The intelligent use of Twitter ecosystems by destination management organisations

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Abstract

Frame of the research: *The recent literature on social media adoption by DMOs identified a lack in the strategic utilization of social media for user-generated content and positive communication as well as for destination brand co-creation and relationship management. In particular, social media's use as a destination knowledge management tool is still a largely unexplored topic and so a novel and promising area of research.*

Purpose of the paper: *The paper investigates the intelligent exploitation by destination management organisations of Twitter to enhance destination knowledge management and value creation. The paper combines analysing the content communicated and shared in the business-to-consumer and the business-to-business Twitter ecosystems and the influential players that shape the knowledge conveyed in these environments. Additionally, the paper explores the impact of the Covid-19 pandemic on content. The joint analysis of these aspects is original and relevant.*

Methodology*: The analysis combines traditional content analysis, modern topic modelling and social media metrics using the specific case of Tourism and Events Queensland (TEQ), the state-level DMO in Queensland, Australia.*

Findings*: The analyses of the two Twitter ecosystems managed by TEQ have shown that each environment has its own knowledge domain and distinguishing characteristics in terms of variety and representativeness of stakeholder categories. The business-to-customer ecosystem primarily serves as a platform for destination marketing knowledge, while the business-to-business ecosystem is more oriented towards destination management knowledge, although less exclusively. The ties between the two are very strong. A handful of influential promotional players have a strategic role in both ecosystems and, crucially, in connecting the business-to-consumer and business-to-business environments.*

Research limits: *The paper deals with a single case study with destination-specific characteristics. To draw broader conclusions, further extensive case study analyses on an international scale and covering various DMOs and social media tools are necessary. Longitudinal evaluation studies are also needed to assess the paths taken in terms of stakeholders engaged, themes covered, and tools used by DMOs.*

Practical implications: *Despite social media having been shown to transfer the locus of knowledge to "the many", e.g., social media users, primary actors continue to exert ownership and control over knowledge. A particular intelligent agent's active management, i.e., promotional players, including the DMO itself, plays a strategic role in shaping the knowledge generated within and across the Twitter ecosystems. DMOs must act as responsible intelligent agents making decisions and taking actions based on common values to sustainably create collective knowledge and value by harnessing Twitter's potential in both business-to-business and business-to-consumer environments.*

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Originality of the paper: *This paper's novelty lies in its comprehensive examination of Twitter use by DMOs in both the business-to-consumer and business-to-business ecosystems and the key players influencing or seeking to influence content within these environments. While existing literature has addressed these issues separately, mainly focusing on the business-to-consumer ecosystem for marketing purposes, this study offers a holistic perspective needed for DMOs to responsibly take the role of intelligent agents in an era characterised by widespread access and participation in value generation and sharing.*

Key words: DMO; digital business ecosystem; social media; Twitter; destination knowledge and value; influential players

1. Introduction

The concept of the digital business ecosystem (Karhu *et al.*, 2011) captures the emergence and embodiment of new collaborative value creation networks that can allow destination management organisations (DMOs) to exploit digital platform potential successfully. These networks present a promising avenue for destination management organisations to effectively harness the potential of digital platforms. Within these digital ecosystems, various stakeholders, encompassing the socio-economic context, institutional entities, and regulatory actors, are strongly interconnected. This interconnectedness amplifies the possibilities for collaboration, competition, innovation, knowledge sharing, and the evolution of business models and adaptive technologies, in alignment with the insights put forth by Zott *et al.* (2010). The creation of their own digital business ecosystems has profoundly changed the role of DMOs from a primary and often exclusive emphasis on place marketing to a more complex set of management responsibilities. The notions of the knowledge-based organisation (Racherla *et al.*, 2008), network manager (Volgger and Pechlaner, 2014) or intelligent agent (Sheehan *et al.*, 2016) all identify the evolving role of the DMO as a body aiming at effective and efficient knowledge management to address threats and opportunities arising within their highly competitive environments.

Their connectivity, data capabilities and smartness (Sigala, 2018) make social media relevant, indeed dominant, digital business ecosystems and one of the main market intelligence sources for destination decision-making (Miah *et al.*, 2017), knowledge management (Bilgihan *et al.*, 2016) and destination marketing (Giannopoulos *et al.*, 2022). Significantly, social media visual content and narration message appeal have shown an increasing role in enhancing destination imagery (Gan *et al.*, 2023). Despite DMOs having integrated these networks of interconnected stakeholders into their management and marketing strategies (Jabreel *et al.*, 2016; Kumar at al., 2022), their potential as knowledge management tools has not yet been fully exploited (Cabiddu *et al.*, 2014). A recent systematic literature review on social media adoption among DMOs (Shah Alizadegan and Liu, 2022), identified the challenges that still need to be addressed including the lack of strategy, knowledge and resources.

Further knowledge is needed on "the strategic utilisation of social media for user-generated content and positive communication" and, significantly, "destination brand co-creation and relationship management".

This is particularly true of Twitter, one of the top most-visited websites worldwide (Antoniadis *et al.*, 2015) and the most popular microblog for current personal and public communication (Tenkanen *et al.*, 2017). As demonstrated in cases such as crisis communication - the COVID-19 pandemic (Morgan *et al.*, 2021), other global health crises or terrorist attacks (Barbe *et al.*, 2018; Oliveira and Huertas-Roig, 2019), Twitter's strength lies in its short and flexible messages (Smith and Brenner, 2012), the short time lags of its updates (Khondker, 2011), intense end-user interactions, and creative content generation (Juntunena *et al.*, 2019). The platform is increasingly serving business communication (Nicolau et al, 2020) and marketing strategies (Soboleva *et al.*, 2017) and its popularity is growing in tourism and destination management organisations (Ćurlin *et al.*, 2019).

The platform's use as a destination knowledge management tool and how DMOs can best exploit their Twitter digital ecosystems are still largely unexplored topics and thus remain a novel and promising area of research (Solazzo *et al.*, 2022). Most studies done in the destination domain focus on Twitter network configurations (Bokunewicz and Shulman, 2017) and the content conveyed on them (Sevin, 2013). However, the literature addresses these critical issues separately, mainly in the business-to-consumer environment and for marketing purposes. Notably, an analysis of the Twitter networks of 14 DMOs (in large US cities) (Bokunewicz and Shulman, 2017) showed that individual, media, and promotional accounts are the most influential on Twitter. However, to determine the account types, only the top 10 most influential accounts in the 14 DMO networks were analysed without explicitly distinguishing between the business-to-consumer and the business-to-business environments and focusing implicitly on the former. Studies on DMOs' Twitter use (Gibbs and Dancs, 2013) and Twitter communication in business-to-consumer and business-to-business accounts (Swani *et al.*, 2014) showed that the specific Twitter environment affects the content communicated.

From both theoretical and empirical perspectives, combining the analysis of the use of Twitter by DMOs in terms of the content communicated and shared in the business-to-consumer and the business-to-business environments and the key players that have most influence or are seeking more influence on content in them, is significant and relevant. These joint aspects shed light on the evolving role of DMOs as intelligent agents using Twitter for this purpose. Accordingly, this paper investigates Twitter's exploitation by a DMO to enhance destination knowledge management and value creation. The paper has been designed to answer these questions: 1) What does the content communicated and shared within the DMO's Twitter ecosystem mainly consist of? 2) Who are the influential players that significantly shape the knowledge conveyed in the ecosystems? 3) How is the Covid-19 pandemic influencing the DMO's Twitter ecosystem?

By integrating advances in qualitative and quantitative research on aspects of the social media digital business ecosystem and Twitter use in

the destination domain, the answer to the research questions is developed by combining social media metrics with traditional content analysis techniques and modern topic modelling using the specific case of Tourism and Events Queensland (TEQ), the state-level DMO in Queensland, Australia. The analyses of the two Twitter ecosystems managed by TEQ have shown that each ecosystem has its own knowledge domain and distinguishing characteristics in terms of variety and representativeness of stakeholder categories. While social media platforms have been observed to shift the focus of knowledge towards the broader user base, "the many" (Munar, 2012), it was evident that primary actors continue to exert ownership and control over the process of knowledge generation and sharing. In fact, the active management of a specific intelligent agent, including promotional actors like destination management organisations (DMOs), plays a pivotal role in shaping the knowledge that emerges within and extends across Twitter ecosystems. This study not only highlights this phenomenon but also paves the way for new avenues of research that centre on DMOs as essential intelligent agents. These agents are responsible for utilising Twitter ecosystems in a sustainable manner to manage destination knowledge and foster value creation within diverse digital environments.

2. Literature review

2.1 The DMO's digital business ecosystem: social media relevance

DMOs involve and coordinate all the elements that form a destination in an open and flexible system of interdependent multiple stakeholders (del Mar Gálvez-Rodríguez *et al.*, 2020. Accordingly, DMOs design strategies to manage created value and foster value creation through collaboration, sharing and trust (Cabiddu *et al.*, 2013). The digital business ecosystems fostered by digital innovations reposition destination value creation on the physical-virtual continuum (Senyo *et al.*, 2019), by putting a socio-economic community of individuals and organisations in a virtual environment. These new organisational networks collectively create value through collaborative and competitive multi stakeholder participation and interaction on shared digital platforms.

Social media platforms are the strategic digital business ecosystem most frequently used by DMOs for multiple purposes (Mariani *et al.*, 2018). They include, among others, network relationships, strategies and process management, knowledge development, dissemination and management and value co-creation. Reshaping real and virtual destination relationships (Baggio and Del Chiappa, 2014), reengineering destination functions (Zeng and Gerritsen, 2014) - including marketing (Felix *et al.*, 2017), image making (Stojanovic *et al.*, 2022) and branding (Buhalis and Sinarta, 2019) - engaging customers (Lee *et al.*, 2021) and fostering knowledge creation, dissemination and management to promote continuous innovation leverage social media connectivity, data capabilities, and smartness (Sigala, 2018). Moreover, they exert influence over perceptions and behaviours (Elshaere *et al.*, 2022; Philander and Zhong, 2016).

Destination knowledge management has been recognised as an important addition to collective destination value creation via social media that needs further investigation (Shah Alizadegan and Liu, 2022). It relies on strategic planning and decision making and communication (especially electronic word-of-mouth, Ćurlin *et al.*, 2019) highlighting trending topics and popular sentiments (Kumar *et al.*, 2022) and identifying opinions and beliefs about products, experiences, and brand reputations (D'heer and Verdegem, 2015) for experience design (Gon, 2021). Destination value co-creation via social media greatly benefits from the network structure (Del Chiappa and Baggio, 2015), the variety of stakeholders involved (Ruhanen *et al.*, 2021), and strong pro-active interactions when these blend market, commitment, trust, and positive emotions (Munar, 2012).

In order to offer relevant and context-aware knowledge while fostering collective value, DMOs must tap into the potential of social media. This entails the identification and adoption of suitable tools for gathering, sifting, extracting, and processing the extensive array of data, often in a variety of formats, as well as the content generated and shared within these ecosystems, as emphasised by Trunfio and Della Lucia (2019). The principal metrics regard the community's size, the volume and nature of the content generated by DMOs and users (links, text, photos and video), the interactions generated by content (comments, shares and likes), and the response time (how fast users react to actions or interactions) (Socialbakers, 2015). In addition to knowing the community's size, the DMO must understand the ties and positions of connected players within the network to gauge whether its digital ecosystem is effective for destination purposes (Bokunewicz and Shulman, 2017).

These social media metrics are complemented with content analyses supported by computerised applications to detect contextual information, i.e., hidden semantic structures in a text body (Trunfio and Della Lucia, 2019). Despite their differences - e.g., inductive vs deductive approaches, dimensions of corpora, data sampling techniques and outputs - Zhang and Wildemuth (2005, p. 2) suggest that "qualitative and quantitative analyses are not mutually exclusive and can be used in combination". Recent studies have shown that their outputs are similar, and their differences complement rather than contradict each other (Lee *et al.*, 2022; Pareschi and Mollona, 2020). Achieving success in these processes is challenging given the diversity of social media ecosystems and the interconnected players that wield most influence within them (Bokunewicz and Shulman, 2017).

2.2 The DMO's Twitter ecosystems: opportunities and challenges

Twitter is an open, public social media platform, and one of the world's most used for personal, public, and business communication (Jin and Cheng, 2020). The tourism industry's use of Twitter for marketing purposes has increased dramatically in recent years for promoting tourist products and services, influencing attitudes and perceptions, answering guests' requests, managing complaints and shedding light on tourists' decision-making processes (Curlin *et al.*, 2019).

The increased sophistication of Twitter's tools and DMO's growing capacity to exploit these tools have extended the platform's use to destination management and marketing. Its usage includes destination image making and branding (Revilla Hernández *et al.*, 2016; Sevin, 2013; Uner *et al.*, 2023), the development of strategies and trend forecasting (Ćurlin *et al.*, 2019), the promotion and monitoring of tourist attractions and services (Jin and Cheng, 2020), the study of people's value, opinions, intentions, and behaviours (Alaei *et al.*, 2023; Becken *et al.*, 2020) and the investigation of the movement of visitors (e.g., during big events; Cheng *et al.*, 2023). Destination stakeholder engagement in real-time through communication, education, outreach efforts and knowledge sharing remains an important application of this platform (Sevin, 2013). As demonstrated by a literature review on Twitter usage in tourism and destination management (Curlin *et al.*, 2019), crisis communication is an emerging use. Due to its features, Twitter has played a crucial role in destination management and marketing not only during (and after) the COVID-19 pandemic but also in other catastrophic events (e.g., hurricanes, snowstorms, earthquakes and terrorist attacks) (Oliveira *et al.*, 2019) and destination event crises (Morgan *et al.*, 2021). Gibbs and Dancs (2013) emphasised that the advances of Twitte's tools and their use by DMOs are shifting this social media from information sharing to information seeking, thus creating opportunities to exploit Twitter's interactive potential for knowledge management and collective value generation.

The key Twitter features that prompted this development were its asymmetric follower model (open and public communication) and its reaction mechanism (retweet and # hashtag) to content (Tweet) (Jin and Cheng, 2020). Retweeting someone by reposting @(suffix with name) multiplies shared conversations (Brandt *et al.*, 2017); liking another person's tweet simply manifests interest and participation but does not directly activate a conversation. When tweets address specific users (i.e., mention), these mentions are also shared. The power of retweets to spread information far and wide makes - potentially all - users peripherally aware of conversations, even if they do not participate in them (Boyd *et al.*, 2010). Information spreads beyond the reach of the original user's followers as the potential audience does not need to give mutual approval to follow or become a follower. The information is available for anyone to read, whether logged into Twitter or not. In addition, using the hashtag symbol (#, suffix with word) before a relevant keyword or phrase in a tweet is a selection strategy that allows content to be categorised and topics to be shown more easily in subsequent searches (Philander and Zhong, 2016). A community of followers commenting on specific Twitter content usually clusters around the hashtag, linking all the tweets that include it (Small, 2011). Meta-hashtags are the most popular hashtags within a set of associated hashtags (Rocheleau and Millette, 2015). They become markers of both the content and related data (Brun and Burgess, 2013) making it easy to reach a wide audience. By contrast, if hashtags are not used, it is hard for the community to access online information. For example, tourists cannot access relevant online content, especially if they do not follow the DMO's account (MacKay *et al.*, 2017).

The features that make Twitter a powerful tool for multiple potential purposes are also potentially problematic to the DMOs endeavouring to understand and exploit its effectiveness for knowledge management and collective value creation (Jin and Cheng, 2020). A destination's Twitter ecosystem is complex and spans both the business and the consumer environment and thus includes heterogeneous stakeholders, all of whom have diverse ranges of geographical reach, roles and influence. Twitter metadata (user profile, Tweet geo-tag, time, and interaction data) are publicly available (de Bruijn *et al.*, 2018) and Twitter users' time-span information can be extracted without violating their privacy (Hasan and Ukkusuri, 2015). However, the high volume, variety and continuous updating of Tweets makes it hard to extract effective information and it is costly, time-consuming, and almost impossible to do manually. Consequently, DMOs are quite often unable "to extract much objective quantitative feedback or establish competitive benchmarks from this available data" (Philander and Zhong, 2016, p. 16). Moreover, the network's scope and the influence of key players shape content and impact the retweeting and mentioning processes (Jin and Cheng, 2020). However, Twitter users do not represent the general population, and Twitter posts do not necessarily represent the whole Twitter user base (Boyd and Crawford, 2012).

Advances in quantitative and qualitative research have been made with regard to a variety of specific issues, but further research is still needed to provide a comprehensive understanding of the use and potential of Twitter (Solazzo *et al.*, 2022). For example, Gretzel *et al.* (2015) classified Twitter's stakeholders according to their role (i.e., residential consumers, tourists, DMOs, tourism suppliers, suppliers from other industries, government agencies and intermediaries). They pointed out that these categories are not necessarily mutually exclusive, as a single actor can play more than one role. Bokunewicz and Shulman (2017) investigated both tourism suppliers and suppliers from other industries and identified the accounts that exerted the most influence on content generation and sharing. Antoniadis *et al.* (2015) analysed the Twitter networks of 38 European DMOs and found that Twitter networks function more like information boards than connected community members mentioning and replying to each other. However, a content analysis of Canadian DMOs' Twitter use, carried out by Gibbs and Dancs (2013), found that Twitter usage underwent a transformation, shifting its focus on seeking information and sharing content related to friendships and relationships.

3. Research design

3.1 Tourism Events Queensland

Queensland, an Australian state covering the continent's northeast with a coastline stretching nearly 7,000 km, is a world-class location for tourism, offering cosmopolitan cities, beaches, outback locations with wildlife and country towns. Prior to the COVID-19 pandemic, Queensland was the third Australian state for visitors (22 million of which 20.4 million were

domestic) and tourism receipts (A$20 billion) and the tourism industry accounted for 7.7% of the national GDP ($28.4 billion) (Tourism Research Australia, 2019). According to forecasts, Queensland's tourism and events sector had the potential to generate around $33 billion by the year 2025; much of the growth was expected to originate from international markets (Tourism and Events Queensland, 2022).

The closure of Queensland's borders from 20 March 2020 to the end of 2021 - and, significantly, its largest domestic source markets (New South Wales and Victoria) - severely impacted the tourism economy. Still, tourism employment decreased at a slower rate, due to the support measures put in place. In the last years other crises also affected the state, such as a "record flooding and rain across South-East Queensland in March 2022 that impacted consumer confidence in travelling to Queensland" (Tourism and Events Queensland, 2022, p. 10) or the war in Ukraine. Nonetheless, the tourism industry has shown encouraging signs of recovery as it adapted to new travel trends and preferences, and the recovery was faster for international leisure rather than international business (Tourism and Events Queensland, 2023).

Tourism and Events Queensland (TEQ) had a major role in this tourism recovery. This case study (Eisenhardt, 1989) provides for a critical evaluation of the intelligent use of social media, such as Twitter, for this purpose. The state's quasi-governmental organisation aims to "achieve economic and social benefits for Queensland by growing the tourism and events industry in partnership with industry and broader government" (Tourism and Events Queensland, 2022). TEQ focuses on marketing and promotional activities (source markets, destination markets and aviation, business-to-customer) in collaboration with the tourism and events industry, and innovation-driven activities which involve researching and analysing big data on tourism in Queensland (business-to-business). It is particularly dynamic and active on social media with a well-developed presence (Hays *et al.*, 2013). TEQ's Twitter strategy is to have distinct consumer and trade environments: @Queensland (business-to-customer) targets travellers and @teqld (business-to-business) targets the tourism industry and businesses.

3.2 Methods

To elucidate the strategic use of Twitter by a DMO for advancing destination knowledge management and value creation, this paper integrates an examination of the content disseminated and exchanged within both the Twitter business-to-consumer and business-to-business ecosystems. Additionally, it performs an identification of influential actors who significantly shape the knowledge disseminated within these environments. In the process, this study delves into the profound effects of the Covid-19 pandemic on these ecosystems.

The research design is a two-step analysis drawing on advances in quantitative and qualitative research in the social media ecosystem (Senyo *et al.*, 2019) in the tourism and destination field and Twitter use for enhancing destination value creation (Jin and Cheng, 2020). It combines traditional content analysis and modern topic modelling (first step) with

social media metrics (second step). The thematic analysis is carried out on content conveyed in TEQ's communications encompassing both the consumer (@Queensland) and business ecosystems (@teqld), including also the impact of Covid-19 on these conversations. Selected social media metrics are used to identify the players exerting most influence on content or seeking knowledge conveyed in the ecosystems.

The research design focuses primarily on the Twitter ecosystems maintained by the DMO, specifically examining the content generated within both the business-to-business and business-to-consumer environments. This choice is driven by Twitter's inherent characteristics of open and public communication, which facilitates the rapid dissemination of information from the original user's account to a wide audience, regardless of whether they are logged into Twitter or not.

Given the research's DMO-centric perspective and its emphasis on one-way communication (i.e., from the DMO to the actors within its Twitter ecosystems), we opted not to incorporate mathematical and graphical techniques commonly utilised in social network analysis to study network structure and dynamics.

3.2.1 Thematic analysis of content communicated in Twitter ecosystems

The themes communicated and shared within each Twitter ecosystem were analysed by combining a traditional qualitative analysis performed using Nvivo and a quantitative one performed using automated topic modelling (TM). The former is mainly inductive, "grounds the examination of topics and themes in the data" (Zhang and Wildemuth, 2005, p. 1) and uses different approaches (conventional, directed, or summative) (Hsieh and Shannon, 2005). Nvivo is a well-established software package for qualitative analyses of relatively large corpora: the software searches data elements by identifying the portions of data that contain them and then providing several possible representations. Nvivo effectively detects main content categories and enables researchers to identify 'unique themes that illustrate the range of the meanings of the phenomenon' (Zhang and Widemuth, 2005, p. 2). However, it is less efficient if required to deal with very large quantities of text as detection and identification must be performed manually.

Quantitative content analysis is deductive and involves the automated discovery of main topics in large corpora; its validity relies on random sampling or other probabilistic approaches. TM is an unsupervised text-mining tool (Lee *et al.*, 2022) which uses a modelling algorithm to detect the most common words and statistical patterns in a corpus and then automatically cluster these words in groups/topics. The most reliable modelling algorithm, the Latent Dirichlet Allocation (LDA) (Eickoff & Neuss, 2017), is well-suited for application to short texts like Tweets (Albalawi *et al.*, 2020). Based on a hierarchical Bayesian approach, it identifies a series of topics in order of importance. Topic importance is evaluated using the frequency of a word and an estimation of the probability that it is associated with a particular topic. The common practice is to perform several trials with different topics and then choose the best number (the

number with the highest coherence) (e.g., Isoaho *et al.*, 2021). The metric used to retain or discard topics is the average value of the (normalised) coherence scores - the semantic similarity of the most frequent words in the topic. For each account, the similarity (Hellinger distance) between topics - the probability distributions of the words describing each topic - is used to connect the topics and identify the core and peripheral ones. The core topics are the most important - the most central and densely connected sets of elements in a network.

3.2.2 Key players exerting most influence on and/or seeking knowledge conveyed in the Twitter ecosystems

As common applications of social network analysis techniques were excluded from our study, well-established social media metrics - community and interaction - were used to identify the key players in each TEQ's Twitter digital ecosystems. A distinction was made between the accounts that follow the DMO's Twitter ecosystems (number of followers), i.e., the community metric, and the single users that the destination management organisation involves in its Twitter conversations, i.e., the *interaction* metric. When possible, all community members (followers and the mentioned single users) were also geocoded at the country level. Twitter account holders do not have to provide this information, so it may be missing and sometimes inaccurate.

The mentioned single users have been regarded as the key actors of the DMO's Twitter ecosystems. Due to the DMO-centric perspective of this research and the one-way conversation, the key actors include the accounts directly mentioned by the DMO. Due to Twitter's open and public communication features, they also include the mentioned accounts that may not be @Queensland's or @teqld's direct followers but whose information is being transmitted directly to TEQ (Retweet). In each ecosystem, the most frequently mentioned single users have been regarded as the most *influential actors*. The representativeness of the mentioned single users has been identified by classifying their role according to Bokunewicz and Shulman's (2017) stakeholder categorisation. In order to cover the variety of actors that the Twitter digital business ecosystem encompasses, this classification was integrated with new categories, i.e., politicians (the premier minister, ministers, members of Parliament and councillors) and regulators of social and environmental domains (institutions, organisations, and associations). Finally, the influence of the five most influential players/categories on the content communicated in the two ecosystems was analysed to connect the analysis of topics with the ecosystems' configuration in terms of key players.

3.2.3 Data collection and analysis

Publicly available data on the Twitter community (follower size, profile, and, when possible, geolocation), content (tweet volume and text content generated by the DMO), and the interactions generated by content, were extracted from TEQ's official Twitter accounts (@Queensland and @teqld).

The period covered is January 1, 2019 to May 30, 2022. Within this time, the period up to June 2020 preceded the increase in COVID-19 cases in Australia. All data were collected through Twitter API using the Tweepy Python library (Roesslein, 2020). Texts (Tweets) generated by the DMO and its retweets for the two accounts were kept separate and were cleaned by identifying words of interest (tokenization), removing punctuation and common terms (stop-words), and normalising and standardising the terms contained in the texts by transforming all inflected words into their basic forms (lemmatization).

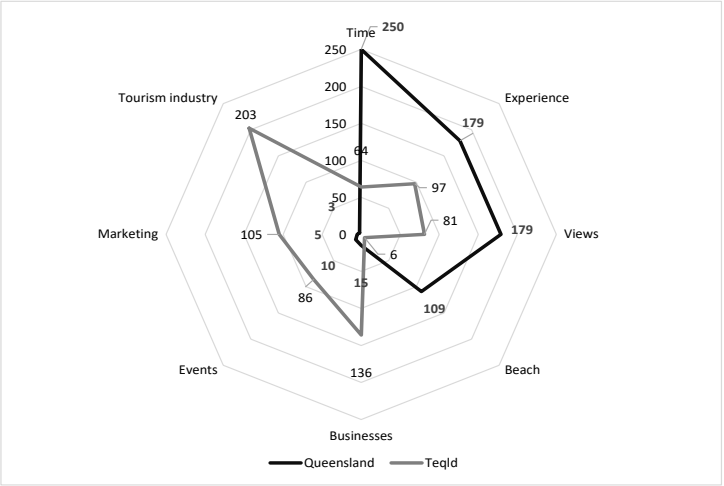
The qualitative content analysis carried out using NVivo 12©1999-2019 used QSR International's auto-code function (lexical analysis) to identify the main themes that group stem words. Synonyms were also manually coded after the text-word searches and matrix-coding comparisons because different parts of a single tweet are sometimes coded to more than one theme. The quantitative analysis was carried out on the same corpus using a machine learning topic modelling (TM) method.

The LDA modelling algorithm extracted and clustered sets of topics and listed the words that most probably belong to each one. The method converged into 20 topics corresponding to coherence scores of 0.456 for Queensland and 0.415 for Teqld, the highest value obtained in the different attempts; calculations were carried out using the Gensim Python package (Řehůřek and Sojka, 2010). The algorithm Gallagher *et al.*'s (2021) Python scripts - an updated and optimised version of Borgatti and Everett's (2000) well-known procedure - were used to perform a network analysis of topics; the 80th percentile was used as the cut-off for defining a link between two topics. Eight main topics were identified for each account, labelled, and compared to identify which themes were common to both accounts and which were unique to one.

Eight major themes that appear in both TEQ's Twitter ecosystems were revealed by comparing the results of the content analyses. Because of the similarity of results of the manual coding (Nvivo) and the network analysis of the topics identified by the LDA (TM), we chose to report the results of the qualitative analysis as they are more effective to illustrate the range of meanings in the Twitter conversations.

This choice is in line with Zhang and Widemuth's (2005) assessment that typologies and descriptions are the most effective way of conveying this information. The eight significant themes that appear in both Twitter ecosystems- time, experience, views, beach, tourism industry, businesses, marketing, and events - were associated with a theme score revealing their different degrees of importance in each ecosystem, i.e., the number of words/references counted in the theme groups for each Twitter account (Figure 1). Any additional themes that were unique to either of the Twitter accounts were identified and coded with manual cross-checking. Turtles and rainforest were found to be unique themes for @ Queensland and COVID-19 and Indigenous tourism were unique for @teqld (Table 4).

Fig. 1: The top eight themes in Tourism and Events Queensland's Twitter ecosystems



Source: our elaboration on TEQ Twitter accounts

Data on TEQ's Twitter ecosystems (community, content and interaction metrics) were collected using Tweepy, a known Python library. In the period examined, more than 3,000 tweets were posted in TEQ's Twitter ecosystems and these generated more than 83,800 interactions, mostly retweets. @Queensland produced more intense communication (2,186 vs 852 tweets) and interactions (79,812 vs 4,042) than @teqld and has a much larger community (165,892 vs 17,910 followers) (Table 1). @Queensland's followers are equally divided between international (30.1%) and domestic (27.6%), with 11.5% from Queensland itself. In contrast, @teqld's followers are mainly domestic (76.4%), and 36.81% are in Queensland (Table 5).

Tab. 1: Tourism and Events Queensland's Twitter ecosystem

Tourism and Events Queensland accounts	Community	Content	Interaction		
	Followers	Tweets	Retweet	Like	Total
@Queensland	165,892	2,186	52,596	27,216	79,812
@teqld	17,910	852	1,412	2,630	4,042
Total	183,802	3,038	54,008	29,846	83,854

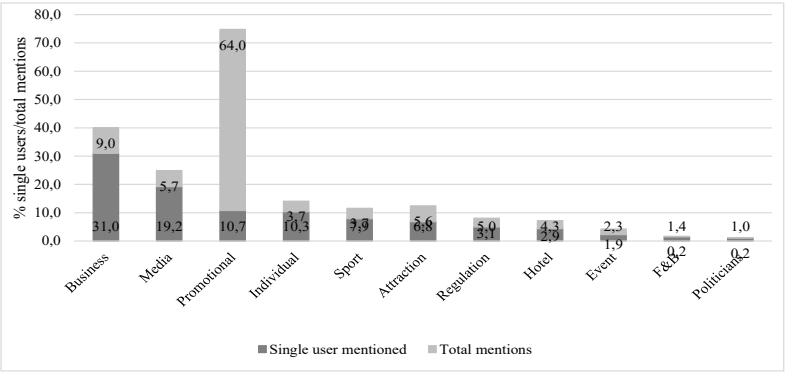
Source: our elaboration on TEQ Twitter accounts

Moreover, the communities of the ecosystems were localised by extracting the location field in the Twitter profiles (less a small - 20% - percentage of empty or invalid values); the locations were classified into three categories (Queensland, Rest of Australia, International). The key players, i.e., single users mentioned on the business-to-consumer and the business-to-business ecosystems, were calculated using Excel on data on accounts collected using Tweepy. Their role - according to Bokunewicz and Shulman's (2017) detailed stakeholder categorisation with the addition of

new categories - was manually coded based on the names and a thorough analysis of the descriptions of their accounts.

Descriptive statistics were used to analyse the representativeness and influence of single user categories in each TEQ's Twitter ecosystem (Figure 2 and Figure 3). Chi-Square statistical tests in R were performed to determine the statistical significance of the difference between the frequencies observed in the dimensions investigated (the representativeness and influence of single user category types) in the two ecosystems.

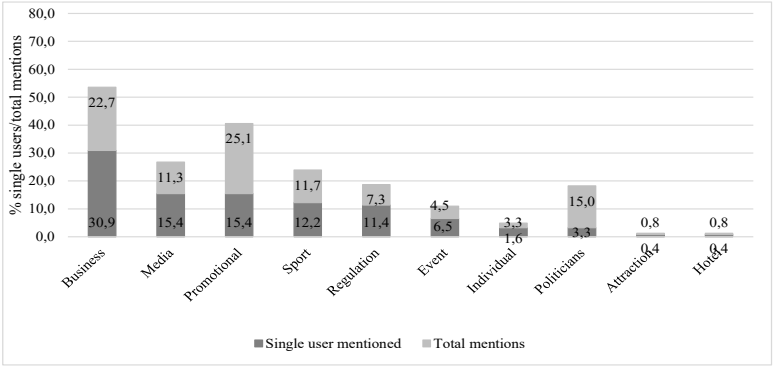
Fig. 2: Single user categories mentioned on @Queensland: representativeness and influence



Footnote:
Single user mentioned: % of single users mentioned in tweets, quotes, replays, and retweets in @Queensland ecosystem per category type.
Total mentions: % of mentions a single user received on the total mentions counted in this ecosystem per category type.

Source: our elaboration on TEQ Twitter accounts

Fig. 3: Single user categories mentioned on @teqld: representativeness and influence



Footnote:
Single user mentioned: % of single users mentioned in tweets, quotes, replays, and retweets in @teqld ecosystem per category type.
Total mentions: % of mentions a single user category received on the total mentions counted in this ecosystem per category type.

Source: our elaboration on TEQ Twitter accounts

The scores of the themes covered by the top five accounts mentioned in both ecosystems were manually coded and cross-tabulated with the eight top-scoring themes. Descriptive statistics along with Lorenz curves and Gini coefficients (Fellman, 2012) were used to identify the concentration or dispersion of the top-scoring themes in the conversations generated in each ecosystem and to show the extent to which the top five accounts mentioned in the ecosystems and their related stakeholder categories, benefit from (and/or lead) the conversation around these themes. These tools are commonly used in tourism management and marketing studies to examine the factors influencing the issues analysed (Kronenberg & Fuchs, 2022).

4. Findings

The study provided an understanding of the significant themes discussed across TEQ's Twitter ecosystems including the subthemes unique to each one of them thus showing the effects of the Covid-19 pandemic on content. Moreover, it identified the key players (and their categories) exerting most influence, or seeking more influence, in the Twitter conversations. Findings are discussed, comparing the content disseminated on the two ecosystems and their connection to the two Twitter accounts' configurations with regard to their key players and influential categories.

4.1 The most significant themes discussed within the TEQ ecosystems

The eight major themes that appear in both TEQ's Twitter ecosystems and spark involvement in a digital conversation differ from one account to the other, with very little overlap (Figure 1). Time (250), experience (179), views (179), and beach (109) are the top-scoring themes in @ Queensland and represent 96.5% of the conversation in this ecosystem. The reverse holds true for @teqld: the tourism industry (203), businesses (136), marketing (105), and events (86) are the most important themes and together they represent 68.1% of the conversation generated in the business ecosystem. This is because three top-scoring themes in the business-to-consumer ecosystem - experience (98, i.e., 12.5%), views (81, i.e., 10.4%) and time (64, i.e., 8.2) - are also important in the business-to-business ecosystem. The distribution of the top-scoring themes, built by combining their frequency (x-axes) and their cumulative share (y-axes), shows that the conversation is not equally distributed among the eight themes. In both ecosystems, four (different) themes have the biggest share (Figure 4 and 5). The Lorenz curves and Gini coefficients show that the concentration is higher on @Queensland (Gini = 0.39) than in @teqld (Gini = 0.29), as the themes are more evenly distributed on the latter.

Upon closer examination, the distinct focus of each ecosystem appears (Tables 2 and 3). On @Queensland, time can refer to the good times tourists have in Queensland, or to having more time to oneself, or to the different times (of the day, of the year) in which they can enjoy nature/ wildlife and activities. Experience mainly relates to (terrestrial and marine)

native Queensland wildlife and how to get up close to them. Views is about what you can see in Queensland, and its beauty and value: the scenery and/or wildlife. Queensland beaches get their own theme, which includes beach names and the activities available at/near them (cricket, quad biking, swimming). Surprisingly, the urban component of the state's tourism offers - Brisbane nightlife, sports stadiums, Gold Coast high-rises, etc. - is almost non-existent in the findings.

The subsequent Tweets serve as examples illustrating the thematic content communicated within the business-to-consumer ecosystem (Table 2), recalling good experiences, memories and feelings:

"We could sit and stare at the view all day" (Time - valuing time)

"Ready for your next selfcare? Let @VisitMackay take care of that for you; Tropo islands, lush rainforests" (Time - activity)

"Lucky guests on board @bluedolphintour witnessed two whales spy hopping" (Experience - native terrestrial and marine animals)

"You will never get tired of swimming with turtles.....ever!" (Experience - with animals"

"@HeronIsle in @gladstoneregion is home to incredible views, turtle hatchlings, research centres, incredible wildlife" (Views - beauty/values of views)

"There's nothing quite like a Surfers Sunset" (View - natural lanscape)

"You can always count on Kirra Beach to have the clearest waters on the Gold Coast" (Beach - specific beaches)

Tab. 2: Top four themes in @Queensland

Themes/score	Sub-theme and description
Time (250)	Valuing time/having more time: beautiful days, days, lazy days, and nap time. Nature/wildlife/activity: turtle hatching season, mountain or island time, day cruises. Moments/seasons: cracking [excellent] daily dose of summer, day trips, Autumn and crushing seasons.
Experience (179)	Native terrestrial and marine animals: koala, kangaroo, dingo, butterfly, lorikeet, cassowary humpback whale, turtle, crocodile. Experience with animals: feeding, 'getting up close and personal', meeting, getting some shots, seeing in person.
Views (179)	Natural landscape/wildlife: beaches, ocean, skyline, valley, birds. Beauty/value of views: dreamy and unforgettable, glittering, idyllic, spectacular, stunning, sublime, sweeping skyline, night-time view, birds-eye view
Beach (109)	Specific beaches: Bullock, Dorilla, Bramston and Wongaling; secluded, favorite, and patrolled. Beach activity: fun things, cricket, quad bike rides, swimming.

Source: our elaboration on TEQ Twitter accounts

The top-scoring @teqld themes (Table 3) include the Tourism industry, covering any issues that TEQ discusses with industry stakeholders and experts in different regions, and the tools and methods used by the DMO to interact with them. Business goes into the DMO's activities in more depth, covering both offline and online business, support, and opportunities, including partnerships. Attention is paid to Indigenous-owned tourism businesses as Indigenous tourism operators and attractions are important industry assets. Marketing provides more details related to the topics and tools central to the DMO's main activities. Finally, events - an important tourism and destination marketing tool that requires funding and management - covers the different types - occasional/recurring, local/regional or mega, sporting, cultural - of events that are, or could be, included in event strategy-making and portfolio building.

The following Tweets provide evidence of thematic content conveyed on the business-to-business ecosystem (Table 3), showing clarity and a professional and informative tone tailored to the needs and expectations of a businesses and professional network:

"This week's industry news - Qld to host the @WNBL [Women's National Basketball League] from next month Good to Go campaign extends to ACT, BIG4 campaign" (Tourism industry - tools to engage the industry)

"Industry news - Queensland events Good To Go, COVID-19 updates, business coaching opportunity and more (Tourism industry - topics and tools to engage the industry)

"Affected by the North Queensland monsoon? Here is a summary of the business assistance grants and loans available" (Business - support)

"Grow Japan market - TEQ invites industry partners seeking growth from Japan to join the QLD on Tour Japan 2019" (Business - event business)

"TEQ's North America office has released a comprehensive update on its marketing activities" (Marketing - topic)

"Industry news - World Number 1 helps promote Indigenous tourism experiences, latest TEQ marketing update" (Marketing - topic)

"TEQ's market briefings series announced, new QDEP funding for events, latest marketing update and tips" (Marketing - tools)

"Latest tourism industry news in Eye on Q - includes Qld's sports showcase at SportAccord" (Tourism industry/Events)

Tab. 3: Top four themes in @teqld

Themes/score	Sub-theme and description
Tourism industry (203)	Industry stakeholders: aviation, hotel, event, Indigenous operators, leaders, leading experts, regional DMOs, tourism regions. Topics: local tourism economy, industry trends, domestic tourism (figures), outback tourism, Indigenous tourism attractions, bushfire recovery, recommencing tourism operations. Tools/ways to engage the industry: briefing, guidance, toolkits, campaigns, brochures and newsletters, snapshots.
Business (136)	Activity: online business, agile business, webinar, local business, events business, business support, business opportunities, business partners and Indigenous-owned tourism businesses.
Marketing (105)	Topic: costs, (international/global/marketing) campaigns, fashion market, (global/international/out-of-home) market, western markets, trends, market changes, initiatives. Tools: planning, briefings, snapshots, insights and (future) approaches, activity updates, (email marketing) metrics
Events (86)	Type: regional and annual events, destination events; major events capital, sporting events, professional surfing, hockey, tourism business-to-business events, festival events and sustainable events; spectacular, live, spawning; event management, huge event funding.

Source: our elaboration on TEQ Twitter accounts

4.2 Unique themes for each Twitter ecosystem: the effects of the COVID-19 pandemic on content

The effects of the pandemic on content only appear in the business-to-business ecosystem in the sub-themes unique to each account (Table 4). COVID-19 (51) includes specific support mechanisms for the tourism industry and businesses to help them to deal with the crisis, the impact of which has been unprecedented. Another niche theme in @teqld is Indigenous tourism (11) which covers specific ways of enhancing, and extracting value from, Indigenous resources in partnership with cultural and creative industry stakeholders (Indigenous artists and the Cairns Indigenous Art Fair). The goal is to raise the profile of Indigenous tourism in Queensland's image-making. Again, the urban component of the tourism offer makes no appearance.

The following Tweets exemplify the unique thematic content conveyed in the business-to-business Twitter ecosystem (Table 4)

"COVID-19 update - What the latest Greater Brisbane restrictions mean for Queensland's tourism operators" (COVID-19 - crisis communication)

"VIC LOCKDOWN: What Qld's tourism operators should do. Get easy-to-understand info for your guests" (COVID-19 - business aids)

"Indigenous tourism resource - Tourism businesses can access information about the support available" (Indigenous tourism - specific aids)

"Year of Indigenous Tourism extended, Queensland the nation's sporting capital, business development opportunities" (Indigenous tourism - development of indigenous tourism)

On @Queensland, unique sub-themes include turtle visiting (44) and rainforest destinations (28) and are linked to this account's main themes (experience, views, and time) (Table 4). The turtle theme teaches people how to experience and protect this native species and its environment, parts of which are currently well preserved while others are at risk. Specific destinations (O'Reilly's, Daintree) feature in the rainforest theme, focusing on both the universal value of this extraordinary ecosystem and the self-help/self-development benefits of experiencing it. Examples of Tweets on these unique sub-themes are the following (Table 4):

"If you're visiting us over the coming months, join one of our complimentary tours. Turtle nesting season has officially begun" (Turtles - time)"

"The turtles are coming to Heron Island: If you've been dreaming of a turtle and awesome nesting or hatching experience" (Turtles - experience)

"Drone footage shows the largest remaining breeding ground for green turtles in the world. The video revealed up to 64,000 turtles" (Turtles - environment/views)

"Daintree Rainforest. Tropical Far North Queensland, Where the rainforest meets the reef. Home to both rare fauna and flora" (Rainforest - specific destinations)

"Craving something new this weekend? From roaring waterfalls to nature walks in ancient rainforests" (Rainforest - value)

"You can't buy happiness but you can book a #RiverDriftSnorkelling tour through the world's oldest tropical rainforest (Rainforest - value)

Tab. 4 Unique themes in @Queensland and in @teqld

Account	Themes/score	Sub-theme and description
@Queensland	Turtles (44)	Experience: magical (turtle) sightings, (turtle) nesting, places to experience the turtles. Environment: habitat conservation, war on waste.
	Rainforest (28)	Specific destinations: O'Reilly's and Daintree. Value: World Heritage Rainforest, destination retreat.
@teqld	COVID-19 (51)	Business aids: resources to prepare and respond, business continuity plans, advice on managing staff, crisis communications, webpage providing the latest official advice and resources.
	Indigenous tourism (11)	Specific aids: new expressions of interest in indigenous tourism resources and indigenous artists, new industry brochure with information and support to develop and promote Indigenous tourism experiences, sculptural/artistic installation at Cairns Airport in partnership with the Cairns Indigenous Art Fair.

Source: our elaboration on TEQ Twitter accounts

4.3 TEQ's Twitter ecosystems: key players and influence

More than 650 single users were directly mentioned in the conversations (tweet, retweet) posted on TEQ's Twitter ecosystems: 484 single accounts were mentioned on @Queensland and 123 on @teqld (Table 5). The overlap between the two ecosystems is marginal - only 40 (6.1%) of the total single users are mentioned in both accounts. They correspond to the key players who benefit most from, and have most influence on, the information shared in the ecosystems. In both Twitter accounts the majority of key players is domestic (77.7% and 76.4%, respectively) and most are located in Queensland (49.4% vs 49.6%) - less than 25% of influential players are international. The intense communication on @Queensland and the community size and location are consistent with the destination marketing strategy of targeting an international audience pursued in the business-to-customer environment.

Tab. 5: TEQ's Twitter ecosystem members and their locations – percentage numbers

Location	@Queensland		@teqld	
	Single user mentioned [1] %	Followers %	Single user mentione %	Followers %
Queensland	49.4	11.5	49.6	36.8
Rest of Australia	**28.3**	16.1	26.8	19.6
International	22.3	30.1	23.6	17.6
Unknown	0.0	42.3	0.0	26.0
Total	100.0 [2]	100.0 [3]	100.0 [2]	100.0 [3]

Footnotes:
1 Single user mentioned: accounts mentioned in tweets and retweets both @Queensland's or @teqld's direct followers and others
2 Total number of single users mentioned: 376 in @Queensland and 123 in @teqld
3 Total number of followers: 165,892 in @Queensland and 17,910 in @teqld

Source: our elaboration on TEQ Twitter accounts

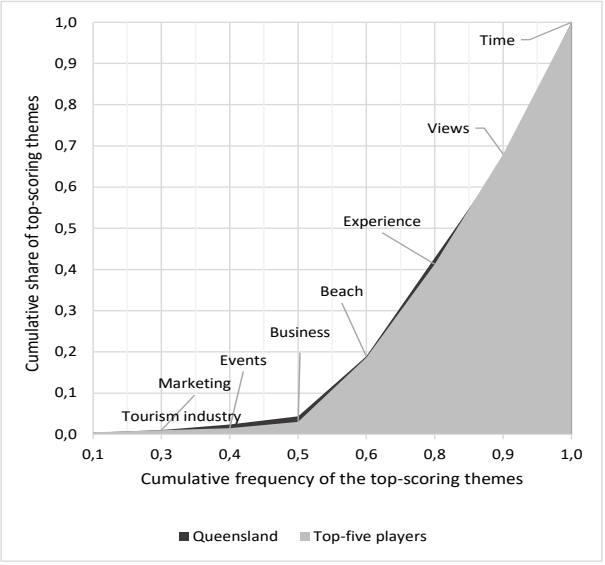
All stakeholder categories are represented amongst the influential players. The top three representative ones - business, media, and promotional categories - are the same in the two accounts (Figures 2 and 3). Their representativeness and influence, however, differ. On @Queensland (Figure 2), the top five represented categories (including individuals and sports) account for 79.1% of the total number of influential players and 86.7% of mentions. On @teqld (Figure 3), they are 85.4% and 78.1% respectively, including sports and regulation. Despite being the third most representative in both ecosystems, promotional accounts are the most influential, accounting for 64.0% of mentions on @Queensland and 25.1% on @teqld. The second most influential category is business, accounting for 9% and 22,7% of mentions in each ecosystem respectively. On @ Queensland, the top five influential players are all promotional accounts, and the most influential player is actually Queensland (self-promotion).

Although (neither national nor regional) politicians are highly represented (3.3%) on @teqld (Figure 3), they are the third most influential (15.0%) category. In fact, one particular politician is actually ranked as the

most influential player. The top five players on @teqld are more diverse than those on @Queensland: two promotional accounts (ranked second and fifth), a business account (third), and a sports account (fourth). One of these promotional accounts (the one ranked fifth) is Queensland; Teqld is the sixth. Promotional accounts are also the most representative and influential of the few stakeholders represented on both ecosystems. The chi-squared tests showed that these differences are statistically very significant (p-value < 0.001).

The disproportionate influence of a handful of accounts on both ecosystems is revealed by cross-tabulating the top-scoring themes with the top five influential players for each account (Figures 4 and 5). Their influence is higher on @Queensland than on @teqld: on the former, it depends on a single category; on the latter, on heterogeneous categories. On @Queensland, the themes are more unequally distributed across the top five accounts than across the entire ecosystem, but the same four themes have the biggest share in both cases: the Gini coefficient raises to 0.54 (0.39 in Queensland). As the top five players are all promotional accounts, this category very largely shapes the conversations around time, experience, views, and beach within the ecosystem; Gladstone's official account is the most influential (Gini = 0.67) followed by @Queensland and Tourism Tropical North Queensland (Gini = 0.60).

Fig. 4 The distribution of the top-scoring themes of the top five influential players in @ Queensland compared to the top-scoring within the ecosystem generally



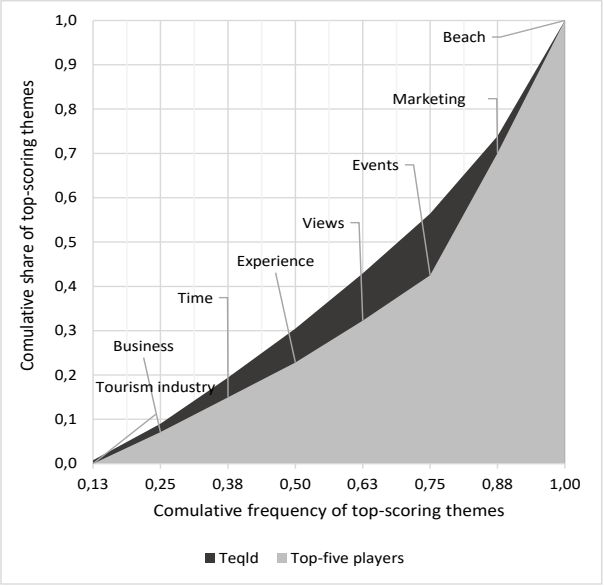
Footnote:
Top five players: the official accounts of promotional stakeholders (Tourism Queensland, Tourism Australia, Tourism Tropical North Queensland, Destination Gold Coast, and Gladstone)
Gini coefficient of @Queensland: 0.39
Gini coefficient of the top five players in @Queensland: 0.54

Source: our elaboration on TEQ Twitter accounts

The same is true for the business-to-business account (the Gini coefficient is 0.40 compared to the entire @teqld, 0.29) although the ranking of themes is different. The first two are the same as on @teqld (tourism industry, business) but they are followed by time and experience, the first and third themes in Queensland. The heterogeneity of the categories into which the top five players fall (a politician, a business, and three promotional accounts including @teqld itself) affects these shares.

The politician (Gini = 0.52), @teqld itself (Gini = 0.57) and the media account (Gini = 0.45) are the most influential of the five and lead the conversations around the tourism industry, business, and time. Tourism Australia and Destination Gold Coast are promotional accounts that appear in the top five within both ecosystems, along with TEQ's Twitter accounts.

Fig. 5: The distribution of the top-scoring themes of the top five influential players in @teqld compared to the top-scoring within the ecosystem generally



Footnote:
Top five players: the official accounts of a politician, a business, and three promotional accounts including @teqld itself.
Gini coefficient of @teqld: 0.29
Gini coefficient of the top five players on @teqld: 0.40

Source: our elaboration on TEQ Twitter accounts

5. Discussions

The content conveyed within Twitter ecosystems reveals the diverse ways in which the DMO uses this social media for creating and managing destination knowledge and who are the intelligent agents exerting the most influence on content conveyed in these environments.

The Twitter business-to-customer ecosystem resulted in being the environment of destination marketing knowledge, while the business-to-business ecosystem the environment of *destination management* knowledge, although less exclusively. This distinction reflects a fairly faithful reproduction in the digital environment of the primary DMO's functions (del Mar Gálvez-Rodríguez *et al.*, 2020; Trunfio and Della Lucia, 2019). It is also in line with previous studies (Gibbs and Dancs, 2013; Swani *et al.*, 2014) showing that the Twitter ecosystem affects the nature of knowledge communicated. This insight is strengthened by the audience that each Twitter ecosystem targets and the sub-themes particular to one or the other ecosystem. As is evident from its marketing content, @Queensland targets a big international audience of followers but interacts mainly with domestic key players (including individuals) - unsurprisingly, since almost all arrivals are currently domestic. In contrast, @teqld mainly targets and engages local stakeholders, in line with its destination management goals.

The themes that were unique to either of the Twitter accounts further qualify the marketing vs management knowledge distinction. The focus is on specific attractions and experiences on @Queensland (turtles and rainforest), and on specific stakeholders/assets (Indigenous people) or current crises impacting the destination on @teqld. The COVID-19 pandemic is a sub-theme unique to the business-to-business environment; the discussion focuses on the strategies and tools used to aid and inform industry stakeholders in this extreme situation. This result not only confirms that crisis communication has emerged as a growing and key function of the Twitter platform (Curlin *et al.*, 2019; Morgan *et al.*, 2021; Oliveira *et al.*, 2019) but also that DMOs are using Twitter as a knowledge management tool, i.e., a "what's-happening-right-now tool that enables interested parties to follow individual users' thoughts and commentary on real-time events" (Noor *et al.*, 2021, p. 610). However, one would have expected the COVID-19 theme to emerge also in the business-to-consumer environment as the literature has shown Twitter playing a crucial role not only in providing real-time information and promoting safety measures to tourism but also in keeping travellers engaged and interested in destinations, e.g., by promoting virtual travel experience, inspiring trust and affecting familiarity, sense of belonging and attachment with the destination (De Canio *et al.*, 2023) in order to reduce perceived risks, particularly for domestic tourists that represent an important share in this destination. Instead, the support measures put in place to promote destination resilience and the tourism industry's recovery prevailed in Twitter communication, probably reflecting the strong partnership of the DMO with the tourism and events industry - the representativeness and influence that the business category has on @teqld.

An important latent insight gained by combining the marketing and management knowledge is the projection of TEQ as a soft and 3S-flavoured ecotourism destination focused on (terrestrial and marine) wildlife, beaches, and rainforests, complemented with Indigenous people and their life. This insight confirms the role of Twitter in supporting destination image shaping and branding (Revilla Hernández *et al.*, 2016; Sevin, 2013; Uner *et al.*, 2023). The fact that the territory's urban (non-

Indigenous) dimension is effectively ignored is also evident, but this finding may be indirectly connected to the COVID-19 pandemic as not crowded destinations offering safety, space, and flexibility were preferred by tourists during the pandemic. This latent ecotourism image risks creating a conflict between the core and the periphery if not carefully managed. Urban-based business stakeholders, including regulators that are highly represented on @teqld, should be involved in promoting, reinforcing, or interacting with the latent ecotourism theme; they might want a stronger urban flavour to be included in the destination management knowledge, particularly in post-pandemic times.

The findings on the key actors exerting more influence over knowledge generation and management complement and strengthen the content conveyed within the Twitter ecosystems. Of relevance to this discussion is that the two accounts appear - at first sight - to function as separate environments, i.e., only a few influential stakeholders are represented across both ecosystems. However, the ties between the two are very strong as shown by the most representative and influential categories in both accounts. Three (business, media, and promotional) categories appear among the top five represented. Promotional accounts are the most influential, followed by business accounts. The third most influential categories are media on @Queensland and politicians on @teqld, although the regulators are more highly represented in the latter.

Significantly, the promotional category plays a strategic role in both ecosystems and, crucially, in connecting the business-to-consumer and business-to-business ecosystems and shaping the knowledge conveyed. Not only is this category the best-represented within both environments but the influence of a handful of its players is disproportionate. The DMO (TEQ) is the primary actor in this regard as its official Twitter accounts appear among the top five agents in each ecosystem. In other words, this particular intelligent agent's active management shapes the knowledge generated within and across the Twitter ecosystems. Promotional players influence the marketing knowledge created on @Queensland and the blending of management and marketing knowledge on @teqld. The conversations of the top players (all promotional accounts) lead the conversation on the business-to-consumer ecosystem: the content concentrates on the same top four marketing themes discussed on @ Queensland. The heterogeneity of player categories, including promotional players, leading the conversation on @teqld blends the marketing themes with the management themes discussed in this ecosystem. Our findings on the extent to which players and particular categories influence Twitter content are partially consistent with the insights offered by an analysis of the networks of 14 DMOs (in large US cities) (Bokunewicz and Shulman, 2017). The latter study revealed that individual, media, and promotional accounts wield the greatest influence. Instead, our research shows that individual players rank as the fifth most influential category in the business-to-consumer ecosystem (@Queensland), while in @teqld, they hold the position of the third least influential. While Bokunewicz and Shulman's study did not explicitly distinguish between the business-to-consumer and the business-to-business environment and focused implicitly on the

former, our study covered both ecosystems and all the influential accounts. The former study analysed only the top 10 most influential accounts in the 14 DMO networks to determine the account types.

6. Theoretical and managerial implications

The insights of this research have methodological and theoretical value and managerial implications that could enable DMOs to reinvent themselves *sustainably* as intelligent agents. The integration of Bokunewicz and Shulman's (2017) stakeholder category types with the regulator and politician categories is novel and contributes to integrating the different strands of the literature on Twitter content, ecosystem configuration in terms of stakeholder categories and influential players. Each ecosystem is confirmed to have its own knowledge domain and distinguishing characteristics in terms of the variety and representativeness of stakeholder categories. The latter's influence is crucial to the shaping of the knowledge domain and connecting the ecosystems. Studying combinations of these issues is thus relevant and effective theoretically and strategically. While the representativeness of individuals (potentially tourists) is significant in the configuration of the business-to-customer environment - as shown by Bokunewicz and Shulman (2017) - and that of regulators in the business-to-business environment - as shown by our study - what resulted to be crucial and impacting on content/knowledge is the promotional category and, indeed, the disproportionate influence of just a handful of promotional players, including the DMO itself. The influence that these actors have on both the destination marketing knowledge created within the business-to-customer ecosystem and the blending of management and marketing knowledge in the business-to-business one, qualifies them as intelligent agents in the destination digital environment. This insight sparks a discussion regarding the ideal characteristics and functions of an intelligent agent within an organisational network that collectively generates value through collaborative and competitive engagement among multiple stakeholders on shared digital platforms. Although social media ecosystems have been demonstrated to shift the centre of knowledge towards "the many" (the social media users) and foster tribal dynamics among community members to drive the evolution toward new value generation paradigms (Munar, 2012), it appears that primary actors still retain ownership and authority over knowledge creation and dissemination. The boundary between collective responsibility and manipulation in value generation appears muddled unless the role of intelligent individuals is rooted in shared values. To put it differently, establishing common values is imperative for the sustainable development of a destination's collective knowledge and value.

From the managerial viewpoint, these advances have preliminary implications. First, Twitter is a destination-knowledge-management tool that can be used actively and intentionally by DMOs to create and manage destination-knowledge in different environments: it targets specific audiences providing specific knowledge within a community of

interconnected players while integrating destination management and marketing knowledge. Second, this integrated knowledge may strongly affect destination image, product development and tourism experience building, thus impacting the collaborative/competitive dynamics between actors who are representative - or not - of this image. Third, and closely related, the health and resilience of the ecosystems may be affected by any concentration of knowledge (creation/management) in the hands of very few promotional intelligent agents, if the latter (choose to) exploit their domination. Fourth, in line with the literature that widely recognizes the role of tribal dynamics between diverse community members for value generation, DMOs must allow and foster these value co-creation dynamics being responsible intelligent agents whose decisions and actions are values-based. Fifth, identifying and involving other representative and/or influential players is crucial to contribute to creating collective knowledge and value within the ecosystems. Such players may be tourists - in the business-to-customer ecosystem - or regulators - in the business-to-business one. Moreover, partnering with strategic stakeholders (digital companies/providers) within the ecosystem may help DMOs to develop their capabilities and tools to sustainably manage destination knowledge.

7. Conclusions

This paper examined the evolving role of the DMO as an intelligent agent (Sheehan *et al.*, 2016) creating and managing collective knowledge and value through digital business ecosystems meant as new organisational networks based on digital platforms (Senyo *et al.*, 2019). Social media are relevant and dominant business ecosystems used as main market intelligence sources for destination management and marketing (Miah *et al.*, 2017). The originality of this paper lies in the combination of relevant topics related to the use of Twitter by DMOs in both the business-to-consumer and business-to-business ecosystems. The joint analysis of content conveyed on Twitter and the key players that have most influence or are seeking more influence offers an integrated perspective on the use of this platform for digital destination management and marketing. This comprehensive perspective is needed for DMOs to consciously take the role of intelligent agents in an era characterised by democratic access and participation in value generation and sharing. While Twitter use is steadily increasing in the destination domain, the literature has done little to explore how this is happening or may happen, responsibly and sustainably. Previous studies have assessed relevant issues separately thus providing fragmented pieces of knowledge. Thus, analysing the intelligent use of the Twitter digital ecosystem through an integrated approach appears to be novel so far, deserving further research, particularly to serve the sustainable goals of responsible intelligent agents.

This exploratory contribution has limits, particularly as it deals with a single case study with destination-specific characteristics. It means that the findings cannot necessarily be easily generalised to other contexts. Extensive case study analyses on an international scale and covering

a variety of both DMOs and social media tools are needed to collect insights about how these organisations are becoming intelligent agents and which social media are best or most often leveraged for this purpose. Longitudinal evaluation studies are also needed to assess the paths taken in terms of stakeholders engaged, themes covered, and tools used by DMOs pre and post-the impact of global crises (e.g., the COVID-19 pandemic). Key issues would appear to include the increased digitalization of DMOs; stakeholder access to and participation in digital ecosystems; social values grounding destination value generation; the development of specific needs such as virtual tourism, which complements and substitutes the physical experience; and further information on health-safety standards, working conditions, and sustainability-related issues.

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