

Article

Can Live Streaming Save the Tourism Industry from a Pandemic? A Study of Social Media

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Abstract: As a reflection of shifting and fluid experiences in time and space, live streaming can reduce losses in the tourism industry associated with travel restrictions during the COVID-19 pandemic. Compared with the use of live streaming activities in entertainment, shopping, sport, e-sport, religious, educational, and academic settings, the tourism context has yet to be explored. This study takes China as a case to examine tourism practices related to live streaming. Specifically, 48,114 social media posts were subjected to systematic content analysis. The dataset contained live streaming content related to 147 countries and 34 Chinese provincial administrative regions between 2010 and 2021. Findings revealed the following: (1) the development of tourism live streaming in China can be classified into germination, exploration, and opportunity stages; (2) live content mainly evoked positive emotions, whereas negative sentiment resulted from illegal or boring content; (3) users' perceptions of tourism live streaming content involved institutions, live streaming tools, live streaming attractions, the live streaming economy, people, facilities and information, time, and regions; and (4) live streaming tools and attractions constituted the core of the identified semantic network and had the strongest regulation capabilities in tourism live streaming activities. Findings shed light on latent cultural meanings in social media communications, where tourism live streaming features high-frequency linguistic signs.

Keywords: live streaming; tourism; social media; big data; content analysis; semantic network analysis



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1. Introduction

The coronavirus (COVID-19) pandemic has severely damaged the tourism industry. According to the World Travel and Tourism Council, the global travel and tourism sector suffered an estimated loss of USD 4.5 trillion and 62 million jobs in 2020 due to the pandemic [1]. A pathogen threat will inherently shape tourists' behavior (e.g., favoring domestic destinations over long-haul ones and avoiding crowds) and requires close collaboration with healthcare and operating systems [2]. Tourism activities have thus transformed amid social distancing and mandated travel restrictions.

Live streaming, a digital medium that involves recording and uploading audio and video in real time [3], has enabled streamers to share content related to sport [4], entertainment [5], education [6], religion [7,8], and shopping [9] under pandemic restrictions worldwide. Some operators of travel companies and attractions have begun to hold online classes, virtual tours, and digital souvenir sales in an effort to replace revenue normally earned from in-person experiences. For instance, the Museum of Krakow in Poland created live streaming and online competitions on nativity scenes [10] and the Emaus tree [11], effectively shifting two annual educational and tourism activities about cultural heritage online. In public health crisis contexts, tourists and organizers have come to favor low-risk tourism activities; these preferences, despite being rooted in safety, will compromise the travel and tourism economy. Some tourist destinations and travel agencies have adopted

long-distance methods to earn profits and abide by health policies; however, live streaming studies on tourism-related topics are scarce. Live streaming tourism could extend the tourism industry chain and create a new marketing mode. More research on related live content and users' perceptions is therefore needed.

To fill these knowledge gaps, the present study explores relevant theoretical and systematic aspects by answering three questions: (1) How has tourism live streaming developed in recent years? (2) How do users perceive tourism live streaming activities? Finally, (3) What are the most important dimensions of tourism live streaming? User-generated social media data can reveal individuals' activity patterns and responses to events through various means. We thus propose two hypotheses based on past studies: (1) the posting time and source can convey the development of live streaming; and (2) textual content can reveal the perceived image and semantic structure of live streaming from users' perspectives. To address these questions and hypotheses, user-generated data were crawled and then submitted to content analysis. This research ultimately uncovered the spatial-temporal distribution of the development, sentiments, live content, and semantic network of live streaming. The remainder of this article is organized as follows. Section 2 reviews the definition, history, use, and research status of live streaming. Section 3 provides an overview of this study's case selection, data collection, and analysis processes. Section 4 outlines the results of content analysis, followed by relevant conclusions and directions for future research in Section 5. Based on abundant social media data, this research investigates viewers' perceptions when watching live streams that feature tourism content. Findings are based on China, a country with a large live streaming audience and a mature live streaming industry. Individuals' usage and perceptions of live streaming in tourism thus offer theoretical and practical implications to promote the tourism industry's restoration amid the pandemic.

2. Research Background

2.1. Definition and History of Live Streaming

Live streaming—also known as live video streaming [12], live video broadcasting [13], social video streaming [14,15], and video streaming [16]—refers to a type of media that is continuously recorded and broadcast to viewers in real time [16]. It also involves one's ability to broadcast video to a remote audience as footage is captured [17]. With real-time video content and text-based chat channels, live streaming can foster sociability through synchronous communication as well [18,19].

Live streaming emerged less than 30 years ago. Some scholars have contended that the first live stream was a performance from a garage band, Severe Tire Damage, in 1993 [5]. The live music scene evolved over the 2000s as evidenced by growth in music festivals and online music services [20]. Other scholars believe that live streaming began in the 21st century [17]. For instance, Juhlin and colleagues [17] pointed out that an initial platform called ComVu Pocket Caster launched in 2005, and eight similar services followed: Qik, Kyte, Bambuser, Flixwagon, Floobs, Next2Friends, Stickam, and Ustream. Later, in 2015, popular social media sites such as Facebook and Twitter offered live streaming functions [21] to capture related market share. Facebook then provided comprehensive live streaming in 2016 [22]. Compared with live media forms such as radio or television, live streaming applications are better able to share content from mobile devices to websites, forums, or live chats. Internet technology has largely opened access to this visual storytelling method and has compensated for the limitations of television. Still other scholars have argued that the gift-giving business model of live streaming enables this medium to be highly profitable [23].

2.2. Use of Live Streaming

Live streaming has become a global trend in recent years [5,19,24,25]. This communication mode is popular in many sectors, including entertainment, shopping, sport, e-sport, religion, education, and academia. Entertainment is one of the most common reasons why

audiences watch live streams. The development of webcasting technology has promoted live streaming as an entertainment alternative to traditional broadcasting models due to the exclusiveness, quality, and variety of content [5]. Hilvert-Bruce and co-authors [26] cited entertainment as a key motivators for viewing live streams, along with information seeking; meeting new people; engaging in social interaction; finding social support, a sense of community, and external support; and reducing social anxiety. Chen and Lin [27] suggested that entertainment, flow, social interaction, and endorsement each positively affect individuals' viewing intentions. Live streams can also offer a solution to unemployment problems and economic pressure for streamers when they receive gifts from their audience. Watching live streams "just for fun" has hence become more popular and profitable for both the audience and streamers.

Shopping during live streams represents a new trend in Asian countries. Streamers' feedback on and interaction with a product can be transmitted to customers in real time despite spatial separation. By using different sales approaches to retain and attract customers, live streaming can effectively enhance the customer experience, foster customer engagement, and boost sales [9]. For some traditional vendors, live streaming offers a new channel to showcase products, increase sales, and clear inventory while encouraging authenticity, visualization, and interactivity [25,28]. Some scholars have proposed research models around purchase intention related to live streaming. For instance, Sun and colleagues [29] devised a model showing that customer engagement and information technology affordance (e.g., guidance shopping affordance, including visibility affordance, and metavoicing affordance) were positively associated with purchase intention. Park and Lin [30] developed and tested an integrative model of internet celebrity endorsement by investigating the congruence effects on live streaming viewers. Results indicated that source trustworthiness, hedonic attitude, and self-product fit increased viewers' purchase intentions.

The sport industry combines the qualities of liveness, emotion, and identity appeal and is one of the most compelling reasons that people watch television. Heavily capitalized services such as DAZN and Amazon Prime Video are now intervening in markets' coverage rights and are changing how live sports are experienced and shared across television, computer, and smartphone screens [31]. The popularity of e-sports—competitive multiplayer gaming that involves watching real-time or asynchronous gameplay, team competitions, and tournaments—has also grown through live streaming [4]. Multiple indicators have been addressed in e-sports research, considering live broadcasts of competitive games; such indicators involve players, audiences, and marketing. For instance, Kim and Kim [32] formulated and confirmed a new live streaming e-sports spectator model. They demonstrated how knowledge, achievement, escape, friendship, drama, player skills, and the social aspects of e-sport spectatorship motivation via live streams affected e-sport fans' flow experience, subjective well-being, behavioral intentions, and game loyalty.

In terms of education and academic activities, live streaming channels (primarily based on Web 2.0 technology) can provide virtual interactive spaces similar to classrooms. These settings can in turn enhance teachers' and students' involvement, engagement, and interaction [6]. COVID-19 has led live streaming to become a necessary tool for most students and teachers. Although the academic world is not entirely ready for a shift to online learning, the community has welcomed live streaming while pandemic-related travel restrictions remain in place [33].

Besides popular ways of using live streaming, some religious sites have adopted the medium to deliver events and experiences. For example, the Wailing Wall in Jerusalem, the Kaaba of Mecca, and Chinese temples in Singapore have communicated via live streaming [7,8]. Golan and Martini [7] identified evangelizing youth, establishing affinity towards the Holy Land, and maintaining a constant transcendental presence as webmasters' three core objectives when mediatizing important holy sites. Alvin Eng Hui Lim [8] considered Sheng Hong Temple in Singapore and found live streaming to promote the

temple's success index by scaling up festivals and blurring the divide between deities and humans. Overall, live streaming can serve various functions in diverse cultural settings.

Even so, compared with other types of live streaming activities, tourism-related live streaming has not been fully explored. The use of live streams for entertainment, sport, educational, or religious purposes can be transferred to tourism content. For example, if tourism live streaming fulfills users' informational, entertainment, and social needs [34], then it can be adopted to market tourist products and destinations. This type of live streaming can also provide enjoyment, satisfy viewers' curiosity, and facilitate experience sharing. Tourism live streaming is an ensemble of shifting and fluid experiences in time and space [24], which are important factors for tourism activities in real life.

2.3. Current Research Methods

Live streaming platforms and services such as Sina Weibo, Twitch, AfreecaTV, Amazon, YouTube Live, and Facebook Live host a range of content and have attracted researchers' attention. Most studies have revolved around technological aspects. Although the history of live broadcasting is relatively brief, extensive research on live broadcast content and associated tools has emerged as of late.

In the social sciences, some researchers have focused on Asian countries rather than European or American countries due to industry development and consumption behavior. Surveys have been conducted in Asian countries such as China [35], India [5], South Korea [23], Singapore [8], Israel [7], and Thailand [9]. For example, Quan Long and his co-author [35] examined gender differences in Chinese social live streaming service use by focusing on audience needs. The authors found that male audiences were more likely to watch and prefer live game broadcasts. Sonali Singh and colleagues [5] studied an array of factors influencing viewers' intentions to continue to use live streaming services in India; convenience value appeared to have the greatest impact on users' continuance intentions, followed by perceived enjoyment. Besides Asian countries, live streaming activities in Norway [20], the United States [36], and other countries have also garnered academic interest.

Traditional methods in social science research, such as netnography [16], case studies [37], content analysis [36], interviews [38], and questionnaires [39,40] have been employed to better understand live streaming. Marita Skjuve and her co-author [36] conducted a content analysis of 1188 Facebook Live videos across three continents to identify individuals' practices in public live streaming; chatting with random people and skills demonstrations were most common. Many well-known theories related to behavior have been adopted in live streaming research as well. Examples include cognitive transactional theory [41], cognitive cost theory [42], perceived value theory [5], uses and gratifications theory [35], social cognitive theory [43], social exchange theory [19], affordance theory [29], communication privacy management theory [37], attachment theory [27], flow theory [27], interaction ritual chains theory [42], and media richness theory [34].

As indicated by previous studies, relevant work has mainly focused on consumer behavior (e.g., reasons for watching live streams and intentions to purchase from them). The actual content of live streams has been relatively neglected but is important given spatial-temporal advantages amid travel restrictions. Specifically, the tourism industry could leverage new avenues during the pandemic to reduce losses. This study therefore explores how users perceive tourism live streaming and identifies currently popular content.

3. Methodology

3.1. Study Case

China was chosen as the study case because it boasts a large and rapidly growing group of live streaming users alongside a well-developed live streaming industry [44]. Many conditions have supported the industry's development in China, from government policies to cultural characteristics. For instance, the National Development and Reform Commission published a government notice entitled "Opinions on Supporting Sound

Development of New Business Forms and New Modes, and Activating the Consumer Market to Drive and Increase Employment” in 2020 [45]. This document promotes the digital transformation of the national economy and society. It also supports diversified forms of self-employment, such as e-commerce and live streaming, to reduce the pandemic’s economic impact. Besides the government, entities such as travel companies have invested and earned profit from live streaming. Ctrip, one of the country’s largest travel companies, sold USD 294 million in travel packages and hotel reservations between March and October 2020 [46]. In addition, cheap labor in the e-commerce industry, a developed logistics industry, and a vast audience from similar cultural backgrounds ground the online streaming economy. These characteristics have collectively spawned hundreds of live streaming platforms in China.

3.2. Data Source and Collection

Common social media platforms such as Facebook and Twitter are restricted in China. Data were thus gathered from Weibo.com (Weibo), the most popular Chinese social media site in terms of usage time and the number of active users. Weibo is a social media platform that enables users to share brief posts including live streams. Certain live streaming websites or applications can also be linked via the platform. Weibo was therefore chosen as the data source to study tourism live streaming.

Data were collected using Houyicaiji (<http://www.houyicaiji.com/>, accessed on 15 April 2021), an open-access web crawler (i.e., spider). Users can set collection rules to simulate human operations, and the crawler will automatically gather data based on a set of user-provided uniform resource locators (URLs). For the purposes of this study, “tourism live streaming (*Lv You Zhi Bo*)” was the chosen keyphrase; 165 URLs were imported into Houyicaiji. Results returned 64,047 posts published between 6 December 2010 (the date of the first relevant Weibo post) and 31 March 2021. Photos and videos were excluded from the dataset, leaving several attributes: post time; poster’s username; post content; connected source (device model, “super topic”, connected platform); and the respective number of shares, comments, and likes.

Prior to engaging in data preprocessing, the authors manually removed posts that contained duplicate textual content or which had been posted for marketing purposes or to specifically attract users’ attention (e.g., clickbait). The final dataset contained 48,114 valid posts totaling 6,681,511 Chinese characters (effective collection rate based on post number: 75.12%).

3.3. Data Preprocessing and Content Analysis

Content analysis has become increasingly popular when deriving theoretical and structural models from review data on social media [47]. The authors chose GooSeeker (<https://www.gooseeker.com/>, accessed on 24 April 2021), a software program used for text analysis, to perform content analysis. The analysis process included segmenting words, screening valid words, merging synonyms, generating a matching co-word matrix, and drawing network diagrams. As shown in Figure 1, the textual content, post year, and post source were considered when evaluating the spatial-temporal distribution, sentiments, and semantic network associated with live streaming.

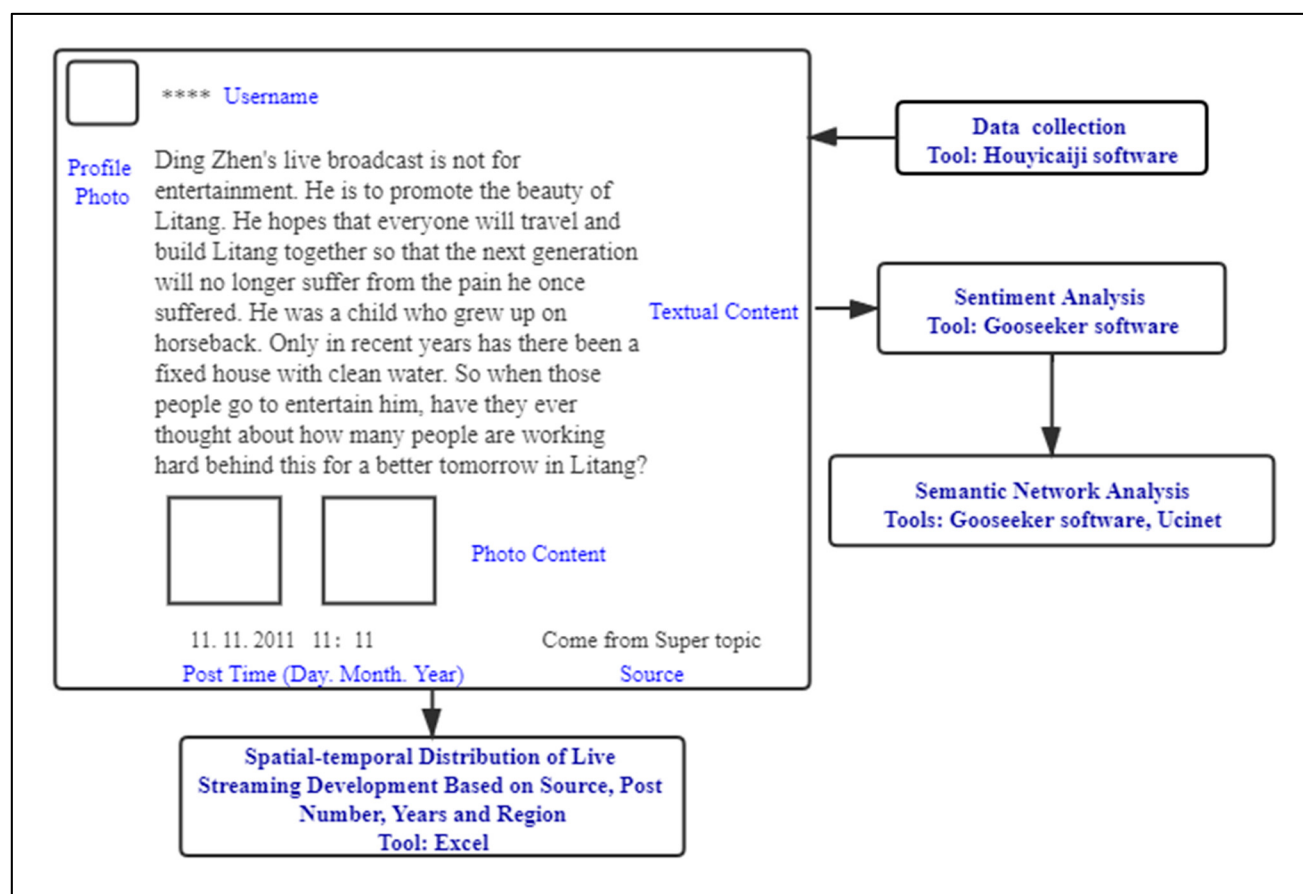


Figure 1. Weibo data content analysis flowchart.

3.3.1. Spatial-Temporal Analysis of Live Streaming Data

This paper explored the spatial and temporal characteristics of live streaming development based on source information, number of posts per year, and regional information in the textual content. First, the authors manually selected valid source names based on multiple sources where the post was linked: device; super topic, representing a group of people on Weibo with common interests; and applications (including Weibo itself), such as news platforms and live broadcast platforms. Altogether, 239 sources (based on the names of live streaming applications, super topics, devices, and past and current phone models) were selected based on online information. Second, regression analysis was conducted to analyze the relationship between the post year and source. Third, regional information (e.g., country and province) was evaluated.

3.3.2. Sentiment Analysis

The authors used GooSeeker to identify emotions expressed in selected live streaming tourism areas. For textual analysis, the authors integrated each post into a complete sentence and imported GooSeeker's sentiment dictionary, which offers highly accurate sentiment results on non-negative expressions. The negative emotional judgment results were later reviewed manually to enhance findings' accuracy. Two researchers independently verified whether the software classified these negative emotions accurately; non-negative emotions were assigned to the appropriate group.

3.3.3. Category and Semantic Network Analysis of Live Streaming

Fifty-four groups of synonyms were developed in GooSeeker to reduce redundancy. For example, "coronavirus", "COVID epidemic", "pathogen", "COVID case", "COVID", "epidemic", "COVID pneumonia", and "pneumonia" were merged into "epidemic". Nouns

extracted from Weibo posts were next categorized into different theoretical elements and dimensions, partially referring to previous tourism research based on Weibo [47]. Then, among 59,532 nouns, 100 words with frequencies greater than 1247 were chosen for inclusion in semantic network analysis (i.e., co-word matrix, degree centrality analysis, and closeness centrality analysis). The lowest frequency among high-frequency words was determined based on the high–low frequency boundary [48] and the original setting of Rost.CM. Lastly, the co-word matrix result was imported into Ucinet [49] to obtain the centrality degree and closeness degree of the network using the “Network-Centrality-Degree” and “Network-Centrality-Closeness” functions. These attributes indicated which network elements were closely connected with others and identified which features possessed the greatest influence.

4. Results and Discussion

4.1. Spatial-Temporal Distribution of Live Streaming Development

As Figure 2 illustrates, the number of posts and sources connected to Weibo rose inconsistently over time. The development of tourism live streaming over the selected 12-year period was classified into three phases. The first stage of development, labeled “germination”, occurred from 2010 to 2015. Between 3 and 32 applications were connected to tourism-related live broadcasts at this stage. Users mainly shared information on tourism live streaming from Weibo’s platform or from select browsers such as UC Browser, 360 Safety Browser, and Sogou browser. The “exploration” phase (2016–2019) included 50–66 Weibo-connected platforms. Platform- and application-specific focuses on live streaming emerged during this period. However, the potential promise of economic benefits and social prestige led to distorted content and illegal behavior as shown on some platforms. The Central People’s Government of the People’s Republic of China [50] soon started to intervene in illegal online streaming platforms, which halted the swift growth of applications and live streaming activity on Weibo. The third phase, from 2020 to present, reflects the “opportunity” stage of tourism live streaming. The pandemic and travel restrictions ravaged the tourism industry; in the meantime, live streaming became an industry breakthrough as users sought excitement from live streams and bought travel-related products (e.g., airfare and hotel reservations).

The number of device types remained stable (roughly 20) over recent years. Additionally, findings revealed that Weibo had created super topics since 2012 enabling users with common interests to post blogs on the same topic. For example, more than 100 posts in this study’s dataset concerned Ding Zhen, a Tibetan boy from Sichuan Province who unexpectedly became popular because of his authentic appearance. His fans frequently posted content under the topic of his name. Attracting audiences via live broadcasts therefore represents an important tool for promoting the local tourism industry.

In regression analysis, the number of applications and devices were respectively taken as independent variables while the number of posts was the dependent variable. The regression model fit the annual data well, and the variables were highly positively correlated ($R = 0.953$, $R^2 = 0.907$). Whereas the correlation between application and post number was significantly high (coefficient = 119.543, sig = 0.000), the correlation between device and post number was insignificant (coefficient = 15.979, sig = 0.805). These findings confirm that the live streaming application is a key tenet of tourism live streaming; devices exerted a negligible impact on live streaming’s development.

Regarding the spatial distribution of live streaming, 147 countries and 34 Chinese provincial administrative regions were detected in textual content (Figure 3). Although Weibo is a Chinese social media platform, live content covered countries in Asia, Europe, Africa, Oceania, and North and South America. In addition to China, Japan, Thailand, and South Korea were mentioned as live travel destinations more than 1000 times. The Maldives, Russia, Britain, Singapore, Canada, Denmark, Germany, New Zealand, Australia, Italy, Turkey, Switzerland, France, Vietnam, Malaysia, South Africa, the Netherlands, Spain, India, and Cambodia were also popular destinations in live broadcasts; each was mentioned

more than 100 times. Some countries that are far from China or have undeveloped tourism infrastructure were rarely or never mentioned in tourism live streaming.

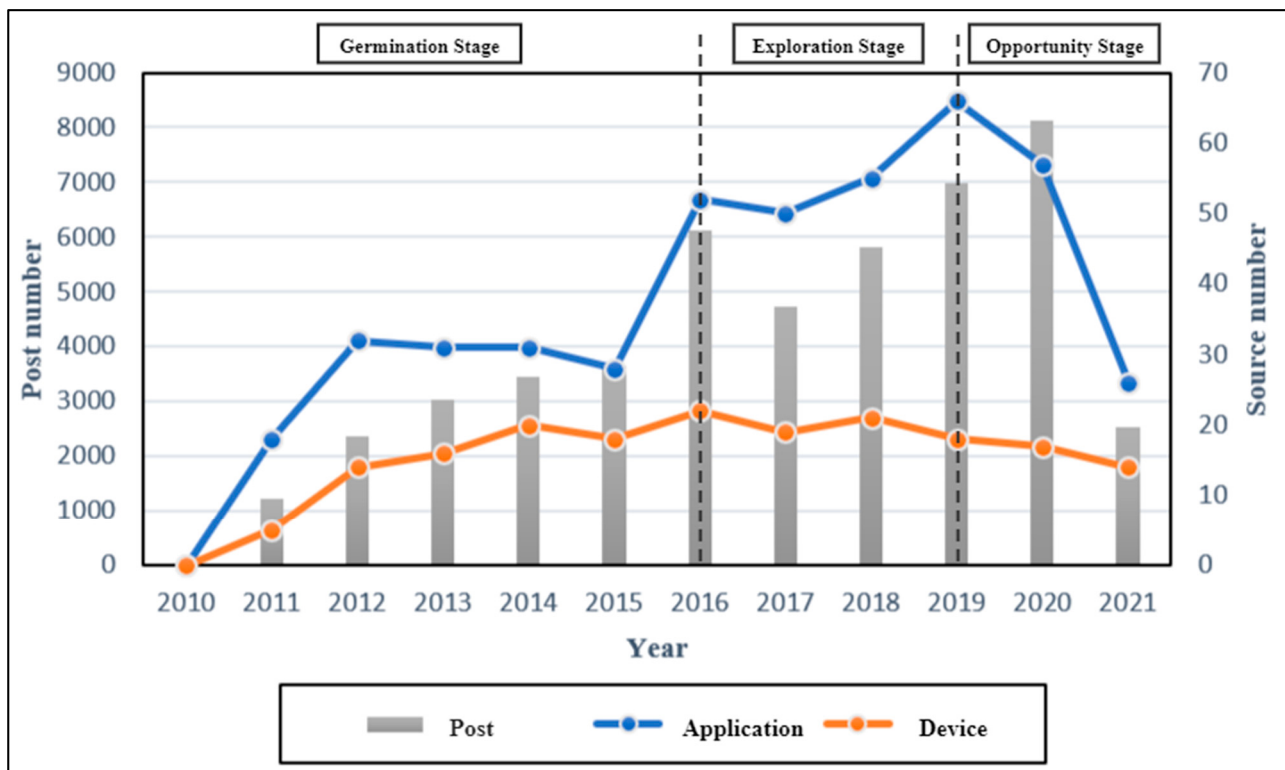


Figure 2. Number of Weibo posts and connected sources by year in study dataset.

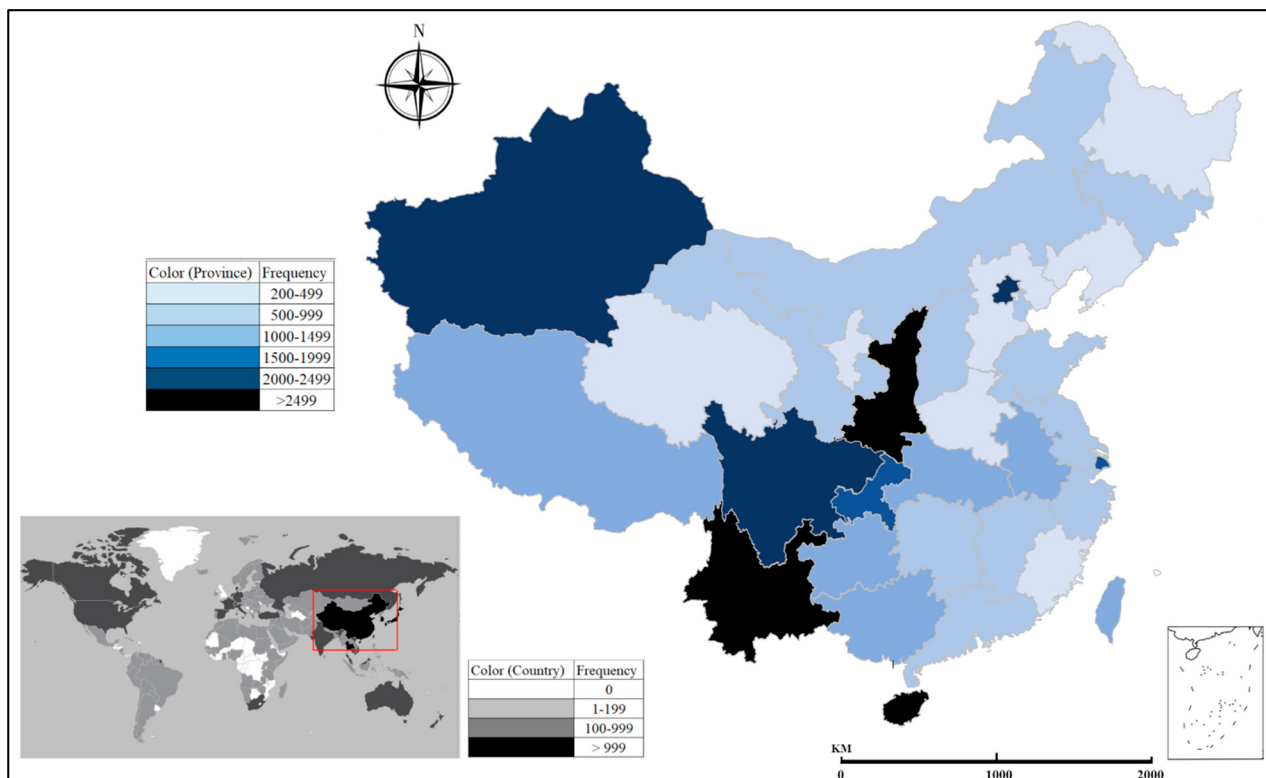


Figure 3. Spatial distribution of live streaming locations.

Among the country's 34 provincial administrative regions, Liaoning ($n = 266$), in north-eastern China, was mentioned least. Shaanxi Province ($n = 2928$), which is home to rich tourism resources, was discussed most. Apart from Beijing, the provincial administrative regions in Western or Southern China (e.g., Shaanxi, Hainan, Yunnan, Sichuan, and Xinjiang) were the most popular for tourism live streaming. Some developed provinces in the east received comparatively less attention. China's eastern region is densely populated, and people tend to choose exotic content when watching tourism live broadcasts—especially as Western China has unique topography and humanistic customs. Therefore, the spatial distribution of live streaming content in this study focused on the western region. Live content seemed to be a core factor in attracting viewers, which could encourage streamers to produce more popular videos.

4.2. Emotion Recognition in Tourism Live Streaming

The authors imported all posts' textual content into GooSeeker's sentiment analysis tool, after which Weibo posts were classified as expressing positive, negative, or neutral emotions. Posts about live streaming tourism on social media were mainly non-negative, accounting for 97.59% ($n = 46,953$) of the dataset. Another 2.41% of posts ($n = 1161$) expressed negative emotions. Watching live broadcasts thus seemed to be a pleasant activity that persisted throughout the germination, exploration, and opportunity phases of tourism live broadcasting development. Negative posts were generally due to illegal or boring plots during live broadcasts.

Keyword analysis of negative sentiment posts (Figure 4) highlighted “illegal” ($n = 384$), “punishment” ($n = 179$), and “vulgar” ($n = 111$) as the top three reasons for a negative image. The negative impact of live broadcasting therefore stemmed from illegal activities, not from travel itself. In most cases, travel activities and live broadcasting presented through social media generated a positive image: the cognitive network of live streaming tourism identified in this study was mainly based on positive and neutral posts.



Figure 4. Keyword analysis of negative sentiment reviews.

4.3. High-Frequency Words and Categories of Tourism Live Streaming

Drawing upon the classification of high-frequency nouns extracted from Weibo posts, the basic theoretical elements and dimensions were summarized into a framework. The authors specifically identified eight dimensions: institutions, live streaming tools, live streaming attractions, the live streaming economy, people, facilities and information, time, and regions (Table 1).

Table 1. High-frequency words, theoretical elements, and dimensions conveying attributes of tourism live streaming.

Dimension	Theoretical Element	High-Frequency Words Extracted from Text (Word Frequency)
Institutions	Government and staff	tourism bureau (7807), police (1619), director (1043)
	Enterprise, association and staff	enterprise (2468), company (2845), travel agency (1581), committee (1278), company group (1277)
	Education	college (1019)
Live streaming tools	Platform name	Yizhibo (3413), Sina (3410), Weizhibo (3009), Miaopai (2570), Weibo Live (2272), Taobao (1678), Kuaishou (1293), WeChat (1283)
	Other media	video (9808), news (9044), studio (6574), internet (6248), broadcast (4352), program (3053), media (2958), TV station (2247), CCTV (2448), satellite TV (2445), channel (2157), live room (2004), mobile phone (1797), music (1711), radio (1705)
Live streaming attractions	Event	activity (9554), opening ceremony (1808) press conference (1822), sport (1474), ceremony (1356), competition (2926), promotion conference (1284), performance (1247), forum (1238)
	Theme	country (3889), life (3733), work (3627), world (3435), theme (2176), vacation (1034)
	Place	scenic spot (10,423), scene (3946), city (3438), rural (3424), scenery (2238), Litang (1576), village (1447), hometown (1320), park (1033)
	Culture	culture (16,646), story (1228), history (1183)
	Animal	horse (1218)
	Nature	snow (2344), mountain (1941), ecology (1531)
Live streaming economy	Industry and investment	industry (3222), economy (1862), resource (1859), tourism industry (1827)
	Market and product	product (2754), market (2324), goods (2291), ticket (1584), brand (1508), shopping (1451), store (1004)
People	Celebrity	Wang Jiaer (1724), Ding Zhen (1512)
	Ordinary people	tourist (6374), netizen (2849), friend (2388), fans (2383), reporter (2293), citizen (1359), guide (1335), expert (1254), people (1225), team (1082)
Facilities and Information	Transportation	traffic (2229), route (1201)
	Hotel	hotel (4208)
	Catering	food (3626), restaurant (1212)
	Information	information (2005), address (1489), message (1488), hotline (1305), provision (1130)
	Health	epidemic (3018)
	Other facilities	service (3669)
Time	Season	winter (1828)
	Holiday	National Day (1185)
Regions	Country	China (13,245), Japan (1210), Thailand (1146), South Korea (1069)
	Province	Shaanxi (2928), Hainan (2901), Yunnan (2527), Sichuan (2401), Xinjiang (2246), Taiwan (1368), Hubei (1355), Guizhou (1302), Anhui (1115), Tibet (1108), Guangxi (1083)
	City	Chaozhou (7074), Xi'an (4241), Baoji (3786), Beijing (2338), Shanghai (1994), Chengdu (1882), Chongqing (1872), Sanya (1858), Wuhan (1792), Hanzhong (1396), Nanjing (1359), Harbin (1230), Dali (1189)

Note: Due to space limitations, only nouns with a frequency of more than 1000 are shown.

The terms “culture” ($n = 16,646$), “China” ($n = 13,245$), and “scenic spot” ($n = 10,423$) were the three most frequently mentioned words on Weibo. The most popular keyword was “culture”, which embodies the tourism theme in which most audiences were interested. “China” indicated that most content was posted by streamers while in China. The third most popular keyword, “scenic spot”, captured the main venues for tourism live streaming; “scenic area” was the most common location. These three terms belonged to the dimensions of “live streaming attractions” and “regions”.

Among nouns with a frequency of more than 1000, the dimensions “live streaming tools”, “live streaming attractions”, and “regions” appeared most often in the dataset. On the contrary, “institutions”, “time”, and “live streaming economy” attracted the least amount of user attention. Results indicated that, on Weibo, users’ descriptions of tourism live streaming referred to where the live stream was held, what it was about, and how to watch it. A limited amount of content entailed the live streaming economy, such as the market, industry, and products. The economic benefits of tourism live streaming thus have yet to be widely acknowledged.

4.4. Semantic Network Analysis Results of Tourism Live Streaming

4.4.1. Network Structure

The authors pinpointed seven dimensions covering 99 elements (among the top 100 elements with the highest word frequency) within the most central connections (see Figure 5). These nodes were at the center of the semantic network and were closely connected. Six elements pertained to institutions, nine pertained to the live streaming economy, nine pertained to people, 20 pertained to regions, nine pertained to facilities and information, 22 pertained to live streaming tools, and 24 pertained to live streaming attractions. No time-related elements were observed in the network.

In general, tourism-related live broadcasts stressed the live broadcast content and live broadcast tools with less focus on time and travel facilities. Therefore, live tourism could apparently transcend pandemic restrictions and pave the way for virtual tourism. Although some industrial chain elements appeared in the network, the profit model is mainly based on gift donations, and a complete industrial chain did not emerge. In addition, some successful tourism live streaming models online can be adapted to other tourism destinations; for example, Litang County employed the internet celebrity Ding Zhen to conduct live streaming, which drastically promoted the local tourism industry’s development.

4.4.2. Semantic Centrality of Live Streaming

In terms of degree centrality, the larger a node’s value, the more direct connections it has, and the more central its position in the network. Regarding closeness centrality, the larger a node’s value, the more easily it can integrate with other nodes.

The average degree centrality score was 7343.040 ($SD = 6127.093$); the standard degree centrality score was 3.585 ($SD = 2.991$). Thirty-four nodes had a higher-than-average degree score; the network centralization was equal to 15.53%. As Table 2 shows, “culture”, “news”, and “China” were central to tourism live streaming. Different from the classification of high-frequency nouns, dimensions within the top 20 centrality degrees mainly consisted of live streaming attractions and live streaming tools. Seven nodes belonged to the dimension of streaming attractions: “culture”, “activity”, “scenic spot”, “scene”, “country”, “work”, and “life”. Seven nodes fell under the “news” dimension: “news”, “video”, “studio”, “Internet”, “TV”, “media”, and “broadcast”.

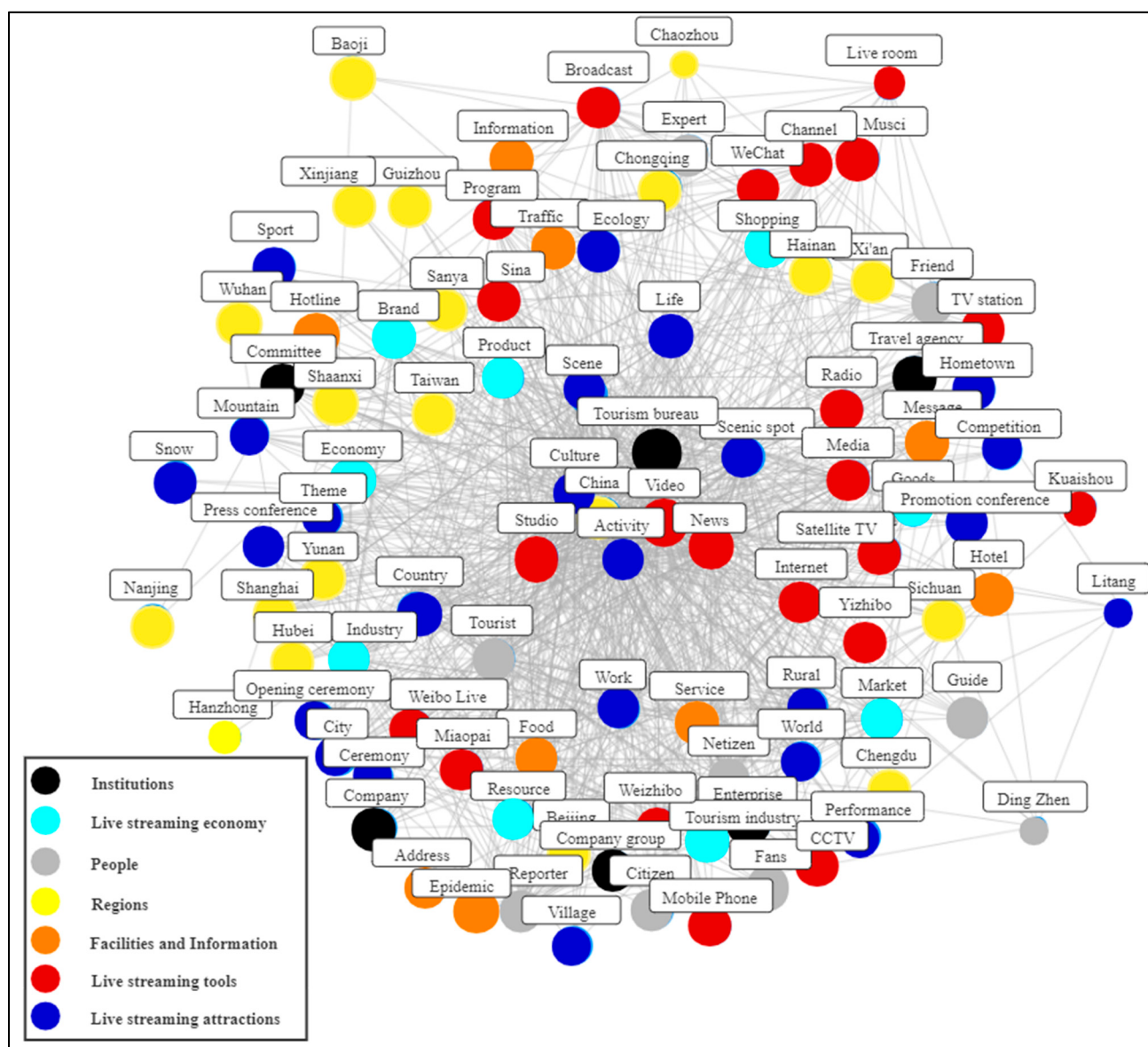


Figure 5. Semantic network results of tourism live streaming. Note: Different colors and dot sizes represent dimensions and degree centrality based on GooSeeker.

The average farness score was 103.440 ($SD = 10.279$), and the average closeness score was 96.322 ($SD = 6.305$). Network centralization equaled 7.47%. As displayed in Table 3, these elements' closeness levels were highly similar; that is, they were most influential in terms of incorporating tourism live streaming. The dimensions constituting the top 20 in terms of closeness degree consisted of live streaming attractions and live streaming tools. Seven nodes belonged to the dimension of streaming attractions: "activity", "world", "city", "life", "theme", "sport", and "scenic spot". Five nodes belonged to the dimension of live streaming tools (i.e., "video", "studio", "music", "channel", "program").

The results of centrality analysis underline webcast tools and live content as mainstays; they are both the center of the network and have the strongest regulation capabilities. Therefore, live streaming can bypass the constraints of time and space while avoiding pandemic-related travel restrictions.

Table 2. Degree centrality analysis of tourism live streaming.

Rank	Nodes	Degree	NrmDegree	Dimensions
1	Culture	38,526	18.809	Live streaming attractions
2	News	28,817	14.069	Live streaming tools
3	China	27,923	13.632	Regions
4	Video	26,230	12.806	Live streaming tools
5	Activity	23,455	11.451	Live streaming attractions
6	Studio	19,046	9.298	Live streaming tools
7	Tourism bureau	18,075	8.824	Institutions
8	Scenic spot	15,112	7.378	Live streaming attractions
9	Tourist	13,883	6.778	People
10	Scene	12,668	6.185	Live streaming attractions
11	Internet	11,975	5.846	Live streaming tools
12	Country	11,664	5.694	Live streaming attractions
13	TV station	11,321	5.527	Live streaming tools
14	Service	11,019	5.380	Facilities and Information
15	Work	10,849	5.297	Live streaming attractions
16	Product	10,415	5.085	Live streaming economy
17	Life	10,080	4.921	Live streaming attractions
18	Media	9869	4.818	Live streaming tools
19	Broadcast	9525	4.650	Live streaming tools
18	Reporter	9459	4.618	People

Note: Only nodes with degree centrality rankings in the top 20 are shown.

Table 3. Closeness centrality analysis of tourism live streaming.

Rank	Nodes	Farness	Closeness	Dimensions
1	Resource	99	100	Live streaming economy
2	Activity	99	100	Live streaming attractions
3	Fans	99	100	People
4	Brand	99	100	Live streaming economy
5	Video	99	100	Live streaming tools
6	Studio	99	100	Live streaming tools
7	World	100	99	Live streaming attractions
8	City	100	99	Live streaming attractions
9	Product	100	99	Live streaming economy
10	Life	100	99	Live streaming attractions
11	Channel	100	99	Live streaming tools
12	Chengdu	100	99	Regions
13	Shopping	100	99	Live streaming economy
14	Program	100	99	Live streaming tools
15	Theme	100	99	Live streaming attractions
16	Sport	100	99	Live streaming attractions
17	Music	100	99	Live streaming tools
18	Scenic spot	100	99	Live streaming attractions
19	Shanghai	100	99	Regions
20	Information	100	99	Facilities and Information

Note: Only nodes with closeness degree rankings in the top 20 are shown.

5. Conclusions and Future Directions

As a set of shifting and fluid experiences in time and space [24], tourism live streaming can reduce industry losses due to travel restrictions. To further explore tourism-related live streaming, China was taken as a study case. Content analysis was employed to assess 48,114 social media posts and outline the development of tourism live streaming between 2010 and 2021 by answering three questions: (1) How has tourism live streaming developed in recent years? (2) How do users perceive tourism live streaming activities? Finally, (3) what are the most important dimensions of tourism live streaming?

Results show that the development stages of tourism live streaming encompass germination, exploration, and opportunity. Since 2020, live streaming has helped the tourism

industry mitigate pandemic-related damage, including based on travel restrictions. Non-negative emotions accounted for 97.59% of Weibo posts. Live broadcasting content on social media was hence perceived as mainly positive; negative sentiment reviews resulted from illegal or boring plots. Tourism live streaming was found to cover eight dimensions: institutions, live streaming tools, live streaming attractions, the live streaming economy, people, facilities and information, time, and regions. Live streaming tools, live streaming attractions, and regions were mentioned most frequently on social media. Travel live broadcasts emphasized content and tools—both elements resided at the center of the network and possessed the strongest regulation capabilities versus other elements. The spatial-temporal analysis, semantic network analysis, and centrality analysis of tourism live broadcasts confirmed the robustness of this finding. In essence, tools and content are paramount to the development of tourism live streaming. In other words, when people watch tourism-related live broadcasts, they pay particular attention to the content and tools. These attributes can therefore help industry practitioners minimize the impacts of pandemic-related restrictions while paving the way for virtual tourism.

Social media features freedom and openness, situating it as a key means of information dissemination. Some scholars have suggested that social media data complement traditional survey data as an information source [51,52]. Upon analyzing the content of the selected Weibo posts, the dimensions associated with tourism live streaming varied somewhat from other types of tourism activities [47]. For instance, users' perceptions of tourism live streaming involved institutions, live streaming tools, live streaming attractions, the live streaming economy, people, facilities and information, time, and regions. By comparison, cognition tied to intangible cultural heritage reflects institutions, intangible cultural heritage and inheritors, tourism products, traditional festivals and seasons, tourism facilities and services, visitors, and regions. When users shared their experiences on social media, they mentioned similar content (e.g., institutions, tourism facilities and services, people, region, and time). Travel contents and live streaming methods were otherwise distinct in various tourism activities.

Owing to the unstructured and biased nature of social media data, new visualization methods are needed to better map and analyze data on individuals' travel activity patterns and responses to events. This study demonstrated the utility of content analysis, including social network analysis (semantic network analysis), in revealing the underlying spatio-social structures of tourism live streaming. Social connection studies have shown that, the more often people share the same codes, and the greater their use of the same sign systems, the closer the two "meanings" of the message will be [53]. Therefore, in this study, the results suggest latent cultural meanings in social media communications. Tourism live streaming is represented by high-frequency linguistic signs and stresses marketing and e-commerce rather than the tourism experience. Specifically, as organizers can only earn a profit by receiving gifts or selling products—or when they can only anticipate future tourism income—it is necessary to identify more profit-oriented models based on traditional tourism and virtual tourism.

This paper marks an initial attempt to explore tourism live streaming. Two main limitations suggest directions for future studies. First, although the data covered several live streaming platforms, data were only obtained from Chinese social media; the findings may not be generalizable to other countries. Future studies should therefore extend the scope of data to platforms from other regions. Whereas most studies on live streaming have focused on Asia, especially China, a question follows: Why is the social commerce of live broadcasting more popular or better developed in Asian countries? This disparity may be attributable to population size, logistics, consumer psychology, technological innovation, or the evolution of the e-commerce industry. This question is worth exploring in the future. Second, in this study, the quantitative approach was limited when analyzing big data from social media. For instance, time series can be adopted in big data analysis with multiple variables and indicators. Subsequent studies should integrate diverse samples and methods to explore tourism live streaming in greater depth.

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