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Balancing economic benefits and environmental costs: Introducing carbon footprint indicators in tourist market targeting

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ABSTRACT

We argue that governments' decisions to target certain tourist markets must consider both benefits and costs. We design a composite indicator methodology to assess economic benefits, using six classic indicators of market desirability (leadership, dynamism, seasonality, length of stay, expenditure and connectivity), which we complement with two carbon footprint indicators indicative of some of the costs incurred by the planet (CO_{2e} per tourist night and CO_{2e} per tourist trip). We model how target market decisions should change as the weight given to carbon costs changes from zero (current scenario) to 25% and 50% in the set of indicators used to select target markets. Adding carbon data in a cost-benefit analysis makes regional and national markets much more attractive than distant markets due to their low carbon footprints, despite shorter tourist stays or lower expenditures. Our method can inform government strategies to decarbonize while maintaining a clear market focus.

1. Introduction

For the managers of Destination Marketing Organizations (DMOs), a target market is an attractive market segment of travelers with shared characteristics. Once identified, those with the greatest potential to meet the organizational goals in the long term are selected (Kotler & Armstrong, 2010), maximizing the efficiency of the marketing strategy (Tkaczynski et al., 2018). It is common for marketing plans to use "country of origin" as a widely accepted segmentation criterion (Gallego et al., 2023). It is also common to prioritize economic indicators in their selection, but to not include climate change evidence to inform their marketing decisions (Scott, 2021; Conefrey & Hanrahan, 2022; Tribe & Paddison, 2023; Guix et al., 2024). This is because decision-makers typically use the well-established moral justification of the economic benefits of tourism to downplay its environmental and social costs (Scott, 2021; Torres-Delgado et al., 2024).

While academics have long recognized that a tourism business model must account for the carbon footprint of its revenue (Gössling & Higham, 2021), government practices are currently based on accounting for benefits while ignoring costs (Sun & Higham, 2021). Consequently, indicators to inform policies are not exhaustive or well-balanced with environmental and social data (Modica et al., 2018), which leads to an oversimplification of "tourist value". We argue that this has only been possible because tourism's economic benefits are tangible, accrued immediately and accrued primarily by local stakeholders, while its environmental costs are less tangible, paid in the future and shared by all society. This narrow economic approach is evident in the criteria informing data-based segmentation (Pesonen & Tuohino, 2017; Hajibaba et al., 2019). Academia has paid little attention to target market selection (Jang et al., 2004), and even less to including environmental criteria in their decisions that are essential to evaluate decarbonization pathways (The Travel Foundation, 2023; Torres-Delgado et al., 2024) that reduce tourist emissions per unit of tourism value created (Gössling & Higham, 2021; Peeters et al., 2018).

The aim of this study is to develop and test a method that can be deployed by DMOs to demonstrate the need for marketing decisions to not be decoupled from decarbonization strategies (Gössling et al., 2015; Luo et al., 2018; Gössling, Ring, Dwyer, Andersson, & Hall, 2016; Guix et al., 2024; Peeters & Papp, 2024). The study responds to calls for better statistical data to consider the substitutivity of different types of tourism

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and, in particular, the trade-offs between international and domestic tourism (Seyfi et al., 2022; Sun et al., 2023). The fundamental idea is to provide a tool that contributes to optimize targeting tourism markets by identifying which visitors can deliver greater benefits and/or cause less harm per trip to the destination (Oklevik et al., 2019; McElroy & Albuquerque, 2002; Sun, Lin, & Higham, 2020). Accordingly, we have built a composite indicator that combines traditional economic indicators with carbon footprint indicators. Our multi-criteria method, based primarily on official statistics, increases their usability without additional data collection costs (Gallego et al., 2023). This composite indicator is not only intended to guide the selection of target markets, but also to encourage decision-makers to more broadly adopt a cost-benefit analysis of tourism into their marketing decisions (Gössling et al., 2016), and in this sense the carbon variables included are for illustrative purposes and not meant to be the final or the only sustainability criteria to be used.

2. Literature review

A DMO is responsible for marketing, managing and promoting a tourist destination to boost its competitiveness and sustainability (UNWTO & UNEP, 2019). The management mandate is gaining importance due to the growing evidence of the negative impacts of tourism. Sustainability indicators and indices make the concept of sustainable development more concrete (Marinello et al., 2023) by offering objective parameters to understand and monitor the performance of destinations (Tor res-Delgado & López Palomeque, 2014). While these metrics have proved to raise awareness of, and foster consensus on, tourism impacts, they have had limited impact on evidence-based policymaking (Crabolu, Font, & Miller, 2023; Gasparini & Mariotti, 2023; Torres-Delgado et al., 2023).

Sustainability is a keyword in most destination tourism strategies, although few DMOs go beyond paying lip service to it (UNWTO & UNEP, 2019), and even fewer use (un)sustainability evidence to inform policy (Font et al., 2023; Torres-Delgado & Font, 2024). Governments' strong emphases on economic growth divert attention away from tourism's social and environmental costs (Schmelzer, 2015). Besides, many decisions are focused on current or urgent issues instead of long-term needs of tourism sustainability (McLoughlin & Hanrahan, 2023). Therefore, DMOs generally pursue short-term economic benefits and ignore data that contradicts their business models (Scott, 2021), as it is experienced as a threat to the organization's identity (Torres-Delgado et al., 2024).

To preserve their status quo, many DMOs symbolically use sustainability data to portray the industry positively, benefiting themselves or influential organizations, or to legitimize decisions that align with their interests (Gudmundsson, 2003; Torres-Delgado & Font, 2024). Thus, most managers narrowly design the actions of their destination marketing strategies to promote business growth and tourists' needs, at best framing environmental issues as opportunities for green growth (Hickel & Kallis, 2020). There are very few examples of strategies that mention both benefits and costs, and those that do, often frame addressing costs in aspirational terms with soft targets, in striking contrast to the hard growth targets of tourist numbers and expenditure (Tribe & Paddison, 2023; UNWTO & UNEP, 2019).

Climate change poses a crucial challenge for tourism policymakers, as the European Union has already set science-based decarbonization targets that are aimed at reducing emissions by 55% by 2030 (compared to 1990 levels), with a view to achieving "climate neutrality" by the middle of the century (European Council, 2023). However, the absence of climate change evidence in tourism destination strategies is highly noticeable (Conefrey & Hanrahan, 2022; Guix et al., 2024; Scott, 2021). Decarbonization requires completely rethinking business-as-usual tourism, to bring about systemic changes at a large scale to break or disrupt existing arrangements and routines (Becken, 2019; Peeters & Papp, 2024; Scott & Gössling, 2022; The Travel Foundation, 2023).

Most managers of DMOs have made the choice to not invest in measuring the carbon footprint of tourism, which, unsurprisingly (or deliberately), removes their ability to incorporate such data in their marketing strategies (Modica et al., 2018). Their argument is that they lack publicly available methodologies or widely accessible tools specifically designed for measuring destination emissions (UNWTO, 2023). We could offer a different explanation: that organizations will not invest in collecting data that contradicts their current business model (Crabolu, Font, & Eker, 2023). After all, DMOs collect high quality, regularly updated, and easily accessible economic data, which proves that time and money are no barrier, when the data is valued. The evident gap between ambitious climate objectives (from Ministries of Environment) and concrete actions (from national and regional tourist boards) may arise because of the lack of accountability of the tourism industry. This is evident in the few examples available of DMOs measuring their destination carbon footprint (see, for example, VLC & Global Omnium, 2019), and even fewer of their use of carbon data in policymaking and governance (Becken et al., 2020).

Target market selection follows a four-step process: defining segmentation criteria, conducting market segmentation, evaluating segment desirability, and ultimately choosing the target markets (Jang et al., 2004; Kotler & Armstrong, 2010). Few studies have addressed the methods to evaluate markets for their subsequent selection, and the studies published are not recent. The common criteria are profitability (measured through spending), variability (e.g., loyalty), and accessibility (Loker & Perdue, 1992). More recently, scholars evaluated markets not only for their ability to generate revenue but also for their stability and risk, and in doing so they offered a more comprehensive and balanced view by considering both the potential benefits and the risks associated with each segment(Zhang et al., 2016; Rakotondramaro & Botti, 2018).

Recent evidence confirms that optimizing the marketing mix for low-emission groups is one of the most effective initiatives for DMOs, and yet one of those least used (Guix et al., 2024). Yet the only study that we found that includes carbon when judging the attractiveness of market segments is that of Gössling et al. (2016). They found that for the 12 countries they studied, 2% of the most distant arrivals were responsible for 10% of the carbon emissions, and 17% of the arrivals caused 62% of the emissions. They also illustrated that there is a tendency for expenditure per day to increase but for length of stay to fall with distance travelled, with the assumption that long haul markets will want to visit multiple countries in a single trip. Gossling et al.'s study (2024) argues for holistic and optimized target market choices and responds to Sun et al.'s (2020) and Peeters and Papp's (2024) calls to provide clear targets for growing and/or degrowing specific markets.

Similarly, academia has developed many indices to measure the attractiveness or competitiveness of a destination (e.g., Gallego et al., 2023; Gooroochurn & Sugiyarto, 2005; Jang et al., 2004). However, generally, these do not include variables to measure the costs of tourism (see however Castellani & Sala, 2010; Blancas et al., 2010; Bertocchi et al., 2021), and sustainability indicators are created in parallel to the data systems used to take decisions (Font et al., 2023). Ambiguity in sustainable development definitions leads to varied interpretations and practical challenges (Tanguay et al., 2013). This ambiguity, along with data scarcity and political oversight gaps, is reflected in decarbonization efforts, contributing to indices' failure to achieve greater sustainability (Wilson et al., 2007). Hence, it is necessary to combine measurement of benefits and costs in a single and politically appealing tool, such a composite indicator. We argue that a cost-benefit composite indicator may provide the knowledge needed to encourage collaboration by integrating diverging views, thus making it easier to advance decarbonization (Becken, 2019). A cost-benefit approach, grounded in indicators, can provide critical policy information for planning and management (Torres-Delgado & Saarinen, 2014).

3. Materials and methods

We have designed a method that empowers managers of DMOs to identify and select target markets according to their goals, encouraging them to use a cost benefit approach and with sufficient flexibility to experiment with, and over time increase, the range of variables relating to costs. Following convention, we use the tourists' countries of origin as a first segmentation variable because this is commonly available information (Gallego et al., 2023; Yadegaridehkordi et al., 2021). Next, we outline the process followed to develop a composite indicator with/-without carbon data, following the steps shown in Fig. 1.

For illustration purposes, the method is tested in Andalusia, a region in the south of Spain with 88,000 km^2 and a population of 8 million inhabitants, where tourism accounts for 9% of its GDP (Junta de Andalucía, 2023). In 2022, Andalusia had 115,195 accommodation establishments that offered a total of 1.1 million beds and received a total of 30.8 million tourists, 68.7% of whom were of national origin (36.9% Andalusian and 31.8% from the rest of Spain), with the remaining 31.3% being international (Junta de Andalucía, 2023).

Changes in the political-administrative structure of the Spanish state, from a centralized state during the Franco's dictatorship to a decentralized one following the establishment of democracy, have significantly influenced the national and regional tourism planning. During the dictatorship, tourism policies were guided by a unified national strategy. However, with the democratic transition and the devolution of tourism competencies to the autonomous communities (a result of the Spanish Constitution of 1978), tourism planning in Spain became more fragmented, gaining prominence at the regional level. This shift implies that national regulation now serves a subsidiary role, while the regional governments, as Andalusia, have full autonomy in matters of tourism promotion and management within their territories (López et al., 2022).

At present, there is no active national tourism plan, only general guidelines for what will become the 2030 Spanish Sustainable Tourism Strategy, which is still under development (MICT, 2019). Meanwhile, Andalusia has already established its General Plan for Sustainable Tourism in Andalusia GOAL 2027; Junta de Andalucía, 2021), which, although developed before the national plan, aligns well with many of its strategic axes and specific lines of action. Both plans, in particular, emphasize the need to rethink the tourism model based on sustainability criteria. Hence the regional government has the mandate and resources to use data on sustainability to inform its policies. The outlined phases below explain the implementation process, using the region of Andalusia (Spain) as a case study; however, the same process could be applied to any other destination.

3.1. Phase 1: Conceptual framework

Andalusia has a Sustainable Tourism General Plan, known as GOAL 2027; Junta de Andalucía, 2021). Among the elements that guide tourism planning and that form the basis for setting its purpose, objectives, strategy and programs are: (1) a commitment to sustainability and territorial cohesion as key axes to improve the competitiveness of the destination; (2) the management of seasonality; and (3) tourism marketing (Junta de Andalucía, 2021). Following these criteria, at the time this paper was written, a decision-making team, comprising managers and civil servants responsible for tourism planning in the destination, was drafting a new Tourism Marketing Plan for 2024–2027. Among the team's various responsibilities, they had to identify the most desirable markets to target their strategies based on sustainability criteria and validate their decisions with public and private stakeholders of the Andalusian tourism sector.

We first reviewed the goals and the market selection criteria being used to operationalize the Tourism Marketing Plan, and we held a workshop in May 2023 which was attended by ten people from the decision-making team. The agenda of the workshop was 1) to present the model for targeting the most desirable markets based on a novel focus of cost-benefit data, 2) to have an open debate to define and validate the model, and 3) to survey decision-making team about the weighting for each criterion to choose the market that better contributes to advancing the goals set in the Tourism Marketing Plan. Seven key aspects that would define the desirability of a market were defined and validated; which were classified in two dimensions: economic benefits (6) and environmental costs (1). These key aspects should be reviewed and adapted, if necessary, by destinations that wish to implement the proposed method to adequately reflect the objectives outlined in their respective tourism plans.

On the economic benefits side.

(1) *Leadership*: the relevance of Andalusia as a tourist destination in Spain, based on its market share of the total number of tourists from market j who arrived in Spain. It is considered desirable to be the leading destination for the main markets that arrive in Spain, therefore, the greater the market share, the more desirable the market. Measuring leadership inherently involves a varying degree of marketing effort in the promotion and positioning of the destination.

(2) *Dynamism*: the evolution of tourist flow. It is considered desirable for market j to have reached, or exceeded, its pre-COVID 19 level. The year 2019 is used as a reference since it was the last year unaffected by the pandemic. Once the situation normalizes, this indicator could be replaced by the year-over-year variation or the cumulative variation over the last three years, for example.

(3) *Seasonality*: the concentration of tourist flows from market j outside the high season, with the latter being defined, for Andalusia, as the summer (3rd quarter of the year). A lower concentration of tourists in the high season, in favor of the rest of the year, is considered more desirable.

(4) *Average length of stay*: the average number of days that tourists from market j spend in Andalusia. A longer stay is considered more desirable, as it implies a greater total expenditure at the destination.

(5) *Expenditure*: the total expenditure made by tourists from market j on their trip to Andalusia. A higher expenditure is considered more desirable as it means the market is more profitable.

(6) *Connectivity*: the market share of Andalusia, as a destination, in the total air supply of market j. A higher share is considered more desirable as a greater weight, or connectivity, favors accessibility to the destination and, thus, a greater predisposition to visit it. For markets where most of their tourists arrived in Andalucia by

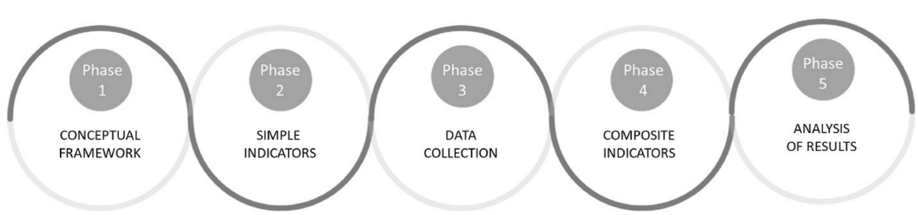

Fig. 1. Method steps.
Source: Authors.

road, connectivity was set as 100 (the maximum value), since the markets had no supply restrictions on travel to the destination.

On the environmental costs side.

(7) *Carbon footprint*: the CO_2 emissions generated by tourists from market j, according to their means of transport and the distance travelled from their origin to Andalusia, as well as the type and category of their accommodation in Andalusia. It is considered that the lower the carbon footprint, the more desirable the market is, due to its lower impact on climate change.

3.2. Phase 2: Identification of simple indicators

After defining the key aspects of the benefit and cost dimensions in Phase 1, we identified indicators that best approximated their measurement (Table 1). For simplicity, we chose to work with one indicator for each of the six aspects included in the benefit dimension ($q_{1j} - q_{6j}$). For the cost dimension's aspect, we selected two indicators to show different perspectives on carbon footprint: per overnight stay (q_{7j}) and per trip (q_{8j}).

All six of the economic benefit dimension indicators are incremental, meaning that an increase in their value signifies a greater attractiveness of the market. The two environmental cost indicators, q_{7j} and q_{8j} are not incremental, as a lower value implies a lower environmental impact and therefore, a more desirable market.

3.3. Phase 3: Data collection

A key issue is the availability of data to calculate indicators (Torres-Delgado & López Palomeque, 2014). Therefore, we conducted an exhaustive review of the national and regional statistical sources to determine the scope of the indicators defined in the previous phase. Priority was given to the use of statistical information already available using rigorous methodologies, preferably from government sources that is statistically representative, longitudinally availability and of homogeneous comparability (see Gallego & Font, 2019). We selected the 17 markets that constituted 95.3% of all tourists visiting Andalusia in 2022, namely: residents of Andalusia travelling within the region, domestic tourists from the rest of Spain (not including Andalusia), Germany, Belgium, France, Ireland, Italy, Netherlands, Norway, Denmark, Finland, Sweden, Portugal, UK, Russia, Switzerland and USA. The inclusion of regional and national tourists alongside international markets was deliberate, to compare their economic and carbon efficiency, although this approach is unusual as tourism marketing strategies tend to focus on attracting international markets.

For the economic benefits dimension, we used three statistical data sources from the Spanish National Institute of Statistics (INE): to obtain data from foreign markets, we used the Tourist Movement on Borders Survey - FRONTUR (INE, 2023a) and the Tourist Expenditure Survey - EGATUR (INE, 2023b); to discover the placement of Andalusia within the national markets (Andalusia and the rest of Spain), we used the Residents Travel Survey - FAMILITUR (INE, 2023c). The rest of the data for Andalusia and the rest of Spain were collected from the Survey of Tourism Situation of Andalusia prepared by the Andalusian Regional Institute of Statistics (IECA, 2023). These official sources disseminate information on their websites, but cross-referenced market information for Andalusia, which this investigation required, was not published. For this reason, we obtained most of the information to prepare the indicators by exploiting the sources' microdata, which can be downloaded from the INE website or, for the IECA, through an express request.

We are aware that there is usually an information asymmetry in economic and environmental data (Sun & Higham, 2021). Hence, for the environmental cost dimension, the carbon footprint emitted by each market was estimated using the open source SusTPol_Carbon Footprint Calculator (Torres-Delgado & Font, 2023). According to the three principles for carbon inventories proposed by Sun, Cadarso, and Driml (2020), the SusTPol calculator follows the principle of allocating emissions to the territory where the tourism activity occurs (recipient allocation). The scope of tourism consumption was intentionally restricted to accommodation and tourist transport to the destination, as these are the main emission focuses, and we deliberately did not include internal mobility or activities that tourists undertook at the destination (Gössling et al., 2023; Rico et al., 2019) because of the additional complexity of using such data for a methodology that is for illustrative purposes. We believe that our simplified format makes the data more easily collected, making our composite indicator much more replicable by other destinations, and we knowingly favor an incomplete but implementable

Table 1
Simple indicators grouped into two dimensions: ECONOMIC BENEFIT and ENVIRONMENTAL COST.

Dimension	Key aspect	Indicator	Definition	Preferred indicator trend	Desirable market
ECONOMIC BENEFIT	Leadership	q_{1j}	Percentage of tourists from market *j* who arrive in Spain and choose Andalusia as the main destination of their trip.	↑	Markets for which this destination has a high share.
	Dynamism	q_{2j}	Variation rate of the number of tourists from market *j* in 2022 compared to 2019 (pre-COVID 19).	↑	Markets that have reached, or exceeded, their pre-COVID 19 levels.
	Seasonality	q_{3j}	Percentage of stays from market *j* in Andalusia outside the summer months (July–September).	↑	Markets with a high concentration of tourists outside summer season.
	Length of stay	q_{4j}	Total number of days that tourists from market *j* stay in Andalusia.	↑	Markets with a long stay.
	Expenditure	q_{5j}	Average daily expenditure (€) per person from market *j*, in Andalusia.	↑	Markets with a high expenditure.
	Connectivity	q_{6j}	(1) For markets where the use of the plane to reach Andalusia exceeds 50% (all foreign markets, except Portugal, see Table 2): the percentage of seats offered by airlines to Andalusia out of the total seats offered from market j to Spain. (2) For markets where car use to reach Andalusia exceeds 50% (Andalusia, Rest of Spain and Portugal, see Table 2): total connectivity 100%, considering that they have no supply restrictions on travel to the destination.	↑	Markets with a high transport connectivity.
ENVIRONMENTAL COST	Carbon Footprint	q_{7j}	Total carbon footprint equivalent per tourist/night from market *j*.	↓	Markets with a low carbon footprint per tourist/night.
		q_{8j}	Total carbon footprint equivalent per tourist/trip from market *j*.	↓	Markets with a low carbon footprint for a whole trip.

Source: Authors

methodology over one that is exhaustive but less likely to be adopted.

Therefore, our simple method only requires information on the means of transport (Table 2) and types of accommodation used by tourists (Table 3), as well as their spending and average stay in Andalusia. All these data are publicly available and have been obtained from previous sources (IECA, 2023; INE, 2023a; INE, 2023b; INE, 2023c) and complemented with data from the Hotel occupancy survey-EOH (INE, 2023d) that provides a breakdown of travelers in hotels by category (Table 3). This breakdown is especially relevant given significant differences in CO_2 emissions.

The carbon footprint indicators were available for the selected markets, except the type of accommodation for travelers from Norway, Denmark, Finland and Sweden. In this case, we input the aggregate data (Nordic Countries) for all four countries.

The calculation of the carbon footprint required us to estimate the average distance travelled by each market to reach Andalusia according to the type of transport used. Here, we made a substantial effort to estimate point by point the distances travelled for the main forms of transport: Flight and Car, which together account for over 83% of all journeys made towards Andalusia by markets and exceed 98% in 14 of the 17 markets analyzed (Table 2). First, through ForwardKeys (2023), a company that supplies big data from the aviation industry, we calculated the flights for all markets as pairs (origin airport – destination Andalusian airport) by calculating a weighted average distance according to the number of seats offered on each route. Second, we calculated road travel for national markets (Spanish province of origin – Andalusian province of destination) through the dataset of tourist behavior based on their use of mobile phones (INE, 2023e). In both cases, we calculated the weighted average distance according to the number of tourists estimated in the same source data. Third, we estimated the carbon data for foreign markets that access Andalusia by road or train and for whom information is not readily available. The distance between the capital of the country of origin and the city of Malaga, the main tourist spot in Andalusia, was imputed. The only variable that the method required (Torres-Delgado & Font, 2023) but that could not be estimated was the group size, which is necessary to calculate the carbon costs per passenger for car journeys, one approach could have been to use the average global travel group size, but this information was also not available, so ultimately we opted to assume individual travel, which we acknowledge will result in an overestimation of CO_2 emissions of car trips.

For other less common means of transport to the region, such as cruises and trains, estimates were made thanks to the information on routes to Andalusia provided by official authorities. For ships, a data request was made to the State Ports Authority. The number of passengers was not available, and only the distance from the port before or after Andalusia was available: hence we estimated the average distance weighted by the number of cruises for each route (State Ports Authority, 2023). For trains, a data request was made to the Spanish National Railway Network (RENFE, 2023); they provided information for the national market that allowed us to calculate the weighted average distance per passenger of each route to Andalusia.

Next, the application of emission factors was necessary, although these factors were not always destination-specific or readily available through open-access platforms. For all the means of transport, we obtained the emission factors needed to measure the carbon footprint of each market from the UK department DEFRA (2022). For the accommodation, we used multiple emission factors: Green View (2023) for hotels, Rico et al. (2019) for apartments and Bergk et al. (2020) for campsites. We summarize the data sources used in Table 4, for convenience and to encourage reproducibility.

3.4. *Phase 4: Building composite indicators*

Our composite indicator is the result of standardizing, weighting, aggregating and comparing multiple individual indicators, as suggested by OECD (2008). Some of the indicators are of the type 'more is better', and some others are of the type 'less is better' (see Table 1). We followed convention in the design of multicriteria, double-point reference methods, that is, by normalizing the position of each indicator against two reference values: (1) its reserve value (the acceptable level), and (2) its aspiration value (the desirable level) (see Cabello et al., 2014). Rather than determining these levels through expert opinions, we opted to follow a statistical procedure (Cabello et al., 2014), which we outline below. For indicator i of market j (i = 1, …, pk, j = 1, …, R), belonging to key aspect k, we eliminated atypical values and outliers, denoted q_{ki}^{max} and q_{ki}^{min} as the maximum and minimum values for each market and proceeded to calculate their mean value, q_{ki}^{av}, as:

$$q_{ki}^{max} = \max_{j=1,\dots,R} \left\{ q_{ki}^{j} \right\},\ q_{ki}^{min} = \min_{j=1,\dots,R} \left\{ q_{ki}^{j} \right\},\ q_{ki}^{av} = \frac{1}{R} \sum_{j=1}^{R} q_{ki}^{j}.$$

Hence, the levels of aspiration (q_{ki}^{a}) and reserve (q_{ki}^{r}) are as follows: When the indicator is of type "more is better"

$$q_{ki}^{a} = \frac{q_{ki}^{av} + q_{ki}^{max}}{2};\ \ q_{ki}^{r} = \frac{q_{ki}^{av} + q_{ki}^{min}}{2}$$

When the indicator is of type "less is better"

Table 2
Distribution of tourists per market according to the means of transport used to travel to Andalusia. Year 2022.

MARKET	Transport mode (%)							
Origin	Flight	Rail	Car	Coach	Cruise	Motorbike	Other	Total
Spain (not including Andalusia)	24.2%	11.7%	59.4%	1.8%	0.4%	0.1%	2.3%	100.0%
Andalusia	6.1%	10.6%	78.9%	2.7%	0.02%	0.1%	1.6%	100.0%
Germany	90.2%	0.080%	9.0%		0.8%			100.0%
Belgium	90.0%	0.039%	8.3%		1.6%			100.0%
France	56.5%	0.122%	40.4%		3.1%			100.0%
Ireland	98.1%	0.006%	1.0%		1.0%			100.0%
Italy	95.3%	0.000%	2.8%		1.9%			100.0%
Netherlands	93.3%	0.183%	5.3%		1.2%			100.0%
Norway	98.4%	0.000%	1.5%		0.1%			100.0%
Denmark	98.7%	0.000%	1.3%		0.0%			100.0%
Finland	99.2%	0.000%	0.5%		0.3%			100.0%
Sweden	97.2%	0.000%	2.4%		0.4%			100.0%
Portugal	9.1%	0.008%	90.7%		0.2%			100.0%
UK	97.2%	0.061%	1.9%		0.9%			100.0%
Russia	100.0%	0.000%	0.0%		0.0%			100.0%
Switzerland	92.4%	0.233%	7.0%		0.4%			100.0%
USA	96.9%	0.464%	2.0%		0.6%			100.0%

Source: Authors, based on INE, 2023a; IECA, 2023.

Table 3
Distribution of tourists per market according to the type of accommodation used in Andalusia. Year 2022.

MARKET	Type of accommodation (%)							
Origin	Hotel 1*-2*	Hotel 3*	Hotel 4*	Hotel 5*	Apartment	Campsite	Other	Total
Spain (not including Andalusia)	2.1%	34.0%	13.2%	15.4%	31.8%	0.7%	2.8%	100.0%
Andalusia	1.8%	29.7%	11.5%	13.4%	38.8%	1.4%	3.3%	100.0%
Germany	4.5%	39.7%	9.4%	10.1%	30.6%	3.1%	2.7%	100.0%
Belgium	4.9%	37.9%	9.7%	7.9%	37.1%	1.5%	1.0%	100.0%
France	3.4%	32.0%	14.0%	11.5%	30.8%	5.0%	3.3%	100.0%
Ireland	4.8%	42.4%	11.1%	5.6%	35.0%	0.2%	0.8%	100.0%
Italy	2.7%	32.8%	16.4%	18.6%	26.2%	0.8%	2.4%	100.0%
Netherlands	4.2%	38.4%	14.8%	9.3%	30.7%	1.5%	1.0%	100.0%
Norway	4.2%	29.2%	8.4%	5.2%	51.1%	0.3%	1.6%	100.0%
Denmark	3.4%	28.1%	10.2%	5.3%	51.1%	0.3%	1.6%	100.0%
Finland	2.9%	27.1%	10.5%	6.5%	51.1%	0.3%	1.6%	100.0%
Sweden	4.9%	27.1%	9.6%	5.5%	51.1%	0.3%	1.6%	100.0%
Portugal	3.1%	35.6%	9.6%	7.7%	39.1%	1.7%	3.2%	100.0%
UK	5.9%	37.9%	10.0%	6.2%	38.4%	0.6%	1.0%	100.0%
Russia	12.9%	42.9%	17.9%	16.8%	9.5%	0.0%	0.0%	100.0%
Switzerland	6.8%	33.0%	9.9%	8.5%	38.4%	1.9%	1.5%	100.0%
USA	10.3%	43.8%	11.0%	7.5%	25.3%	0.1%	2.0%	100.0%

Source: Authors, based on INE, 2023b; INE, 2023e; IECA, 2023.

Table 4
Sources used in the calculation of simple indicators.

Dimension	Key aspects	Indicator	Sources
ECONOMIC BENEFIT	Leadership	q_{1j}	FAMILITUR. Spanish National Institute of Statistics (INE). FRONTUR. Spanish National Institute of Statistics (INE).
	Dynamism	q_{2j}	ECTA. Andalusian Regional Institute of Statistics (IECA). FRONTUR. Spanish National Institute of Statistics (INE).
	Seasonality	q_{3j}	ECTA. Andalusian Regional Institute of Statistics (IECA). FRONTUR. Spanish National Institute of Statistics (INE).
	Length of stay	q_{4j}	ECTA. Andalusian Regional Institute of Statistics (IECA). EGATUR. Spanish National Institute of Statistics (INE).
	Expenditure	q_{5j}	ECTA. Andalusian Regional Institute of Statistics (IECA). EGATUR. Spanish National Institute of Statistics (INE).
	Connectivity	q_{6j}	ForwardKeys.
ENVIRONMENTAL COST	Carbon Footprint	q_{7j}	FAMILITUR, FRONTUR, EGATUR, EOH and
		q_{8j}	Experimental statistics. Measurement of tourism using mobile phones. Spanish National Institute of Statistics (INE). ECTA. Andalusian Regional Institute of Statistics (IECA). State Ports Authority. Spanish National Rail Network (RENFE). ForwardKeys. DEFRA (2022) Green View (2023) ; Rico et al. (2019) Bergk et al. (2020)

Source: Authors.

$$q^{a}_{ki} = \frac{q^{av}_{ki} + q^{min}_{ki}}{2}; \quad q^{r}_{ki} = \frac{q^{av}_{ki} + q^{max}_{ki}}{2}$$

Next, we calculated the composite indicators for each key aspect k and market j. We continued to follow convention by calculating the individual achievement functions (S_{ki}) for each indicator i ($i = 1, \ldots, pk$), in the context of the reserve and aspiration reference points determined in the previous step (Cabello et al., 2014; Ruiz et al., 2011; Wierzbicki, 1980; Wierzbicki et al., 2000).When the indicator is of type "more is better":

$$S_{ki}\left(q^{j}_{ki}, q^{a}_{ki}, q^{r}_{ki}\right) = \begin{cases} 1 + \dfrac{q^{j}_{ki} - q^{a}_{ki}}{q^{max}_{ki} - q^{a}_{ki}} & \text{if } q^{a}_{ki} \leq q^{j}_{ki} \leq q^{max}_{ki}, \\ \dfrac{q^{j}_{ki} - q^{r}_{ki}}{q^{a}_{ki} - q^{r}_{ki}} & \text{if } q^{r}_{ki} \leq q^{j}_{ki} \leq q^{a}_{ki}, \\ \dfrac{q^{j}_{ki} - q^{r}_{ki}}{q^{r}_{ki} - q^{min}_{ki}} & \text{if } q^{min}_{ki} \leq q^{j}_{ki} \leq q^{r}_{ki}. \end{cases}$$

When the indicator is of type "less is better":

$$S_{ki}\left(q^{j}_{ki}, q^{a}_{ki}, q^{r}_{ki}\right) = \begin{cases} 1 + \dfrac{q^{j}_{ki} - q^{a}_{ki}}{q^{min}_{ki} - q^{a}_{ki}} & \text{if } q^{min}_{ki} \leq q^{j}_{ki} \leq q^{a}_{ki}, \\ \dfrac{q^{j}_{ki} - q^{r}_{ki}}{q^{a}_{ki} - q^{r}_{ki}} & \text{if } q^{a}_{ki} \leq q^{j}_{ki} \leq q^{r}_{ki}, \\ \dfrac{q^{j}_{ki} - q^{r}_{ki}}{q^{r}_{ki} - q^{max}_{ki}} & \text{if } q^{r}_{ki} \leq q^{j}_{ki} \leq q^{max}_{ki}. \end{cases}$$

Hence, this normalization can be interpreted in the following way for any type of variable ("more is better" or "less is better"): a tourist market has a value below its reserve level for a given indicator when (S_{ki}) < 0, which indicates that the key aspect that the indicator relates to is a weak point that makes the market less attractive for the tourist destination. Moreover, a market has a value between the reserve and aspiration levels [(S_{ki}) between 0 and 1] or above the aspiration level [(S_{ki}) > 1] for each key aspect (see Fig. 2). The higher the value, the higher the attractiveness of that market in relation to that aspect.

We calculated the performance for each indicator corresponding to each key aspect, and next we grouped these indicators into a composite

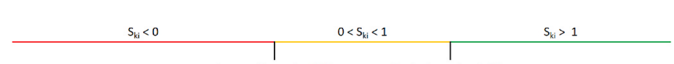

Fig. 2. Values of the individual achievement function (S_{ki}).
Source: Authors, based on Ruiz et al. (2011); Gallego and Font (2019).

indicator as the weighted sum. For illustration purposes, for market j, we had:

$$I^j = \sum_{i=1}^{p_k} \omega_{ki} S_{ki}\left(q_{ki}^j, q_{ki}^a, q_{ki}^r\right)$$

The composite indicator (I^j) was the result of compensations between key aspects according to the weightings allocated (ω_{ki}). Rather than allocating the same weightings to each key aspect, we use the weightings obtained from the survey conducted for the Tourism Marketing Plan of Andalusia's decision-making team (see section 3.1). It is important to note that the survey was conducted before the team saw the results from the different markets, to avoid bias in their weightings. The weights allocated to each simple indicator (see Table 5) show that the decision-making team gave greatest importance to those markets that help to reduce seasonality and those that have high average daily expenditure. The two indicators related to the carbon footprint were valued equally.

This part of the process allows not only an adaptation to the different tourist realities and planning objectives, but it is also useful to simulate different scenarios in decision making by destination managers (Gallego & Font, 2019). To test the versatility of the method, once the individual indicators are weighted by the decision-makers, the results (section 4) simulate three scenarios according to the relevance given to the two dimensions of the model (economic benefit and environmental cost):

Scenario 0 (Benefit: 100%; Cost: 0%): The cost is not considered, only the benefit. This scenario simulates the traditional decision-making approach towards selecting target markets by DMOs.

Scenario 1 (Benefit: 75%; Cost: 25%): Cost indicators are incorporated, and the weights of both dimensions are defined by the number of indicators in each (Benefit: 6/8 = 75% and Cost: 2/8 = 25%). This option was chosen by the managers of the Andalusia DMO within the framework of this research.

Scenario 2 (Benefit: 50%; Cost: 50%): This is the most idealized scenario where both dimensions are equally weighted.

3.5. Phase 5: Data analysis

The final step in the process was the data analysis to classify the markets and identify their strengths and weaknesses. A ranking of market desirability was developed (from the best to the worst market for Andalusia) for the three proposed scenarios, and the differences in the positions of each market were analyzed. The results were contrasted considering only the benefits, as is more commonly done by DMOs and, particularly, in our case study of Andalusia, versus the incorporation of costs according to the weight given (25% in scenario 1 and 50% in scenario 2).

To facilitate reproducibility, we have prepared an online appendix with a step-by-step calculation of the composite indicator using the Belgian market in Andalusia as an example.

Table 5
Weighting of the key aspects informing the desirability of a market for Andalusia (where 1 means of little relevance to 5 very relevant).

Dimension	Key aspects	Indicator	Weight
ECONOMIC BENEFIT	Leadership	q_{1j}	2.7
	Dynamism	q_{2j}	3.2
	Seasonality	q_{3j}	4.8
	Length of stay	q_{4j}	3.8
	Expenditure	q_{5j}	4.8
	Connectivity	q_{6j}	3.9
ENVIRONMENTAL COST	Carbon Footprint	q_{7j}	3.8
		q_{8j}	3.8

Source: Authors.

4. Results

Applying the method outlined above, we established a single indicator that synthesizes all the key aspects collected on the desirability of markets. We did this by calculating the individual achievement functions (S_{ki}) for each aspect and market (Table 6). This allowed us to identify weaknesses (S_{ki} <0) and strengths (S_{ki} >1) and intermediate situations between the reserve value (acceptable level) and aspiration value (desirable level) [(S_{ki}) between 0 and 1]. Based on this data, we diagnosed the key aspects that made more or less desirable a market for Andalusia (Table 6).

Table 6 shows that all the markets, except France and Italy, present strengths (S_{ki} >1), but it is the regional Andalusian market that ranks as the most desirable market overall for Andalusia as a destination, both for its lower environmental cost ($q_{7Andalusia}$, $q_{8Andalusia}$ and $q_{9Andalusia}$) as well as leadership ($q_{1Andalusia}$), dynamism ($q_{2Andalusia}$) and connectivity ($q_{6Andalusia}$). However, the Andalusian market presents weaknesses in terms of length of stay ($q_{4Andalusia}$) and expenditure ($q_{5Andalusia}$), both of which have values below the reserve level (S_{ki} <0). The next most desirable markets are the Netherlands, Belgium and Ireland, which do not present any negative achievement functions and gather some aspect above the aspiration value. In the case of the Netherlands, its dynamism stands out ($q_{2Netherlands}$) as it is one of the few markets that had already reached the pre-COVID 19 volume of tourists in Andalusia. In the case of Belgium, its strong points are its length of stay in Andalusia ($q_{4Belgium}$) and its good air connectivity ($q_{6Belgium}$) to Andalusia. Belgium and Switzerland are the two only international markets with high achievement scores in relation to the indicator of CO_{2e} per tourist night. Finally, in the case of Ireland, only its connectivity ($q_{6Ireland}$), stands out as a strength, with the rest of the key aspects analyzed scoring between their reserve and aspiration values.

The least desirable markets are Russia and the United States, which, due to their distance from Andalusia, present both carbon footprint indicators with negative achievement functions. However, they both outperform other markets in relation to tourist spending ($q_{5Russia}$ and q_{5USA}), and the United States also contributes to reducing the seasonality of the Andalusian destination (q_{3USA}). Equally, France and Italy also stand out for their lack of suitability as they do not present any strength (S_{ki} >1).

Table 7 summarizes the rankings of the markets according to the overall desirability indicator based on the scenario considered (see section 3.4). Comparing the positions of the markets in the more traditional decision-making approach where only benefits matter (Scenario 0) versus those scenarios where environmental costs are considered (Scenarios 1 and 2), the markets can be grouped into three groups. First, those markets with unchanged positions, that retain their ranking across different scenarios. For example, France and Russia consistently occupy the two lowest positions. Second, those markets with minimal position changes. The Netherlands, Portugal, Switzerland, the UK, Germany, and Italy either maintain their position relative to Scenario 0 or move up/down by one position. And finally, those markets with significant changes. Among these, Andalusia and the rest of Spain show significant improvements, while Finland, Norway, and the USA lose positions, especially in Scenario 2, where costs are given equal weight as benefits.

Next, Fig. 3 visualizes the markets according to their degree of desirability for Andalusia in the scenario that seeks the greatest balance between economic benefits and environmental costs, at 50/50 on the Y axis (the higher up the axis, the greater the desirability) and their market shares in Andalusia's tourism demand on the X axis (the more to the right of the axis, the greater the market share within the tourist demand of the destination. We observe that there is a high dependence on domestic tourism, both the regional Andalusian market and tourists from the rest of Spain, with the Andalusian market having the highest desirability indicator. The three largest international markets for Andalusia: UK and Germany present a composite indicator of medium desirability,

Table 6
Achievement functions (S_{ki}) of the key aspects that determine the desirability of a market for Andalusia. Year 2022.

		ECONOMIC BENEFIT						ENVIRONMENTAL COST	
		q_{1j}	q_{2j}	q_{3j}	q_{4j}	q_{5j}	q_{6j}	q_{7j}	q_{8j}
MARKETS	ABR	LEADERSHIP	DYNAMISM	SEASONALITY	LENGTH OF STAY	EXPEDITURE	CONECTIVITY	CO_{2e} PER TOURIST NIGHT	CO_{2e} PER TOURIST TRIP
SPAIN (without Andalusia)	SPA	-0.33	1.02	-0.05	-0.08	-0.16	2.00	1.16	1.14
ANDALUSIA	AND	1.79	1.02	0.05	-0.26	-0.21	2.00	1.54	1.62
GERMANY	GER	-0.30	-0.02	1.04	1.06	0.11	0.12	0.94	0.19
BELGIUM	BEL	0.62	0.52	0.25	1.03	0.42	1.01	1.07	0.44
FRANCE	FRA	-0.13	0.19	-0.02	0.74	0.04	0.26	0.30	0.21
IRELAND	IRE	0.89	0.09	0.57	0.58	0.56	1.00	0.80	0.53
ITALY	ITA	-0.01	0.51	0.41	0.31	0.24	-0.06	0.65	0.61
NETHERLANDS	NET	0.49	1.04	0.73	0.66	0.84	0.94	0.63	0.42
NORWAY	NOR	0.55	0.08	0.08	1.02	0.73	0.12	0.09	-0.01
DENMARK	DEN	1.00	0.29	0.73	0.49	1.04	1.00	0.00	0.16
FINLAND	FIN	1.08	-0.09	1.11	1.02	0.96	0.61	-0.01	-0.03
SWEDEN	SWE	1.01	-0.02	1.04	1.02	0.69	0.74	0.00	-0.01
PORTUGAL	POR	0.76	1.04	-0.32	-0.27	0.45	2.00	0.18	0.96
UK	UK	0.31	-0.01	0.08	0.40	0.55	1.00	0.66	0.57
RUSSIA	RUS	0.01	-0.25	0.08	0.06	1.13	-0.99	-0.08	-0.08
SWITZERLAND	SWI	0.06	0.07	0.73	0.94	0.25	0.51	1.10	0.60
USA	USA	-0.11	0.42	1.18	0.93	1.31	-0.70	-0.08	-0.16

●$S_{ki} < 0$ The individual achievement function (S_{ki}) has a value below its reserve level = **weak point** that makes the market less attractive.
●$0 < S_{ki} < 1$ The individual achievement function (S_{ki}) has a value between the reserve and aspiration levels = **acceptable point** that makes the market attractive.
●$S_{ki} > 1$ The individual achievement function (S_{ki}) has a value above its aspiration level = **strong point** that makes the market more attractive.
The higher the value of the function, the more attractive that market is with respect to the key aspect.
Source: Authors.

Table 7
Ranking of markets according to the desirability indicator (I^j) for Andalusia (from most to least desirable) by each scenario. Year 2022.

ECONOMIC BENEFIT (50%); ENVIRONMENTAL COST (50%)			ECONOMIC BENEFIT (75%); ENVIRONMENTAL COST (25%)			ONLY ECONOMIC BENEFIT			DIFFERENCES IN RANKING	
SCENARIO 2			SCENARIO 1			SCENARIO 0			SCE. 0 SCE. 2	SCE. 0 SCE. 1
RANK	Desirability Index (I^j)	Market	RANK	Desirability Index (I^j)	Market	RANK	Desirability Index (I^j)	Market		
1	0.42	ANDALUSIA	1	0.48	NETHERLANDS	1	0.81	FINLAND	-4	-1
2	0.36	NETHERLANDS	2	0.46	FINLAND	2	0.79	NETHERLANDS	0	1
3	0.33	BELGIUM	3	0.44	DENMARK	3	0.77	DENMARK	-3	0
4	0.31	IRELAND	4	0.44	ANDALUSIA	4	0.76	SWEDEN	-3	-1
5	0.30	FINLAND	5	0.43	SWEDEN	5	0.62	BELGIUM	2	-1
6	0.30	DENMARK	6	0.40	BELGIUM	6	0.61	IRELAND	2	-1
7	0.29	SWEDEN	7	0.39	IRELAND	7	0.61	ANDALUSIA	6	3
8	0.29	SPAIN (without AND)	8	0.35	PORTUGAL	8	0.59	USA	-5	-1
9	0.28	PORTUGAL	9	0.29	USA	9	0.55	PORTUGAL	0	1
10	0.25	SWITZERLAND	10	0.29	SPAIN (without AND)	10	0.46	SWITZERLAND	0	-1
11	0.23	UK	11	0.28	SWITZERLAND	11	0.43	NORWAY	-4	-3
12	0.22	GERMANY	12	0.26	UK	12	0.40	UK	1	0
13	0.19	USA	13	0.26	GERMANY	13	0.39	GERMANY	1	0
14	0.17	ITALY	14	0.25	NORWAY	14	0.38	SPAIN (without AND)	6	4
15	0.17	NORWAY	15	0.18	ITALY	15	0.24	ITALY	1	0
16	0.10	FRANCE	16	0.12	FRANCE	16	0.18	FRANCE	0	0
17	0.01	RUSSIA	17	0.03	RUSSIA	17	0.06	RUSSIA	0	0

Source: Authors.

while France presents low desirability. Other markets with a smaller market share, such as the Netherlands (2.2%), Belgium (1.5%) or Ireland (1.4%), are more attractive for Andalusia.

5. Discussion

This study responds to calls to develop decarbonization strategies for the tourism industry (Gössling et al., 2015; Peeters & Papp, 2024; Sun, Cadarso, & Driml, 2020; The Travel Foundation, 2023). DMOs have blamed the complexity of capturing carbon footprint data as part of the reason for not incorporating it in their business models (Modica et al., 2018; UNWTO, 2023). We are aware that the scope of carbon reduction policies depends on data availability (Gössling et al., 2023; Seyfi et al., 2022). Accordingly, we have developed and piloted a transparent, and relatively simple, method to help DMOs to understand the carbon implications of their target markets and, consequently, their segmentation decisions.

We argue that a cost-benefit composite indicator of market segments that includes carbon footprint indicators and, thus, provides a new perspective on the attractiveness of different markets, may display a

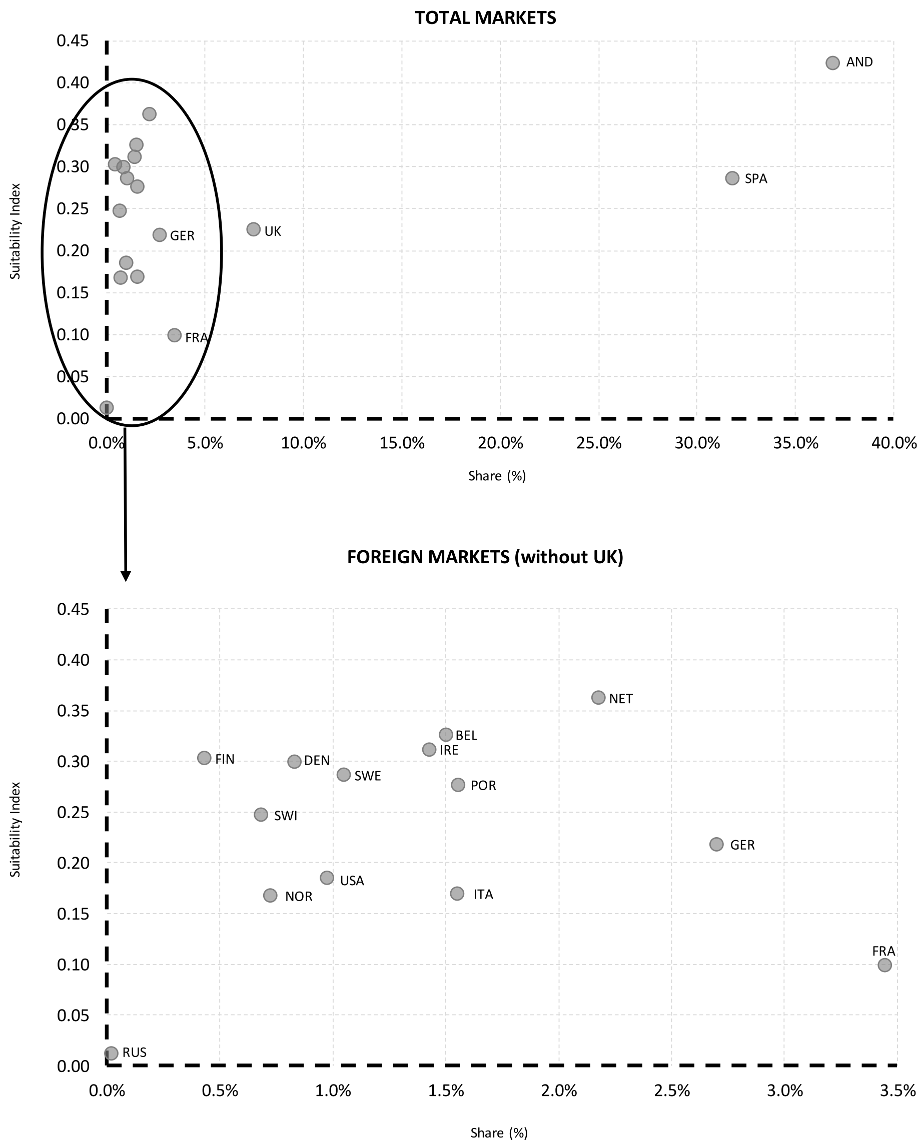

Fig. 3. Market matrix for Andalusia in scenario 2 (economic benefit:50%; environmental cost:50%). Year 2022.
Source: Authors.

clear path to optimize target market decisions (Guix et al., 2024; McElroy & Albuquerque, 2002; Sun, Cadarso, & Driml, 2020) and consequently minimize the effort necessary to embed sustainability data in decision-making (Vessey, 1994). While decarbonization is often seen as an impossible task by DMOs, a zero-emissions tourism scenario can accommodate growth, if it is redistributed towards decarbonized subsectors and resulting from short-distance markets (Peeters & Papp, 2024). The method developed in this study provides a standardization of indicators and a traffic light system that, together, make the indicators easily comparable and highly appealing to inform decisions (Cabello et al., 2014). We argue that this type of indicator is easier to communicate than raw data and may be useful to raise the awareness, and knowledge, of both costs as well as benefits of tourism, which is essential for the industry to transition towards actual decarbonization (The Travel Foundation, 2023).

Given the importance of data availability to calculate indicators (Torres-Delgado & López Palomeque, 2014; Gallego & Font, 2019), we make the thoughtful decision to use of comparable and harmonized official statistics that are required by the European Statistical Program (EUROSTAT, 2023) from the National Statistical Institutes of its Member States, and that, therefore, every DMO, at least until NUT2, should have access to. We understand that different DMOs use different methods to prioritize markets, hence we create a system that is highly transferable. We suggest that each destination revises the criteria, indicators and weighting we propose, adding or incorporating those that suit their reality, depending on data availability and policymakers' priorities. As this is a demonstration project only, we limit ourselves to using a single indicator for each key aspect; however, we understand that more sophisticated systems could be used, for example, we know that some target markets are relatively small countries, where there is a limit to the demand that can be generated and, therefore, DMOs may choose to allocate budgets proportionally to the total population of a country. We argue that the specific choices of indicators made here do not invalidate the method. Our aim here is to mirror current systems, while facilitating the addition of new data points to make their integration into target market selection practices more realistic. We believe that the priority here is for DMOs to start to consider data on environmental costs, not only economic benefits, as inputs to their target market decisions. Any adjustments in market targeting because of including costs in decision-making may enhance optimization in terms of competitiveness for the destination (McElroy & Albuquerque, 2002), yielding greater benefits and/or less harm compared to the baseline without (substantially) changing the number of tourists.

Measuring benefits and not costs is common practice among governments in general (Schmelzer, 2015) and DMOs in particular (Gössling & Higham, 2021; Sun & Higham, 2021; UNWTO & UNEP, 2019). Hence, we choose to tentatively experiment with two carbon footprint indicators indicative of some of environmental costs. We acknowledge that different destinations may want to use different indicators according to their target marketing practices and that they may want to experiment with other carbon indicators. We hope that destinations in future may consider at least one of the two carbon indicators and that they will give environmental cost indicators as much weighting as their political realities allow (Crabolu, Font, & Eker, 2023; Dredge & Jenkins, 2011; Moniche & Gallego, 2023).

It's worth acknowledging at this point that a certain pragmatism is required in the choice of environmental cost indicators, to ensure that the decision-making team of a destination will accept the importance of these indicators and that their market research team will be able to get data without incurring costs that would make it easy to dismiss the indicators. More environmental cost indicators could be used, for example indicators of negative impacts of tourism beyond carbon, but such data was not available within the administrative system at the time of this study, and since the impact would not necessarily vary across markets, the researchers felt it would not be helpful for target marketing purposes. Furthermore, expanding the range of costs to include non-carbon data would disproportionately increase the effort required for data collection, hence for pragmatic reasons our study proposes that DMOs first work on carbon data, and once the principle of decision-making is based on cost-benefit analysis, the 2.0 version can incorporate other economic, environmental or social cost variables.

Our results provide further empirical evidence, but using a different method, that inbound air travel needs to be accounted for in a destination's carbon inventory (Lenzen et al., 2018). We confirm how transport (primarily air and road) is the biggest contributor to emissions, and that changes in marketing mix that account for long haul carbon footprints can make a significant difference (Gössling et al., 2016; Peeters & Papp, 2024). This is concerning as the literature shows tourism is the sector with the largest growth (Gössling et al., 2023; Happonen et al., 2023; Lenzen et al., 2018). Peeters and Papp (2024) evidenced how conventional climate measures, such as carbon offsetting, technological efficiencies and sustainable aviation fuel, are insufficient to change the emissions trajectory, and that DMOs cannot absolve themselves of responsibility towards decarbonization by expecting that technology will solve the problem. However, they also showed that under a zero-emissions tourism scenario, the number of tourists, guest-nights, and revenues can be kept as in business as usual, if distances travelled do not grow until mid-century (Peeters & Papp, 2024). Accordingly, implementing all the available measures *plus* a policy of reducing the growth of aviation and long-haul trips seems to be the only way for society to realistically work towards a net zero target by 2050. Our results further confirm that marketing to domestic markets, while demarketing long-haul markets, might be a bold first step to lowering the carbon footprint of tourist arrivals (Gössling et al., 2015; Gössling et al., 2016; Guix et al., 2024; Luo et al., 2018). Encompassing low-carbon markets, and targeting latent tourism demand segments by type of tourism, seasonality and expected expenditure (Cazorla-Artiles & Eugenio-Martin, 2023; Oklevik et al., 2019), could increase both the sustainability and competitiveness of destinations.

Yet, we acknowledge that what we propose in this method is an improvement of the business-as-usual model and not the systemic change that has been called for elsewhere (Becken, 2019; Gössling & Schweiggart, 2022), as we "only" aim to reduce tourist emissions per unit of tourism value created (Gössling & Higham, 2021). Sustainability data can be perceived as dissonant to DMOs' interests (Alkin & King, 2017), contravening the growth mindset that underpins most destination marketing strategies (Conefrey & Hanrahan, 2022; Scott, 2021), which makes DMOs reluctant to change behaviors. Therefore, a dissonant evaluation of carbon footprint data may arise from a fear of unsatisfactory outcomes, which may lead to legitimizing established actions and delaying decisions, thus, protecting the status quo (Alkin & King, 2017).

We argue that a cost-benefit composite indicator, coupled with a toolkit of options to improve performance, can downplay this threat. Demarketing to the highest carbon intense source markets may be resisted by DMOs, and the breath of this composite indicator gives a much wider set of choices, not only to reduce the average distance travelled, but also to improve transport efficiencies, promote transport modal shifts, increase lengths of stay and increase expenditure per trip, amongst others (see Gössling & Higham, 2021; Luo et al., 2018; Oklevik et al., 2019). Such a range of choices may be more palatable for a DMO that is only beginning to come to terms with the impact of the EU's Fit for 55 Strategy (European Council, 2023). Having said that, policies replacing international tourism with domestic, to reduce carbon emissions, will also need to consider unintended rebound effects, such as increases in carbon-intense expenditures in other parts of the economy, as well as overcrowding of domestic tourism resources without the appropriate infrastructure (Seyfi et al., 2022), which are issues outside the scope of the current study.

If DMOs acknowledged climate change evidence, their marketing plans would vary substantially (Becken et al., 2020; Scott, 2021; Conefrey & Hanrahan, 2022; Gössling et al., 2016), and our results show that much more emphasis would be placed on attracting markets with a better income per carbon unit in the first instance. Andalusia was a useful destination for testing this method because each of its regional, national and international markets accounts for a third of its tourists in volume (Junta de Andalucía, 2023) — we acknowledge that many other destinations will have fewer options available to them. Andalusia is at a pivotal point, however, as specific actions were born from the General Plan for Sustainable Tourism in Anda lusia GOAL 2027, such as the Strategic Tourism Marketing Plan for the period 2024–2027. This plan was defined as we conducted this study and, for the plan, the destination marketing managers had to choose the best markets to target in their marketing strategy. This study was developed to inform such policy decisions, by incorporating the vision of sustainability through the carbon footprint that each market generates on its trip to Andalusia, in addition to the traditional market selection criteria based on tourist benefits. Our indicator challenges conventional promotion practices in the tourism industry. Previously favored markets for travel to Andalusia (such as Finland, Norway, and the USA) are now being reassessed by weighing their benefits against their costs. However, the current national and regional plans call for a shift in the tourism model—a sentiment echoed by both public and private stakeholders. We are encouraged that the Andalusian DMO engaged in this project demonstrates an initial willingness to consider carbon data as a possible variable to inform target marketing and segmentation, yet we are fully aware of the complexity behind policymaking and governance decisions (Becken et al., 2020; Crabolu, Font, & Eker, 2023).

6. Conclusions

Accounting for benefits but not costs is flawed by definition and yet, DMOs everywhere in the world keep celebrating record arrivals in the number of international visitors as the only figure that matters, because costs can be treated as externalities (Gössling & Higham, 2021; Sun & Higham, 2021). Academics have long argued that the attractiveness of market segments can no longer be based exclusively judged on the benefits that the destination will gain from it, but must include the environmental costs that the planet pays as a result. If the organization, in this case a DMO, has narrow goals that only consider benefits and not costs, target marketing decisions will continue to ignore carbon footprint data. The contribution made by this study is not conceptual as these principles are well known, but methodological, by incorporating one environmental cost variable (carbon) as a determining factor in a decision-making tool to select target markets. We argue that considering this cost when valuing the attractiveness of tourist markets will optimize the demand mix in terms of pursuing long-term strategies to achieve carbon mitigation in tourism sector, as recently suggested by Guix et al. (2024). We are also acutely aware that this cannot be the only cost variable included in target marketing decisions, but we use it as an illustration of the need to incorporate new variables into the business-as-usual models used for segmentation and targeting (The Travel Foundation, 2023; Torres-Delgado et al., 2024).

There are some limitations in the current method, which we hope to address over time. Except for connectivity, the key aspects included in the benefits dimension could all be approximated with data offered by EUROSTAT for any European destination, offering comparable and harmonized figures. But the environmental cost dimension requires more detailed data on the origin of tourists according to the different means of transport or other tourism emission aspects (such as food, activities, and retail) and indirect emissions (such as those from the supply chain). This data is currently not available, although we acknowledge that DMOs are improving their carbon inventories. In addition, it's worth noting that the emission factors we used only consider the direct effects on climate change (CO_2, CH_4, and N_2O) due to significant scientific uncertainty regarding the magnitude of the indirect effects of non-CO_2 aviation emissions (DEFRA, 2022). While this ensured consistent results in our carbon footprint measurement, as data quantity and quality improves, the calculations will need to be updated. The method will also improve as we see how it is utilized by DMOs, and we can adjust it to their needs as well as available data sources.

Impact statement

We are determined to engage with pioneering DMOs to slowly shift their views and create a window of opportunity for such data to be perceived as less threatening, while also encouraging stakeholders to demand such data to be made public and incorporated into policy decisions. Results from this study have been: i) used in one-to-one mentoring for DMOs members of the network NECSTouR, with the DMO of Andalusia taking the lead, ii) presented to over 80 heads of market research and heads of sustainability from European DMOs, during the CityDNA AGM in October'23; iii) incorporated into the training for sustainable DMO governance delivered through the Travel Foundation and funded by Expedia; and iv) presented to the Board of the British Tourist Authority. We are in discussion with the European Travel Commission to pilot the methodology with national tourist boards of European Union member states.

CRediT authorship contribution statement

Inmaculada Gallego: Writing – original draft, Visualization, Methodology, Formal analysis, Data curation, Conceptualization. **Xavier Font:** Writing – review & editing, Writing – original draft, Supervision, Conceptualization. **Anna Torres-Delgado:** Writing – original draft, Validation, Conceptualization.

Declaration of competing interest

none.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.tourman.2024.105066.

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