

Article

# Characteristics and Temporal Trends of Regional Tourism Along the Border Areas

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**Abstract:** This study aims to extract topics from news articles on DMZ tourism published between 1990 and 2020. This study uses LDA to extract topics within the contents of news articles on DMZ tourism. Furthermore, this study aims to examine the trends of each topic within news articles and identify the characteristics of topics over the past 30 years by developing graphs. A total of 23,093 news articles published from 1990 to 2020 were collected. The data were analyzed using LDA, descriptive analysis, odd ratios, and visualized graphs. The results found that news articles on DMZ tourism can provide considerable information in terms of political, social, and environmental issues. The results provide profiles of news articles on DMZ tourism and identify the unique topics and characteristics of these news articles. The study presents findings regarding topic trends over the last 30 years. All topics show an upward trend from 1990 to 2020. Significant issues have attracted attention to the DMZ region. Furthermore, the findings demonstrate spatial and temporal differences in the volumes of topics. This study identified topics from the past 30 years and important issues related to DMZ tourism that can strengthen the unique features of the DMZ and surrounding area, promoting tourism products and content. The present study contributes to identifying topics of DMZ tourism and temporal changes from 1990 to 2020. The findings can provide meaningful insight into developing policies for DMZ tourism.

**Keywords:** border tourism; regional tourism; latent Dirichlet allocation (LDA); topic modeling; trends

**Citation:** Ahn, Y.-j.; Kim, K.B.; Kim, J.-y. Characteristics and Temporal Trends of Regional Tourism Along the Border Areas. *Sustainability* **2023**, *15*, 3111. <https://doi.org/10.3390/su15043111>

Academic Editors: Lóránt Dénes Dávid, Laszlo VASA and Setiawan Priatmoko

Received: 28 December 2022

Revised: 2 February 2023

Accepted: 7 February 2023

Published: 8 February 2023



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## 1. Introduction

Tourism is a vehicle that can foster peaceful interactions between North and South Korea in the DMZ and surrounding areas [1–4]. The DMZ is a symbol of peace and a manifestation of the ongoing conflict between the two opposing ideologies of North and South Korea [5]. The 2019 historic summit between the leaders of two Koreas, which share the DMZ area as a border, has garnered domestic and international attention, resulting in increased demand for tourism [6]. Tourists are banned from visiting the DMZ; however, they can access a few designated sites. When tourists visit the DMZ, they must provide their identification cards for verification, including their personal information, such as their phone numbers and home addresses [7]. Moreover, tourists are allowed to take photos within designated areas but are prohibited from taking photos of military sites [7]. Only tour guides who have earned a special tour guide license and have received training can guide tourists [8].

News articles are an accessible resource for exploring DMZ and DMZ tourism, and such articles provide the public with a significant volume of information [9–11]. However, few studies have used news articles to create a dataset to formulate various categories. Previous studies using news articles included research on the gambling industry in a community [10], tourists' changing behaviors, the trends of a tourism destination over time [9], city identity [12], and risk perceptions [13].

Studies on news articles that extract topics from large, unstructured datasets using a topic modeling approach were carried out in the hospitality and tourism fields [14,15]. Big data analysis is useful for uncovering patterns and characteristics in data accumulated over time. Data-driven information obtained from big data analysis helps researchers solve problems, respond to rapidly changing industry trends, and make suitable decisions [16–18]. Latent Dirichlet allocation (LDA), which is used for topic modeling analysis, can reveal the structure of documents, extract topics from documents, and classify the features of an unstructured dataset [18]. Recently, studies in the hospitality and tourism field have used topic modeling and big data to study and understand prevailing issues [12,15,19]. Moreover, newspapers can provide information over consecutive years. Therefore, conducting a further analysis of topic trends over time is necessary [9]. However, few studies have used text mining to examine the trends of news media content about DMZ tourism. Understanding these trends is essential to satisfy the needs of tourists traveling for different purposes [20]. Moreover, the development of sustainable tourism policies regarding the DMZ and surrounding areas is strongly influenced by the relations between North and South Korea.

Therefore, this study aims to extract topics from news articles on DMZ tourism published between 1990 and 2020. This study uses LDA to extract topics within the contents of news articles on DMZ tourism. Furthermore, this study aims to examine the trends of each topic within news articles and identify the characteristics of topics over the past 30 years by developing graphs. In this regard, the present study contributes to identifying topics of DMZ tourism and temporal changes from 1990 to 2020 and knowledge of border areas and tourism. This study can generate a deeper understanding of peripheral areas along border areas for sustainable regional management plans and policies.

## 2. Literature Review

### 2.1. Borders and Tourism

Borders refer to political boundaries and barriers that limit the mobility of social and spatial entities [21]. The topics of physical borders and cross-border tourism have been explored by scholars for decades [22,22–28]. Globalization and strategies for effective governance and the balanced development of territories facilitate mobility and cross-border tourism [22,27]. Understanding features of border areas and cross-border cooperation is an important issue for reducing economic gaps between peripheral areas and other areas [29,30]. Border areas have disadvantage features such as high unemployment rate, high rates of aging populations, lower quality of living conditions, and lack of infrastructure [31]. However, Lóránt and colleagues [32] demonstrated advantageous features of border tourism and cross-border tourism development. Unique natural and cultural resources attract tourist flows [30]. Border tourism has positive economic impacts on rural areas and improves infrastructure and superstructures [33].

Situations around border zones are complex because many borderlands are influenced by various political, economic, and socio-cultural factors [28]. Multiple stakeholders are involved in border tourism development and provide various products and services related to specific ethnicities [21,33]. For example, the number of domestic tourists visiting border areas in China increased, and these tourists seek to experience indigenous communities populated by ethnic minorities [28]. However, border tourism also has negative effects, such as a flow of illegal tourists, increased gambling and drugs, and corruption among government officials. As a result, central governments have imposed strong regulations and policies to govern border tourism [28,33]. As a result, the previous studies explored dynamic actors for effective and efficient cross-border cooperation and a system of border tourism [29,30,34].

Previous studies have attempted to explicate the structures of cross-border tourism to facilitate effective and efficient governance and maximize the benefits of tourism [27,35–39]. Specifically, Prokkola [24] indicated that between 1809 and 2000, tourism development transformed border landscapes and increased cross-border collaboration. Stoffelen and

Vanneste [35] explored the history and culture of the German–Czech borderlands and sought to understand place identities, prevent inequitable development, and improve the governance process. Gao, Ryan, Cave, and Zhang [23] examined changing border landscapes and rural communities near borders following tourism development. Recently, Kozak and Buhalis [40] examined the Turkey–Greece border. Their findings indicated that multiple stakeholders are involved in border tourism and that border tourism has a positive impact on borderlands. Cross-border tourism is developed by building cooperative relationships between bordering countries and promoting collaboration on destination marketing and identity-building.

## 2.2. DMZ Tourism

One of the main research streams on DMZ tourism offers a unique geopolitical perspective. Previous research has focused on perceptions of the reunification of two Koreas and ethnic identity on the Korean peninsula [4]. Furthermore, the symbolic image of the DMZ is shaped by power relations, tensions, and the history of the DMZ and surrounding areas [41].

In addition, the DMZ is well known as a nature sanctuary as it provides expansive habitats for wild animals and migratory birds [42]. Previous research has demonstrated that the DMZ provides many ecological resources [43–45]. For example, Choi [43] examined the value of conservation by estimating visitors' willingness to pay more to be able to visit ecological attractions inside the DMZ. Residents living near the DMZ perceive the area as possessing a higher ecological value and recognize the importance of the natural and cultural attractions within the areas surrounding the DMZ.

Because the ecological and economic value of the DMZ and surrounding areas has increased, a number of studies on DMZ tourism have been conducted. These studies, which draw on conceptual and empirical research, provide insights and findings [46–52]. For example, Kim and Thapa [49] examined the effect of self-congruity on loyalty and tested the perceived value and satisfaction of DMZ tourist trips. The results revealed that tourists visited the DMZ to experience Korean culture and heritage, and their symbolic value and positive emotion were linked to destination loyalty. Bessiere and Ahn [8] suggest important components of storytelling around DMZ areas for inbound tourists.

Previous research also focuses on the role of various stakeholders around DMZ areas for tourism and the decision-making process for tourism development [53,54]. Specifically, Kim, Choe, and Lee [50] investigated residents' support for DMZ visits during pre- and post-development stages. Residents who show a higher level of support tend to hold positive attitudes toward DMZ tourism. Moreover, residents living near the DMZ tended to display a higher level of patriotism and supported DMZ tourism. Finally, Lee and colleagues [51] examined whether tourists who perceived congruency, shared beliefs, and attachment toward the DMZ and surrounding areas are likely to support tourism development. Tourists who placed more importance on the value of the DMZ supported tourism development.

## 2.3. News Articles and Topic Modeling Analysis

This study uses news articles to identify topics within an unstructured dataset. The periodical data help us understand what trends are prominent and how consumers demand changes [10]. Previous studies used news articles to understand emerging issues regarding gaming in a local community [10], city identity [12], the safety of certain destinations [13], and tourist consumption behaviors [9]. Specifically, Liu and Pennington-Gray [55] explored the effect of news articles on a crisis related to health, hygiene, and risks associated with a specific travel destination. They identified the themes framed by the news media and pointed out that news media messages provide important insights. Previous studies have demonstrated that analyzing news articles can help researchers understand specific situations and provide guidance for appropriate decision-making [12].

Topic modeling is a text mining method used to identify underlying patterns from documents and extract topics from unstructured documents [16,18]. LDA is used to identify specific topics from documents and calculate the probability that a document is likely to fall into a certain topic category. It can also be used to calculate the probability of obtaining words in documents [18].

Previous studies used the topic modeling approach to identify the main topics of news reports [12,17,56–58]. For example, Capela and Ramirez-Marquez [12] examined news articles published in specific cities and explored each city's identity and attributes by using topic modeling. The results revealed that topics and cities have both similar and different identity profiles. Keller and Wyles [56] explored reports about marine plastics in online newspapers by applying a structural topic modeling approach. The results identified 36 different topics related to plastic pollution in marine areas and articulated the difference between topics based on the political alignments of newspaper companies, publication date, and newspaper type. Ma and Kirilenko [57] examined news coverage about climate change over a 30-year period. They identified the topics of news articles related to the effect of climate change on the economy and tourism. Moreover, they identified the geographic differences between European countries regarding article topics. This study used a topic modeling approach to identify the main topics of news articles and analyze the trends of these topics over a 30-year period.

Therefore, we seek to answer the research questions: (1) How many news articles on DMZ tourism have been published since 1990? (2) What topics can be identified in news articles on DMZ tourism? (3) What trends can be identified regarding news article topics from 1990 to 2020? (4) What are the differences between the extracted topics according to the region?

### 3. Methods

#### 3.1. Research Procedures

The integrated database Bigkinds provides newspaper text data beginning in 2016 [59]. Bigkinds contains a total of 54 registered news media companies and provides archive access to daily newspapers, financial newspapers, local daily newspapers, and press reports. Data regarding publication year, company, author, title, content, keywords, the municipality name, and URL are stored on Bigkinds, and the collected dataset was used for the final analysis of this study. Words similar to “tourism” were used as keywords (e.g., visit, tour, and tourism) to obtain the maximum volume of news articles on DMZ tourism. The number of news articles related to the DMZ and tourism has increased since 2008. Since the inter-Korean summits, tourism has played a critical role in a peaceful relationship between the two Koreas and highlighted the importance of preserving the habitats of endangered species around the DMZ [44,50,52]. This study also included the municipality names near the DMZ in order to identify the differences among administrative divisions. A total of 23,093 newspaper articles published from 1990 to 2020 were collected. The data were analyzed using the R-program.

#### 3.2. Analysis

The dataset was analyzed as follows: First, the dataset was collected using several keywords, and finally, the term “DMZ tourism” was selected because the number of published news articles matching this term was higher than the number of articles identified using similar words. Second, data were preprocessed and then prepared for text analysis. Especially, the titles of news articles were preprocessed by filtering and extracting parts of speech, such as nouns. In the case of the news articles, data preprocessing, such as tokenizing and morpheme analysis, was conducted. Then, a word list designating spam words, synonyms, defined words, and exceptional terms was created to exclude the stop words, similar terms, space, and punctuation marks [60]. In order to conduct morphology analysis and create document term matrix (DTM) and term document matrix (TDM), the Korea-language text dataset was further analyzed using NLP4kec. Third, Term-frequency-

inverse document frequency (TF-IDF) was computed to evaluate how important a word is within a document [18]. Moreover, it calculates word frequency within the corpus of a document in the dataset [60]. Fourth, LDA was used to identify topics in the documents. Moreover, the topics identified by LDA help to understand the key terms and main topics within the documents [18]. We used FindTopicsNumber in the R program for selecting optimal topic numbers [61]. Moreover, LDA was conducted several times to identify the parameters of the LDA and the number of topics was decided after evaluating the number of overlapping terms between topics and words within the topics. Finally, the 15 topics were visualized by using trends and calculating odds ratios based on nine regions and topics. The odds plots of the 15 topics from 1990 to 2020 were presented.

## 4. Results

### 4.1. Descriptive Results

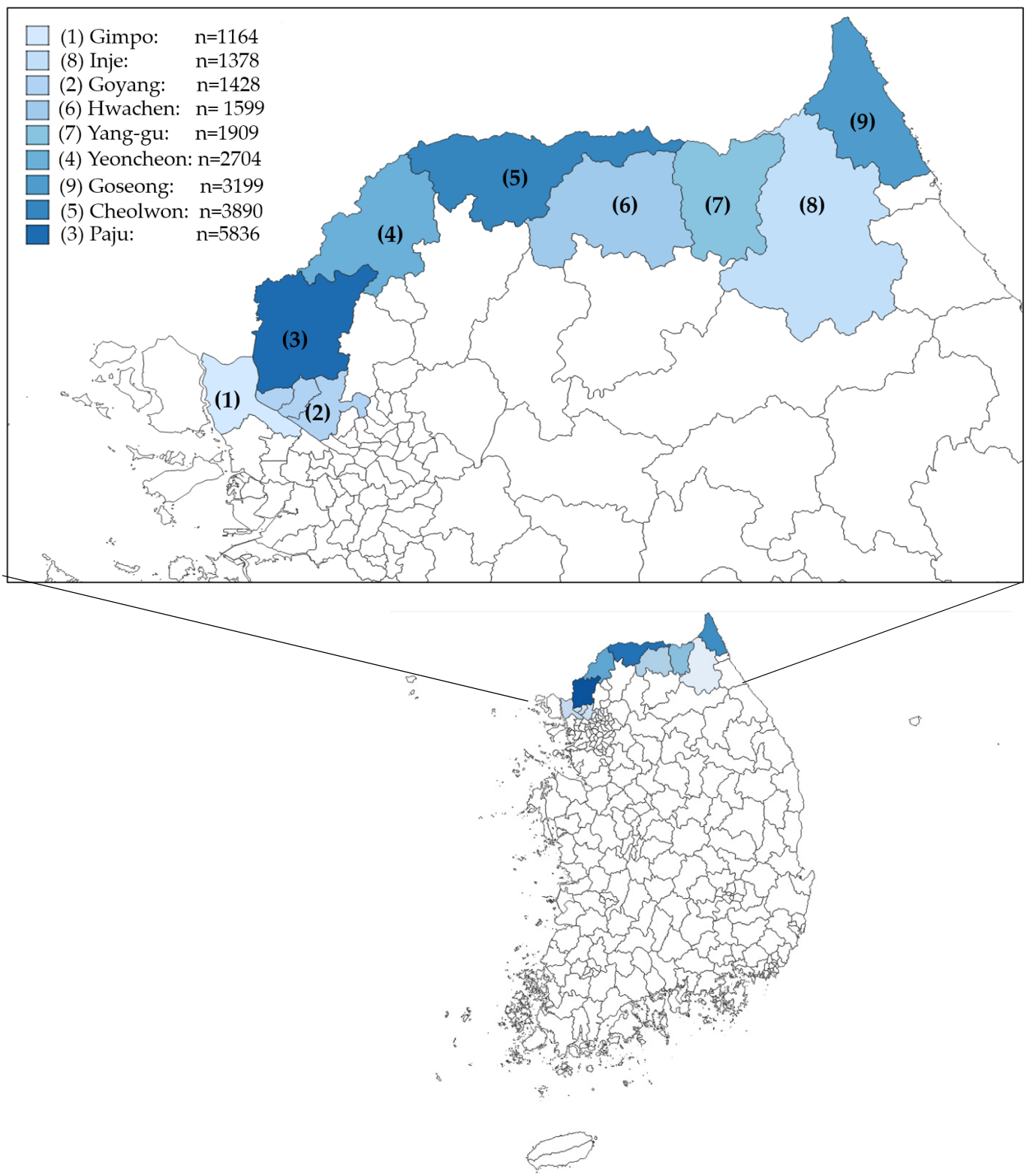
This study searched articles by applying the following keywords from news articles: DMZ, tourism, and nine municipalities. A total of 23,093 news articles were used for analysis. Figure 1 presents the volume of the news articles based on nine municipalities. Figure 2a,b present time series plots of the news articles from 1990 to 2020. However, very few news articles on DMZ tourism were found from the early 1990s. The volume of news articles increased after 2000. After the two Koreas attempted to build better relations following the inter-Korean and North Korea–United States summits, news articles on DMZ tourism increased.

The border between North and South Korea is located along two provinces, namely, Gyeonggi Province (n = 11,132) and Gangwon Province (n = 11,961). As shown in Figure 2a, between 2014 to 2017, there were more news articles on DMZ tourism in Gyeonggi Province than in Gangwon Province. However, after 2018, there were more articles on DMZ tourism in Gangwon Province. As shown in Figure 1, there are four cities and regions in Gyeonggi Province, and news articles on DMZ tourism were collected from contents related to Kimpo (n = 1164), Goyang (n = 1428), Paju (n = 5836), and Yeoncheon (n = 2704). In Gangwon Province, there were four guns, and news articles on DMZ tourism were obtained from Cheolwon (n = 3890), Hwacheon (n = 1599), Yanggu (n = 1895), Inje (n = 1378), and Goseong (n = 3199). The highest number of news articles on DMZ tourism was collected from Paju in Gyeonggi Province, followed by Cheolwon and Goseong in Gangwon Province.

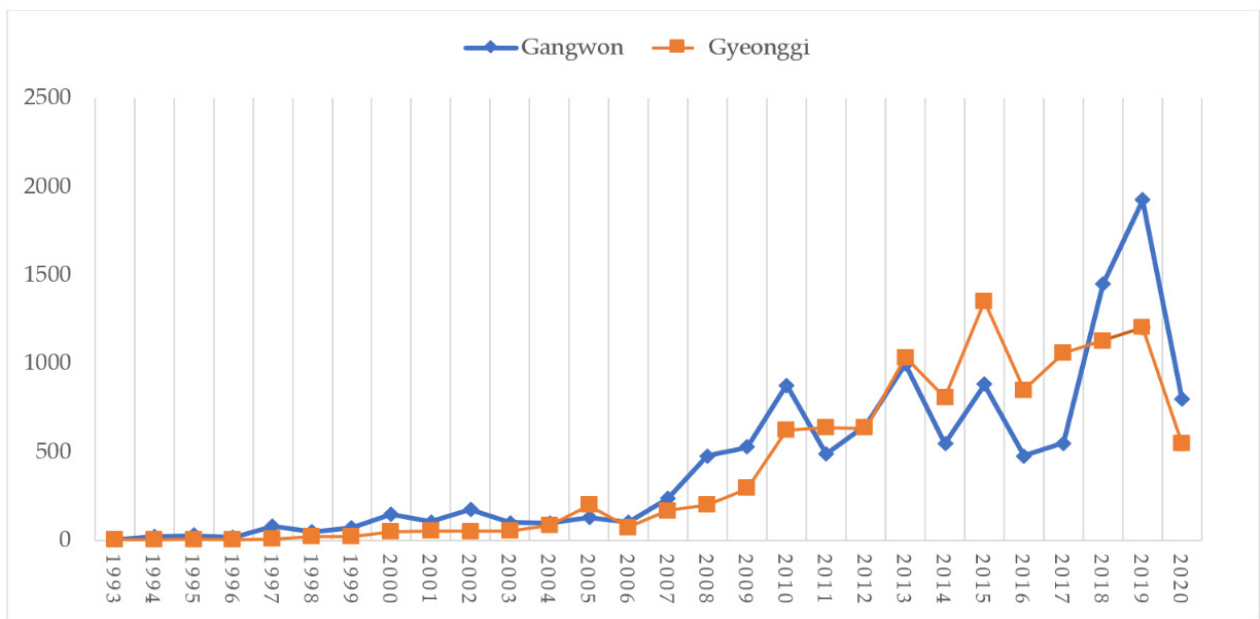
### 4.2. Topic Modeling Analysis

LDA topic modeling identified a total of 15 topics in the documents on DMZ tourism and nine regions. Among the 23,093 documents, 22,152 were classified into topics. Table 1 shows each topic's frequency. Each topic contains a number of documents ranging from 8.53% (n = 1980) to 4.95% (n = 1097). Topic 1 (n = 1089, 8.54%), Topic 2 (n = 1712, 7.73%), Topic 6 (n = 1684, 7.60%), and Topic 5 (n = 1662, 7.50%) showed a higher number of documents than other topics. Topics are related to creating travel products, regenerating urban areas, developing an ecological tourism belt along the DMZ, and mega sporting events, such as the 2018 PyeongChang Olympic games.

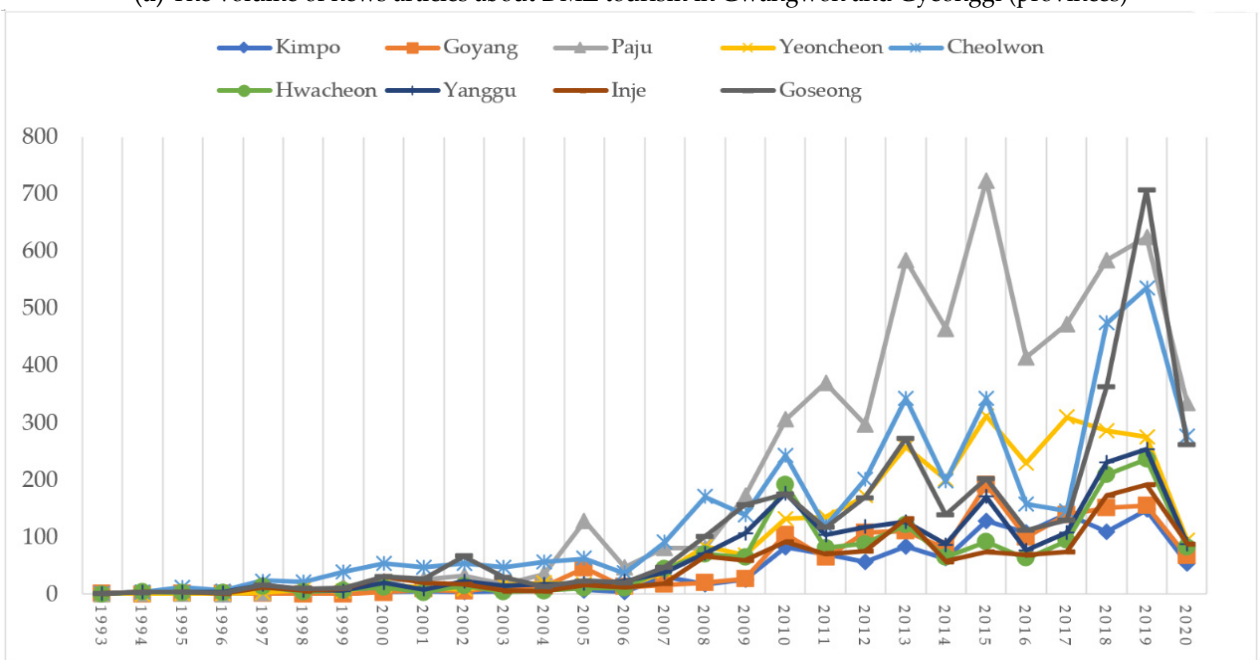




**Figure 1.** The volume of news articles about DMZ tourism based on nine municipality areas.



(a) The volume of news articles about DMZ tourism in Gwangwon and Gyeonggi (provinces)



(b) The volume of news articles about DMZ tourism in nine cities

Figure 2. The volume of news articles about DMZ tourism in two provinces from 1990 to 2020.

**Table 1.** Topics of news articles about DMZ tourism.

Topic		n	%
Topic 1: Travel product	Tourism, product, Gangwon, development, KTO, Gyeonggi-do, business, fair, travel, resource, push, promotion, security, agreement, hold, Paju, Gwangwon-do, win-win, tourists, cooperation, course, peace, partnership, domestic, host, link, experience, attraction, develop, subject, inform	1890	8.53
Topic 2: Urban regeneration	Gyeonggi-do, culture, ecology, camp, Paju, tourism, security, experience, Greaves, village, create, field, unification, open, environment, eco-tourism, tourism destination, nature, support, Hallyu, make, history, art, undergraduate, education, research, national treasure, CCL*, explore, living, visit, select	1712	7.73
Topic 3: UNESCO	Region, preservation, UNESCO, Gangwon-do, park, creature, designation, border, push, world, support, peace, Yeonchoen, Cheolwon, Gyeonggi, forest, culture, Imjin-gang, Korea Forest Service (KFS), certification, CCL*, Yanggu, development, belt, management, country, restore, resource, protect	1320	5.96
Topic 4: Mt. Geumgang	Peace, tourism, Mt. Geumgang, era, Gangwon-do, economics, resumption, President, promotion, crisis, Panmumgeom, reunification, benefit, ambassador, Gyeonggi-do, extinction, open, declaration, made, actor, preparation, discover, human, visit	1525	6.88
Topic 5: Ecological tourism belt	Peace, park, world, make, ecology, host, Gyeonggi-do, Cheolwon, Goseong, promotion, belt, Paju, center, best place, Korean peninsula, Gangwon-do, review, suggestion, government, candidate, politics, launch, make, life, competition, attraction, brand, research, connect	1662	7.50
Topic 6: PyeongChang Olympic Games	Watch, travel, culture, Gangwon-do, Olympic, PyeongChang, Gangwon, leave, festival, do, fall, find, ecology, meet, history, come, winter, nature, art, weekend, ride, enjoy, human, live, movie, experience, project, picture, go, family, attraction	1684	7.60
Topic 7: South–North economic cooperation	North–South, exchange, cooperation, partnership, Geonggi-do, business, Gangwon-do, economic, cooperation, peace, push, forum, high level, relationship, agreement, theme, connection, discover, era, special, military, declare, reunification, autonomy, begin, center, parliament, build, North Korea, expectation, special issue, receive	1536	6.93
Topic 8: Festivals and events	International, film festival, contest, document, open, bicycle, Gyeonggi-do, adolescent, open, run, hold, trail, recruitment, running, expedition, documentary, world, participant, festival, marathon, peace, Yeoncheon, national, Goyang, next month, give, ride, movie, next time, peace	1504	6.79
Topic 9: Swine fever	Cheolwon, swine, fever, Gangwon-do, Yanggu, CCL*, Goseong, Gangwon-do, Paju, tourism, wild boar, Africa, stop, quarantine, border, control, make, museum, region, festival, first, Hwacheon, Yeoncheon, event, opening, fire, restart, wild, national, Imjin-river, crane	1252	5.65
Topic 10: Political election	Gyeonggi, Northern, Gyeonggi-do, promise, branch, Gangwon, candidate, region, business, progress, economics, presidential election, push, reunification, development, policy, government, politician, local, election, special economic zone, issue, industry, capital, strategy, municipality, agenda, support, metropolitan, competition, Incheon,	1470	6.64



Table 1. Cont.

Topic		n	%
Topic 11: Peace and Unification	Peace, land, division, demilitarized, desire, run, life, war, hope, peace-reunification, iron fence, watch, Korean Peninsula, pain, symbol, walk, field, follow, Korea, dream, blackout, know, bicycle, picture, pass, ecology, reality, space	1535	6.93
Topic 12: North Korea provocation	Paju, North Korea, resident, Yeoncheon, provocation, market, evacuation, shooting, enforcement, mine, CCL*, governor, bombardment, South–North, response, border, village, Kimpo, tension, Goseong, total, afraid, Gaeseong, hold, city, find, possible, North Korea, freedom, government	1097	4.95
Topic 13: Walk trail	Peace, photo, concert, Cheolwon, open, journey, Goseong, country, trail, division, reunification, picture, open, love, Paju, today, country, open, crossing, share, Imjin-river, news, undergraduate student, civil, festival, sponsor, citizen, safety, experience	1459	6.59
Topic 14: Tourism development planning	Border, local, Gangwon-do, development, progress, reunification, future, business, Gangwon, economics, plan, growth, green, policy, forum, toward, do, resident, promotion, open, county, column, total, investment, expectation, strategy, regulation, debate, reality, new, support, secure, solution	1197	5.40
Topic 15: Sport event	Peace, enjoy, walk, Geonggi-do, event, bicycle, tour, open, hold, competition, course, Kimpo, walk, year, luxury, YeonCheon, Goyang, install, KTO, fall, run, Imjin-river, connect, travel, begin, Paju, remembrance, win-win, fence, ride	1309	5.91

Note: \* Civilian Control Line (CCL); Korea Forest Service (KFS).

Topic 1 (n = 1890, 8.53%) is titled “travel products.” The DMZ is located in both Gyeonggi and Gangwon Provinces, and two local governments have cooperated to develop DMZ tourism and build a mutually beneficial partnership.

Topic 2 (n = 1712, 7.73%) is titled “urban regeneration.” Urban regeneration was an important issue for sustainable and eco-friendly development around the DMZ. For example, after Camp Greaves was relocated, the old base became used as accommodations and now offers a unique MICE value for tourists visiting the DMZ and surrounding area.

Topic 3 (n = 1320, 5.96%) is titled “UNESCO.” Because tourists are banned from entering the DMZ, as it is designated as a civilian control zone, the DMZ and surrounding area have been well preserved for approximately 70 years. As a result, the DMZ was granted UNESCO Biosphere Reserve status.

Topic 4 (n = 1525, 6.88%) is titled “Mt. Geumgang.” Mt. Geumgang became a symbolic tourism zone for peace tourism, and Mt. Geumgang tourism started in 1998. However, tourism to Mt. Geumgang was suspended because of the death of a tourist who was shot by a North Korean soldier in 2008.

Topic 5 (n = 1662, 7.50%) is titled “ecological tourism belt.” The development of the ecological tourism belt was initiated to preserve the natural resources of the DMZ and surrounding areas. Moreover, an ecological park was developed for ecotourism. Watching birds, such as cranes and spoonbills, is also popular.

Topic 6 (n = 1684, 7.60%) is titled “PyeongChang Olympic games.” Pyeongchang in Gangwon Province was the host for the 2018 PyeongChang Winter Olympic and Paralympic Games, which was a mega sporting event. DMZ tourism was also promoted alongside this mega sporting event.

Topic 7 (n = 1536, 6.93%) is titled “south–north economic cooperation.” Economic cooperation between North and South Korea is an important issue, and DMZ tourism has served as an important vehicle for boosting economic cooperation, increasing interaction between the two countries, and building a peaceful relationship between the two Koreas.

Topic 8 (n = 1504, 6.79%) is titled “festivals and events.” Festivals and events, such as music concerts, cultural events, and educational programs, were held around the DMZ. An ice festival in Hwacheon has been popular since 2003, and small- and large-sized festivals and events have been held.

Topic 9 (n = 1252, 5.65%) is titled “African swine fever” (ASF). ASF does not influence human health; however, it has a high mortality rate in pigs and is highly contagious. Therefore, tourists were informed about ASF and asked not to visit areas near pig farms.

Topic 10 (n = 1470, 6.64%) is titled “political elections.” DMZ tourism has been an issue during political elections. Political parties have made promises regarding boosting the economies of areas near the DMZ and DMZ tourism development.

Topic 11 (n = 1535, 6.93%) is titled “peace and unification.” The DMZ is a symbolic place that represents peace. DMZ tourism can motivate people to wish to pursue the unification of Korea.

Topic 12 (n = 1097, 4.95%) is titled “North Korean provocation.” North Korea tested and shot ballistic missiles and increased its psychological provocation. Political instability and risks have an influence on DMZ tourism.

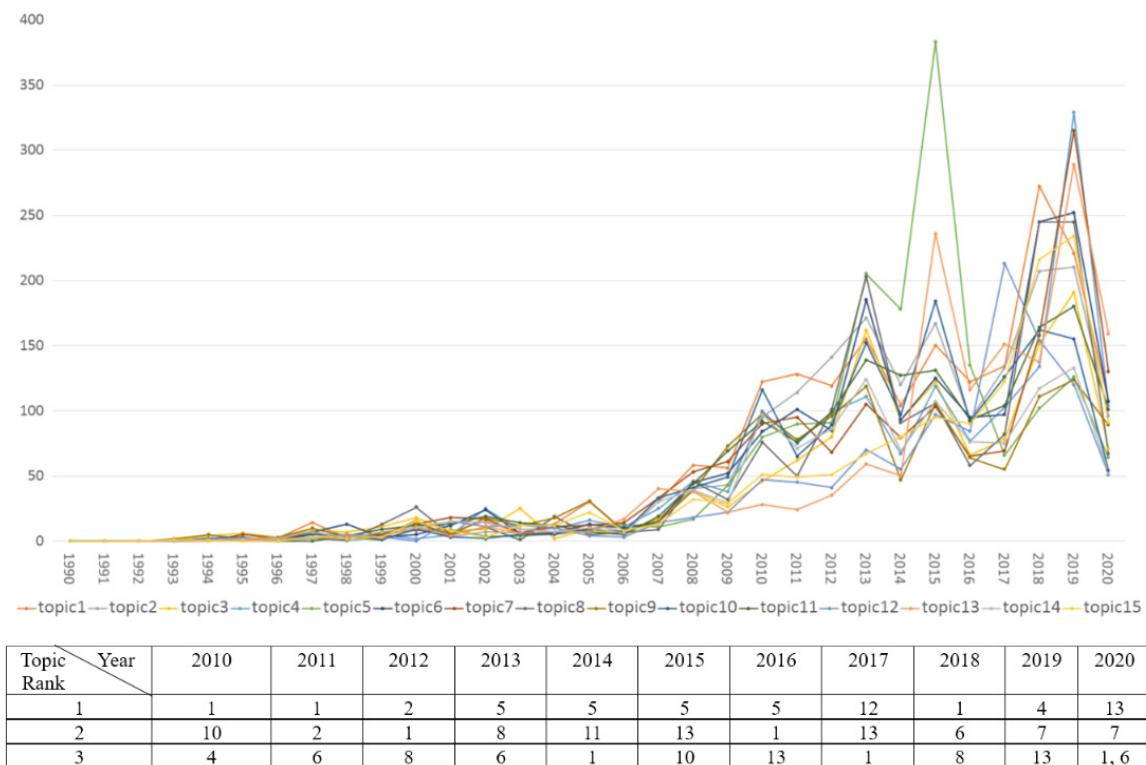
Topic 13 (n = 1459, 6.59%) is titled “walking trails.” DMZ tourism is popular because of its well-preserved natural resources. Ecological diversity attracts many tourists who wish to partake in experiential and educational activities during their visits. Walking trails near the DMZ were developed to allow for hiking and promote peace tourism.

Topic 14 (n = 1197, 5.40%) is titled “tourism development planning.” Political parties have given speeches to residents and made promises during their election campaigns. The government has also promised to pursue regional development and promote DMZ tourism.

Topic 15 (n = 1309, 5.91%) is titled “sporting events.” For example, Tour de DMZ is a popular international bicycle sporting event that has been held for years. All cities and guns in three provinces (Incheon, Gyeonggi, and Gangwon) have participated in international sporting events.

#### 4.3. Topic Modeling Analysis

Figure 3 presents the volume of topics from 1990 to 2020. The following results were obtained from the chi-square analysis used to identify the volume of news articles on DMZ tourism ( $\chi^2(378) = 2.60, p < 0.000$ ). There were few articles on DMZ tourism up until 1996. News articles on DMZ tourism were more published in 2007 (n = 402), 2008 (n = 676), and 2009 (n = 815). After 2010 (n = 1500), many news articles on DMZ tourism were published, and the most popular topics were Topic 1, travel products (n = 122, 8.1%), and Topic 10, political elections (n = 116, 7.7%). In 2013 (n = 2027), the most frequently occurring topics were Topic 5, ecological tourism belt (n = 205, 10.1%), and Topic 8, festivals and events (n = 203, 10.0%); in 2015 (n = 2231), the most popular topics were Topic 5, ecological tourism belt (n = 383, 17.2%), and Topic 13, walking trails (n = 236, 10.6%). In 2018 (n = 2575), the most popular topics were Topic 1, travel products (n = 272, 10.6%), Topic 6, PyeongChang Olympic games (n = 245, 9.5%), and Topic 8, festivals and events (n = 245, 9.5%). In 2019 (n = 3124), the most popular topics were Topic 4, Mt. Geumgang (n = 329, 10.5%), Topic 7, south–north economic cooperation (n = 315, 10.1%), and Topic 13, walking trails (n = 289, 9.3%). Finally, after the COVID-19 pandemic, DMZ tourism destinations were shut down, and the number of news articles in 2020 (n = 1343) decreased. Moreover, the most discussed topic was Topic 13, walking trails (n = 159, 11.8%).

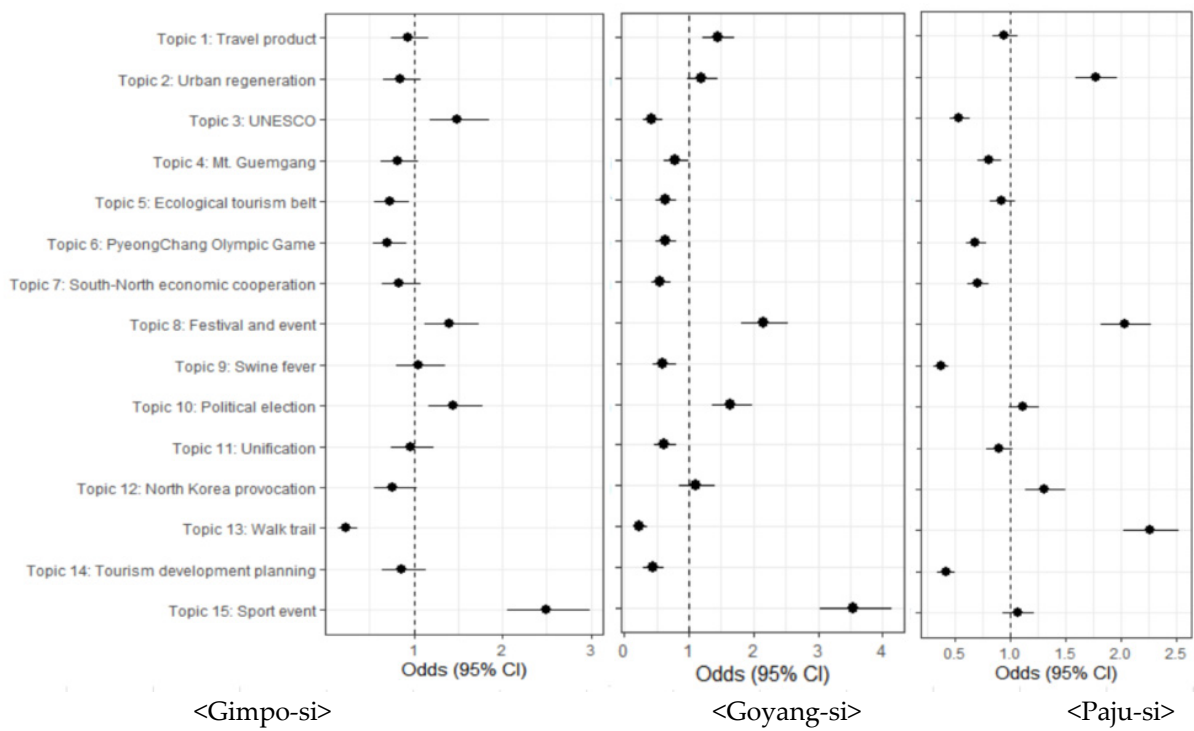


**Figure 3.** The volume of news articles about DMZ tourism and topics.

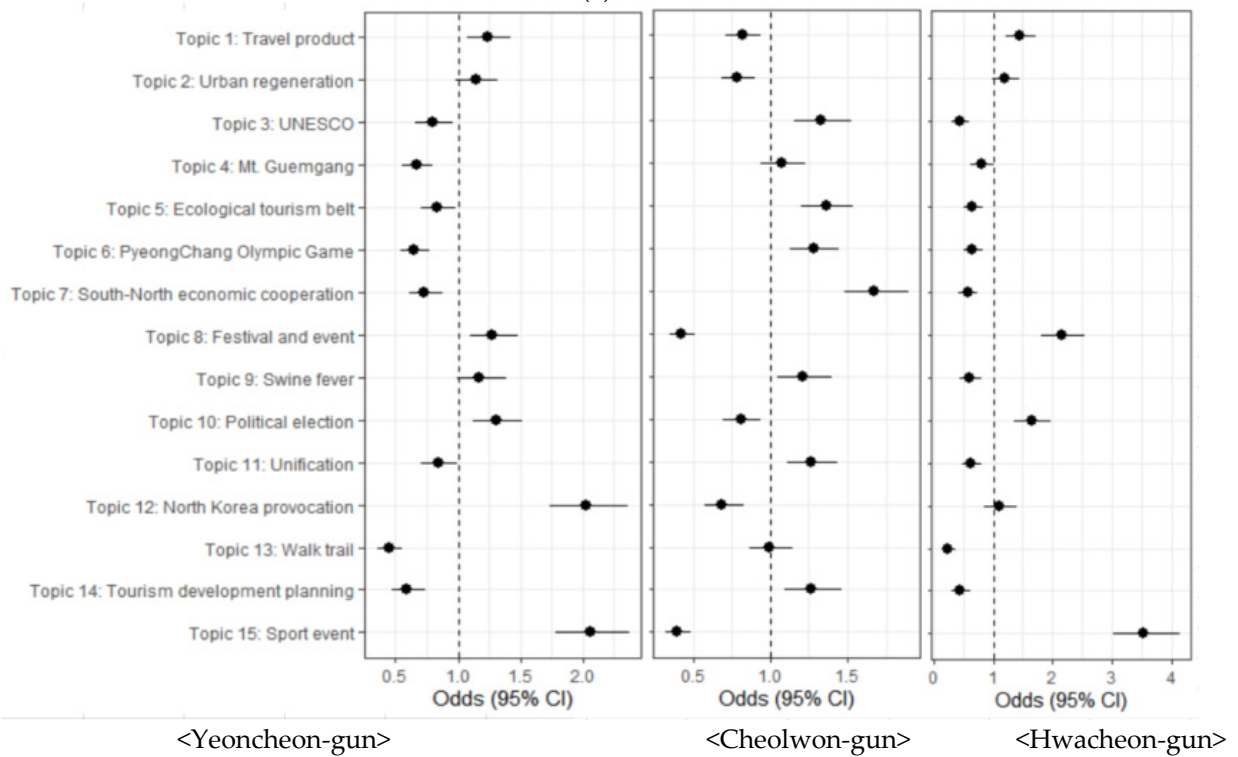
The top-ranked topics are presented in Figure 3. Topic 1, travel products, has been one of the most frequently published topics since 2010. Topic 2, urban regeneration, was actively discussed in 2011 and 2012. Topic 5, ecological tourism belt, was one of the most important issues from 2013 to 2016. Topic 12, North Korean provocation, and Topic 13, walking trails, were important topics in 2017. Topic 1, travel products, Topic 6, PyeongChang Olympic games, and Topic 8, festivals and events, were popular topics in 2018. Moreover, Topic 4, Mt. Geumgang, Topic 7, south–north economic cooperation, and Topic 13, walking trails, appeared frequently in 2019. Finally, Topics 13, walking trail, and Topic 7, south–north economic cooperation, were the most published topics in 2020.

#### 4.4. Region and Topics

Figure 4a–c present the results as odds ratio plots. The odds ratio and the upper and lower confidence limits are presented in the graphs. In Figure 4a–c, the odds ratio values are represented by a black round dot, and the 95% confidence interval values are on the line through the black round dots. A custom grid line is one on the graph. All extracted 15 topics are compared based on regions. The odds plots show the probability of frequency of topics on DMZ tourism in a region compared to topics on DMZ tourism in other regions.

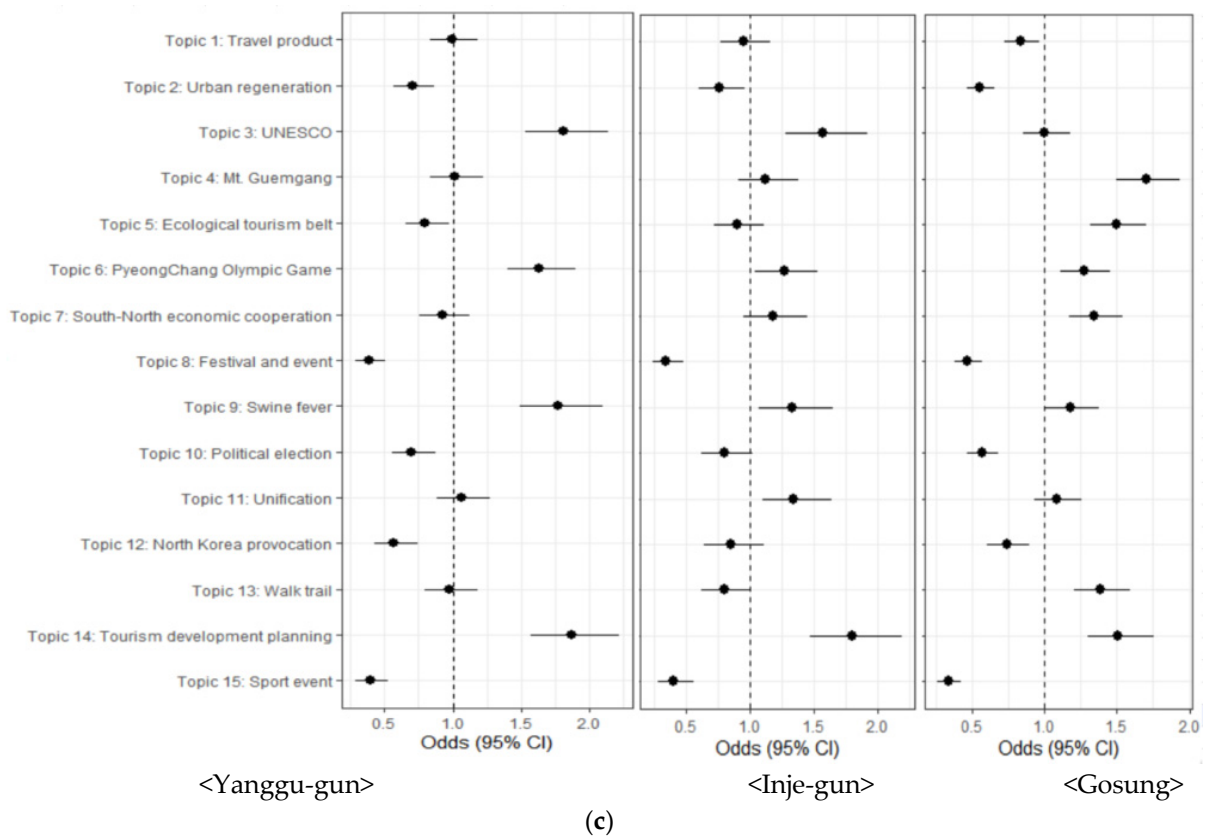


(a)



(b)

Figure 4. Cont.



**Figure 4.** (a) The odds ratio plot of Gimpo-si, Goyang-si, and Paju-si in Gyeonggi province. (b) The odds ratio plot of Yeoncheon-gun in Gyeonggi province, Cheolwon-gun, Hwacheon-gun in Gangwon province. (c) The odds ratio plot of Yanggu-gun, Inje-gun, Gosung in Gangwon province.

An odds ratio is a measure of the relative topics shown in a region compared to other regions, and an odds ratio greater than 1 indicates that the outcome is more likely, while a value less than 1 indicates that it is less likely. As shown in Figure 4a, a relatively large population is living in Gimpo-si and Goyang-si in Gyeonggi Province. Topics about festivals and events, political elections, and sporting events were more common in these regions compared to in other regions. The results show that the topic of festivals and events are frequently shown in Goyang-si (OR = 2.14, 95% CI (1.81, 2.53)), Gimpo-si (OR = 1.40, 95% CI (1.13, 1.73)), and Paju-si (OR = 2.03, 95% CI (1.82, 2.27)). The results show that topics about sporting events are popular in Goyang-si (OR = 3.54, 95% CI (3.03, 4.14)), Gimpo-si (OR = 2.49, 95%CI (2.06, 3.00)), and Yeoncheon-gun (OR = 2.06, 95% CI (1.79, 2.37)). Paju-si in Gyeonggi Province is one of the most popular destinations for DMZ tourism. Urban regeneration, festivals and events, and walking trails are important topics in Paju-si. The topic of walking trails displayed the highest odds ratio in Paju-si (OR = 2.26, 95% CI (2.02, 2.53)). Yeoncheon-gun showed a higher number of news articles about North Korean provocation (OR = 2.03, 95% CI (1.74, 2.36)). Moreover, regions in Yeonchen-gun (OR = 1.17, 95% CI (0.99, 1.38)), Yanggu-gun (OR = 1.77 95% CI (1.49, 2.10)), and Inje-gun (OR = 1.33, 95% CI (1.07, 1.65)) showed the dense livestock farms include the topic of ASF. DMZ tourism in Cheolwon-gun includes various topics related to UNESCO (OR = 1.33, 95% CI (1.16, 1.52)), the ecological tourism belt (OR = 1.36, 95% CI (1.20, 1.54)), south–north economic cooperation (OR = 1.68 95% CI (1.48, 1.89)), and tourism development planning (OR = 1.26, 95% CI (1.09, 1.46)).

## 5. Discussion

### 5.1. Theoretical Implication

The present study aims to extract topics from a large volume of news articles on DMZ tourism published from 1990 to 2020. Furthermore, it aims to examine relevant trends regarding the target topics from 1990 to 2020 and provide graph visualizations. Important theoretical and practical implications can be deduced from the findings. First, news articles on DMZ tourism can provide considerable information in terms of political, social, and environmental issues. This study attempts to search for appropriate keywords to generate a dataset, and it adopted “DMZ tourism” as its keyword, as this keyword is more important than other similar keywords. Moreover, this study applies LDA to extract 15 topics. The results provide profiles of news articles on DMZ tourism and identify the unique topics and characteristics of these articles. As a result, the findings of this study provide valuable information and present key terms focusing on DMZ tourism, such as “peace”, “defense”, “ecological resources”, “migratory birds”, “UNESCO”, and “the PyeongChang Olympic games.” The key terms from the 15 topics cover issues related to major regions, cities, and provinces along the DMZ.

Second, the topics appear to be closely associated with both positive and negative events that have occurred over the past 30 years. The volume of news articles on DMZ tourism increased when tensions between the two Koreas eased. Most news articles on DMZ tourism were published in the 1990s. The DMZ tourism appears not to have received much attention before the 1990s, and it may have been considered a confidential military area or a restricted zone vital to the defense of South Korea. The government implemented the Sunshine policy and the Peace and Prosperity policy. Hence, the government has attempted to ease tensions between the two Koreas. Positive events include the reunions of separated families and Mt. Geumgang tourism initiatives. Approximately 24,000 family members who were separated during the Korean War were reunited in 2000, and tourists were able to visit Mt. Geumgang in 1998. In 2004 and 2005, the two Koreas celebrated the anniversary of the inter-Korean summit. Moreover, ministerial meetings were held to facilitate economic cooperation between the two Koreas. Political developments and the relationship between the two Koreas have substantially influenced DMZ tourism.

However, negative events, such as the shooting of a tourist at Mt. Geumgang and the North Korean nuclear program, emerged as serious threats that increased tensions with North Korea in 2008, 2010, and 2016. Recently, given South and North Korea’s communication via summits and joint participation in the 2018 PyeongChang Winter Olympics, they have established improved diplomatic relations, and DMZ tourism has become a prevalent issue. The number of news articles on the DMZ has been increasing since 2018, and the two Koreas and the private sector agreed to plan economic cooperation projects in tourism development, such as Mt. Geumgang tourism, the Kaesong Industrial Complex, and an inter-Korean tourism cooperation project. However, this momentum dramatically decreased after the emergence of COVID-19 in 2020.

Third, the study presents findings regarding topic trends over the last 30 years. All topics show an upward trend from 1990 to 2020. Significant issues have attracted attention to the DMZ region. Furthermore, the findings demonstrate spatial and temporal differences in the volumes of topics on DMZ and border tourism. News articles related to migratory birds, ecological resources, and the UNESCO Biosphere Reserve have been consistently highlighted over the past 30 years. The findings of this study suggest that news articles can be important information sources for understanding how DMZ tourism has been portrayed over time. As the previous research indicated [3], media and newspapers play an essential role in increasing recognition of DMZ and border tourism. Further research needs to examine accumulated databases of media and newspapers for a deeper understanding of trends in border tourism and regions along borders and impacts of tourism for developing sustainable regional tourism management and maximizing benefits of peripheral regions.



## 5.2. Practical Implication

Important practical implications can be deduced from the findings. First, this study identified topics from the past 30 years and important issues related to DMZ tourism that can strengthen the unique features of the DMZ and surrounding area, promoting tourism products and content. The findings can provide meaningful insight into developing policies for DMZ tourism. Practitioners need to develop travel products and programs consistent with the destination identities of border areas and communities. Furthermore, they need to increase their understanding of the DMZ, the history of the border areas in Korea, and the relationship between the two Koreas. Underdeveloped and abandoned facilities, such as military bases, should be utilized as important attractions (e.g., Topic 2: Urban regeneration). Furthermore, DMZ attractions need to be promoted by formulating strategies for target markets. Domestic and international tourists visiting the DMZ are less likely to have personal connections to the Korean War or family members in North Korea because of temporal distance. Hence, practitioners and governments need to identify historical and educational storytelling contents and use local cultural commentators and local tour guides to expand tourists' knowledge of war-related facilities and DMZ attractions.

Second, the findings of this study reveal that inter-Korean relations involve complex economic, political, and environmental issues. The DMZ and surrounding area were developed according to top-down tourism development policies led by the government. The interactions between the two Koreas are strictly controlled and regulated. However, the two Koreas have reached a consensus and aim to cooperate on achieving economic prosperity. Tourism is expected to play a vital role in building a peaceful relationship and boosting the economic development of the DMZ and the surrounding area. Practitioners and scholars need to understand the various geopolitical factors that affect tourism development in the DMZ and surrounding areas. These factors both positively and negatively influence project initiative schemes, implementation, and the suspension and resumption of the tourism development processes and policies for DMZ tourism.

Third, the findings identified ecological resources, festivals, and events as important topics. Natural resources and biodiversity are well preserved, and endangered species have been observed in the DMZ and surrounding areas. Topics related to ecological resources are frequently reported because of the existence of the UNESCO Biosphere Reserve, ecological diversity, and walking trails around the ecological belt. Consistent with previous studies [54], festivals and events, as well as sporting events, are important topics regarding DMZ tourism. Practitioners and policymakers should facilitate bottom-up development and encourage residents to strengthen the unique features of the DMZ and obtain additional income sources. Balancing the conservation and development of tourism products and contents are also essential for sustainable regional tourism development along border areas.

## 5.3. Limitations and Suggestions for Future Research

This study provides vital information regarding DMZ tourism over the past 30 years; however, limitations exist. First, an LDA approach was used to examine the underlying topics in the accumulated dataset. Because there are other topic model approaches, further studies should test the results for generalizability and suggestions for robust results. Second, the study identified the top terms from the topics using an LDA approach. Understanding the history and content of news articles about the DMZ and surrounding area in terms of the political context and policy changes is important for interpreting the results of the topics. Moreover, future research should consider influential variables, unique techniques, and data visualization. Third, this study mainly focused on the content of news articles on DMZ tourism. The characteristics of the information in news articles would be different if sourced from content generated by tourists; therefore, this study could not account for the perspectives of tourists visiting the DMZ. Further research should include various types of content regarding DMZ tourism.

**Author Contributions:** Conceptualization, K.B.K., J.-y.K. and Y.-j.A.; data collection, Y.-j.A.; methodology, Y.-j.A.; analysis, Y.-j.A.; writing, Y.-j.A., K.B.K. and J.-y.K.; supervision, Y.-j.A., K.B.K. and J.-y.K. All authors have read and agreed to the published version of the manuscript.

**Funding:** This research was funded by [National Research Foundation of Korea (NRF)] grant number [2020S1A5A8046191].

**Institutional Review Board Statement:** Ethical review and approval were waived for this study, due to no ethical concerns.

**Informed Consent Statement:** All individuals have consented.

**Data Availability Statement:** Data is available from the authors upon reasonable request.

**Conflicts of Interest:** The authors declare no conflict of interest.

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