Online Annex of the STOST Annual Progress Report 2023

I. Data management workflow and participatory design

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

During the development of STOST, many organisations have participated in the observatory's working group workshops or joined bilateral exchanges to share their knowledge and provide data. We would like to thank all of them, including IDM; HGV; HGJ; the Institutes of Eurac Research for Regional Development, for Alpine Environment, for Earth Observation, and for Renewable Energy; ASTAT; Agency for Energy South Tyrol – KlimaHaus/CasaClima; Südtiroler Amt für Mobilität/ Ufficio Mobilità Alto Adige; Südtiroler Amt für Natur, Landschaft und Raumentwicklung/Ufficio Natura, paesaggio e sviluppo del territorio Alto Adige; WIFO; VPS; Südtiroler Bauernbund; Free University of Bozen-Bolzano; LTS; VCS; AVS and CAI; HDS; lvh.apa; Hogast; Südtiroler Amt für Forstwirtschaft/Ufficio Foreste Alto Adige; BikeHotels Consortium; Landesagentur für Umwelt und Klimaschutz/Agenzia provinciale per l'ambiente e la tutela del clima; Terra Institute; AFI-IPL; Alpine Convention; Tourismusverein Wolkenstein/Associazione Turistica Selva; Tourismusverein Schnalstal/ Ufficio Turistico Val Senales; Verband der Fremdenführer und Reiseleiter Südtirols/Associazione guide e accompagnatori turistici Alto Adige; Heimatpflegeverband Südtirol; Südtiroler Landesarchiv/Archivio

provincial; Museumsverband Südtirol/Associazione musei Alto Adige; Sozialgenossenschaft/cooperative a sociale independent L.; Naturmuseum Südtirol/Museo scienze naturali Alto Adige.

II. Technical notes on indicators

Tourism exposure

For each municipality in South Tyrol, we compute its tourism exposure as follows. First, we calculate the tourism intensity for each municipality. We then standardize this variable to mean zero and unit variance. Second, we calculate the number of beds per surface for each municipality. We then standardize this variable to mean zero and unit variance. Finally, we define tourism exposure of a municipality as the average between the variables.
We divide municipalities into three different groups: low tourism exposure (bottom 25%), average tourism exposure (25%-75%) and high tourism exposure (upper 25%) according to their tourism exposure measure.

1 Tourism seasonality

1.1 Tourist arrivals by month and market

"Tourist arrivals by month and market" stands for the absolute number of tourists arrived in South Tyrol, distinguished by market of origin. Data, provided by ASTAT, are available on a monthly basis. In order to summarize this vast amount of information, we decided to calculate monthly average absolute values for each available market of origin over the time span 2013-2022 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 (2022), t = first available year (2013), m = month, y = year.

Values can range from 0 to infinity.

1.2 Overnight stays by month and period

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

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

Equation 2: Share of monthly stays

Where m = month, y = year.

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

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

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

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

Equation 3: Share of weekly arrivals

Where w = week, y = year.

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

2 **Employment**

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

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

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

Equation 4: Tourism employees proportion calculation

Where m = month.

It should be noted that these data report only employees, i.e., they exclude the self-employed. Moreover, we decided to calculate this indicator using data regarding employees working in

South Tyrol, i.e., they may not necessarily live in South Tyrol. Values can range from a minimum of 0% (no employees working in the accommodation or food service sector) to a maximum of 100% (all the employees working in the accommodation or food service sector).

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

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

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

Equation 5: Female enterprises proportion calculation

Where y = year.

Unioncamere (the public entity representing the system of the Italian Chambers of Commerce), defines an enterprise as owned by a woman if different conditions are met, depending on the types of enterprises[1]. 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;

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

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

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

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

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

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

The citizenship is classified in the following way:

— **Italy**: Italian nationals

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

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

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

— **Outside Europe**

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

3 Economic benefits at the destination level

3.1 Value added by industries

"Value added by industries" stands for the value of output minus the value of intermediate costs. When expressed based on the economic sectors, it allows the growth of the economic system to be measured in terms of new goods and services available for final use. Data, provided by ISTAT, were available on a yearly basis and were distinguished by NACE Rev.2 sector (statistical classification of economic activities provided by Eurostat). Data are expressed in current prices and refer to South Tyrol. For the sake of coherence with the other indicators, the tourism sector refers to the NACE Rev.2 sector "Accommodation and Food Service Activities".

3.2 Profit situation for the accommodation and food service sector

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

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

3.3 **Gross occupancy rates of bed places**

"Gross occupancy rates of bed places" indicates the extent to which available beds within accommodation facilities are occupied by tourists within a specific period in South Tyrol. The indicator can be interpreted as a capacity utilization indicator. Data, provided by ASTAT, were available on a yearly basis. According to ISTAT (2008), the gross occupancy rate of bed places is calculated as follows:

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

Equation 6: Gross occupancy rates of bed places calculation

Where y = year.

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

4 **Governance**

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

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

4.2 **"Red Rooster" branded products**

"Red Rooster branded products" aims at measuring the number of agritourism ventures offering certified regional products. Data, provided by Red Rooster, were available on a yearly basis. The graph represents the total number of products awarded with the "Red Rooster" label. Values can range from 0 to infinity.

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

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

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

Equation 7: Organic milk sales calculation

Where y = year.

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

5. **Local and visitor satisfaction**

5.1 **Tourism intensity index**

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

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

Equation 8: Tourism intensity index calculation

Where y = year.

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

5.2 **Difference in minimum rent prices by tourism exposure**

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

6. **Energy management**

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

"Estimated minimum electricity consumption in accommodation facilities" is an estimation of the lower bound of the level of electrical energy consumed in all accommodation facilities

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

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

Equation 9: Estimated minimum electric energy consumption

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

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

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

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

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

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

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

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

Equation 10: Estimated minimum water consumption

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

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

7.2 **Water use by snow guns**

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

9. **Solid waste management**

9.1 **Estimated waste production in accommodation facilities**

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

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

Equation 11: Estimated waste production

Where y = year.

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

10. **Mobility**

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

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

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

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

0 to infinity.

10.3 **Number of charging stations for e-mobility**

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

11 **Land use and landscape diversity**

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

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

11.2 **Areas for tourist facilities**

The indicator “Areas for tourist facilities stands for the change in hectares of areas for tourist facilities. Data on the areas for tourist facilities, provided by the Office of Regional Planning and Cartography Province Bolzano-South Tyrol, was calculated for the years 2018 and 2023 and subsequently compared. Values are expressed in hectare and can theoretically range from - infinity to infinity. In reality, the range depends on the municipalities’ surfaces and can never be greater than this.

11.3 **Bed density in residential zones**

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

12. **Nature conservation**

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

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

13. **Culture**

13.1 **Museums by type and tourism exposure**

The indicator “Museums by type and tourism exposure” shows the number of museums by type and tourism exposure. Location data of all museums in South Tyrol, provided by ASTAT, was gathered for each municipality. Data for each municipality was clustered by the category of tourism exposure.

Subsequently, the graph gives an overview of the types of museums in each category in percent. Values can range from a minimum of 0% to a maximum of 100%.

13.2 **Percentage of tourists of total museum visitors**

The indicator "Museum visitors" shows the proportion of entries into South Tyrolean museums with mobilcards. Overall data on entries in museums in South Tyrol, provided by ASTAT, were compared to the data on entries with mobilcards, provided by Lorima. The values for the overall number of museums can range from 0 to 100.

14. **Climate action**

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

"Estimated car-related CO_2 equivalent emissions from inbound tourism" is an estimate for the amount of greenhouse gas emissions attributable to the movement of tourists in South Tyrol by car. Data for the calculation is derived from various sources: ASTAT (arrivals by market of origin and information on travelling behaviour of guests), STOST (information on travelling behaviour of guests) and Google Maps (distances). Furthermore, we decided to use average emission factors provided by the German Umweltbundesamt, based on the software TREMOD 6.23 (Transport Emission Model)[2]. This choice is motivated by the fact that Germany provides the biggest market of origin for South Tyrolean tourism. In addition, other main markets such as Austria, the Benelux countries and Switzerland are expected to have similarly composed car fleets and thus similar average emission factors. As far as the Italian market is concerned, German emission factors are used as well, since the Italian factors from the ISPRA agency use a different standard (COPERT) that is not comparable to the one of the Umweltbundesamt. Following the territorial principle, which attributes only those emissions to a region that are produced within its geographical boundaries, we considered the movement of tourists from the moment they enter the South Tyrolean border to the moment they leave it (i.e., arrival/departure as well as internal mobility). The estimation was calculated as follows:

$$Car-related\ CO2\ equivalent\ \ emissions_y = \sum_{i=1}^{n} \frac{arrivals_{i,y} * \%\ of\ tourists\ arriving\ by\ car_y * distance\ arrival_i * 2 * emission\ factor_y}{load\ factor_y} + \frac{arrivals_y * \%\ of\ tourists\ using\ mostly\ car\ during\ stay_y * distance\ stay_y * 2 * emission\ factor_y}{load\ factor_y}$$

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

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

[2] https://www.umweltbundesamt.de/themen/verkehr-laerm/emissionsdaten#tremod

destination.

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

15. **Accessibility**

15.1 **Number of accessible gastronomy and accommodation facilities**

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

15.2 **Number of accessible cultural facilities and free time activities**

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