Chapter N

A framework for carbon footprint assessment in tourism sector

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**Abstract.** Climate change and global warming are among the most important challenges we face nowadays. For this reason, the greenhouse gas (GHG) emission assessment has become the research topic of many studies. One of the indicators that best allows to determine the environmental impacts of anthropogenic activities is the measurement of the Carbon Footprint (CF). The tourism industry, in this context, is the cause of negative environmental impacts and it represents about 8% of global GHG emissions. Therefore, the purpose of this preliminary study is to provide a framework, through ISO 14064-1:2018 standards, which aims to: a) defining the main environmental pressure in a Mediterranean micro-destination between Monopoli (BA) and Fasano (BR) municipalities in Apulia region; b) enhancing and promoting the sustainable tourism growth of this area through the assessment, monitoring, and reduction of the CF of the organizations involved. Main results show the difficulty in choosing a suitable functional unit for the tourism industry that combine all the organizations that belong to the micro-destination, as well as the obstacle in obtaining accurate data. The future research study will provide the assessment of GHG emissions of the tourism organizations involved in the examined area.

**Keywords.** Carbon footprint, tourism, low-carbon tourism organizations.

# Introduction

Climate change and global warming are among the most important challenges we face nowadays. Carbon Footprint (CF) can be defined as “The quantity of GHGs expressed in terms of CO2-e, emitted into the atmosphere by an individual, organization, process, product, or event from within a specified boundary” (Pandey et al., 2011). It is considered a sustainable development indicator since allows to determine the environmental impacts of anthropogenic activities causing climate change (Rico et al., 2019). In this context, the travel and tourism sector represent about 8% of global greenhouse gas (GHG) emissions (Koçak et al., 2020). However, this sector generated huge benefits for the economic growth of a country, in fact in 2019, according to the World Travel & Tourism Council (2021), this industry generated 10.4% of global Gross Domestic Product. In accordance with Filimonau et al. (2013) there is a need to develop a specific and innovative methodological approach for the CF assessment in the field of tourism, especially when it focuses on a specific territorial destination. There is a body of literature that focuses on estimating the CF of the tourism industry (Sun, 2014; Cai, 2016; Lanzen et al., 2018; Kitamura et al., 2020; Sun and Drakeman, 2020) with different calculating methods, but there are few research using ISO 14064-1:2018 standards in tourism as a guide for GHG reporting. This is the main reason to develop a methodological and replicable framework to be adapted to the tourism phenomena in a micro-destination of a Mediterranean site located in Apulia region. Hence, this framework and the assessment of the Carbon Footprint could allow the identified micro-destination to reach a territorial and economic sustainable development, through the adoption of the ISO 14064-1:2018 standards. We choose to assess the CF of this micro-destination as preliminary research because this paper is part of a key output of the European project Cross-border Cooperation Program 2014 - 2020 Interreg V-A Italy – Croatia, named “TAKE IT SLOW - Smart and Slow Tourism Supporting Adriatic Heritage for Tomorrow”, which aims to develop sustainable tourism in a micro-destination in Apulia region (European Union, 2019).

# Material and methods

The framework methodology was based on ISO 14064-1:2018 standards “Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals” (Wintergreen and Delaney, 2009; ISO 14064-1:2018) and it has been adapted to the tourism sector. According to the ISO 14064-1:2018 standards and to a recent study by Choudhary et al. (2018), a five-step methodology for GHG quantification and reporting has been defined, as Figure 1 displays.

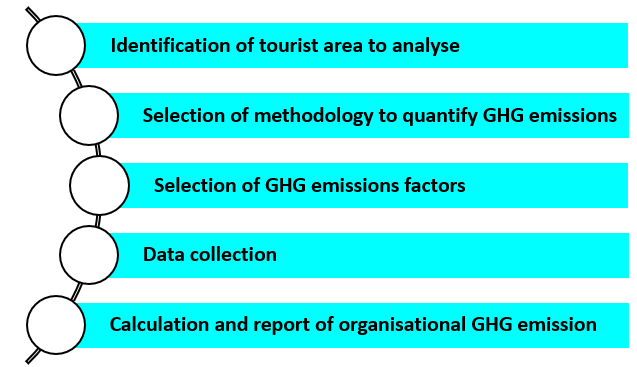


Fig. 1. Five-step methodology for GHG quantification and reporting in the tourism sector.

Sources: personal elaboration of the authors based on Choudhary et al. (2018) research and ISO 14064-1:2018 standards.

The first step concerns the identification of the tourist area and the organizations involved (such as accommodation, food, and beverage, crafts, tourist agencies, rental services, etc.).

The second step involves the choice of methodology to quantify the CF and it depends on the dimension of the selected area. Among the different methods used for accounting for CF in the tourism sector, the most widely used are the top-down and the bottom-up approach. The first is based on tourism expenditure, calculated by using secondary data, such as statistical information, and it is considered transparent, not economically expensive, and easy to replicate. This method is preferred for nations or large territories, and it allows CF comparison between tourism and other economic sectors. The second approach is based on tourism activity, calculated by using primary data, such as interviews or questionnaires, and it is considered more detailed and accurate, but also more expensive in terms of time and money costs. This method is preferred for regions or small territories.

Then, the inclusion and exclusion criteria to analyze and quantify the direct and indirect GHG emissions are identified in the third step. The organization shall specify the kind of GHG emissions considered (CO2, CH4, N2O, etc.) and compare the impacts generated by the different gases by converting the quantity of each type of GHG to tons of CO2-e using suitable Global Warming Potential (GWP) index.

The fourth step concerns the collection of data in an identified period, following the inclusion and exclusion criteria expressed in the previous step.

Lastly, in the fifth step, the organizational GHG emissions are calculated through the aforementioned steps, and the results are shown in a GHG report.

This preliminary study focuses on the first three steps of the proposed framework related to B&Bs and travel agencies included in the considered

Apulia micro-destination applying a bottom-up approach.

# Results and discussions

The tourist area identified in the European project is a Mediterranean micro-destination delimited by the area between Monopoli (BA) and Fasano (BR) municipalities in Apulia region. According to the demographic report provided by ISTAT (2020), Monopoli has a population of 48,101 inhabitants and Fasano of 39,025. The area considered is about 157 km² for Monopoli and 131 km² for Fasano (ISTAT, 2022). Moreover, according to the annual tourist movement report provided by Puglia Promozione - Regional Tourism Agency (2022) these areas registered, in the whole 2021, domestic and foreign tourist arrivals of 233,407 people (46% in Monopoli and 54% in Fasano) totalizing 853,023 nights (equal to 3-4 nights per tourist) of which less than 42% spent in Monopoli and more than 58% in Fasano. These data can be compared to tourist arrivals and the presence of Apulia region in 2021, respectively 3,336,729 people and 13,875,537 nights. Hence, tourist flows in Monopoli and Fasano municipalities represent about 7% of the total tourist flows in Apulia.

Concerning the second step, we choose the bottom-up approach for the CF assessment because it is suitable for small territories and is considered more detailed and accurate.

In addition, for the third step, the criteria chosen for the GHG emissions assessment are shown in Table 1.

Table 1. Chosen criteria for the GHG emissions assessment.

|  |  |
| --- | --- |
| **Items** | **Evaluation methods** |
| Technological systems (e.g., electrical, heating, air conditioning, sanitary and water systems) | Survey |
| Electricity consumption referring to the year 2021 | Electricity invoices |
| Electricity production referring to the year 2021 (if any) | Survey |
| GAS/LPG consumption for the year 2021 | Invoices/Bills |
| Inventory of heat pump systems (split/fan coil) | Survey and the copy of the periodic maintenance booklet with communication to the Fluorinated Gases (F-Gas) system |
| Quantification of the gas in the refrigerators  (if present) | Survey |
| Quantification of daily commuting of employees and the identification of the means of transport used | Survey |
| List of the company vehicle fleet (if present) and the km traveled by employees | Survey |
| List of the company vehicle fleet (if present) and the km traveled by customers | Survey |

Source: personal elaboration of the authors.

Many issues emerged, for example the choice of a suitable functional unit (which is the description of the reference basis of the study for the quantification of the assessment of the impact) for the tourism industry that combines all the organizations that belong to the micro-destination (such as accommodations, food, and beverage, crafts, tourist agencies, etc.). It emerges the need to avoid the identification of a tourist as functional unit, as generally displayed by the literature. Probably a more detailed and specific functional unit could be used. Moreover, to implement the ISO 14064-1:2018 standard, in order to enhance and promote the sustainable tourism growth of the organizations involved in the micro-destination, the development of a network of companies needed because a juridical body to obtain the environmental certification must be constituted. Hence, further analysis is required to complete the research with the collection of data through surveys, the calculation of GHG emissions, and then the presentation of the results in a GHG report.

As this is preliminary research, its main limits concern the obstacle in acquiring data because, as small businesses, they do not have an environmental reporting system and/or a financial report and there is often a lack of awareness of sustainability. Furthermore, it is necessary to identify the consumption of the inhabitants compared to that of tourists.

# Conclusions

In this preliminary study, through ISO 14064-1:2018 standards, a framework for quantifying and reporting the CF of tourism organizations has been drawn up. This framework can be adapted to other destinations with similar characteristics with the aim of reducing their environmental pressure, enhancing, and promoting their sustainable growth through the assessment, monitoring, and reduction of the CF of the organizations involved.

The future research study will provide the assessment of GHG emissions of the tourism organizations involved in the examined area, on the basis of the accurate data which will be gathered and a sustainability report. The results will be benchmarked with others from different calculation methods, as well as the development of a standardized structured report.

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