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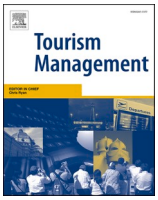

Research on user-generated photos in tourism and hospitality: A systematic review and way forward

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ABSTRACT

Visual content has become an integral component of consumers' experience sharing. People increasingly search for visual content posted by others prior to making purchase decisions. This work adopts a systematic review methodology to examine user-generated photo–related tourism and hospitality research published in academic journals between 2006 and 2021 by topics, methods, and theoretical underpinnings. The 106 articles analyzed fall under four themes: 1) motivation for photo sharing; 2) tourists' destination image perception; 3) tourists' spatiotemporal behavior; and 4) impact of user-generated photos. Analytical methods have progressed in their abilities to collect, process, and analyze large volumes of imagery data. Techniques range from traditional manual qualitative content–semiotic analysis to advanced spatial analysis and artificial intelligence–based quantitative approaches. Theoretical development has varied topically given the descriptive nature of research questions in some domains. A multi-dimensional framework is developed to offer a holistic view of the progress, limitation, and future directions for user-generated photo research.

1. Introduction

User-generated content (UGC) refers to original content posted on public websites or social media networks without commercial interests (Lu & Stepchenkova, 2015). Thanks to the social media boom, UGC is continually uploaded to platforms such as Facebook, Twitter, TripAdvisor, Yelp, Instagram, and Flickr where consumers' digital trails are instantly recorded (Lu & Stepchenkova, 2015). In 2015, 500 million photos were uploaded to the Internet every day (Lo & McKercher, 2015), and this figure has increased exponentially in the past few years. The latest statistics show that more than 1,000 photos are uploaded on Instagram every second, with the total number of uploads exceeding 50 billion (Omnicore, 2021). Numerous studies have explored the antecedents and consequences of UGC (Herrero et al., 2015; O'Hern & Kahle, 2013; Wilson et al., 2012). However, most have been text-centric; visual data have garnered far less attention.

User-generated photos (UGPs) are a form of static visual content that users post to reflect their views (Mak, 2017). Technological developments have made photography more accessible than ever via devices including mobile phones, digital cameras, and remote-controlled aerial vehicles (Chen et al., 2020). Users are therefore keen to take photos and share them online (Munar & Jacobsen, 2014). Photos are travelers' preferred mode of information exchange on social media (Oliveira et al., 2020). Associated platforms have hence shifted from being text-centric to image-centric (Payntar et al., 2021). This change has been accompanied by the rise and fall of certain platforms: those featuring visual content (e.g., Instagram and Flickr) have become especially popular, corresponding to the explosive growth of UGPs in the last decade.

Humans possess advantages in processing visual information versus textual information; images are transmitted to the brain intuitively and require fewer cognitive resources for retention (Li et al., 2021). Two-thirds of the brain is occupied by visual processing sensors, and visual information is processed 60,000 times faster than text. Li and Xie (2020) contended that photos attract more visual attention and intention to engage than text: a tweet featuring an image consistently receives more likes and retweets in the tourism (including hospitality) context. Yet tourism scholars have only recently begun to recognize the importance of visuals and to encourage research using image-based data (Azevedo, 2020; Balomenou & Garrod, 2019). A synthesis of UGP studies in tourism is therefore timely—to understand how UGP research has evolved theoretically and methodologically, address gaps in the literature, and explore new avenues. This paper aims to conceptualize state-of-the-art knowledge in UGP-based work by characterizing

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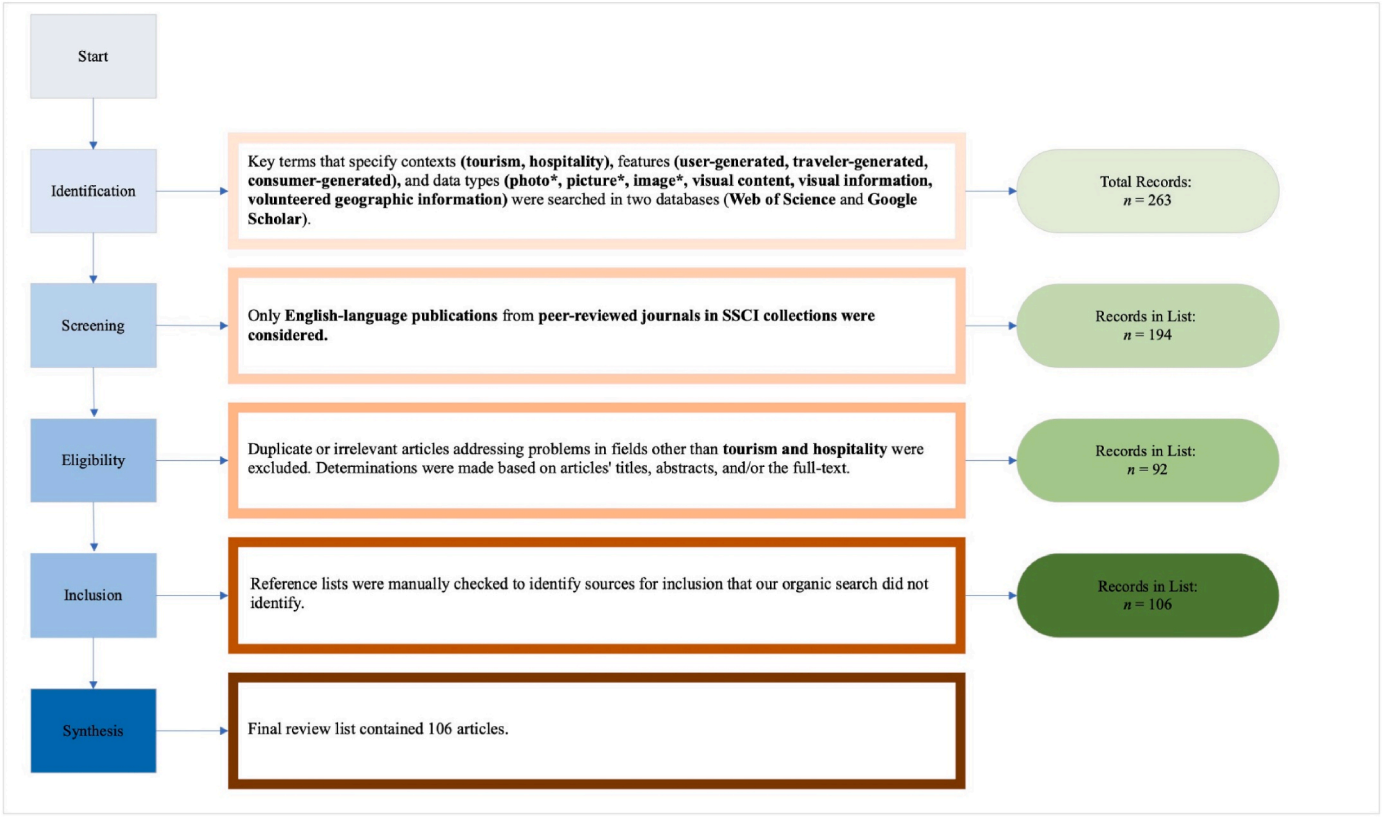

Fig. 1. Adapted PRISMA flowchart for the literature selection process.

theoretical lenses, methods, and research themes to propose a path forward in the tourism discipline.

2. Methodology

To enhance the rigor of our literature search and review process, this study followed a "systematic quantitative approach" to conduct literature reviews in response to the suggestions from Pickering and Byrne (2014). Their recommended stages have been widely incorporated in previous systematic literature reviews published in top-tier tourism and hospitality journals (e.g., Li, Zhou, & Wang, 2018; Le et al., 2019). The process includes to (1) define topics and formulate research objectives; (2) identify keywords and databases and establish literature selection criteria; (3) access the databases, screen search results and refine inclusion and exclusion criteria; (4) review relevant materials and document a summary table; and (5) synthesize findings and conclusions.

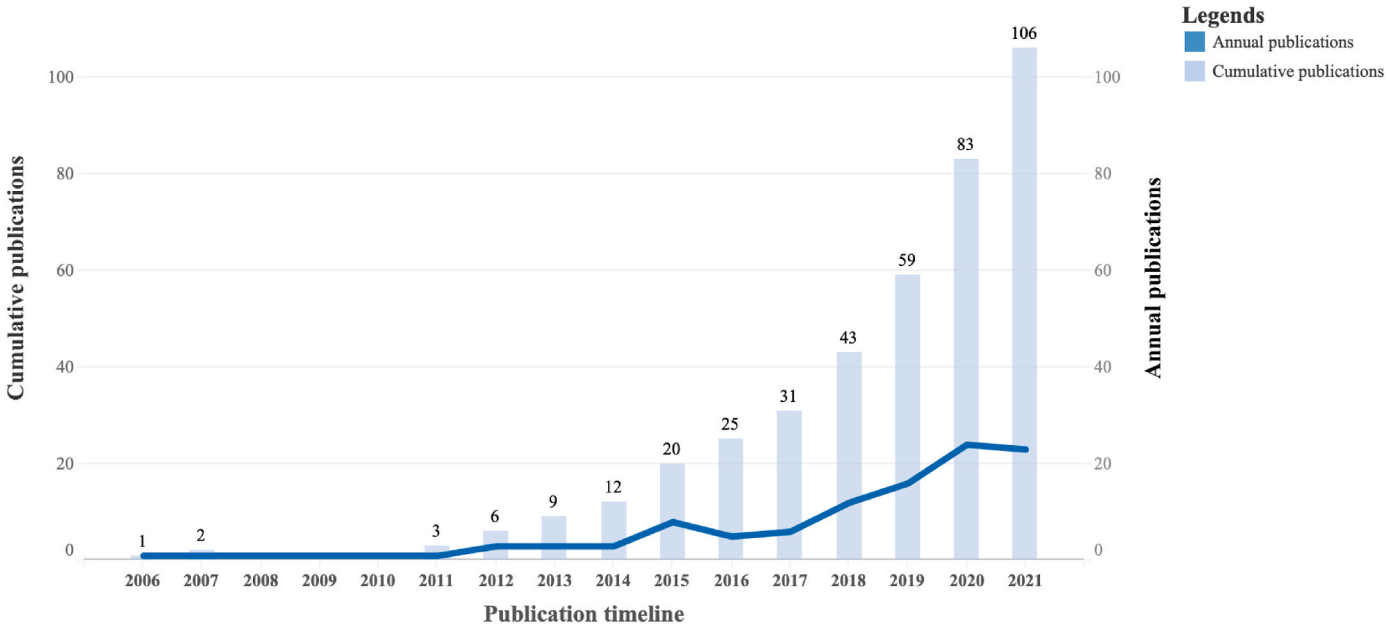

Fig. 2. Publication count by year.

Fig. 3. Publication sources.

Specifically, to ensure the maximum inclusion of relevant literature, multiple search terms related to research contexts (i.e., "tourism," "hospitality"), data types (i.e., "user-generated," "traveler-generated," "consumer-generated", "volunteered geographic information"), and term variations (i.e., "photo*," "picture*," "image*," "visual content," "visual information") were used within the search fields *title*, *keyword*, and *abstract* to cover UGP-related articles. The keyword combinations were firstly searched in Web of Science, and the procedure was repeated in Google Scholar. Comparisons across the two databases were conducted to remove duplicates and acted as a strengthening means to ensure that no articles were missed by either database. As of December 2021, 263 records were identified and exported from the online databases. Exclusion criteria were then applied to filter irrelevant literature. First, only English-language articles from peer-reviewed journals listed in the Social Science Citation Index (SSCI) were retained (n = 194), as publications from SSCI-listed journals help ensure high-quality, state-of-the-art academic reviews (Law et al., 2014). Second, only UGP-related articles in the tourism context were selected. Two research assistants independently helped determine articles' relevance during this stage by manually reviewing 194 articles. The titles and abstracts were examined first, and then the complete text of papers was evaluated where further clarification was required. Articles that did not have a strong tourism or hospitality theme (for example, travel connected to everyday commute rather than tourism) were removed. Only studies in tourism and hospitality context to assess UGPs at the individual tourist, business, or destination level were retained. Subsequently, 92 records remained in the review list, and the entire texts of these articles were carefully checked for eligibility of synthesis. The reference lists of these 92 articles were then cross-checked to find papers that may have been overlooked. A total of 106 studies qualified for the final analysis. Fig. 1 outlines the number of studies identified, screened, excluded, and included at different stages of the literature review. PRISMA framework adapted from Moher et al. (2010) was used to report the literature selection process and outcomes for each of the consecutive steps.

The review list was then subjected to a two-stage analysis, namely, quantitative descriptive analysis and qualitative content analysis. First, the quantitative descriptive analysis offers an overview of identified literature (Lin et al., 2021); in our case, it presented an intuitive picture of the development of UGP-related publications. We visualized articles along their publication time and sources using Tableau with the bibliographic data acquired from online databases. Then, keyword co-occurrence analysis was performed using a bibliometric analysis tool (i.e., Vosviewer). Notably, Vosviewer has been frequently adopted for systematic review studies in tourism and hospitality due to its advantage in providing in-depth analysis of lexical and temporal networks by keywords (e.g., Kim & So, 2022). The keyword co-occurrence analysis assumes that keywords represent a brief description of the core contents, and therefore keywords occurring in the same articles can signify links between different sub-topics and be used to cluster articles sharing a similar main topic (Blomstervik & Olsen, 2022). In our study, out of 642 keywords, co-occurrence analysis revealed 86 main keywords meeting the minimum threshold of 3 occurrences. Additionally, 4 main clusters (i.e., themes) emerged and were identified.

To synthesize the research progression of each main theme, we attributed each of the 106 articles to the four clusters via thematic analysis. The categorization consists of several steps following prior systematic research in tourism and hospitality (e.g., Le et al., 2019; Ye et al., 2020). First, the research team discussed the results of keyword

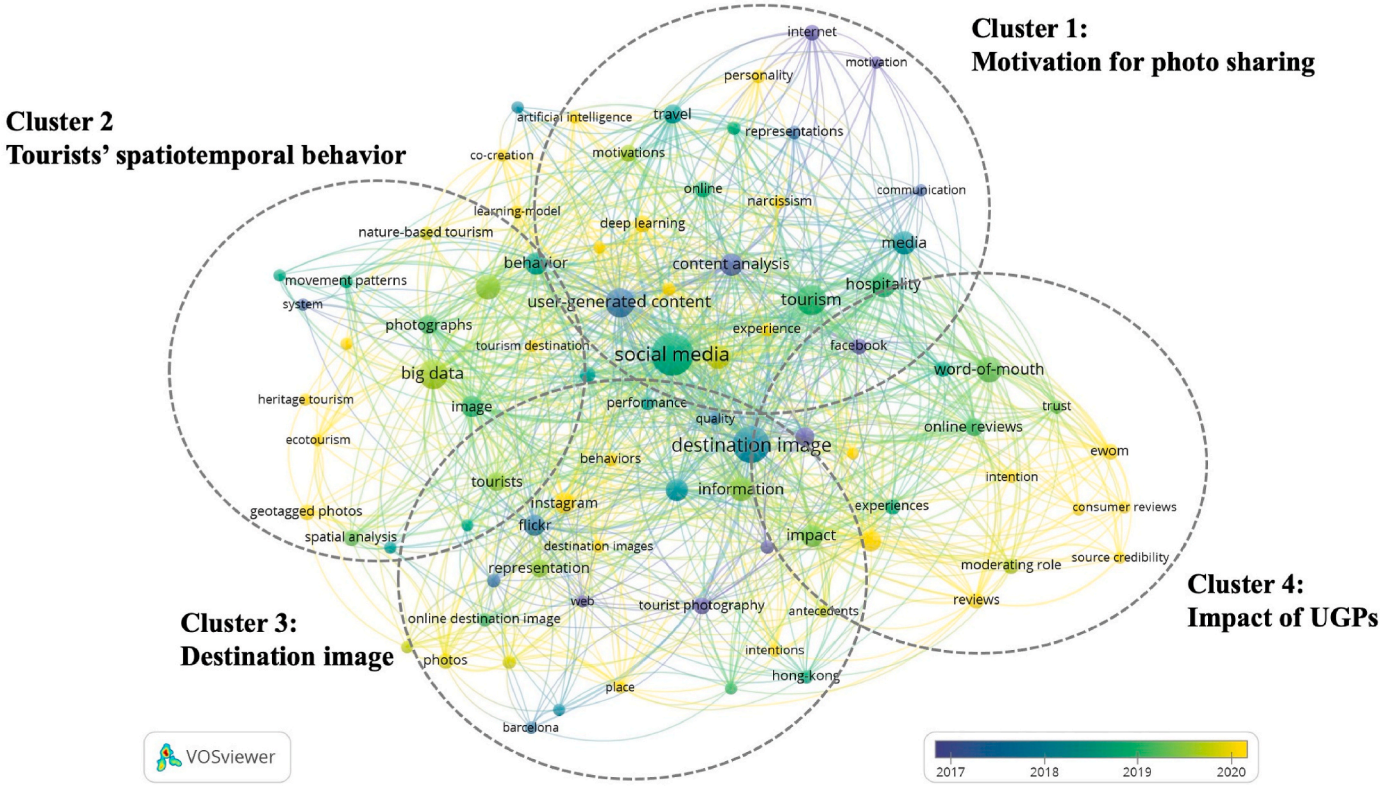

Fig. 4. Keyword Co-occurrence by time period.[11].

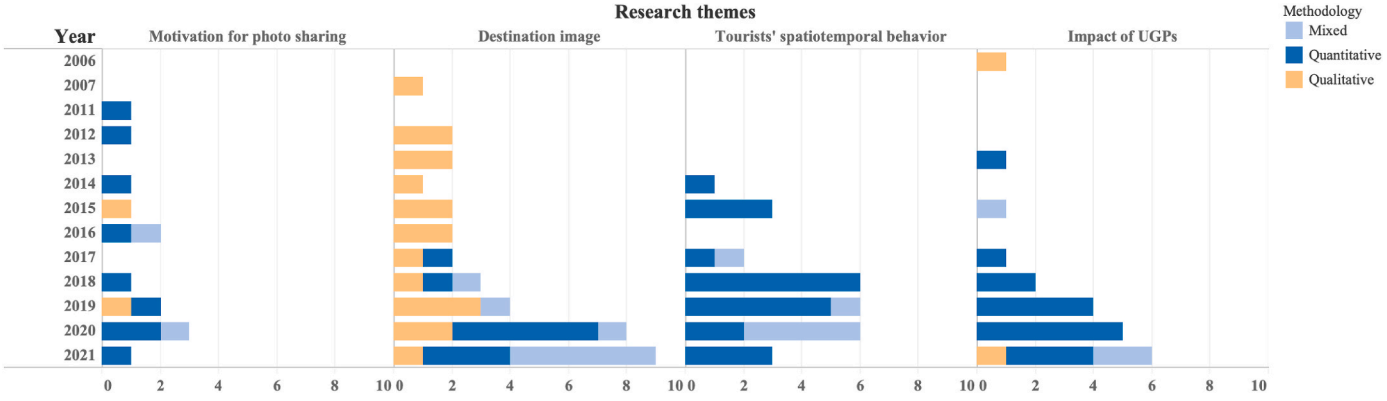

Fig. 5. Methodological progression of UGP studies over time.

co-occurrence analysis to refine the initial clusters. Second, two research assistants in the team read the article's title, keywords, abstract, and/or full text independently to determine to which cluster an article best belongs. Discussions were held if there were uncertainty in cluster allocation. As the evaluation and coding of an article can be influenced by the researchers' linguistic backgrounds and interpretations (Blomstervik & Olsen, 2022), to ensure consistency in the content analytical process, two research assistants independently conducted the categorization and information extraction of the first 10% of the articles. Then, results were cross-checked and confirmed with a senior researcher to reach a consensus. The process continued for each subsequent 10% of the sample until all articles were assessed (Pickering & Byrne, 2014). Finally, the 106 articles were categorized into 4 themes, namely motivation for photo-sharing, destination image perception, tourists' spatiotemporal behavior, and impact of UGPs. Meanwhile, several elements of each article were documented and aggregated to develop cluster-specific insights, which included methodological approaches, theoretical foundations, and key findings. The thematic analysis adopted a concept-driven approach (Webster & Watson, 2002) to synthesize literature. Compared to an author-driven approach that only focused on how individual authors analyzed various concepts in their own articles, this approach discussed relevant concepts presented by all authors across studies, which allowed us to develop a holistic view of the development for each key research theme under investigation (King et al., 2014). Thus, this study adapted the e-WOM framework from King et al. (2014) to guide the mapping of research progress conceptually.

3. Characterizing UGP research in tourism

3.1. Publication timeline

As shown in Fig. 2, UGP-related research emerged after 2005 when many social media platforms were established (e.g., Facebook was born in 2004, Flickr in 2005, and Instagram in 2010). The annual publication

Table 1
Theories/frameworks underpinning UGP-related research.

Theories and frameworks	Frequency
No theory	71
One theory	29
Two theories	5
Three or more theories	1
Tourist gaze theory	5
Dual coding theory	4
Dual processing theory	2
Postcolonial theory	2
Media richness theory	2
Motivation theory	2
Semiotics theory	2
Grounded theory	2
Tourism demand theory	1
Negativity bias theory	1
Personality traits theory	1
AIDA model	1
Basic emotion theory	1
Source credibility theory	1
Culture theory	1
Color theory	1
Narrative framing theory	1
Visual representation theory	1
Emotional contagion theory	1
Self-verification theory	1
Sender–message–receiver communication model	1
Social actor model	1
Social cognitive theory	1
Social comparison theory	1
Social identity theory	1
Stimulus–organism–response model	1
AC-TEA model	1
Core–periphery model	1
Typology theory	1

of UGP-related studies has expanded steadily over the past 15 years, becoming particularly pronounced since 2015 and enjoying a boost in 2020. This phenomenon may have arisen for two reasons. First, social media offers people wide access and user-friendly functions; thus, abundant visual information is available for research purposes. Second, advances in artificial intelligence (AI) and big data analytics have enabled researchers to analyze unstructured data (e.g., photos) in an automatic and scalable way.

3.2. Publication sources

Fig. 3 displays the publication sources of reviewed articles. The three journals featuring the most UGP papers during our review horizon were *Tourism Management* (26 articles), *Journal of Travel Research* (11 articles), and *Journal of Destination Marketing and Management* (8 articles). Eleven journals published three or more UGP articles in tourism, accounting for 33% of included journals.

3.3. Keyword co-occurrence over time

Fig. 4 displays the keyword co-occurrence and temporal progression network, with four clusters emerged and identified. Each dot in the figure represents a term that appeared in the *title* or *abstract* of the articles analyzed. The dot and font sizes indicate the term's frequency. Cluster 1 includes publications focusing on tourists' photo-sharing motivation, with terms such as "motivation", "representation", "personality", and "experience" appearing frequently. Cluster 2 contains publications related to tourists' spatiotemporal behavior, featuring "movement patterns", "spatial analysis", and "geotagged photos" in different types of tourism. Cluster 3 aggregates articles that examine destination image perception with names of some popular destinations emerged. Cluster 4 identifies publications assessing the impact of UGPs as a component of electronic Word-of-Mouth (e-WOM). Furthermore, Fig. 4 shows that "social media" is represented by the largest dot, indicating the most popular UGP data sources in many articles. Fig. 4 also presents the temporal evolution of terms represented by colors from blue to yellow, which indicates sub-periods of the study horizon. The color of dots is determined by the average publication year of the articles in which a term occurs. Aligned with the most current industrial phenomena and practices, "big data", "geotagged photos", "artificial intelligence" and "deep learning" are popular terms in yellow that appeared in recent years, indicating the growing interests of researchers to examine UGPs with novel methodologies.

3.4. Methodological nature

Our sampled studies employed various research methods and analytical techniques. The approaches spanned three broad categories: qualitative, quantitative, and mixed methods. Fig. 5 illustrates the 106 studies' methodology and themes over time. The four themes will be elaborated with detailed findings in Section 4. Qualitative research was initially more common in UGP-related studies within tourism, especially for destination image perception. Quantitative and mixed designs have gained popularity as of late.

Qualitative approaches usually accompanied destination image analysis in early UGP-related research (Chiu & Cho, 2021; Choi et al., 2007; Gali & Donaire, 2015; Hunter, 2013; Lin & Huang, 2006; Önder, Koerbitz, & Hubmann-Haidvogel, 2016; Stepchenkova & Zhan, 2013). This research stream primarily entails content analysis and semiotic analysis, with content analysis often used to investigate photo content in the social sciences. Content analysis normally complements semiotic analysis, through which scholars can extract meanings and interpretations. These two methods have mainly been employed to assess tourists' destination image perception (Stepchenkova & Zhan, 2013; Zhao et al., 2018), the differences between UGPs and marketer-generated photos in destination image projection (Mak, 2017), places of interest in destinations (McMullen, 2020), and tourists' spatial trajectories (Go et al., 2020).

Frequently seen quantitative methods include experimental designs (Kim et al., 2020; Lee & Shin, 2014; Lin et al., 2012; Marder et al., 2021) and questionnaire surveys (Bigne et al., 2020; Boley et al., 2013; Garrod, 2008; Kim & Stepchenkova, 2015). These techniques can uncover the effects of UGPs, such as how these photos influence review usefulness and viewers' purchase intentions as well as the underlying mechanisms of these impacts. Questionnaires pervade studies on motivation for photo sharing. For example, multi-dimensional psychometric scales have been established to understand the benefits of photo sharing. A key limitation of these methods is that they do not use real UGP data, which may compromise findings' validity. AI-based methods can rectify this issue when analyzing UGPs by using Internet big data to handle image recognition and classification (Taecharungroj & Mathayomchan, 2021). In addition, together with mobile technology, UGPs' embedded metadata have given rise to spatial analysis. This approach involves clustering analysis (Barros et al., 2020) and density analysis (Leung et al., 2017; Miah et al., 2017; Vu et al., 2015). Spatial analysis can highlight the popularity or appeal of tourist attractions (Giglio et al., 2019) and clarify tourists' spatiotemporal behavior (Agustí, 2020a).

Mixed methods in UGP research combine two or more facets of qualitative and quantitative approaches (Nikjoo, 2019). This type of study seeks to quantify a phenomenon of interest and provide in-depth insight to support quantified results. Readers can then gain a comprehensive sense of the complexity of UGP-related phenomena. For

[1] The years 2017–2020 denote that the software calculated the average year of publication in which a term occurs.

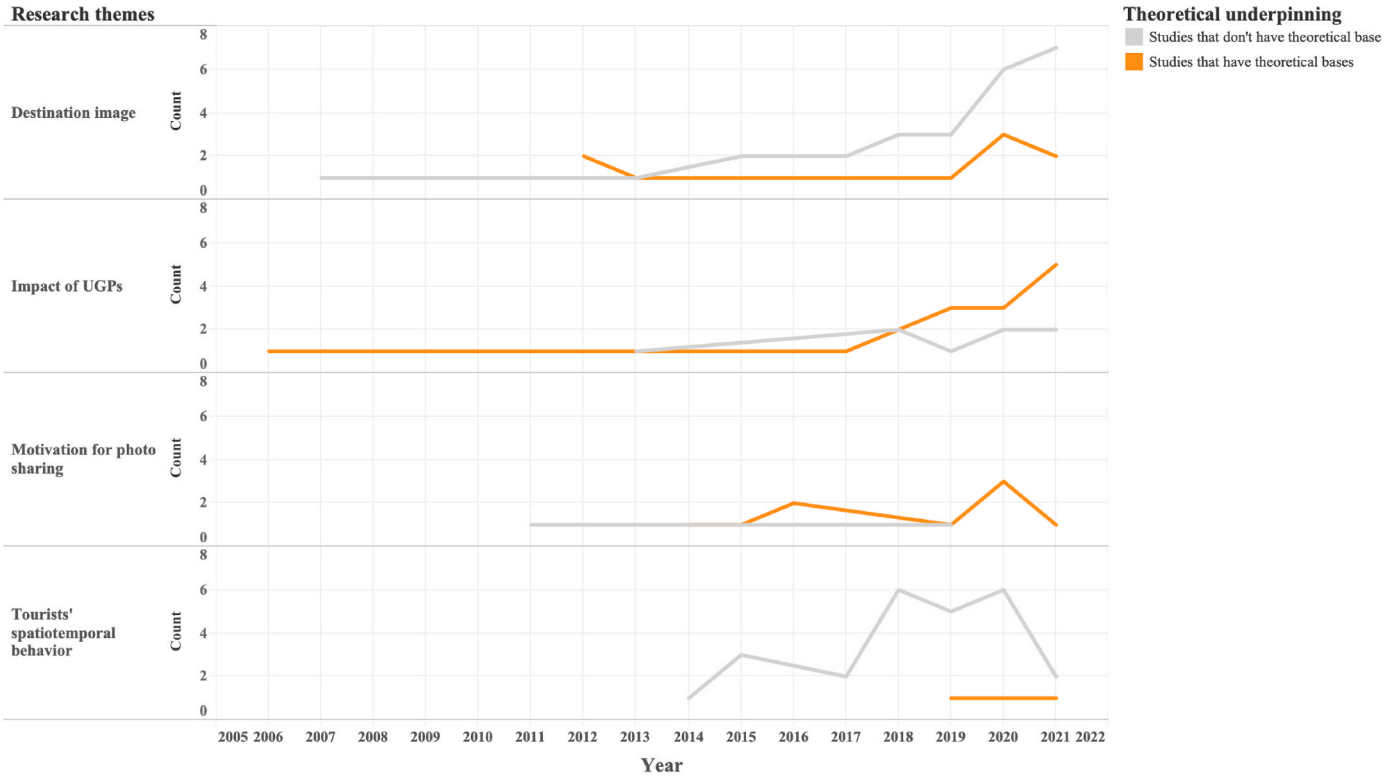

Fig. 6. Progression of theoretical bases in UGP studies over time.

instance, studies on photo-sharing motivation have harnessed qualitative approaches (e.g., interviews) to produce motivational items and then tested a developed instrument using quantitative survey data to increase results' validity and reliability (e.g., Li, 2020).

3.5. Applied theories and frameworks

Analyzing theories and frameworks in the chosen studies reveals the foundation of UGP-related research and can inform ongoing theoretical development. Table 1 shows that only one-third of the 106 articles reported theory-guided UGP research, whereas the remaining papers were atheoretical. This distribution mirrors that of other big data–dominated research topics, such as sentiment analysis (Mehraliyev et al., 2021). Tourist gaze theory and dual coding theory were most prevalent in our sample, followed by dual processing theory, postcolonial theory, media richness theory, motivation theory, semiotics theory, and grounded theory. Of the 35 studies with a theoretical basis, most cited information processing theories (e.g., dual coding theory, sender–message–receiver communication model) and framed UGPs as a medium for information delivery that can shape people's conceptions or behavior. Some psychological theories (e.g., motivation theory, personality traits theory) were used to describe human behavior in relation to personality, emotion, and cognition. Socio-psychological theories were borrowed to elucidate interpersonal relationships (e.g., social cognitive theory, social identity theory, and self-verification theory), particularly to discern how people fit into their social environment and how social connections are maintained. Fig. 6 presents a thematic summary of UGP-related studies with and without theoretical bases. Among studies on destination image perception and the impact of UGPs, the number of articles with theoretical underpinnings has climbed in recent years. Research on tourists' spatiotemporal behavior remains dominated by data.

4. Thematic synthesis

Consumers increasingly rely on user-generated visual content when making purchase decisions. To better accommodate people's changing needs and preferences, industry practitioners have incentivized consumers to share more photos. UGPs have thus become a key component of online reviews and have elicited growing interest in academia. Identifying major themes of UGP research in tourism unveiled foci and underexplored areas. Content analysis showed that most UGP-related studies in our sample (102 out of 106) addressed one of the following themes (Table 2): 1) motivation for photo sharing; 2) tourists' destination image perception; 3) tourists' spatiotemporal behavior; and 4) the impact of UGPs. Studies that investigated interrelated questions were classified by their dominant topic. Four studies were not associated with any of the identified themes. Each research theme is reviewed in the ensuing sections; recurrent topics are examined inductively to summarize findings.

4.1. Motivation for sharing photos: Who and why

Fig. 7 summarizes the conceptual development of studies on tourists' photo-sharing motivation. Researchers first focused on who shares photos online and under what circumstances people are more motivated to share photos. The main goal was to consider how sociodemographic characteristics (e.g., nationality, income, education, and age) influence tourists' online photo-sharing behavior. Representatively, Lo et al. (2011) outlined a demographic profile of Hong Kong residents who posted travel photos online; residents who had a higher income, higher education level, and younger age were more likely to post. Related studies have expanded this scope by assuming a cross-cultural perspective to compare ethnic groups' sharing behavior. For instance, Wilson et al. (2012) found that British and Swiss visitors were more likely to share travel photos than people from Spain because the former groups were more driven to offer altruistic guidance or to warn others of negative incidents (i.e., service failure). Konijn et al. (2016) grouped individuals by continent and discovered that people in South America and Oceania shared more photos online among those samples. In addition to tourists' intrinsic attributes, scholars have explored

Table 2
Identified research themes.

Research Themes	References	No. of Studies	Weight (%)
Motivation for photo sharing	Apaolaza et al. (2021); Christou et al. (2020); Dinhopl and Gretzel (2016); Gonzalez-Rodriguez et al. (2021); Jovanovic et al. (2019); Konijn et al. (2016); Li (2020); Lo and McKercher (2015); Lo et al. (2011); Lyu (2016); Munar and Jacobsen (2014); Taylor (2020); Wilson et al. (2012); Wong et al. (2019)	14	13.7%
Destination image perception	Agustí (2018); Agustí (2021); Arabadzhyan et al. (2021); Bui, Alaei, Vu, Li, and Law (2022); Chen et al. (2020); Chiu and Cho (2021); Choi et al. (2007); Conti and Lexhagen (2020); Deng and Li (2018); Deng and Liu (2021); Deng et al. (2019); Fayzullaev et al. (2021); Filieri, Yen, and Yu (2021); Gali and Donaire (2015); He et al. (2021); Hunter (2013, 2016); Lee (2020); Mak (2017); McCreary et al. (2020); McMullen (2020); Michaelidou et al. (2013); Picazo et al. (2019); Pickering et al. (2020); Robinson (2012); Song and Kim (2016); Stepchenkova et al. (2015); Stepchenkova and Zhan (2013); ; Taecharungroj and Mathayomchan (2021); Tamajon and Valiente (2017); Sun et al. (2015b)Tomaz and Walanchalee (2020); Wang et al. (2020); Wei and Wu (2021); Yu et al. (2020); Zhang et al. (2019); Zhang et al. (2020); Zhang et al. (2021); Zhao et al. (2018)	39	38.2%
Tourists' spatiotemporal behavior	Agustí (2020a); Agustí (2020b); Alivand and Hochmair (2017); Barros et al. (2020); Da Mota and Pickering (2021); Ghermandi et al. (2020); Giglio et al. (2019); Go et al. (2020); Gunter and Önder (2021); Henar Salas-Olmedo et al. (2018); Hoepken et al. (2020); Wan et al. (2018); Vu et al. (2015); Vu, Li, et al. (2018); Vu, Luo, et al. (2018); Kim et al. (2019); Kim et al. (2022); Li, Xu, et al. (2018); Ma et al. (2020); Miah et al. (2017); Mou et al. (2020); Önder, Koerbitz, & Hubmann-Haidvogel (2016); Ö nder (2017); Payntar et al. (2021); Stienmetz and Fesenmaier (2019); Sun et al. (2015a); Yan et al. (2018)	27	26.5%
Impact of UGPs	An et al. (2020); Assaker and O'Connor (2021); Bigne et al. (2020); Boley et al. (2013); Filieri, Lin, et al. (2021); Giglio et al. (2020); Hu and Yang (2021); Kim and Stepchenkova (2015); Kim et al. (2020); Li et al. (2021); Lin and Huang (2006); Ma et al. (2018); Marder et al. (2021); Oliveira and Casais (2019); Ren et al. (2021); Schoner-Schatz et al. (2021); Shin et al. (2020); Wu et al. (2021); Yang, Hlee, et al. (2017); Yim et al. (2021); Zhu et al. (2019); Zinko et al. (2021)	22	21.6%

environmental stimuli in various settings. In the restaurant sector, Apaolaza et al. (2021) noted that restaurants' symbolic design enhanced diners' willingness to share photos online. An et al. (2020) studied the lodging sector and observed that people tended to post photos of hotels that had well-recognized service, that were in the luxury segment, or that offered positive experiences (e.g., high-quality stays).

Regarding the mechanisms that demonstrate why some people are more motivated than others to share photos, scholars have turned to psychology and anthropology to uncover the drivers of such behavior. For example, tourist gaze theory has been adopted to conceptualize tourists' photo sharing as part of the travel experience and to explain how digitalized internet services have redefined the tourist gaze (Konijn et al., 2016; Lo & McKercher, 2015). Theories from social psychology, such as social comparison theory and social identity theory, have also been used to explain photo-sharing behavior by considering how the presence of other people influences one's actions (Apaolaza et al., 2021; Munar & Jacobsen, 2014). Researchers generally agreed that self-presentation and impression management are primary motivators (Jovanovic et al., 2019; Lo & McKercher, 2015). Even though people post photos in numerous categories, pictures related to food (Wong et al., 2019; Zhu et al., 2019), the destination (Dinhopl & Gretzel, 2016), or selfies (Christou et al., 2020; Lyu, 2016; Taylor, 2020) are often carefully curated (Kim & Tussyadiah, 2013; Lyu, 2016): people strive to express an ideal self-image and view photo sharing as performing in front of the camera (Dinhopl & Gretzel, 2016). Based on a survey, Lyu (2016) reported that Korean women who posted travel selfies on social media sought to strategically present a positive self-image. Wong et al. (2019) delved into food consumption. Specifically, they tested the relationship between impression management and travel satisfaction through benefits (including self-expression and social recognition) of posting culinary photos. Tourists have also been found to take more photos of themselves than of scenic spots because establishing a connection with a superior destination contributes to one's self-identity (Dinhopl & Gretzel, 2016). Overall, tourists share photos online to exhibit a positive self-image via photo content or to indirectly convey their superiority through experience sharing.

4.2. *Perceived destination image among various stakeholders*

Destination image research began as early as the 1970s and has evolved into a critical theme in tourism studies (Crompton, 1979). UGPs provide direct insight into consumers' authentic destination image perception. These photos are available at a low cost and on a large scale; they are also diverse, accessible in real time, organic, and commercial-free (Li, Zhou, & Wang, 2018; Lu & Stepchenkova, 2015; Miah et al., 2017). Fig. 8 displays the process of destination image perception research.

Destination image research using UGPs concentrates on extracting cognitive and affective aspects of tourists' perceived image. This work can be classified by country/region, state/province/city, and scenic areas based on the scope of investigation. Along with describing tourists' perceptions, scholars have discerned nuances among heterogeneous groups of tourists and stakeholders in an attempt to identify the roots of destination image perception. Many studies in this vein have lacked a solid theoretical foundation, as evidenced by the descriptive nature of research questions and objectives. A handful of papers introduced grounded theory and semiotics theory, both of which served as a theory and an approach for mining and interpreting the content and representation of photos (Conti & Lexhagen, 2020; Hunter, 2013).

The travel industry involves stakeholders from the supply and demand sides, and information from multiple channels often projects distinct destination images (Agustí, 2018; Choi et al., 2007; Syed-Ahmad et al., 2013). Researchers have examined destination image from various perspectives, including official (e.g., governments, associations) and commercial (e.g., tour operators, travel agencies, travel magazines) channels as well as tourists and residents. Data from these sources have

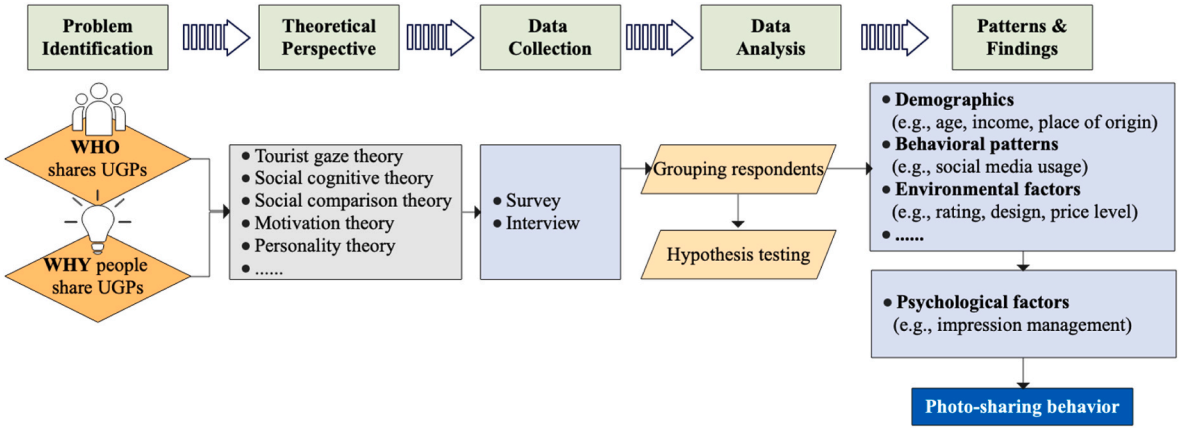

Fig. 7. Research on photo-sharing motivation.

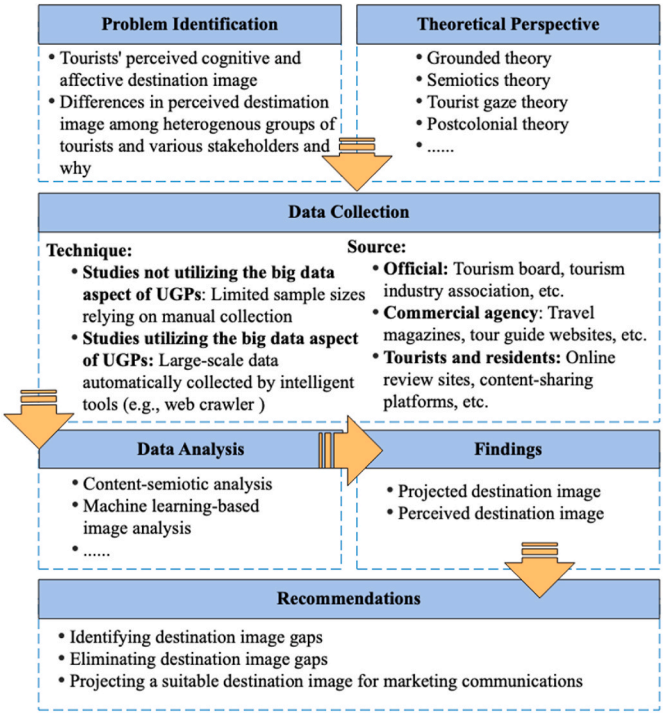

Fig. 8. Research on destination image perception.

been integrated to analyze discrepancies in heterogeneous tourist groups' perceived destination images and differences between perceived and projected destination images. Some studies have leveraged the big data aspect of UGPs whereas others have not (Lu & Stepchenkova, 2015). Research excluding big data has typically featured small samples and manual in-depth content analysis. Scholars who referred to big data often deployed machine-learning based techniques to extract meaningful image attributes in an automatic and scalable manner.

Research on tourists frequently identifies their geographic origins as influencing image perceptions. For instance, Zhang et al. (2019) collected photos of visitors to China from 64 countries/regions and found that Asian visitors perceived local cuisine, shopping, and traditional Chinese culture as most appealing, whereas European visitors focused more on the sky and panda-related attributes. Scholars have further argued that culture outweighs geographic origins in explaining tourists' perceptions. Deng et al. (2019) observed apparent differences in perceptions of Shanghai between Eastern and Western tourists based on an analysis of 34,799 photos on Flickr. In the same vein, Choi et al. (2007) compared photos of Macau posted on different channels' websites. Results showed that the government portrayed an international city with rich cultural resources and modern facilities, but travel magazines featured images of "people and locals" and "entertainment/sports activities/games". Michaelidou et al. (2013) used data from tour guides, tour operators, and travel agencies and conducted a similar exercise for Taiwan's destination image. He et al. (2021) established a deep learning model to retrieve elements from marketer-generated and user-generated photos in the form of noun–adjective pairs and constructed a semantic network for content and sentiment comparison.

Destination marketing organizations (DMOs) strive to highlight ideal destination characteristics to attract potential visitors (Stepchenkova & Zhan, 2013). However, these efforts are sometimes ineffective. Deng and Li (2018) proposed the first-ever machine learning-based model to assist DMOs in ranking UGPs based on how well these photos sparked viewers' visit intentions. Studies have found a DMO-projected destination image to differ from that received by tourists (Choi et al., 2007; Mak, 2017; Song & Kim, 2016). These discrepancies also exist in hospitality settings (Ren et al., 2021). Therefore, the question of how to minimize disparity between projected and perceived images represents a critical line of inquiry among researchers and practitioners (Deng & Li, 2018). Scholars have acknowledged tourists' roles in information dissemination and the importance of learning from UGPs to build a successful destination image (McMullen, 2020; Song & Kim, 2016). DMOs have thus been advised to develop promotional materials rooted in UGPs (Deng & Li, 2018; He et al., 2021; Wang et al., 2020).

4.3. Tourists' spatiotemporal behavior

Studying tourists' spatiotemporal behavior based on UGPs has become a popular way to capture tourists' digital trajectories over time and space. Digital trajectories refer to traces that tourists leave on the Internet. These traces can depict tourists' travel paths and movement; they are considered important indicators for tourism demand forecasting (Önder, Koerbitz, & Hubmann-Haidvogel, 2016). Tourists' spatiotemporal behavior is typically analyzed along two main paths grounded by three sub-topics: 1) exploratory and descriptive research ([a] discovering tourists' favorite locations; [b] describing tourists' trajectories and travel patterns); and 2) demand forecasting ([c] actual visitor arrivals and spatiotemporal behavior). Drawing empirical findings from big data is common, corresponding to the lack of a theoretical foundation for studies in this area. One article in our sample featured typology theory, which was used to segment special interest–based tourists and to identify variation in their spatial behavioral preferences (Ma et al., 2020). Fig. 9 summarizes the research flow of work on tourists' spatial and temporal activities.

In terms of exploratory and descriptive research, tourists'

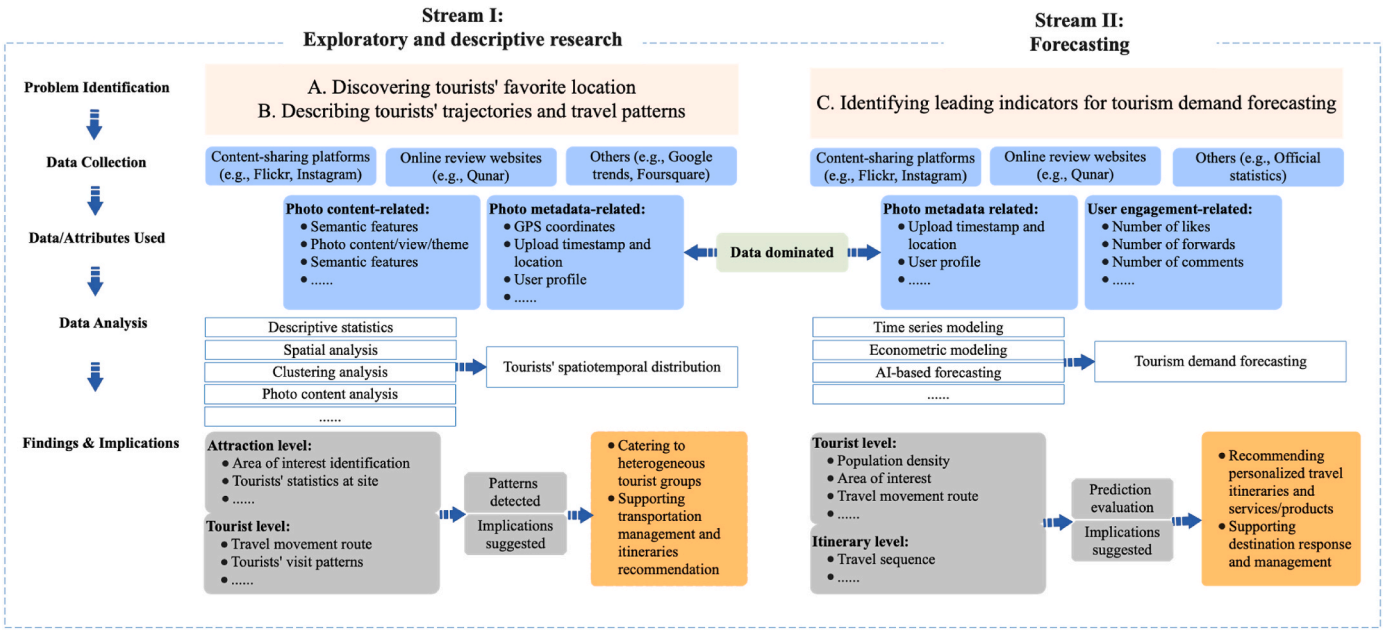

Fig. 9. Research on tourists' spatiotemporal behavior.

spatiotemporal behavior depicts their historical trajectories and travel patterns (McMullen, 2020). Places of interest can be deduced by analyzing paths with a high footprint concentration and repetition (Agustí, 2020a, 2020b; Giglio et al., 2019; Kim et al., 2019; McMullen, 2020). For example, Agustí (2020a, 2020b) studied UGPs in popular tourist cities with high murder rates to infer spatiotemporal routes. The author concluded that tourists' trajectories were most concentrated in places perceived as having high security. Payntar et al. (2021) analyzed tourists' movement in Cusco, Peru, via machine learning and a computer vision algorithm. Foci included popular scenic spots and routes; results led to valuable implications for managerial efficiency and corresponding services to enhance the tourist experience. By mining volunteered geographic information (VGI) from geo-tagged photos, recommendation systems which incorporate tourists' preferences on landmarks and trajectories were developed (Sun et al., 2015a). Studies have also addressed heterogeneous tourists' behavior (Vu et al., 2015). Local, domestic, and international visitors differ in their visitation patterns and spatiotemporal distribution. Most research has described this variation based on geographic origins (Leung et al., 2017; Vu et al., 2015; Zhang et al., 2019), with fewer exploring divergent travel trajectories between tourists and residents (Zhang et al., 2020). With imagery VGI from Flickr, Da Mota and Pickering (2021) compared temporal and spatial patterns of beach visits in Australia between locals, and Australian and international tourists, which indicates a cost-efficient and effective way of data acquisition and provides insights for management of open spaces of urban cities. Ghermandi et al. (2020) pointed out that international tourists only visit well-known attractions, but locals visit places more extensively. By contrast, Gunter and Önder (2021) noticed no obvious distinctions in travel patterns between tourists and residents; this finding might be explained by the focal region, Vienna, Austria, covering a small geographic area.

UGPs have also been leveraged to predict visitors' spatiotemporal behavior. These photos contain rich geographic information (e.g., geotags, latitude, and longitude), visual cues (e.g., photo content), and temporal features (e.g., upload time), which tend to be highly reliable (Latorre-Martinez et al., 2014). From a DMO perspective, UGPs are ideal indicators of tourism demand (Önder, Koerbitz, & Hubmann-Haidvogel, 2016) and can inform relevant forecasts (Gunter & Önder, 2021; Miah et al., 2017; Vu, Luo, et al., 2018). Önder, Koerbitz, and Hubmann-Haidvogel (2016) reported that UGP data suggest estimated tourist arrivals, which can be useful for tracking visits and projecting demand in destinations that do not issue entrance tickets. Kim et al. (2022) used VGI to capture the visitor flows between attractions and estimate tourism demand with spatial econometric models. Studies have also shown that UGPs can preemptively convey tourists' spatiotemporal distribution (Barros et al., 2020), potential destination choices (Latorre-Martinez et al., 2014), tourism footprints (Önder, Koerbitz, & Hubmann-Haidvogel, 2016) and destination travel sequences (Vu, Luo, et al., 2018). These elements are each of great importance for destination management. Notably, most studies under this theme appear data-dominated without solid theoretical bases.

4.4. Impact of UGPs

The fourth prominent research theme revolves around the effects and consequences of UGPs. Given the uncertain credibility of marketer-generated content, consumers often question its hidden commercial motives and biased messaging (Kim & Stepchenkova, 2015). They instead turn to fellow consumers for more transparent information (Oliveira & Casais, 2019). UGPs increasingly accompany online textual reviews as an information source, but their impacts have not been thoroughly examined due to insufficient image analysis techniques (Kim & Stepchenkova, 2015; Lin & Huang, 2006). The theoretical bases of UGP impact studies are usually communication and information processing theories, such as dual processing theory (e.g., elaboration likelihood model and heuristic systematic model), media richness theory, and the sender–message–receiver communication model. Based on the reviewed articles, studies followed two main streams: the impact of UGPs on consumers' decisions and the roles of UGPs in review usefulness.

The first and most common theme deals with the effects of UGPs on decision making among photo posters and viewers. Studies have investigated the impact of UGPs on consumers' perceptions of a destination's visual appeal, purchase intentions, and willingness to visit (Bigne et al., 2020; Boley et al., 2013; Kim & Stepchenkova, 2015; Lin & Huang, 2006; Marder et al., 2021). Boley et al. (2013) identified a positive correlation between individuals' UGP posts and souvenir purchases. Likewise, UGPs have been shown to influence potential tourists: travel is fraught with uncertainty, and UGPs serve as readily available information sources. One of the earliest and most representative studies,

conducted by Lin and Huang (2006), demonstrated through a case study that UGPs crucially influence other people's willingness to visit a destination; 45% of respondents reported a desire to visit Greece after viewing photos shared by other travelers. Oliveira and Casais (2019) further supported this finding when exploring how UGP content can shape consumers' restaurant choices.

The second research theme on the impact of UGPs discusses the roles of photos in online reviews. Some researchers have examined the superiority of reviews containing UGPs compared with those using only plain text (An et al., 2020; Djafarova & Deluce, 2018; Li et al., 2021). Wu et al. (2021) argued that reviews with images were more useful than text-only reviews because the images provided more diagnostic information. Yang, Hlee, et al. (2017) reinforced this view and indicated that images indeed offer richer information. Therefore, a combination of images and text is thought to enhance review usefulness. In terms of the amplified effects of text–image integration, UGPs complement textual content (Ma et al., 2018). Images also function as visual evidence of written text to corroborate information. Yet images alone do not give viewers sufficient clues to judge review helpfulness. Viewers therefore do not solely rely on images for evaluation purposes. Additional studies have extended this line of work by investigating related attributes that compose a useful review, such as photo quality (Djafarova & Deluce, 2018), aesthetics (Marder et al., 2021), and disclosure of posters' profile photos (Kim et al., 2020; Lee & Shin, 2014). Apart from the positive impact of UGPs, an increasing body of knowledge pertains to the boundary conditions of photos on perceived usefulness, such as the congruency of photos and text (An et al., 2020; Bigne et al., 2020) and review sentiment (i.e., positive/negative reviews). Viewers prefer to see evidence of poor reviews to prevent fabrication (Yang, Shin, et al., 2017); as such, negative reviews with UGPs are considered more helpful than positive reviews with UGPs (Li et al., 2021).

5. Discussions

5.1. Main findings

UGP-related research has undergone nearly 20 years of development, with UGPs widely adopted as a data source for studies in various fields and topics. Thoughtful reflections on UGP-related research are limited despite this high utilization. Following the framework adapted from King et al. (2014) and contextualized in tourism and hospitality research, we first positioned the four identified research themes as antecedents, exploratory and descriptive analysis, and consequences of UGPs (Fig. 10). Synthesis of the current knowledge landscape from the thematic, methodological, and theoretical perspectives is discussed below.

According to the thematic analysis, the literature was found to cover four primary themes along three dimensions: 1) Antecedents: motivation for photo sharing (i.e., who shares UGPs and why); 2) Exploratory and descriptive analysis: tourists' destination image perception (i.e., description of tourists' perceived destination image and how it differs from those of other stakeholders) and description of tourists' spatiotemporal behavior; and 3) Consequences: the impact of UGPs (on tourists' decision-making, review usefulness and tourism demand forecasting). Research on destination image accounted for over 38% of publications in our sample, reflecting attention to how UGPs can be best harnessed to understand tourists' views in greater depth. The impact of UGPs (21.6%) and tourists' spatiotemporal behavior (26.5%) also attracted large shares of research attention. Relevant articles focused on individuals' behavior, including those who posted (i.e., the senders of UGPs) and who viewed photos (i.e., the receivers of UGPs).

Regarding methodologies, earlier studies generally featured qualitative content–semiotic analysis and were limited by small sample sizes and subjectivity bias (Stepchenkova & Zhan, 2013). The validity of results appeared ambiguous; such studies did not use UGP data directly. Advances in quantitative analysis have given rise to AI-based methods which can process UGP data, and which specialize in direct image recognition and classification for large data volumes. Mixed methods were also enlightening among the reviewed studies: these approaches enable a more comprehensive understanding of user-generated content by combining qualitative and quantitative approaches. Mixed method efforts embody a research trend.

Our analysis highlighted more theoretically grounded studies in recent years, especially on topics such as destination image perception and the impact of UGPs. However, data-driven research accounted for roughly two-thirds of the publications reviewed. Earlier studies either lacked theoretical underpinnings or did not explicate theoretical frameworks—possibly due to the immediacy of research applications or the idea that straightforward managerial implications can substitute a theoretical framework (Lu & Stepchenkova, 2015). From a technical point of view, the potential of using UGPs to statistically evaluate hypotheses has not been fully explored. More scholars are lately attempting to combine theories from psychology, social psychology, communication, and information processing to explain patterns in big

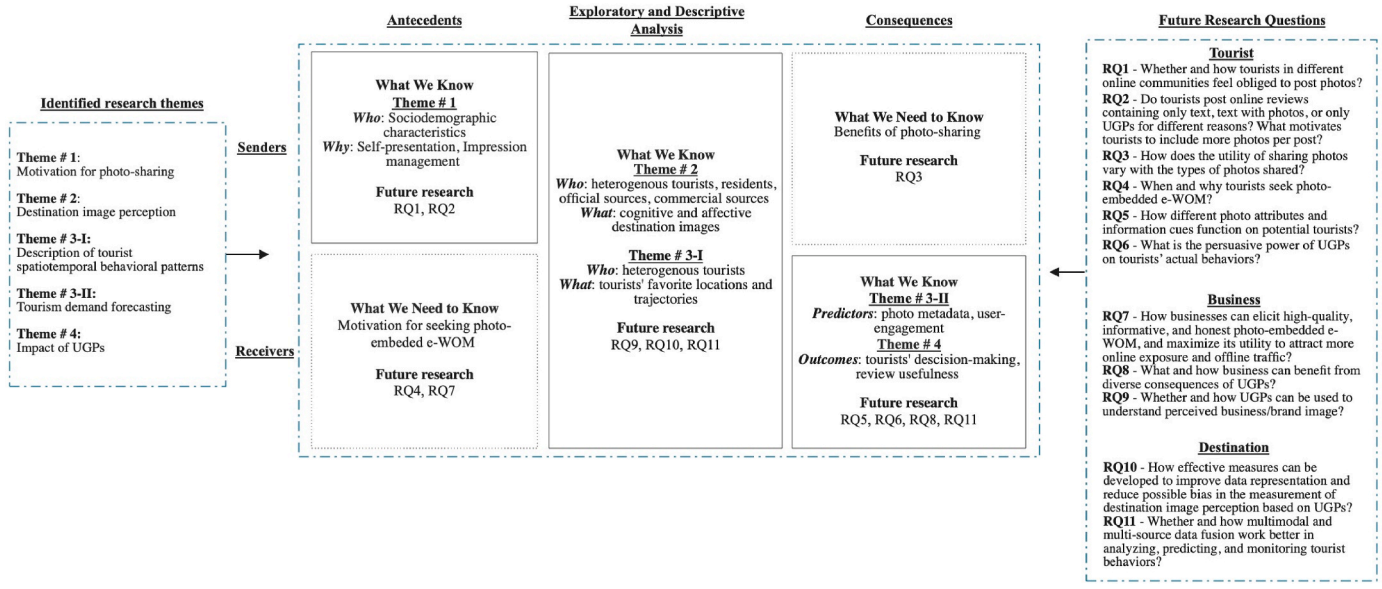

Fig. 10. Research framework of UGP-related studies in tourism and hospitality.

data. These efforts are notably prominent for topics such as motivation for photo sharing and the impact of UGPs, which have seen relatively more theoretical development than other aspects. UGP-related content will continue to serve as a popular data source. Nevertheless, a question persists about how big data–dominated studies spur theoretical advancement (Mehraliyev et al., 2020). Scholars should design studies with strong theoretical underpinnings to guide their empirical investigations (Mazanec, 2020). To further expand the tourism research ecology, additional cross-disciplinary research may be needed that applies generic social and natural science theories (e.g., from psychology, communication/media studies, information science, geography, health, and neuroscience) to tourism phenomena.

5.2. Future research directions

Ongoing technological progress is revolutionizing how people travel and how service providers, including destinations, attractions, and hospitality businesses, market their offerings. Data are being produced at unprecedented speeds, granting researchers tremendous opportunities to explore tourism phenomena more precisely. The ecosystem of tourism research has evolved as a result. Our systematic literature review unveiled several research pathways to specify the antecedents and consequences of UGPs, underlying mechanisms of UGP-related phenomena, and methodological possibilities from an individual-business-destination tripartite perspective. Based on the noted gaps, research questions within and beyond the four identified research themes are proposed (Fig. 10).

5.2.1. Tourist perspective

First, although the who and why of photo sharing have been examined, closer investigation of the determinants and underlying mechanisms of such behavior can generate more theoretical extensions and practical implications. For example, given the complex nature of motivation, comparison studies that identify user groups by platform (e.g., online review websites vs. content-sharing platforms) are sorely needed. A more nuanced segmentation of tourists is critical for exploring whether and how people in different online communities feel obliged to post photos (RQ1). Managerially, findings can guide companies' resource allocation. Also, even though studies have pointed out that online reviews containing text and UGPs are more useful than text-only reviews (An et al., 2020; Li et al., 2021; Ma et al., 2018; Wu et al., 2021), more remains to be uncovered: why do people post online reviews featuring only text, text and photos, or only UGPs? Among people who post photos, what motivates them to include more photos per post (RQ2)? Technological breakthroughs may facilitate but not determine these decisions. In addition, how does the utility of sharing photos vary with the types of photos shared (RQ3)? Future studies on photo-sharing behavior could draw on theories from fields such as psychology, social psychology, and neuroscience to deepen the understanding of this practice. Results could help practitioners capitalize on this phenomenon more effectively.

Second, most studies uncovered antecedents of UGPs from the photo sender perspective, but the question of when and why consumers seek photo-embedded e-WOM was left under-explored (RQ4). Studies adopting the heuristic and systematic model posited that the presence of photos offers additional information cues and thus accelerates consumers' decision-making, especially when they are more motivated to find out relevant clues (Zhang et al., 2014), which raises debates with the previous assumption that e-WOM consumption is non-goal-oriented (Bailey, 2005). Regulatory Focus Theory (Crowe & Higgins, 1997) indicated that individuals have two distinctive modes of self-regulatory goals, which is either promotion-oriented or prevention-oriented. Individuals' regulatory orientation can be induced in the processing of persuasive messages, among which review texts have been a popular medium for manipulation in research (e.g., Kwon & Sung, 2012). However, limited findings were present to understand how people respond to differently framed UGPs, and their effects on subsequent evaluation of a focal review or a product/service depicted in the review. For instance, will prevention-oriented consumers be more willing to seek photo-embedded e-WOM to justify their inferences due to the "seeing is believing" effect? Do UGPs differ from or interact with the textual message to persuade consumers and why? Will the congruence of review texts and photos in terms of content and sentiment reinforce and facilitate consumers' decision-making process? Motivation and cognitive and affective characters of the receivers of UGPs deserve more focused research attention.

Third, methodological improvements are needed to extend the understanding of how UGPs function on potential consumers by extracting more meaningful dimensions from UGPs in an automatic, scalable fashion (RQ5). These enhancements would encourage advanced imagery analysis on phenomena of interest while obtaining empirical evidence to enrich associated theories. Scholars have evaluated the impacts of photos with respect to photo quantity, valence, and aesthetics. Other influential information (e.g., photo color, composition, editing, and facial presence) has generally gone overlooked. More studies on the persuasive power and enhancing or hindering effects of these characteristics merit consideration (Deng & Liu, 2021; Lee, 2020). For example, filtered photos can be more visually appealing than others due to balanced shadow adjustment but may be seen as less authentic by potential consumers. Similarly, human presence in a photo can provide rich information (e.g., facial expression, body posture, and interaction with products) that increases perceived information load. However, people in photos may distract receivers' attention from core services and products, leading to a distortion effect. Future work should assess the impacts, directions, and magnitudes of these UGP attributes on tourists' behavior. An interdisciplinary perspective can provide a firmer theoretical foundation to guide the interpretation of results (Deng & Liu, 2021), especially those that are counterintuitive. Our systematic review indicates that most studies on the impact of UGPs have straightforwardly regressed determinants on variables related to consumers' perceptions (e.g., review usefulness and/or enjoyment). Little is known about why such factors are important to consumers. Classical consumer theories such as consumption vision theory (Sheth et al., 1991) can be applied to discern the internal psychological mechanisms underlying consumers' decisions about tourism products. UGPs can then better stimulate consumers' mental imagery of future consumption experiences to encourage actual consumption (i.e., by determining which UGPs have stronger impacts than others and why). In addition to behavioral intentions (e.g., visit intention, booking intention), longitudinal studies should be considered to investigate the impact of UGPs' persuasive power on tourists' actual behaviors (RQ6), especially in relation to other promotional or marketing messages (e.g., traditional WOM, marketer-generated content).

5.2.2. Business perspective

First, online reviews have been an important source of information referred by consumers in their decision-making, especially for the purchase of experiential tourism products, when the product quality and utility are not directly observable until post-consumption (Choi et al., 2017). Prior research suggested that consumers can be influenced by online reviews in two routes (Cui et al., 2018). The attention effect posits that online reviews spread e-WOM and reach wide audiences. Consumers normally do not visit a business that is not in their awareness set. UGPs pronounce the attention effects by serving as visual stimuli to catch more attention. The other route of influence is the endorsement effect. Service attributes conveyed by photo content and consumer satisfaction conveyed by photo sentiment can guide future consumers' judgement. Positive e-WOM leads to increased financial gains for businesses and brings advantages to outperform competitors (Mayzlin et al., 2014), which consequently prompts the question of how businesses can elicit high-quality, informative, and honest photo-embedded e-WOM, and maximize its utility to attract more online exposure and offline

traffic (RQ7).

Second, scholars are encouraged to extend the understanding of possible impact of UGPs, especially what and how businesses can benefit from diverse consequences of these photos (RQ8). Common outcome variables adopted are either review-centric (e.g., message quality; review credibility, usefulness, and enjoyment) or consumer-centric (e.g., willingness to visit and purchase intention). A macro view is lacking. This line of research can be extended by including business management- and performance-related variables to identify business efficacy indicators from UGPs. For instance, traditional business performance forecasting largely relies on financial figures; these statistics are a proxy of consumer satisfaction rather than a direct measure. Conversely, UGPs are a form of consumer-generated feedback that businesses can easily access. Real-time UGP data could inform top-level managerial strategies but have yet to be fully exploited if approaches for extracting relevant information from such data sources are made available, albeit attempts in this line of research are still limited. Consumers are key contributors to successful, sustainable businesses and increasingly turn to e-WOM to make purchase decisions. Businesses should thus consider taking a bottom-up approach by analyzing UGPs as an authentic consumer feedback source for various purposes: to address consumer dissatisfaction, evaluate business performance, and adjust day-to-day operations. The predictive power of UGPs for business survival/failure has been confirmed with empirical evidence in the restaurant context (Zhang & Luo, 2022). More studies could extend this line of work to investigate tourism enterprises in sectors such as attractions, hospitality establishments, and theme parks. Rather than predicting a binary result of business failure, researchers can conduct business risk state modeling to decompose the business failure process and develop a dynamic business intelligence system to monitor the rise and fall of business at the regional level based on photo-embedded e-WOM. Future UGP research could also explicate variables including financial-driven business performance indicators (e.g., revenue and profit capability), non-financial-driven business performance indicators (e.g., consumer satisfaction, market share), product/service-related satisfaction (e.g., product evaluation, brand affiliation) and customer engagement from descriptive, explanatory, and/or predictive angles to enlarge the research scope and industry insights.

Third, whether and how UGPs can be used to acquire useful information to facilitate the understanding of tourists' perceived business/brand image (RQ9)? Broadly speaking, perceived brand image is defined as a set of functional cognitions and consumers' mental associations, which form their overall impression of a brand (Brodie et al., 2009). Based on the integration of intrinsic attributes of a product or service and consumer's attachment and emotional responses to such characteristics (Padgett & Allen, 1997), a sound understanding of brand image is important to enhance brand equity and create business competitive advantages over others (Świtała et al., 2018). This is especially important for service-oriented tourism businesses, where the observability of visual images become vivid cues that visualize the intangible services and speak for the authentic experiences (Bakri et al., 2020). However, despite the significance of service brand image in influencing consumer behaviors, the value and implications of visual messages from UGPs is under-explored in the tourism brand marketing literature. Prior research concentrated on destination-level studies in an aggregated manner while neglected to understand business/brand image (e.g., hotels, restaurants, travel agencies) and capture its value in influencing tourists' decision-making. By mining thematic topics and tourist sentiment directly from massive first-hand consumer-generated data, studies with UGPs will expand the landscape of tourism brand management.

5.2.3. *Destination perspective*

Despite the claims that studies utilizing online big data (e.g., UGPs) to understand destination image perception can generate better generalizability and validity of results compared to manual content analysis with limited sample sizes, prior research noticed potential biases in UGC and its usage. Biases include population bias (e.g., data from social media platforms overrepresent young people), extremity bias (e.g., people tend to share more positive attitude than negative), and language bias (e.g., data acquired from platforms mostly are generated by English-speaking users), which raise the concern of data representation and undermine the advantage of using UGPs to research destination image (Bui et al., 2022). Moreover, the cognitive and affective aspects of destination image mined from UGPs are affected by individual's socio-economical and personality characteristics (Gallarza et al., 2002). Thus, the question of how effective measures can be developed to improve data representation and reduce bias of using UGPs to research destination image calls for more investigation (RQ10).

As platforms are encouraging people to share textual content supplemented by photos and even videos, multimodal data (i.e., integration of textual, imagery, audio, and video modalities) are becoming available on many online communities. Multimodal data provides information about an observation target from complementary angles (Zheng, 2015). From a methodological perspective, rather than solely focusing on UGPs, future research should consider whether the integration of multiple data modalities and sources works better in analyzing, predicting, and monitoring tourist behaviors in a destination (RQ11). Notably, studies in which photos are separated from review content for analysis have been deemed problematic because photos are context-dependent. Respondents may misinterpret individual photos due to a lack of context, and research outcomes may then be less valid. Multimodal data analysis integrating complementary modalities can paint a more vivid picture while overcoming challenges in potential information loss. Furthermore, integrating sources other than social media provides information about a subject from different angles. For instance, search volume data indicates real-time tourists' interests and preferences in the pre-visit stage. Venue check-in data provides understanding of when tourists come and how long they stay at a place (e.g., attraction, restaurant, shopping mall) during a visit (Wang et al., 2015). Such data sources can be integrated with the multimodal social media data to gain additional value from combining multiple datasets. Organic components of a journey (e.g., sightseeing, dining, leisure) can be thus systematically linked to develop a holistic view of tourist behaviors at the destination level. Issues related to destination image perception and tourists' demand forecasting can be further excavated by exploiting large-scale, high-volume, and high-frequency data in myriad formats and sources to better understand tourist behaviors and interpret tourism demand. These data usually possess a massive scale and complex format requiring interdisciplinary work spanning information systems, computer science, and data science, which offers opportunities for methodological development and the infusion of novel big data analytics into tourism. Table 3 summarizes and specifies the above-mentioned topics to direct future research.

6. Conclusion

UGP-related research is gaining popularity with an increasing number of scientific publications and non-scientific commentaries. Owing to its nature of being data-dominated, extant literature is built on mostly empirical data with limited theoretical development. This study conducted a systematic review of UGP-related tourism research by characterizing studies according to research themes, theoretical foundations, and analytical techniques to synthesize knowledge. This study represents a rare attempt to review UGP-related tourism research, summarize scholarly progress, and propose directions for future endeavors. In particular, this study proposed a contextualized multi-dimensional framework that incorporates antecedents, exploratory and descriptive analysis, and consequences to comprehensively summarize the fragmented UGPs-related tourism literature. Research gaps, unsolved questions, and specific research directions are highlighted for future researchers to explore. Managerially, by synthesizing the current body of literature, we lay the foundation for business owners and destination

Table 3
Proposed future research.

Unit of analysis	Directions proposed for future research
Tourist	•Conduct cross-platform comparisons to identify similarities and differences among tourist groups regarding photo-sharing motivation and behavior •Deepen discussion of the link between tourists' review-posting and photo-posting behaviors •Explore the motivation of sharing certain types of photos (e.g., brand-related photos; experience-based photos) •Uncover the mechanisms of individuals' seeking for photo-embedded user-generated content •Extract more photographic attributes from UGPs •Use information processing and message persuasion theories to examine the enhancement or hindering effects of different information cues in UGPs •Adopt longitudinal research designs to study the actual influences of UGPs on potential tourists
Business	•Establish measures to detect high-quality photo-embedded e-WOM •Study successful marketing contents and strategies by considering and incorporating UGPs •Understand business/brand image from UGPs in various contexts (e.g., hotel, restaurant, travel agency) •Examine what types of UGPs make business more appealing and compelling in the online environment
Destination	•Identify possible bias in using UGPs to analyze perceived destination image •Propose a holistic framework using mixed approach to measure destination image by combining online (e.g., UGP) and offline data (e.g., survey, interview) •Sample tourists from multiple sources •Tap into the growing platforms (e.g., TikTok) to develop analytical frameworks that can be transferred to user-generated video content •Explore effective ways to manage consistent destination image on online and offline channels

marketers to understand the complexity of UGPs and bridge the gap between the digital and physical spaces in the present omnichannel world (Liu et al., 2018). Findings will guide tourism stakeholders to maximize the utility of UGPs for their own benefits.

Similar to other studies, this paper also has some limitations. First, we only searched in two databases for SSCI-listed journal articles (i.e., Web of Science and Google Scholar). Despite being the most reputable and complete scientific databases, they may have missed relevant articles. Future research could expand the searched sources, publication categories (e.g., dissertations, conference proceedings), and journal scopes (e.g., in different languages) to gain more comprehensive insights. Second, we adopted a concept-driven approach to conduct a systematic review of UGP-related tourism studies regarding the general thematical, theoretical, methodological progression of each research theme. Reviews in the future could also be conducted from a methodological perspective to uncover the development of image analytics techniques and their associated research topics beyond tourism to synthesize how relevant research has been designed and conducted.

Author contribution statements

Hengyun Li: Conceptualization; Funding acquisition; Investigation; Methodology; Project administration; Supervision; Validation; Writing - original draft; Writing - review & editing. **Lingyan Zhang**: Data curation; Formal analysis; Investigation; Methodology; Software; Visualization; Writing - original draft; Writing - review & editing. **Cathy H. C. Hsu**: Conceptualization; Methodology; Validation; Visualization; Writing - review & editing.

Impact statement

Amid users' continuous production of visual data, this study reviews the state of research on user-generated photos (UGPs) within tourism and hospitality in a systematic and holistic way. It traces the methodological and theoretical progression of this area and presents a thematic analysis of key research foci. Findings can facilitate UGP use and contribute to scientific solutions to uncover the informativeness of UGPs. This study notifies tourism stakeholders in governmental and commercial positions of the importance of using UGPs to study tourists' behavior and guide managerial decisions. Takeaways can particularly enlighten destination management—why tourists share photos, what is their perceived destination image, and how UGPs serve as information carriers in influencing tourists. While focusing on tourism and hospitality, this study considers a big data context rooted in the social network boom. Results thus shed light on social media analytics and consumer behavior research more broadly.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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