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UNWTO INSTO World Tourism Organization International Network of Sustainable Tourism Observatories

The Sustainable Tourism Observatory of South Tyrol (STOST)

Annual Progress Report (2020)

IMPRESSUM
We thank the INSTO network and the Sustainable Development of Tourism Programme of the United Nations World Tourism Organization (UNWTO), chaired by Dr. Dirk Glaesser, the Autonomous Province of Bolzano (Klaus Egger), IDM Suditrol/Alto Adige (Thomas Fill and Alexandra Mair) for their invaluable collaboration in the realization of this study.

Furthermore, we would like to extend our heartfelt thanks to partners and colleagues that kindly shared both data and precious advice: Institutes of Eurac Research for Alpine Environment (Erich Tasser, Caroline Pecher), Earth Observation (Marc Zebisch, Kathrin Renner), Renewable Energy (David Moser) and Central Services of Eurac Research (Agnieszka Stawinoga, Norbert Andreatta), Agentur für Energie Südtirol - KlimaHaus (Mariadonata Bancher), ASTAT (Timon Gartner, Maria Elena Iarossi), WIFO (Georg Lun, Felix Steinwandter, Nina Overhage, Thomas Schatzer), Alpine Pearls (Katja Hofbauer), Amt für Arbeitsmarktbeobachtung (Walter Niedermair, Stefan Luther), APAC Ufficio Tutela Acque (Roberto Colaone), APAC Ufficio Gestione sostenibile delle Risorse Idriche (Walter Sommadossi), BioHotels (Marlies Wech), Car Sharing Alto Adige (Hanna Hofer, Cristina Larcher), AVS (Karin Leichter), CAI (Alberto Zanella), ESRI (Raul Jimenez Ortega), Hogast (Markus Widmann), Südtirol Bauernbund (Hans J. Kienzl), Landesagentur für Umwelt und Klimaschutz (Gudrun Reden), the Alpine Convention (Marianna Elmi), Neogy (Massimo Minighini), Universität Bozen (Thomas Bausch), Messe Bozen (Jana Varesco und Thomas Mur), HGV (Thomas Gruber, Simon Gamper), Amt für Landesplanung und Kartografie (Christine Obermair), Terra Institute (Marcel Fischer), Tourismusverein Wolkenstein (Irene Delazzer) and Tourismusverein Schnals (Manfred Waldner)

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SÜDTIROL ALTO ADIGE

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Foreword

What you can't measure, you can't manage.

(Peter Drucker)

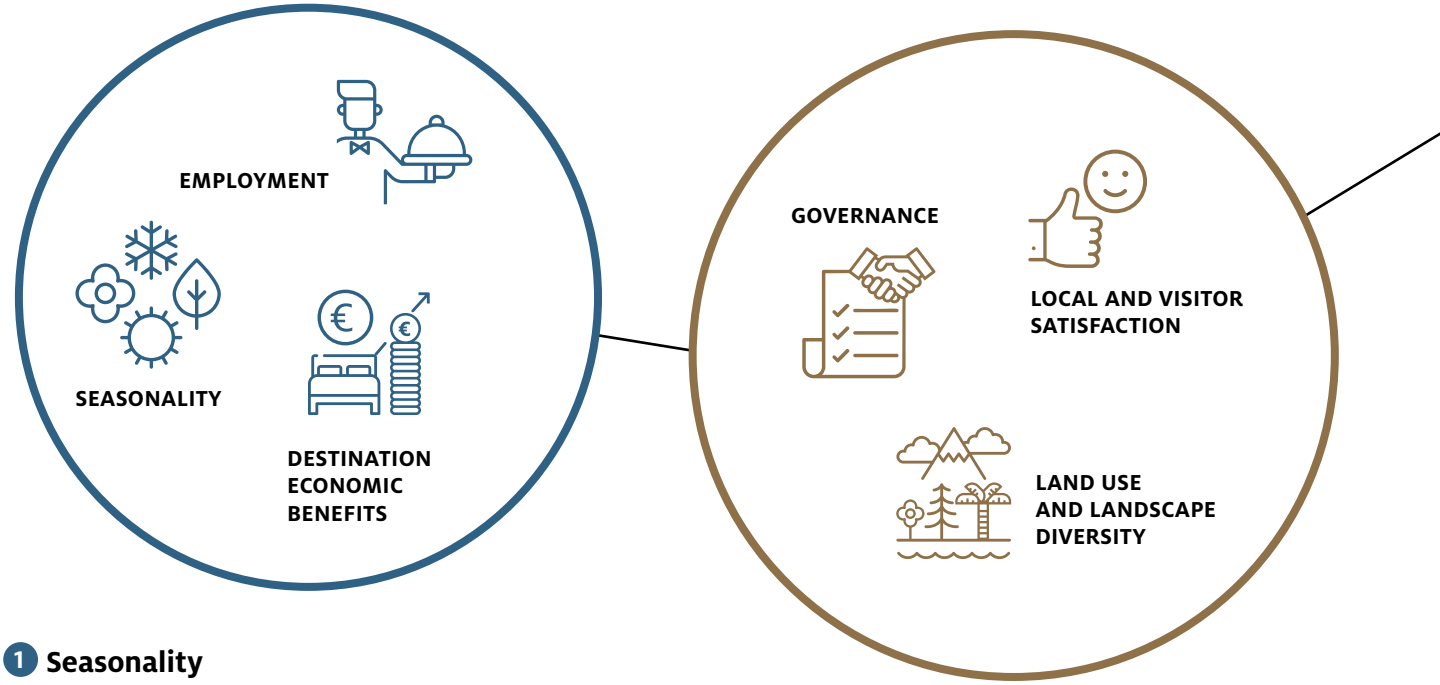
Notwithstanding the global Covid-19 crisis, tourism remains an important economic and social phenomenon. The growing awareness of the reciprocal effects of tourism on the economy, society and environment paired with the growing acceptance of the sustainable development principles demand an increasingly strong focus on monitoring issues. The Italian Autonomous Province of Bozen/Bolzano – Südtirol/Alto Adige, located in the Italian Alpine area, works hard to continuously strives to further improve its sustainability and to pursue this goal, it relies on factual data, following the principles of evidence based decision making. The region is investing in renewable energies, provides sustainable transport, promotes e-mobility and reveals a strong will to shape tourism in harmony with the natural and human territorial entities. The participation of the Autonomous Province of Bozen/Bolzano – Südtirol/Alto Adige at the International Network of Sustainable Tourism Observatories is fundamental in setting the basis for sustainability implementation based on data evidence. After one year of activity, STOST (The Sustainable Tourism Observatory of South Tyrol) has increased its competences and outputs, focusing not only on the fine-tuning and update of existing monitoring indicators, but also on the effects of the pandemic on site and on the consideration of culture as an additional issue to investigate. STOST offers a chance to understand tourism from a broad perspective and enables multi- and interdisciplinary work and knowledge transfer, networking and best practice exchange that can be fruitful also for other economic sectors. Ultimately, the current pandemic crisis illustrated the importance of the STOST in providing timely and reliable information about up to date developments and by that providing the basis for a fact-based decision making of local authorities.

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 monitors, evaluates, and communicates tourism developments in South Tyrol (Italy). It examines benefits and costs of tourism for South Tyrol and provides recommendations and guidelines for policy makers to support sustainable tourism management. In 2019, tourism in South Tyrol produced over 7.7 million arrivals and 33.7 million overnight stays.



1 Seasonality

South Tyrol has a constant seasonal pattern of tourist arrivals. Typically, 60% of tourists arrive during the summer season and 40% in the winter season. However, in some municipalities, up to 40% of yearly arrivals were hosted in August.

2 Employment

14% of total employees in South Tyrol work in the accommodation or food and service sector. During Spring and Summer 2020, Covid-19 reduced the number of employees in the accommodation (up to 50%) and food and service sector (up to 25%) dramatically.

3 Destination Economic benefits

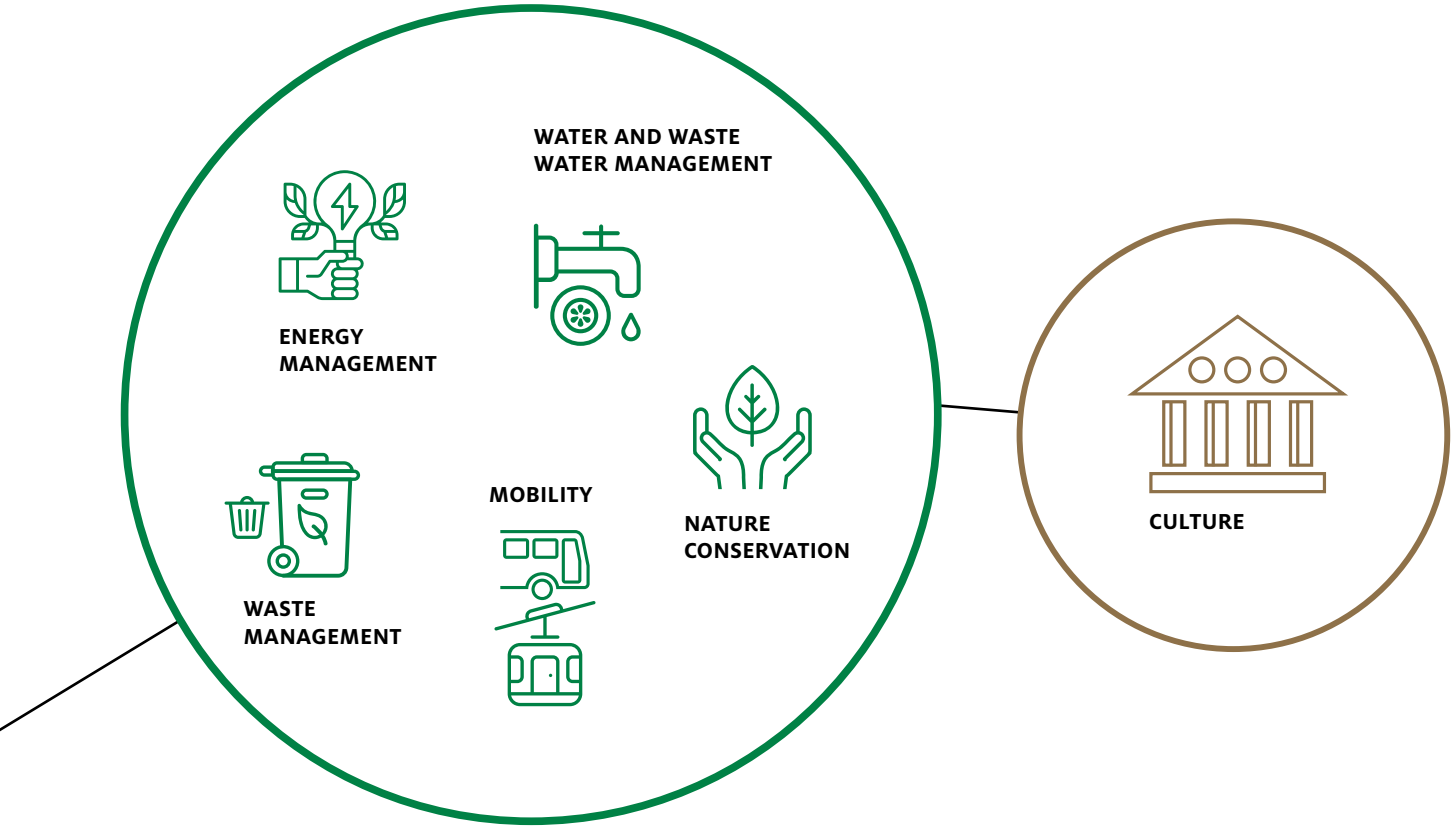
In 2017, the accommodation and food and service sector contributed around 11% to total GDP. In 2019, the profit situation remained at high level. In 2020, the business situation fell to historical low level because of the Covid-19.

4 Governance

Over the last years, the accommodation and food service sector increased the provision of regional agricultural products. In 2019, 21 municipalities, 100 events and 30 accommodation facilities adopted voluntary certification schemes with sustainability purposes or strategies for sustainable development.

5 Local and visitor satisfaction

Tourism intensity continued to rise in 2019. On average, South Tyrol counts 17 tourists per 100 inhabitants. However, some municipalities show a much higher intensity and count, up to 200 tourists per 100 inhabitants.



6 Energy management

Electricity consumption attributable to tourism is rising. In 2018, 8.7% of total electricity consumed in South Tyrol can be attributed to tourism. During the last years, the number of e-mobility charging stations steadily increased. Currently, there exist more than 300 charging stations in the region.

7 & 8 Water and waste water management

The water used in snow making is rising over time. In 2018, about 10 million cubic meters of water have been used to create artificial snow. A maximum share of 23.6% of waste water treated can be attributed to tourism.

9 Waste management

Approximately 9% of waste produced in South Tyrol can be attributed to the tourism sector.

10 Mobility

In 2019, South Tyrol counts approximately 1.7 million activated guest tickets and mobilcards. The use of cable cars boomed during the summer, showing a +38.7% over the last decade (2006-2016).

11 Land use and landscape diversity

In 2019, little less than 0.9% of total buildings are hotels and similar establishments in South Tyrol. The share of hotels and similar establishments decreased slightly over the last 6 years. This dynamic is driven by a slight decrease in the absolute number of hotels and similar establishments and an increase in the amount of total buildings.

12 Nature conservation

Nature conservation and protection is a central goal of the region. Currently, 1/4 of the surface of South Tyrol is protected.

13 Culture

Culture and tourism are densely interwoven: mountain regions often retain cultural traditions that have hardly changed over the centuries. Future research will explore the relationship between culture and tourism.

Overall, the growing quantity of tourists in South Tyrol is linked with an increased quality of tourism, not only from the user perspective, but also from that of the environment. Environmental certification schemes are promoted and increasingly welcomed, sustainable transport is supported, and land use is carefully managed to preserve the landscape diversity. We can interpret these farsighted reactions to an increased tourism pressure and resource use as first signs of a sustainable development process at its very beginning.

South Tyrol in brief

South Tyrol is an Italian Autonomous Province and constitutes, together with the other 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 kilometers and a total population of over 530,000 inhabitants. Its capital is the city of 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. 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 (25%) is protected area (Morello, Oggiano, 2015). This includes those protected areas that form part of the core of the renowned Dolomites natural heritage site, which was declared a UNESCO World Natural Heritage 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 in South Tyrol's economy, contributing over 8.2% to the local GDP with direct effects only, according to the result of the most recent assessment of the tourism satellite account (TSA), referring to the year 2005 (ASTAT, 2019a). In 2019, tourism in South Tyrol produced over 7.7 million arrivals and 33.7 million overnight stays. The main tourist markets are the DACHI markets, named after an abbreviation standing for Germany, Austria, Switzerland, and Italy. Germany accounts for nearly 50% of total visitors, followed by Italy (30.3%), Switzerland (4.8%), and Austria (3.3%). The average length of stay amounts to 4.4 days, a number that has steadily decreased over the last few decades.

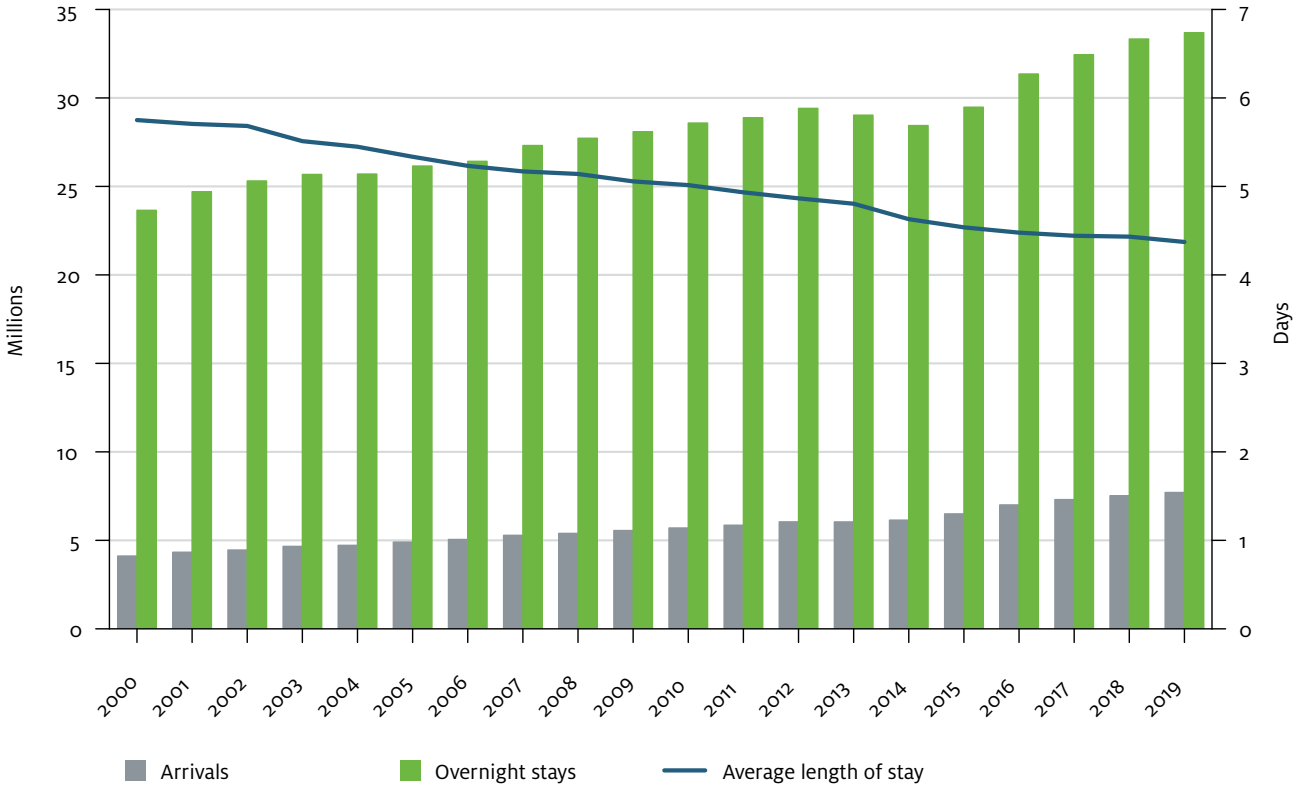


Figure 1: Arrivals and overnight stays (left axis) and average length of stay in days (right axis) in all accommodation facilities, South Tyrol – 1998 - 2018. Yearly data in thousands. Source: ASTAT Online Database, 2019, own elaboration.

Accommodation facilities have experienced dynamics of concentration and an increase in quality. The number of hotels and similar establishments has decreased over the last two decades by 12.6% (4,517 facilities in 2000 vs. 3,947 in 2019), while the number of beds in hotels and similar establishments increase by 3.1% (146,026 in 2000 vs. 150,509 in 2019). On the other hand, the quality of accommodation facilities has increased, with a rise in 3, 4, and 5-star hotels and a reduction of 1- and 2-star hotels (see **Figure 2**). Other accommodation services, such as campsites, private accommodations and agritourism ventures, when compared to hotels and similar establishments have experienced an almost opposite trend, increasing by 16.4% (5,536 in 2000 vs. 6,446 in 2019). The number of beds in other accommodation services increased proportionally by 14.6% (65,454 in 2000 vs. 75,029 in 2019), but remains considerably lower than those offered by hotels and similar establishments.

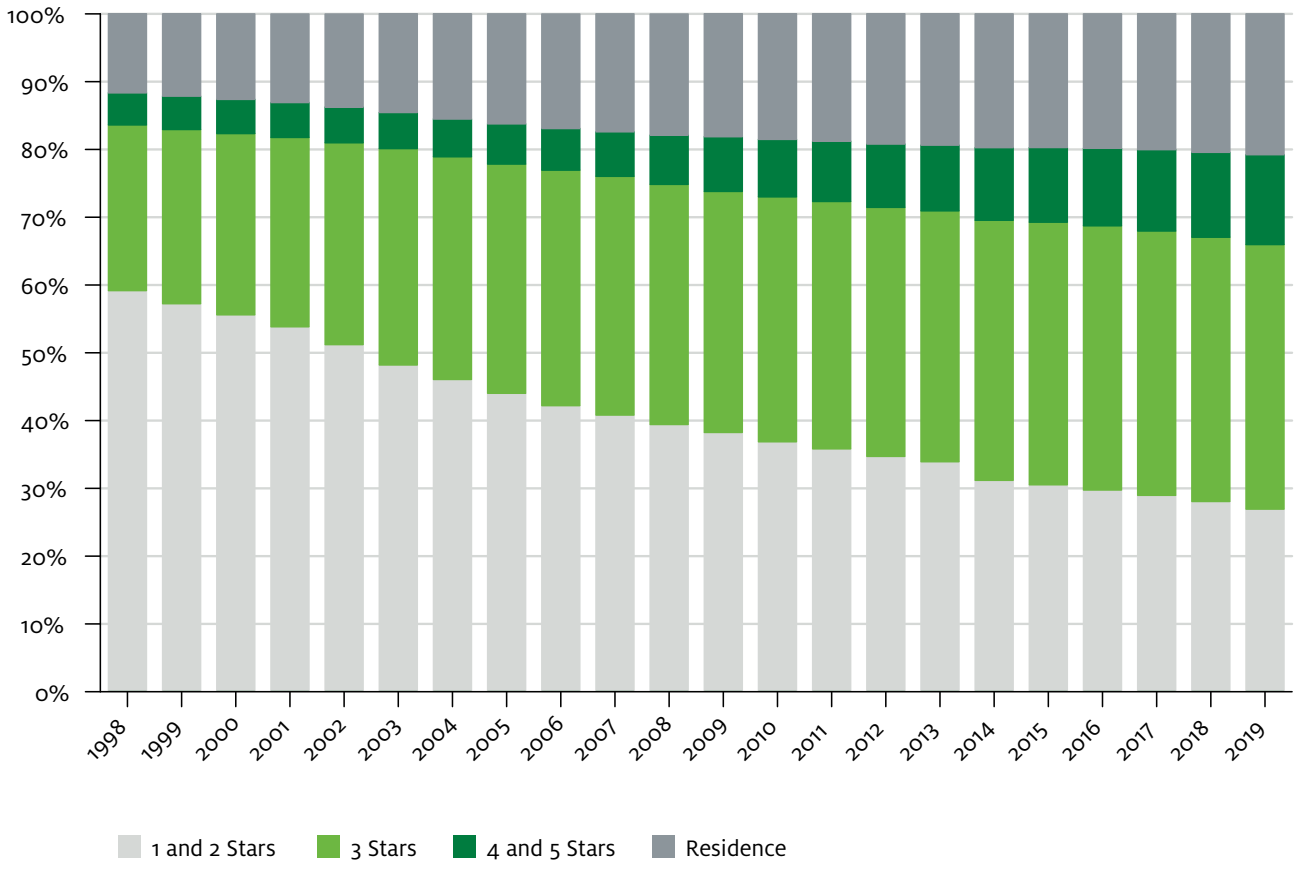


Figure 2: Hotel and similar establishments by accommodation category, South Tyrol – 1998-2017. Percentage values. Source: ASTAT, 2019, own elaboration.

The tourism hospitality sector is spread over all South Tyrolean valleys, with a higher concentration of beds in the South-Eastern part of the province (see **Figure 3**). The number of "Red Rooster" branded agritourism ventures is spread over almost all touristic areas, with only few exceptions mostly related to ski areas located in higher altitudes, which usually cannot be used for farming activities.

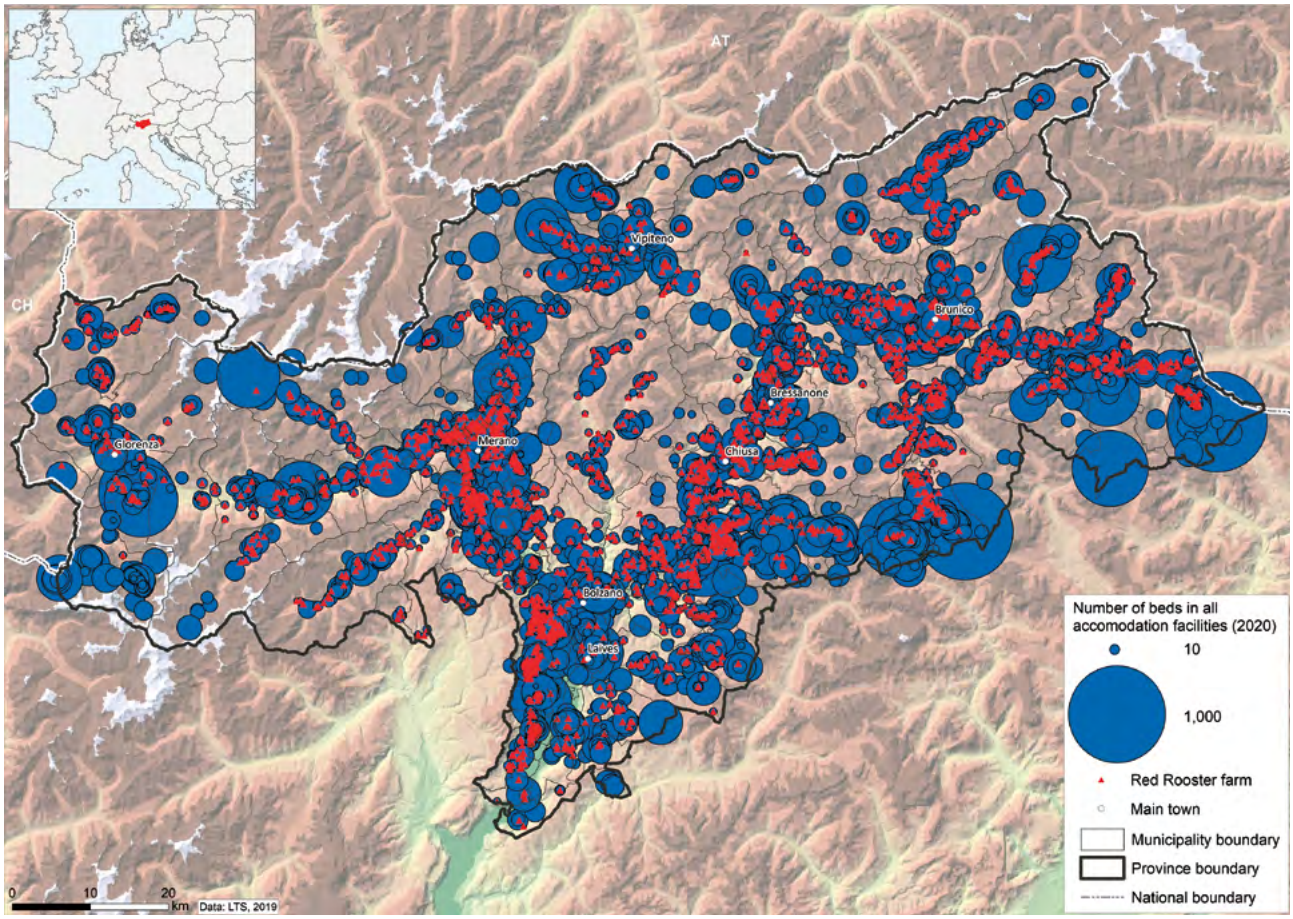


Figure 3: Geolocation and bed capacity of all accommodation facilities (in blue) and location of "Red Rooster" branded agritourism ventures (in red). Source: Open Data Hub South Tyrol Online database, 2020.

Concerning tourism markets, as shown in **Figure 4**, proximity markets prevail over long-distance markets. The region is an attractive destination for tourists mostly originating from the DACHI markets. They visit South Tyrol to practice outdoor sport activities, but also just to enjoy the landscapes and protected areas. German and Italian tourists have made up more than 80% of the overnight stays in South Tyrol for over twenty years. The Swiss market has recently been developing, while the Austrian market is small but stable. Additional international markets have increased since 2000, e.g. Poland, the Czech Republic, and the United Kingdom.

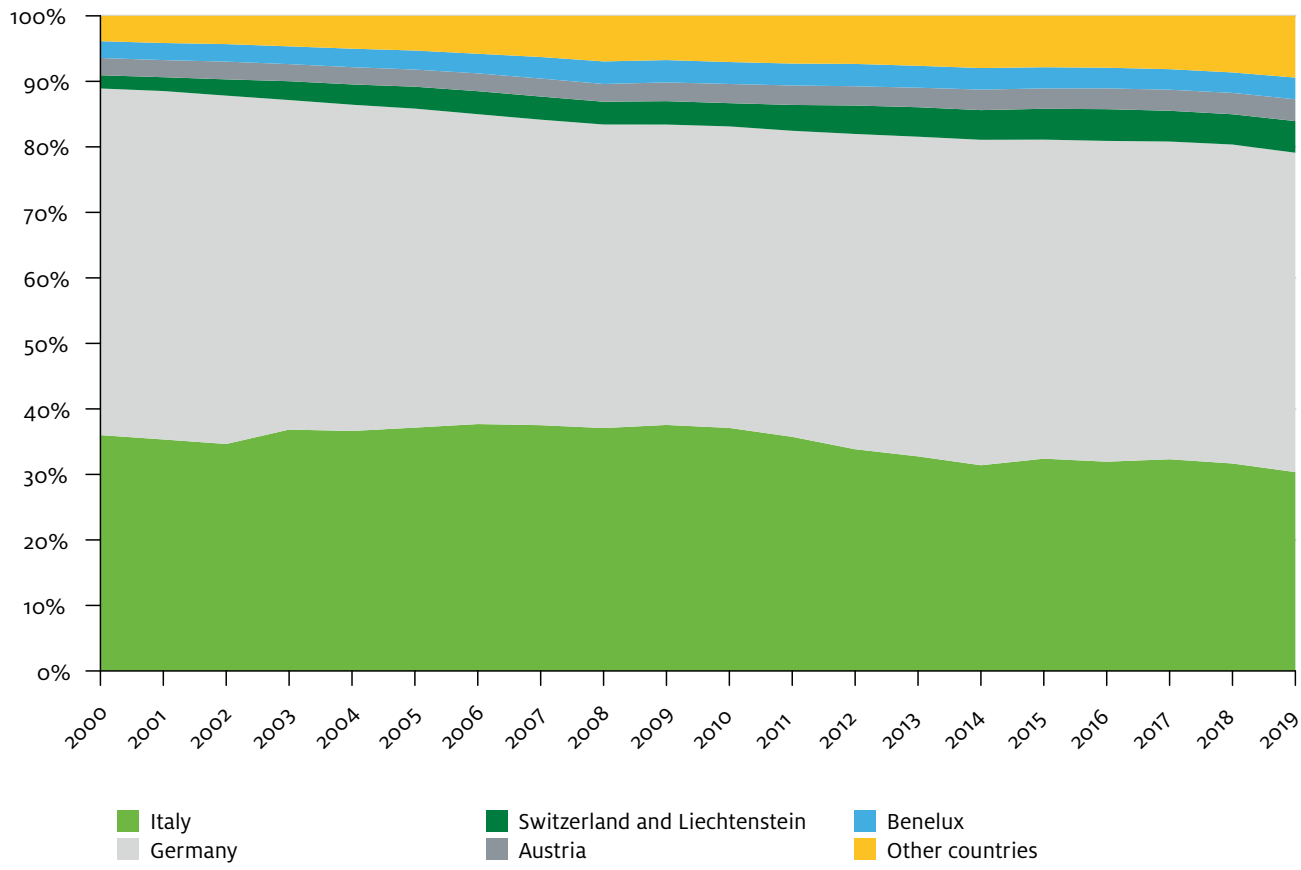


Figure 4: Overnight stays in all accommodation facilities by market of origin, South Tyrol – 1998-2008. Source: ASTAT, 2019

In 2017 South Tyrol issued a strategy for 2030 that contains several trends and measures relevant for tourism development. The strategy, ZTS 2030 (2017), consisted of 20 deployment plans: almost half of them relate to sustainability issues (see **Figure 5**, highlighted topics). These covers topics related to environmental sustainability (e.g. transport, cross-sectoral relationships to enhance the consumption of regional products, de-seasonalization) and social issues (e.g. quality of employment in tourism, quality of life for local communities). They also cover the ability to use marketing techniques to encourage sustainable and discourage unsustainable behaviors (e.g. marketing campaigns, sustainable experience design).

Figure 5: The 20 deployment plans of ZTS 2030. Source: ZTS 2030 (2017)

In this context, establishing a monitoring system for sustainable tourism in the region (#20 Tourism-Intelligence-Act) was considered essential to foster the implementation of such a strategy, while at the same time motivating and informing the destination's stakeholders on how to proceed on the ongoing path towards improved sustainability in tourism.

STOST:
a Tourism Intelligence tool

The Sustainable Tourism Observatory of South Tyrol (hereafter STOST) belongs to the United Nations World Tourism Organization (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 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).

STOST began its activities in early 2018, when a preliminary report was submitted to the INSTO network. On October 22nd, 2018, during the Global INSTO Meeting, South Tyrol officially became part of the UNWTO-INSTO network initiative 1: the inclusion of STOST into this global network plays an important role in fostering the management and monitoring of sustainable tourism development in the region. Moreover, by piloting the membership of an Italian destination in the INSTO Network, the engagement of South Tyrol also aims to contribute to improving sustainability monitoring on a national scale. In 2019 the first monitoring report was submitted to the UNWTO and presented in Madrid, while the official website of the observatory was launched in summer 2020 (https://sustainabletourism.eurac.edu).

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 livable 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 awareness, learning, and evidence-based decision making for different target groups of South Tyrol's society shall lie at its very core.

Objectives

Striving towards the achievement of the vision and the implementation of the mission, the following table shows the short-, medium-, and long-term objectives for the observatory that were elaborated based on a synthesis of the perceptions of experts interviewed during the preliminary phase of the STOST settlement.

Table 1: Objectives of the observatory. Source: own elaboration

OBJECTIVES		Short term	Medium term	Long term
Be in the loop of developments and regularly informed about them:				
√	Deliver a clear and regular picture of the resources used and the impact tourism has on South Tyrol's society, economy, and environment.		√	√
√	Identify and communicate good developments, potentials, and opportunities.		√	√
√	Warn about extreme developments, risks, and dangers.		√	√
Serve as a think-tank:				
√	… which enables sustainable tourism planning and practices through the provision of ideas, possible measures, recommendations and solutions for politicians and other decision makers (e.g. private sector) as well as for other target groups - including young locals and guests.		√	√
√	… which provides ideas on how to sustainably tackle the challenges of continuous tourism growth and its impacts and which proposes possibilities for a balanced development.		√	√
√	… which can impact on politics - at provincial level, national level and at global level (by being a member of the UNWTO-INSTO network).		√	√
Raise awareness and enable learning:				
√	Create a better public understanding of what sustainable tourism is, raise awareness amongst different target groups, including the private sector, the population in general, schools and students, visitors etc.		√	√
√	Explore the possibility of creating a short training scheme for destination managers and other tourism stakeholders, based on findings gathered by the monitoring.		√	
√	Compare and identify best practices of the individual places and communities in South Tyrol. Bring community actors together so they can learn from each other.		√	√
√	Network and exchange sustainable tourism knowledge and experience with other tourism destinations worldwide, compare practices, discuss problems and learn from each other.	√	√	√
Provide evidence for decision makers:				
√	Provide reliable data and facts as a solid basis for decision-makers from the private and public sector, from which they can derive strategic orientations, objectives, and modalities.		√	√
√	The monitoring results can also support tourism marketers in communicating more credibly about sustainable tourism.		√	√
√	Create evidence to enable decision-makers to perceive the impacts and results of their decisions.		√	√
Enable communication, cooperation, and networking - build trust:				
√	Foster trust, mutual understanding and engagement through regular communication and networking between the private sector, research sector, public and civil sector and between nature conservation, economy, society, and culture.		√	√

Governance

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 (abbreviation for Innovation, Development, Marketing) (see **Figure 7**) and the provincial government of South Tyrol.
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 reflects: a) data providers, among which are, e.g., the Provincial Statistical Office, the Chamber of Commerce and Industry, the local Environmental Agencies; b) support and advice providers, such as, e.g., Institutes for Sustainable Development, the University of Bolzano/Bozen, other local research institutions and local 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 the National Ministry for Agriculture and 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 supraregional knowledge network.

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. Therefore, the main target groups of the observatory are policy makers, the private sector, and the general public.

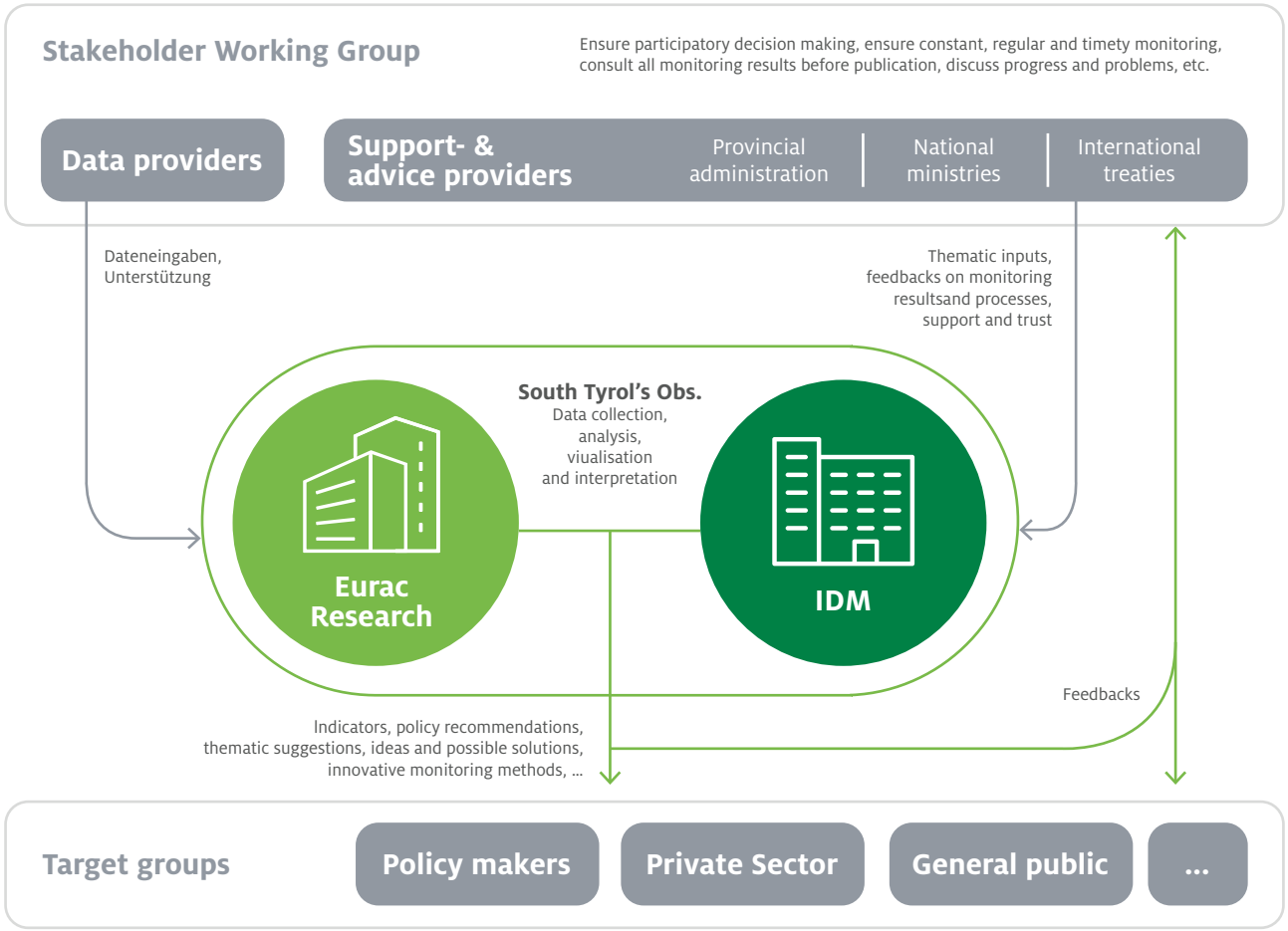


Figure 6: Governance of the STOST observatory. Source: own elaboration

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Research strategy

The observatory is rooted in a deep reflection on the meaning of sustainability in tourism, as well as an applied approach to measure it in the South Tyrolean region. The combination of a conceptual and territorial knowledge has given birth to the monitoring operations and results. This document represents the second STOST annual report in compliance with the regulations and recommendations of the UNWTO-INSTO initiative.
Preliminary analyses were discussed with local stakeholders during face to face interviews and workshops. During these meetings, STOST presented the UNWTO mandatory issue, i.e. the issue areas that UNWTO obligates its members to monitor and discussed their relevance for South Tyrol. In order to meet the additional needs of the region, STOST decided to augment the UNWTO mandatory issue areas with additional topics that were considered important for a complete analysis of sustainable tourism in South Tyrol. In this second report, an additional monitoring area is drafted, that will be developed in 2020. Moreover, Covid-19-related issues are introduced in form of boxes, since it was not possible to get real time data for most indicators.

Definition of Sustainable tourism

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, UNWTO's and UNEP's (2005: 11-12) "sustainable tourism development guidelines and management practices are applicable to all forms of tourism in all types of destinations, including mass tourism and the various niche tourism segments. Sustainability principles refer to the environmental, economic, and socio-cultural aspects of tourism development, and a suitable balance must be established between these three dimensions to guarantee its long-term sustainability. Thus, sustainable tourism should:

1) Make optimal use of environmental resources that constitute a key element in tourism development, maintaining essential ecological processes and helping to conserve natural resources and biodiversity.

2) Respect the socio-cultural authenticity of host communities, conserve their built and living cultural heritage and traditional values, and contribute to inter-cultural understanding and tolerance.

3) Ensure viable, long-term economic operations, providing equal socio-economic benefits to all stakeholders, including stable employment and income-earning opportunities and social services to host communities, and contributing to poverty alleviation.

Sustainable tourism development requires the informed participation of all relevant stakeholders, as well as political leadership to ensure wide participation and consensus building. Achieving sustainable tourism is a continuous process and it requires constant monitoring of impacts, introducing the necessary preventive and/or corrective measures whenever necessary.
Sustainable tourism should also maintain a high level of tourist satisfaction and ensure a meaningful experience to the tourists, raising their awareness about sustainability issues and promoting sustainable tourism practices amongst them."

BOX 1 :

A SHORT NOTE ON TOURISM-RELATED SDGS

Since the concept of sustainability was taken up by international organizations such as the United Nations (UN), the World Trade Organization (WTO), the Organization for Economic Co-operation and Development (OECD) and other actors, a variety of different steps were made to enforce and implement sustainability as a core principle for development, among which the most relevant are the Earth Summits of 1992, 2002, and 2012 and the Resolution 70/1 of the United Nations General Assembly, the Global Agenda for Sustainable Development. The reference points for this report, apart from the official UNWTO definition cited in the text, are the 17 Sustainable Development Goals (SDGs) of the 2030 Global Agenda for Sustainable Development (see **Figure 7**). INSTO observatories are an active part of the initiative Tourism4SDGs (http://tourism4sdgs.org) and the South Tyrolean observatory is listed among the exemplary initiatives to support the implementation of the SDGs at local level (http://tourism4sdgs.org/initiatives/south-tyrol-sustainable-tourism-observatory/). Moreover, the South Tyrolean Institute for Statistics recently launched an interactive SDGs tracker, a platform for the monitoring of the SDG targets (see https://astat.provinz.bz.it/barometro/upload/sdg/html/en/index.html), capable of screening the performance of South Tyrol compared to other Italian regions for each goal. Given the rise of interest around SDGs concerns, the request came from local stakeholders to better link SDGs and STOST activities, in order to assess the sustainability challenge from a holistic perspective.

Figure 7: United Nations Sustainable Development Goals. Figure source: https://sdgs.un.org

To better link SDGs to the issue areas of the STOST observatory, we tried to assign the relevant SDGs to each of the 29 indicators (see **Table 2**). The results of this exercise were very interesting: the monitoring system not only includes the Sustainable Development Goals in which tourism is directly mentioned (Goals 8, 12 and 14 on inclusive and sustainable economic growth, sustainable consumption and production (SCP) and the sustainable use of ocean and marine resources – in the specific case of South Tyrol lakes and rivers – respectively), but also many other SDGs, that are briefly addressed in the following. It is important to mention that sometimes the interpretation of the goal needs to be local-specific: hunger and poverty are not severe conditions in the region of South Tyrol; however, there might be phenomena such as geographical segregation related to the effects of tourism on prices that somehow affect local wellbeing.

Precisely, goal 1 (No poverty) is addressed when it comes to geographical segregation of local inhabitants due to increasing renting prices. Goal 2 (Zero hunger) is linked to cross-sectoral collaborations triggered by tourism, e.g. agro-tourism. Goal 5 (Gender Equity) is assessed when it comes to the monitoring of the quote of female managers in the accommodation sector, goals 6 and 7 (respectively Clean water & sanitation and Affordable and clean energy) link to consumption patterns for accommodation and tourist activities (also addressed by Goal 12). Goal 9 (Industry, Innovation and Infrastructure) is crucial when it comes to land use planning, especially in a mountain region with limited space for built areas. Further, not only marine resources but also cities and communities (Goal 11) and life on land (Goal 15) are affected by tourism activity. Finally, tolerance, peace, and justice (Goal 16) are pursued through the encounters between people of diverse cultural backgrounds, both as workers and as visitors, with possible effects also on reduced inequalities among workers (Goal 10). Goal 13 (Climate action) is also actively involving tourism activities, particularly when it comes to services in the accommodation facilities, transport and snowmaking. All in all, the first screening of the relationships between SDGs and monitoring areas shows that – although local-specific understandings for each goal should be discussed – almost all SDGs seem to be related to the tourism industry. Conversely, this does also mean that pursuing these goals at regional level should take actively into account the crucial role of the tourism sector.

Methodological strategy: how to measure and understand?

The UNWTO guidelines for INSTO observatories propose nine mandatory issue areas to monitor sustainability in tourism. These are: tourism seasonality, employment, destination economic benefits, governance, local satisfaction, energy management, water management, waste water management, and solid waste management. However, further monitoring topics are welcomed to assess place-specific issues. Therefore, 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 8**). In the year 2020, we added an additional issue area on culture with the goal to measure the reciprocal effects of culture and tourism. Thus, currently, STOST monitors 13 issue areas.

Figure 8: Mandatory (in black) and additional (in green) issue areas.
Source: own elaboration.

In the long-term, we plan to equip each of the 13 issue areas with three indicators, selected with reference to international standards (i.e. European Tourism Indicators System for sustainable destinate ion management - ETIS, Global Sustainable Council Tourism Criteria for Destinations - GSTC-D), and one think tank, related to innovative or emerging (but not yet measurable) issues in each field (see **Figure 9**). We selected most indicators were in collaboration with different administrative and private stakeholders, and revised some indicators compared to 2019 based on stakeholders' feedbacks.
The current report includes 29 indicators, as the first report in 2019 did. The three indicators per issue area are divided as follows: one indicator per each issue area is always general, and the further two illustrate specific phenomena of interest. The think tank is interpreted as an occasion – usually during a working group workshop – to discuss innovative and groundbreaking innovations in the respective issue area by inviting experts in the respective field. For instance, in the issue area "Employment", the general indicator refers to employees in the hospitality and food service sector, whereas the more specific indicators assess the percentage of female enterprises and the citizenships of tourism employees.

Finally, the think tank addresses artificial intelligence (AI) and robotics in the hospitality sector, a major driver of change for the future with potentially disruptive social impacts. Think tanks work as a source of monitoring new concerns but are qualitative in their structure because they cannot (yet) rely on existing data.
With a view to 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 (R), typically undertaken by civil society to minimize impacts. 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 pillar it refers to: a blue circle indicates the economic, a brown one the social and a green one the environmental pillar.

Table 2 List of indicators and their classification. Source: own elaboration

ISSUE AREA	INDICATOR	DESCRIPTION	PILLAR	TYPOLOGY (DPSIR)	SDGs
1 **Seasonality**	**1.1**	Tourist arrivals by month and market	Economic	Driving forces (DF)	Decent work & economic growth (8); Sustainable cities & communities (11)
	1.2	Number of tourist arrivals occurring in peak months by municipality	Economic	Pressure (P)	Industry, innovation & infrastructure (9); Sustainable cities & communities (11)
	1.3	Number of tourist arrivals occurring in peak weeks by municipality	Economic	Pressure (P)	Decent work & economic growth (8); Industry, innovation & infrastructure (9); Sustainable cities & communities (11)
2 **Employment**	**2.1**	% of employees in the accommodation and food service sector	Economic/ Social	Driving forces (DF)	No poverty (1); Decent work & economic growth (8)
	2.2	% of female enterprises in the accommodation and food service sector	Economic/ Social	State (S)	Gender Equality (5)
	2.3	Employees in the accommodation and food service sector by citizenship	Economic/ Social	State (S)	No poverty (1); Decent work & economic growth (8); Reduced inequalities (10); Peace and justice (16)

ISSUE AREA	INDICATOR	DESCRIPTION	PILLAR	TYPOLOGY (DPSIR)	SDGs
3 **Economic benefits** 	**3.1**	Value added by industries	Economic	Driving forces (DF)	Decent work & economic growth (8)
	3.2	Profit situation for the accommodation and food service sector	Economic	State	Decent work & economic growth (8)
	3.3	Gross occupancy rates of bed places by municipality and tourism exposure	Economic	Driving forces (DF)	Decent work &economic growth (8); Industry, innovation & infrastructure (9)
4 **Governance** 	**4.1**	Number of municipalities, accommodation facilities and events involved in voluntary certification schemes for sustainability	Environmental/ Social	Responses (R)	Clean water & sanitation (6); Affordable & clean energy (7); Responsible consumption and production (12)
	4.2	Number of "Red Rooster" branded agritourism ventures producing and selling regional products	Environmental/ Social	Responses (R)	Zero hunger (2); Responsible consumption and production (12)
	4.3	Organic milk sold to members of the main local buying syndicate	Environmental/ Social	Responses (R)	Zero hunger (2); Responsible consumption and production (12)
5 **Local and visitor satisfaction** 	**5.1**	Tourism intensity index	Environmental	Pressure (P)	Decent work &economic growth (8); Sustainable cities & communities (11);
	5.2	Prices of rents in the destination	Social	State (S)	No poverty (1); Sustainable cities & communities (11)
	5.3	Tourist satisfaction with prices	Social	State (S)	Sustainable cities & communities (11)
6 **Energy management** 	**6.1**	Estimated minimum electricity consumption in accommodation facilities	Environmental	Pressure (P)	Affordable & clean energy (7); Climate action (13)
	6.2	Electricity consumption by ski-lifts and snow cannons	Environmental	Pressure (P)	Affordable & clean energy (7); Climate action (13)
	6.3	Charging stations offered for e-mobility in accommodation facilities and public spaces	Environmental	Responses (R)	Affordable & clean energy (7); Responsible consumption and production (12); Climate action (13)
7 **Water management** 	**7.1**	Estimated minimum water consumption in accommodation facilities	Environmental	Pressure (P)	Clean water & sanitation (6); Responsible consumption and production (12)
	7.2	Water use by snow guns	Environmental	Pressure (P)	Responsible consumption and production (12); Climate action (13)

ISSUE AREA	INDICATOR	DESCRIPTION	PILLAR	TYPOLOGY (DPSIR)	SDGs
8 **Waste water management** 	**8.1**	Discharge of sewage water attributable to tourism	Environmental	Pressure (P)	Clean water & sanitation (6); Responsible consumption and production (12)
9 **Waste management** 	**9.1**	Estimated waste production in accommodation facilities	Environmental	Pressure (P)	Responsible consumption and production (12)
10 **Mobility** 	**10.1**	Mobilcards, bikemobil cards, museumobil cards and guest tickets	Environmental	Responses (R)	Industry, innovation & infrastructure (9); Sustainable cities & communities (11); Climate action (13)
	10.2	Number of ski-lift and cable car users by season	Environmental/ Economic	Driving forces (DF)	Industry, innovation & infrastructure (9); Responsible consumption and production (12); Climate action (13)
	10.3	Kilometers travelled using car sharing services by non-local users	Environmental	Responses (R)	Industry, innovation & infrastructure (9); Climate action (13)
11 **Land use and landscape diversity** 	**11.1**	Number of accommodation facilities by municipality and tourism exposure	Environmental/ Social	Driving forces (DF)	Sustainable cities & communities (11); Climate action (13)
	11.2	Shannon's Diversity Index	Environmental/ Social	State (S)	Climate action (13); Life on land (15)
12 **Nature conservation** 	**12.1**	Hemeroby (human activity impact on the ecosystem)	Environmental/ Social	State (S)	Climate action (13); Life below water (14); Life on land (15)
	12.2	Natural parks and protected areas	Environmental	Responses (R)	Climate action (13); Life below water (14); Life on land (15)
13 **Culture** 	**13.1**	Transhumance in South Tyrol (Research proposal)	Cultural	N/A	Sustainable cities & communities (11); Peace and justice (16)

Concerning data granularity, for mandatory issue areas we tried to collect municipal (LAU2) data and address a 10-year time span (2009-2019 was set as a common standard). For additional issue areas (10-12) several efforts were made to create new data from scratch. Municipal data are not always presented in this report, but they are stored and available for interested stakeholders. Whenever possible, we group municipalities based on tourist exposure and indicators are presented comparing highly touristic areas with less touristic ones. Tourism exposure combines a municipality's tourism intensity with the municipality's number of beds per surface (see Annex 2 for a detailed definition of tourism exposure). Data frequency might be daily, monthly, yearly, or one-off. Further details on the procedures of data management, storing and processing are provided in Annex 1. Several collaborations were crucial in calculating specific indicators. For instance, the Eurac Research Institute for Alpine Environment updated the indicators for landscape diversity (SHEI) and hemeroby (human activity impact on the ecosystem) (see indicator 11.1 and 12.2). Further efforts need to be made concerning energy, water, and waste management, since estimates were produced by a linear combination of overnight stays and standard coefficients available in literature (see Annex 2). However, more precise evaluations could only be made after a tailored data collection phase in local accommodation facilities. Primary data about resource consumption could also be useful to calculate the overall amount of greenhouse gas (GHG) emission related to tourism, a figure that strictly depends on transport, heating, and cooling services in the hospitality sector.

BOX 2 :

THE EVOLUTION OF THE COVID-19 PANDEMIC IN SOUTH TYROL

The first patients with Covid-19 infections in South Tyrol were recorded in the beginning of March. From the 10th of March until mid-April there was a rapid and steady rise of new infections, slowing down in the end of April. The upwards trend slowed down as abrupt as it started, but there are still new cases reported almost daily. The graph shows that the development of cases is unlikely to be linked to testing, as daily smear tests have been conducted somewhat steadily throughout the pandemic, with a slight decrease between mid-June and mid-July. The highest amount of new recorded cases was on the 12th of April with 141. As of the 28th of August 2020, 2,923 persons have been tested positive for the Corona virus in South Tyrol. 2438 of these patients have been cured, 193 persons still battle the illness and 292 patients have passed away. The last death contributed to the Covid-19 virus was on June 3rd (Südtiroler Landesverwaltung, 2020).

The spread of Covid-19 and the entailed lockdown measures have had a massive impact on the tourism sector. In the months of March, April, and May of 2019, a total of 5,645,450 overnights stays was recorded in South Tyrol. In the same time period in 2020, the number of overnights stays amounted to only 631,630, a decrease of over 5 million stays (ASTAT, 2020). As for testing in the tourism industry, until August 13th 18,452 rapid test were conducted. Of the persons tested, 503 showed anti bodies to the virus and two resulted positive to the PCR test (IDM, personal communication, August 13, 2020).

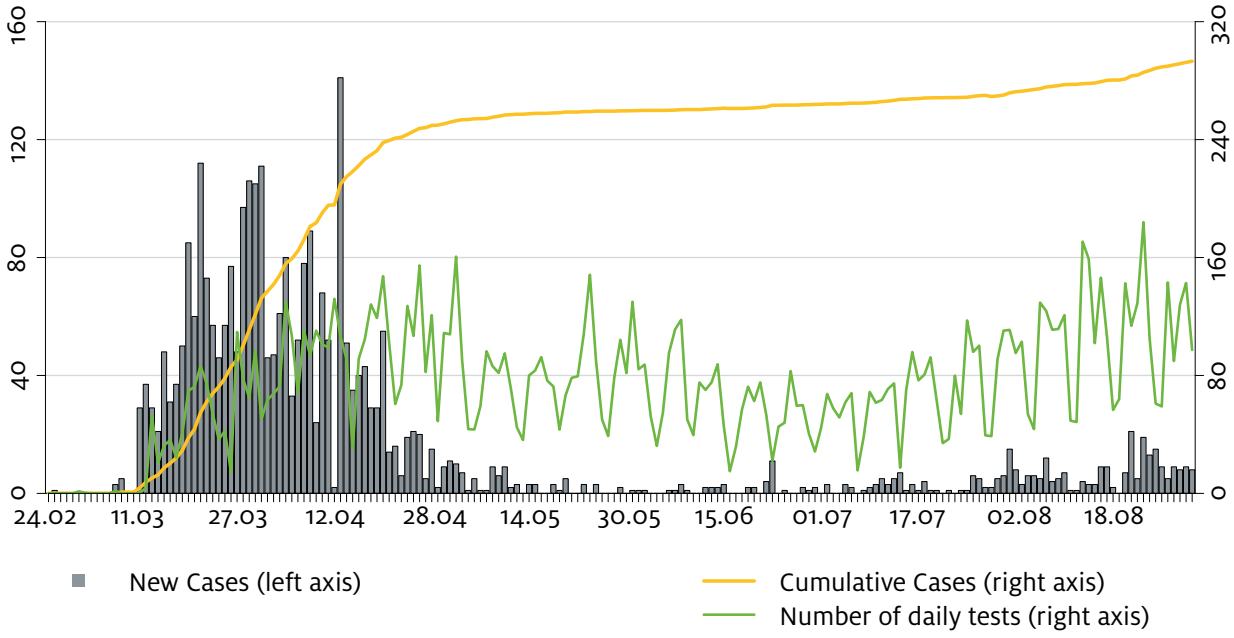

Figure 9: Development of Covid-19 cases and tests in South Tyrol from February 24th, 2020 to August 31st, 2020. Source: Italian Ministry of Health, data available on demand.

Issue areas

1

1 Tourism seasonality

Notwithstanding the attempt to expand tourism offers and products in shoulder seasons, tourism peaks are inevitable in most destinations. Destinations characterized by high fluctuations in seasonality often suffer from various issues, such as overcrowding, high prices, inadequate infrastructure in peak seasons and a lack of services and job opportunities in shoulder seasons.

South Tyrol is not an exception and it experiences its peak seasons in summer and winter, when the weather is ideal for the practice of outdoor activities such as hiking, mountain biking, and skiing. High peak periods may be linked not only with seasons/months, but also with specific events/festivals or festivities, such as Christmas (and the Christmas Markets) and Easter. Each tourism market has its own seasonality.

This has remained almost stable over the past twenty years, although absolute numbers have increased. Monitoring the percentage of tourist arrivals per market, months and weeks helps to identify high and low peaks and to foresee and tackle the issues linked with both periods in a timely manner.

It further suggests when and how to concentrate efforts aimed at managing tourist flows. How to efficiently manage visitor flows is in fact the main topic that a selected group of stakeholders is addressing within a dedicated think tank.

1.1 TOURIST ARRIVALS BY MONTH AND MARKET

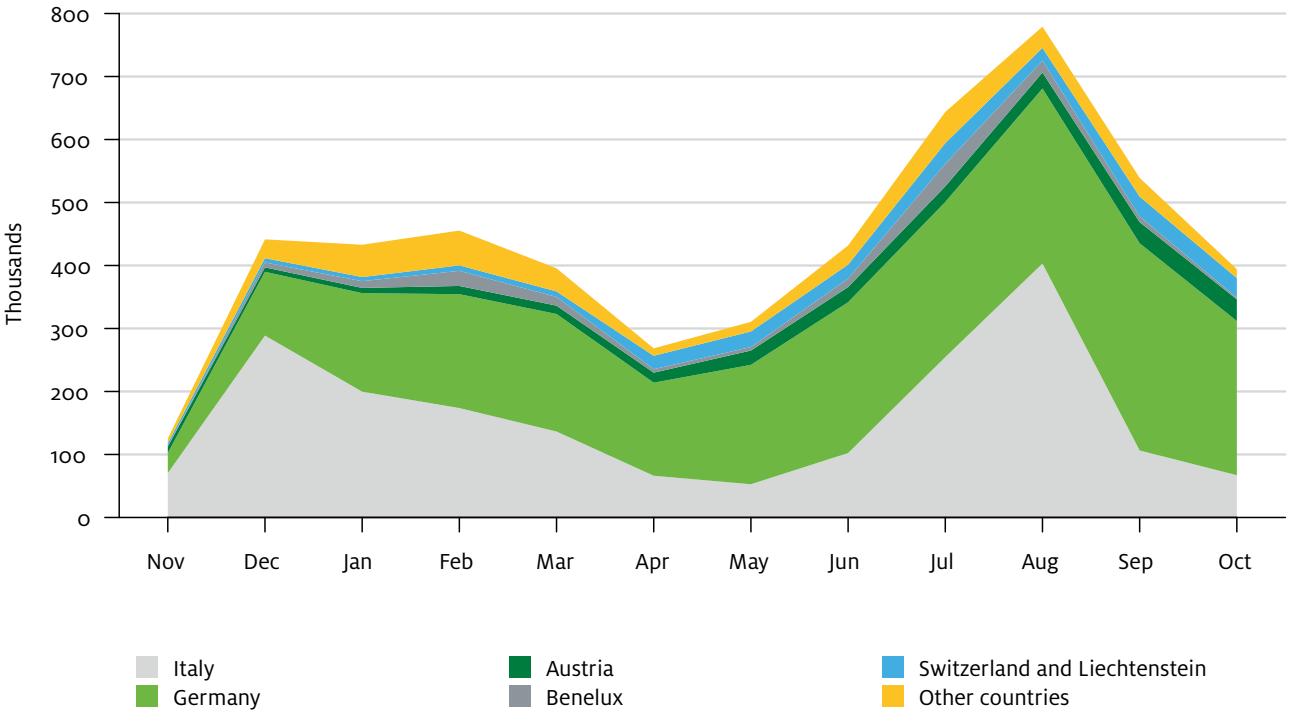

Figure 10: Total tourist arrivals by month and market, South Tyrol 2008-2019. Monthly average values in thousands.
Source: ASTAT, data available on demand.

Figure 10 shows the mean values per month of tourism arrivals in South Tyrol between 2008 and 2019, distinguished by market. One can clearly identify the seasonal pattern, i.e. tourism in South Tyrol has a winter and a summer season. This pattern has remained constant over the last 20 years, although absolute numbers of arrivals have changed. Regarding the countries of origin, proximity markets (Italy and Germany) clearly prevail over long-distance markets. The various markets display different seasonal patterns. Italian tourists arrive predominantly in December and August, while the arrivals of German tourists are more evenly distributed. Other type of guests, often referring to long-distance markets, tend to concentrate more in the wintertime.
The calculation of the Gini index, normally used to measure the degree of inequality of a distribution, helps in classifying the different tourist markets according to their high or low degree of seasonality. The index takes the value 0 when tourist arrivals from a country are uniformly distributed over the whole year and assumes a value of 1 in the case that all tourists of one nationality arrive in the same month. Comparing the Gini index for the most important markets of origin gives the following picture: German tourists are the most uniformly distributed across the year, with a Gini value of 0.254. Tourists from Austria, Italy, and Switzerland and Liechtenstein follow with values equal to 0.308, 0.368 and 0.388 respectively. Italian tourists are more likely to arrive in South Tyrol in August (20.7%) and in December (15.3%). Finally, with a Gini index of 0.444, tourists from Benelux, few in absolute numbers, display a particularly high concentration in July (25%).

1.2. NUMBER OF TOURIST ARRIVALS OCCURRING IN PEAK MONTHS BY MUNICIPALITY

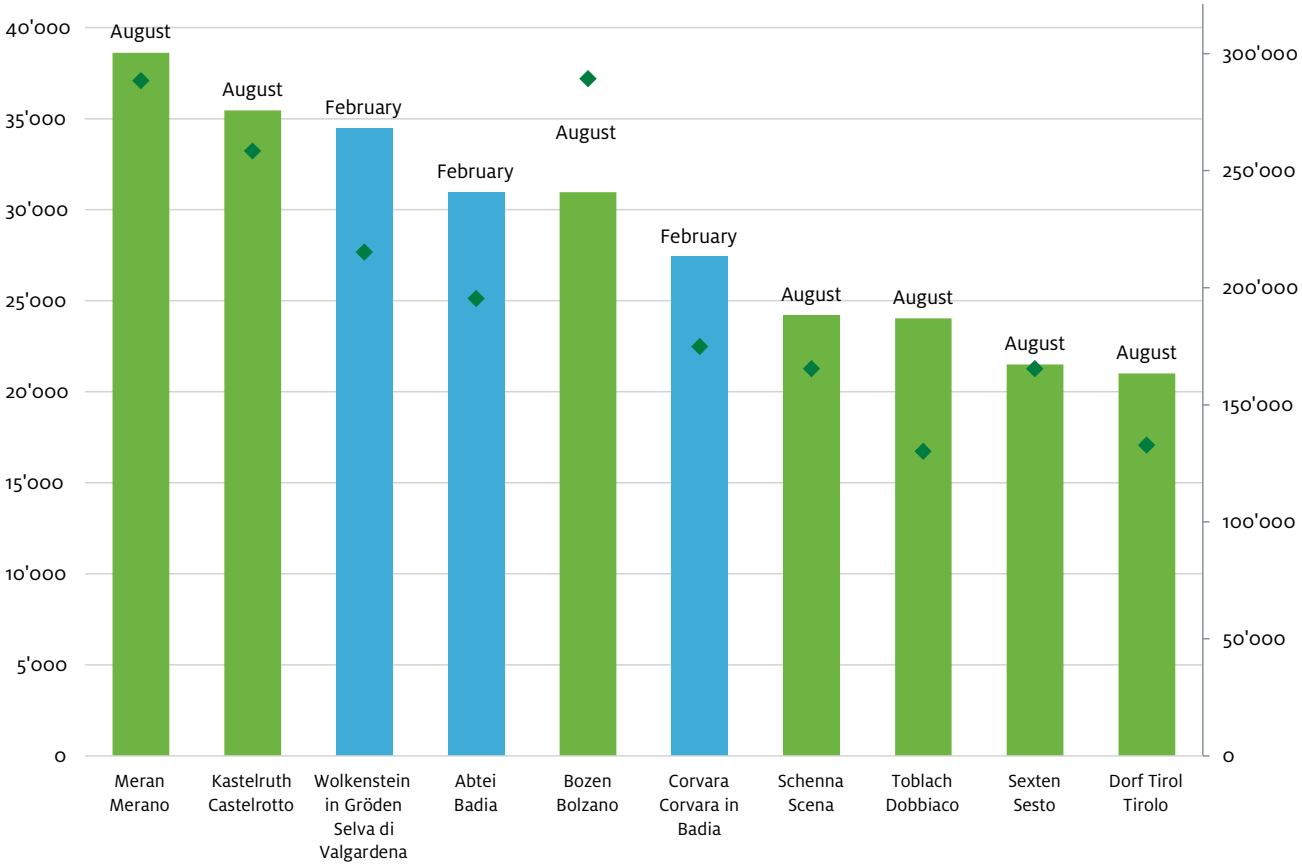

Figure 11: Total tourist arrivals occurring in peak months by municipality (top 10 municipalities), 2008-2019. Monthly absolute arrivals (left scale) and total arrivals per year (right scale). Source: ASTAT, data available on demand, own elaboration.

Figure 11 illustrates the municipalities of South Tyrol with the highest seasonal peaks in the time span 2009-2019, that is to say the municipalities experiencing more tourist arrivals within one month. The figure confirms the concentration of arrivals during the months of February and August. 7 out of 10 municipalities experience this phenomenon in August, when most of Italian tourists are more likely to go on holiday during the summer, while the remaining 3 experience it in February, during the winter holidays. The municipalities of Wolkenstein in Gröden/Selva di Valgardena, Abtei/Badia and Corvara/Corvara in Badia are situated in fact in the Dolomites WHS and well-known for ski tourism. The highest concentration of tourists within one month is reached by the city of Meran/Merano, counting on average almost 40'000 arrivals in August, while Wolkenstein/Selva displays the highest number of arrivals in February with almost 35'000.

1.3 NUMBER OF TOURIST ARRIVALS OCCURRING IN PEAK WEEKS BY MUNICIPALITY

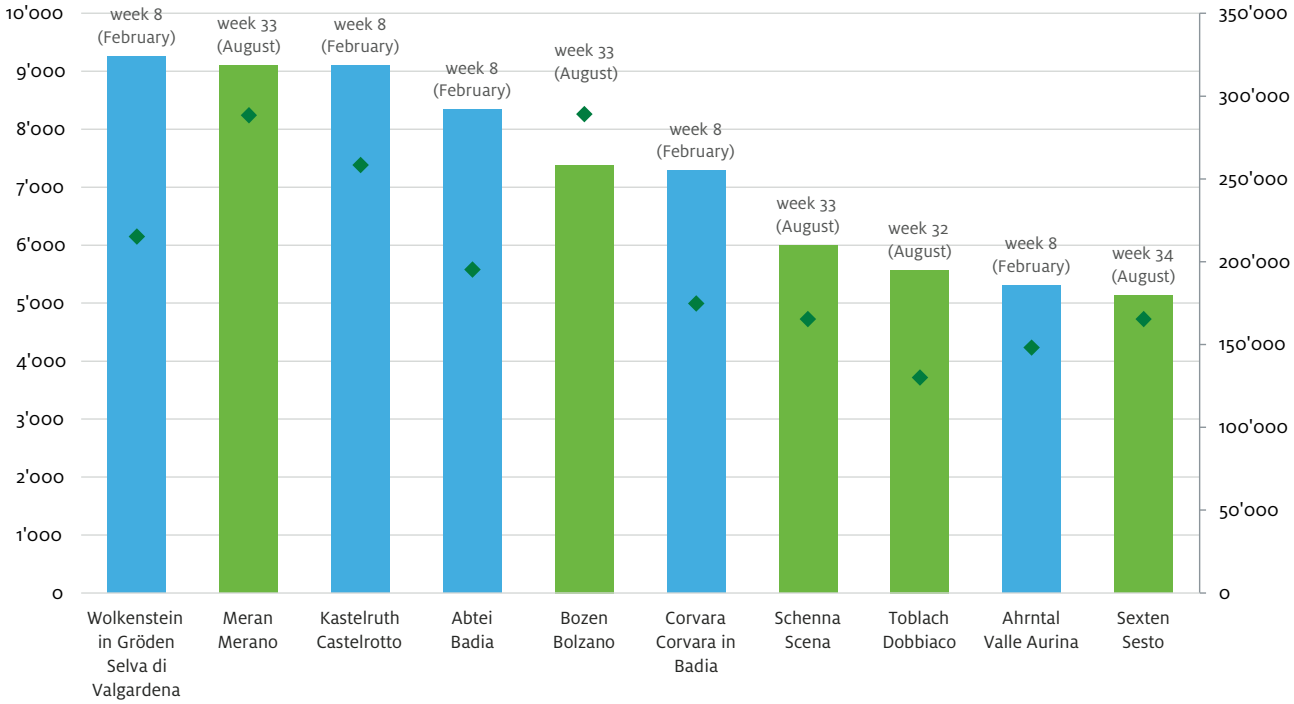

Figure 12: Total tourist arrivals occurring in peak weeks by municipality (top 10 municipalities with the highest share), 2008-2019. Weekly average percentage values (left scale) and total arrivals per year (right scale). Source: ASTAT, data available on demand, own elaboration.

In line with Figure 11, Figure 12 highlights the predominance of arrivals during week 8 and week 33 (weeks 8 lies in February and 33 in August). Wolkenstein/Selva has the highest weekly concentration of arrivals. More than 9'000 guests arrive during week 8 on average. Also, the city of Meran/Merano and Kastelruth/Castelrotto have more than 9'000 new guests during their busiest week. Figure 12 shows that during the end of February (week 8) and Mid-August (week 33) most tourists arrive in South Tyrol, representing the moments of the year with the highest demands to infrastructure such as road and railways.


2

2 Employment

Employment within the tourism sector is a crucial area, as it impacts both the quality of life of the local population as well as tourists' experience and therefore satisfaction. Monitoring the percentage of people employed within the tourism sector in respect to other sectors is a good proxy of the importance of tourism within the local overall economy, while indicators related, for example, to gender equality help to understand the quality of such employment. The gender composition of the workforce is a relevant aspect in this context, as it is widely recognized (see for instance Baum 2013) that the labor market within the tourism sector is characterized by horizontal and vertical gender segregation. 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). Finally, the last aspect that we explore in this section concerns the composition of the labor force with respect to nationality. According to a study by Amt für Arbeitsmarktbeobachtung (Department of Labour Market Observation, hereinafter AMB) (2008), up to 2007, employment growth in the tourism sector was driven mostly by an increase of foreign workers. The aim was therefore to understand the extent to which the local economy can benefit from the steady growth of the sector, at least as far as the supply of workers is concerned.
Within this specific issue area, a think tank was established to discuss within a selected group of stakeholders, topics such as artificial intelligence (AI) and robotics in the hospitality sector and its potential impacts on the social and economic pillars.

2.1 % OF EMPLOYEES IN THE ACCOMMODATION AND FOOD SERVICE SECTOR

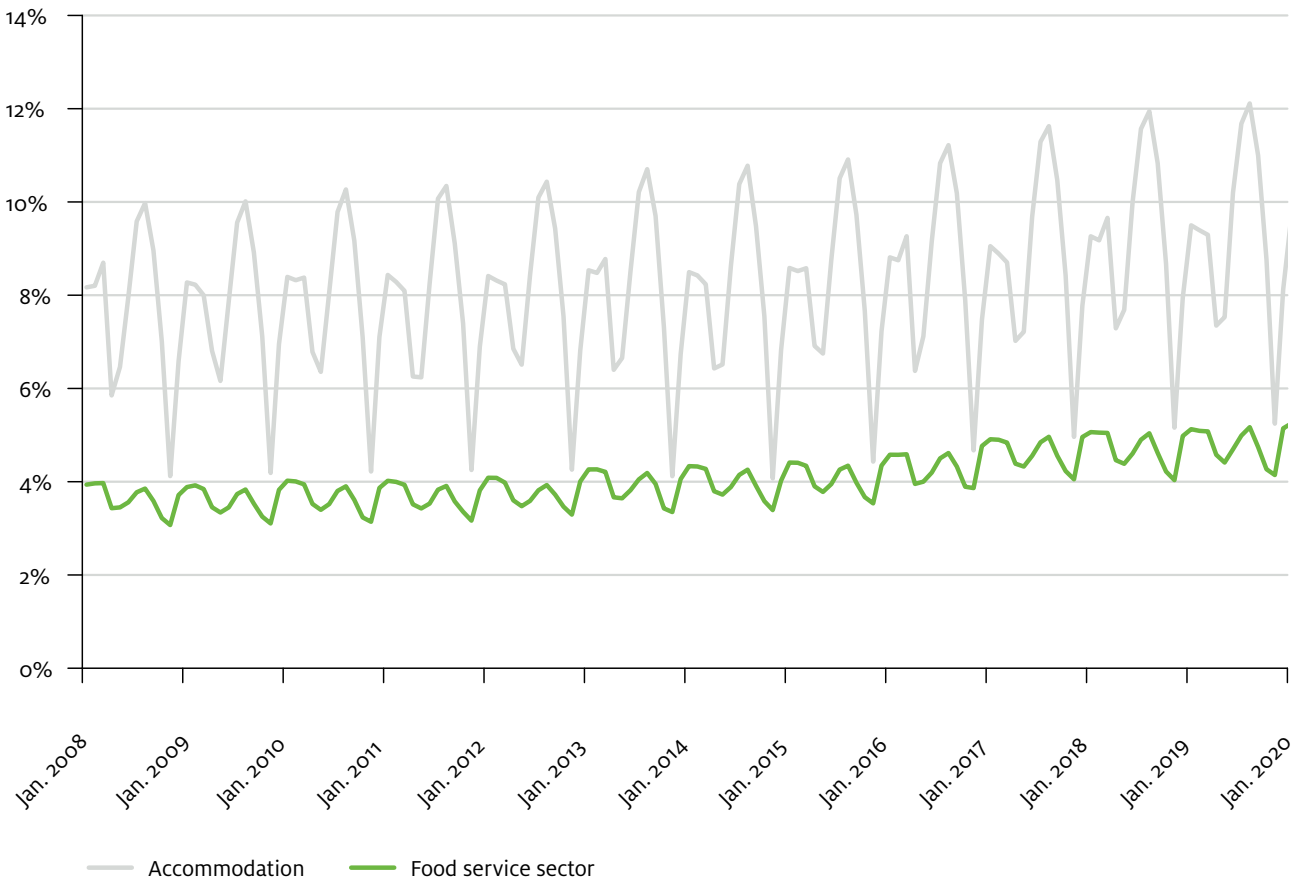

Figure 13: Employees in the accommodation and food service sector by sector and month, South Tyrol 2008-2018. Percentage values over total employment. Source: AMB, data available on demand.

Employees in the accommodation and food service sector make up about 15% of total employment in South Tyrol. In 2020, the absolute number of employees working in these sectors in South Tyrol was, on average, 30,218. Out of the 15%, about 10% work in the accommodation sector and the remaining 5% in food service activities (cafes and restaurants). Note that the numbers displayed in **Figure 13** 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 share of workers (employees and self-employed) in the tourism sector compared to the total number of workers in South Tyrol might be higher. Employment in the tourism sector is highly seasonal with notable differences between the two sub-sectors. That is, employment in food service activities fluctuates less than employment in the accommodation sector. The reason is that, compared to the accommodation sector, the food service industry depends much less on tourists, i.e. in the food service industry, the share of demand that stems from residents is more important.

2.2 % OF FEMALE ENTERPRISES IN THE ACCOMMODATION AND FOOD SERVICE SECTOR

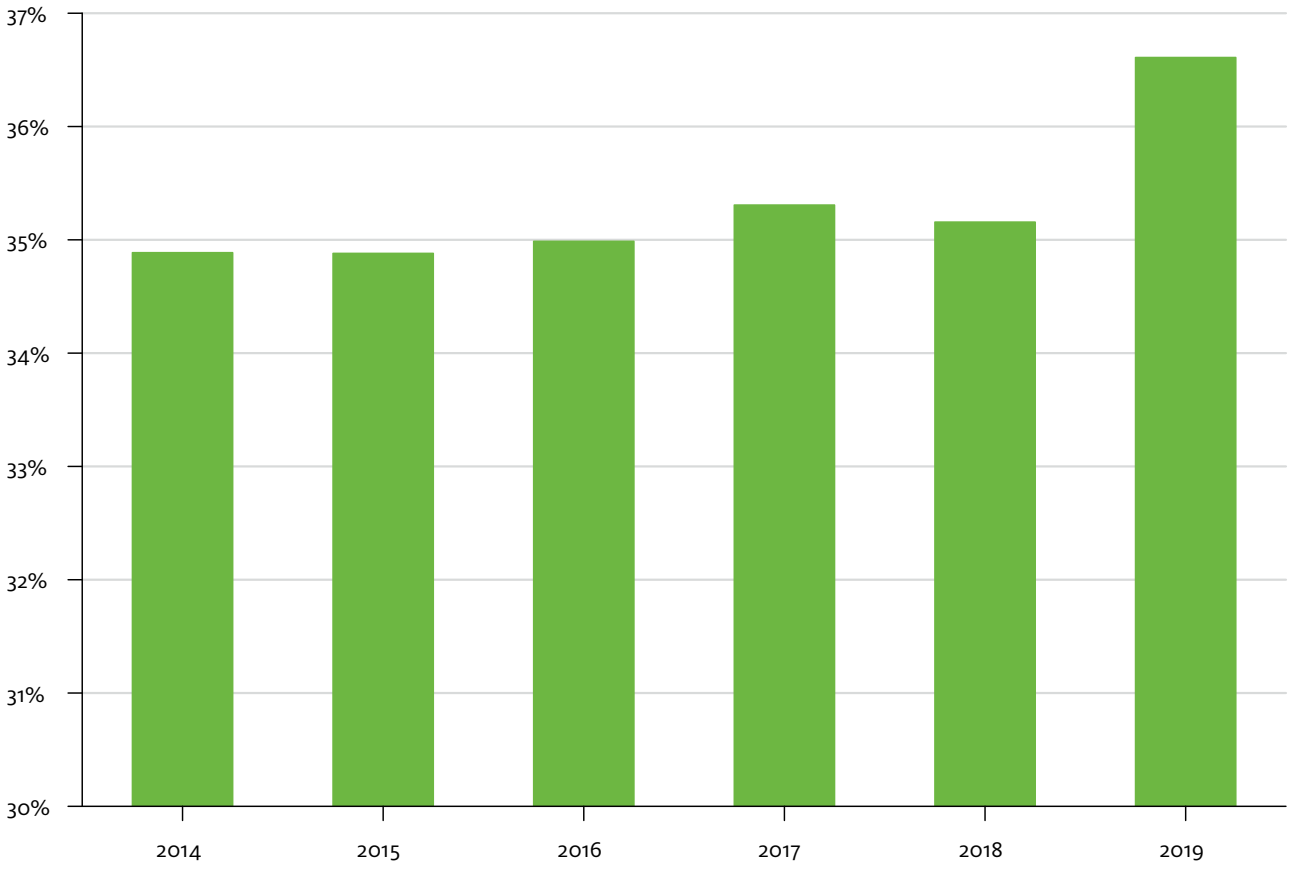

Figure 14: Female enterprises in the accommodation and food service sector, South Tyrol 2014 – 2019. Percentage values over total number of tourist enterprises. Source: WIFO, data available on demand, own elaboration.

Among the 7,580 enterprises active in the accommodation and food service sector in 2019, 2,775 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 Bolzano (source: Unioncamere), leading to a share of 36.6%. Data from 2019 witness a slight increase in the percentage of female enterprises, given that this percentage was relatively stable around 35% between 2014 and 2018. This is due to both an increase in the overall number of active enterprises within the sector, as well as in the number of female enterprises.

At the Italian level, according to data provided by the Women's Entrepreneurship Observatory of Unioncamere[1], 22% of enterprises (in all sectors) were owned by women in 2015, while a higher share of female enterprises (29.7%) was observed for the tourism sector in 2017[2]. This relatively high share of women entrepreneurs in the accommodation and food service sector in South Tyrol demonstrates that vertical segregation turns out to be not a major issue in the tourism sector, and that South Tyrol outperforms the national average within this field.

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

2 Source: http://www.unioncamere.gov.it/P42A3528C160S123/donne-motore-della-ripresa--imprenditoria-femminile-nel-turismo-.htm

2.3 EMPLOYEES IN THE ACCOMMODATION AND FOOD SERVICE SECTOR BY CITIZENSHIP

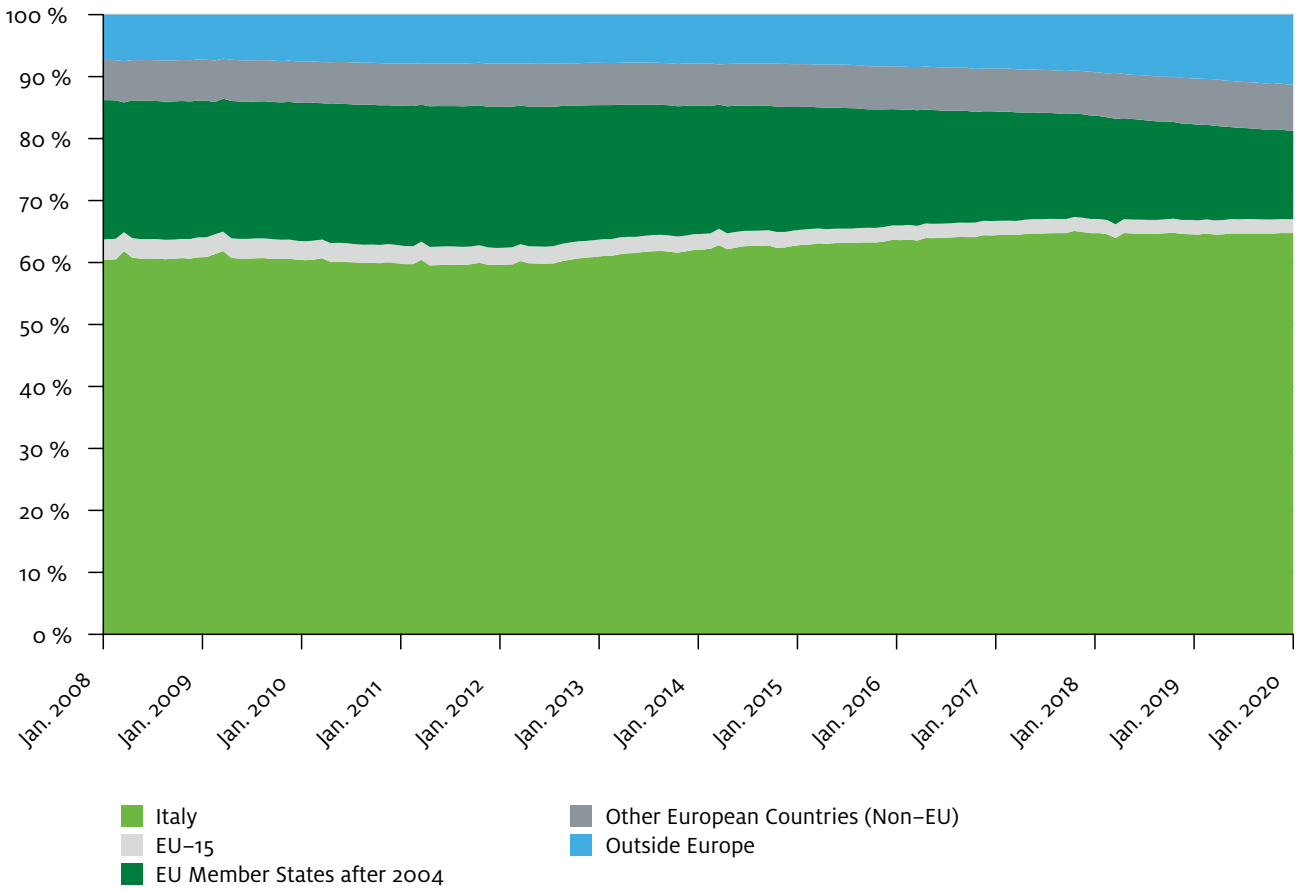

Figure 15: Employees in the accommodation and food service sector by month and citizenship, South Tyrol 2008 – 2018. Seasonally adjusted data, percentage values. Source: AMB, data available on demand, own elaboration. The following link provides an overview of all EU member countries and the history of the EU enlargement: https://ec.europa.eu/neighbourhood-enlargement/sites/near/files/pdf/publication/factsheet_en.pdf

Do the local inhabitants of South Tyrol benefit from employment growth in the tourism sector? **Figure 15** shows that the share of employees in the tourism sector with Italian nationality increased within the last decade. The average number of Italian citizens working in the accommodation and food service sector increased from 12,692 workers in 2009 to 19,783 in 2019. However, these data do not allow differentiation between employees coming from South Tyrol and from other Italian regions. While the share of employees coming from Eastern Europe (the main countries here are Poland, Hungary, Czech Republic, Slovakia, Romania, Bulgaria) remained constant in absolute terms and decreased in relative terms between 2008 and 2020, South Tyrol experienced a sharp increase of employees coming from countries outside the European Union. While in 2008, on average 1,500 employees came from non-European countries, in 2019 this number doubled (3,300). Note that the naturalization procedure (the acquisition of Italian citizenship) may play a role in explaining these trends.


3

3 Economic benefits at the destination level

Tourism brings economic growth and prosperity to regions (Brida & Risso, 2009). Tourism creates jobs, fosters private investment, and increases public spending in infrastructure. 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 value added by the hotel and food service industry over time is a good proxy of the relative contribution of tourism to total GDP, since the last tourism satellite account of South Tyrol refers to 2007/2008. Further indicators to assess the economic benefit of tourism at 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 profit situation and the issue area 2 on employment provides a well-structured image of the local benefits related to tourism. Within this issue area, a think tank has been established in order to reflect on the concept of post-growth society, i.e., how tourism can be measured according to new criteria, that do not necessarily take into consideration the mere economic growth.

3.1 VALUE ADDED BY INDUSTRIES

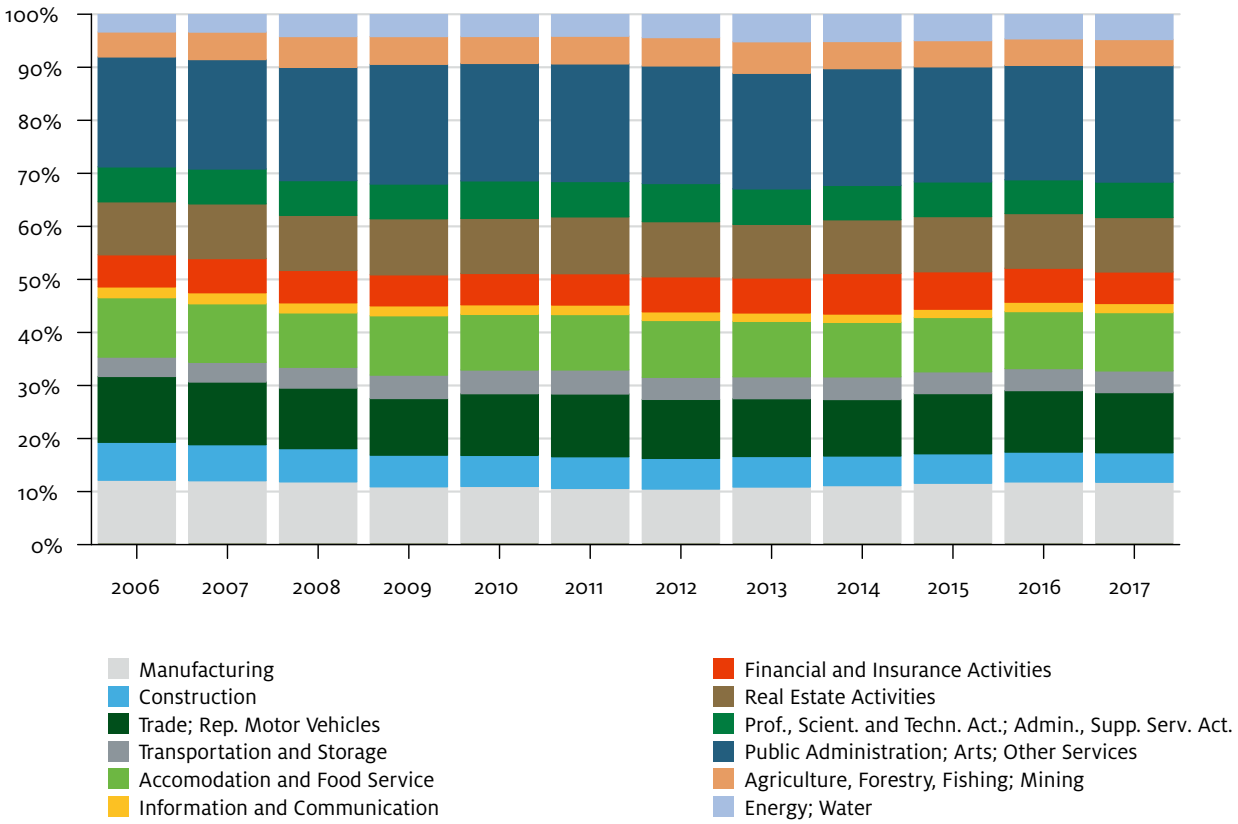

Figure 16: Value added by industry, South Tyrol 2006 – 2017. Percentage values.
Source: ISTAT, online database (I.Stat database), own elaboration.

Figure 16 depicts the relative contribution of single industries to total GDP. The light green shade represents the share of the tourism industry. In 1995, the tourism industry produced goods and services corresponding to a nominal worth of 1,769.4 million EUR. In 2017, the sum of all goods and services produced by the tourism sector amounted to almost 2,400 million EUR. Despite an average nominal growth rate of 2.4%, the tourism sector did not outperform the overall economy. While the tourism industry accounted for 13.1% of total value added in 1995, in 2017 the sector only contributed 11% of total GDP. Between 2006 and 2017, data are almost stable: in 2006 tourism accounted for 11.2% of total GDP. Despite this trend, the tourism industry remains an important industry for South Tyrol.

3.2 PROFIT SITUATION FOR THE ACCOMMODATION AND FOOD SERVICE SECTOR

Figure 17: Profit situation in the accommodation and food service sector, South Tyrol 2008 – 2019. Index. Source: WIFO, data available on demand, own elaboration.

Figure 17 illustrates the profit situation of hotels and restaurants 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 situation of the past year. In 2013 and 2014, both hotels and restaurants experienced a dip in their profit situation. This dip is consistent with the dynamics observed in tourist arrivals and overnight stays, which declined during both years (see Figure 1).

Between 2014 and 2018, the profit situation rose again and reached all-time highs. Recently, after 2018, especially the profit situation in the accommodation sector declined relative sharply, whereas the indicator for the food service sector remained almost stable.

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

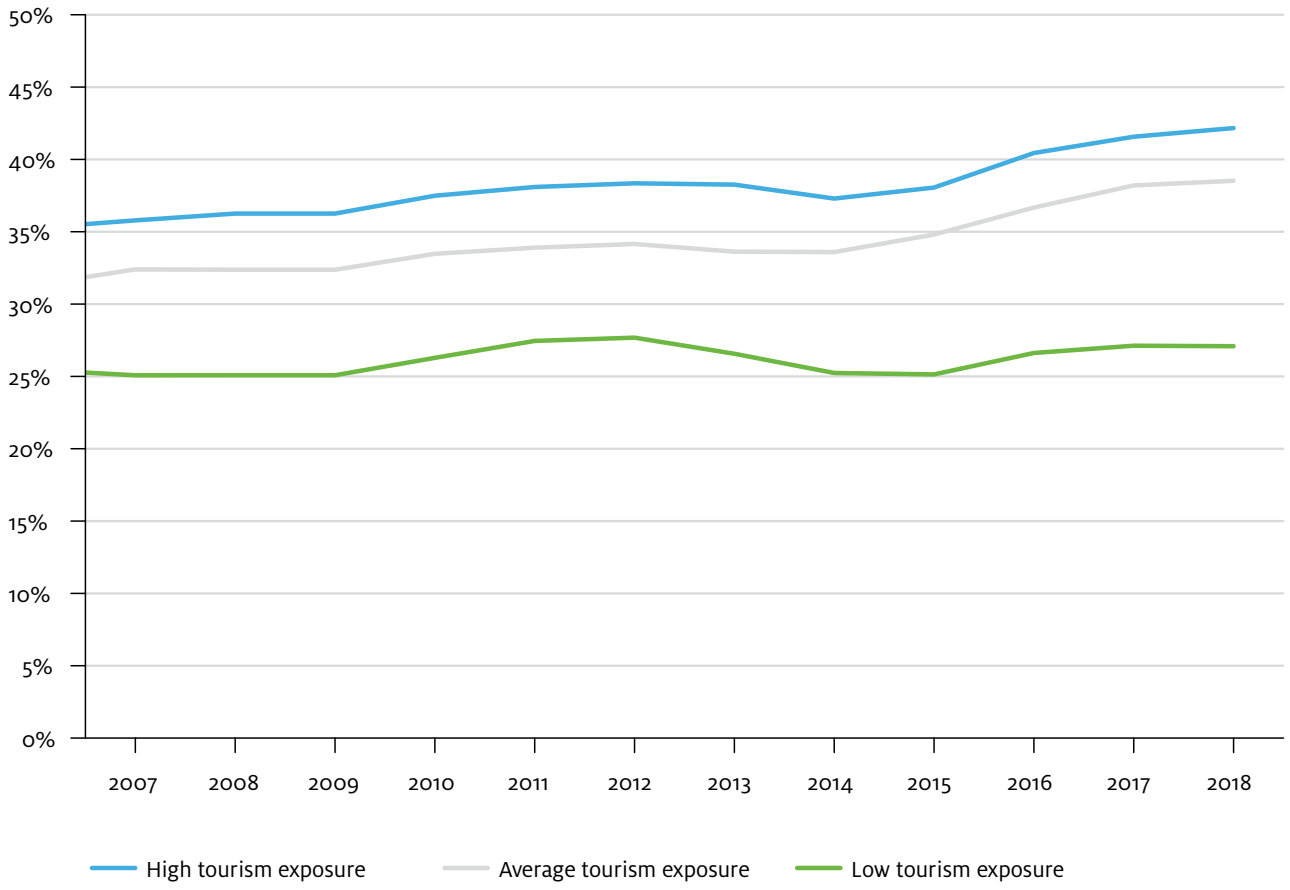

Figure 18: Gross occupancy rates of bed places by municipality and tourism exposure, South Tyrol 2007-2018. Percentage values. Source: ASTAT, online database.

Figure 18 shows gross occupancy rates of all accommodation facilities of South Tyrolean municipalities with a high, average and low tourism exposure (see Annex 2 for a definition). Besides the indicator on firms' business climates, the indicator on occupancy rates represents an additional indicator of the economic benefits of tourism. A higher occupancy rate implies a higher capacity utilization that is associated with increasing prices, higher margins, and an increasing pressure for investment. Over the last ten years, the overall occupancy rates increased by more than 5 percentage points, from an average occupancy rate of 34% in 2007 to 39% in 2018. The figure shows a clear difference in gross occupancy rates between bed places in high, average and low tourism intensive places. Whereas in 2018 in low tourism intensive places, the gross occupancy rate of bed places was 27%, in high tourism intensive places it was 42%. Box 2 discusses the effects of Covid-19 on the gross occupancy rate of hotels and shows that it decreased significantly because of the pandemic.

BOX 3 :

THE ECONOMIC CONSEQUENCES OF COVID-19 ON THE TOURISM SECTOR IN SOUTH TYROL

In March 2020, the outbreak of Covid-19 and the subsequent lock down abruptly ended the winter season in South Tyrol. The winter season 2019/2020 has been the most successful winter season in history. In order to understand the economic consequences of Covid-19 on the economy and the tourism sector and to shed led on the longer lasting effects of the pandemic on tourism in general, STOST initiated various monitoring projects.

In April 2020, STOST conducted in collaboration with WIFO a representative survey among a large panel of South Tyrolean firms to study the economic consequences of Covid-19 in the region. The results show that Covid-19 and the subsequent shut down caused a strong increase in uncertainty among a large share of South Tyrolean firms. Besides the increase of uncertainty, the pandemic led to sever economic consequences. The survey showed that turnover in the food and accommodation sector reduced by 66% in March 2020 compared to March 2019. This is the strongest decline among all sectors (see **Figure 19**). In April 2020 firms in the accommodation sector expected a decrease in annual turnover of about 50% (Riz et al., 2020).

In order to monitor the accommodation and food service sector throughout the crisis, at the beginning of August 2020, STOST conducted a follow-up survey in cooperation with the South Tyrolean Hotels and Restaurants Association (HGV). The exploratory survey was conducted among all members of HGV. The survey results show that in July 2020, even though tourism started to pick up again, turnover was still one third blow the level of July 2019. For August, survey participants expected turnover to be somewhat less negative. Nevertheless, on average firms still expected turnover in August 2020 to be 25% below corresponding 2019 levels. Besides turnover, the survey also focused on employees and gross bed occupancy rates. Similar to turnover, gross bed occupancy rates were significantly lower in July and August 2020 compared to 2019 values. In July and August 2019, the gross bed occupancy rates of participating firms corresponded to 82% and 93%. In 2020, the same firms reported average gross bed occupancy rates of 55% and 74%. In July 2020, participating firms in the food and accommodation reported on average their number of employees to be 13% lower compared to July 2019.

The survey results show that the tourism and accommodation sector was heavily affected by Covid-19 crisis. Even though overnight stays slowly increase again during the summer season, the overall value added created by tourism still lies well below pre-crisis levels.

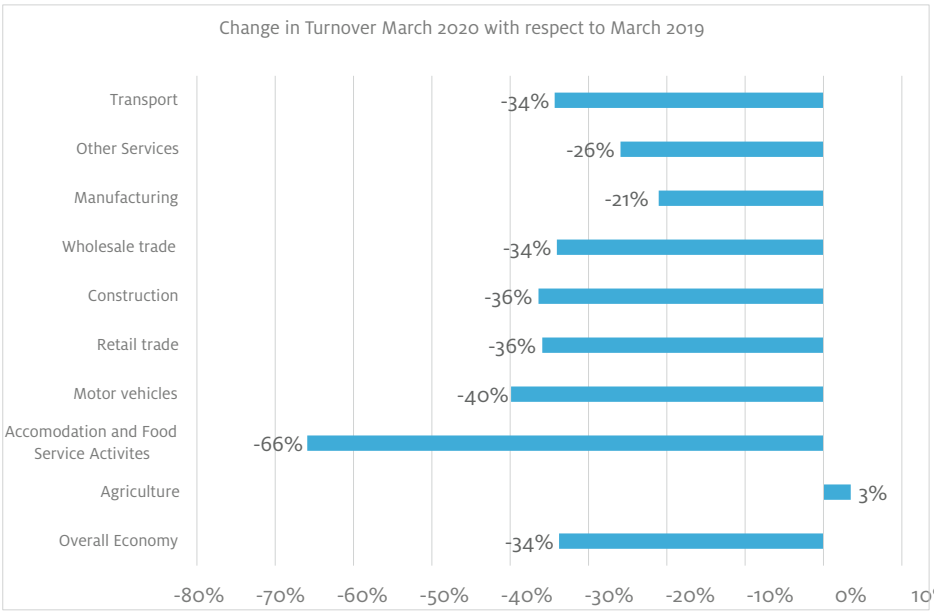

Figure 19: Change in turnover by sector in South Tyrol. Year-over-year growth rates from March 2019 to March 2020. Source: WIFO & EURAC (Riz et al. 2020).

4

4 Governance

The concept of governance refers to a myriad of steering approaches that include means such as trust, money, formal power, and knowledge (Pechlaner, Volgger & Herntrei, 2012; Raich, 2006). These work as an alternative to hierarchical steering in today's complex environment and are essential for linking many different stakeholders at destination scale. In fact, the participation of government, businesses and the community in a sustainable development path is crucial to achieve a successful implementation of the concept (Bramwell and Lane, 2011). Monitoring governance and the different steering approaches on site are of great importance to understand the formal and informal mechanisms that develop locally to increase decision-making capacities, shape more balanced policies and turn them into actions.

South Tyrol's tourism system includes a wide range of different actors, networked through corporations, informal agreements, and agencies (e.g. the South Tyrolean Hotels and Restaurants Association - HGV, the South Tyrolean Non-commercial Accommodation Providers Association – VPS, the South Tyrolean Farmers' Association – SBB, the Agency for Energy South Tyrol – KlimaHaus (Agentur für Energie Südtirol – KlimaHaus) and the Provincial Agency for Environment). They all support many of the strategies and voluntary regulatory mechanisms aimed at increasing the level of quality and sustainability of the entire tourism system.

One possible way to understand the steering mechanisms active in a destination is to monitor these voluntary certification schemes. In the following section, we present several examples of certification schemes that appear relevant for the tourism sector. They refer to municipal strategies (Comuni Clima and Alpine Pearls) and to certification schemes (Green Events, Bio Hotels, Clima Hotels and Ecolabel certified hotels). Compared to the previous editions of the report, this year time series were available to show the temporal development of stakeholders' pro-sustainability engagement. In the following years, a think tank could be dedicated to exploring and further fostering cross-sectoral relationships and synergies.

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

R

The next three illustrations (Figure 20-22) show the number of different voluntary schemes adopted to increase the sustainability level of tourism at a local scale. They vary from certification schemes awarded to municipalities, accommodation facilities and events in South Tyrol.

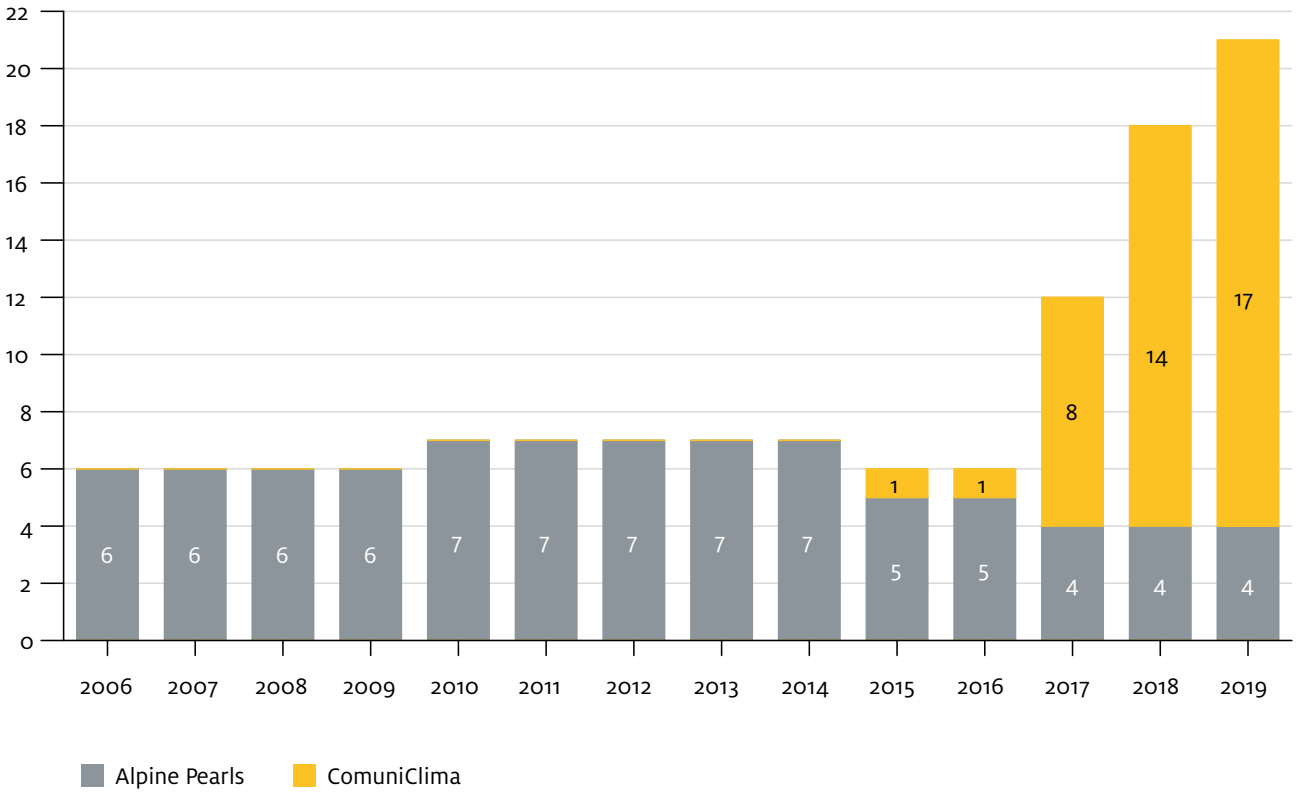

Figure 20: Number of municipalities involved in sustainability schemes by certification categories, South Tyrol 2019. Source: Agency for Energy South Tyrol – KlimaHaus, Alpine Pearls, data available on demand, own elaboration.

Figure 20 shows that a total of 21 certifications have been awarded to municipalities. Four municipalities are members of "Alpine Pearls", a network of villages offering green mobility services and complying with some standards in terms of traffic regulation and reduction, whereas 17 municipalities are members of the "Comuni Clima" , a program which supports municipalities step by step in the preparation and implementation of a sustainable energy and environmental management plan and awards exemplary municipalities the "Comuni Clima" certification. The program analyses, evaluates and improves the energy and water consumption of municipal buildings and facilities, the sustainable mobility concept, the local production of renewable energy and waste management according to sustainability aspects. In this way, municipalities minimize their consumption of resources and the emission of climate-damaging greenhouse gases.

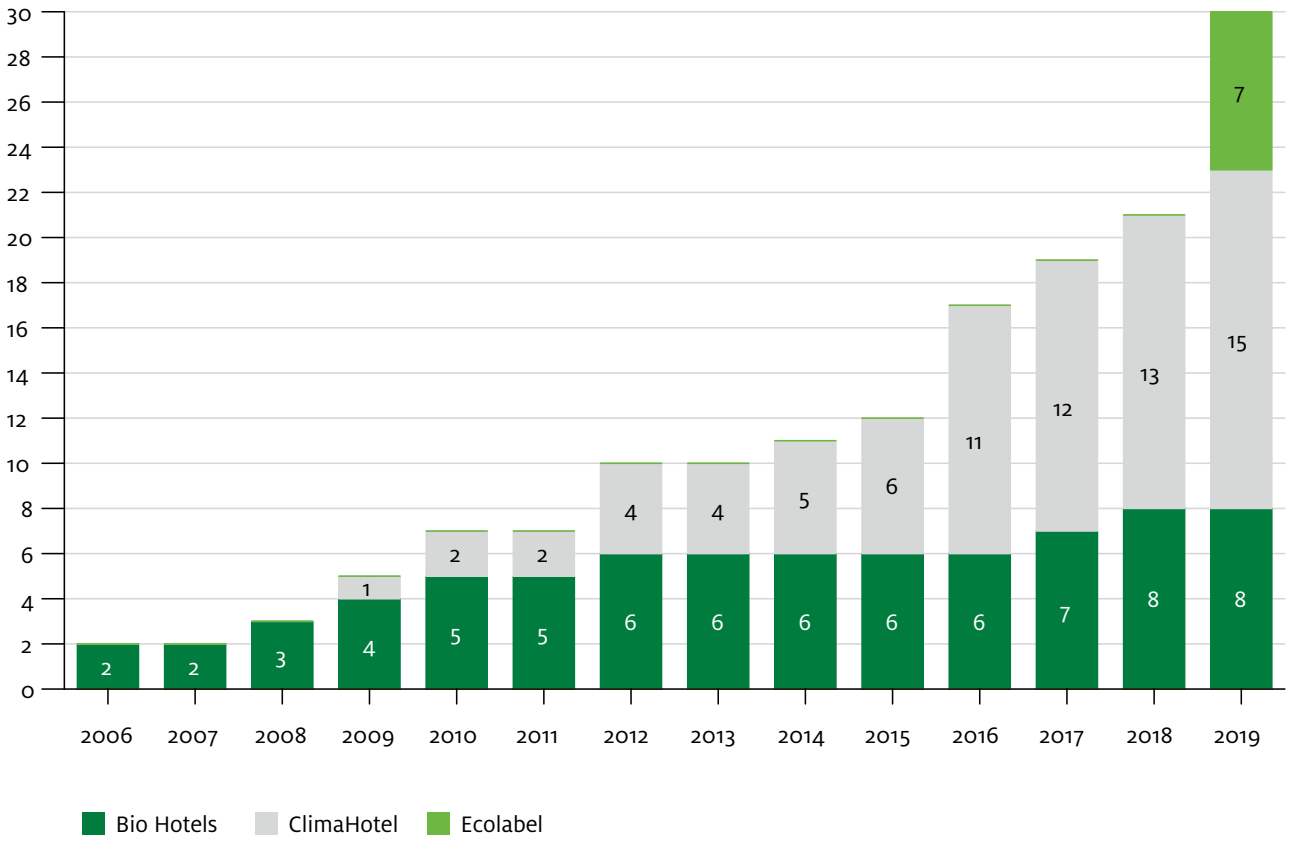

Figure 21: Number of accommodation facilities involved in sustainability schemes by certification categories, South Tyrol 2019. Source: Bio Hotels, Agency for Energy South Tyrol – KlimaHaus, ISPRA, data available on demand, own elaboration.

Figure 21 shows sustainability schemes for accommodation facilities, including hotels, hostels, residences, etc. Overall, 30 facilities are certified with different labels such as Bio Hotel, ClimaHotel and Ecolabel. Although 30 certified facilities out of a total of 4,000 hotels and similar establishments corresponds to quite a low percentage share (0.8%), it is interesting to note that some accommodation facilities seem to work as pioneers in the voluntary certification schemes and have collected more than one certification. This might be because of a decreasing marginal effort to accomplish with an additional sustainability certification when already owning one, but also because of a strong will to position the accommodation facility in the field of sustainability, as is the case of Vitalpina Hotels, a group of hotels coordinated by the South Tyrolean Hotels and Restaurants Association – HGV, that recommends Ecolabel certifications for their members.

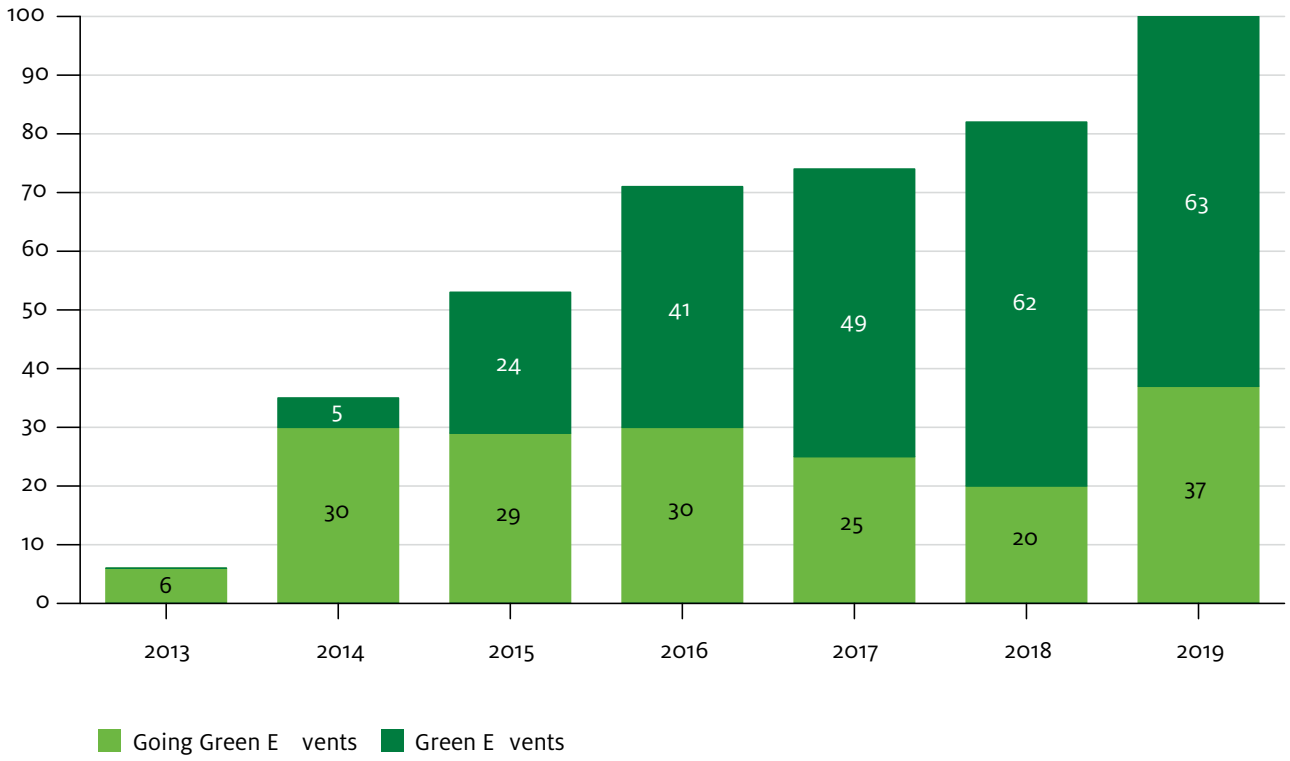

Figure 22: Number of events involved in sustainability schemes by certification categories, South Tyrol 2019. Source: Landesagentur für Umwelt und Klimaschutz, data available on demand, own elaboration.

In the region of South Tyrol, there is a possibility – provided by the Provincial Agency for Environment (Landesagentur für Umwelt und Klimaschutz) – to certify different types of events as "Green Events". Sports events, cultural events, festivals/culinary events, and conferences/congresses can be certified as "Green Events" if they are planned, organized and implemented according to sustainability criteria corresponding to the long-term climate strategy of the South Tyrolean government. In order to receive the certification, organizers must provide evidence that they have managed resources, waste, mobility, catering, energy, communication, noise, and other issues (e.g. alcohol and accessibility) following these sustainability criteria. During the first year, when an event applies for the becoming a "GreenEvent", the event is certified with the "goingGreenevent" award (if more than 50% of the measures are implemented). From the second year onwards the label "GreenEvent" is awarded, if the final assessment has been positively evaluated and more than 75% of the preset measures are implemented. In 2019, 63 events received the "goingGreen" certification, whereas 37 events received the "Green Event" certification (see **Figure 22**).

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

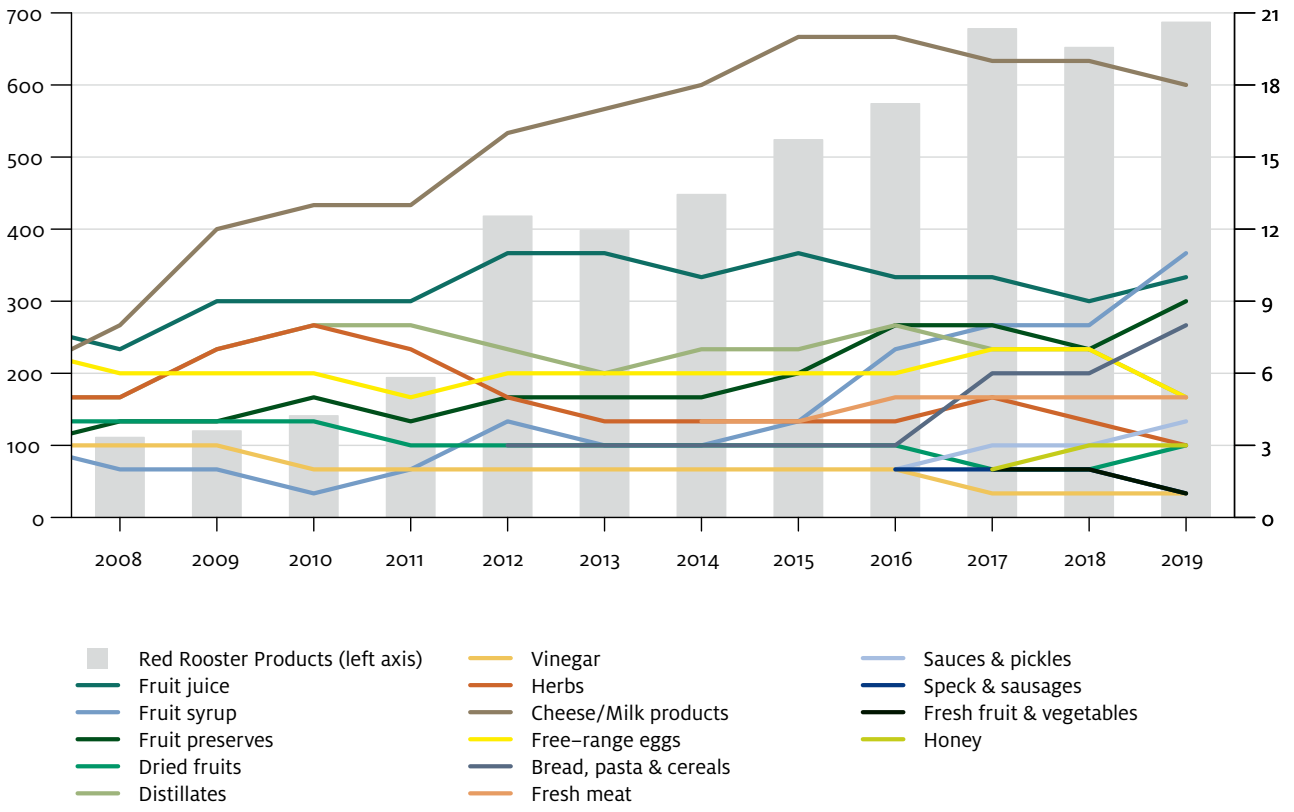

Figure 23: Number of "Red Rooster" branded agritourism ventures producing and selling regional products by type of product and year, South Tyrol 2008-2019. Absolute numbers. Source: Red Rooster, data available on demand, own elaboration.

"Roter Hahn" (German for "Red Rooster") is a South Tyrolean quality label for agritourism. Figure 23 shows the number of "Red Rooster" branded agritourism ventures that offer certified regional products. The label "Red Rooster (Roter Hahn/Gallo Rosso)" includes a wide range of products, such as fresh fruit and vegetables, fruit juices, fruit syrups, jams, dried fruit, sauces and pickles, spirits, vinegar, herbs, dairy products, fresh meat, bacon and sausages, bread, pasta, and cereals as well as free range eggs and honey. Roter-Hahn-products are only produced in farms that fulfill strict quality standards.

For instance, at least 75% of raw ingredients must originate from the family farm. The remaining ingredients can be purchased from other South Tyrolean farms. To date, 66 South Tyrolean farms commit themselves to fulfill the rigorous 'Red Rooster' requirements and they sell a total of 603 Red Rooster products (see Figure 23, left axis) in their agritourism ventures and elsewhere. In addition, constant quality controls such as regular blind tastings by an independent expert commission guarantee consistently high-quality products (Red Rooster, 2019).

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

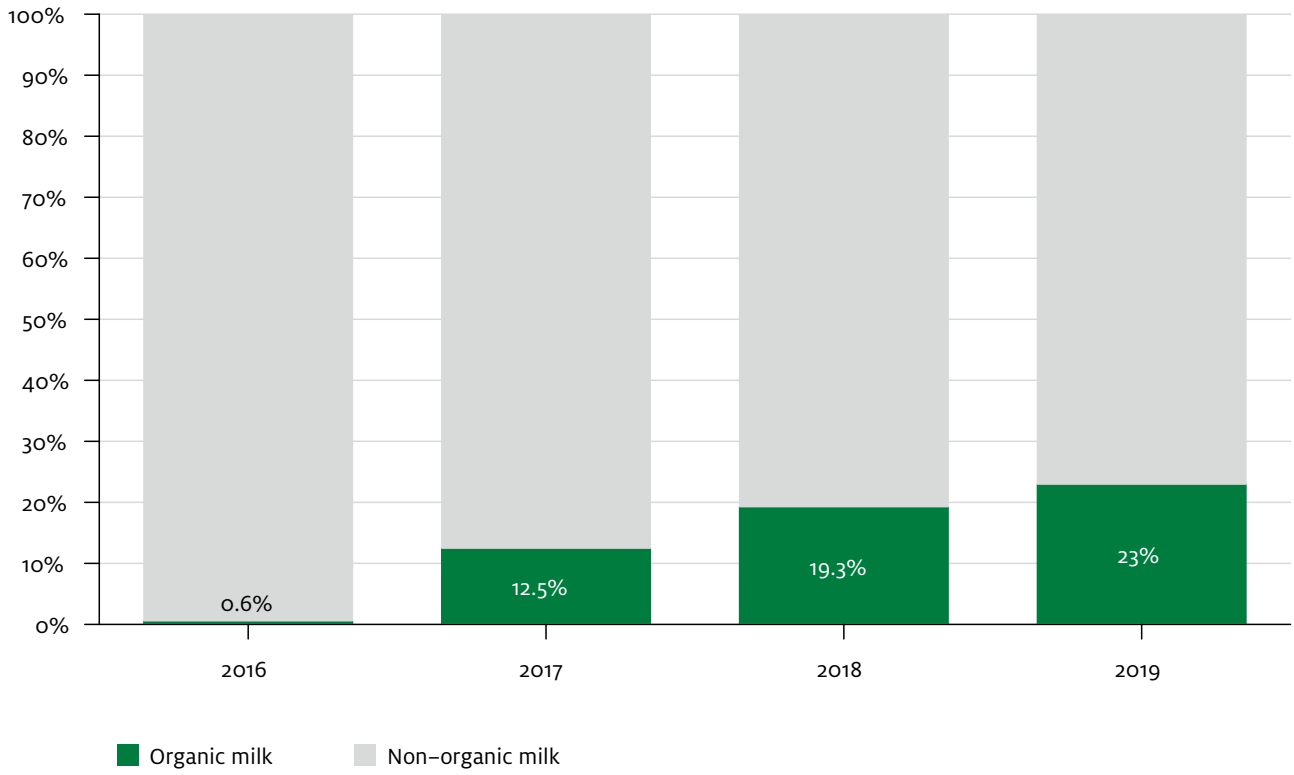

Figure 24: Sales of organic milk to members of the main local buying syndicate by year, South Tyrol 2016-2019. Percentage values over total sold milk.
Source: Hogast, data available on demand.

Figure 24 shows the increasing demand for organic products – and particularly organic milk – in the food and accommodation service sectors. Organic milk is produced according to the rules of organic farming. Independent, state-recognized control bodies inspect organic farms at least once a year and make sure that they comply with various framework conditions with regard to animal-friendly husbandry, healthy and limited feeding, no manure application and limited hectares per livestock unit (LU).
Data on the percentage of organic milk over total milk sold were provided by the main local buying syndicate HOGAST, the major purchasing organization of the accomodation and food service sector in South Tyrol, consisting of 654 members (status quo December 31th, 2019). After its introduction in 2016, the demand for organic milk has increased from 0.6 % (2016) of the total provision of milk to 12.5 % (2017), 19.3 % (2018) and to 23 % (2019). This steady increase shows the interest and awareness of local stakeholders towards products of quality, local production, and certified regional products, which also seems to be appreciated by tourists themselves.


5

5 Local and visitor satisfaction

Satisfaction of both local inhabitants and visitors plays a crucial role in destination development. The local community can be impacted both positively and negatively by tourism. Related positive aspects are the creation of jobs, economic activity, and improved social services. However, tourism can cause stress or damage to local resources and cultural values. According to UNWTO, one needs to properly consider these negative effects in order to get a complete picture of sustainability (UNWTO, 2004).

Continuously measuring the level of satisfaction of locals and tourists can help to detect potential problems, such as stress, noise, and other forms of disutility from tourism, even before these problems unfold a severe negative impact on the host-guest relationship. On the other hand, it is generally believed that visitor satisfaction affects the financial performance of suppliers associated with the tourism industry: high service quality and resulting satisfaction lead to positive word-of-mouth endorsements, referrals, and repeat visits (Žabkar et al., 2010).

For the moment, the available data refer to indirect measures of local and visitor satisfaction, such as tourism intensity and the prices of rents and goods. STOST is planning to investigate other aspects of local and visitor satisfaction within the framework of two surveys, which will be conducted to assess the effects of the COVID-19 pandemic on tourism in South Tyrol. Results will be available in the upcoming STOST report. At the same time, a think tank has been planned to focus on the topic of subjective well-being within the local population, considering also happiness and life satisfaction.

5.1 TOURISM INTENSITY INDEX

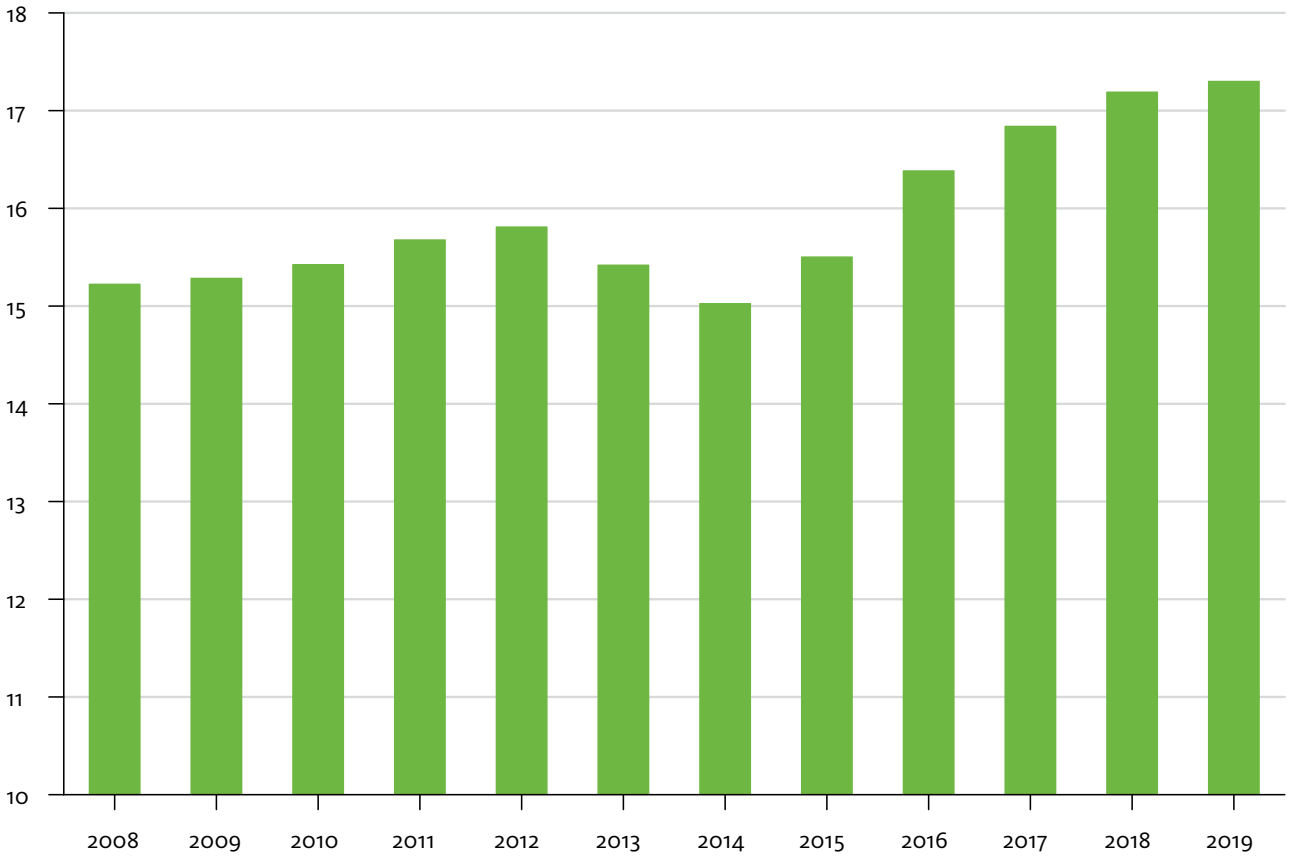

Figure 25: Tourism intensity index by year, South Tyrol 2008-2019. Source: ASTAT, own elaboration.

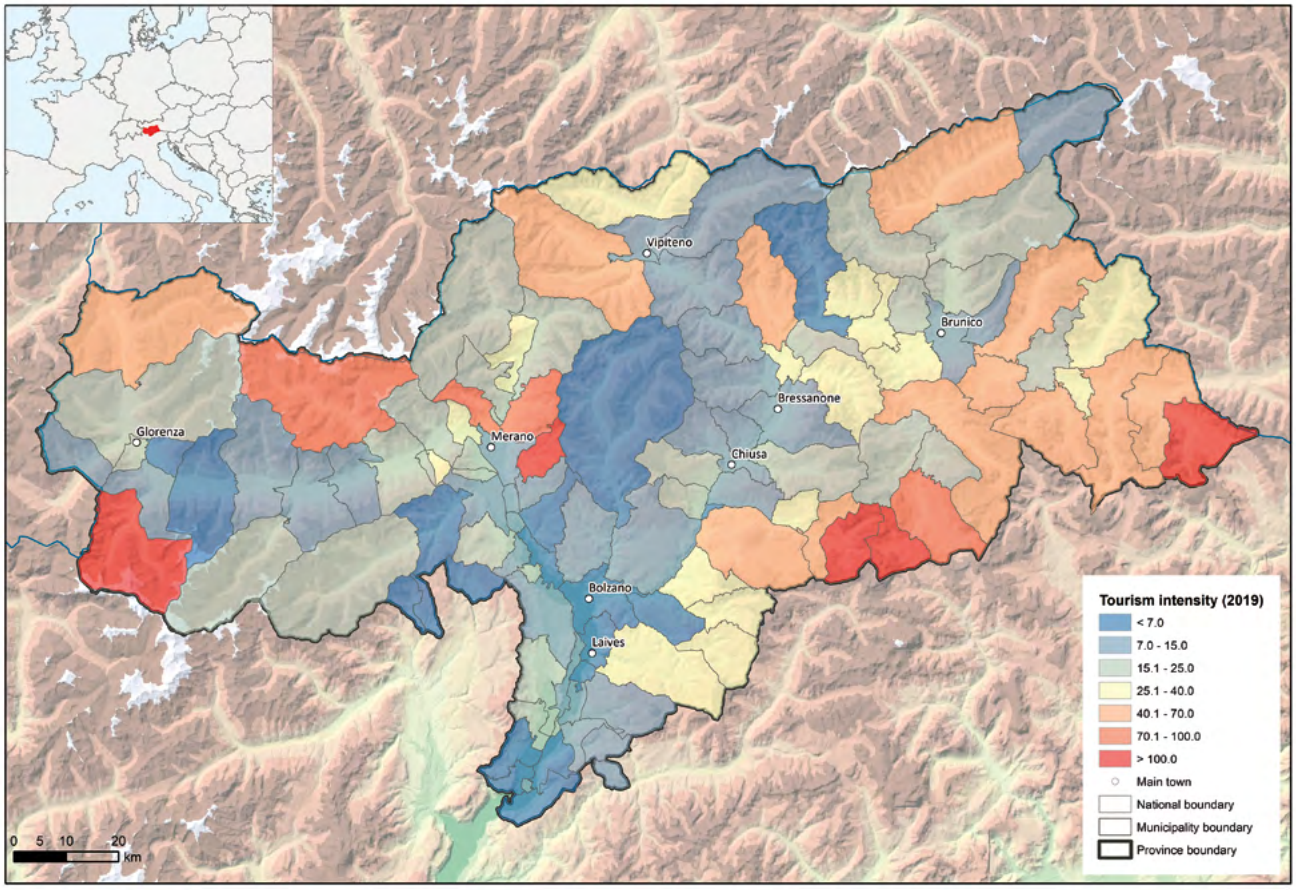

Figure 26: Map of tourism intensity index. South Tyrol, 2019. Source: ASTAT, own elaboration.

Tourism intensity indicates how much an area is exposed to tourism. The tourism intensity index is obtained by dividing the number of overnight stays in all types of accommodation facilities by 365 days and then by the resident population (see Annex 2).
A tourism intensity of 17.2% therefore indicates that for every 100 inhabitants, 17 overnight stays are registered. Starting from 2014, tourism intensity has continually increased in South Tyrol, meaning a greater presence of tourists compared to inhabitants, with tourism intensity exceeding 17% in 2019 (see **Figure 25**).
This trend is driven by the steady increase in overnight stays (**Figure 1**). Although not all municipalities undergo the same pressure and face the same seasonal peaks, this indicator shows the relative proportion of stable and non-stable populations at the provincial scale and gives an idea of the overall tourism intensity. However, it should be noted that the variance of this indicator is high along the provincial territories and the scores of single touristic municipalities might be much higher than average: e.g. the two tourism-intense municipalities of Corvara/Corvara in Badia and Wolkenstein/ Selva di Val Gardena show tourism intensities of respectively 199.9% and 137.0% in 2019 (see **Figure 26**).

5.2 PRICES OF RENTS IN THE DESTINATION

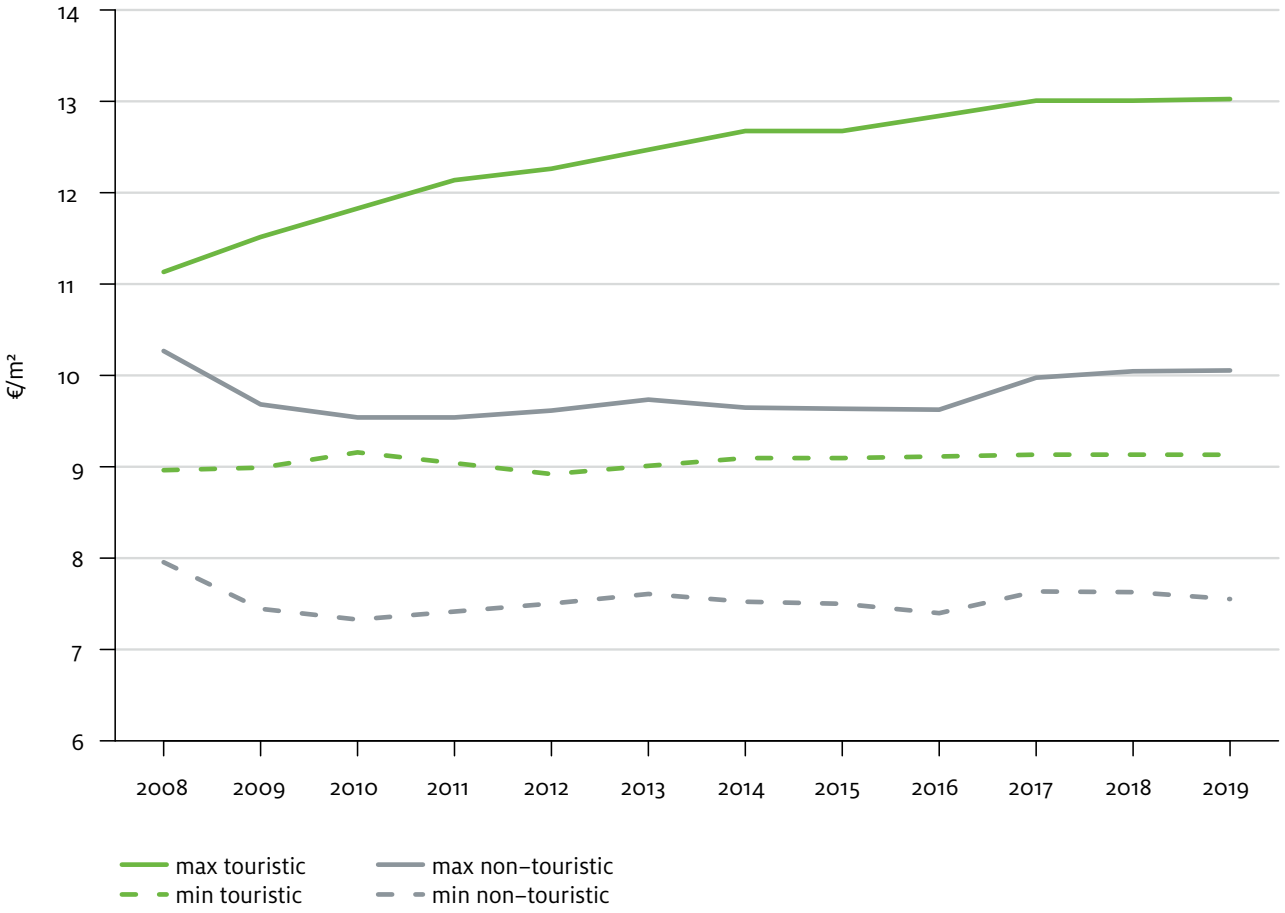

Figure 27: Prices of rents in the central area of touristic and non-touristic municipalities by year, selected South Tyrolean municipalities*, 2008-2019. Average values in Euros/square meter. Source: Agenzia del Territorio, elaboration by ASTAT and Eurac Research.
**Touristic and non-touristic municipalities were defined based on ASTAT (2019)*

High touristic intensity is likely to pressure upwards inflation on goods, prices and accommodation. **Figure 27** shows the price trend of accommodation rents expressed in euros per square meter. According to the data, there is evidence of inflationary pressure on rent prices in touristic locations compared to non-touristic areas, both in the maximum and minimum price. In 2019 the difference between the maximum price in touristic locations and the maximum price in non-touristic areas was almost 4€/m²; moreover, the maximum price in non-touristic locations is comparable to the lowest rent price in more touristic municipalities (less than 1€/m² difference). As a result, people living permanently in touristic locations are also touched by the inflated prices. Residents of touristic municipalities need to pay much more for renting a flat than residents of less touristic places, while owners of houses in these municipalities benefit from higher rents. In the long run, such a phenomenon might cause an erosion of the number of houses rented to the stable population and an increase in temporary rental services, such as, e.g. Airbnb. This phenomenon is not desirable, especially in Alpine or other rural areas, because the geographical segregation of local inhabitants might cause disfunction in the maintenance of building standards (e.g. local architecture) and the provision of primary services (e.g. commercial activities out of season).

5.3 TOURIST SATISFACTION WITH PRICES

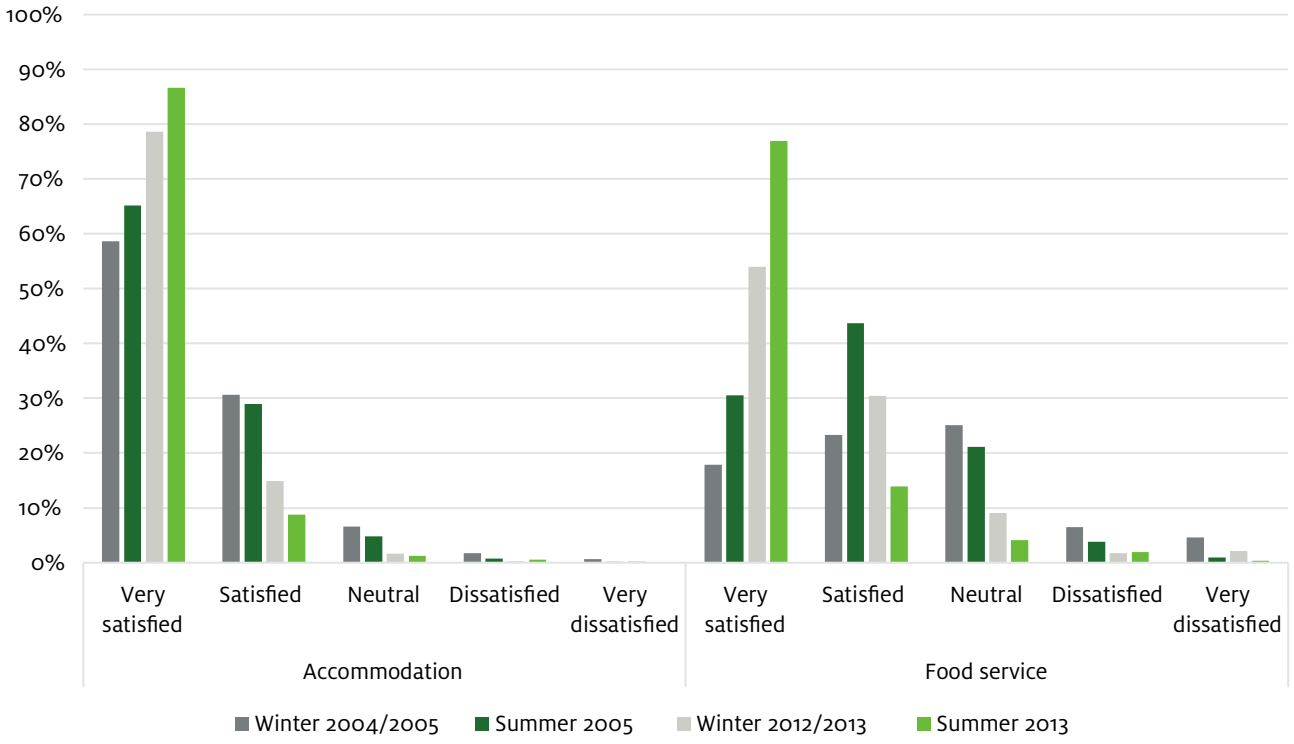

Figure 28: Tourist satisfaction with prices by season, South Tyrol 2004/05 and 2012/13.
Average values. Source: ASTAT and Eurac Research, own elaboration.

Notwithstanding the higher level of prices in touristic municipalities, a sample survey conducted by ASTAT and Eurac Research in 2004/2005 and 2012/2013, representative of South Tyrol (ASTAT, 2015), shows a high satisfaction level of tourists with local prices. 78.6% of winter tourists and 86.6% of summer tourists in 2012/2013 were very satisfied with the prices of the accommodation facilities, whereas 54.0% (in winter) and 76.9% (in summer) reported very high satisfaction levels with the food service. These figures in turn seem to support the hypothesis of the higher spending power of some tourists and/or the high value for money perceived while buying goods and services on site. Guests show higher degrees of satisfaction in the summer season than in the winter season and in 2012/13 than in 2004/2005. This might be related to the high price of the skipass in winter (around 40-50 € per person per day). Finally, the accommodation sector registers higher scores than the food service sector in both years. This difference might be explained both by the high-quality accommodation standards on site, and their increase over time, as shown in **Figure 2** above. In the upcoming report, this indicator is going to be updated based on a sample survey to guests that is ongoing at the time of writing.

6

6 Energy management

The tourism industry requires vast amounts of energy for the creation of products, services, and visitor experiences. One can allocate the sector's energy consumption to either mobile assets (mostly vehicles, but also, especially in alpine regions, cable cars, ski-lifts, and snow cannons) or fixed assets (such as accommodation facilities, restaurants, and other buildings).
Measuring the energy consumption in the tourism sector is a tedious task, as, beyond the energy directly attributable to tourism consumption, it is difficult to capture the indirect energy consumption, used in the production of goods and provision of services. For this reason, we decided to focus on accommodation facilities, ski lifts, and snow cannons, areas in which the consumption of electricity is (relatively) easy to attribute to tourists. In addition, we estimate the overall electricity consumption using literature-based coefficients.
Moreover, we monitor the number and geographical location of charging stations for e-mobility in order to provide an overview on how capillary energy is provided to encourage alternative forms of mobility.

6.1 ESTIMATED MINIMUM ELECTRICITY CONSUMPTION IN ACCOMMODATION FACILITIES

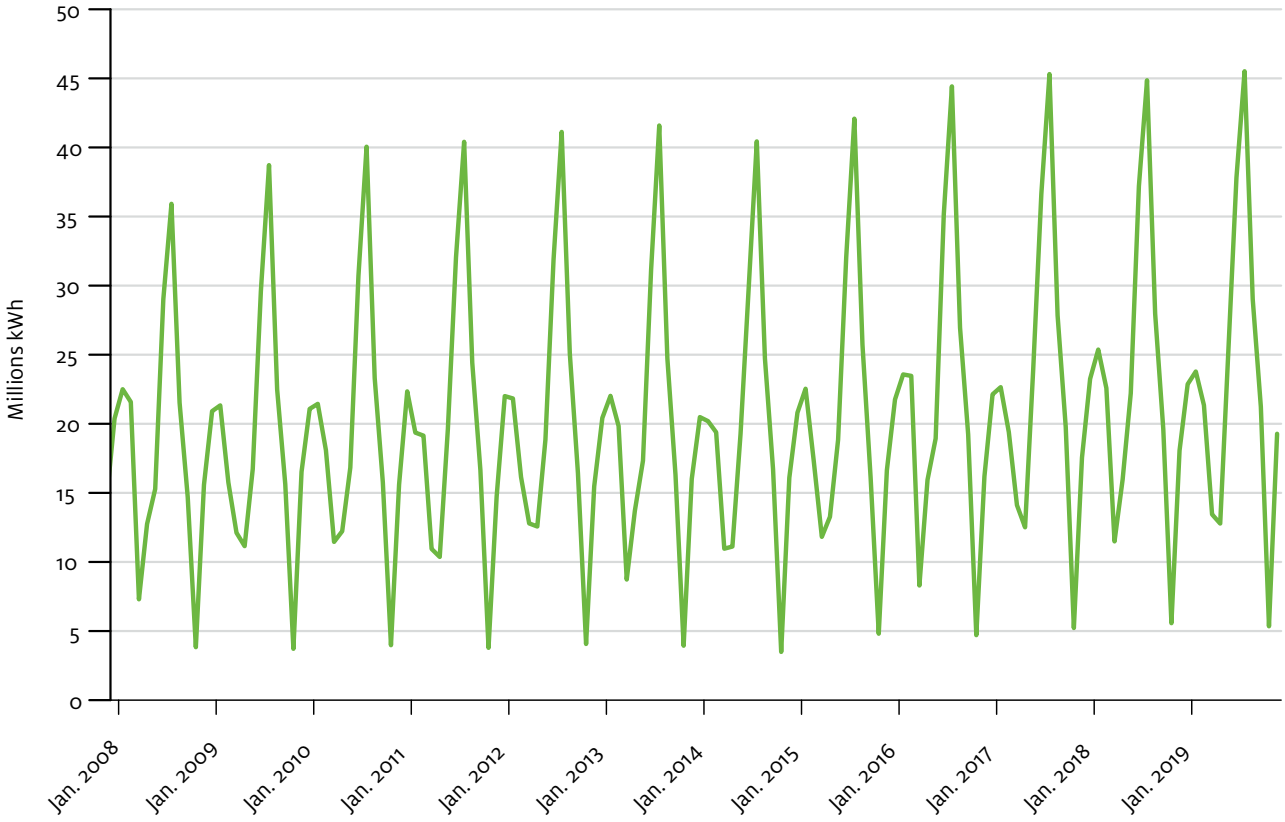

Figure 29: Estimated minimum electricity consumption* for accommodation facilities by month, South Tyrol 2008-2019. Millions of kWh. Source: own elaboration.
**The estimation procedure is based on energy consumption coefficients estimated per night and accommodation category according to the Bundesministerium für Wirtschaft, Familie und Jugend Wirtschaftskammer Österreich, Fachverband Hotellerie, Fachverband Gastronomie, Österreichische Hoteliervereinigung (2011). For a detailed description of the estimation procedure refer to Annex 2.*

We estimate the amount of electricity consumed by tourists based on overnight stays and a coefficient for electricity consumption (Bundesministerium fur Wirtschaft, Familie und Jugend Wirtschaftskammer Osterreich, Fachverband Hotellerie, Fachverband Gastronomie, Osterreichische Hoteliervereinigung, 2011) These coefficients represent the energy consumption of an energy-efficient accommodation facilities in South Tyrol. Hence, one can interpret the estimate as a lower bound. Figure 29 shows the estimated electricity consumption in accommodation facilities (hotels and similar establishments and other accommodation services) from 2008 to 2019. The figure shows a clear seasonal pattern that reflects the seasonal pattern of arrivals (see Figure 10): consumption increases in peak seasons (especially in August) and declines in low seasons (April and November). Further, the electricity consumption has been steadily rising throughout the last decade. In 2017, the estimated monthly average electricity consumption amounted to 22 million kWh. Thus, the electricity consumption of the accommodation facilities account for approximately 9% of the Province's total electricity consumption (equal to 3,027 million kWh in 2017, ASTAT[3]).

3 https://astat.provincia.bz.it/it/territorio-ambiente-energia.asp

6.2 ELECTRICITY CONSUMPTION BY SKI-LIFTS AND SNOW CANNONS

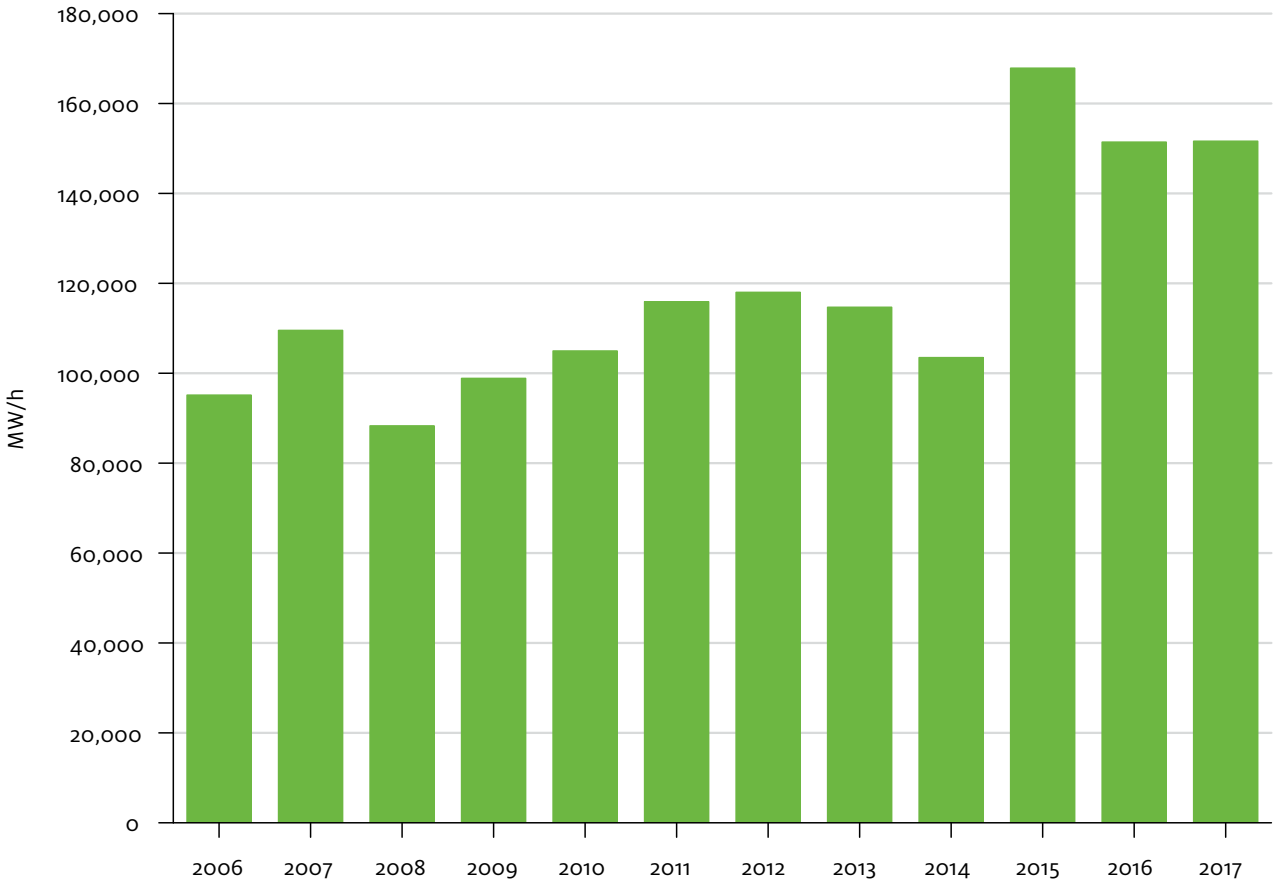

Figure 30: Electricity consumption by ski lifts and snow cannons, South Tyrol 2006-2016. Megawatts per hour. Source: Agenzia del Territorio, elaboration by ASTAT.

Being surrounded by mountains, skiing represents an important activity for tourists. However, this activity is suffering from the increased temperatures (+0.8°C in winter since the 1960s in South Tyrol, source: Zebisch et al., 2018) and the trend towards less snowfall, two phenomena that are related to global warming. In order to ensure a high-quality and less weather-sensitive skiing experience, 3,765 snow cannons operate on the 3,847 ha of ski slopes in South Tyrol. They ensure snow quality standards, extend the ski seasons and counterbalance moments of scarcity of natural snowfall. Figure 30 plots the energy consumed by the artificial snowmaking system between 2006 and 2017. The energy consumption by ski lifts saw a great increase in 2015 and 2016 compared to previous years; in 2014 the energy consumed by ski lifts reached 103,473 thousand MW/h, while in 2015 it skyrocketed to 167,857 MW/h, an increase by 66.6% in just one year. 2015 was in fact an exceptional year with scarce natural snowfall by the beginning of the winter season, and it was one of the warmest years of the last three decades (Zebisch et al., 2018). In 2016 and 2017, the electricity consumption decreased slightly to 151,411 MWh and 151,611 MWh.

6.3 CHARGING STATIONS OFFERED FOR E-MOBILITY IN ACCOMMODATION FACILITES AND PUBLIC SPACES

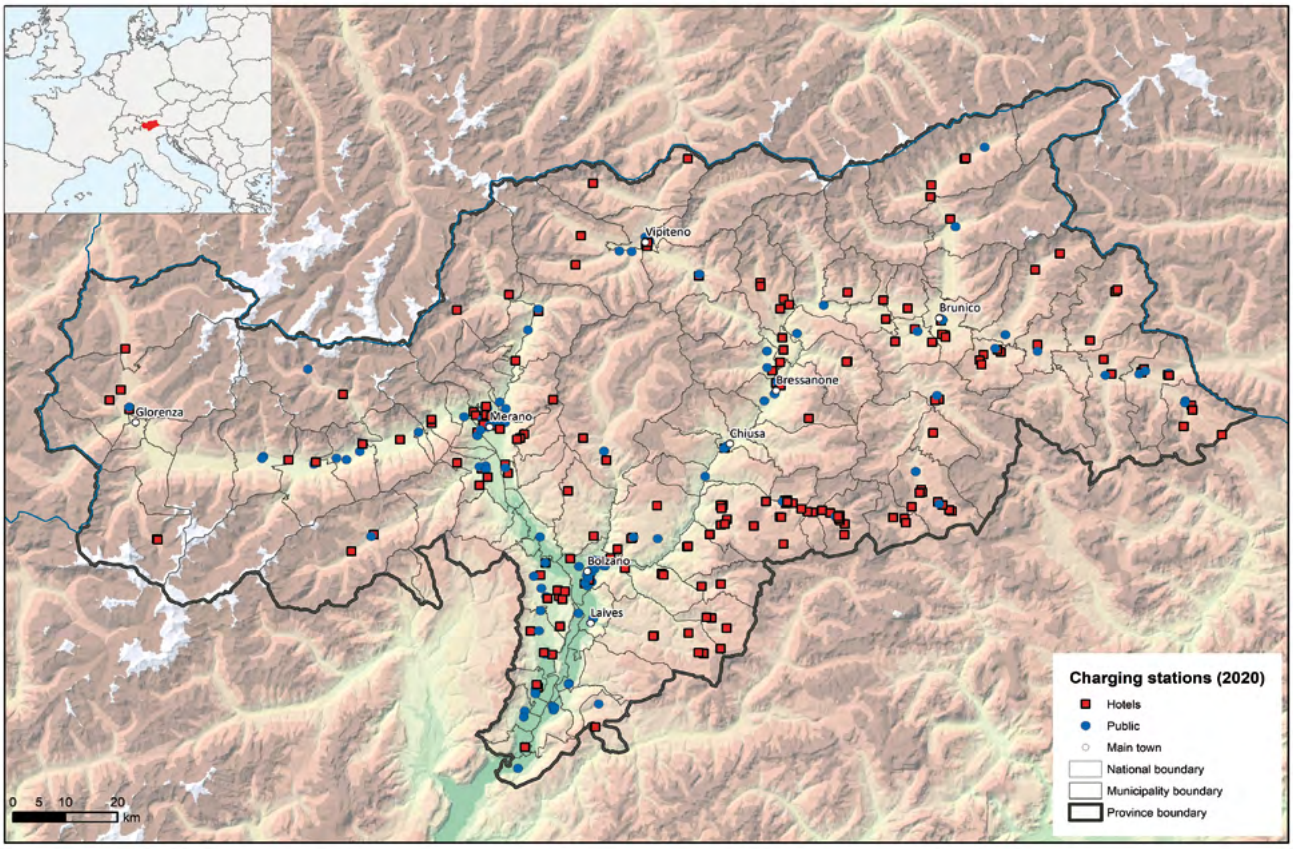

Figure 31: Map of hotel-based and other charging stations for e-mobility, South Tyrol 2020.
Source: Neogy[4] and Tesla, elaboration by Eurac Research.

Among the climate change mitigation strategies implemented in South Tyrol, the support for e-mobility is Among the most prominent ones. In fact, a strategy for sustainable mobility (www.greenmobility.bz.it/en/) was developed in the destination that encourages a modal shift towards public transport and subsidizes the purchasing of e-vehicles. The development of e-mobility, however, is strictly related to the availability of charging infrastructure. The presence of such an infrastructure might encourage tourists driving e-vehicles to visit the region (Scuttari, Isetti, 2019). To monitor the development of charging infrastructure on site, and to evaluate the importance of the tourism sector in providing alternative forms of mobility, Figure 31 represents the number of charging stations in accommodation facilities (in red) compared to those in other public spaces (in blue). Out of the 319 charging stations available in 2020, 209 are in accommodation facilities, underlining the role of the accommodation sector in promoting e-mobility. Compared to the previous year, there are now 35 new charging points (9 of which in accommodation facilities), compensating for the dismissal of 16 charging points (2 of which in accommodation facilities) since 2019. These charging stations are not only available to guests, but also to the local community, creating thereby indirectly positive social effects on the local population. Moreover, the South-Eastern part of the province, which has the highest tourism intensity and accommodation density and hosts the Dolomites WHS, shows a higher concentration of charging stations in the map. This might suggest that those areas with higher tourist inclination are also more reactive to sustainability challenges, with local businesses also trying to leverage on e-mobility to sharpen their strategic positioning.

4 New denomination for the company managing charging stations since 01/07/2019 (previously Alperia).


7-8

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

Fresh water is an essential resource for tourism, as it is consumed directly by tourists, e.g. for hygienic purposes, but also by the hospitality industry, e.g. for the irrigation of gardens, to fill up swimming pools and supply wellness and spa facilities, and for cleaning rooms and washing bed and table linen. Moreover, it is linked to many leisure activities, such as golf and skiing (Gössling, 2015). Tourism impacts not only on the direct water use, but also on waste water treatment: for this reason, the waste water aspect is analyzed separately in this report.
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 might 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. However, like energy consumption, secondary data on tourism-related water use are only partly available, and not for the hospitality sector. Therefore, we estimated water use in accommodation facilities using literature-driven coefficients specific for each hotel category. We also included available data for water consumption by snow guns, as water cycle for snow making and technological advancement to make it more efficient could be an interesting topic for a dedicated think tank.
Waste water management is an issue area in which significant activities must be planned for future monitoring, since there is little data available. While it is known that all the water in hotels and similar establishments is treated in South Tyrol, there is a lack of knowledge about the amount of mountain huts with waste water treatment. This issue should be tackled in future monitoring actions. For the moment, the only available data relates to the amount of waste water attributable to tourism according to the calculations of the Provincial Agency for Environment, as explained below.

7.1 ESTIMATED MINIMUM WATER CONSUMPTION IN ACCOMMODATION FACILITIES

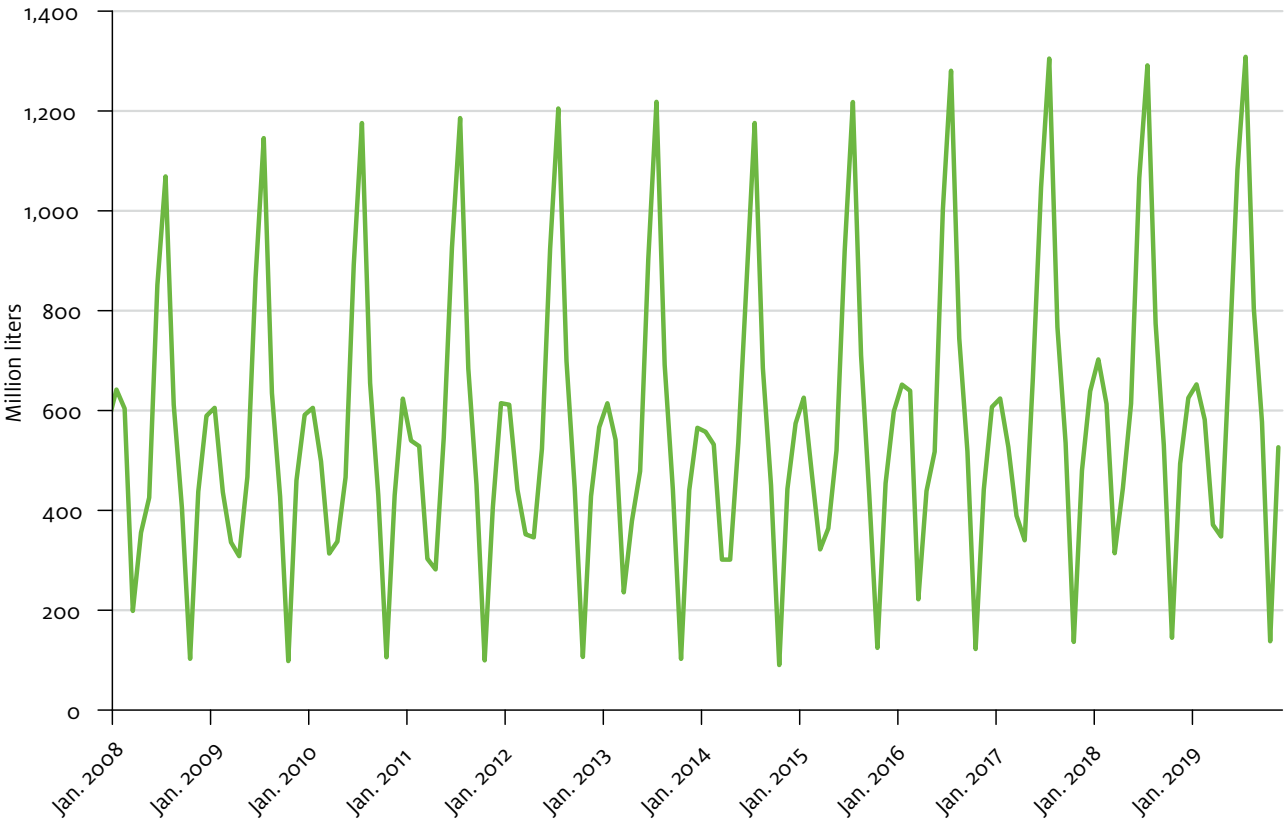

Figure 32: Minimum water consumption estimated* for accommodation facilities by month, South Tyrol 2008-2018. Millions of liters. Source: own elaboration.
**estimation procedure based on water consumption coefficients estimated per night and accommodation category in Bundesministerium für Wirtschaft, Familie und Jugend Wirtschaftskammer Österreich, Fachverband Hotellerie, Fachverband Gastronomie, Österreichische Hoteliervereinigung (2011).*
For further details refer to Annex 2.

Similar to energy consumption, the minimum water consumption in accommodation facilities (estimated using water consumption coefficients per night and accommodation category provided by Bundesministerium für Wirtschaft, Familie und Jugend Wirtschaftskammer Osterreich, Fachverband Hotellerie, Fachverband Gastronomie, Osterreichische Hoteliervereinigung, 2011) reflects the seasonal trend of overnight stays: consumption rises in peak seasons (especially in August) and declines in low seasons (April and November). Notwithstanding seasonality, water consumption has been steadily rising throughout the last decade. Given that the 2015 estimated monthly average water consumption amounted to 561 million liters, it could be stated that accommodation facilities are estimated to account for 8% of the Province's total potable water consumption (equal to 83.4 million cubic meters in 2015, ASTAT 2018a).

7.2 WATER USE BY SNOW GUNS

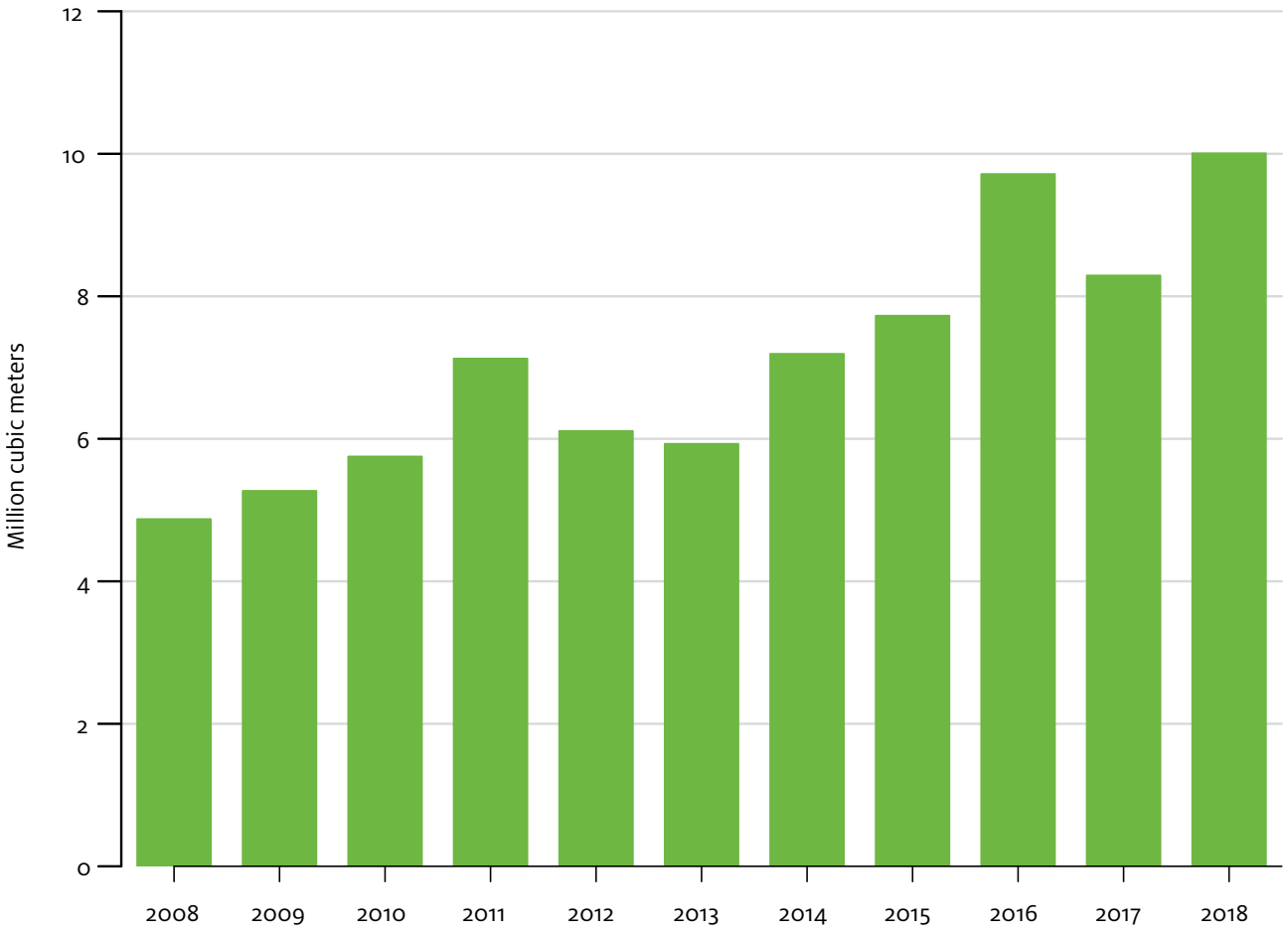

Figure 33: Water use by snow guns, South Tyrol 2008-2018. Million cubic meters. Source: APAC, data available on demand.

Figure 33 displays the water use by snow guns in South Tyrol to produce artificial snow. According to Zebisch et al. (2018), the surface with natural snow cover in South Tyrol has been decreasing since 2014. Especially in the winters from 2014 to 2017, the snowfall in December and January was far below the average of the last 15 years (Zebisch et al., 2018, 39-41), which explains the corresponding increase in water consumption by snow production. It is also worth mentioning that in late fall and early winter, with the weather of the upcoming winter still unpredictable, snow production is used to ensure high-quality snow by the opening of the slopes, even in years with high natural snowfall and cold temperatures. This is the reason why, even in years with abundant natural snow cover, the snow production does not substantially decrease (Rixen et al., 2011). It should be noted that the impact of snowmaking on alpine water resources management is still an underexplored research field (de Jong, 2015); however, some studies assert that the increasing water demand for snowmaking and the diversion of water from its water cycle might cause hydrological impacts and water conflicts (see, e.g. de Jong, Barth, 2007).

8.1 DISCHARGE OF SEWAGE WATER ATTRIBUTABLE TO TOURISM

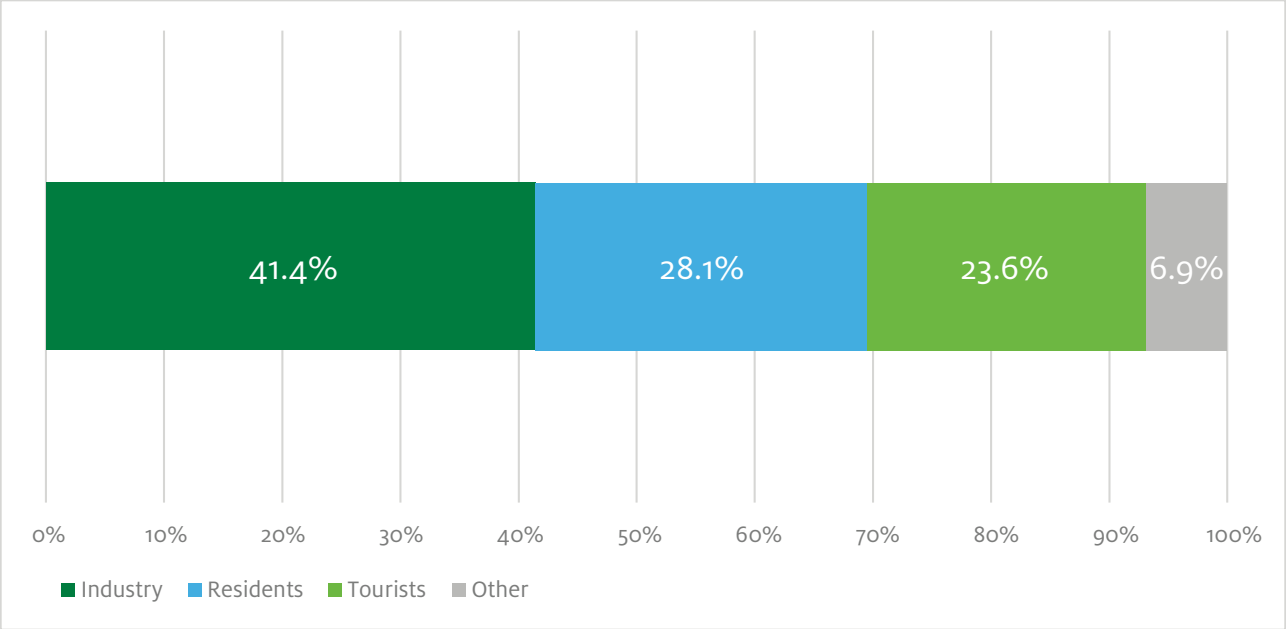

Figure 34: Users connected to sewerage and sewage treatment plants, South Tyrol 2014. Percentage values, population equivalent. Source: APAC (2015).

According to the data provided by APAC (2015), it is possible to classify users connected to sewerage and sewage treatment plants in four main categories: industry, residents, tourists, and others. To estimate the capacity of these plants, APAC calculates the number of estimated users per category. While resident users are estimated based on population data, tourists are assessed by calculating a population equivalent according to hydraulic engineering standards that link back to available beds in accommodation facilities. Therefore, total users connected to sewerage and sewage treatment plants in South Tyrol were estimated at around 1,684,160 in 2014. Among them, tourists amount to 397,327, making up 23.6%. It should be noted here that this is an upper-bound assessment of the impact of tourism on waste water, and that more specific and more recent data should be generated in this field, as outlined above.


9

9 Solid waste management

Solid waste is generated in nearly all activities that humans undertake. However, it is acknowledged that tourism-related activities produce amounts of waste well above those encountered in normal domestic usage (Hamele & Eckardt, 2006). In fact, they often expect higher standards of hygiene and a wider range of choices in food and other services, which translate into more waste. Moreover, while on vacation, people tend to use more disposable products than at home, a habit that also increases waste volumes. To mitigate the impacts of these phenomena, a good waste management system and well-made information policies for guests and staff members can help. In turn, 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 generally include reduction, reuse, recycling, residual treatment, and residual disposal of waste: their adoption should be considered at destination level and particularly within accommodation facilities. An efficient waste management might also represent a source of cost savings for a tourism business, whose entity depends also on the business location and the local waste management regulations (Pirani & Arafat, 2014). Notwithstanding the relevance of waste management for the tourism sector, the literature on the topic is very limited, making it difficult to pin down the impact of tourism on waste production.

In order to circumvent this problem, similar to energy and water management, the decision was taken 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 resulting graph shows the output of this estimation. 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.

9.1 ESTIMATED WASTE PRODUCTION IN ACCOMMODATION FACILITIES

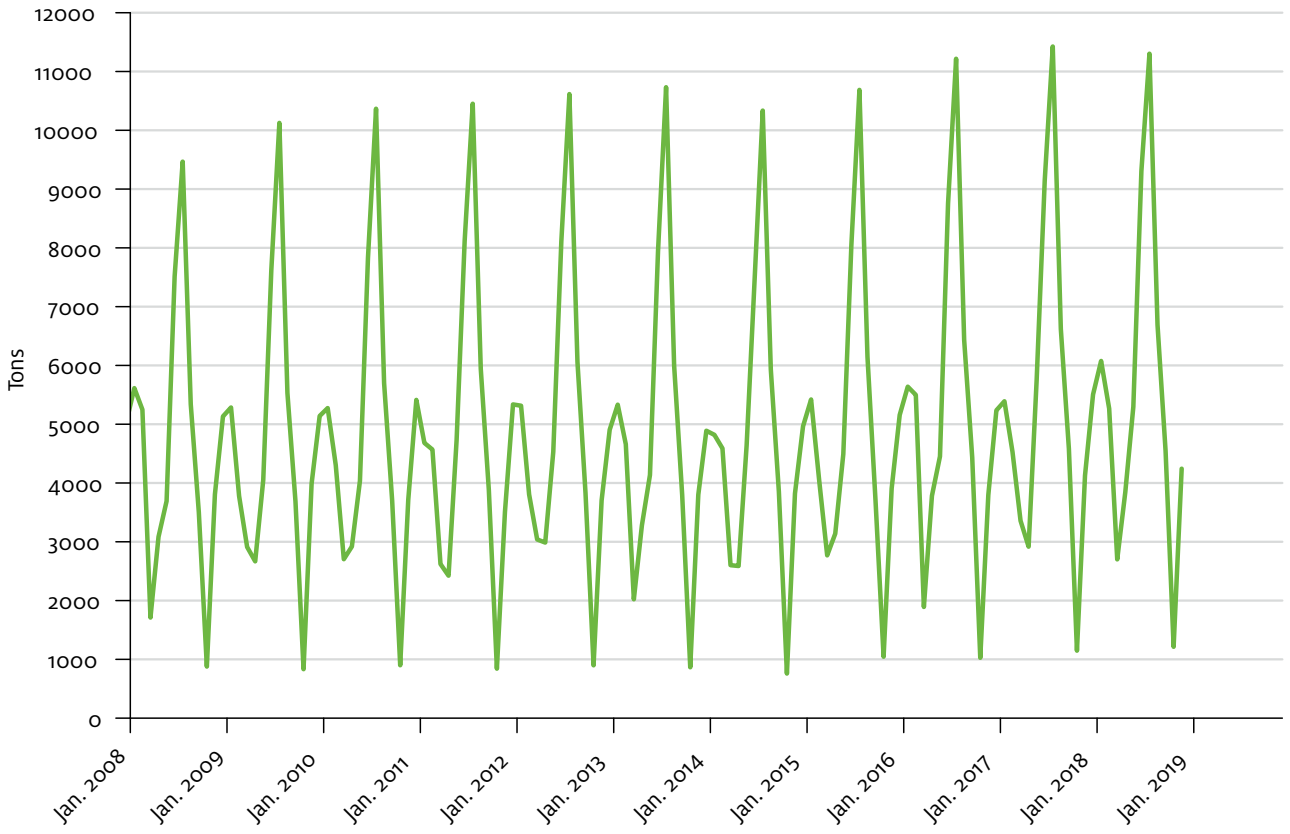

Figure 35: Waste production estimated* for accommodation facilities by month, South Tyrol 2008-2019. Tons. Source: own elaboration.
**estimation procedure based on waste production coefficients estimated per night in Hamele & Eckardt (2006). For further details refer to Annex 2.*

The production of waste in accommodation facilities shows a clear seasonal trend, reproducing that of overnight stays: production rises in peak seasons (especially in August) and sharply declines in low seasons (April and November). Notwithstanding seasonality, waste production – like energy and water consumption – has been increasing throughout the last decade. Given that the estimated waste production in accommodation facilities in 2017 amounted to 32,436 tons, accommodation facilities are estimated to account for 9% of the total waste production (the total production of waste in South Tyrol in 2017 amounted to 347,900 tons, see APAC 2018).


10

10 Mobility

Tourism without transportation is unconceivable, as the tourist system is intertwined with transportation systems (Pearce, 2005). The process of accessing and returning from tourist sites alone, i.e. travel to the tourist location, requires approximately 90% of the energy used globally in tourism (UNWTO, 2014). The growing trend in international mobility pressures the environment, from land and spatial use, energy consumption, air and noise pollution, and greenhouse emissions. Monitoring transportation-related data provides an early warning of possible infrastructure pressures, and it might help forecast and therefore prevent congestions on peak days. Secondly, collecting knowledge on the modal split (i.e. the different modes used by visitors to reach the destination) creates a crucial knowledge milestone to design a more fitting mobility offer and incentivize more sustainable means of transport. Those in turn can be monitored once visitors have reached the destination by collecting data on their use of car sharing solutions and cable cars. Notwithstanding the energy use (see indicator 6.2) and the possible negative impact on the landscape, the use of cable cars in Alpine contexts can be generally read as an encouraging signal, as they can substitute less sustainable means of transport, such as private cars or motorcycles, especially in summer and in combination with traffic regulations and road closures (see, e.g., Scuttari et al., 2016).

In South Tyrol, 85.5% of incoming tourists enter the region by means of private transport and 55.7% use this means to travel around during their holiday (ASTAT, 2009; ASTAT, data available on demand). The fact that South Tyrolean tourism markets are not relying on the use of air connections is definitely positive in terms of greenhouse gas (GHG) emissions, however it translates into a high pressure on the local road infrastructure capacities, which are often overstretched during peak summer days and weeks. The distribution of tourism-related traffic flows in South Tyrol was estimated in previous analyses, showing that over half (51.2%) of the almost 14 million light vehicles entering South Tyrol in the tourism year 2007/2008 (November 2007 to October 2008) were tourism-related (Scuttari et al., 2013). 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.

10.1 MOBILCARDS, BIKEMOBILCARDS, MUSEUMOBIL CARDS AND GUEST TICKETS

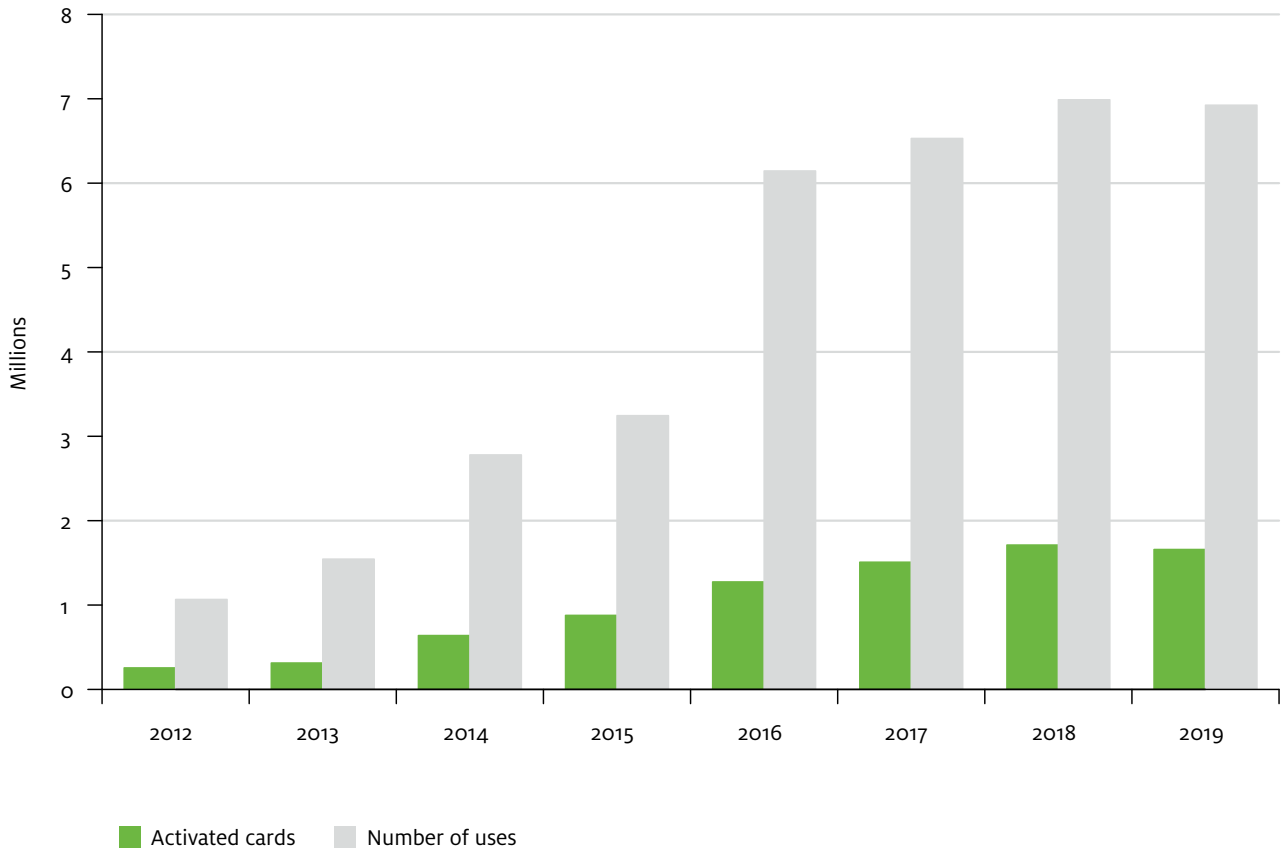

Figure 36: Mobilcard tickets in South Tyrol, 2012-2019. Millions.
Source: Sistema di trasporto integrato.

Tourists have different possibilities to move around South Tyrol with public transport: a large share of tourists receives a guest card at the hotel or buys a special ticket. Special tickets include Mobilcards, bikemobil cards or museumobil cards and they can be used without limits during the validity period (1, 3 or 7 days) on all trains, buses, and some cable cars in South Tyrol and can include also access to bike rental (bikemobil cards), museums, and exhibitions (museumobil cards). Similarly to special tickets, guest tickets include several services (e.g. entry tickets to museums or exhibitions, cable car tickets, etc.) in addition to public transport. The composition of the included services varies from sub-region to sub-region. The difference between the two is that the former is a standard format for the whole province and can be bought also by residents and workers for a use in their free time, while the latter is place-specific and is mostly distributed (and not directly paid) in accommodation facilities. Guest tickets are indirectly financed through overnight taxes. As of September 2019, 5,570 accommodation facilities (representing 55.0 % of total accommodation facilities in South Tyrol) were adhering to the initiative and were distributing guest tickets to their guests (Strutture Trasporto Alto Adige, data available on demand). The number of activated cards increase greatly over the last years. The increase is mostly due to the increase in use of guest tickets. On the other hand, the number of uses is much higher than the number of activated cards, because tickets need to be validated before each trip and are used multiple times during vacation. In fact, the average number of uses per card amounts to approximately 4 in 2019 and is relatively stable over time.

10.2 NUMBER OF SKI-LIFT AND CABLE CAR USERS BY SEASON

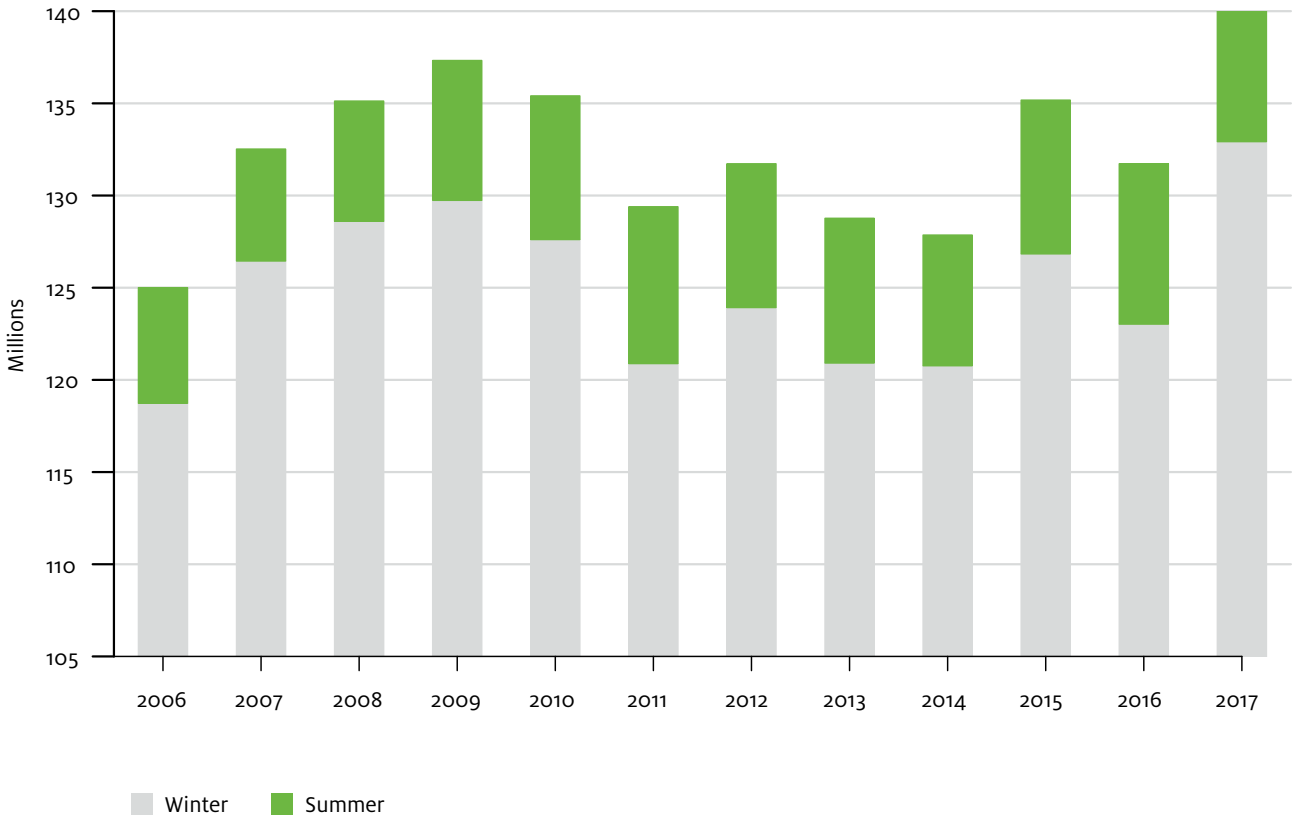

Figure 37: Number of ski-lift and cable car users by tourist season, South Tyrol 2006-2016. Millions.
Source: ASTAT (2018b).

Figure 37 shows the number of ski-lift and cable car users over time. The use of cable cars and ski-lifts is higher during the winter season, due to the importance of ski tourism. In summer, the use of ski-lifts and cable cars is much lower also because the trend to use ski lifts in summer is relatively recent. It should be noted here that users refer to both inhabitants and tourists. During the last ten years, the total number of people transported has changed only slightly, but the decreasing numbers in 2014 recall the trend of arrivals and overnight stays presented above (Figure 1). Note also that during the same period, passengers that used the ski-lift and cable car in winter grew by 3.6%, whereas the number of rides during summer increased by 38.7%. Given the decreasing trends in natural snow cover and the increasing consumption of water and energy for artificial snowmaking, the summer use of ski lifts might be an early sign of an adaptation strategy to climate change, according to which the same type of infrastructure (a ski lift) is used for a different and initially unplanned function (the transport of hikers, and increasingly, mountain bikers with their bikes).

10.3 KILOMETERS TRAVELLED USING CAR SHARING SERVICES BY NON-LOCAL USERS

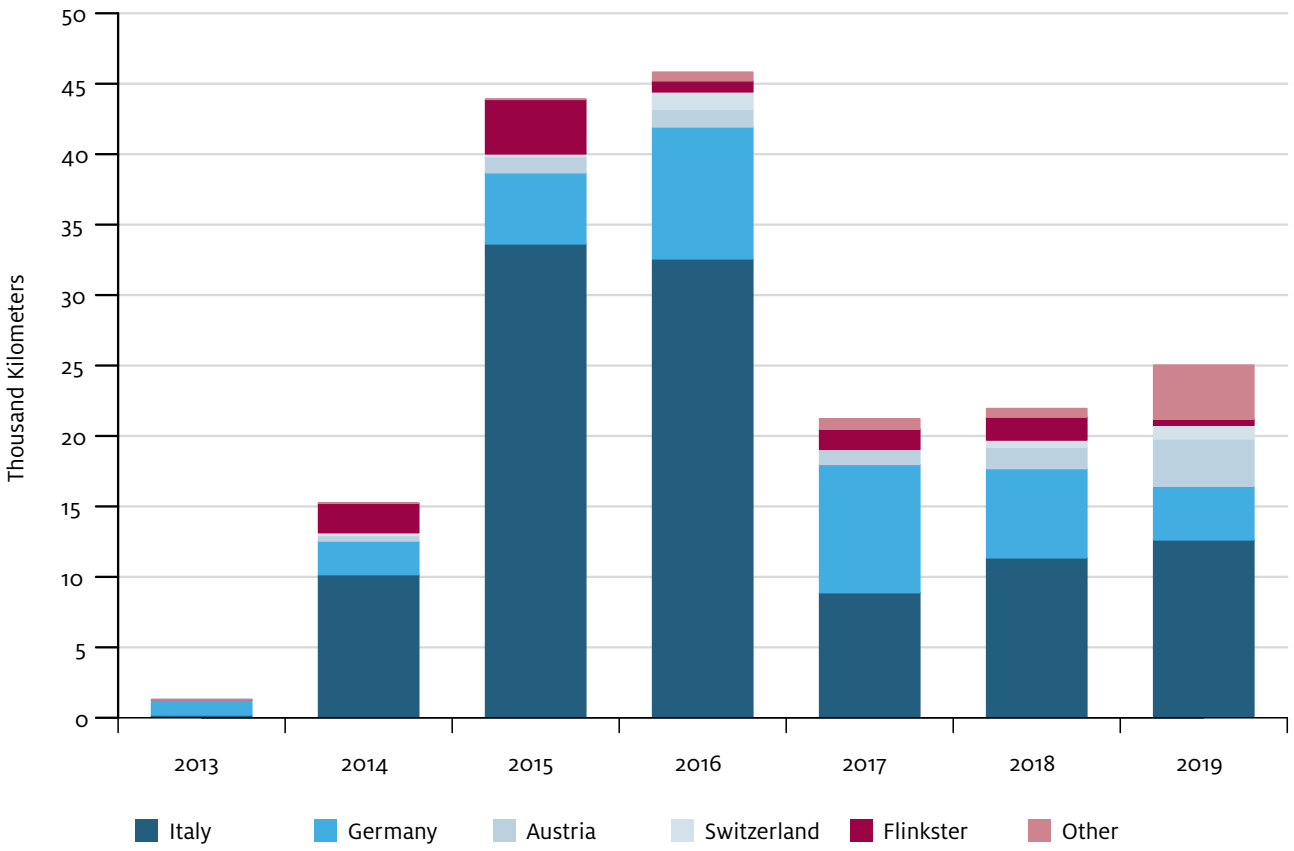

Figure 38: Kilometers travelled using car sharing services by non-local users, South Tyrol 2014-2018.
Source: Car Sharing South Tyrol, data available on demand, own elaboration.

Figure 38 illustrates the distances covered by car-sharing users that were classified as non-local, i.e. not resident in South Tyrol. In 2010, all Italian users from other regions travelled approximately 12,600 km, whereas all German users travelled 3,800 km. All Flinkster users, i.e. all users of the carsharing operation of the railway and logistics company Deutsche Bahn (DB), cover almost 426 km. In general, it can be stated that the trend of car sharing use is quite irregular: while German users increased from 2014 to 2017 and slightly decreased in 2018 and 2019, Italians were travelling much longer distances in 2015 and 2016 than in other years. Possible explanations provided by the car sharing service of South Tyrol are the increase in prices up to 2016, the fluctuating cooperation mechanisms with tourism boards to promote the car sharing service, the loss of some business travelers that regularly came to South Tyrol using a shared car (although working and living somewhere else), and finally the increasing trend to use guest tickets and mobilcards (see indicator 10.1). For a correct interpretation of these data, please note that users considered in the analysis might not always travel for leisure purposes: they might be business travelers, or even commuters from other regions, a category that would only partly link to tourism.


11

11 Land use and landscape diversity

Monitoring a destination's land use needs to take the natural environment, the urban areas and the current infrastructures into consideration. Both the natural environment and the built-up areas are shaped by tourism and by other activities simultaneously, and in turn they also actively constitute a bounding framework for economic activities performable on site. The infrastructure expansion for leisure activities is indirectly ascribed to various sectors, as it also serves the local population. Referring the tourism sector, some scholars even concluded that the pact of tourism on landscape diversity might be less significant than that of some traditional industries or intensive forms of agriculture (Schirpke, Altzinger, Leitinger, Tasser, 2019). Keeping this cross-sectoral relationship in mind, the assessment of landscape diversity and land use is relevant, since landscape diversity and the structural richness of landscapes are positively related to the scenic beauty of Alpine landscapes, whereas large homogeneous areas decrease the perceived level of scenic beauty (Schirpke, Tasser, Tappeiner, 2013). Landscape diversity and a balanced and varied landscape use – measured e.g. through the Shannon Evenness Index – work as proxies for the scenic beauty of South Tyrol, and thereby its attractiveness for tourists. The development trend of building more accommodation facilities than any other buildings reflects the relative pressure of tourism on the urban environment. A further interesting topic that this issue areas might embrace thanks to a think tank yet to be established, is a reflection on environmental and social impacts of the process of Airbnb-fication and its linked socio-spatial inequalities.

11.1 SHARE OF ACCOMMODATION FACILITIES OF TOTAL BUILDINGS BY MUNICIPALITY AND TOURISM EXPOSURE

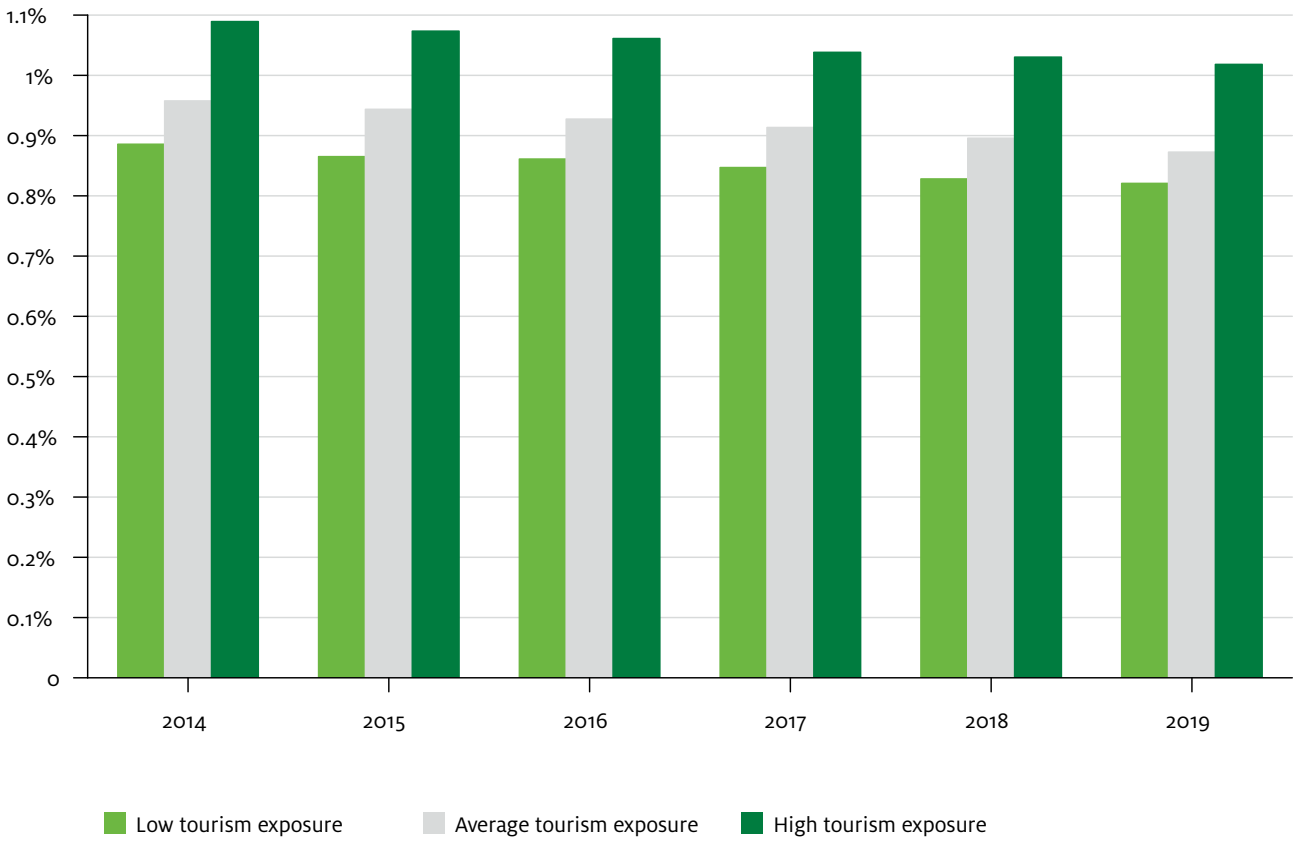

Figure 39: Share of accommodation facilities of total buildings by municipality and tourism exposure, South Tyrol 2014-2019. Source: Ripartizione provinciale Libro fondiario, Catasto fondiario e urbano, elaboration by ASTAT and Eurac Research.

Figure 39 shows what percentage of all buildings and facilities are accommodation facilities. The relative number of buildings decreased slightly from 0.96% in 2014 to 0.90% in 2019. The graph shows a slowly but steady decreasing trend in low as well as in average and high touristic places. Even though this indicator indicates the development of buildings dedicated to tourism activities over time, it does not take into consideration the size of buildings or the consumption of land. Thus, the indicator in Figure 39 provides only a rough approximation of the effect of tourism on land use. Unfortunately, at the moment, no better indicator exists for this issue area.

11.2 SHANNON'S EVENNESS INDEX

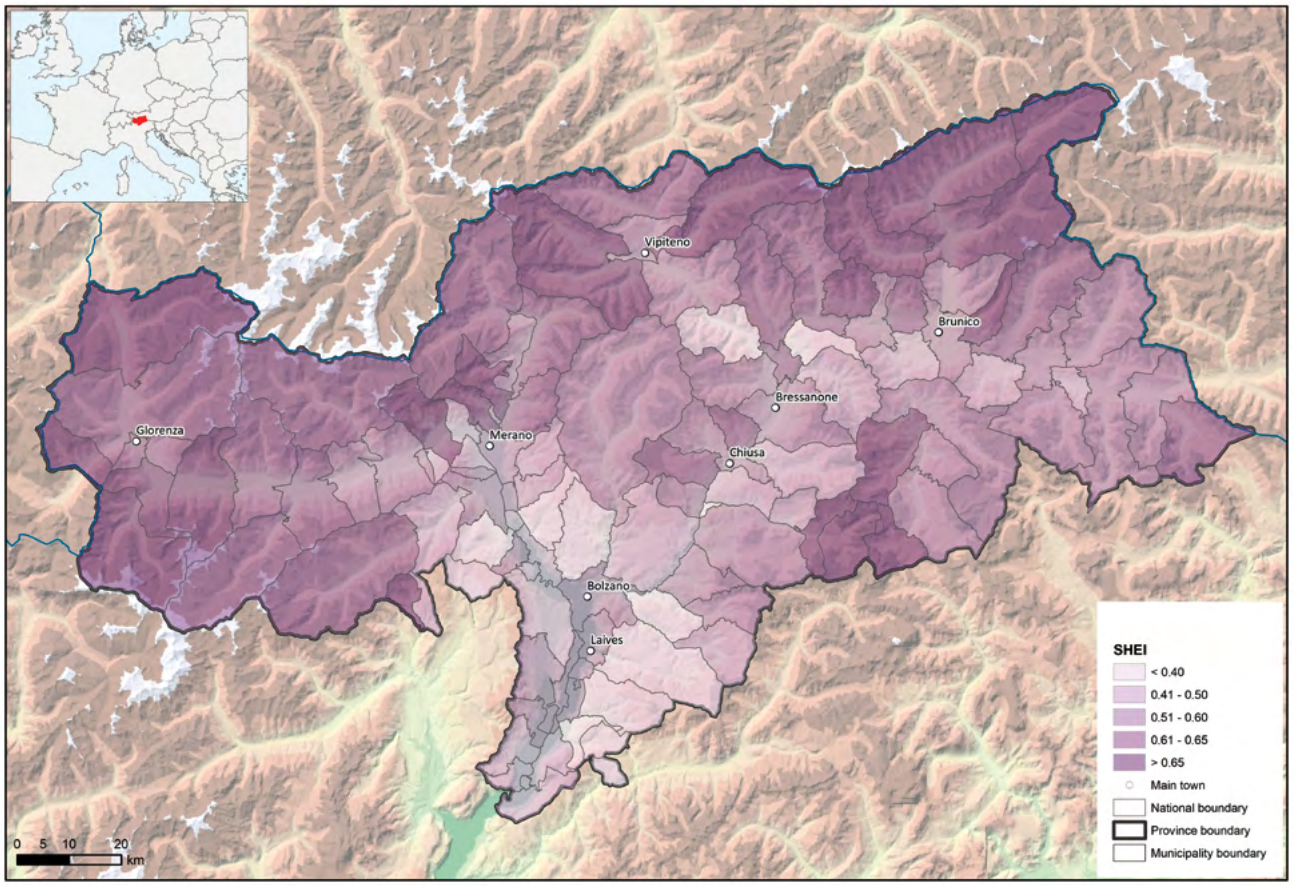

Figure 40: Map of the Shannon's Evenness Index, South Tyrol 2000-2012. Source: Eurac Institute for Alpine Environment, own elaboration.

The Shannon's Evenness Index (SHEI) is a measure of landscape diversity that "provides information on area composition and richness. It covers the number of different land cover types (m) observed along the straight line and their relative abundances (Pi)" (Eurostat, 2018). Since the indicator varies from 0 (low landscape diversity) to 1 (high landscape diversity), the areas of the map in a darker color should be interpreted as those with a co-existence of multiple land uses, whereas those with light colors show the opposite. The map shows that the north-eastern part of South Tyrol has a higher richness and diversity of landscapes, while the southern is more homogeneous. Landscape diversity and tourism display a reciprocal relationship. While tourism indirectly affects landscape diversity through constructions, landscape diversity contributes significantly to the attractiveness of destinations, but its only one factor amongst others (Schirpke et al., 2013). Also places with a low or medium landscape diversity might be very attractive for tourism, as the example of the Dolomites UNESCO WHO shows. The Dolomites UNESCO WHO are one of the most attractive destinations in South Tyrol and located in areas with a medium-high SHEI index.

12

12 Nature conservation

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, Isetti, Habicher, 2019). In this context, tourism, depending on the intensity, concentration and behavior 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, can play a positive role in raising awareness and consumer education through its vast channels of communication and can 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. In order to link tourism and nature conservation and identify those areas where a balance between conservation and development is pursued, we decided to monitor the extent to which natural areas are protected. As already stated in Section 11 for land use and landscape diversity, the effects of human activities on nature are multifold and it is not always easy to define which role tourism plays in this context. Nevertheless, for the purpose of this study it could be useful to at least measure the overall impact of human activities on nature by the hemeroby index, which assesses the impact of human activity on the ecosystem (Indicator 12.2).

12.1 NATURAL PARKS AND PROTECTED AREAS

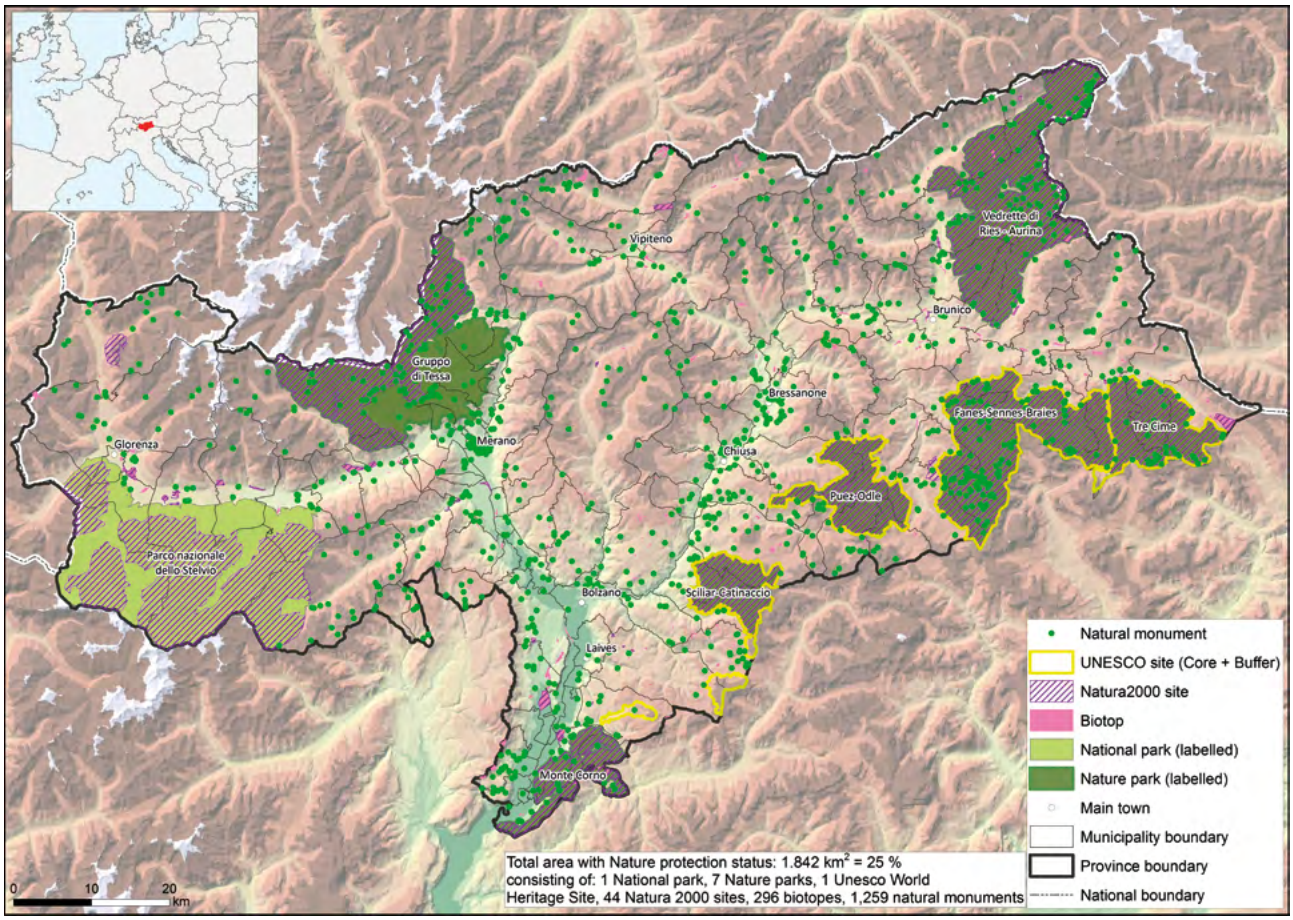

Figure 41: Natural parks and protected areas by park typology, South Tyrol 2018. Source: Eurac Institute for Earth Observation.

One fourth of South Tyrol's surface is under natural protection. The different protection policies include one national park, seven natural parks, 296 biotopes, 44 Natura2000 Sites, 1,259 natural monuments and the Dolomites UNESCO WHS, whose surface overlaps those of already-existing protected areas. The amount and composition of the protected surface has been relatively stable over the last decade, with some small exceptions regarding four Natura2000 Sites being added to the list (Provincial Office for Natural Parks, data available on demand). These protected areas represent an attraction for visitors and South Tyrol increasingly faces the challenge of managing traffic on mountain passes, e.g. the Stelvio or Sella Pass. The paradox of preserving protected areas and enabling their enhancement through tourism might only be solved with specific and widely accepted solutions that require time and effort before they can be introduced (Scuttari, Isetti, Habicher, 2019).

12.2 HEMEROBY (HUMAN ACTIVITY IMPACT ON THE ECOSYSTEM)

S

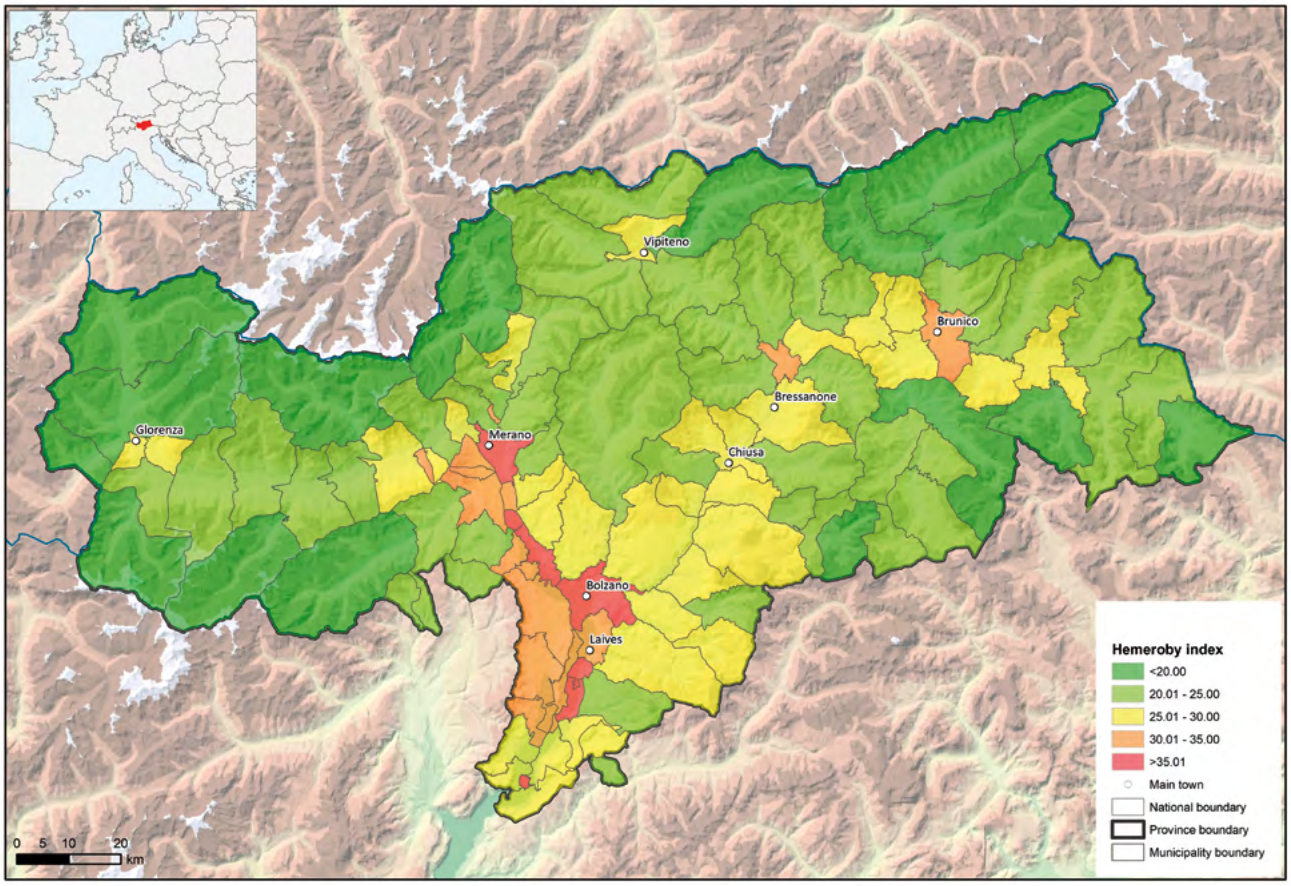

Figure 42: Municipalities by hemeroby values, South Tyrol 2000-2012.
Source: Eurac Institute for Alpine Environment.

The hemeroby index measures the hemerobiotic state of an area: the magnitude of the deviation from the potential natural vegetation caused by human activities. The degree of hemeroby increases with the increase of human interference. It should be noted that measured human impact is not directly linkable to tourism, since tourism-intense areas are not necessarily those with higher levels of hemeroby. Similar to the SHEI (see indicator 11.2), the indicator should rather be interpreted as a proxy of attractiveness to tourists, since intact nature without human interference is perceived as a source of scenic beauty (Schirpke et al., 2013). Reflecting the picture of SHEI, the hemeroby index also shows a difference between the core area of South Tyrol, where the valleys allow a higher anthropization, and the remote areas close to the northern borders, where the Alpine landscape is more natural and less affected by human interventions.

13

13 Culture

South Tyrol is a popular holiday destination for culturally interested tourists due to its many cultural treasures and its rich history. In addition to the natural landscape with its mountains, many guests also appreciate the South Tyrolean culture with its traditions and customs.
The variety ranges from cultural sights such as castles and other architectural monuments, museums, South Tyrolean personalities to numerous cultural events and celebrations that attract many visitors every year. Traditionally these include the "Törggelen" where in autumn one celebrates the young wine and eats Speck (smoked ham) and chestnuts, the grape festival in Merano and the folk music scene.
More recently numerous other events have been added, such as the South Tyrolean Jazz Festival, the South Tyrolean Festival Merano, Rock am Ring, the Transart Festival and the South Tyrolean Knights' Games. Furthermore, numerous sport events attract guests from all over the world, such as the biathlon in Antholz/Anterselva and various marathon races. Such events therefore play an important role for tourism in South Tyrol and are expected to play an even greater role in the future, including events that focus on resilience, health and culture (ZTS 2030, 2017).
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 and their architecture, infrastructure etc., but also indirectly through the prosperity made possible by tourism in a region. The influence of tourism on immaterial cultural assets is more difficult to assess. How this influence can be determined precisely, documented or even measured represents a difficult but important challenge for a region with a long history of tourism such as South Tyrol. In order to close this knowledge gap, qualitative surveys should lead to a better understanding of this relationship.

13.1 THE THREE-PILLAR MODEL AND CULTURAL SUSTAINABILITY

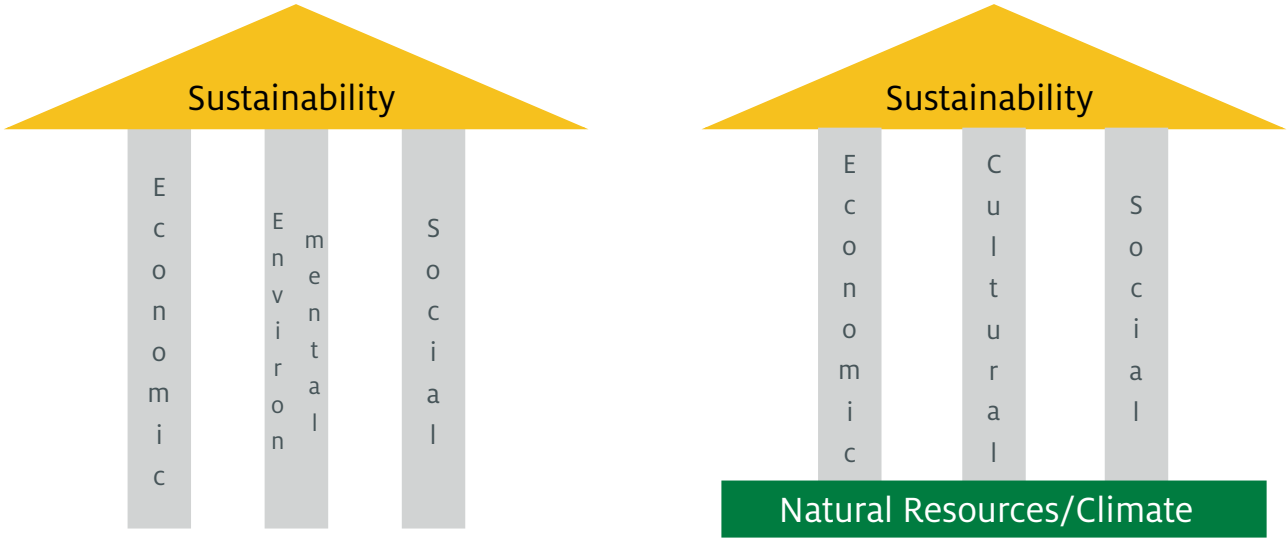

Figure 43: The three-pillar model of sustainability and its extension (Source: World Ocean Review 2015)

The three-pillar model of sustainability encompasses environmental, economic and social aspects, with all pillars being equally important, since it is based on the idea that sustainable development can only be achieved if environmental, economic and social objectives are treated and implemented simultaneously and equally (Brocchi 2007). However, in the last decades the role of culture as a model of sustainable development has been reassessed and a four-pillar model is often proposed in which culture is the fourth pillar of sustainability (Voss 1997) or an extended three-pillar model with the environment as the foundation of the other three pillars.

13.2 THE CASE STUDY OF IMMATERIAL HERITAGE

Culture and tourism are densely interwoven: mountain regions often retain cultural traditions that have hardly changed over the centuries. The relationships between tourism and this cultural diversity should be observed and studied, as it is an important part when talking about cultural sustainability. Since culture comprises a wide range of different aspects, including both material and immaterial cultural objects, such as architecture but also oral traditions, performing arts, traditional crafts and religious rituals, the study will focus on one particular traditional custom, i.e. transhumance, which takes place in many parts of the Alps.

The research will be carried out in summer-autumn 2020 and results will be reported in the 2020 STOST report.

BOX 4 :

TRANSHUMANCE

The word transhumance stems from Latin and combines *trans* "across" and *humus* "ground", which conveys the basic idea behind this tradition. It describes the seasonal movement of livestock from one region to another due to climatic reasons. The tradition is as old as animal husbandry itself, with evidence showing that it was practiced already in the Neolithic period, 6000 years ago (Barker 1985). This form of nomadism can be observed all across the globe, with examples in North and South America, Western Asia, and Europe, especially in the Mediterranean regions. Although there are some cultural and technological variations, the underlying principle of taking advantage of two regions with different climate conditions remains the same. This ensures year-around grazing, without the necessity to stable the animals (with exceptions of course). Generally, one can distinguish horizontal and vertical transhumance. The former is practiced in plain or plateau regions, the latter in mountainous areas. In Alpine regions livestock herds remain in seasonal mountain pastures (*"Alm"*) during the summer, to escape the dry heat in the valley, and then transfer to lower pastures during the colder months of the year. Transhumance allows to shift the grazing areas from the valleys into the mountains, which frees space for other cultivating activities. The transfer of the animals takes place on steady routes, which have been used by herders for centuries. Every year, once in spring and once in autumn (exact dates vary), thousands of animals, mostly sheep, cattle, and goats, are led by shepherds and their dogs over these routes to find the best place for grazing. The transfer itself is no walk in the park. The routes can lead through rocky areas, across snowy passes and completely exposed to the weather. Shepherds must have a deep understanding of the animals and the environment in order to cope with the dangers along the way. A successful flock migration is celebrated not only by the herders and their families, but also by the whole village and visitors, who can observe the homecoming of the flocks. Until this day, this nomadic grazing tradition contributes substantially to the ecological balance in the regions. Altogether, transhumance is one of the most efficient and sustainable livestock farming systems in terms of land management. With its long-lasting roots in Alpine history transhumance furthermore had a lasting historic influence on economic, cultural, social, and ethical aspects of life in these regions. Transhumance reinforces social bonds and a sustainable relationship between land, animals and humans; but also combines a set of practices, knowledge and skills. Traditional knowledge and crafts such as shearing, songs, dances, tales and anecdotes have been passed on by shepherds for ages. At the end of 2019 the centuries-old tradition was included in the UNESCO Representative list of Intangible Cultural Heritage, which yet again underlines the cultural importance of this old custom.

13.3 EXAMPLES OF TRANSHUMANCE IN SOUTH TYROL

In the valley of Schnals, the ritualized tradition of transhumance is deeply rooted in local custom, with its origins dating back to pre-Christian times. Every year in June, shepherds cross the Alps with their flocks of sheep and goats to reach the neighboring Ötztal valley in Austria. The difficult and exhausting journey is 44 kilometers long and leads from Kurzras and Vernagt over the mountain passes Niederjoch and Hochjoch to the fresh meadows of Vent in Austria. Following the paths of their ancestors, humans and animals jointly hike across glaciers, snow fields and dangerous crevasses. At the end of the season, in September, the return of the flocks is celebrated by the local population and visiting guests. When the herds descend into the valley, the animals are festively welcomed and the shepherds are praised for the successful conclusion of the summer season. The annual mountain crossing in the valley of Schnals represents one of the last transborder and trans-glacier practices of transhumance in the Alps.

Figure 44: Cross-border transhumance below the Hochjoch-ferner in the Schnalstal valley. Source: Katerina Fiser, 2016, Tourismusverein Schnalstal

Similarly, in Wolkenstein, in the heart of the Dolomites, the traditional transhumance takes place in form of an event at the end of the summer season, when cattle return from the alpine pastures in Langental. For the occasion, special floral wreaths and decorated head-dresses are prepared by farmers and owners of cows. Symbolic elements such as braided crosses embodying religious protection as well as mirrors and bells, which are supposed to ward off evil spirits, embellish the heads of the alpha cows that lead the way towards their home stables. The most beautiful cow wins a prize in an ambiance of general celebration, accompanied by local food specialties, popular music and folkloristic dances. The celebration is traditionally held as a form of thanks-giving for a prosperous season.

Figure 45: Folkloristic transhumance in Wolkenstein, Gardena Valley. Source: Tourismusverein Wolkenstein (valgardena.it)

Conclusions and outlook

This report is both an update of the first STOST report and an attempt to uncover new concerns for a balanced touristic development in the South Tyrol region, with particular reference to the Covid-19 crisis and the role of culture and immaterial heritage for tourism development. This year the STOST report has also profited from a constructive feedback of the stakeholder working group on all indicators, improving and refining the quality of monitoring. Further, it has started to elaborate on a new issue area linked to cultural heritage by means of an exploratory qualitative study on transhumance.
Concerning data visualization, this edition of the report makes a distinction between municipalities with high and low exposure where possible, in order to indirectly show the variability of some indicators across geographical areas.
The 29 indicators confirmed a development path towards sustainability, accommodation quality, voluntary environmental certification schemes and sustainable transport. The overall goal remains a regional-specific harmony that embraces development needs, the imperative of minimizing negative impacts and the challenge of coordinating actions to shape the future of tourism in the region. Particularly in the issue area about Governance, an increasing trend to design green and sustainable forms of tourism and to self-regulate them using voluntary initiatives or certification schemes is shown in the corresponding section. Positive developments are also perceivable in the issue area Mobility: The use of public transport remains at high levels and the availability of charging stations is increasing.
Indicators have been all updated until the newest data possible, but could not take into account the effects of the pandemic on tourism. To close this gap, a survey was conducted among local hotel managers with the collaboration of the local hotel and restaurant association (HGV). Results showed a clear drop in economic indicators, a stabile interest in sustainability-related issues and some form of resilience of the accommodation sector, that was capable of adapting and proactively acting to ensure security and health in the summer season 2020. The real impact of the Covid-19 crisis will become more perceivable in the upcoming report, when data of each indicator and issue area will show Covid-19 effects in their trends and will confirm or disconfirm the projections made during the crisis.
In winter 2020 a survey is planned to assess residents' attitudes towards tourism. These were initially planned for 2019, but the pandemic forced the research team to revise priorities and monitor the economic impacts of the lockdown for the tourism industry. Plans for 2021 are set in the hope that the pandemic will come to an end and monitoring (as well as tourism) activities will run regularly.

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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 labor market office of South Tyrol (AMB), various sector associations as well as from private firms. Thereby, the collected data surpasses 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. As incoming data is transmitted to us in different data forms (xlsx, csv, RData, json, pdf) with varying data structures, in a second step, 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 seasonally adjust data using 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 participating in the Working Group Workshops

During the development of STOST, many organizations participated in the Observatory's Working Group Workshops or joined bilateral exchanges to share their knowledge and provide their data. Among them are: IDM, Eurac Research institutes other than the Center for Advanced Studies, ASTAT (Provincial Institute of Statistics), Agency for Energy South Tyrol – KlimaHaus (Agentur für Energie Südtirol – KlimaHaus), Provincial Mobility Department, Provincial Department of Nature, Landscape and Spatial Planning, WIFO (Chamber of Commerce), HGV (South Tyrolean Hotels and Restaurants Association), VPS (South Tyrolean Non-commercial Accommodation Providers Association), SBB (South Tyrolean Farmers' Association), Free University of Bolzano, LTS (South Tyrolean Tourism Organizations Association), VCS (South Tyrolean Campsite Operators Association), AVS and CAI (associations of mountain huts/shelters), HDS (South Tyrolean Trades and Services Association), LVH (South Tyrolean Crafts and Services Association), Hogast (local buying syndicate), Provincial Forestry Department, Provincial Nature Parks Office, Provincial Landscape Ecology Office, BikeHotels Consortium, South Tyrolean Umbrella Organization for Nature and Environment Protection (Dachverband für Natur- und Umweltschutz), Terra Institute, Provincial Environment Agency, Labor Market Monitoring Office, Alpine Convention, Technical School for Hospitality and Food Industry (Brixen-Bressanone).

Annex 2: Technical notes on indicators

TOURISM EXPOSURE

For each municipality in South Tyrol, we compute its tourism exposure. We compute 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, i.e. low tourism exposure (<25%), normal tourism exposure (25%-75%) and high tourism exposure (>75%) according their tourism exposure measure.

1 Tourism seasonality

1.1 Tourist arrivals by market

"Tourist arrivals by 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 2008-2018 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 (2018), t = first available year (2008), m = month, y = year. Values can range from 0 to infinity.

1.2 Number of tourist arrivals occurring in peak months by municipality

"Number of tourist arrivals occurring in peak months by municipality" stands for the absolute number of tourists arrived in South Tyrolean municipalities within specific months. Data, provided by ASTAT, are available on a daily basis.
The graph in the report shows the ten municipalities registering the highest values. That is, those municipalities with the highest number of tourist arrivals in a specific month. Values can range from a minimum of 0 (no tourist arriving in one month) to infinity.

1.3 Number of tourist arrivals occurring in peak weeks by municipality

"Number of tourist arrivals occurring in peak weeks by municipality" stands for the absolute number of tourists arrived in South Tyrolean municipalities within specific weeks. Data, provided by ASTAT, are available on a daily basis.
The graph included in report shows the ten municipalities with the highest values. That is, it displays those municipalities with the highest concentration of arrivals during one specific week. Values can range from a minimum of 0 (no tourist arriving in a week) to infinity.

2 Employment

2.1 % of employees in the accommodation and food service sector

"Percentage of employees in the accommodation and food service sector" stands for the number of employees working in the accommodation and food service 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 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 2: 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 % of female enterprises in the accommodation and food service sector

"Percentage of 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 sector "Accommodation and Food Service Activities". The indicator was determined in the following way:

$$female\ enterprises\ in\ the\ tourism\ sector_t\ (\%) = \frac{Female\ enterprises\ in\ the\ tourism\ sector_t}{Total\ tourism\ enterprises_t} * 100$$

Equation 3: Female enterprises proportion calculation

Where t = 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[5]. 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;

5 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).

1.3 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 accommodation and food service 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 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”.
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 by economic sector, 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 accommodation and food service 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 qualitative surveys are designed to receive timely data on economic development. Among other questions, the questionnaire asks firms to assess their profit situation of the previous year. Thereby, firms can assess their profit situation as good, satisfactory, or bad. In addition, firms are asked to express their expectations about the current year’s profit situation. Thereby, firms can state that 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 ticked 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 informa-

tion, we calculated the balance statistic between the possible answers (good, satisfactory, and bad) for each year. In this way, we get an estimate of the average assessment of the past profit situation as well as an estimate of the average expected business situation.

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

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

Equation 4: Gross occupancy rates of bed places calculation

Where t = 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 Number of municipalities, accommodation facilities and events involved in voluntary certification schemes for sustainability

The figures regarding the "number of 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 Number of "Red Rooster" branded agritourism ventures producing and selling regional products

"Number of 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. It should be noted that an agritourism venture could produce more than one type of products, therefore each time series shows how many agritourism venture produce a specific type of regional product. The grey bar (left axis) shows the total number of all products per year 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 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:

$$organic\ milk\ slaes_t\ (\%) = \frac{Organic\ milk\ sold_t}{Total\ milk\ sold_t} * 100$$

Equation 5: Organic milk sales calculation

Where t = 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 analyzed. 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.

$$Tourism\ intensity\ index_t = \frac{Overnight\ stays_t / 365}{Total\ resident\ population_t} * 100$$

Equation 6: Tourism intensity index calculation

Where t = 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 Prices of rents in the destination

"Prices of rents in the destination" stands for the prices of rents in the central areas of selected South Tyrolean municipalities, as recorded by the real estate registry (Agenzia del Territorio). Data, elaborated by ASTAT, were 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 rent prices between touristic and non-touristic municipalities. These were selected according to the standard used by ASTAT for monitoring prices of goods and services, that refers to tourism intensity index (ASTAT, 2019). Accordingly, Welschnofen/ Nova Levante, Dorf Tirol/ Tirolo, Mühlbach/ Rio di Pusteria and Abtei/ Badia represent the touristic municipalities, while Neumarkt/ Egna, Schlanders/ Silandro, Sterzing/ Vipiteno and Sand in Taufers/ Campo Tures represent the non-touristic ones. We calculated average values of prices for each municipality group and available year. Values are expressed in Euros and can range from 0 to infinity.

5.3 Tourist satisfaction with prices

"Tourist satisfaction with prices" stands for tourists' evaluation of prices in South Tyrol. Data, collected by ASTAT and Eurac Research during the winter and summer season of 2004/2005 and 2012/2013, consist of survey data. This specific question was aimed at measuring the extent to which tourists were satisfied with prices of accommodation facilities and food services, irrespective of the price level. For each possible answer (very satisfied/satisfied/neutral/dissatisfied/very dissatisfied), percentage values of respondents are reported, ranging from a minimum of 0% to a maximum of 100%.

6 Energy management

6.1 Estimated minimum electricity consumption in accommodation facilities

"Estimated minimum electricity consumption in accommodation facilities" stands for an estimation of the minimum energy consumption in accommodation facilities using coefficients from existing literature (Bundesministerium für Wirtschaft, Familie und Jugend Wirtschaftskammer Österreich, Fachverband Hotellerie, Fachverband Gastronomie, Österreichische Hoteliervereinigung, 2011). Coefficients for electric energy are different according to accommodation category and performance conditions of the facilities. We chose to use those expressed in units per overnight stay. Given that data provided by ASTAT on overnight stays were available on a monthly basis, the resulting indicator is on a monthly basis as well. Therefore, we estimated the minimum energy consumption in accommodation facilities based on the following formula:

$$minimum\ electric\ energy\ consumption_t = \sum_{i=1}^{n} o_i * \alpha_i$$

Equation 7: Minimum electric energy consumption calculation

Where i = type of accommodation categories, o = overnight stays, a = electric energy consumption coefficient under optimal performance conditions and t = month.

We obtain data on monthly overnight stays by accommodation category (n=3) from ASTAT. The categories provided by ASTAT are comparable to the categories found in the guidelines provided by the Bundesministerium für Wirtschaft, Familie und Jugend Wirtschaftskammer Österreich et al. (2011). In this way, we can estimate the minimum energy consumption. That is, the energy consumption in the case that all accommodation facilities are energy efficient. Values are expressed in millions kWh and can range from 0 to infinity.

6.2 Electricity consumption by ski-lifts and snow cannons

"Electricity consumption by ski-lifts and snow cannons" stands for the amount of electric energy consumed by these two infrastructures. Data are provided by ASTAT on a yearly basis and are available only aggregated (consumption by ski-lifts cannot be distinguished by that of snow cannons). Values are expressed in MW/h and can range from 0 to infinity.

6.3 Charging stations offered for e-mobility in accommodation facilities and public spaces

"Charging stations offered for e-mobility in accommodation facilities and public spaces" 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 obtain data from the Neogy and Tesla websites. Data refer to the year 2020.

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 coefficients 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 the calculation formula, please refer to Equation . 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.

8.1 Discharge of sewage water due to tourism

"Discharge of sewage water due to tourism" stands for the proportion of sewage water attributable to tourism when compared to other users. Data are provided by APAC on a yearly basis. The calculation done by APAC is based on the population equivalents for tourism, which is calculated according to hydraulic engineering standards, in conformity with local legislation (Decreto del Presidente della Provincia 21 gennaio 2008, n. 6, Disciplina degli scarichi di acque reflue, Allegato A6). For accommodation facilities the population equivalent is based on the number of beds (1 or 2 population equivalent per bed, depending on the accommodation category). This calculation is used to estimate the maximum capacity of waste water treatment plants, rather than their actual use. That is, APAC uses the calculation estimate the maximum capacity a plant must be able to handle. Values can range from a minimum of 0% (the discharge of sewage water is not attributable to tourists at all), to a maximum of 100% (the discharge of sewage water is entirely attributable to tourists).

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 monthly basis, the resulting indicator is on a monthly basis as well. Therefore, we estimated the average waste production in accommodation facilities based on the following formula:

6 Available here: http://lexbrowser.provinz.bz.it/doc/it/dpgp-2008-6/decreto_del_presidente_della_provincia_21_gennaio_2008_n_6.aspx?view=1

$$Average\ waste\ production_t = o_t * 1{,}98\text{kg}$$

Equation 8: Average waste production calculation

Where o represents overnight stays and t indicates time.

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 tons 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 Number of ski-lift and cable car users by season

"Number of 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 Kilometers travelled using car sharing services by non-local users

"Kilometers travelled using car sharing services by non-local users" stands for the number of kilometers travelled using Car Sharing South Tyrol by non-local users. That is, by persons have their residence outside South Tyrol. Data are then distinguished by user type (Italian, German, Austrian, Swiss, Flinkster or other users). Car Sharing South Tyrol provides data on a daily level. We aggregate the daily data to annual data using summation. Values are expressed in kilometers and can range from 0 to infinity.

11 Land use and landscape diversity

11.1 Number of accommodation facilities by municipality and tourism exposure

"Number of accommodation facilities by municipality and tourism exposure" aims at showing the extent to which the number of accommodation facilities changed over time in South Tyrol, distinguishing between municipalities with low, average and high tourism exposure. Data is available on a yearly basis. Values can range from 0 to infinity.

11.2 – Shannon's Evenness Index

The Shannon's Evenness Index (SEI) provides information on area composition and richness. Data were provided by the Eurac Institute for Alpine Environment and refer to the time span 2000-2012. The indicator is calculated as follows:

$$SEI = \sum_{i=1}^{n} \frac{(P_i * \ln(P_i))}{\ln_m}$$

Equation 9: Shannon's Evenness Index formula

Where m refers to the number of different land cover types and P_i refers to the relative abundance (of). Values can range between 0 and 1, where 0 indicates a low landscape diversity and 1 a high landscape diversity.

12. Nature conservation

12.1 Natural parks and protected areas

"Natural parks and protected areas" aims at monitoring the extent to which the South Tyrolean territory is under protection status, distinguished by protection status type (natural monument, UNESCO site, Natura2000 site, Biotope, national and nature park). Data were provided by the Eurac Institute for Earth Observation. Data displayed refer to the year 2018, since we were not able obtain older data. We will start monitoring the evolution over time starting next year.

12.2 Hemeroby (human activity impact on the ecosystem)

"Hemeroby (human activity impact on the ecosystem" measures the magnitude of the deviation from the potential natural vegetation because of human activities. Data were provided by the Eurac Institute for Alpine Environment and refer to the time span 2000-2012. Hemeroby, or mean degree of naturalness (), is calculated as follows:

$$N = 100 * \sum_{i=1}^{n} p_i * m_i$$

Equation 10: Mean degree of naturalness (hemeroby) formula

Where n = number of land use type, p_i = area proportion of land use type on the total area of the reporting unit, and m = degree of naturalness (on a scale from 0 to 7, from more natural systems to more artificial systems). The higher the human influence on the ecosystem, the higher hemeroby values; the lower human influence, the lower the hemeroby values.

List of abbreviations

AMB: Amt für Arbeitsmarktbeobachtung [Department of Labour Market Observation]
APAC: Agency of the Autonomous Province of Bolzano/Bozen of the Environment and Climate
ASTAT: Statistic Institute of the Autonomous Province of Bolzano/Bozen
HGV: South Tyrolean Hotels and Restaurants Association
ISTAT: Istituto nazionale di statistica [National Institute of Statistics]
WIFO: Institut für Wirtschaftsforschung [Institute of Economic Research], Chamber of Commerce of Bolzano/Bozen

Anmerkungen

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