Topic and sentiment analysis of crisis communications about the COVID-19 pandemic in Twitter’s tourism hashtags

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Abstract
The purpose of this paper was to assess Twitter as a means of communication during tourism crises with the following objectives: (a) identify the topics that are discussed, (b) establish the text sentiment, and (c) determine the differences in gender regarding the topics under discussion and the text sentiment. The data were collected from Twitter between March and April 2020. Using big data software, this study extracted 123,868 tweets globally in different languages through the Twitter API of popular tourism hashtags. Two techniques were applied: word association and sentiment analysis. The results show that the communication made through Tweets has the characteristics of a crisis communication related to the effects of the COVID-19 pandemic in the tourism industry. The theoretical contribution of the research is that Twitter in social media is an effective means of communication during pandemic crises and contributes to reducing negative perceptions and adverse effects of the tourism crises in companies and destinations. The practical contribution of the research is that Twitter can be used as a means of communication helping the communication strategies of companies and organizations.

Keywords
social media, tourism, crisis communication, COVID-19

Introduction
Crisis management is a prevalent theme in tourism; however, the crisis due to the COVID-19 pandemic is a new phenomenon for the tourism industry. A growing number of studies have focused on tourism crises and change in recent years, but only a few have explicitly investigated health-related crises (Gössling, 2002; HALL, 2006; 2011; Mair et al., 2016). In crisis management, social media has emerged as a research area for crisis communication in tourism (Zeng and Gerritsen, 2014).

In crisis communication different types of social media lead to consumer responses, like Facebook that allows two-way communication to manage the crisis (Ki and Nekmat, 2014) however in the case of Twitter the evidence of Twitter as a means of crisis communication in tourism crises is scarce (Barbe and Pennington-Gray, 2018). We argue that it is vital to respond to this gap in the literature because Twitter is an important means of communication in tourism...
Twitter has permitted to know the differences in the sentiment of participants in the Olympic Games (Kirilenko and Stepchenkova, 2017) and has been used as a means of communication for mega-events with implications for destination marketing (Jin and Cheng, 2020) Therefore, it is important to respond to the gap in the literature on the feelings expressed by the participants in the crisis communication in pandemic and if there is a gender difference in the participants of this communication.

The present study has the following objectives, using Twitter’s tourism hashtags in crisis communication during the COVID-19 pandemic: (a) identify the topics that are discussed, (b) establish the text sentiment, and (c) determine the differences in gender regarding the topics under discussion and the text sentiment.

Theoretical background

Crisis communication

Situational crisis communication theory suggests that organizations can use various communication strategies during crises. These strategies depend on the type of crisis, the crisis situation, and the organization’s responsibility for the crisis (Coombs, 2015). Situational crisis communication theory attempts to establish crisis response strategies with positive results for the organization in the public perception of the crisis and its attitude toward protecting its reputation and reducing the adverse effects (Coombs, 2007, 2014). During crises, response strategies represent the words or terms and actions that organizations can take (Coombs, 2007). In crises where there is minimal responsibility on the part of the organization, the appropriate communication strategies are instructions and adjustments to information to achieve positive results for organizations, such as protecting their reputation and reducing adverse effects (Coombs, 2015, 2017).

The situational crisis communication theory is a classic business-to-consumer theory. However, it does not cover consumer-to-consumer crisis communication that it is a customer-driven communication that also occurs during crises (Sano and Sano, 2019). Furthermore, situational crisis communication theory focuses on organizational behavior through organizational communication strategies; therefore, using this theory alone leaves little explored on how people process these crisis messages (Liu and Fraustino, 2014; Liu et al., 2016).

To understand crisis communication between people or consumers, Liu et al. (2016) suggested using the extended parallel process model as a theoretical framework to understand how people process these crisis messages in the context of cruise travel. The extended parallel process model has been used in several studies on health risks and the communication of health campaigns (Roberto, 2013). The extended parallel process model indicates that people exposed to fear messages will have one of three results: response, acceptance, or rejection (Witte and Allen, 2000). Liu et al. (2016), using the situational crisis communication theory and the extended parallel process model, found that crisis and person-to-person communication helps improve safety perception and travel decisions.

In this regard, Sano and Sano (2019) proposed extending the situational crisis communication theory to an individual level and also use the networked crisis communication theory to explain crisis communication from consumer to consumer. Their study concluded that business-to-consumer and consumer-to-consumer communication is equally important, and in situations of low perceived risk, consumer-to-consumer communication seems more important to increase the perception of safety and willingness to travel.

Crisis communication in social media

Twitter is an efficient means of crisis communication in social media and allows interactive dialogues; it is imperative since it provides immediate reactions to crises (Schultz et al., 2011). In this sense, Twitter is a medium that users turn to as the first source of online information and links to other means for additional details (Barbe and Pennington-Gray, 2018). Therefore, Twitter has been used as an information hub during disasters (Schwarz et al., 2016).

The situational crisis communication theory in tourism was tested on social media, specifically using Twitter by Barbe and Pennington-Gray (2018) and using Facebook by Ki and Nekmat (2014) and Möller et al. (2018). The use of social media, specifically Facebook, during crisis communication was bidirectional and has been effective in managing crisis communication (Ki and Nekmat, 2014).

Other studies add the importance of the medium in crisis communication in social media. However, situational crisis communication theory, like classical crisis communication theories, focuses on the interaction of crisis type and communication strategy and does not consider the importance of the medium in crisis communication on social media that could have a more significant effect than the type of crisis (Utz et al., 2013). On this topic, Schultz et al. (2011) suggest that different types of media on social media lead to different consumer responses. This constitutes the networked crisis communication theory which suggests
that the crisis communications distributed by social media can provoke different responses that are affected or impacted by the medium used, the type of crisis, and the person’s emotions (Schultz et al., 2011; Utz et al., 2013).

In crisis communication the response strategies represent the words or terms, and actions that organizations can take during a crisis (Coombs, 2007). To examine the characteristics of this crisis communication on Twitter, it is necessary to extract the main discussion topics of communication, for which the following research question is asked:

RQ1: What topics are discussed in crisis communications during the COVID-19 pandemic in Twitter’s tourism hashtags?

Considering the text sentiment, as the ability to detect positive and negative opinions from the text (Thelwall, 2019) and meanings of tweets (Alaei et al., 2019), and sentiments, attitude, thought or judgment (Fang and Zhan, 2015), knowing the text sentiment of the main discussion topics contributes to the characteristics of crisis communication. The following research question is asked.

RQ2: What is the text sentiment of crisis communications during the COVID-19 pandemic in Twitter’s tourism hashtags?

Considering that women use more explicit positive language than men and avoid writing negative terms in strongly positive reviews or positive terms in strongly negative reviews, it is important to establish the difference in gender sentiment both at the level of sentiment and at the level of linguistic expression (Thelwall, 2018a). Therefore, it is important to establish if there is a gender difference in the topics of discussion and sentiment in crisis communication during the COVID-19 pandemic, so the following research question is asked:

RQ3: What is the difference in gender regarding the topics discussed and the text sentiment in crisis communications during the COVID-19 pandemic in Twitter’s tourism hashtags?

**Methodology**

*Techniques for data analysis*

In recent years, two modern techniques to analyze Twitter’s big data have emerged: word association, which is a technique of finding syntagmatic relation between the terms or words used in tweets, and sentiment analysis, which is the appreciation of negative, positive sentiment expressed in tweets. Both techniques have found applications in tourism and are used in this research to process crisis communication data on the COVID-19 pandemic. Association mining. The word association technique is a method to find syntagmatic relationships between terms or words when they appear together in a context (Correia et al., 2018). For example, by analyzing word frequencies and hashtags, topics and keywords relevant to tourism are identified (Park et al., 2016). In word associations, knowledge is derived from patterns and relationships that reveal facts, trends, or constructs. Text analysis has been used as exploratory analysis, but it can also test hypotheses or interrelationships between constructs (Harlow and Oswald, 2016).

Word association generally uses a quantitative approach to analyze larger volumes of texts to discover knowledge, increasing the volume of text analyzed (Kobayashi et al., 2018). Furthermore, when analyzing large volumes of data, this technique is used to classify and explain the data using existing knowledge (Harlow and Oswald, 2016).

**Sentiment analysis.** Text sentiment analysis is emerging as an automated process of examining semantic relationships and the meanings of tweets (Alaei et al., 2019). Sentiment analysis has been identified by Thelwall (2019) as the ability to detect positive and negative opinions from text, making it a key component of tourism research using big data.

In fact, sentiment analysis is one of the main activities of natural language processing (NLP) to find its sentiments, attitude, thought, or judgment (Fang and Zhan, 2015). Data in text form are unstructured; it is a data repository from which content can be extracted through text analysis (Geetha et al., 2017). Combining sentiment analysis techniques of text and other data, such as transportation, crisis, and destination components, can obtain patterns that previously could not be understood (Alaei et al., 2019).

There are several methods for analyzing data sentiments: lexicon-based methods, machine learning methods, and hybrid methods (Medhat et al., 2014). Lexicon-based methods need a predefined group of lexicons of sentiments used to determine the polarity of a text; this group of lexicons is the emotions in the text (Saif et al., 2016).

There are studies in tourism using lexicon-based approaches or tourism dictionaries; for example, Misopoulos et al. (2014) carried out a sentiment analysis in airlines consumers to evaluate relevant comments on service provision, indicating a value for airlines in unsatisfied and satisfied comments. In another study, Xiang et al. (2015) also used a lexicon-based method to analyze hotel customer satisfaction sentiment. In addition, the SentiStrength lexicon has been used in tourism studies such as Gomez et al. (2018) that used it to process opinions of tourist
services. Likewise, Ramanathan and Meyyappan (2019) used it to obtain feedback about Oman’s tourism.

Differences have been found in the analysis of sentiment by gender, to the extent of how sentiment is expressed in the social network (Bagić Babac and Podobnik, 2016). Sentiment analysis, by gender, of data, online has a bias because women tend to express their sentiments more explicitly than men (Thelwall and Mas-Bleda, 2018). Therefore, it is unclear if these differences occur at the sentiment or linguistic level (Thelwall, 2018a).

Data collection

Twitter hashtags. Studies on social data in tourism have been carried out to identify popular tourism hashtags, such as those from which users seek information and express their opinion on recent topics of public attention (Fatanti and Suyadnya, 2015; Park et al., 2016). The use of hashtags to collect information is beneficial because it allows concentrating the opinions of a specific sector or the dialogues on a specific community issue (Fatanti and Suyadnya, 2015). In addition, the data from Twitter allows identifying communication patterns and information dissemination of communities through hashtags (Park et al., 2016). Hashtags are commonly used in crisis communication in tourism, and during the crisis, there is usually an associated hashtag that allows users to obtain relevant information (Barbe and Pennington-Gray, 2018).

Twitter data provides a means of analyzing the attitudes and behaviors of a broad spectrum of the population (Harlow and Oswald, 2016). Through Twitter’s big data process, data patterns and text sentiment analysis can be obtained; this is an important technique applied to tourism (Kirilenko et al., 2018).

Data. The data were collected from Twitter between March and April 2020, and a group of popular tourism hashtags was identified (see Table 1). The data were collected through the Twitter API using big data software. The extraction of the tweets was carried out globally, in different languages, gathering 123,868 tweets that met the condition that each tweet had one or more of the popular tourism hashtags in its text.

The collected tweets came from various types of users: male, female, organizations, or people without a specific gender since they use identifications that are not derived from their names. For identification by gender, lists of the 1022 most common male names and the 3938 most common female names, compiled from the common names data from the 1992 US Census, were used (Thelwall, 2018b). Table 2 presents the gender of the authors of tweets identified from the names; when it was not possible to identify the gender, as in cases in which the account belongs to organizations or people without an identified gender, they are shown in the list as “none.”

Data analysis

Before analyzing the data collected from the popular tourism hashtags, a search was made of the terms used on Twitter to refer to COVID-19, identifying various terms. It was also agreed that tweets that referred to COVID-19 directly included a COVID-19 or pandemic hashtag. All equivalent terms used in searches for COVID-19 are shown in Table 3.

The data analysis comprised the following steps:

1. The data were cleaned by removing duplicate tweets.
2. The word association technique was used to obtain the words associated with the term COVID-19 in the Twitter data collected using a

| Table 1. Popular tourism hashtags used in Twitter data collection. |
|---------------------|----------------------|
| Hashtag             | Number of tweets mentioned in the hashtag |
| #tourism            | 10,437               |
| #adventure          | 14,275               |
| #turismo            | 8,858                |
| #travel             | 57,835               |
| #viajes             | 2,688                |
| #destinations       | 1,180                |
| #hotel              | 7,005                |
| #hospitality        | 7,955                |
| #trip               | 5,906                |
| #aventura           | 2,443                |
| #journey            | 5,698                |
quantitative process with the Pearson’s Chi-square Statistical Test, derived from a $2 \times 2$ contingency table with a critical threshold value 3841. In addition, the method of Benjamini and Hochberg (1995) was used to reduce the risk of falsely believing that a word is significant when examining multiple Chi-square values. This procedure tests all words at the same time and shows all words as results or significant terms. Thus, this method controls the risk of false positives by running multiple tests.

3. The sentiment analysis of the terms associated with COVID-19 was carried out in the collected data. The technique used was SentiStrength, a lexicon made up of 2310 words obtained from the Linguistic Inquiry and Word Count (LIWC) program (Pennebaker et al., 2003). SentiStrength uses a lexical approach to detect the strength of sentiments based on a list of sentiments and related terms (Thelwall, 2017). The algorithm SentiStrength uses for each text separates words, emoticons, and punctuation marks and then performs a search for each word in the SentiStrength lexicon. If it is found, the punctuation of that word is used in the lexicon. For each text or tweet, the SentiStrength algorithm generates a positive score from 1 to 5 and a negative score from −1 to −5 as a result of the match or search of the words in the SentiStrength lexicon. The general score of a tweet or sentence is the highest positive and negative of the words that make up the text or tweet (Thelwall, 2017).

4. Gender differences were established in the terms associated with COVID-19.

5. Gender differences were determined in the text sentiment analysis.

Results

Word associations with COVID-19 of the tweets using popular tourism hashtags

Through the word association analysis of the tweets of the popular tourism hashtags using COVID-19 or its equivalent terms, the topics or words most used in the tweets examined were obtained, following the criteria of Coombs (2007), which states that during crises, response strategies represent the words or terms and actions that organizations can take during the crisis.

Table 4 presents the results of the word associations with the term COVID-19. The term COVID-19 matched 12,562 tweets out of the 123,868 tweets from the collected data. In Table 4, the “Match” column displays the percentage of tweets that contain the word that match the term COVID-19. The “NoMatch” column displays the percentage of tweets that contain the word that does not match the data collected with the search term COVID-19. The “Total” column is the number of tweets that match the word with the term COVID-19. The “Matches” column is the number of tweets that match the word with the term COVID-19. The “Difference” column is the number of tweets that contain the word. The “DiffPZ” column is the difference in proportion z. The “Sig” column shows if the relationship was significant to the Chi-sq test performed.

The most discussed topics presented in Table 4 provide insight into the characteristics of crisis communication in the tourism industry during the COVID-19 pandemic. According to the theory of situational crisis communication (Coombs, 2007, 2014), organizations present crisis communication responses or strategies depending on the type of crisis (travel, hotel, hospitality, etc.) and the crisis situation that they perceive.

Based on the data presented in Table 4, a cluster dendrogram was constructed illustrating the cluster structure of the word associations (Figure 1). When reviewing the crisis communications with the dendrogram of Figure 1, it is observed that the most discussed topics were: “travel,” “crisis,” “hotel,” “sector,” “tourism,” “industry,” “home,” “help,” and “impact” that include the crisis communication strategies of multiple organizations regarding the COVID-19 pandemic and reflect crisis communications from the public and consumers in opinions, perceptions, and emotions. These results answer the first research question, RQ1: What topics are discussed in crisis communications during the COVID-19 pandemic in Twitter’s tourism hashtags?

Table 5 shows for each discussion topic found in Table 4, the five most used terms or words in the tweets, which contain the perceptions in the tweets, and show that crisis communication revolved around the global impact and effect of the COVID-19 pandemic on the tourism industry, hospitality, travel, airlines, the impact on people and businesses, restrictions, the need for support and plans for the crisis, and the need for people’s safety during the pandemic.

The content of some tweets about the crisis was analyzed, which are presented below.
Tweets from organizations and companies:

“We are pleased to share with you, @_ has recently launched an online “Hospitality Crisis Support Hub” to support businesses during the Coronavirus crisis. For more information, please read https://_.”

“Our travel experts are here to guide you, support you in the period of crisis!! Immediate support, emergency assistance, data change, schedule change, immediate cancellation.”

“Need some advice? Take a look at The center advice hub for hospitality operators and employees during the COVID-19 crisis and see what the experts are saying.”

“You just need to follow all the precautions and spread hope and positivity. Get authentic and reliable information on the current situation on https://_.”

“A useful round-up of all the help available of employees within the #hospitality industry during the #coronavirus crisis.”

Table 3. Equivalent search terms for COVID-19.

| Search term      | Other terms equivalent to COVID-19 used by users on Twitter               |
|------------------|--------------------------------------------------------------------------|
| COVID-19         | Coronavirus, covid, covid19, #coronavirus, #covid19, #covid_19, pandemic, #pandemic, #covid, #covid2019, #covid-19, pandemic, #cuarentena, covid-19, #coronaviruspandemic, #coronavirusupdate, #virus, #coronavirusoutbreak, #coronalooldown, #covid19pandemic, #coronacrisis, #coronaviruschina, #coronavirusuk, #covid19greece, #covid19gr, #coronavirususa, #coronavirusindia, #covid19italy, #covid19update, #covid19outbreak |
| Travel           | 7.90 4.80 993 6311 15.1 228.3 *** |
| Industry         | 5.30 1.00 665 1761 38.7 1,495.6 *** |
| Tourism          | 5.10 1.20 648 2045 21.6 466.5 *** |
| Crisis           | 4.50 0.70 563 1355 38.5 1,483 *** |
| Sector           | 3.90 0.60 496 1142 37.4 1,401.8 *** |
| Hotel            | 3.80 2.20 474 2931 10.9 119.8 *** |
| Impact           | 3.10 0.10 389 531 48.3 2,331.2 *** |
| Help             | 3.00 1.00 377 1540 18.8 351.8 *** |
| Home             | 2.70 1.60 344 2144 9.1 83.4 *** |
| Lockdown         | 2.10 0.40 265 675 25.1 631.4 *** |
| Flight           | 2.00 0.60 245 944 16.2 261 *** |
| Hospitality      | 1.90 0.60 240 892 16.6 277.1 *** |
| Airline          | 1.90 0.40 238 722 20.4 415.1 *** |
| Support          | 1.90 0.60 236 869 16.7 278.1 *** |
| Business         | 1.70 0.30 211 555 21.8 475.4 *** |
| Safety           | 1.70 0.60 209 921 12.7 160.4 *** |
| Restaurant       | 1.60 0.90 195 1204 7 48.9 *** |
| Global           | 1.40 0.20 182 385 24.2 584.3 *** |
| Service          | 1.40 0.60 180 877 10.2 104.5 *** |
| Plan             | 1.40 0.70 180 906 9.7 94.7 *** |
| Worker           | 1.40 0.30 172 454 19.6 384.9 *** |
| Government       | 1.30 0.20 166 344 23.4 549.9 *** |
| Restriction      | 1.10 0.10 143 256 24.3 588.4 *** |
| Affect           | 0.80 0.00 96 132 23.8 568 *** |

* significant at 5%
** significant at the 1%
*** is significant at 0.1%
"At times of crisis, the hotel industry makes every effort to take care of its own, as well as others in the areas that they serve. #hotels #hospitality #businesspartners #staywell #COVID19 #coronavirus."

"During the #coronavirus crisis, will it still possible to get a visa to #travel to #Italy? Here’s what you need to know. via @_."

"Safeguarding #tourism employment is one of the priorities in the #COVID19 crisis. For this, distance work and the reduction of working hours have been prioritized over the temporary cessation of activity."

"@_continues to work on projects that encourage the reactivation of tourism after the COVID-19 https://__"

"#Coronavirus has brought #tourism to a standstill. Here are some actions that can be implemented to preserve #jobs and help the industry survive this crisis."

"The #Coronavirus crisis has completely paralyzed the #tourism sector, and it is estimated that 50 million jobs will be lost worldwide."

"New Study Shows How #Coronavirus Crisis has Devastated # Florida’s Tourism Industry: https:///"

Tweets from consumers and users:

"A content marketing agency is to offer its services complimentary to small business owners and hospitality companies to provide support and guidance through the coronavirus crisis."

"Many thanks to @_ for leading from the front during this crisis – measures like this will help support vulnerable restaurants, small biz in the hospitality industry devastated by COVID19."

"Airlines owe you a refund when they cancel a flight. So why is _-Airline balking during coronavirus crisis? https://_/"

"The COVID-19 pandemic has seen strong restrictions imposed on the Hospitality industry. Here are some tips for restaurant and hotel owners to help mitigate risks brought on by new exposures related to the current crisis."
More than one in four Americans are actively avoiding eating out in restaurants as coronavirus crisis worsens."

"To return to the levels of 2019, we will need at least three years." #Tourism becomes one of the sectors most affected by the crisis."

"#Canarias will come out the last of the crisis. Unlike the industry, where production will begin as soon as the state of alarm is lifted just by turning on the machinery, in #Tourism, we will have to wait"

"Staying at home to work makes me think of going out and traveling more. I can’t wait for the #COVID19 crisis to subside. I’d love to do more #travel in Europe."

"Thank you @__ for being very accommodating and allowing me to change my flights to a later date during this Coronavirus crisis with no fees! #UnitedTogether #COVID19 #Travel"

The detailed analysis of the Tweets shows that the crisis communication strategies organizations and companies mainly have is to provide instructing information for their consumers. They also try to reduce negative perceptions and negative effects of the tourism crises in companies’ people, destinations, and reputations. In addition, consumers and users’ tweets show the reactions on the side of the receiver, which are influenced by their own emotions and reactions to the communication strategies of companies.

Sentiment analysis from words associated with COVID-19

Table 6 presents the results of the text sentiment analysis conducted with the terms associated with COVID-19. The results indicate the sentiments...
expressed in the tweets were different for each term discussed. Still, most of these terms had a higher positive than negative assessment, which means that the sentiment is related to an evaluation or positive perception despite the crisis. However, a group of terms had higher negative than positive evaluations, such as “crisis,” “help,” and “hospitality,” which means that the majority of tweets that contained these terms had more significant negative sentiment due to a negative evaluation or perception of the situation related to those terms.

The results, shown in Figure 2, compare the positive and negative values of the text sentiment for each discussion term associated with the term COVID-19. It is observed that each term had different positive and negative evaluations that were between the range of 1 and 2. That is, they did not have extreme valuations between 4 and 5. The term crisis is an exception since it had a much higher valuation of 3, markedly with negative sentiment, but not to the extreme, which means that tweets containing this word were marked with much more negative sentiment. Other terms also had more considerable differences between positive and negative values such as “worker,” “service,” “affect,” “global,” “impact,” and “lockdown,” which means that the tweets that contained these terms had a primarily positive sentiment despite the COVID-19 crisis.

The analysis of the positive and negative evaluation of the sentiments of the terms allows us to understand the characteristics of crisis communication for organizations and consumers. For example, crisis communications (instructions, information, opinions, reactions, etc.) were more marked by positive than negative sentiments during the COVID-19 pandemic.

The sentiment representing the emotion and the thinking of the organizations and consumers is different for each term. In addition, there is a different sentiment assessment for different types of crises perceived by both the organizations and consumers. However, in general, the majority of terms display more positive sentiments than negative, except for words such as “crisis,” “help,” and “hospitality” that have more negative than positive sentiments, which shows us the emotions of the users before crisis communications. Thus, the results answer the second research question, RQ2: What is the text sentiment in crisis communications during the COVID-19 pandemic in twitter’s tourism hashtags?

### Gender differences of words associated with COVID-19

Table 7 presents the results of the gender comparison of the words associated with COVID-19. The results show a comparison of the top 20 most used terms by both genders, and it can be seen that the majority of terms (such as “travel,” “crisis,” “industry,” “sector,” “impact,” etc.) were used by both genders in crisis communications. Likewise, it is observed that there is a difference in the ranking of terms between men and women.

### Gender differences in the sentiment analysis

Table 8 shows the gender comparison of the text sentiment analysis. The results demonstrate a gender difference in the valuation of the positive and negative sentiment of the main terms. For example, the terms “crisis” and “travel” have a higher positive rating by men than women, while the word “hotel” has a higher positive and negative rating in women than in men. This indicates that women and men react with different sentiments to crisis communications. Because the SentiStrength method analyzes linguistic expressions of sentiment, it is known that women use more explicit positive language than men and avoid writing negative
terms in strongly positive criticisms or positive terms in strongly negative criticisms (Thelwall, 2018a), therefore that in crisis communication, this difference between men and women is explicitly shown both at the level of sentiment and the level of linguistic expression.

Figure 3 shows slight gender differences between the assessment by term and by type of positive or negative sentiment. It has been found that the main difference between the genders is that although they contain common discussion topics, such as “travel,” “crisis,” and “impact,” they differ in their ranking of the issues and different evaluations of sentiments. This provides an answer to the third research question, RQ3: What is the difference in gender regarding the topics discussed and the text sentiment in crisis communication during the COVID-19 pandemic in Twitter’s tourism hashtags?

**Discussion**

This study to contribute to the gap in the literature about Twitter as a means of communication during tourism crises with the following objectives: (a) identify the topics that are discussed, (b) establish the text sentiment, and
Table 7. Gender differences of words associated with COVID-19.

| Rank | Word  | Female Match | Female NoMatch | Word  | Male Match | Male NoMatch |
|------|-------|--------------|----------------|-------|------------|--------------|
| 1    | Travel| 10.30%       | 5.00%          | Travel| 6.90%      | 5.10%        |
| 2    | Crisis| 4.70%        | 1.10%          | Industry| 5.50%     | 1.60%        |
| 3    | Industry| 4.70%     | 1.40%          | Crisis| 4.70%      | 1.00%        |
| 4    | Sector| 3.40%        | 0.90%          | Restaurant| 4.30%    | 0.90%        |
| 5    | Help  | 3.40%        | 1.20%          | Sector| 3.80%      | 0.90%        |
| 6    | Impact| 2.80%        | 0.40%          | Impact| 3.00%      | 0.40%        |
| 7    | Flight| 2.70%        | 0.70%          | Cruise| 2.90%      | 0.50%        |
| 8    | Support| 2.60%      | 0.70%          | Blog  | 2.40%      | 0.70%        |
| 9    | Service| 2.40%       | 0.70%          | Tourism| 4.40%     | 1.60%        |
| 10   | Tourism| 4.70%       | 1.60%          | Business| 2.10%    | 0.40%        |
| 11   | Worker| 2.30%        | 0.30%          | Lockdown| 2.10%     | 0.50%        |
| 12   | Change| 2.00%        | 0.40%          | Airline| 2.10%      | 0.60%        |
| 13   | Government| 1.90%    | 0.30%          | Flight| 2.10%      | 0.70%        |
| 14   | Delivery| 1.80%       | 0.20%          | Ship  | 1.80%      | 0.20%        |
| 15   | Lockdown| 1.80%       | 0.50%          | Global| 1.70%      | 0.30%        |
| 16   | Hotline| 1.60%        | 0.00%          | Service| 1.70%     | 0.60%        |
| 17   | Refund| 1.60%        | 0.20%          | Passenger| 1.60%   | 0.20%        |
| 18   | Close  | 1.50%        | 0.20%          | Close  | 1.60%      | 0.20%        |
| 19   | Global| 1.40%        | 0.30%          | Worker| 1.60%      | 0.30%        |
| 20   | Effect| 1.10%        | 010%           | Restriction| 1.50%  | 0.20%        |

Table 8. Gender differences in the sentiment analysis.

| Rank | Word     | Positive sentiment male | Negative sentiment female | Positive sentiment female | Negative sentiment female |
|------|----------|--------------------------|---------------------------|---------------------------|---------------------------|
| 1    | Travel   | 1.57                     | 1.29                      | 1.38                      | 1.31                      |
| 2    | Industry | 1.79                     | 1.39                      | 1.63                      | 1.34                      |
| 3    | Tourism  | 1.58                     | 1.39                      | 1.75                      | 1.35                      |
| 4    | Crisis   | 1.82                     | 3.01                      | 1.52                      | 3.01                      |
| 5    | Sector   | 2.37                     | 1.88                      | 2.28                      | 1.83                      |
| 6    | Hotel    | 1.64                     | 1.41                      | 1.90                      | 1.48                      |
| 7    | Impact   | 2.05                     | 1.30                      | 1.91                      | 1.20                      |
| 8    | Help     | 1.73                     | 2.04                      | 1.50                      | 1.54                      |
| 9    | Home     | 1.81                     | 1.48                      | 1.67                      | 1.22                      |
| 10   | Lockdown | 1.68                     | 1.39                      | 1.63                      | 1.09                      |
| 11   | Flight   | 1.52                     | 1.28                      | 1.54                      | 1.15                      |
| 12   | Hospitality| 1.84        | 1.62                      | 1.80                      | 1.59                      |
| 13   | Airline  | 1.54                     | 1.18                      | 1.31                      | 1.31                      |
| 14   | Support  | 1.70                     | 1.39                      | 1.51                      | 1.55                      |
| 15   | Business | 1.69                     | 1.30                      | 1.71                      | 1.48                      |
| 16   | Safety   | 1.79                     | 1.45                      | 1.44                      | 1.31                      |
| 17   | Restaurant| 1.47                    | 1.32                      | 1.61                      | 1.27                      |
| 18   | Global   | 1.83                     | 1.25                      | 2.11                      | 1.32                      |
| 19   | Service  | 2.15                     | 1.13                      | 1.72                      | 1.20                      |
| 20   | Plan     | 1.79                     | 1.38                      | 1.87                      | 1.32                      |

(c) determine the differences in gender regarding the topics under discussion and the text sentiment.

Twitter hashtags concentrate communities that exchange messages; the collection of Twitter data through popular tourism hashtags is an adequate means to examine the communication of pandemic crises like COVID-19. Previous studies estimate the importance of data from tourism hashtags (Barbe and Pennington-Gray,
The data collected through popular tourism hashtags on Twitter and processed through big data techniques, such as word association and sentiment analysis, can allow one to know the characteristics of crisis communications during the COVID-19 pandemic.

The results show that the communication made in the popular tourism hashtags on Twitter has the characteristics of crisis communication since two identified groups send tweets: the first group are companies and organizations and the second group are users and consumers and the crisis communication corresponds to messages related to the crisis generated by the COVID-19 pandemic.

The main topics of discussion found represent the crisis communication strategies during the pandemic that revolve around of the most discussed topics as: “travel,” “crisis,” “hotel,” “sector,” “tourism,” “industry,” “home,” “help,” and “impact.” The perceptions in the tweets show that crisis communication revolved around the impact of the COVID-19 pandemic on the tourism industry such as hospitality, travel, airlines, and the impact on people and businesses, the restrictions, the need for support and plans for the crisis, and the need for people’s safety during the pandemic. Companies and organizations share instructing information with users at critical moments, trying to preserve the reputation of companies and destinations and reduce the negative perceptions. On the receiver side, communication represents the responses of users and consumers, which is influenced by Twitter, and represents the reactions to these communication strategies of companies and organizations, impregnated by the feeling of the effect of the crisis.

The sentiment analysis of the tweets on each topic of discussion, represent the emotions, perceptions, and reactions of consumers and users, it can be observed that most topics have positive value. This is related to the fact that crisis communication strategies of organizations and companies contribute to minimizing the negative effects of the tourism crises on people, destinations, and companies’ reputations.

These findings are compared to those achieved by Ki and Nekmat (2014) and Möller et al. (2018) using

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**Figure 3.** Sentiment analysis by gender.
Facebook. They found that using Facebook during crisis communication was bidirectional and has been effective in managing crisis communication (Ki and Nekmat, 2014). Also, the results are compared to those achieved by Barbe and Pennington-Gray (2018). They identified little use of Twitter as a means of crisis communication by hotels in a pandemic. Instead, the scholars found Twitter helped keep tourists safe and maintain the reputation of the destination. However, in this study, crisis communication corresponds to various tourism industries, such as hospitality, hotels, restaurants, travel, and businesses in destinations. It is an interactive communication with multiple voices from organizations and consumers.

The results show gender differences in the main topics discussed and in the valuation of sentiments for each topic. These results are compared with those found by Thelwall (2018a) in the hotel and restaurant industry. In addition, they found a difference on Twitter in the ranking or preference of discussion topics between the genres and the sentiment analysis of the tweets.

The effectiveness of Twitter as a means of crisis communication is due to the ease of communication through tweets with few characters and the quick response that can be obtained. Companies in new tweets can adjust their crisis communication strategy based on the answers they are getting and trying to achieve their crisis communication objectives, which is to reduce negative perceptions and negative effects of the crisis. According to the theory of situational crisis communication (Coombs, 2007, 2014), companies and organizations with minimal responsibility in the crisis can maintain their reputation and reduce the negative effects of the crisis through crisis communication.

Previous studies have determined the effectiveness of Twitter as a means to avoid spreading fake news (Cifuentes-Faura, 2020) and as a means to combat digital disinformation (Cheng and Luo, 2020), and as a communication hub in disasters (Schwarz et al., 2016), and to allow immediate reactions during crises (Schultz et al., 2011), and as a means of communication for mega-events with implications for destination marketing (Jin and Cheng, 2020), but Twitter is little known in the literature as a means of communication during tourism crises, so this research contributes to this gap.

Conclusions

This study aims to contribute to the gap in the literature about Twitter as a means of communication during tourism crises with the following objectives: (a) identify the topics that are discussed, (b) establish the text sentiment, and (c) determine the differences in gender regarding the topics under discussion and the text sentiment. The data collected from popular tourism hashtags and processed through big data techniques, such as word association and sentiment analysis, allow for the evaluation of the communication characteristics of the COVID-19 pandemic crisis.

The results show that crisis communication was revolved around the global impact and effect of the COVID-19 pandemic on the tourism industry, such as hospitality, travel, and airlines. Also, it considered the impact on people and businesses, restrictions, the need for support and plans for the crisis, and the need for people’s safety during the pandemic. Communication on the organizations’ side was developed using communication strategies, especially for sharing instructing information. On the receiver side, it shows the communication between users or consumers impregnated by their own emotions due to the crisis and in response to the communication strategies crisis of companies.

Through the text sentiment of the tweets, it can be assessed that crisis communication generally shows a positive assessment in most of the topics discussed, which shows the characteristics of the effectiveness of the crisis communication carried out. Furthermore, crisis communication shows a difference between the genders in the main topics most discussed and in the evaluation of the text sentiment of the tweets.

The theoretical contribution of the research is that Twitter in social media is an effective means of communication during pandemic crises and contributes to reducing negative perceptions and adverse effects of the tourism crises in companies and destinations. This is due to the ease of communication through tweets with few characters and the quick response obtained. Furthermore, companies in new tweets can adjust their crisis communication strategies based on their responses. Thus, they could try to achieve their crisis communication objectives. Moreover, Twitter in communication crises is an interactive communication with multiple voices from organizations and consumers. Therefore, Twitter allows two-way communication between companies and organizations of the tourism industry as hospitality, hotels, and travels with consumers and users, and allows organizations to share instructing information about the tourism crises with their consumers and users. Twitter is a medium where users can express their emotions between users and respond to companies’ crisis communication strategies.

The practical contribution of the research is that companies and organizations in the tourism industry could use Twitter as a means of communication during pandemic crises, which allows managing the crisis.
sending information with instructions to tourists and consumers, and try to reduce the negative effects of the crisis and preserve the reputation of the destination.

Finally, the study’s main limitation is the temporality of the data collected during March and April 2020. As a future line of research, it would be interesting to analyze the Twitter data to examine changes in consumer tourist behavior and changes in tourism demand due to the COVID-19 pandemic in the post-health emergency stage.

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