONE?

- ➜ Raise awareness of the importance of tangible and intangible culture for the region
- ➜ Preserve and promote the culture as a living heritage for future generations
- ➜ Let hosts act as communicator and role model of cultural sustainability for their guests

14.

Climate action

14 Climate action

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Being responsible for around 8% of global greenhouse gas emissions (Lenzen et al., 2018), the tourism industry substantially contributes to climate change. At the same time, the touristic offer is directly affected by changing climate conditions, with negative effects for many destinations worldwide (Scott et al., 2012). Therefore, it is both a responsibility of and necessity for tourism actors to actively engage in climate action – a plea forcefully promoted in the Glasgow Declaration on Climate Action in Tourism, whose signatories commit to at least cutting global tourism emissions in half over the next decade and to reach Net Zero emissions as soon as possible and before 2050[10]. More specifically, climate action enfolds along two main lines: climate change mitigation and climate change adaptation. Climate change mitigation regards any human intervention that reduces greenhouse gas (GHG) emissions or contributes to the absorption of GHG from the atmosphere (IPCC, 2018). For the tourism sector this includes, among other things, measures to reduce emissions from transport, such as promoting high-quality and affordable cross-border public transportation and e-mobility, as well as monitoring and reducing emissions produced in accommodation facilities in line with internationally agreed upon targets, while switching to renewable energy sources. While the Glasgow declaration emphasizes decarbonisation as a central strategy towards climate neutrality, the adjustment to actual or potential effects of climate change is equally important in order to reduce risks and take advantage of favourable opportunities. This is the second main aspect of climate action and goes under the name of climate change adaptation. In this context, a vital step to strengthen the resilience and adaptive capacities of the local tourism industry would lie in the elaboration of a climate adaptation plan comprising climate impact analyses, the identification of vulnerabilities and risks as well as concrete adaptation measures. These concrete measures might include technical measures to reduce specific environmental risks, a diversification of the touristic product creating new offers for low seasons, as well as visitor guidance and management systems (for more measures see Pechlaner et al., 2022).

South Tyrol is no exception when it comes to the two-way relationship between tourism and climate change. Rising average temperatures, a lack of snowfall and the increasing risk of avalanches, as well as extreme weather events pose major challenges for future tourism in South Tyrol. Although data on the emissions attributable to the tourism sector in South Tyrol are rare, three key areas to look at can be identified: transport, accommodation and touristic activities.

10 https://www.oneplanetnetwork.org/programmes/sustainable-tourism/glasgow-declaration

According to a recent estimation, accommodation facilities alone are responsible for almost 5% of South Tyrol's total GHG emissions (Zebisch et al., 2018). In addition, it was estimated that the arrival in and departure from the destination by tourists cause around 3% of all transport-related emissions in South Tyrol (Ibid.). For the third area of touristic attractions and activities, as of today, no such estimation exists. As the transport sector constitutes the largest emitter of CO_2 emissions in South Tyrol, in this first year of this new issue area we want to provide a solid and up-to-date estimation of transport-related touristic emissions.

INDICATOR		VALUES (ABSOLUTE)		CHANGE (%)	
14.1	Estimated car-related CO_2 equivalent emissions from inbound tourism	2019	2021	2010-2019	2019-2021
		102.4 kt CO_2eq	68.9 kt CO_2eq	+39.9%	-32.7%

Table 15: Indicators of climate action. Source: own calculation based on data from ASTAT, STOST, Google Maps, German Umweltbundesamt.

14.1 ESTIMATED CAR-RELATED CO_2 EQUIVALENT EMISSIONS FROM INBOUND TOURISM

To estimate the transport-related touristic emissions in South Tyrol, we rely on various data sources, from which we draw key information on, among other things, the number of arrivals per market, the travelling behaviour of guests and average emission factors per vehicle kilometre. In order to reduce complexity, and since more than 90% of guests arrive by car (de Rachewiltz et al., 2021), we focus on private cars and exclude other types of transportation in our first calculation (such as trains, coaches or motorcycles). Following the territorial principle, used among others by the IPCC, which attributes only those emissions to a region, which are produced within its geographical boundaries, we considered the movement of tourists from the moment they enter the South Tyrolean border to the moment they leave it (i.e., arrival/departure as well as internal mobility). For a detailed description of the estimation procedure see **Annex 2**.

According to our calculation, in 2021, car-related CO_2 emissions attributable to inbound tourism in South Tyrol amounted to 68.9 kilotonnes CO_2 equivalents. This equals 5.7% of all the traffic-related emissions produced in South Tyrol in that year. While emissions rose by almost 40% between 2010 and 2019, they fell again between 2019 and 2021 (-32.7%). This reduction is mostly explained by the reduced tourist activity compared to pre-pandemic levels. In order to reduce touristic car-related emissions on South Tyrolean territory in the long term, different measures are instrumental, the most important of which is the promotion of alternatives to individualized, fossil-fuel-based traffic (e.g., public transport, e-mobility), both for the arrival/departure of guests and their movement within the destination (see **10 Mobility**).

While the territorial approach of calculating emissions employed above is useful in terms of international and interregional accounting and comparability, a more comprehensive analysis would need to consider emissions generated outside of South Tyrolean borders as well. If we thus include the journey to and from the South Tyrolean border in our calculation, we reach 387.2 kilotonnes CO_2 equivalents. Furthermore, taking a consumption-based rather than a production-based approach would imply considering production-related emissions as well, based for instance on the lifetime mileage of the means of transport, as well as upstream emissions from fuel supply (Davis & Caldeira, 2010). If we include these indirect emissions, our estimation of

car-related CO_2 equivalent emissions of inbound tourism in South Tyrol increases by 15.8%. This broader perspective opens new possibilities to reduce emissions, beyond the one mentioned above. This includes, for example, national as well as international, cross-border cooperation in providing alternatives to private cars (e.g., network of high-speed trains, better range of night trains) and a strategic selection of touristic markets, aiming at reducing the distance to be travelled by car (or by airplane). In this latter regard, South Tyrol is already well positioned (see **Figure 4**) and should, from a mitigation perspective, continue to focus on close-distance markets.

BOX 6: CLIMATE CHANGE ADAPTATION OF THE TOURISM SECTOR IN TRENTINO – SOUTH TYROL. AN EXPLORATORY STUDY IN GRÖDEN/VAL GARDENA AND MADONNA DI CAMPIGLIO.

The Italian Provinces of Trient/Trento and Bozen/Bolzano, which together form the Trentino-South Tyrol region, are highly exposed to climate risk, especially due to the economic importance of ski tourism (ESPON & IRPUD, 2011). Although the regional tourism sector has a high potential to adapt to the impacts of climate change, the acceptance of adaptation measures among tourism stakeholders is needed (Kruse et al., 2013, p. 282). Indeed, tourism stakeholders react (or fail to react) to climate change depending on their perceptions, their roles, as well as the solutions at hand, and these conditions vary among territorial units. Therefore, understanding their views and the local context is the first step to foster successful climate change adaptation (CCA). To investigate the extent to which there are differences in adaptation processes between these two areas and between stakeholder groups, one locality in Trentino (Madonna di Campiglio) and one in South Tyrol (Gröden/Val Gardena) were chosen as case-studies. The research was conducted as part of a master's thesis between July 2021 and January 2022 and submitted for the completion of the M.Sc. Environmental Governance at the Albert-Ludwig University of Freiburg (Garzon, 2022).

Based on the concept of adaptive capacity (Adger et al., 2007), this research used both quantitative and qualitative approaches to explore climate change awareness and adaptation of public and private actors engaged in the tourism sector. For the qualitative part, provincial and local politicians, as well as nature park managers, tourism offices, cable car companies and mountain guides were interviewed, (12 interviews). At the same time, the attitudes of managers in the hotel industry of "low" (1-2 star), "medium" (3 star) and "high" (4-5 star) categories and resorts were investigated through a quantitative survey. The online questionnaire was submitted to 142 hotel owners in the Campiglio area and 254 hotel owners in Gröden/Val Gardena. 54 questionnaires were collected in total. Given the low response rate (17,6% and 11,4%, respectively) and possible non-response biases, results are to be considered merely exploratory in nature, that is, they are not representative of the destination as a whole. The findings of the study indicate that the two areas and stakeholder groups vary in certain aspects. The most relevant difference between the areas regards the awareness of climate variability and its local effects, which appears to be greater in Campiglio than in Gröden/Val Gardena. In Campiglio, all interviewed stakeholders claimed changes in the weather and the local environment to be direct causes of climate change, and overall reported more visible climate change effects compared to their counterparts from Gröden/Val Gardena. The results of the analysis in Gröden/Val Gardena, on the contrary, suggest a slightly higher tendency towards climate change denial or scepticism. Out of six interviewed actors, two said they had not noticed any changes in the climate in the past decades, other than the occurrence of extreme temperature leaps, which however, they both attributed to theories of "waves". Climate scepticism also emerged from the survey in Gröden/Val Gardena. Many hotel owners contacted claimed not to be interested in responding, as climate change did not concern them, and one of them even called the existence of local changes in climate, as well as the scope of the research into question. The higher consciousness level in Campiglio could be partly explained by the considerable impacts of the Vaia storm in Trentino, which hit the area in 2018. As local actors reported, Vaia left a mark on the minds

and spirits of the local population, as one of the victims of the storm happened to be within the study area. In Gröden/Val Gardena on the contrary, damages caused by Vaia were rather limited, and no interviewee reported it as a climate change effect.

To a certain extent, climate awareness tends to reflect the willingness of local actors to face climate change impacts. Here, the most important differences were between case-study areas and between mountain guides and other actor types. While Trentino has adopted a Provincial Strategy of Climate Change Adaptation, South Tyrol still lags behind, as its Climate Plan – South Tyrol Energy 2050 does not envisage specific climate adaptation measures, which will have to be defined by individual municipalities. Policymakers in Trentino claimed the delay in the definition of the plan by higher institutions to be the biggest barrier to adaptation, whereas the picture that emerged from the interviews with policymakers in Gröden/Val Gardena at the local and provincial level is that of a policy 'silo mentality', which risks leading to a 'buck passing' in adaptation issues. As far as the private sector is concerned, Campiglio cableways are at the forefront of climate mitigation action, and the newly introduced dynamic price system make them quite flexible and adaptable to changing weather and snow conditions. Gröden/Val Gardena cableways on the contrary might be more exposed to coordination issues, given the higher number of companies coexisting on site (41). Among all interviewed stakeholders, Campiglio mountain guides were the only ones explicitly referring to CCA, given their direct experience with a changing environment on a regular basis. Measures by other groups, on the other hand, might have been taken with the possibility of increasing profit in mind, rather than in view of a potential shortening of the winter season. In addition to awareness and willingness, differences in the factors that affect stakeholder groups influence the way they view adaptation, and tourism development in general. The main diverging view that emerged from the analysis is that of a "creative" or "sustainable" adaptation, as opposed to a "technological" adaptation, which is mostly advocated for by mountain guides, and by cable car companies, respectively. The former see skiing as an environmentally and economically unsustainable activity, which should be abandoned in favour of more diversified, less-impacting alternatives. The latter, on the contrary, perceive skiing as a crucial component of the winter season offer, which requires a constant adjustment through the deployment of technical measures, e.g., performing snow cannons, given that no comparable GDP-generating activity has been found so far.

The variety of perceptions and responses to climate changes requires the support for CCA actions to be actor- and context-specific. Based on the collected evidence, in Gröden/Val Gardena there is a need for greater awareness-raising on CCA. In fact, adaptation actions are usually reactive, but should ideally also be proactive (Amundsen et al., 2010). In order to guide all economic sectors in the process, specific policy guidelines on adaptation at the provincial level could be elaborated, following the example of the neighbouring province. Greater coordination among provincial departments and between the province and the municipalities on climate matters could also be beneficial. In Campiglio, and Trentino at large, there is room for further engagement of local tourism operators and the fostering of bottom up CCA initiatives. This could help counteract the problem of inefficient institutions at higher levels. In both case-study areas, the existence of diverging views on adaptation as described above, suggests that winter tourism would require both a long-term view on tourism and more ambitious actions to diversify risk, as well as technology-based short-term measures to support the ski industry in the first transitional phase.

Climate action

WHAT COULD BE DONE?

- ➔ Monitor and reduce CO_2 emissions across the whole touristic value chain
- ➔ Promote alternatives to individualised, fossil-fuel-driven transportation and infrastructures
- ➔ Elaborate a climate adaptation plan including climate impact analyses, the identification of vulnerabilities and risks as well as concrete adaptation measures


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15.

Accessibility

15 Accessibility

Maximilian Walder

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Accessibility is a comprehensive concept that enables everyone equally to participate in social life and is not solely limited to special solutions for people with disabilities (PwD). Globally, the WHO estimates that 15% of the population has requires some form of accessibility assistance (WHO, 2022). This number includes people who might have temporary difficulties, like pregnant women or persons recovering from accidents and in a progressively aging society also elderly people cannot be forgotten. In order to ensure a fair society with room (and to move in this room) for everyone, every part of life needs to be accessible. This includes people's holidays.

For a long time, PwD have been largely excluded from travel and tourism because of lack of opportunities. Destinations were not prepared for people with special needs, also because generally PwD were not part of the social discourse. Only in the year 1975, when the UN published the *Declaration on the Rights of Disabled Persons* a disability social movement began to form and to call for equal rights for PwD (Darcy et al., 2019). Another important step towards accessible tourism happened in the year 1990, *The European Year of Tourism*, during which the *Tourism for All in Europe* conference was held and publicly raised awareness of the issue (Ability Advisor, 2022). In succession, social organizations started to focus on this matter, initiating campaigns and events and overall raising awareness. Destinations followed the call for tourism for all and started adjusting for special needs.

Today, accessible tourism is defined as an all-inclusive tourism (Lodgify, 2022), which means people with or without disabilities have equal access and enjoyment of tourist accommodation, transport, tourist activities, trained service staff and an inclusive marketing system (such as accessible websites[11]) (ENAT, 2022). To ensure that people with disabilities and the people who take care of them can fully enjoy the destination, combined efforts from local stakeholders and decision makers are therefore needed. Tourism for all is hereby not only beneficial for PwD, barrier-free living spaces also represent added value for local populations and overall for a more fair society.

11 Accessible websites are designed and developed in a way that people with auditory, cognitive or visual impediments, can still use them.

INDICATOR			VALUES (ABSOLUTE)
15.1	Accessible gastronomy and accommodation facilities	Accommodation	**2021***
			362
		Gastronomy	**2021***
			170
15.2	Accessible cultural facilities and free time activities		**2021***
			244

Table 16: Indicators for accessibility. Source: independent L. (15.1, 15.2). *Data for previous years were not available.

15.1 ACCESSIBLE GASTRONOMY AND ACCOMMODATION FACILITIES

In order to assess accessibility in touristic facilities, certain standards need to be checked. Indicators for accessibility are e.g., reserved parking spaces for PwD, level-access showers, inclusive menus or barrier-free facilities within the structure. Indipendent L., a social association with the mission to promote a self-determined life and mobility for PwD in South Tyrol, among many other things provides the online platform Südtirol für alle – Alto Adige per tutti. The website **https://www.altoadigepertutti.it/** is an information platform for PwD who are looking for accessible accommodation facilities, food services, transportation, leisure activities and public infrastructures in South Tyrol. Südtirol für Alle – Alto Adige per tutti uses trained staff to evaluate and describe structures and services in respect to their accessibility and if acceptable include them on their platform. Independent L. hereby ranks accessibility from 1 to 5, 5 being the highest grade of accessibility and 1 the lowest grade. Indicators for the level of accessibility are e.g., reserved parking spaces for PwD, level-access showers, inclusive menus or barrier-free facil ities within the structure. Due to their expertise in the field and their thorough evaluation processes, this report will adapt their definition of accessibility in the tourism sector.

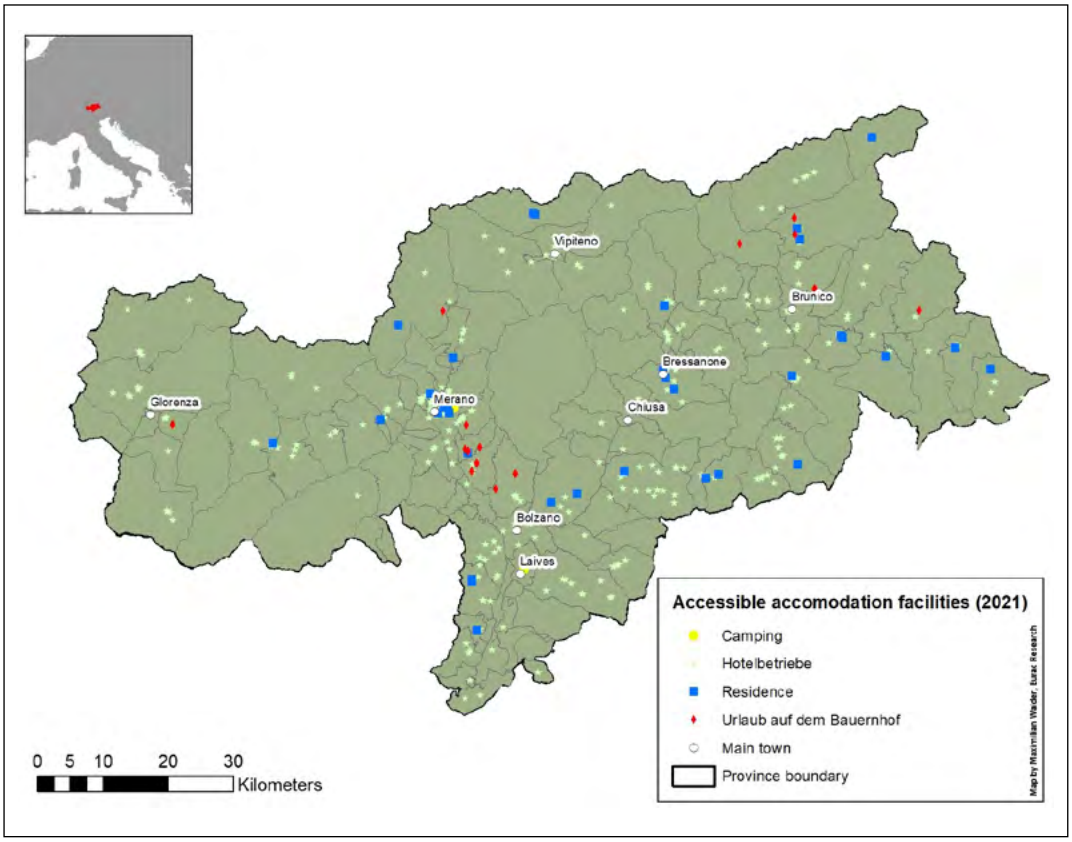

Figure 32: Accessible accommodation facilities by the standards of Südtirol für alle - Alto Adige per tutti, South Tyrol 2022. Source: independent L., own elaboration.

In the year 2021, 362 accommodation facilities in South Tyrol are labeled "accessible" by *independent L.* standards. Compared to the overall number of accommodation facilities in South Tyrol (3,940), this represents only 9.2%, which shows a huge need to catch up in this regard. 308 of these facilities are hotels, 36 are apartments, 16 farm residences and 2 camping sites. More than half of accommodation facilities are in municipalities with average tourism exposure (54.9%), 38.4% are in municipalities with high tourism exposure and only 6.7% in the lesser touristic towns. About three thirds of all accommodation facilities (74.3%) are rated with the grade 3 or higher, indicating a high level of accessibility in the included structures. The distribution of accessible facilities is quite even in the whole province, the highest presence of facilities though can be found in the greater Meran/Merano area.

Similarly, 170 restaurants and bars are labeled accessible in 2021. Compared to the overall number of gastronomy establishments in South Tyrol, 3254 as of 2019 (ASTAT, 2022), it only represents 5.2%. Even more than in the accommodation sector, there is room for improvement. Almost two thirds of gastronomy facilities can be found in municipalities with average tourism exposure

(62%), around 29.9% in high touristic municipalities and only 8.1% in lesser touristic towns. Meran/Merano again has the biggest offer of accessible gastronomy in the province. **Figure 32** shows that most accessible accommodation facilities are in the main towns.

15.2 ACCESSIBLE CULTURAL FACILITIES AND FREE TIME ACTIVITIES

Equal to accommodation facilities, Südtirol für alle – Alto Adige per tutti also checks for accessible cultural offers and other free time activities. On their platform, for each activity information on the specific characteristics of the structures is shown. In 2021, 80 accessible museums and cultural institutions were labeled accessible. This means that only 27 out of the 107 museums in the destination are not recognized as accessible, which compared to the numbers in the previous indicator seems to be a good quota. Most of these museums are located in the two main towns, Bozen/Bolzano and Meran/Merano. Furthermore, guests have the possibility to use 76 barrier-free hiking trails and promenades all over the province. Next to the offers in the cities, Sand in Taufers/Campo Tures offers the most accessible opportunities (10 trails and promenades). 52 accessible spa and sport activities, including pools, sport venues and gyms are equally present in South Tyrol and 36 accessible playgrounds for children. Other activities that are included in these numbers and which were not explicitly mentioned are accessible cinemas, theaters, castles and cultural centers.

Accessibility

WHAT COULD BE DONE?

- ➔ Provide the necessary resources to support the adaptation of stations, stops and public transport to the requirements of accessibility
- ➔ Increase the accessibility to accomodation facilities and touristic attractions
- ➔ Develop a concept for a barrier-free South Tyrol

Conclusions and outlook

The fourth STOST report sheds light on the beginning of a recovery phase after the Covid-19 crisis. It describes the tourism restart phase relying on demand data, but also on tourists' behavioural patterns on site. Despite the out of ordinary seasonal patterns throughout 2020 and 2021, the second half of 2021 shows encouraging figures, both in terms of arrivals and employment. The perception of the enterprises regarding the profitability of the sector has improved in 2021 compared to 2020, showing an additional sign of optimism and recovery. Sustainability as a principle to shape future tourism development has gained strategic importance, as well. The sustainability governance in the tourism sector, and particularly the intersectoral collaboration between the tourism industry and the agricultural sector seems to have improved, with more local and organic products offered to the accommodation facilities. However, there were fewer certified events registered, possibly attributable to the decrease in events in general, caused in turn by the pandemic-related restrictions. Notwithstanding the positive trend towards sustainability, there is a perceivable risk that rising inbound flows will provoke again a rise in ecological and social pressures and impacts in the near future. This is why the recovery phase is also characterized by a new attention directed towards the local communities. The results from the survey among local inhabitants concerning their acceptance of current tourism developments were not elaborated yet, but will be included in the next edition of the report. In sum, a new sensitivity towards local communities is perceivable, as well as a novel intention to plan future tourism development based on their needs and expectations. Evidently, a new phase is beginning for tourism in South Tyrol, and sustainability is awarded the role of a guiding principle for the future.

This edition of the STOST report aims to provide structured ways to analyse the pre-pandemic as well as the pandemic time frames. It relies on the use of comparable tables for all indicators, highlighting the difference in figures before and after the Covid-19 breakout and thereby also tracking the recovery phase, its speed and its specificity in each indicator. A second innovation in the report is that clear goals have been set for each thematic area to better link the fields of monitoring, reporting and implementation. Finally, the STOST observatory has established new issue areas on climate action and accessibility, proposing new indicators for estimations of CO_2 emissions related to touristic transport and accessible infrastructures.

After four years of operation, STOST considers regular monitoring as the baseline activity to initiate transformation and co-create new avenues for tourism development. Observing and co-creating change at local and global levels is the main goal for the future of STOST. Future monitoring activities will be geared towards capturing the ongoing and desired transformation.

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Annex 1: Data management workflow and participatory design

WORKFLOW AND TECHNICAL ASPECTS

This report contains a wide range of indicators on different subjects related to tourism. The indicators themselves are based on an even wider set of data that have been collected from different sources, i.e., we collected data from different statistical offices (ASTAT, ISTAT), the chamber of commerce (WIFO), the labour market office of South Tyrol (AMB), various sector associations as well as from private firms. Thereby, the collected data surpass the amount that one can handle efficiently without a data managing plan. In order to handle the amount to data efficiently, we laid out the following workflow: First, we collect data from various data providers. Second, as incoming data are transmitted to us in different data forms (xlsx, csv, RData, json, pdf) with varying data structures, we use the statistical software R to pre-process the data. As most data can be represented in a timeseries format, we chose to transform the available data into R time series objects. Third, after transforming the data into R time series objects, we store the timeseries in PostgreSQL database. Particularly, we set up a time series database according to the R package timeseriesdb (Bannert, 2015). The basic idea behind the timeseriesdb package is a storage concept that uses the PostgreSQL extension hstore to store time series in a key-value-pair. Thereby, timeseriesdb maps R time series objects into their PostgreSQL counterparts for permanent storage. The package timeseriesdb also allows us to store meta information in several languages and associate it with the same series. Finally, we use the stored timeseries to compute the indicators used in this report. In order to ensure reproducibility of all results, all scripts used to transform the data and compute the indicators are managed within a GitLab environment. In cases of seasonal adjusted data, we use the X-13Arima-SEATS library provided by the US Census Bureau. Specifically, we use the R package seasonal that provides a powerful interface between R and X-13ARIMA-SEATS (see Sax and Eddelbuettel, 2008). We use TRAMO-SEATS as the default procedure.

ORGANIZATIONS PROVIDING VALUABLE KNOWLEDGE AND DATA

During the development of STOST, many organizations have participated in the Observatory's working group workshops or joined bilateral exchanges to share their knowledge and provide data. We would like to thank all of them, including: IDM, HGV, the Institutes of Eurac Research for Regional Development, for Alpine Environment, for Earth Observation, and for Renewable Energy, ASTAT, Agency for Energy South Tyrol – KlimaHaus/CasaClima, Südtiroler Amt für Mobilität/Ufficio Mobilità Alto Adige, Südtiroler Amt für Natur, Landschaft und Raumentwicklung/

Ufficio Natura, paesaggio e sviluppo del territorio Alto Adige, WIFO, VPS, SBB, Free University of Bozen-Bolzano, LTS, VCS, AVS and CAI, HDS, LVH, Hogast, Südtiroler Amt für Forstwirtschaft/ Ufficio Foreste Alto Adige, BikeHotels Consortium, Landesagentur für Umwelt und Klimaschutz/ Agenzia provinciale per l'ambiente e la tutela del clima, Terra Institute, AFI-IPL, Alpine Convention, Tourismusverein Wolkenstein/Associazione Turistica Selva, Tourismusverein Schnalstal/ Ufficio Turistico Val Senales, Verband der Fremdenführer und Reiseleiter Südtirols/Ass. guide e accompagnatori turistici Alto Adige, Heimatpflegeverband Südtirol, Platform Cultural Heritage Cultural Production - Free University of Bozen/Bolzano, Landeschronistin/Cronista provinciale, Südtiroler Landesarchiv/Archivio provinciale, Museumsverband Südtirol/Ass. musei Alto Adige, Sozialgenossenschaft/cooperative a sociale *independent L.*

Annex 2: Technical notes on indicators

TOURISM EXPOSURE

For each municipality in South Tyrol, we compute its tourism exposure as follows. First, we calculate the tourism intensity for each municipality. We then standardize this variable to mean zero and unit variance. Second, we calculate the number of beds per surface for each municipality. We then standardize this variable to mean zero and unit variance. Finally, we define tourism exposure of a municipality as the average between the variables.

We divide municipalities into three different groups: low tourism exposure (bottom 25%), average tourism exposure (25%-75%) and high tourism exposure (upper 25%) according to their tourism exposure measure.

1 Tourism seasonality

1.1 Tourist arrivals by month and market

"Tourist arrivals by month and market" stands for the absolute number of tourists arrived in South Tyrol, distinguished by market of origin. Data, provided by ASTAT, are available on a monthly basis. In order to summarize this vast amount of information, we decided to calculate monthly average absolute values for each available market of origin over the time span 2012-2021 in the following way:

$$Arrivals_m = \frac{1}{T-t+1} * \sum_{y=t}^{T} arrivals_{m,y}$$

Equation 1: Monthly average arrivals

Where T = last available year (2021), t = first available year (2011), m = month, y = year. Values can range from 0 to infinity.

1.2 **Overnight stays by month and period**

"Overnight stays by month and period" indicates the overnight stays registered in all accommodation facilities for each month as a share of the total overnight stays in a given time period. Data in absolute numbers of tourist arrivals, provided by ASTAT, are available on a daily basis. The shares were calculated for different years, using the following formula:

$$Overnight\ stays_{\,m}\,(\%) = \frac{overnight\ stays_{\,m,y}}{overnight\ stays_{\,y}} * 100$$

Equation 2: Share of monthly stays

Where m = month, y = year.

Values can range from a minimum of 0% (of all the overnight stays in the given period, none are registered in this month) to 100% (all of the overnight stays in the given period are registered in this month).

1.3 **Tourist arrivals in peak weeks by municipality**

"Tourist arrivals in peak weeks by municipality" stands for the shares of tourists arriving in South Tyrolean municipalities within specific weeks. Data in absolute numbers of tourist arrivals, provided by ASTAT, are available on a daily basis. For the analysis, municipalities were divided according to their tourism exposure. The focus is then placed on those municipalities with the highest percentages of tourist arrivals in one specific week of the year.

$$Overnight\ stays_{\,w}\,(\%) = \frac{overnight\ stays_{\,w,y}}{overnight\ stays_{\,y}} * 100$$

Equation 3: Share of weekly arrivals

Where w = week, y = year.

Values can range from a minimum of 0% (no tourist arriving in a week) to 100% (all yearly tourists arriving in one week).

2 **Employment**

2.1 **Employees in the accommodation and food service sector**

"Employees in the accommodation and food service sector" stands for the number of employees working in the tourism sector in South Tyrol, expressed as a percentage of total employment. Data, provided by AMB, were available on a monthly basis and were distinguished by ATECO 2007 sector (classification of economic activity provided by the Italian National Institute of Statistics – ISTAT). For the sector "Accommodation and Food Service Activities", which was the focus of our analysis, data have been further distinguished between the two sublevels, namely "Accommodation" and "Food service activities". The indicator was determined in the following way:

$$Tourism\ employees\ compared\ to\ tot\ employment_m\ (\%) = \frac{accommodation\ sector\ employees_m + food\ service\ sector\ employees_m}{all\ sectors\ employees_m} * 100$$

Equation 4: Tourism employees proportion calculation

Where m = month.

It should be noted that these data report only employees, i.e., they exclude the self-employed. Moreover, we decided to calculate this indicator using data regarding employees working in South Tyrol, i.e., they may not necessarily live in South Tyrol. Values can range from a minimum of 0% (no employees working in the accommodation or food service sector) to a maximum of 100% (all the employees working in the accommodation or food service sector).

2.2 **Female enterprises in the accommodation and food service sector**

"Female enterprises in the accommodation and food service sector" stands for the number of female enterprises active in the tourism sector in South Tyrol, expressed as a percentage of total tourism enterprises. Data, provided by WIFO, were available on a yearly basis and were extracted by Infocamere, the database of Unioncamere. The indicator reports only the number of active enterprises. For the sake of coherence with the other indicators, the tourism sector refers to the ATECO 2007 sector "Accommodation and Food Service Activities". The indicator was determined in the following way:

$$Female\ enterprises\ in\ the\ tourism\ sector_y\ (\%) = \frac{female\ enterprises\ in\ the\ tourism\ sector_y}{total\ tourism\ enterprises_y} * 100$$

Equation 5: Female enterprises proportion calculation

Where y = year.

Unioncamere (the public entity representing the system of the Italian Chambers of Commerce), defines an enterprise as owned by a woman if different conditions are met, depending on the types of enterprises[12]. More specifically:

— **For the Italian "società di capitali" (which could be classified as limited liability companies)**: female shareholders should be more than 50% of the shareholders;

— **For "società di persone" (partnerships)**: female partners should be more than 50% of the partners;

12 http://www.imprenditoriafemminile.camcom.it/P42A0C0S806/Osservatorio-imprend%20%20itoria-femminile.htm

— **For "ditte individuali" (sole practitioners)**: the entrepreneur should be a woman;

— **For other types of enterprises**: more than 50% of the administrators should be women.

It should be noted that the remaining enterprises should not be necessarily classified as owned by men, as they could be controlled by an equal share of men and women or by legal persons. Values can range from a minimum of 0% (no female enterprises in the tourism sector) to 100% (all the enterprises in the tourism sector are female enterprises).

2.3 **Employees in the accommodation and food service sector by citizenship**

"Employees in the accommodation and food service sector by citizenship" stands for the number of employees working in the tourism sector in South Tyrol, distinguished by citizenship. The graph presented in the report shows this number expressed in percentage values over total employment within the tourism sector only. Data, provided by AMB, were available on a monthly basis and were distinguished by ATECO 2007 sector (classification of economic activity provided by the National Institute of Statistics – ISTAT). For the sake of coherence with the other indicators, the tourism sector refers to the ATECO sector "Accommodation and Food Service Activities". The citizenship is classified in the following way:

— **Italy**: Italian nationals

— **EU-15**: Citizens from Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Luxembourg, Netherlands, Portugal, Spain, Sweden, United Kingdom (for statistical purposes, citizens from the United Kingdom are still present within the EU-15).

— **EU Member States after 2004**: Bulgaria, Croatia, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovak Republic, Slovenia

— **Other European Countries (Non-EU)**

— **Outside Europe**

It should be noted that these data report only employees, i.e., they exclude the self-employed. Moreover, we decided to calculate this indicator using data regarding employees working in South Tyrol, i.e., they may not necessarily live in South Tyrol. Values can range from a minimum of 0% (no employees with a specific citizenship working in the accommodation or food service sector) to a maximum of 100% (all the employees working in the accommodation or food service sector have a specific citizenship).

3 **Economic benefits at the destination level**

3.1 **Value added by industries**

"Value added by industries" stands for the value of output minus the value of intermediate costs. When expressed based on the economic sectors, it allows the growth of the economic system to

be measured in terms of new goods and services available for final use. Data, provided by ISTAT, were available on a yearly basis and were distinguished by NACE Rev.2 sector (statistical classification of economic activities provided by Eurostat). Data are expressed in current prices and refer to South Tyrol. For the sake of coherence with the other indicators, the tourism sector refers to the NACE Rev.2 sector "Accommodation and Food Service Activities". The graph presented in the report shows the value added of all industries expressed in percentage values over the total. Values can range from a minimum of 0% (the sector does not add any value to the economic system), to 100% (the sector alone adds all the value to the economic system).

3.2 **Profit situation for the accommodation and food service sector**

"Profit situation for the accommodation and food service sector" displays the perceived profit situation of South Tyrolean firms working in the tourism sector. The underlying data is collected and provided by WIFO on a yearly basis.

At the beginning of each year, WIFO conducts business tendency surveys among a large panel of private firms. These surveys are designed to collect timely data on economic development. Among other questions, the firms are asked to assess their profit situation of the previous year. Thereby, firms can report their profit situation as good, satisfactory, or bad. In addition, firms are asked to express their expectations about their current year's profit situation by stating if, in their opinion, the profit situation will increase, remain unchanged or decrease. WIFO provided us with the timeseries on each item for both questions. That is, we received the share of firms that selected one specific item, i.e. the share of firms that stated that their profit situation will decrease, the share of firms that stated that their profit situation will remain unchanged as well as the share of firms that reported that their profit situation will increase. Using this information, we calculated the balance statistic between the possible answers (good, satisfactory, and bad) for each year. In this way, the average assessment of the past profit situation as well as the expected current business situation can be estimated.

3.3 **Gross occupancy rates of bed places by municipality and tourism exposure**

"Gross occupancy rates of bed places by municipality and tourism exposure" indicates the extent to which available beds within accommodation facilities are occupied by tourists within a specific period in South Tyrol, distinguishing between municipalities with low, average and high tourism exposure. The indicator can be interpreted as a capacity utilization indicator. Data, provided by ASTAT, were available on a yearly basis and were distinguished by tourism exposure.

According to ISTAT (2008), the gross occupancy rate of bed places is calculated as follows:

$$Gross\ occupancy\ rate\ of\ bed\ places_y\ (\%) = \frac{overnight\ stays_y}{365 * bed\ places} * 100$$

Equation 6: Gross occupancy rates of bed places calculation

Where y = year.

The number of days (365) does not take into account the days in which accommodation facilities are inactive, i.e., seasonal or temporary closures are not considered here. As data are expressed in percentage, values can range from a minimum of 0% (empty accommodation facilities) to a maximum of 100% (fully booked accommodation facilities).

4 **Governance**

4.1 **Municipalities, accommodation facilities and events involved in voluntary certification schemes for sustainability**

The figures regarding the "Municipalities, accommodation facilities and events involved in voluntary certification schemes for sustainability" aim at measuring the number of voluntary schemes adopted throughout South Tyrol to increase tourism sustainability. Data were provided by Agency for Energy South Tyrol – KlimaHaus (Agentur für Energie Südtirol – KlimaHaus), Provincial Agency for Environment (Landesagentur für Umwelt und Klimaschutz), ISPRA, Bio Hotel and Alpine Pearls. Values can range from 0 to infinity.

4.2 **"Red Rooster" branded agritourism ventures producing and selling regional products**

"Red Rooster branded agritourism ventures producing and selling regional products" aims at measuring the number of agritourism ventures offering certified regional products. Data, provided by Red Rooster, were available on a yearly basis. The left axis shows the total number of "Red Rooster" branded agritourism ventures per year, while the right axis represents the total number of products awarded with the "Red Rooster" label. Values can range from 0 to infinity.

4.3 **Organic milk sold to members of the main local buying syndicate**

"Organic milk sold to members of the main local buying syndicate" aims at measuring the number of organic milk sales to accommodation facilities in South Tyrol, expressed as a percentage of total sold milk. Data, provided by Hogast, the major purchasing organization of the accommodation and food service sector in South Tyrol, were available on a yearly basis. The indicator has been calculated as follows:

$$Organic\ milk\ sales_y\ (\%) = \frac{organic\ milk\ sold_y}{total\ milk\ sold_y} * 100$$

Equation 7: Organic milk sales calculation

Where y = year.

It should be noted that organic milk sold by an organization different from Hogast is not recorded here. Values can range from a minimum of 0% (only non-organic milk is sold) to a maximum of 100% (only organic milk is sold).

5. **Local and visitor satisfaction**

5.1 **Tourism intensity index**

Tourism intensity aims at measuring the ratio between tourists and resident population. As such, it can be measured in different ways, e.g. with arrivals or overnight stays. Following ASTAT (2015a), we decided to adopt the following definition: "tourism intensity index" stands for the ratio between overnight stays in accommodation establishments within a specific area and the product between the population residing in the same area and the days of the period analysed. Given that data on the resident population, provided by ASTAT, were available only on a yearly basis (and it can reasonably be assumed that the number of inhabitants remains stable throughout one year), we chose to use the year as reference period.

$$Tourism\ intensity\ index_y = \frac{overnight\ stays_y/365}{total\ resident\ population_y} * 100$$

Equation 8: Tourism intensity index calculation

Where y = year.

Values can range from a minimum of 0% (every 100 inhabitants, 0 tourist overnight stays within a year) to a maximum of 100% (every 100 inhabitants, 100 tourist overnight stays within a year), but the index can potentially take on values higher than 100%, given that there is no limit to the number of overnight stays with respect to the number of inhabitants.

5.2 **Rent prices by municipality and tourism exposure**

"Rent prices by municipality and tourism exposure" is an indicator for price differences of rents in more and less touristic municipalities. Data, elaborated by ASTAT, are available on a yearly basis and were distinguished by central and peripheral areas of each municipality. To summarize this vast amount of information, we decided to compare the evolution of minimum rent prices between municipalities with high and low tourism exposure. We calculated average values of prices for both municipality groups and all available year. Values are expressed in Euros and can range from 0 to infinity.

5.3 **Visitor satisfaction**

In the year 2021 no individual survey for measuring visitors' satisfaction in the destination was conducted. The most recent data stems from De Rachewiltz et al. (2021) and is expressed in percent.

6. **Energy management**

6.1 **Estimated minimum electricity consumption in accommodation facilities**

"Estimated minimum electricity consumption in accommodation facilities" is an estimation of the lower bound of the level of electrical energy consumed in all accommodation facilities in South Tyrol using coefficients from existing literature (Bundesministerium für Wirtschaft, Familie und Jugend Wirtschaftskammer Österreich, Fachverband Hotellerie, Fachverband

Gastronomie, Österreichische Hoteliervereinigung, 2015). The coefficients differ for different accommodation categories and performance conditions of the facilities. We chose those for optimal (i.e., energy-efficient) performance conditions, expressed in units per overnight stay. The accommodation categories were bundled into three macro-categories to be comparable to the three categories found in the guidelines provided by the Bundesministerium für Wirtschaft, Familie und Jugend Wirtschaftskammer Österreich et al. (2015). We then estimated the minimum electricity consumption – that is, the electricity consumption if all accommodation facilities were energy-efficient – based the following formula:

$$Minimum\ electricity\ consumption_y = \sum_{i=1}^{n} overnight\ stays_{i,y} * electr.consumption\ coefficient_i$$

Equation 9: Estimated minimum electric energy consumption

Where i = type of accommodation category, y = year.

Given the data provided by ASTAT was available on a yearly basis, the resulting indicator is on a yearly basis as well. Values are expressed in GWh and can range from 0 to infinity.

6.2 **Electricity consumption of cable cars and snow guns**

"Electricity consumption of cable cars and snow guns" refers to the amount of electrical energy consumed by the existing infrastructure of cable cars and snow guns. Data are provided by ASTAT on a yearly basis and are available only aggregated, which means that the consumption of cable cars cannot be distinguished from that of snow guns. Values are expressed in GWh and can range from 0 to infinity.

7. and 8. **Water & Waste water management**

7.1 **Estimated minimum water consumption in accommodation facilities**

"Estimated minimum water consumption in accommodation facilities" stands for an estimation of the minimum water consumption in accommodation facilities using the water consumption coefficient under optimal performance conditions from existing literature. The same calculation used for energy consumption was done using the water coefficients available in literature (Bundesministerium für Wirtschaft, Familie und Jugend Wirtschaftskammer Österreich, Fachverband Hotellerie, Fachverband Gastronomie, Österreichische Hoteliervereinigung, 2011). For a better understanding, please refer to the following formula:

$$Minimum\ water\ consumption_t = \sum_{i=1}^{n} overnight\ stays_{i,y} * water\ consumption\ coefficient_i$$

Equation 10: Estimated minimum water consumption

Where i = type of accommodation category, y = year.

Given the data provided by ASTAT was available on a yearly basis, the resulting indicator is on a yearly basis as well. Values are expressed in million liters and can range from 0 to infinity.

7.2 **Water use by snow guns**

"Water use by snow guns" stands for the quantity of water used by snow guns throughout South Tyrol. Data, provided by APAC, were available on a yearly basis, referring to the winter season only. Values are expressed in million cubic meters and range from 0 to infinity.

9. **Solid waste management**

9.1 **Estimated waste production in accommodation facilities**

"Estimated waste production in accommodation facilities" stands for an estimation of the average waste production in accommodation facilities using coefficients from existing literature (Hamele & Eckardt, 2006). The average weight of waste per overnight stay according to Hamele & Eckardt (2006) amounts to 1.98 kg per overnight stay. This coefficient was retrieved by an analysis of 36 hotels in the 2 to 4-star categories in Germany and Austria. We decided to use this coefficient because of the similarities between South Tyrol, Germany, and Austria in terms of geographical characteristics, governance, target markets and seasonality. Given that data provided by ASTAT on overnight stays were available on a yearly basis, the resulting indicator is on a yearly basis as well. Therefore, we estimated the average waste production in accommodation facilities based on the following formula:

$$Average\ waste\ production_y = overnight\ stays_y * 1.98kg$$

Equation 11: Estimated waste production

Where y = year.

The output is therefore an estimate of the waste production in South Tyrol under the assumption that accommodation facilities are comparable with the sample used by Hamele & Eckardt (2006). Values are expressed in tonnes and can range from 0 to infinity.

10. **Mobility**

10.1 **Mobilcards, bikemobil Cards, museumobil Cards and guest tickets**

"Mobilcards, bikemobil cards, museumobil cards and guest tickets" stands for the number of tickets giving access to public transport that have been activated throughout South Tyrol and their use. Data, provided by the South Tyrolean agency responsible for public transport are available on a yearly basis and are distinguished by card type. Values can range from 0 to infinity.

10.2 **Ski-lift and cable car users by season**

"Ski-lift and cable car users by season" stands for the number of users of either ski-lifts or cable car throughout South Tyrol, distinguished by season (winter and summer). Data, provided by ASTAT, were thus provided twice a year. Values are expressed in million users and can range from 0 to infinity.

10.3 **Charging stations for e-mobility**

The indicator "Charging stations for e-mobility" aims at showing how many charging stations for e-mobility are available throughout South Tyrol and of which type. Stations can in fact be public or located in accommodation facilities. We obtained data from the Neogy and Tesla websites. Data refer to the month of April in the year 2022 and can range from 0 to infinity.

11 **Land use and landscape diversity**

11.1 **Beds per land use zone and category**

"Beds per land use zone and category" indicates the number of beds per land use zone and category on municipality level. The geolocation of accommodation facilities in South Tyrol, provided by LTS, was overlapped with data on the land use zones in South Tyrol, provided by the Office of Regional Planning and Cartography Province Bolzano-South Tyrol to identify in which land use zones beds in accommodation facilities lie. The software ArcGis was used for the elaboration of the data. Values can range from 0 to infinity.

11.2 **Areas for tourist facilities**

The indicator "Areas for tourist facilities stands for the change in hectares of areas for tourist facilities. Data on the areas for tourist facilities, provided by the Office of Regional Planning and Cartography Province Bolzano-South Tyrol, was calculated for the years 2016 and 2021 and subsequently compared. Values are expressed in hectare and can theoretically range from -infinity to infinity. In reality, the range depends on the municipalities' surfaces and can never be greater than this.

11.3 **Bed density in residential zones**

The "Bed density in residential zones" is calculated by selecting all the beds of accommodation facilities which lie in residential zones of each municipality (data provided by LTS) divided by the size of the respective residential zones for each municipality in hectare (data provided by the Office of Regional Planning and Cartography Province Bolzano-South Tyrol). The software ArcGis was used for the elaboration of the data. Values can range from 0 to infinity.

12. **Nature conservation**

12.1 **Natural and protected areas at the interface to tourism**

The cartographic overlap shown was created using the geolocated accommodation facilities and the number of beds and a map of the nature reserves, natural monuments, and biotopes. Accommodations are interpolated into the area, considering all accommodations and their number of beds in a certain radius. Depending on the distance of the accommodations, their number and targeted grid resolution, a continuous area is generated. The software ArcGIS was used for the elaboration of the data.

13. **Culture**

13.1 **Museums by type and tourism exposure**

The indicator "Museums by type and tourism exposure" shows the number of museums by type and tourism exposure. Location data of all museums in South Tyrol, provided by ASTAT,

was gathered for each municipality. Data for each municipality was clustered by the category of tourism exposure. Subsequently, the graph gives an overview of the types of museums in each category in percent. Values can range from a minimum of 0% to a maximum of 100%.

13.2 **Museum visitors**

The indicator "Museum visitors" shows the proportion of entries into South Tyrolean museums with mobilcards. Overall data on entries in museums in South Tyrol, provided by ASTAT, were compared to the data on entries with mobilcards, provided by Lorima. The values for the overall number of museums can range from 0 to 100. No data is available for January, February and March of 2021, as museums were not open due to the COVID-19 restrictions.

14. **Climate action**

14.1 **Estimated car-related CO_2 equivalent emissions from inbound tourism**

"Estimated car-related CO_2 equivalent emissions from inbound tourism" is an estimate for the amount of greenhouse gas emissions attributable to the movement of tourists in South Tyrol by car. Data for the calculation is derived from various sources: ASTAT (arrivals by market of origin and information on travelling behaviour of guests), STOST (information on travelling behaviour of guests) and Google Maps (distances). Furthermore, we decided to use average emission factors provided by the German Umweltbundesamt, based on the software TREMOD 6.23 (Transport Emission Model)[13]. This choice is motivated by the fact that Germany provides the biggest market of origin for South Tyrolean tourism. In addition, other main markets such as Austria, the Benelux countries and Switzerland are expected to have similarly composed car fleets and thus similar average emission factors. As far as the Italian market is concerned, German emission factors are used as well, since the Italian factors from the ISPRA agency use a different standard (COPERT) that is not comparable to the one of the Umweltbundesamt. Following the territorial principle, which attributes only those emissions to a region that are produced within its geographical boundaries, we considered the movement of tourists from the moment they enter the South Tyrolean border to the moment they leave it (i.e., arrival/departure as well as internal mobility). The estimation was calculated as follows:

$$\textit{Car-related } CO_2 \textit{ equivalent emissions}_y = \sum_{i=1}^{n} \frac{arrivals_{i,y} * \%\ of\ tourists\ arriving\ by\ car_y * distance\ arrival_i * 2 * emission\ factor_y}{load\ factor_y} + \frac{arrivals_y * \%\ of\ tourists\ using\ mostly\ car\ during\ stay_y * distance\ stay_y * 2 * emission\ factor_y}{load\ factor_y}$$

Equation 12: Car-related CO_2 equivalent emissions from inbound tourism

13 https://www.umweltbundesamt.de/themen/verkehr-laerm/emissionsdaten#tremod

Where *i* = market of origin (i.e., Italy, Germany, Austria, Benelux, Switzerland and Liechtenstein, Other countries; in the case of Italy and Germany, we used information on arrivals and travelling distances for each region), *y* = year, *distance arrival* = distance travelled to get to the destination, calculated from the South Tyrolean border to the main town of the destination (Bolzano), *emission factor* = coefficient for average CO_2 equivalent emissions per vehicle km, *load factor* = average number of people riding in one car, *distance stay* = average radius travelled during the stay in the destination.

Values are expressed in kilotonnes CO_2 equivalents and can range from 0 to infinity.

15. **Accessibility**

15.1 **Accessible gastronomy and accommodation facilities**

This indicator shows the number of gastronomy and accommodation facilities in South Tyrol, which were labelled "accessible" by the social association *independent L.* The facilities in question get assessed by trained staff members and, if complying to the association's standards, get added to association's database. This database is the basis for this indicator. The location of the structures is also overlapped with the indicator of tourism exposure, to show interfaces. Values represent the year 2021, as prior data could not be elaborated, and can range from 0 to infinity.

15.2 **Accessible cultural facilities and free time activities**

"Accessible cultural facilities and free time activities" indicates the sum of all museums, theatres, cinemas, sport venues, pools, hiking trails and promenades labelled as "accessible" by the social association *independent L.* in the destination. Values represent the year 2021, as prior data could not be elaborated, and can range from 0 to infinity.

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