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Analysing social media climate change discourses by coastal destinations

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Abstract

This study investigates social media climate change communication by Spanish coastal destinations on Twitter/X, analysing the communication themes (causes, impacts, adaptation, and mitigation) and contrasting strategies between destinations. Using a systematic methodology, tweets from January 2018 to February 2022 were collected and processed for extracting climate change-related content. The analysis highlighted a significant focus on mitigation and adaptation messages, with varying engagement levels across destinations. Results show a low volume of climate change communication in this platform and distinct communication strategies between Destination Marketing Organizations (DMO) and City Councils, reflecting different goals concerning climate change discourses. Clustering and similarity analyses helped to identify communication strategies. This research note contributes to highlight the importance of understanding social media climate change communication emphasizing the need for comprehensive engagement on these issues by coastal destinations.

Keywords: Climate Change Communication; Social Media Analysis; Destination Marketing Organizations; Coastal Destinations; Spain.

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1. Introduction

Climate change (CC) has a direct impact on tourism activity (Santos-Lacueva & Velasco González, 2018; Loehr & Becken, 2021). It can damage tourist attractions and affect destination image, generating tourists' risk perception and creating crises for tourist destinations. Tourists react negatively to the perception that a destination has undergone geomorphological changes due to climate change (Atzori *et al*., 2018) specially on sun and beach destinations (Schliephack & Dickinson, 2017). However, despite scholars recommend destinations to engage in active communication to prevent misinformation (Coombs, 2015; Pang, 2013), a lack of information on CC has been observed precisely in countries and destinations most vulnerable to climate risks and heavily dependent on tourism (Scott, Hall & Gössling, 2016).

The Mediterranean region has been identified as one of the most vulnerable hotspots in terms of tourism vulnerability to CC (UNWTO & UNEP, 2008). Coastal destinations face even more complex scenarios as their main resources are threatened by CC, often leading to a reduction in the attractiveness and quality of beaches (Bombana *et al*., 2023; Seekamp *et al*., 2019; Santos-Lacueva *et al*., 2017). Consequences of CC such as sea-level rise, cyclones, and storms can alter temperatures, destroy beaches, and even damage the destination's heritage (Li *et al*., 2022).

Communication plays a vital role in crisis management, risk perception, awareness, and the development of adaptation and mitigation strategies and actions (Hu *et al*., 2022). Moreover, failure to address CC awareness and its impact by destinations can lead to tourist frustration when their expectations clash with the modified reality at the destination (Buzinde *et al*., 2010; Jeuring & Becken, 2013).

Despite tourists' reactions to CC communication are not always positive due to the sensitivity of the tourism industry to CC perceptions (Hübner & Gössling, 2012), research has shown that increased information about CC enhances individuals' awareness of the issue and their likelihood of taking adaptation measures (Hu *et al*., 2022). Effective actions on CC require access to information on the subject (Loehr & Becken, 2021).

Previous studies have examined the CC communication of governments/institutions through their policy reports on CC (Moyle *et al*., 2018; Santos-Lacueva & Velasco González, 2018; Becken *et al*., 2020) or accommodation (Brazyte *et al*., 2017; Lee *et al*., 2016). However, there is a research gap regarding destinations communication on CC (Gómez-Martin *et al*., 2016).

Therefore, this is an exploratory study that aims to examine the aspects of CC that Spanish coastal destinations communicate through their official Twitter/X accounts in order to know what professional practices exist in this regard and what academic analysis needs arise from it.

2. Literature review

2.1. CC risk perception and crisis/emergency risk communication

The tourism sector is particularly sensitive to CC (Dogru *et al*., 2019; Ma & Kirilenko, 2020; Hu *et al*., 2022). Consequently, CC is a growing concern for tourist destinations (Loehr & Becken, 2021; Scott, 2021). Tourist demand is also highly responsive to risks and crises (Cho & Lee, 2006), and CC is perceived as a risk that generates crises in the field of tourism (Birkmann & von Teichman, 2010; Buzinde *et al*., 2010; Hu *et al*., 2022).

Risk perception and crisis have a significant impact on travel decisions (Jonas & Mansfeld, 2017; Karl, 2018), directly influencing the choice of destinations (Sönmez & Graefe, 1998). It has been shown that even the slightest perceived risk leads tourists to opt for an alternative destination (Araña & León, 2008).

Additionally, the perception of risk negatively affects destination image (Marine-Roig & Huertas, 2020), which is a key factor in attracting visitors and promoting prosperity for a place (Morgan *et al.*, 2003; Lee & Gretzel, 2012). Extensive evidence demonstrates that destination image strongly influences tourists' opinions and decisions (Nadeau *et al.*, 2008).

Researchers are beginning to investigate tourists' perceptions regarding the adaptation actions of destinations to effects to CC and their impact on tourist demand (Buzinde *et al.*, 2010; Atzori *et al.*, 2018). Buzinde *et al.* (2010) showed that tourists react negatively to the perception that a destination has undergone geomorphological changes due to CC. In coastal destinations, beaches suffer damage from storms, erosion, or sea-level rise, which deteriorates the image and attractiveness of the destination, even though marketers continue to advertise beautiful beaches that no longer exist or are not the same. Schliephack and Dickinson (2017) demonstrated that the risk of decreased sand on the beaches and restricted beach access had the most negative impact on tourist demand for sun and beach destinations. Hence, seasonality and extreme events influence perceived risk, which, in turn, affects tourist demand. Furthermore, it must be acknowledged that CC perceptions and perceived risk are influenced by the information and communication received (Hu *et al.*, 2022). Nevertheless, a lack of information on CC has been observed precisely in countries and destinations most vulnerable to climate risks and heavily dependent on tourism (Scott, Hall & Gössling, 2016).

The media often present the impact of CC on destinations in an alarmist manner with the aim of creating awareness, sometimes even without scientific evidence, and influencing the perceptions of potential tourists. Headlines declaring the Mediterranean 'too hot' for summer tourism (Hübner & Gössling, 2012) have been shown to have a negative influence on tourists' perceptions of destinations. Moreover, a study by Gómez-Martín *et al.* (2016) demonstrated that news coverage primarily focuses on the adverse consequences of climate change on tourism rather than the adaptation and mitigation measures adopted by destinations. The media also neglect to report the actions taken by private tourism companies against climate change (Gómez-Martin *et al.*, 2016). However, previous studies have shown a limited response by the tourism industry and destinations to climate change in many countries (Knowles, 2019; Steiger *et al.*, 2019; Knowles & Scott, 2021).

2.2. Destination CC Communication

Research has shown that increased information about CC enhances individuals' awareness of the issue and their likelihood of taking adaptation measures (Hu *et al.*, 2022). Information about CC not only increases risk perception but also facilitates acceptance of measures to address the risks. Effective actions on CC require access to information and knowledge on the subject (Loehr & Becken, 2021).

Jeuring and Becken (2013) suggest that tourists should be informed about extreme weather events to prepare them for the conditions they may encounter at destinations. Failure to address CC awareness and its impact by DMO can lead to tourist frustration when their expectations clash with the modified reality at the destination (Buzinde *et al.*, 2010). Moreover, comprehensive and timely information on CC has been shown to reduce climate risk perception and promote adaptation (Jeuring & Becken, 2013). Conversely, untimely and incomplete information can lead to inadequate perception of climatic risks and hinder adaptive behaviour. Therefore, the presence of CC in destination communication is crucial, but attention must be given to the source, message, and channel (Wood *et al.*, 2012). However, despite these findings, tourism operators have been hesitant to engage their guests on CC (Goldberg *et al.*, 2018).

Mariani and Borghi (2022) analysed tourists' reviews on platforms like Tripadvisor and Booking to understand the environmental issues they discuss in their digital communication. They found that tourists frequently mention environmental aspects that concern them, which in turn influences their

satisfaction and ratings. Similarly, Brazyte *et al.* (2017) demonstrated that tourists appreciate information about sustainable actions undertaken by accommodations and exhibit higher satisfaction with hotels that communicate such initiatives. Lee *et al.* (2016) also observed positive responses from tourists to communication regarding sustainable actions by hotels, even though not all hotels actively communicate their efforts.

Therefore, destinations should provide information and communicate about CC, yet they currently offer limited and incomplete information about the impact of CC or the adaptation actions they undertake (Scott, 2021). Jarrat and Davis (2020) and Gössling and Scott (2018) have found that CC is not yet a priority for many tourist destinations, and many lack policies or action plans.

Furthermore, studies have shown that destinations that neglect CC communication are less aware of their vulnerability and the impact of CC. They conduct less research on the subject, make fewer decisions, and take fewer adaptation actions (Hu *et al.*, 2022). These authors also emphasized the importance of DMO providing information on CC to the tourism industry and its workers to encourage the implementation of measures that reduce climate impacts. They found that workers in the tourism sector who perceive CC as a risk and believe they have the capacity to adapt are more likely to take adaptation measures. This goes in line with a recent study by Torres-Delgado *et al.* (2024) that has shown the misuse of carbon footprint data by DMO workers to justify their inactivity on sustainability or previous actions. Therefore, CC communication is crucial for DMO to initiate and promote adaptation measures. Additionally, Bigné *et al.* (2020) found that online reviews related to environmental dimensions have higher levels of perceived destination helpfulness and destination brand equity.

3. Methodology

3.1. Concept identification

Research started determining the specific concepts associated with CC to be considered in the study. Drawing from a breadth of CC emergency crises literature (Atzori *et al.*, 2018; Becken *et al.*, 2020; Bombana *et al.*, 2023; Fang *et al.*, 2018), a preliminary list encompassing 282 terms was compiled. These terms were categorized into four domains: impacts, causes, ways to mitigate, and measures for adapting to climate change. To ensure the relevance of the concepts, a detailed screening was performed. This involved assessing the frequency and context of these terms in a sample set of 50 tweets per account related to climate change, that were selected through human review following the random sample criterion. The process led to a refined list, focusing on the most significant terms in CC communication.

The selected groups of keywords were the following:

- Impacts of CC: fire, snow, rain, floods, wildfires, extreme weather events, and global warming.
- Causes of CC: pollution, solid waste, greenhouse gases.
- Mitigation of CC impacts: sustainability, recycling, circular economy, activism, waste management, carbon footprint, reuse, social action.
- Adaptation to CC: social justice, water management.

3.2. Twitter/X account selection and data collection

Twitter was selected for analysis because it is the most appropriate social media for addressing environmental, political and public awareness issues. Initially, 53 Spanish beach destinations were identified based on Exceltur (2022). The search yielded 93 accounts (50 municipal accounts and 43 DMO). The tweets sent from these accounts from January 2018 to February 2022 were retrieved using the Twitter API. The study took place during the pre-COVID/recovery period from COVID and this is of particular interest because the destinations refined their communication strategy in order to attract demand.

The activity level of each account was analysed and categorised into: (1) Almost inactive – very low activity, (2) Not very active - less than a daily tweet, (3) Active – at least 1 tweet per day, (4) Very active – at least 2 tweets per day. Finally, the 45 Twitter/X accounts more active in CC communication were selected (38 municipalities and 7 DMO, shown in Figure 1). The total number of tweets posted by these accounts during the analysed period was 178,677.

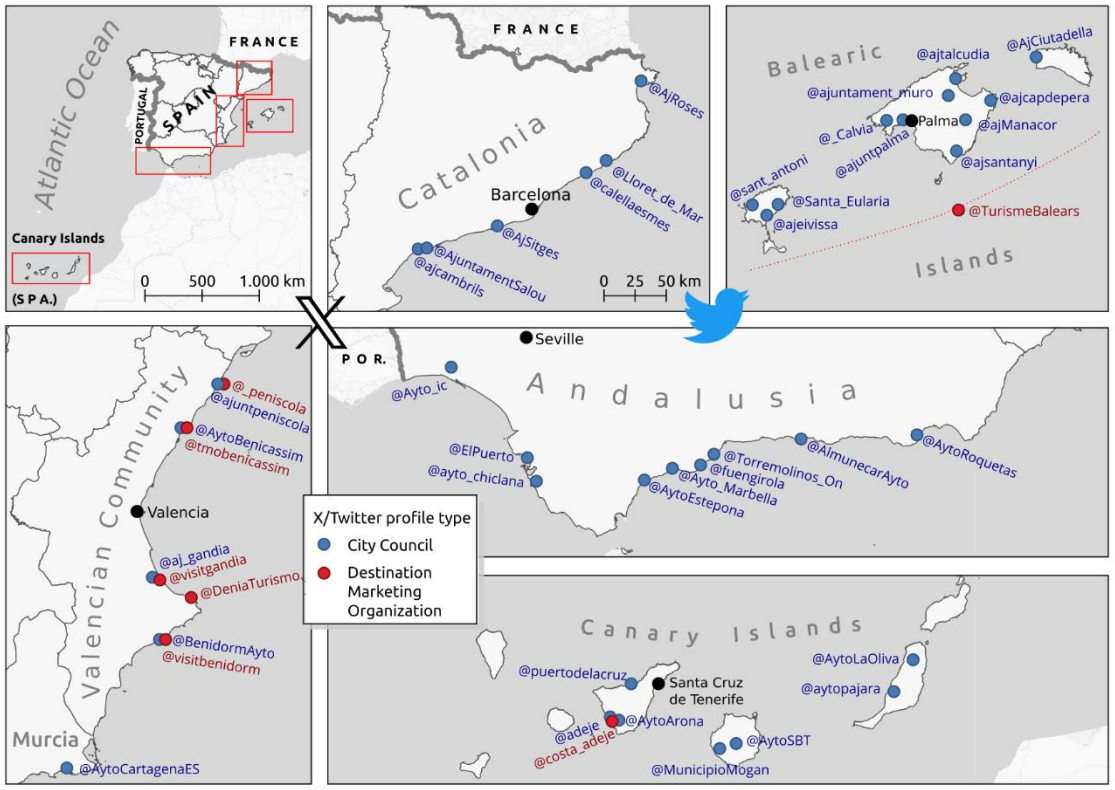

Figure 1. *Map of the selected Twitter/X accounts. Source: Author's own elaboration.*

3.3. Selection *of relevant tweets*

A syntactic analysis was performed to identify the occurrence of concepts associated with CC in the selected tweets. The tweets were mostly written in Spanish and Catalan and some in English. To handle all lexical variants of the same concept in different languages, *lemmatizers* provided by the spacy library in Python (https://spacy.io/models) were used.

After a general inspection of the first selected tweets, it was noticed that a purely syntactic analysis of the contents would be inappropriate. The meaning of tweets can be affected in different ways. For this reason, the manual review of tweets constituted a critical part of the methodology, ensuring the accuracy of the data analysed. Each retrieved tweet was examined to categorize it. This granular level of manual analysis facilitated the categorization of tweets into nuanced sub-themes like prevention, awareness, infrastructures, and social action, ensuring a high degree of precision in the subsequent analysis. The subcategories identified were: prevention, snow, awareness, infrastructures, fire, social action, event cancellation, campaigns, rain, pollution, floods, sustainability, recycling, extreme weather, waste management, award recognition, energy transition, sustainable mobility, water management, activism, circular economy, public consultation, climate change, and reuse.

These subcategories were then further classified into the previously four main target categories, encompassing the broad spectrum of CC discourse: impacts, causes, mitigation, and adaptation. This classification provided a structured framework to analyse and understand the various facets of CC communication as reflected in the tweets.

3.4. Analysis of communication strategies

The analytical phase included a clustering of Twitter accounts.

Utilizing the Mclust library in R, a model-based clustering was performed to categorize tweets into distinct groups (Stahl & Sallis, 2012; D'Angelo *et al*., 2023), enhancing our understanding of the varying CC communication strategies. The selection of the optimal number of clusters was guided by Bayesian Information Criterion (BIC) optimization, ensuring the most statistically significant grouping. To assess the quality of these clusters, silhouette analysis was employed (Ogbuabor & Ugwoke, 2018), which provided a quantitative measure of how well each tweet was matched to its cluster compared to neighbouring clusters. This methodological approach allowed for the identification of coherent groups that share similar CC communication themes.

The cleaned and processed tweets underwent similarity analysis to identify patterns within the data. This involved the transformation of tweets into a term-frequency inverse document frequency (TF-IDF) matrix, followed by the calculation of cosine similarities among tweets. The resultant similarity matrix was then used to explore the relationships between tweets, revealing the extent to which different Twitter/X accounts share similar CC communication content.

4. Results

4.1. Distribution of tweets per category

Despite the importance of CC, many accounts have a very low percentage of tweets on the topic. Most tweets focus on *mitigation* (48.40%) and *adaptation* (38.49%). This result could be attributed to the current emphasis in tourism strategies on mitigation efforts, such as decarbonization measures (Gössling *et al*., 2023; Santos-Lacueva & Velasco González, 2018). It appears that *adaptation* measures are a little less commonly mentioned. However, beach renourishment is a common practice in many Spanish coastal destinations and an essential measure for beach maintenance. Moreover, only 12% of tweets mention *impacts* and 0.46% *causes* of CC.

The main communication topics about CC *impacts* from destinations revolve around *fires* and *rains*, while neglecting to address other significant issues such as *droughts, heat waves*, and *beach erosion*. These are recognized threats in many Spanish coastal destinations, as reported by the mass media (La Vanguardia, May 15, 2023) and scientific studies (Gómez-Martín *et al*., 2016; Moreno, 2010; Saurí *et al*., 2013), but they are not present in the tweets. Interestingly, *extreme weather events*, which are common in many of the coastal destinations analysed, and *global warming* are rarely mentioned in the tweets of any destination.

Despite communicating about the c*auses* of CC can help raise tourists' awareness and promote more responsible behaviour (Wibeck & Neset, 2020), the number of tweets and percentages about that category are rare.

The most mentioned topic about *mitigation* was *awareness*, followed by *recycling*, *campaign* and *sustainability*. On the other hand, topics such as *climate change*, *pollution*, or *activism*, practically do not appear. However, *Waste management* is a crucial issue for coastal destinations and very few destinations are addressing this topic.

Table 1. *Percentage of tweets about CC per Twitter/X account, between 2018 and 2022.*

Region	Municipality	Twitter/X account	CC % of total tweets in the account (CC tweet count)				
			Impacts	Causes	Mitigation	Adaptation	Overall
Andalusia	Estepona	@AytoEstepona	0.73% (21)	-	0.76% (22)	1.39% (40)	2.88% (83)
	Fuengirola	@fuengirola	0.08% (6)	-	1.82% (130)	0.81% (58)	2.72% (194)
	Marbella	@Ayto_Marbella	0.48% (36)	-	0.51% (38)	1.67% (124)	2.67% (198)
	Torremolinos	@Torremolinos_On	0.16% (12)	-	0.57% (42)	0.41% (30)	1.15% (84)
	Almuñécar	@AlmunecarAyto	0.22% (23)	0.04% (4)	0.43% (44)	0.21% (22)	0.9% (93)
	Roquetas de Mar	@AytoRoquetas	0.15% (6)	-	0.32% (13)	0.37% (15)	0.83% (34)
	Puerto de Santa María	@ElPuerto	0.02% (2)	-	0.26% (25)	0.46% (44)	0.74% (71)
	San Bartolomé de Tirajana	@AytoSBT	0.05% (1)	-	0.52% (11)	0.05% (1)	0.61% (13)
	Isla Cristina	@Ayto_ic	0.17% (2)	-	0.34% (4)	0.09% (1)	0.6% (7)
	Chiclana de la Frontera	@ayto_chiclana	0.08% (5)	-	0.32% (20)	0.18% (11)	0.58% (36)
Canary Islands	Arona	@AytoArona	0.11% (5)	-	1.14% (53)	0.67% (31)	1.92% (89)
	Adeje DMO	@costa_adeje	-	-	1.49% (14)	-	1.49% (14)
	Puerto de la Cruz	@puertodelacruz	0.12% (2)	-	0.93% (16)	0.17% (3)	1.22% (21)
	Mogán	@MunicipioMogan	0.2% (16)	-	0.22% (18)	0.5% (41)	0.92% (75)
	Pájara	@aytopajara	0.09% (1)	0.09% (1)	0.52% (6)	0.09% (1)	0.78% (9)
	Adeje City Council	@adeje	-	-	0.47% (16)	0.06% (2)	0.53% (18)
	La Oliva	@AytoLaOliva	0.16% (2)	-	0.16% (2)	-	0.32% (4)
Catalonia	Calella	@calellaesmes	0.25% (6)	0.04% (1)	1.06% (26)	0.78% (19)	2.13% (52)
	Lloret de Mar	@Lloret_de_Mar	0.32% (5)	-	0.69% (11)	0.82% (13)	1.83% (29)
	Roses	@AjRoses	0.5% (24)	-	0.4% (19)	0.44% (21)	1.34% (64)
	Sitges	@AjSitges	0.08% (9)	0.02% (2)	0.7% (82)	0.35% (41)	1.15% (134)
	Salou	@AjuntamentSalou	0.05% (4)	-	0.65% (51)	0.24% (19)	0.94% (74)
	Cambrils	@ajcambrils	0.03% (3)	-	0.25% (22)	0.3% (26)	0.58% (51)
Valencian Community	Benicassim City Council	@AytoBenicassim	1.55% (5)	-	2.48% (8)	1.24% (4)	5.26% (17)
	Peñíscola City Council	@ajuntpeniscola	0.83% (32)	0.05% (2)	0.34% (13)	2.35% (91)	3.57% (138)
	Gandia City Council	@aj_gandia	0.7% (40)	-	1.48% (84)	0.95% (54)	3.13% (178)
	Benidorm City Council	@BenidormAyto	0.06% (3)	-	1.42% (68)	0.61% (29)	2.09% (100)
	Benidorm DMO	@visitbenidorm	-	-	0.9% (47)	0.17% (9)	1.07% (56)
	Denia	@DeniaTurismo	0.13% (2)	-	0.57% (9)	0.25% (4)	0.95% (15)
	Benicassim DMO	@tmobenicassim	0.56% (12)	-	0.14% (3)	0.19% (4)	0.89% (19)
	Gandia DMO	@visitgandia	-	0.04% (1)	0.68% (17)	0.08% (2)	0.79% (20)
	Peñíscola DMO	@_peniscola	-	-	0.14% (2)	0.07% (1)	0.2% (3)
Balearic Islands	Santa Eulalia des Rius	@Santa_Eularia	0.13% (3)	-	1.83% (42)	1.74% (40)	3.7% (85)
	Calviá	@_Calvia	0.16% (1)	-	2.79% (18)	0.62% (4)	3.57% (23)
	Eivissa	@ajeivissa	0.04% (1)	-	2.51% (60)	0.38% (9)	2.93% (70)
	Sant Antoni de Portmany	@sant_antoni	0.4% (7)	0.06% (1)	1.38% (24)	0.86% (15)	2.71% (47)
	Manacor	@ajManacor	0.27% (6)	-	1.64% (36)	0.68% (15)	2.6% (57)
	Alcudia	@ajtalcudia	0.1% (1)	-	0.51% (5)	1.12% (11)	1.74% (17)
	Palma	@ajuntpalma	0.04% (2)	-	1.06% (59)	0.54% (30)	1.64% (91)
	Muro	@ajuntament_muro	0.24% (6)	-	0.4% (10)	0.88% (22)	1.52% (38)
	Capdepera	@ajcapdepera	-	-	0.16% (6)	1.03% (40)	1.19% (46)
	Ciutadella	@AjCiutadella	0.13% (1)	-	0.5% (4)	0.25% (2)	0.88% (7)
	Santanyi	@ajsantanyi	0.29% (3)	-	0.29% (3)	0.19% (2)	0.76% (8)
	Balears	@TurismeBalears	-	-	0.39% (23)	-	0.39% (23)
Murcia	Cartagena	@AytoCartagenaES	0.26% (12)	-	0.77% (35)	1.12% (51)	2.15% (98)

Adaptation topics are less frequent in the analysed tweets. Adaptation is important for tourists to be aware of the availability of adapted services. The study reveals that *prevention* and *event cancellation* are present in tweets of many Twitter/X City Hall accounts, but i*nfrastructures* and w*ater management* are much less present.

It should be noted that both DMO and city councils should communicate about CC, and especially about the actions they take in this regard, to their target audiences, which are tourists and locals. These institutions seem that try to avoid CC topics, but they are the responsible organizations for this communication. However, as can be seen, this is very scarce in the social media analysed.

4.2. Clustering of Twitter/X accounts per CC communication categories

The Mclust library in R was used to identify optimal clusters in the categories of CC communication. Principal Component Analysis (PCA) was subsequently employed to visualize the clustering. The clustering model identified four distinct groups.

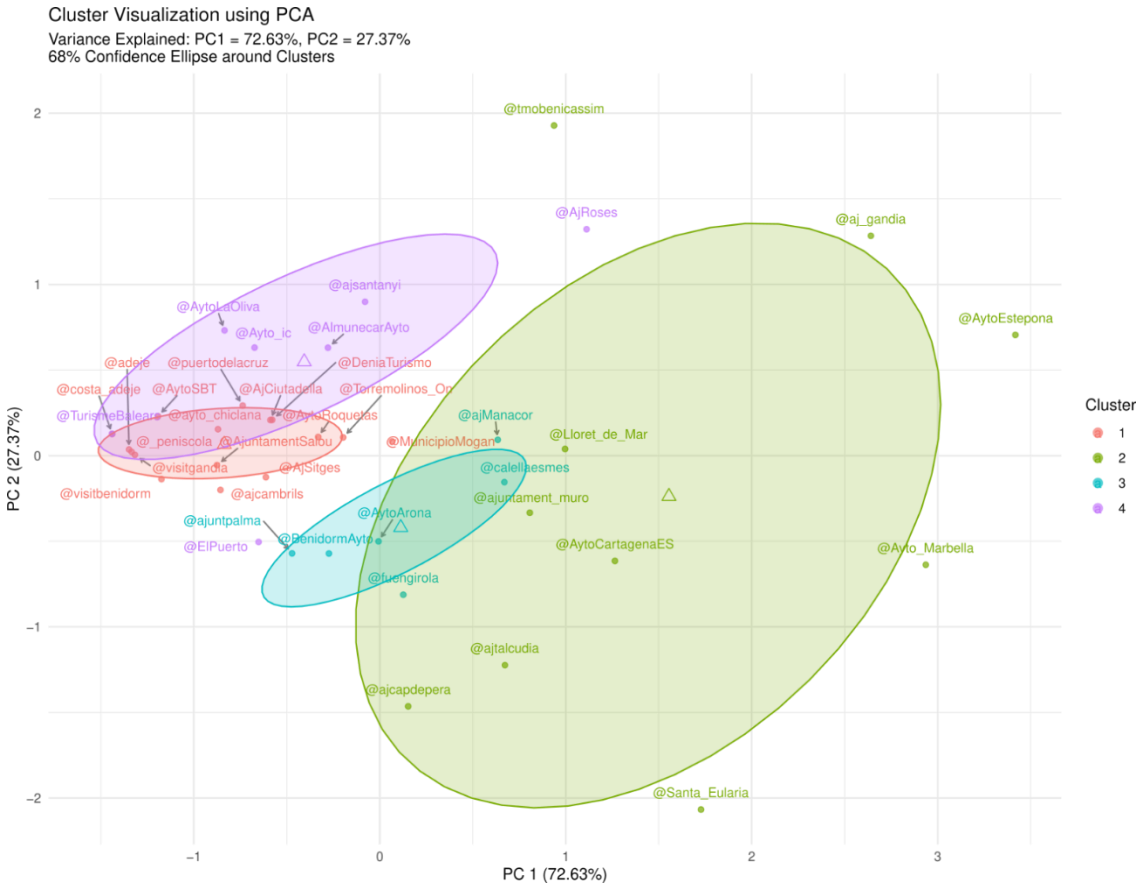

Figure 2. *Principal Component Analysis visualization. Source: Author's own elaboration.*

Cluster 2, that groups only city council accounts, the majority of which are from island towns and specially from the Balearic Islands, exhibited the highest average engagement in the *adaptation* category, indicative of a strong focus on adaptive strategies for CC. Similarly, Cluster 3 stood out in *mitigation*, reflecting a significant orientation towards mitigative actions with also a considerable focus on *adaptation*.

In contrast, *impacts* received less emphasis across all clusters, with Cluster 2 showing a marginally higher mean engagement compared to others.

In the clustering analysis, a noteworthy observation emerged regarding the classification of DMO accounts. Four out of the five DMO accounts analysed were grouped into Cluster 1, characterized by less frequent communication on CC but with a more focused emphasis on *mitigation* strategies. It must be noted that the 91% of the analysed CC tweets are communicated by city councils, while only 9% are from DMO. The analysis also reveals a regional variation in engagement, with the active DMO located in the Valencian Community. Most of DMO messages are related to CC *mitigation* and to a lesser extent on *adaptation* and *causes*. It is puzzling that if destinations are implementing adaptation actions, as communicated on the city councils' Twitter/X accounts, it is not reflected in the tourist accounts.

5. Discussion

The study revealed gaps in the communication of different dimensions of CC, with a focus on *mitigation* and *adaptation* while *impacts* received less attention, and *causes* are practically non-communicated. Communicating about the causes of CC can help raise tourists' awareness and promote more responsible behaviour (Wibeck & Neset, 2020). Previous studies have shown that individuals who are informed about these causes are more likely to be aware of the problem and take measures (Hu *et al.*, 2022). However, the number of tweets and percentages about that category are rare. This indicates that there is significant room for improvement in all the analysed destinations to leverage causes CC communication.

There were also variations observed between regions and destinations. The study highlights the positive contributions of Benicàssim, Peñíscola, Gandía, Benidorm, Santa Eulàlia, Calvià, Estepona, Calella and Fuengirola in terms of communication on CC-related issues. Additionally, island destinations, which are particularly vulnerable to CC, are encouraged to reinforce their messages on the climate crisis, especially Canary Islands.

The research identified gaps in communicating crucial impacts such as extreme weather events and global warming, with very few mentions found. However, other impacts that are already affecting coastal destinations were excluded from the analysis due to their even lower frequency in tweets. Due to has previously been shown that comprehensive and timely information on CC reduce climate risk perception, promote adaptation (Jeuring & Becken, 2013) and is appreciated by tourists generating their satisfaction (Brazyte *et al.*, 2017; Lee *et al.*, 2016), destination CC communication should be improved. Jarrat and Davis (2020) and Gössling and Scott (2018) have found that CC is not yet a priority for many tourist destinations lacking policies or action plans. The present study has also shown that CC crisis communication is not a priority too for Spanish Coastal destinations.

Finally, the clustering resuts have shown that there are different communication strategies among the organizations analysed. A common pattern observed in the analysed DMO is that most of their messages are related to CC *mitigation* and to a lesser extent on *adaptation* and *causes*. However, it is puzzling that if the destinations are implementing mitigation actions, as communicated on the city councils' Twitter/X accounts, this information is not reflected in the tourist accounts. It seems that the focus is on communicating this topic to residents but not to tourists, despite the importance of CC being a matter that concerns both groups.

However, despite the DMO lower volume of tweets, have a more focused communication strategy than other accounts. Meanwhile, the varied distribution of city council accounts across clusters indicates a broader range of communication strategies.

6. Conclusions

This paper conducted a descriptive analysis of 45 Twitter/X accounts and their tweets from the most relevant coastal destinations in Spain, focusing on CC communication. The study considered various topics related to the *causes, impacts, mitigation*, and *adaptation* dimensions of CC. Due to limited communication on the CC crisis from destinations, the analysis was limited to a specific number of Twitter/X accounts, tweets, and CC topics.

The research findings indicate a significant need for improvement in CC communication among the most relevant coastal destinations in Spain. If it has been shown that CC perceptions and perceived risk are influenced by the information and communication received (Hu *et al*., 2022) it is surprising the little communication found. This is particularly crucial due to the socioeconomic dependence on tourism in the analysed territories, which are also highly vulnerable to the impacts of CC. This goes in line with previous studies that observed a lack of information on climate change precisely in countries and destinations most vulnerable to climate risks and heavily dependent on tourism (Scott *et al*., 2016).

The study results have several implications for CC tourist communication management of European destinations. DMO need to have a communication strategy, avoiding automated posting, that addresses the dimensions and topics of CC that concern tourists and the results show that are less communicated. Due to raising awareness of the CC *causes* could motivate more responsible actions among tourists, this topic should be fostered among destinations' communication. Destinations need also to address more *adaptation* issues, because *adaptation* and *mitigation* reduces the perceived risk among tourists. This study is a diagnosis and a contribution that will help to better define the strategies of the destinations in order to communicate their concerns about CC and also to understand the gap that exists between the scholar debate and professional practices (Torres-Delgado *et al*., 2024).

The study acknowledges its limitations, such as the methodology employed and topics that appeared but did not specifically refer to CC. It would be worth to move from a purely syntactic analysis to a semantic analysis, probably profiting from the use of the emergent Large Language Models. Another limitation is to have analysed the CC communication through only one social media, Twitter/X, although it was the most suitable for the study.

In future research the study could take into account other social media, to observe possible differences in communication strategies, and also the results by year to see the communication changes over time.

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References

Araña, J. E., & León, C. J. (2008). The impact of terrorism on tourism demand. *Annals of Tourism Research*, *35*(2), 299–315. https://doi.org/10.1016/j.annals.2007.08.003.

Atzori, R., Fyall, A., & Miller, G. (2018). Tourist responses to climate change: Potential impacts and adaptation in Florida's coastal destinations. *Tourism Management*, *69*, 12–22. https://doi.org/10.1016/j.tourman.2018.05.005.

Becken, S., Whittlesea, E., Loehr, J., & Scott, D. (2020). Tourism and climate change: evaluating the extent of policy integration. *Journal of Sustainable Tourism*, *28*(10), 1603–1624. https://doi.org/10.1080/09669582.2020.1745217.

Bigné, E., Zanfardini, M. and Andreu, L. (2020). How online reviews of destination responsibility influence tourists' evaluations: an exploratory study of mountain tourism. *Journal of Sustainable Tourism*, *28*(5), 686–704. doi: 10.1080/09669582.2019.1699565.

Birkmann, J., & von Teichman, K. (2010). Integrating disaster risk reduction and climate change adaptation: Key challenges – scales, knowledge and norms. *Sustainability Science*, 5, 171–184. https://doi.org/10.1007/s11625-010-0108-y.

Bombana, B., Santos-Lacueva, R., & Saladié, Ò. (2023). Will climate change affect the attractiveness of beaches? Beach users' perceptions in Catalonia (NW Mediterranean). *Sustainability*, *15*(10), 7805. https://doi.org/10.3390/su15107805.

Brazyte, K., Weber, F., & Schaffner, D. (2017). Sustainability management of hotels: How do customers respond in online reviews?. *Journal of Quality Assurance in Hospitality & Tourism*, *18*(3), 282–307. https://doi.org/10.1080/1528008X.2016.1230033.

Buzinde, C. N. *et al.* (2010). Tourists' perceptions in a climate of change: Eroding destinations. *Annals of Tourism Research*, *37*(2), 333–354. doi: 10.1016/j.annals.2009.09.006.

Carrillo, J., González, A., Pérez, J. C., Expósito, F. J., & Díaz, J. P. (2022). Projected impacts of climate change on tourism in the Canary Islands. *Regional Environmental Change*, *22*(2), 61. https://doi.org/10.1007/s10113-022-01880-9.

Cho, J., & Lee, J. (2006). An integrated model of risk and risk-reducing strategies. *Journal of Business Research*, *59*(1), 12–120. https://doi.org/10.1016/j.jbusres.2005.03.006

Coombs, W. T. (2015). The value of communication during a crisis: Insights from strategic communication research. *Business Horizons*, *58*(2), 141–148. https://doi.org/10.1016/j.bushor.2014.10.003.

D'Angelo, S., Alfò, M., & Fop, M. (2023). Model-based clustering for multidimensional social networks. *Journal of the Royal Statistical Society Series A: Statistics in Society, 186*(3), 481-507. https://doi.org/10.1093/jrsssa/qnac011.

Dogru, T. *et al*. (2019). Climate change: Vulnerability and resilience of tourism and the entire economy. *Tourism Management*, *72*, 292–305. doi: 10.1016/j.tourman.2018.12.010.

Exceltur (2022). *Barómetro de la rentabilidad de los destinos turísticos españoles. Balance 2022.* Exceltur. https://www.exceltur.org/wp-content/uploads/2023/03/Baro%CC%81metro-Rentabilidad-Balance-2022.pdf

Fang, Y., Yin, J., & Wu, B. (2018). Climate change and tourism: A scientometric analysis using CiteSpace. *Journal of Sustainable Tourism, 26*(1), 108-126. https://doi.org/10.1080/09669582.2017.1329310.

Goldberg, J., Birtles, A., Marshall, N., Curnock, M., Case, P., & Beeden, R. (2018). The role of Great Barrier Reef tourism operators in addressing climate change through strategic communication and direct action. *Journal of Sustainable Tourism*, *26*(2), 238–256. https://doi.org/10.1080/09669582.2017.1343339.

Gómez-Martin, M. B., Armesto-López, X., & Amelung, B. (2016). Tourism, climate change and the mass media: The representation of the issue in Spain. *Current Issues in Tourism*, *19*(2), 174–198. https://doi.org/10.1080/13683500.2015.1048196.

Gössling, S., Balas, M., Mayer, M., & Sun, Y. Y. (2023). A review of tourism and climate change mitigation: The scales, scopes, stakeholders and strategies of carbon management. *Tourism Management*, *95*, 104681. https://doi.org/10.1016/j.tourman.2022.104681.

Gössling, S. & Scott, D. (2018). The decarbonisation impasse: Global tourism leaders' views on climate change mitigation. *Journal of Sustainable Tourism*, *26*, 2071–2086. https://doi.org/10.1080/09669582.2018.1529770.

Hu, Q., Becken, S., & He, X. (2022). Climate risk perception and adaptation of tourism sector in China. *Journal of Destination Marketing and Management*, 100675. http`://doi.org/10.1016/j.jdmm.2021.100675.

Hübner, A. & Gössling, S. (2012). Tourist perceptions of extreme weather events in Martinique. *Journal of Destination Marketing and Management*, *1*(1-2), 47–55. http`://doi.org/10.1016/j.jdmm.2012.09.003.

Jarratt, D. and Davies, N. J. (2020) Planning for climate change impacts: Coastal tourism destination resilience policies. *Tourism Planning and Development, 17*(4), 423-440. https://doi.org/10.1080/21568316.2019.1667861.

Jeuring, J., & Becken, S. (2013). Tourists and severe weather –An exploration of the role of 'locus of responsibility'in protective behaviour decisions. *Tourism Management*, *37*, 193–202. https://doi.org/10.1016/j.tourman.2013.02.004.

Jonas, A., & Mansfeld, Y. (2017). Exploring the interplay between the use of risk-related information, risk perception formation, and the stages of travel product consumption. *Current Issues in Tourism*, *20*(14), 1470–1488. https://doi.org/10.1080/13683500.2015.1024104.

Karl, M. (2018). Risk and uncertainty in travel decision-making: Tourist and destination perspective. *Journal of Travel Research*, *57*(1), 129–146. https://doi.org/10.1177/0047287516678337.

Knowles, N. (2019). Can the North American ski industry attain climate resiliency? A modified Delphi survey on transformations towards sustainable tourism. *Journal of Sustainable Tourism*, *27*(3), 380–397. https://doi.org/10.1080/09669582.2019.1585440.

Knowles, N. L. B. & Scott, D. (2021). Media representations of climate change risk to ski tourism: a barrier to climate action?. *Current Issues in Tourism*, *24*(2), 149–156. https://doi.org/10.1080/13683500.2020.1722077.

La Vanguardia (15th May 2023). La sequía pone a prueba el turismo ante la llegada de millones de visitantes a España. https://www.lavanguardia.com/economia/20230515/8966717/sequia-pone-prueba-turismo-llegada-millones-visitantes.html

Lee, W., & Gretzel, U. (2012). Designing persuasive destination websites: A mental imagery processing perspective. *Tourism management*, *33*(5), 1270–1280. https://doi.org/10.1016/j.tourman.2011.10.012.

Lee, H., Jai, T. M., & Li, X. (2016). Guests' perceptions of green hotel practices and management responses on TripAdvisor. *Journal of Hospitality and Tourism Technology*, *7*(2), 182–199. https://doi.org/10.1108/JHTT-10-2015-0038.

Li, P., Xiao, X. & Seekamp, E. (2022). Climate adaptation planning for cultural heritages in coastal tourism destinations: A multi-objective optimization approach. *Tourism Management*, *88*, 104380. https://doi.org/10.1016/j.tourman.2021.104380.

Loehr, J., & Becken, S. (2021). The tourism climate change knowledge system. *Annals of Tourism Research*, *86*, 103073. https://doi.org/10.1016/j.annals.2020.103073.

Ma, S. (David) & Kirilenko, A. P. (2020). Climate change and tourism in English-language newspaper publications. *Journal of Travel Research*, *59*(2), 352–366. doi: 10.1177/0047287519839157.

Mariani, M. & Borghi, M. (2022). Exploring environmental concerns on digital platforms through big data: the effect of online consumers' environmental discourse on online review ratings. *Journal of Sustainable Tourism*, *31*(11), 2592-2611. doi: 10.1080/09669582.2022.2033982.

Marine-Roig, E., & Huertas, A. (2020). How safety affects destination image projected through online travel reviews. *Journal of Destination Marketing & Management*, *18*, 100469. https://doi.org/10.1016/j.jdmm.2020.100469.

Moreno, A. (2010). Mediterranean tourism and climate (change): A survey-based study. *Tourism and Hospitality Planning & Development, 7*(3), 253–265. https://doi.org/10.1080/1479053X.2010.502384.

Morgan, N. J., Pritchard, A., & Piggott, R. (2003). Destination branding and the role of the stakeholders: The case of New Zealand. *Journal of vacation Marketing*, *9*(3), 285–299. https://doi.org/10.1177/135676670300900307.

Moyle, C. L. J., Moyle, B. D., Chai, A., Hales, R., Banhalmi-Zakar, Z., & Bec, A. (2018). Have Australia's tourism strategies incorporated climate change?. *Journal of Sustainable Tourism*, 9582. https://doi.org/10.1080/09669582.2017.1387121.

Nadeau, J. *et al.* (2008). Destination in a country image context. *Annals of Tourism Research*, *35*(1), 84–106. doi: 10.1016/j.annals.2007.06.012.

Ogbuabor, G., & Ugwoke, F. N. (2018). Clustering algorithm for a healthcare dataset using silhouette score value. *International Journal of Computer Science & Information Technology, 10*(2), 27-37. https://doi.org/10.5121/ijcsit.2018.10203.

Pang, A. (2013). Dealing with external stakeholders during the crisis: Managing the information vacuum. In *Handbook of research on crisis leadership in organizations.* Edward Elgar Publishing.

Santos-Lacueva, R., Anton Clavé, S. & Saladié, Ò. (2017). The vulnerability of coastal tourism destinations to climate change: The usefulness of policy analysis. *Sustainability*, *9,* 2062. https://doi.org/10.3390/su9112062.

Santos-Lacueva, R. & Velasco González, M. (2018). Policy coherence between tourism and climate policies: the case of Spain and the Autonomous Community of Catalonia. *Journal of Sustainable Tourism*, *26*(10), 1708–1727. https://doi.org/10.1080/09669582.2018.1503672.

Saurí, D., Olcina, J., Vera, J. F., Martín-Vide, J., March, H., Serra-Llobet, A., & Padilla, E. (2013). Tourism, climate change and water resources: Coastal Mediterranean Spain as an example. In P. Schmidt-Thome & S. Greiving (Eds.), *European climate vulnerabilities and adaptation: A spatial planning perspective* (231–252). Chichester: Wiley.

Schliephack, J., & Dickinson, J. E. (2017). Tourists' representations of coastal managed realignment as a climate change adaptation strategy. *Tourism Management*, *59*, 182–192. https://doi.org/10.1016/j.tourman.2016.08.004.

Scott, D., Hall, C.M., & Gössling, S. (2016). A report on the Paris climate change agreement and its implications for tourism: Why we will always have Paris. *Journal of Sustainable Tourism*, *24*, 933–948. https://doi.org/10.1080/09669582.2016.1187623.

Scott, D., Hall, C. M. & Gössling, S. (2019). Global tourism vulnerability to climate change. *Annals of Tourism Research*, *77*, 49–61. https://doi.org/10.1016/j.annals.2019.05.007.

Scott, D. (2021). Sustainable tourism and the grand challenge of climate change. *Sustainability*, *13*(4), 1–17. doi: 10.3390/su13041966.

Seekamp, E., Jurjonas, M., & Bitsura-Meszaros, K. (2019). Influences on coastal tourism demand and substitution behaviors from climate change impacts and hazard recovery responses. *Journal of Sustainable Tourism*, *27*(5), 629–648. https://doi.org/10.1080/09669582.2019.1599005.

Sönmez, S. F. & Graefe, A. R. (1998). Influence of terrorism risk on foreign tourism decisions. *Annals of Tourism Research*, *25*(1), 112–144. doi: 10.1016/S0160-7383(97)00072-8.

Stahl, D., & Sallis, H. (2012). Model-based cluster analysis. W*iley Interdisciplinary Reviews: Computational Statistics, 4*(4), 341-358. https://doi.org/10.1002/wics.1204.

Steiger, R., Scott, D., Abegg, B., Pons, M., & Aall, C. (2019). A critical review of climate change risk for ski tourism. *Current Issues in Tourism,* *22*(11), 1343–1379. https://doi.org/10.1080/13683500.2017.1410110.

Torres-Delgado, A., Font, X., & Oliver-Solà, J. (2024). Self-defence against carbon footprint evidence: How employees of destination management and marketing organisations cope with conflicting environmental and economic data. *Annals of Tourism Research*, *104*, 103722. https://doi.org/10.1016/j.annals.2023.103722.

UNWTO & UNEP. (2008). *Climate change and tourism: Responding to global challenges.* Madrid: UNWTO.

Wibeck, V. & Neset, T. S. (2020). Focus groups and serious gaming in climate change communication research—A methodological review. *Wiley Interdisciplinary Reviews: Climate Change*, *11*(5), 1–16. https://doi.org/10.1002/wcc.664.

Wolf, F., Moncada, S., Surroop, D., Shah, K. U., Raghoo, P., Scherle, N., ... & Nguyen, L. (2022). Small island developing states, tourism and climate change. *Journal of Sustainable Tourism*, 1–19. https://doi.org/10.1080/09669582.2022.2112203.

Wood, M. M., Mileti, D. S., Kano, M., *et al.* (2012). Communicating actionable risk for terrorism and other hazards. *Risk Analysis: International Journal*, *32*(4), 601–615. https://doi.org/10.1111/j.1539-6924.2011.01645.x