

Google Trends in tourism and hospitality research: a systematic literature review

A systematic
literature
review

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Abstract

Purpose – This paper aims to conduct a review of the literature published, between 2006 and 2018, that used search engine data on tourism and hospitality research, namely, Google Insights for Search and Google Trends. More specifically, it intends to identify the purpose and context of the data use, ascertaining the main findings and reviewing the methodological approaches.

Design/methodology/approach – A systematic literature review of Scopus indexed research has been carried out. Given the novelty of search engine data use in tourism and hospitality research and the relatively low number of search results in Scopus, other databases were used to broaden the scope of analysis, namely, EBSCO and Google Scholar. The papers selected were subjected to content and statistical analyses.

Findings – Google Trends data use in tourism and hospitality research has increased significantly from 2012 to 2017, mainly for tourism forecasting/nowcasting; knowing the interest of users' searches for tourist attractions or destinations; showing the relationship between the official tourism statistics and the search volume index of Google Trends; and estimating the effect of one event on tourism demand. The categories and search terms used vary with the purpose of the study; however, they mostly focus on the travel category and use the country as the search term.

Originality/value – Google Trends has been increasingly used in research publications in tourism and hospitality, but the range of its applications and methods used has not yet been reviewed. Therefore, a systematic review of the existing literature increases awareness of its potential uses in tourism and hospitality research and facilitates a better understanding of its strengths and weaknesses as a research tool.

Keywords Google Trends, Tourism and hospitality, Systematic review, Search engine data, Google insights for search

Paper type Literature review

论酒店旅游研究中的谷歌趋势：文献回顾法

摘要

研究目的 – 本文回顾2006年至2018年发表文献使用酒店旅游相关的搜索引擎数据, 即Google Insights for Search 以及Google Trends。确切地说, 本文旨在研究数据使用目的和背景, 归纳主要研究成果和研究方法。



研究设计/方法/途径 – 本文采用Scopus索引。由于旅游酒店领域使用搜索引擎数据的文献较少, Scopus搜索结果样本量较低, 本文扩展到其他数据库, 即EBSCO以及Google Scholar。选定的样本文献采用文本分析和统计分析法。

研究结果 – 旅游酒店领域中对Google Trends数据使用的增加主要集中在2012年到2017年, 主要研究领域有 (1) 旅游预测/即时预报。 (2) 了解用户搜索旅游景点或目的地的需求。 (3) 官方旅游数据和Google Trends搜索量索引之间的关系。以及 (4) 评估大事件对旅游需求的影响。文献归类和搜索名词根据研究目的而不同。然而, 大多数文章使用‘旅游’归类以及使用国家作为搜索关键词。

研究原创性/价值 – Google Trends在酒店旅游领域研究中的使用逐渐增加, 但是据作者所知, 其应用的范畴和方法仍处在起步阶段。因此, 对现有文献的系统回顾可以提高对其在旅游酒店领域中应用的认知, 并且本文结果使其作为研究工具的优劣分析更深理解。

关键词 – Google Trends, Google insights for search, 搜索引擎数据, 旅游酒店研究, 系统文献回顾

1. Introduction

The rapid development of the internet led to the possibility to generate, store and access a large amount of data, which paved the way to the opening of the big data era. Big data is one of the buzzwords of the twenty-first-century, being studied in different scientific areas. Different researchers use diverse definitions, however, there are three defining properties or dimensions of big data introduced by Laney (2001) – “volume”, “variety” and “velocity” – being added “value” as the forth characteristic by Gantz and Reinsel (2011). Although there is no consensual definition, big data and big data technologies have contributed to the improvement of scientific research, including in tourism, where this concept is an emerging topic of research (Li *et al.*, 2018) with great prospects of application in academic studies and market research.

Despite being recent, there has been a great interest in using big data mainly to better understand consumer behaviour, which is constantly changing. Given that big data is too vast for traditional data management to handle (Sivarajah *et al.*, 2017), the use of big data analytics can be of great assistance to decision-making. It can be used to know patterns and trends and to offer the right services that suit the consumers’ preferences at the right time, contributing to enhance their tourism experience. Moreover, as timely information can be gathered in a simple way, and sometimes at no costs (Dimis *et al.*, 2017), it can be used to complement official statistics or create new indicators. In the scope of the European Union, Eurostat has already started exploring new sources for tourism statistics, leading to a pioneering project on using big data for official statistics (European Commission, 2014), which has become an important reference for statisticians interested in using big data. This work paved the way to other initiatives (European Commission, 2015) so as to debate the diversification of sources of big data (e.g. mobile positioning data, data using traffic control cameras, flight reservation systems’ data, payment cards data) and the enhancement and/or replacement of more traditional sources for tourism statistics.

According to Kaushik (2010), there are several tools that can be used to assist organizations in their strategies in big data analysis, which can be chosen according to the needs and financial, human and technical capacity of the organization. Some of these tools are associated with search engines, which are often referred to as the first step in the consumer decision-making process (Xiang and Fesenmaier, 2006). Google is the search engine with the largest market share in the world (90.1 per cent) (StatCounter, 2018), therefore stored data on consumers’ searches are representative of the internet users’ intentions and interest in a given topic.

In 2006, Google launched a tool named Google Trends to visualize the popularity of searches over time. Because of the good results achieved with this tool, two years later, it launched Google Insights for Search with the objective of providing statistics based on search volume patterns conducted in the Google’s search engine (Dimis *et al.*, 2013). In 2012,

Google Insights for Search was merged with Google Trends, including features from both products and a “new interface to give a clearer view of what’s on the world’s mind” (Mathias, 2012). In May 2018, it was updated with “new features, simpler navigation and more ways to explore data and stories around one of the world’s biggest journalistic data sets” (Smith, 2018).

Google Trends is a publicly available tool (<https://trends.google.com/>) that reports an index of the volume of Google queries, which can be filtered by category, search type, geographic location and time range. “Google Trends analyzes a portion of Google Web searches to compute how many searches have been done for the terms you enter, relative to the total number of searches done on Google over time” (Google, 2012a). To ensure that the underlying characteristics of the data sets can be compared, the query share is then normalized and scaled. This means that data sets are divided by a common variable to cancel out the effect of the variable on the data, so when the user compares the data from two different locations, interest is being compared, i.e. the proportion of searches rather than volume (Smith and White, 2011). Therefore, data are presented in relative values, instead of absolute numbers for the search volume, on a scale of 0 to 100. The value 100 represents the peak of search and all others are displayed as the search volume ratio in relation to this; the value 0 is displayed when the search volume is insufficient (Google, 2012b).

The data are available at a daily or monthly basis and can be visualized by interest over time, interest by subregion, top searches and related searches. Google Trends allows comparing search volume patterns by search terms. Users can specify until five entries of search terms or up to a maximum of 30 search terms grouped in a single entry using quotation marks, to return searches that match an exact expression, and use the “+” or “-” signs between the search terms to include or exclude search terms, respectively (Google, 2012c). The query index is available, with data since 2004, for several countries and some states or regions, and for different Google products (e.g. web, videos, image), being the search terms classified under 25 categories (one of them being “travel”) and 288 subcategories.

Google Trends data provide information, that is, not only available from other sources (e.g. official statistical data), being possible to be used to support decision-making in tourism but also to carry out market or academic research. Its advantages relate to its availability in a timely manner, on a regular basis, being easily upgradable, at no cost, and refer to a large amount of data representing the population from all over the world (Dinis, 2016). However, when analyzing and interpreting Google Trends data it is necessary to consider its inherent limitations and pitfalls. The most relevant ones are the use of relative rather than absolute volumes of searches; search terms may have different meanings in different languages, and, on the other hand, searches terms in just one language do not to capture all searches for a certain topic; search results are presented based on the internet protocol (IP) address, thus, existing the risk of including searches made by users that are not in the geographical location of the IP address, for instance in case of using virtual personal networks (VPN); it does not present results for search terms with low search volume, thus, eliminating searches with less common or unusual terms, more restricted time intervals or certain geographical locations (Smith and White, 2011). It is necessary to bear in mind these limitations and pitfalls while analyzing Google Trends data, therefore, for a better understanding of the tourism phenomena, big data should be used as a complement to other data statistical sources and not as a substitute.

Due to this granularity and classification, Google Trends data have been used by researchers of different areas of knowledge, notably from health sciences, economics, communication, marketing and cinema. It can be used to know, compare and predict the

behaviour and interests of the public on a certain subject, however, in existing papers the potentialities and limitations of the tool, as well as the purpose of the data and methodological choices of researchers, are still poorly understood and explored.

Although there has been an increasing number of studies using this data in tourism and hospitality research (Chamberlin, 2010; Saidi *et al.*, 2010; Gawlik *et al.*, 2011; Artola and Galán, 2012; Artola *et al.*, 2015), they are still relatively scarce, remaining largely unknown to practitioners and scholars. Therefore, this paper aims to systematically review the literature that used Google Insights for Search or Google Trends to identify the purpose and context of the data use, ascertaining the findings that are of particular relevance and reviewing the methodologic approaches. A systematic review of the existing literature benefits both practitioners and academics, by increasing awareness about the topic and equipping them with knowledge on its use in tourism and hospitality research and facilitating a better understanding of its strengths and weaknesses as a research tool.

2. Methodology

This paper carries out a systematic literature review, to have a comprehensive view of the state-of-the-art on the use of Google Insights for Search or Google Trends in tourism and hospitality research, and possibly identifying future avenues for research. With this review, we aim to assess the articles published on this topic and get an overview of the purpose of the studies, the methods used to collect and analyze data, as well as the main findings. Given that it is one of the first reviews on this issue, the study has an exploratory objective. This section details how this literature review was conducted, describing the process of article selection and analysis, and presenting the research streams of the selected articles.

2.1 Selection of the articles

To select the publications to be analyzed in this paper, the Scopus and the EBSCOhost databases were used. These databases were selected due to being among the largest and most popular abstract and citation databases of peer-reviewed publications and widely used for literature reviews in the tourism area (Leung *et al.*, 2013; Damian and Suárez-Barraza, 2015; Martins and Costa, 2017; Dorcic *et al.*, 2018). Data collection were conducted on July 12th, 2018, using the following search string on the title, abstract and keywords: (“Google Trends” OR “Google Insights for Search”) AND (touris* OR travel* OR hospitality OR hotel*). The inclusion criteria relates to the year of publication, being limited to the period between 2006 and 2018, the language of publication (English) and the type of publication, which was limited to full-text articles published in refereed academic journals, following other review studies in different research areas in the tourism and hospitality fields (Leung *et al.*, 2013; Schuckert *et al.*, 2015; Cardoso *et al.*, 2017; Yang *et al.*, 2017; Ólafsdóttir and Tverijonaite, 2018). The selection process is presented on Figure 1.

The search yielded a total of 45 records (33 from Scopus and 12 from EBSCOhost), of which 13 were excluded for being duplicated or not meeting the inclusion criteria. In the second stage of analysis, titles and abstracts of retrieved publications were checked against eligibility requirements, and 10 articles that had no substantial use of Google Insights for Search or Google Trends data were also excluded. Each record was verified by two researchers to determine its inclusion for analysis, which was based on their joint agreement of its relevance to the purpose of the study. Despite this independent analysis, it is possible that personal bias may have existed. Nonetheless, the consensus of the researchers, experienced in IT and tourism, should have minimized it. To the 22 selected articles, 11 more

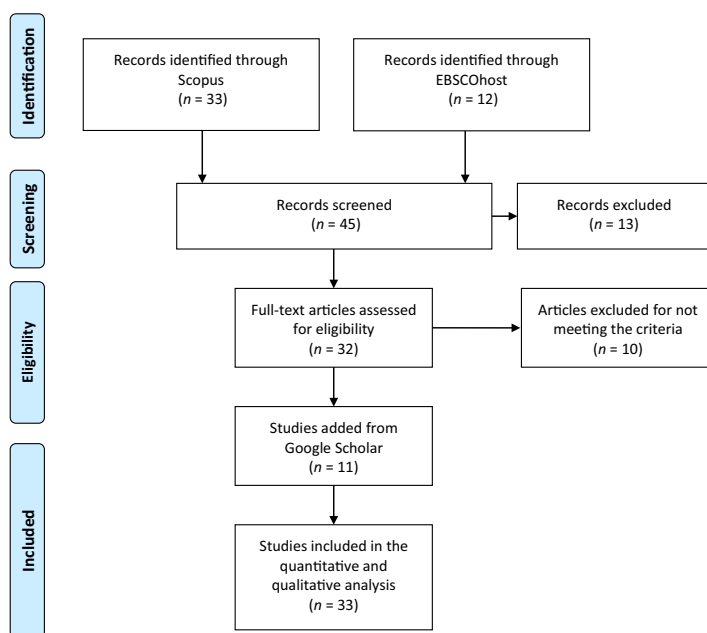


Figure 1.
PRISMA flow
diagram

were added from the review of daily Google Alerts received from 2012 to 2018 regarding new publications added to Google Scholar on this topic. The added papers followed the same inclusion criteria, that is, language and type of publication. To complement this analysis, a Google Scholar search was conducted to find publications prior to 2012. From this process, 11 new articles were added to the records. At the end, a total of 33 published studies were determined to be relevant and were included in the analysis.

2.2 Data analysis

Following the selection of publications, a systematic analysis was conducted on the selected articles, with data from each article being organized onto a table with several categories and associated concepts that were identified as relevant for the analysis of the articles: purpose, limitations and novelty of the study, methods' variables, type of analysis, primary findings and number of citations (Table I). If the information to be collected was not explicitly stated it was marked as not reported, and when it was not clearly evident it was marked unclear.

To ensure the accuracy and objectivity of the article assignment and minimize the probability of bias, two authors independently reviewed all the selected articles and assigned them to five research streams (Table II). If the study focus was multifaceted, as Google Trends data can be used in several ways, one study was assigned to more than one research stream.

3. Results

In this section, the characterization of the studies and the identification of the methods' variables are introduced. The key findings and discussions in the articles of each research stream are also presented and their limitations and contributions.

Category		Definition
Method variables	Purpose of the study	The main aim of the study, which was extracted to provide an overview of how researchers are using Google Trends and to facilitate the categorization of the research streams
	Object of the search	The object of the search that was chosen to study, be it a geographical area, a service or a company
	Time period searched	The time horizon that was chosen to conduct the study; this was abstracted in as much detail (year, month) as provided in the article
	Query category/subcategory	The query category that was chosen. The default category is “all categories”, if this was not explicitly stated, it was marked as not reported
	Data source	The use of Google Trends or Google Insights for Search
	Date of access	The date that Google Trends or Google Insights for Search was accessed
	Country of origin of the search	The location from which the data search was conducted
	Search tool	The type of search tool provided by Google used as data source (e.g. video, web, image, news, shopping, etc.)
	Periodicity of the data	The quantum of time (e.g. weekly, monthly) for which Google Trends data were used in time trend analyses
	Search input variables	The process used to select the terms used in the search
	Process of search terms' selection	
	Search terms	The terms that were used in the search to gain output
	Combination of terms	The use of “+” or “–” marks for search inputs that use more than one term, denoting an “OR” and “AND NOT” functions, respectively
	Type of analysis	The methodology used in terms of data processing and analysis
	Primary findings	The main findings of the article were abstracted to easily provide information on what each study found
	Limitations of the study	The limitations of the study and restrictions regarding the use of the tool were identified, when available
	Novelty of the study	The contribution and originality of the study were identified, when available
	Number of citations	The number of citations for an article were recorded to assess the leveraging of articles on this topic by academia

Table I.
Categories defined for the analysis

Source: Adapted from [Nuti et al. \(2014\)](#)

3.1 Characterization of the selected articles

In the search process, no articles were found until 2008, which might be due to the fact that Google Trends was only launched two years back. The first article published is [Wolk and Wöber \(2008\)](#) comparative study of information needs of city travellers in Europe, published in the journal “Information Technology and Tourism”. Sporadic articles were published between this year and 2015 when research on the topic began to emerge. As then, a general growth trajectory until current days is recorded. Although the articles of 2018 are only until July, the number of publications is the same as of the previous year, showing a clear sign of growing interest on the topic. The temporal distribution of articles can be seen on [Figure 2](#).

The 33 selected articles are published in 28 different journals, showing a wide dispersion of publication sources, ranging from the field of tourism and hospitality studies (12 journals), and several other areas, such as agricultural science, computer science, engineering, economics and business studies. The most featured journals are tourism management (4 articles), International Journal of Tourism Research (2 articles) and tourism

Research streams	Description	Publications
Forecasting	Studies that make predictions of the future based on past and present data, mostly by analyzing the trends	Artola <i>et al.</i> (2015) ; Bangwayo-Skeete and Skeete (2015) ; Choi and Varian (2012) ; Dergiades <i>et al.</i> (2018) ; Kim and Malek (2018) ; Önder (2017) ; Önder and Gunter (2016) ; Padhi and Pati (2017) ; Pan <i>et al.</i> (2012) ; Park <i>et al.</i> (2017) ; Rivera (2016) ; García Rodríguez (2017) ; Siliverstovs and Wochner (2018) ; Yang <i>et al.</i> (2015)
Nowcasting	Studies that examine how the data can be used to monitor trends as they happen, avoiding the time lag of official statistical releases	Antolini and Grassini (2018) ; Jackman and Naitram (2015)
Interest, popularity and consumer behaviour	Studies that aim to identify the interest and popularity of search terms related to tourism and hospitality or understand the consumer behaviour	Al-Kabi <i>et al.</i> (2012) ; Ballatore and Arsanjani (2018) ; Chang <i>et al.</i> (2017) ; Correia <i>et al.</i> (2018) ; Tang <i>et al.</i> (2018) ; Kuminoff <i>et al.</i> (2010) ; Lengyel (2015, 2016) ; Liu <i>et al.</i> (2017) ; Palos-Sanchez and Correia (2018) ; Wolk and Wöber (2008)
Relation between search engine data and official tourism statistics	Studies that relate the interest in travel of internet users with effective tourism demand	Chamberlin (2010) ; Dinis <i>et al.</i> (2016, 2017)
Estimation of the effect of one variable on another variable	Studies that estimate the effect of one event on tourism demand, the interest in a tourism destination or the use of tourism services	Fenichel <i>et al.</i> (2013) ; Rosselló and Waqas (2016) ; Palos-Sanchez and Correia (2018) ; Xu and Reed (2017)

Table II.
Research streams of
selected papers

management perspectives (2 articles). Of all the articles, Pan is the most significant author, with three publications, followed by Costa, Dinis, Guo, Kuminoff, Lengyel, Liu, Önder and Pacheco, each having published two articles on the topic, while the remaining 61 have just authored or co-authored one publication.

3.2 Purpose of the studies

The aims of the studies under analysis are manifold; however, it is possible to find some common aspects, which are in line with the research streams identified in [Table II](#). These relate essentially in using Google Trends to forecast or nowcast tourism demand in destinations, either countries or cities ([Antolini and Grassini, 2018](#)) or in specific tourism services, such as hotels ([Pan *et al.*, 2012](#)) and casinos ([Kim and Malek, 2018](#)). Other group of studies aims to identify the interest and popularity of search terms related to tourism and hospitality ([Al-Kabi *et al.*, 2012](#)) or understand online search behaviours of potential tourists choosing destinations using Google Trends data ([Padhi and Pati, 2017](#)). With less expression, there is also studies that aim to determine whether Google Trends data regarding tourism has similar distribution patterns, and therefore, is correlated to official tourism statistics ([Dinis *et al.*, 2016](#)). The last group of studies aims to estimate the effect of one event (e.g. pollution, pandemic influenza and weather) in tourism demand, the interest in a tourism destination or the use of tourism services ([Palos-Sanchez and Correia, 2018](#)).

[Figure 3](#) depicts the areas under analysis in the selected articles. The great majority (58 per cent) deals with studies that do not target any specific tourism subsector, mostly dealing with travel flows ([Artola *et al.*, 2015](#); [Park *et al.*, 2017](#); [Antolini and Grassini, 2018](#)), as these

Figure 2.
Evolution of the
number of articles by
publication year

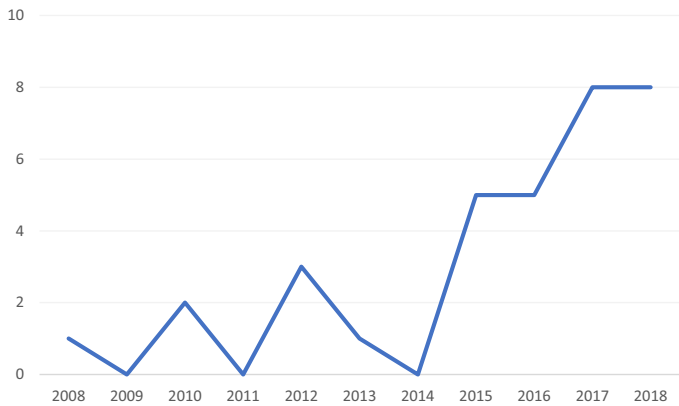
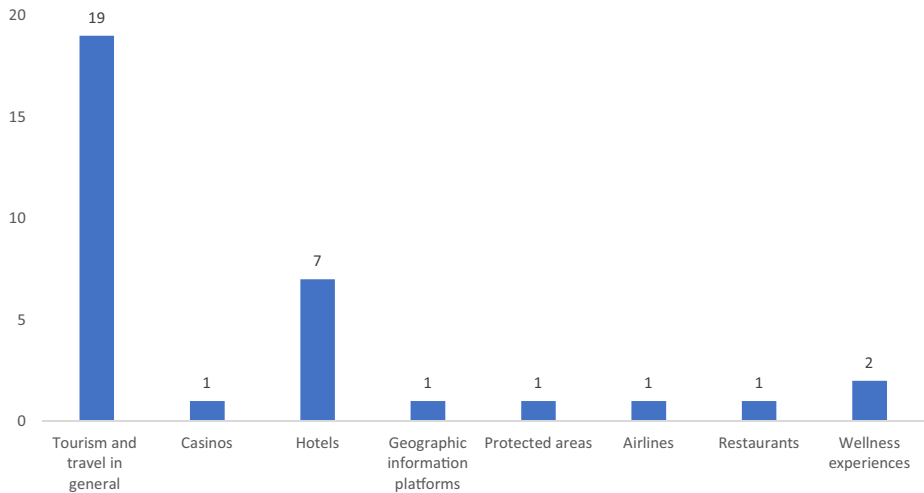


Figure 3.
The area under
analysis in the
selected articles



studies are linked with tourism demand forecast/nowcast in different geographical areas (e.g. Japan, Spain, China, Italy, South Korea, UK and USA). The second-largest category of studies focus on hotels (Wolk and Wöber, 2008; Kuminoff *et al.*, 2010; Pan *et al.*, 2012; Bangwayo-Skeete and Skeete, 2015; Rivera, 2016; Chang *et al.*, 2017; Liu *et al.*, 2017), being the rest scattered in other tourism services, such as casinos, restaurants and airlines (Fenichel *et al.*, 2013; Kim and Malek, 2018; Tang *et al.*, 2018), wellness experiences (Lengyel, 2015, 2016), protected areas (Correia *et al.*, 2018) and a geographic information platform (Ballatore and Arsanjani, 2018).

3.3 Methods variables

The *object of the search* in most of the studies (76 per cent) is a destination (either a country or a region), the remaining focussing on a specific service or company. The geographic location searched is mainly in Europe (52 per cent), with a prevalence of studies addressing

Spain and Portugal (Artola *et al.*, 2015; Dinis *et al.*, 2016, 2017; Rosselló and Waqas, 2016; García Rodríguez, 2017; Önder, 2017). Other searched destinations are located in Asia (24 per cent) – mainly China and South Korea (Fenichel *et al.*, 2013; Yang *et al.*, 2015; Park *et al.*, 2017; Xu and Reed, 2017; Kim and Malek, 2018) – and America (24 per cent), notably countries in the Caribbean. The maximum *time period searched* is 13 years, from 2004 until 2017 (Chang *et al.*, 2017), with each article considering, on average, 7.5 years in the analyses.

In only 33 per cent of the articles, the *query category or subcategory* was able to be identified: “travel” (Artola *et al.*, 2015; Jackman and Naitram, 2015; Önder and Gunter, 2016; Rivera, 2016; Önder, 2017; Antolini and Grassini, 2018), Hong Kong (Choi and Varian, 2012), “hotels and accommodations” (Dinis *et al.*, 2016, 2017) and “food and drink” (Tang *et al.*, 2018). One of the articles (Chamberlin, 2010) used more than one category (“travel”, “vacation destinations”, “hotels and accommodation”, “air travel” and “cruises and charters”).

Regarding the *data source*, given that Google Insights for Search was merged with Google Trends in 2012, it was used solely by Al-Kabi *et al.* (2012) and by Palos-Sanchez and Correia (2018), who resorted to both tools to extract data. The *date of access* to Google Trends was mentioned in only 12 per cent of the articles (Rivera, 2016; Antolini and Grassini, 2018; Ballatore and Arsanjani, 2018; Correia *et al.*, 2018) and 67 per cent identified the *country of origin of the search*, the remaining referring to worldwide searches, without specifying a precise location (Wolk and Wöber, 2008; Fenichel *et al.*, 2013; Yang *et al.*, 2015; Chang *et al.*, 2017; Xu and Reed, 2017; Antolini and Grassini, 2018; Ballatore and Arsanjani, 2018; Correia *et al.*, 2018; Kim and Malek, 2018; Siliverstovs and Wochner, 2018).

Merely 15 per cent of the articles refer to the *search tools* used in the analysis: web and image were used by Önder and Gunter (2016) and Önder (2017), web and video were used by Lengyel (2015, 2016), while Rivera (2016) used the only web search engine.

In terms of the *periodicity of the data*, given that in forecasting studies, most of the times, the tourism demand (independent) variable is available at a monthly frequency and Google Trends indices are retrieved either on a weekly or a daily basis, it is necessary to aggregate them to monthly data, by averaging. Önder and Gunter (2016), Önder (2017) and Antolini and Grassini (2018) opted for the four-week average, Choi and Varian (2012) used the average query index in the first two weekly observations of the month, while García Rodríguez (2017, p. 956) “transformed the data from weekly into monthly data by implementing dynamic tables”.

The *process of search terms’ selection* is vital in studies that use web search data, giving that empirical results are highly dependent on the selection methods (Li *et al.*, 2018). Keyword selection methods derive primarily from researchers’ experience (Choi and Varian, 2012; Bangwayo-Skeete and Skeete, 2015; Jackman and Naitram, 2015; Kim and Malek, 2018). In a smaller scale, there are studies that are based on knowledge obtained from the existent literature (Park *et al.*, 2017), feedback from experts (Rivera, 2016) and keywords recommended by Google Trends or other technological tools. For instance, Siliverstovs and Wochner (2018) built several Google Trends indices, each of them composed by 30 queries related to top hotel-bed-intensive political municipalities in any given Swiss tourism region with support from Google Knowledge Graph. Other authors used combined methods, such as García Rodríguez (2017), who selected the research terms based on the literature, the related queries provided by Google Trends and also statistical methods, namely the Pearson correlation.

Most studies select the *search terms* as the name of a country or city (Jackman and Naitram, 2015; Önder and Gunter, 2016; Önder, 2017), sometimes associated with accommodation (Dergiades *et al.*, 2018) or the terms “tourism”, “travel” or other elements of

the tourism supply, such as “restaurants” (Pan *et al.*, 2012; Artola *et al.*, 2015; Kim and Malek, 2018). Choi and Varian (2012) and Chamberlin (2010) did not use any search term, considering only the category, while the rest chose only one service (e.g. hotel or restaurant).

Some studies (Pan *et al.*, 2012; Antolini and Grassini, 2018) directly used the raw data, however, other researchers chose to use a *combination of search terms* in a single entry, such as Yang *et al.* (2015), who aggregated search data into one to construct a composite search index using a shift and sum method. Park *et al.* (2017, p. 362) state that when “the number of keywords is large, it is more efficient to construct a composite index rather than to use all keywords in the regression”, having applied a similar method to that used by Yang *et al.* (2015). Dergiades *et al.* (2018) have combined keywords identified for each outbound country to Cyprus to a single search, aggregating keywords using the sum method. However, to construct the corrected aggregate intensity index, they performed a separate search using Google Trends’ comparison feature for search terms.

The *number of citations* allows assessing the leveraging of articles on this topic by the academia, however, we should have in mind that citation rates are heavily dependent on the discipline and the number of people working in that area. Choi and Varian’s (2012) study seems to be a highly visible publication, achieving 422 citations, followed by Kuminoff *et al.* (2010) with 60. The average number of citations of all the selected articles is 21, showing a wide gap between articles, with 11 that have not been cited yet, being all published in recent years (2017 and 2018).

3.4 Analysis, findings, limitations and novelty of the studies

3.4.1 Forecasting and nowcasting. Önder (2017) transformed Google Trends indices into natural logarithms to ensure a linear functional relationship between the variables. Park *et al.* (2017) investigated the non-stationarity and seasonality of the data. On the other hand, Jackman and Naitram (2015) decided to use raw data from Google Trends (seasonally unadjusted), while Yang *et al.* (2015) converted the Google Trends variable to logarithm to reduce the impact of outliers.

The methods of analysis are diverse (Table III). For instance, Siliverstovs and Wochner (2018) used the Mincer–Zarnowitz regression model on Swiss tourism demand forecasts and concluded that search-based tourism predictions are, on average, highly accurate approximations of reality. Bangwayo-Skeete and Skeete (2015) compared the performance of the autoregressive mixed-data sampling (AR-MIDAS) model with two other models – seasonal autoregressive integrated moving average (SARIMA) and autoregressive (AR) – having evaluated the accuracy of the models using mean absolute percentage error (MAPE) and the root mean squared error (RMSE), and concluded that Google Trends data offers significant benefits for forecast tourism demand for Caribbean destinations. Kim and Malek (2018) used the autoregressive integrated moving average (ARIMA) with interventions, also concluding that using Google Trends data significantly improves forecasting models for casino revenue. The forecasting accuracy was tested through RMSE e MAPE. Rivera (2016) used a dynamic linear model for predicting the number of hotel non-resident registrations in Puerto Rico and found that the proposed model results in more realistic prediction intervals, namely, when making forecasts on a horizon of over six months. Choi and Varian (2012) confirmed the power of Google search data to predict the present values of economic indicators by forecasting visitors to their travel destination (Hong Kong), having concluded that the model that includes Google search data improves the prediction capacity.

3.4.2 Interest, popularity and consumer behaviour. One-third of the studies under analysis used Google Trends data to understand the behaviour and search interest for certain topics of internet users. For example, Ballatore and Arsanjani (2018) used it to know

Data analysis techniques	Publications
ARMA model	Pan <i>et al.</i> (2012) ; Yang <i>et al.</i> (2015)
ARMAX model	Pan <i>et al.</i> (2012) ; García Rodríguez (2017)
ARIMA model	Artola <i>et al.</i> (2015) ; Antolini and Grassini (2018) ; Kim and Malek (2018)^a
ARIMAX model	Padhi and Pati (2017)
SARIMA model	Bangwayo-Skeete and Skeete (2015) ; Park, Lee and Song (2017)
AR-MIDAS model	Bangwayo-Skeete and Skeete (2015)
ADL model	Pan <i>et al.</i> (2012) ; Önder and Gunter (2016) ; Önder (2017) ; Padhi and Pati (2017) ; Antolini and Grassini (2018)
AR model	Choi and Varian (2012) ; Bangwayo-Skeete and Skeete (2015) ; Padhi and Pati (2017)
VAR model	Pan <i>et al.</i> (2012) ; Padhi and Pati (2017)
Support vector regression (SVR)	Jackman and Naitram (2015)
Time-varying parameter (TVP) model	Pan <i>et al.</i> (2012)
Model augmented with the Google-index	Artola <i>et al.</i> (2015)
Mincer–Zarnowitz regression model	Siliverstovs and Wochner (2018)
Granger non-causality test	Dergiades <i>et al.</i> (2018)
Breitung and Candelon non-causality test	Dergiades <i>et al.</i> (2018)
Dynamic linear model	Rivera (2016)
Note: ^a With interventions	

Table III.
Data analysis techniques of forecasting and nowcasting papers

the online visibility of a volunteered geographic information project – Wikimapia – and compare it with OpenStreetMap, over time and regarding the spatial distribution of its searches around the world. They concluded that searches over time present different patterns of interest and are strongly seasonal, and there are widely divergent and segregated geographies of searches. Moreover, [Chang *et al.* \(2017\)](#) used Google Trends to compare a variety of hotel brands and the interest in Hilton and TripAdvisor over time and by subregion. They also identified the related topics and keywords that users usually search together with a “Hilton hotel” query.

[Tang *et al.* \(2018\)](#) used Fourier transform and Parseval’s theorem to compare the online search behaviour from the USA and China demonstrated by restaurant consumers. [Lengyel \(2015, 2016\)](#) demonstrated that there is a strong and rising interest in mindfulness, both globally and for major outbound countries to Hungary, and that in the last few years the popularity of search terms concerning meditation and mindfulness has been growing steadily.

The findings of [Al-Kabi *et al.*’s \(2012\)](#) study showed that the majority of Arab internet users search for topics related to entertainment, recreation, computer and internet, searching for images, songs, chat, forums and new feeds, mainly in their native language. [Kuminoff *et al.* \(2010\)](#) used Google Trends to track the online search volume for phrases that prospective travellers are likely to use in a search for green lodging, estimating a hedonic model of hotel room pricing, which reported that travellers can expect to pay a significant premium for a standard room in a green hotel.

Although [Wolk and Wöber \(2008, p. 128\)](#) just used Google Trends as an example to analyze the trend of internet users’ search behaviour, mentioning it as a topic for further research, they concluded that it offers great opportunities to compare internet data, giving “a

good example for type of insights managers can gain by performing longitudinal studies based on log file data". However, they also mentioned that the amount of information and possibilities for comprehensive competitive studies is very limited, as Google Trends do not provide the absolute numbers of queries, and it is not possible to perform comparisons for more than five search terms simultaneously. "In addition, the selection of terms used for the comparisons need to be provided by the analyst because the most frequently searched terms are not available by this tool." (Wolk and Wöber, 2008, p. 129).

3.4.3 Relation between search engine data and tourism official statistics. There are a few studies that compared Google Trends with official data sets. These studies showed moderate to strong strengths of association, which demonstrates the potential of this tool to be used for researching tourism-related topics. For example, Dinis *et al.* (2016) found a strong correlation between a set of search terms and Portuguese official tourism data. The study concluded that Google Trends can provide information about the intentions of online search behaviours of potential tourists choosing accommodation, with the results showing that the actual nights spent in accommodation establishments by foreign tourists are strongly correlated with the Google index. Moreover, Dinis *et al.* (2017) showed that Google Trends could be used to forecast overnights in hotel establishments by Portuguese residents, as the official data are strongly correlated with the Google index. Chamberlin's (2010) study aimed at looking at the correlation between official data and Google Trends data of over 30 categories, ranging from retail sales to foreign trips. In terms of tourism, the research concluded that none of the Google Trends categories were significant in a regression with the numbers of foreign trips. Nonetheless, the study unveiled that the "travel" category showed similar seasonal movements to the official statistics.

3.4.4 Estimation of the effect of one variable in another variable. As aforementioned, this group of studies aims to estimate the effect of one event in tourism demand, the interest in a tourism destination or the use of tourism services. Rosselló and Waqas (2016) investigated the role of weather variables in explaining short-term variability in Google searches related to Majorca from its main tourist markets (Germany and UK). For that, they estimated a regression model and the results show that weather conditions are significantly related to a higher interest in Majorca. Xu and Reed (2017) used a VAR model to examine the interaction between perceived pollution, measured by Google Trends data, and inbound tourism in China, concluding that it leads to lower levels of inbound tourism. Fenichel *et al.* (2013) used Google Trends data to measure public knowledge about swine flu. They verified that a subset of passengers, who had already purchased tickets, chose not to fly in response to swine flu. The results suggest that they do not respond to actual reported cases, but perhaps to media attention to the epidemic. Palos-Sanchez and Correia (2018) used the Goal-Question-Metric methodology with the purpose of verifying if the rise of internet searches has an impact in the Airbnb service. The results indicate that Google Trends constitute a potential source for the observation of the preferences and interests of consumers and the evolution of demand for this service.

4. Discussion

Currently, in the face of the increasing popularity of the internet and the use of search engines in the travel planning process, search engine companies hold data on query formulations, which can contribute to the establishment of consumer behaviour patterns. Access to these data are increasingly facilitated because search engine companies are increasingly providing their own tools for data mining (Kaushik, 2010). The growing number of articles published in scientific journals, which use Google Trends data in the tourism sector, reveal that this tool is growing in importance in the field of big data for tourism.

However, from the analysis of the selected articles, it was found that Google Trends data are still little explored academically, since the articles using this data are quite recent, being the first study published in 2008, and scattered in different journals of several scientific areas. This study has contributed to systematize this research and, mainly, to show its purpose and how it has been developed. It was concluded that Google Trends data are being used in tourism and hospitality research for different purposes, although most studies have focussed on forecasting/nowcasting of tourism demand and on the comparison of interest and popularity of search terms related to tourism destinations or services. These studies have introduced a certain degree of innovation by using data from several geographical contexts (e.g. worldwide regions and countries) and tourism activities (e.g. accommodation, casinos and restaurants), and data that relate tourism with other phenomena (e.g. weather and pollution). The methods have been refined to improve the accuracy of the results, namely, in terms of search terms, as is the case of the study of [Yang *et al.* \(2015\)](#), who have proposed a systematic mechanism to better pick search queries. Research has also been conducted to identify the models that present the best accuracy using Google Trends data.

Despite the progress made by the literature in terms of knowledge about Google Trends data and tourism, in most of the articles the potentialities and limitations of this tool, as well as the purpose of the data and methodological choices of researchers are still poorly understood and explored. There is a generalized lack of information in the analyzed variables, which makes it difficult to understand the methodologies used in the studies and the reproducibility of the findings, similarly to what [Nuti *et al.* \(2014\)](#) concluded about the use of Google Trends in healthcare research. One of the reasons for the existing limitations is that “researchers may not have known how to document their methods as this is still a nascent tool for research, without guidance or methodological standards for its use by either Google Inc. or the research community” ([Nuti *et al.*, 2014](#), p. 46).

Another crucial issue in studies that use Google Trends data are the selection of search terms, and it is currently a mostly arbitrary process, as such, we recommend a relatively systematic method in tourism research for web selection search data, and the need to test other statistical methods to find the most predictive web search data, which is in line with what has been suggested by [Li *et al.* \(2018\)](#). Furthermore, the existing methods for index search construction require clarification in the methodology and in the keyword aggregation criteria, being also evident that studies on identifying which method is most advantageous are scarce, that is, whether it is better to use a keyword or a set of keywords (index construction). It is, therefore, essential that researchers make efforts to clearly state their rationale and describe the methodology used in the study to ensure the reproducibility of results.

Researchers should continue to explore the potentialities of Google Trends data for tourism, as there is still a lot of room to progress, namely, in terms of other issues that can be studied, such as the effect of extreme events and terrorism in tourism demand (or the reasons and impact of significant peaks of search interest for certain tourism destinations) or other important factors in tourism (e.g. tourism revenue and environmental carrying capacity) ([Li *et al.*, 2018](#)). For future research, it would be interesting to define standard methodologies so that they could be replicated by other researchers and allow the comparability of results. In addition, it is suggested a literature review of studies using Google Trends data in tourism published in other databases or journals, thus increasing the knowledge on this subject. Data quality and ethical concerns related to big data analytics should also be more discussed in the literature, to identify its future implications ([Davis, 2012](#); [Bunnik *et al.*, 2016](#)).

5. Conclusion

Although search engine data has been used in tourism and hospitality research, to the best of our knowledge, this article is one of the first in reviewing the range of applications and methods used, by performing a systematic literature review on the use of Google Trends data in tourism and hospitality research. This systematic review contributes mainly to better understand the aim, methods and results of the analyzed articles, allowing to identify potential uses of Google Trends data in tourism and hospitality research and to facilitate a better understanding of its strengths and pitfalls as a research tool. Moreover, this study contributes to identify gaps in the literature and to point the way toward future research.

As seen before, Google Trends data can be used to know, compare and predict the behaviour and interests of the public on a certain subject, being its use in tourism and hospitality research still quite recent. It is noted that the number of studies using this tool has increased significantly from 2012 to 2017, mainly with the aim of:

- tourism forecasting/nowcasting;
- knowing the interest of users' search for tourist attractions or destinations;
- showing the relationship between the official tourism statistics and the search volume index of Google Trends; and
- estimating the effect of one event in tourism demand.

The categories and search terms used vary with the purpose of the study, however, mostly focussing in the "travel" category and using the country as the search term.

Google Trends has a great potential, as a free and easily accessible means to big data, to provide meaningful insights about internet users' behaviour and its link to tourism and hospitality. However, to be used as a reliable research tool, there should be more transparency in the Google Trends data gathering algorithm and the studies that use it should also better explain the methodology used, to increase the trustworthiness of the results and its general applicability for tourism and hospitality.

Although a systematic review involves several steps to ensure its methodological transparency, we recognize the limitations of the search process and possible biases in document selection and analysis. Due to the parameters of the databases and search criteria, some relevant literature might have been excluded from this study. Even though measures were taken to be objective, some bias is inherent in the review process. Nevertheless, a large portion of available literature on the topic has been reviewed, providing insights on the use of Google Trends in tourism and hospitality research, highlighting gaps in knowledge and showing opportunities for future research.

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