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# MDDDM

Master's Degree Program in  
**Data-Driven Marketing**

## **Travelers' Perceptions of Sustainability: A Text Analysis of Reviews Across Indonesian Destinations**

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Master Thesis

presented as partial requirement for obtaining a Master's Degree in Data-Driven Marketing

**NOVA Information Management School**  
**Instituto Superior de Estatística e Gestão de Informação**

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by  
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Master Thesis presented as partial requirement for obtaining the Master's degree in Data-Driven Marketing, with a specialization in Data Science in Marketing.

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July, 2025

## STATEMENT OF INTEGRITY

I hereby declare having conducted this academic work with integrity. I confirm that I have not used plagiarism, any form of undue use of information or falsification of results along the process leading to its elaboration. I further declare that I have fully acknowledged the Rules of Conduct and Code of Honor from the NOVA Information Management School.

*[Lisboa, July 2025]*

*Salma Natasha Saraswanto*

## ABSTRACT

Sustainable tourism is gaining more attention in Indonesia, until now research on tourist perceptions of sustainable hotel is limited. This study aims to explore sentiment how international and local tourist reviews towards surrounding areas to comparand aspects of destination are most valued, using advanced text analysis techniques. Using data set of Booking.com with reviews of hotels in Indonesian cities such as: Jakarta, Ubud, Lombok & Gili Islands were analyzed to evaluate compare how sustainability is mentioned and the features of the location that are more valued. Using advanced text analysis techniques, such as BERT-based sentiment analysis and keyword frequency analysis, with 3000 reviews were examined. The outcomes indciates that reviews from nature-based destinations (Ubud and Lombok&Gili Islands) have more frequent and positively framed mention of sustainability, which are typically related to natural setting and eco-friendly acoomondations. In contrast the reviews from urban destinations (Jakarta), have less sustainability references, which are typically linked to noise, pollution and traffic. This study aims to better undesrtand how travelers see and talk about sustainability in various of travel destinations. This gaves destinations managers and other tourism stakeholders useful advices on how to match sustainable actions and communication with traveler expectations.

## KEYWORDS

Sustainable tourism; Tourist perception; Text analysis; Online reviews; Eco-tourism, The role of Policy Sustainability Marketing

### Sustainable Development Goals (SDG):



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# 1. INTRODUCTION

Sustainable tourism has become increasingly important in the tourism industry, influencing traveler preferences, government policies and business strategies (Dodds & Butler, 2019). Tourist progressively, they seek for eco-friendly accommodation and experiences, which leads to grow discussion more about sustainability in online travel platforms (Merli et al., 2019).

For tourist, planning a trip becomes a conscious process which they devote their time, money and energy to make it memorable experience. According to (Karayilan & Cetin, 2016) the motivation for travel is driven by the primary reason for going to a tourist location or attraction. These tourist attractions are typically the ones that encourage travelers to take travels. The location itself serves as attraction (Ngwira, 2018). Certainly, there is well-known, and less known locations can be destinations. Travelers tend to choose well-known places, but it is also important to promote them as offering an excellent travel experience to promote word of mouth advertising.

Online hotel reviews, specifically on website platform like Booking.com, offer important insight regarding how tourist perceive and talk about sustainability in various destinations. However, the reference to sustainability varies depending on the location. The example of metropolitan city like Jakarta might place more focus on infrastructure and convenience, whether for instance nature-related destinations like Ubud, Lombok and Gili Islands more likely emphasize environmental friendliness and comfort.

Indonesia is a country with thousands of islands of all sizes, rich with natural resources and a rich with cultural heritage stretching along the equator, so sustainable tourism is essential (Arismiyanti, 2017). In 2023 recorded by (OECD, 2024), had over 11.7 million international tourist overnight visited with 825.8 million domestic tourist overnight visitors, that were registered also plays a significant contribution for the country.

There has been increased research according to sustainable tourism. Smaller number of studies have looked at how tourist talk about the sustainability in online reviews, although many research have looked from the management and policy perspective (Dodds & Butler,

2019; Gössling et al., 2020). Although it is still as one of the more recent research fronts in tourism and hospitality studies, the idea of sustainability in tourism is still expanding in practice as well as in research (S. S. Huang, 2025).

Differentiated development between urban and nature destination has been examined base on study (Arismiyanti, 2017) nevertheless there is no empirical data regarding how machine learning influences perceptions of differed development in different locations. Furthermore, a lot of research put more focus on policies and business strategies, leaving a gap in understanding how tourist actively perceive and communicate mixed-use development in their travels.

Moreover, the distinctions between nature-based and urban tourism destinations in their sustainability discourse are not adequately examined by current research. Additionally, there is a lack of empirical research examining the potential positive or negative effects of sustainability mentions in reviews on review scores and visitor happiness.

Accordingly, this study aims to answer the following research question:

How do both domestic and international tourist mention and view sustainability in online hotel reviews for various Indonesian destinations? Analyzing how urban tourism in Jakarta and nature tourism in Ubud, Lombok and Gili Islands are varied in sustainability discuss employing text analysis techniques like sentiment analysis. Not many studies have examined how travelers themselves interpret and discuss sustainability in online hotel reviews, even though prior research has thoroughly examined sustainability in tourism from a policy and business point.

## 2. LITERATURE REVIEW

In the tourist sector, sustainability has emerged as major issue that affects travelers' decision-making, destination competitiveness and hospitality business strategy. While choosing accommodations, travelers are increasingly taking sustainability initiatives environmental regulations and social responsibility into account due to the growth of eco-tourism and responsible travel (Paiva Neto et al., 2020).

Online travel reviews sites like Booking.com and TripAdvisor are important sources of information about how tourist regard sustainability. As mentioned by (Chang & Ko, 2024; Zheng et al., 2023) websites such as TripAdvisor demonstrate how tourist perceive sustainability and reflect their experience. By sharing their experiences, travelers can get insight into their expectations, intentions and concerns regarding sustainable hotel and destination operations (Mokgehle & Fitchett, 2024). Researchers can determine whether sustainability branding is in line with real guest experiences and uncover important elements that influence sustainability-related conversations in the travel industry by examining these reviews.

### 2.1. SUSTAINABILITY IN TOURISM THEORIES

The thought of sustainability has been thoroughly studied in various fields, particularly in tourism research, according to the first definition provided by (Ghanem & Elgammal, 2017; Santos et al., 2022; WCED, 1987; Zolfani et al., 2015). Sustainability in tourism sector is significantly impacted by environmental quality, the protection of natural and cultural assets, and the wise utilization of resources, as noted by (Angelkova et al., 2012). These elements together with social and economic values, these factors support the long-term viability of tourist sites, in response to concerns about sustainability, a variety of tourism-related activities have arisen, such as ecotourism, gastronomy tourism, adventure and nature tourism and landscape tourism (Sfodera et al., 2022).

Apart environmental and economic factors, social sustainability is essential to the growth of the tourism industry. In addition to creating jobs and economic advantages, tourism also affects the standard of living for both visitors and locals. A crucial component of sustainability is making sure that the growth of the tourism industry complements the welfare of the

community (Crouch & Ritchie, 1999; Hassan, 2000; Jeon et al., 2016). Transparency and diversity in tourism services are ensured by social tourism, which is especially well-developed in Europe and offers travel chances for underprivileged populations (Morgan et al., 2015; Özdemir & Yolal, 2017).

As tourism keeps growing, particularly in developing nations, solid framework are becoming more and more necessary to access and successfully implement sustainability measures. The Sustainable Development Goals (SDGs) of the UN place a strong emphasis on the necessity of sustainable tourism practices that promote social well-being, encourage responsible consumption and boost economic growth.

## **2.2. ONLINE SUSTAINABLE MENTION IN TOURISM DESTINATIONS**

Nowadays the importance environmental, social, economic and cultural sustainability issues they have become crucial for organization in the tourism industries, as has the communication of sustainable tourism programs and goods (Bogren & Sörensson, 2021). Traveler satisfaction is strongly impacted by economic considerations, including the cost and perceived value of tourism services (X. Huang & Chelliah, 2024). In addition to influencing their perception of sustainability, tourist weigh costs against service quality (Soltani-Nejad et al., 2024). This points up the growing importance of sustainability communication in tourism for influencing other traveler behavior during the purchase and travel phases (Smith & Font, 2015; Tölkes, 2020). Travelers' perceptions of socio-cultural and technological sustainability have been shown to significantly increase the satisfaction and revisit intention with satisfaction acting as a important factor (Rasoolimanesh et al., 2025).

For instance (Tölkes, 2018) in her research mentioned, the websites of tourism organization are key for communication, but they still being utilized for messages on sustainability. Online platforms may help in the decision making and change their behavior (Smith & Font, 2015; Xiang, 2018), yet research shows that the content is still varied and often inadequate (Garbelli et al., 2017; Joseph et al., 2014; Mura & Sharif, 2015). Through their websites destination management organizations (DMOs) have a significant impact on how many visitors perceive their destination (Pennington-Groy & Thapa, 2004). Approach by (d'Angella & De Carlo, 2016) shows the inconsistency in sustainability oriented content, when in (Ghanem & Elgammal,

2017) research has been found shortcoming in effectively engaging stakeholders. Not so many locations have sections devoted to sustainable travel, according to studies by (Spinelli, 2021) on Italian travel websites. Numerous studies indicates that a more comprehensive and equitable approach is required for online sustainability communication (Marchi et al., 2021).

### **2.3. TEXT MINING ON CONSUMER REVIEWS**

According to (Tang & Guo, 2015), key market phrases and themes, like brand names and product attributes, can be found in online forums and social media by using information extraction, a text mining function. (Netzer et al., 2012) cited number of earlier research that used text mining on product reviews, for example, to predict stock performance for companies, disclose market dynamics and assess consumer preferences. (Marchi et al., 2023) mentioned as one of the major fields in data mining, is text-mining techniques have received much attention in recent years since textual data helps to research to explore building data for usability and their user's attitudes. There are numerous studies which show that text mining is useful, for exemple (Dutta et al., 2021) combined textual data and complaint categories to analyze the effectiveness of building operations and maintenance by mining an occupant survey database. In turn (Park et al., 2022) in his research applied Google Map reviews to identify the representative topic of passenger concern in airports during the COVID-19 pandemic and he found out that general neutral or negative experiences that is related with airport spatial design and planning. Further, online travel reviews are believed to lower risk (Gretzel & Yoo, 2008) and boost travel planning effectiveness (Hwang et al., 2013). When choosing a hotel, tourist frequently regard customer reviews to be significant and in certain situations. Other travelers reviews may influence a person's hotel preference (Gretzel & Yoo, 2008). Hotels need to analyze online customer evolutions because travelers frequently conduct information searches online. Several research on hospitality and travel have used online customer reviews as their data source in recent years and some of them have used text mining techniques.

Many researches have used a variety of text mining algorithms to analyze online hotel reviews in order to identify trends in customer satisfaction. (Xiang et al., 2015) in their study examined 60,648 customer reviews from 10,537 hotel in the top 100 American cities. In their examinations they have process the data using the web crawling and text mining techniques,

they used ANOVA model to investigate deeper the connection between visitor happiness and elements of the guest experiences. Based on another studies (G. Li et al., 2015) they have examined 118,300 evaluations from 1,740 hotels in Sydney, Bangkok, Shanghai, Singapore and Hong Kong in order to discover emergent hotel characteristics. In order to find new patterns in customers' comments, they used text mining and emerging pattern mining. In a different study (Xie et al., 2014) reviewed at over 1,000 user-generated reviews available on Agoda.com for four and five star hotels in Hangzhou, China. After conducting a theme analysis, two researchers divided the review content into six main customer satisfaction dimensions. (H. Li et al., 2013) have used hierarchical clustering and automatic text mining in a case study on a 774 – room hotel in China. Meanwhile in other studies (Ye et al., 2011) have analyzed reservation and review data from 1,639 hotels in ten randomly chosen Chinese cities to examine the effect of online word-of-mouth (WOM) on hotel sales. Applying web crawler to collect data from Ctrip.com website, then they utilized log-linear regression model to investigate the relationship between the reservation behaviour and the volume, valence and variety of reviews.

These studies have examined how sustainability is discussed in online hotel evaluations, despite the fact that these studies show how well computational techniques may extract customer insight from massive reviews data. This study fills the gap by examining references to sustainability in Booking.com reviews for popular Indonesian locations.

#### **2.4. THE ROLE OF POLICY SUSTAINABILITY MARKETING**

To achieve sustainable growth, the complex process of tourism development requires the integration of several policies, planning, procedures and management instrument (Lin et al., 2021; Pazhuhan & Shiri, 2020). With the objective to guide tourism stakeholders toward responsible behaviors while balancing sociocultural, environmental and economic factors, tourist policies work as a roadmap (Almeida et al., 2017; Angelevska-Najdeska & Rakicevik, 2012). The negative impacts of tourism, especially on the environment and local people, can be reduced through the effective application of policies (Dunets et al., 2019). A crucial aspect of sustainable tourism policy is governance, which emphasizes cooperation between public and private sector organizations as well as local communities (Aktymbayeva et al., 2020; Rizal et al., 2021). Establishing rules, keeping an eye on their execution and modifying them in

response to shifting environmental and economic circumstances are all part of Sustainable tourism governance (Dredge & Jamal, 2015).

Policies in the early stages mainly focus on marketing and infrastructure investment to promote destinations. To regulate, control and enhance tourism while preserving natural and cultural resources, laws are changing to include sustainability consideration as competition rises (Bécherel, 2001). To ensure that tourism marketing tactics are in line with sustainable principles and strike a balance between expansion and maintenance, governance frameworks are required (Beritelli et al., 2007; Zeppel, 2012). To achieve a long-term advantages tourist sustainability plans must include social cultural, economic and environmental factors (Dodds, 2007). Efficient governance structures help to manage stakeholders relations and establish policy implementation mechanisms (Volgger & Pechlaner, 2014). Sustainable tourism policy should not only regulate the management of resources, but also promote public awareness and community participation in nature conservation activities (Liasidou, 2019).

### 3. METHODOLOGY

Three Indonesian tourist destinations – Jakarta, Ubud and Lombok & Gili Islands a examined in this study employing a qualitative and quantitative text analysis approach to investigate how visitors perceive sustainability. This research is based on online reviews from Booking.com, where travelers speak about their experiences with sustainability, ecotourism and environmental issues serve as the basis for this study.

This study aims to identify sustainability mentions, evaluating their emotion (positive or negative), and compare sustainability discussions across urban (Jakarta) and nature-based (Ubud, Lombok & Gili Islands) destinations. Applying with Natural Language Processing (NLP) tools, including sentiment analysis using BERT, these research follows a text-mining methodology to extract and analyze relevant sustainability related terms.

#### 3.1. SAMPLE AND DATA COLLECTION

All the data were collected from publicly available Booking.com reviews of accommodations in Jakarta, Ubud and Lombok & Gili Islands. The data set includes in total 3,000. Reviews, covering period.

Reviews were selected from first 100 hotels in each location to ensure an accurate and varied sample. The ten most recent reviews for each hotel were taken out providing a data set with 1,000 reviews for each city and 3,000 reviews for all locations.

Table 1. Variables contained in Dataset

Variables contained in Dataset	
Collumn Name	Description
HotelID	Hotel Name
DataReview	Review date
ReviewerScore	Score given by reviewer
UserName	Reviewer's username
TypeOfTrip	Type of traveler (e.g., Couple, Family)
CountryID	Reviewer's country code
Review	Text of the review
PropertyType	Type of accomodation

To ensure the dataset's reliability preparation procedure were used to eliminate: Duplicate reviews, special characters and irrelevant symbols, non-English reviews (if applicable) following cleaning, this data set was examined to find mentions of sustainability, assess sentiment (positive or negative), and compare sustainability discussions across urban (Jakarta) and nature -based (Ubud, Lombok&Gili Islands) destinations.

## **3.2. DATA PROCESSING AND ANALYSIS**

This study uses a combination of text mining and sentiment analysis to examine how travelers mention sustainability in online hotel reviews across various Indonesian destinations. These methods were used to effectively process large volumes of qualitative data, extract meaningful insights and minimize human bias.

### **3.2.1.TEXT MINING WERE USED FOR DATA PREPARATION**

Using text mining and Natural Language Processing (NLP) techniques, the dataset was carefully processed and cleaned to make sure the extraction of relevant sustainability related mentions. Since online reviews often contain unstructured language, NLP techniques like text normalization and filtering were used here to improve the analysis's precision and consistency. Preprocessing procedures included by deleting duplication, converting text to lowercase and deleting special characters and stop words.

On Appendix A, a customized sustainability keyword dictionary was used as a reference for keywords extraction. Keywords were divided into three thematic groups: eco-friendly features, nature-related features and environmental comfort. With the help of this methodological technique, the study was able to identify and measure relevant sources in all three locations (Jakarta, Ubud and Lombok & Gili Islands).

To evaluate the frequency of sustainable related terms appeared in reviews from urban versus nature-based destinations. To determine how travelers associated sustainability to elements like comfort, the environment or natural surroundings, these frequencies were then thematically interpreted.

A BERT-based NLP model was used for sentiment analysis, which allowed reviews to be categorized as either positive, neutral or negative. This made it possible to gain a better knowledge of how travelers emotionally assessed sustainability-related factors including eco-friendly accommodations, environmental preservation, cleanliness and noise.

By combining rule-based keyword extraction with NLP driven sentiment analysis, this approach allowed for an in-dept examination of how travelers in different types of destinations discuss, perceive and emotionally define sustainability without the need for unsupervised topic modeling techniques.

### **3.3. SUSTAINABILITY MENTION ON SURROUNDINGS ON THE REVIEWS**

A keyword extraction and dictionary matching method was created to analyze whether travelers take sustainability into consider while making the booking accommodations. A customized list of keywords to sustainability was developed to guide the extraction process, considering certain keywords associated with the initiatives related to nature. This allowed to identify evolution that mentioned eco-friendly traits, which helped in determining how aware and attentive travelers were of sustainable accommodations.

In order to find sustainability-related content in reviews from Jakarta, Ubud, Lombok & Gili Islands:

- (1) Eco-Friendly terms, such as “sustainable”, “eco”, “eco-friendly”, “organic” and “gren”;
- (2) Nature-related terms, such as “jungle”, “rice fields” and “monkey forest”;
- (3) Environmental Comfort, which includes both positive and negative terms like “peaceful”, “fresh air” and “traffic noise”.

Appendix A contains the complete list of keywords used for each theme.

## 4. RESULTS

This part shows the results of the text pattern and sentiment analysis conducted on hotel reviews collected from Booking.com from cities Jakarta, Ubud, Lombok & Gili Islands. Crucial sustainability-related keywords were identified using the keyword extraction and frequency analysis, which resulting the ability to compare reviews between urban and natural based destinations. Furthermore, the sustainability mentions emotional tone was evaluated by using the sentiment analysis with BERT, which classified them into neutral, negative or positive.

### 4.1. RESULTS OBTAINED SUSTAINABILITY MENTIONS ON SURROUNDINGS BY THE REVIEWS ON BOOKING.COM

In order to understand how tourist view sustainability in connection to their surroundings, this study employed a dictionary based keyword extraction technique across three different destination types: Urban (Jakarta) and Nature based (Ubud; Lombok & Gili Islands). The analysis reveals significant thematic variations in the way sustainability is discussed based on the location.

The top keywords for nature-based travel locations like Ubud and the Lombok & Gili Islands show a deep connection to tranquility and the natural world. Terms like Eco (74 mentions), Quiet (49 mentions), Jungle (47 mentions) and Rice Fields (38 mentions) are commonly used in Ubud to express a preference for accommodation, surrounded by green, serene and environmentally friendly environments. Similarly to this terms such as Eco (89 mentions), Beach (80 mentions), Sea (73 mentions) and Quiet (62 mentions) and Quiet (62 mentions) which emphasize relaxation and intimate ties to the underwater world.

Despite the odd mention of certain negative aspects like loudness, humidity or mosquitos there were mostly overwhelmed by neutral or positive wording related to sustainability and the natural environment.

The results of the reviews from Jakarta, on the other hand highlight more urban-centered issues. Concerns regarding about pollution, traffic like Noise (16 mentions), Traffic (8 mentions) and public transportation (4 mention), even though Eco (28 mentions) and View (99 mentions) were among the top keywords. There were very few mentions to the garden or quiet, which indicate lack of interaction with green or peaceful spaces. Instead of a stronger

bond with environment or sustainability, the focus on view promotes a more aesthetic or visual satisfaction.

For each destinations, there a full list of extracted keywords together with their frequencies can be found in Appendix B.

Table 2. Results of Top 10 Keywords for Ubud

Keywords mentions Ubud	
Eco: 74 mentions	Peaceful: 25 mentions
Quiet: 49 mentions	Nature: 22 mentions
Jungle: 47 mentions	Forest: 19 mentions
Rice fields: 38 mentions	Greenery: 18 mentions
Garden: 31 mentions	Calm: 16 mentions

Table 3. Results of Top 10 Keywords for Lombok&Gili Islands

Keywords mentions Lombok & Gili Islands	
Eco: 89 mentions	Garden: 32 mentions
Beach: 80 mentions	Relaxing: 21 mentions
Sea: 73 mentions	Tree: 19 mentions
Quiet: 62 mentions	Peaceful: 17 mentions
Rain: 33 mentions	Cleanliness: 12 mentions

Table 4. Results of Top 10 Keywords for Jakarta

Keywords mentions Jakarta	
View: 99 mentions	Park: 8 mentions
Eco: 28 mentions	Quiet: 6 mentions
Noise: 16 mentions	Cool: 5 mentions
Noisy: 13 mentions	Environment: 5 mentions
Traffic: 8 mentions	Public transport: 4 mentions

#### 4.1.1. RESULTS SUMMARY OF SUSTAINABILITY MENTIONS BY VOLUME

The percentage of the keywords sustainable-related revealed varied significantly among destinations, according to a keyword frequency analysis in Table 5.: Ubud: 281 out of 998

reviews, about 28.16% featured terms associated with sustainability. Lombok & Gili Islands: 343 out of 1000 reviews had the highest percentage of the reviews around 34.3% featured terms associated with sustainability. Jakarta: As we may see on the Table 5. there is less interaction between travelers and environmental topics in urban settings.

Destination to Lombok & Gili Islands, marked as top-ranked location revealed a significant representation in the following thematic keywords categories:

Eco-friendly: 138 mentions

Nature-related: 370 mentions

Environmental comfort: 203 mentions.

Therefore this suggest that sustainability is not only more commonly dicussed in these regions, but it is also appears in a more comprehensive way, taking into consideration of eco-practices, natural landscapes and sensory environmental aspects.

Table 5. Sustainable Mentions by Volume

Destinations	Total Reviews	Sustainabiliy Mentions	Percentage (%)	Notes
Ubud	998	281	28.16	Frequent use of sustainable keywords that are associated with nature and the environment
Lombok & Gili Islands	1000	343	34.30	Has the amount of mentions for sustainable keywords
Jakarta	1000	181	18.10	Limited involvement mainly in urban environmental terms

**4.2. RESULTS OF QUANTITATIVE SENTIMENT AND TEXT PATTERN ANALYSIS OF THE REVIEW ON BOOKING.COM**

The results of a structured quantitative analysis on reviews were gathered from Booking.com for three destinations in Indonesia: Jakarta, Ubud and Lombok&Gili Islands. The goal of this work was to explore patterns in sentiment, language use and content topics using both performance based on labelling and language models (e.g.BERT).

To understand, each review was categorized into one of three sentiment categories as may be seen on the Table 6.: negative (scoring < 5), neutral (5 ≤ score < 8) and positive (score ≥ 8). Cities differed significantly in how they spread of emotions. As an instance, compared to Jakarta city which displayed a comparatively higher number of negative ratings a greater percentage of reviews in Ubud were categorized as positive. An introduction of the various sites’ degrees was made possible by the first classification.

Table 6. Sentiment count and percentage by City

City	Positive	Neutral	Negative	Total	Positive %	Neutral %	Negative %
Jakarta	865	209	66	1000	72.5%	20.9%	6.6%
Ubud	844	117	39	1000	84.4%	11.7%	3.9%
Lombok & Gili Islands	725	100	25	1000	86.5%	10.0%	3.5%

To investigate further the sentiment quality and tourist experiences the summary data have been determined for every sentiment category in every city in more detail in the Table 7. Metric such as the mean, median and standard deviation of review scores shows how tightly clustered or varied the experiences were. While negative reviews frequently displayed bigger score dispersions indicating a range of dissatisfied levels, and for the positive reviews generally had higher average score with less variability.

Table 7. Score summary by city and sentiment

City	Sentiment	Count	Mean Score	Median	Std Dev
Jakarta	Negative	56	2.77	3.0	1.19
Jakarta	Neutral	209	6.41	7.0	0.78
Jakarta	Positive	725	9.0	9.0	0.84
Lombok&Gili Islands	Negative	39	2.18	2.0	1.27
Lombok&Gili Islands	Neutral	117	6.43	7.0	0.77
Lombok&Gili Islands	Positive	844	9.32	10.0	0.80
Ubud	Negative	35	2.89	3.0	1.18
Ubud	Neutral	100	6.47	7.0	0.73
Ubud	Positive	865	9.39	10.0	0.76

To conclude, a clear picture of how various locations do in terms of visitor pleasure is offered by the combination of sentiment classification and statistical score profiling. The differences in mean scores and sentiment balance between cities underline that both the subjective nature of travel experiences and the importance of contextual factors in shaping travelers reviews.

#### 4.3. INSIGHTS FROM BIGRAMS AND TRIGRAMS FREQUENCY ANALYSIS

The use of bigrams and trigrams in phrase-level analysis offers a deeper insight perspective for analyzing visitor experiences. These multi-word expressions, as compared to single-word frequencies, show how tourist structure and emotionally encode their experiences in addition to what they declare. From trigrams we may see like “within walking distance” and “staff friendly helpful”, as well as high-frequency bigrams such as like “private pool” and “staff friendly”, indicate a prevalent language that emphasizes comfort, attention and geographical convenience. These terms, which are frequently seen alongside nature-related keywords in reviews of Ubud and Lombok & Gili Islands, shows that sustainability is viewed not just by environmental factors but also by the quality of services provided in the natural surroundings. That is significant to note that many qualities which are associated with sustainability such as peace, greenery and eco-features are not usually stated clearly but instead appear as part of more general feelings of relaxation and place. The results show how crucial phrase-based analysis is for revealing hidden sustainability themes that keyword matching alone would miss

highlighted by this. Figure C1 and C2 in Appendix C contains the full list of dominant bigrams and trigrams.

## 5. DISCUSSION

This study provides a new perspective on how travellers visiting Indonesian urban and nature based locations view their surroundings and express sustainability through user-generated content from Booking.com reviews. The research determined that there were noticeable variations in the context, tone and frequency of sustainability related comment between Jakarta, Ubud and Lombok & Gili Islands.

Findings reveal that the mention of sustainability were more common and diverse in nature-based travel locations, such as Ubud and Lombok&Gili Islands. These places are frequently linked by tourist to environmental comfort, natural beauty and eco-friendliness. The common usage of terms like “eco”, “jungle”, “peaceful” and “beach” suggest that travelers respect the environment and believe these location are more in line with sustainable tourism standards. The finding are consistent with the previous studies by (Angelevska-Najdeska & Rakicevik, 2012; Merli et al., 2019) which indicate that eco-conscious tourist are more likely to visit places that highlight nature.

For the contrast Jakarta has the fewest mentions of sustainability (18.10%). With few mentions of green areas or environmentally friendly accommodation, the reviews tended to concentrate on urban problems like traffic, noise and pollution. By this support the argument by (Arismiyanti, 2017) that urban environments face greater challenges in integrating visible and experiential sustainability measures. Although there were a certain terms that related to sustainability such as “eco”, “view” and “public transport”, they were dominated by complaints regarding by the environmental and issues with infrastructure.

Sustainability mentions in Ubud and the Lombok & Gili Islands were primarily positive or neutral, according to performed sentiment analysis using BERT indicates satisfaction with eco-friendly facilities, serene surroundings and natural settings. Although they were typically associated with natural nuisance like humidity or mosquitoes, negative thoughts did not substantially affect the overall positive tone. This follows with research conducted by (Crouch & Ritchie, 1999), who underlined the significance of emotional experience in determining destinations satisfaction.

When it came to sustainability, opinions in Jakarta seemed to be more negative with problems including the poor air quality, loud noises and lack of green spaces affecting the experience of tourist. As stated by (Lin et al., 2021), these observations highlight the significance of combining urban sustainability planning, especially in megacities that are expanding quickly.

The gaps in how sustainability is perceived point to the necessity for customized approaches. There is a definite chance for nature-based travel to destinations to promote and improve their eco-credentials. As suggested by (Tölkes, 2018), destinations management organizations (DMOs) might concentrate on better communicating these advantages in pre-travel materials in order to influence behavior during the planning phase.

Although, urban areas like Jakarta need to take a more proactive approach to addressing environmental issues. And to satisfy the rising demands of environmentally concerned tourist, policies should concentrate on promoting urban sustainability through improved air quality, green infrastructure and eco-accommodations certifications. Moreover, in order to bridge the gap noted by (Ghanem & Elgammal, 2017) sustainability communication in urban hotels and on websites like Booking.com needs to be more engaging and transparent.

This study adds to the expanding corpus of research on sustainable tourism by focusing on traveler-generated content rather than provider and policy-centric perspectives. This study illuminates how travelers themselves experience and express sustainability through emotional, situational and experiential language in online reviews, whereas the majority of the literature to date has concentrated on sustainability as defined by corporate strategies or government policies (Dodds & Butler, 2019; Gössling et al., 2020).

One of the main theoretical contributions is illustrating how natural language processing methods, specifically BERT-based sentiment analysis and keyword-based extraction can identify implicit sustainability related themes present in unstructured textual data. This provides a new way to understand travellers' sentiment regarding the various destination surroundings and enhances more traditional survey based or empirical studies.

Furthermore, the result emphasizes how important it is the sensory and emotional value are in the impact how people view sustainability. Terms like “peaceful”, “quiet” and “eco” are frequently used in good reviews for nature-based places, which offers credence to previous suggestion that environmental aesthetic and emotional resonance are important factors in destination fulfilment (Crouch & Ritchie, 1999; Jeon et al., 2016). These varied aspects of these experience indicators emphasize the importance of considering not only visible sustainability promises but also how tourist perceive and emotionally encode sustainability.

Lastly, this study contributes to destination specific sustainability theory by showing the distinctions in sustainability discourse between urban and nature-based settings, revealing that expectations and perceptions of sustainability are very situational. This confirms the argument made by (Angelevska-Najdeska & Rakicevik, 2012) for destination specific strategies in planning for sustainable tourism.

To conclude, this studies contributes to the expanding literature of research on tourism sustainability by examining user-generated content instead of just policy or business viewpoints. The present research shows a perspective of traveler by utilizing text analytics to examine their impression on emotional reactions, in contrast to earlier studies that are more focused on provider-based sustainability initiatives. Futhermore it also emphasizes how topic modelling and sentiment analysis can be combined to provide a more complex understanding of tourist opinion in the tourism studies.

## 6. CONCLUSIONS

With a focus on three Indonesian locations such as Jakarta, Ubud and the Lombok & Gili Islands this study examined how both domestic and foreign tourist perceive and express in online hotel reviews. This research reveals significant differences in sustainability communication between urban and nature-based tourism environments using comprehensive natural language processing techniques, such as BERT-based sentiment analysis and keyword frequency analysis for the topic modeling.

The results from this study indicate that nature-based travel destinations like Ubud and the Lombok & Gili Islands have higher and more positive mentions of sustainability. These areas are valued for their environmentally conscious operations, picturesque settings and emotional appeal to tourist. However, reviews in Jakarta had fewer mentions of sustainability and reviews that were more neutral or critical in nature, with noise, pollution and traffic issues predominating. According to earlier research, urban destinations face difficulties in implementing and communicating experiential sustainability (Arismiyanti, 2017; Lin et al., 2021).

### 6.1. MANAGERIAL IMPLICATIONS

Based on the findings, we also aim to contribute practically by offering some managerial implications for marketing managers of eco-friendly hotels in Indonesia, specifically in Jakarta, Ubud, Lombok & Gili Island.

In practical terms, the outcomes provide useful information for tourism, policymakers, destinations managers and hospitality businesses. By promoting concepts like peace, environmentally friendly and personal attention could strengthen market positioning in places that are centered around nature. Keywords like “private pool”, “quiet surroundings” and “staff friendly” are frequently used and provide suggestions for content marketing and service improvement.

In contrast, cities like Jakarta still have trouble communicating and implementing sustainability. These places seek to concentrate on better environmental planning and make

sure that green activities are more promoted and supported. Boosting urban sustainability initiatives through pollution control, green infrastructure and improved public transportation could reduce concerns and enhance the perceptions among tourists.

The results suggest that sustainability initiatives must be customized to the features and challenges of every kind of destination. It is crucial to have tailored sustainability programs and communication plan that suit the taste of tourist. Understanding how tourist perceive and communicate sustainability might help promote more accepting and targeted tourism development.

## **6.2. LIMITATIONS AND FUTURE RESEARCH**

This study contains certain limitations, like other studies, which should be taken into consideration in future research as they might have affected the findings. There is multiple limitation on this study.

Firstly, based only on Booking.com reviews that is written in English eliminates culturally complex terms, this could reduce the accuracy of sentiment analysis (Mokgehle & Fitchett, 2024). Furthermore, trough understanding of traveler point of view might be provided by using multilingual data.

Secondly, while BERT-based sentiment analysis worked well, it may overlook cultural or emotional clues. The setting of sensitivity could be enhanced by combining it with qualitative techniques like interviews or manual coding (Marchi et al., 2023).

Third, this research was limited to a single review website. Traveler behavior differs across platforms as noted by (Xiang et al., 2015) comparing TripAdvisor or Airbnb content could be more insightful cross-platform data.

Lastly, the impact of sustainability mentions on booking behavior and guest loyalty was not examined in this study. Based on earlier research, future studies could examine how sustainability communication in reviews affects behavior (Hwang et al., 2013; Ye et al., 2011).

Moreover, this investigation on how sustainability mentions affect on the booking decision or guest loyalty could provide deeper marketing insights. When all these factors in this study highlights how travellers' decision are becoming more influenced by sustainability and how important it is to listen their opinion in order to shape Indonesia's sustainable tourism industry going ahead.

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# APPENDIX A. SUSTAINABILITY KEYWORD DICTIONARY

The following table is the customized keyword dictionary was used to extract sustainability-related terms from Jakarta, Ubud, Lombok & Gili Islands. Three thematic categories are used to group keywords: eco-friendly, nature-related elements and environmental comfort indicators.

Table A1. Keywords Dictionary - for Jakarta

Category	Keywords Dictionary - Jakarta
Eco-Friendly	sustainable, green, environment, eco, eco-friendly, organic, renewable, recyclable, carbon footprint, waste management, plastic-free, solar panel, bike lane, public transport, zero waste, compost, green building, leed certified, urban farming, reuse, eco-conscious, green space, green energy, community garden, electric vehicle, EV charging
Nature-Related	garden, park, greenery, natural, trees, scenery, plants, view, outdoor space, river, urban forest, mangrove, rooftop garden, botanical, fresh air, open space, shade, canopy, eco-park, wildlife, plant-based, flora, wetlands, reforestation, city park, arboretum, urban jungle, cooling space
Environmental Comfort	quiet, calm, peaceful, breeze, humid, humidity, shady, air quality, ventilation, noise, noisy, traffic, pollution, smoke, smog, cool, temperature, heat island, green buffer, less traffic, noise barrier, dust-free, windy, fresh air, thermal comfort, sunlight, climate comfort

Table A2. Keywords Dictionary - for Ubud

Category	Keywords Dictionary - for Ubud
Eco-Friendly	sustainable, green, eco, eco-friendly, organic, rain, raining, solar, bamboo, natural materials, biodegradable, zero waste, plant-based, vegan, permaculture, eco lodge, eco resort, slow living, handcrafted, local produce, herbal, natural soap, reuse, recycle, earth-friendly, off-grid, carbon neutral, clean energy, ethical, no plastic, refill station, rainwater harvesting
Nature-Related	jungle, rice fields, paddy fields, terraced fields, greenery, garden, nature view, sawah, nature, forest, waterfall, waterfalls, monkey forest, valley, tropical, banana trees, palms, bamboo grove, lush, flora, riverside, campuhan ridge, sacred springs, coconut trees, nature walk, wildlife, canopy, eco-park, creek, jungle trail, rainforest
Environmental Comfort	loud, noisy, traffic noise, construction noise, disturbance, music, parties, zen, calm, serene, peaceful, meditative, quiet, retreat, sound of birds, crickets, water sounds, gamelan, chanting, dogs barking, roosters, mosquitoes, humid, breeze, fresh air, cool air, jungle sounds, sunlight, shade, ventilation, smoke, burning trash, motorbike noise

Table A3. Keywords Dictionary - for Lombok & Gili Islands

Category	Keywords Dictionary - Lombok & Gili Islands
Eco-Friendly	sustainable, green, eco, eco-friendly, organic, rain, raining, solar, recyclable, zero waste, eco resort, eco lodge, biodegradable, compost, bamboo, natural materials, no plastic, refill station, ethical, clean energy, rainwater harvesting, off-grid, coral restoration, marine conservation, local produce, plant-based, reef-safe sunscreen, volunteering, low impact, carbon footprint, bike friendly
Nature-Related	beach, sea, ocean, waves, coastline, sand, coral, reef, turtle, turtles, snorkeling, diving, marine life, dolphins, island, mount, mountain, Mount Rinjani, volcano, valley, jungle, forest, rice fields, terraced fields, trees, tree, palm trees, garden, cliff, sunset, sunrise, waterfall, waterfalls, cave, bay, lagoon, humid, humidity, flora, wildlife, natural view, nature walk, tropical
Environmental Comfort	loud, noisy, construction noise, mosque, mosque noise, disturbance, music, parties, trash, litter, smoke, zen, calm, quiet, peaceful, relaxing, breeze, ocean breeze, sea breeze, fresh air, shade, sunlight, heat, humidity, humid, cool, ventilation, dog barking, boat noise, generator, cleanliness, air quality, serene

## APPENDIX B. KEYWORD MENTIONS BY DESTINATION IN REVIEWS

Table B1. Results Keywords Mention Ubud

Keywords Mentions Ubud	
garden: 37 mentions	wildlife: 2 mentions
calm: 22 mentions	raining: 3 mentions
eco: 74 mentions	forest: 22 mentions
rice fields: 38 mentions	banana trees: 1 mentions
quiet: 49 mentions	rainforest: 1 mentions
tropical: 8 mentions	monkey forest: 10 mentions
loud: 10 mentions	green: 10 mentions
nature: 33 mentions	waterfalls: 3 mentions
valley: 4 mentions	music: 5 mentions
mosquitoes: 13 mentions	natural materials: 1 mentions
serene: 8 mentions	sustainable: 1 mentions
jungle: 47 mentions	organic: 1 mentions
noisy: 6 mentions	parties: 1 mentions
peaceful: 23 mentions	canopy: 1 mentions
waterfall: 5 mentions	zen: 1 mentions
rain: 15 mentions	disturbance: 1 mentions
lush: 9 mentions	plant-based: 1 mentions
retreat: 10 mentions	smoke: 1 mentions
humid: 12 mentions	traffic noise: 1 mentions

Table B2. Results Keywords Mention Lombok & Gili Islands

Keywords Mentions Lombok & Gili Islands	
eco: 89 mentions	parties: 2 mentions
rain: 33 mentions	green: 7 mentions
sea: 73 mentions	waves: 9 mentions
peaceful: 17 mentions	turtle: 4 mentions
relaxing: 21 mentions	shade: 7 mentions
trees: 5 mentions	waterfall: 9 mentions
tree: 19 mentions	bay: 8 mentions

zen: 1 mentions	sunrise: 2 mentions
bamboo: 5 mentions	mosque: 9 mentions
sunset: 9 mentions	heat: 4 mentions
cleanliness: 12 mentions	noisy: 15 mentions
loud: 10 mentions	raining: 3 mentions
tropical: 3 mentions	humid: 8 mentions
beach: 80 mentions	humidity: 6 mentions
calm: 6 mentions	forest: 4 mentions
music: 8 mentions	cool: 9 mentions
quiet: 62 mentions	coral: 3 mentions
garden: 32 mentions	volunteering: 1 mentions
mount: 11 mentions	rice fields: 7 mentions
mountain: 8 mentions	waterfalls: 4 mentions
reef: 2 mentions	construction noise: 2 mentions
snorkeling: 14 mentions	serene: 3 mentions
diving: 2 mentions	jungle: 2 mentions
ocean: 8 mentions	trash: 1 mentions
sand: 4 mentions	wildlife: 2 mentions
island: 32 mentions	

Table B3. Results Keywords Mention Jakarta

Keyword Mentions Jakarta	
eco: 28 mentions	pollution: 1 mentions
garden: 2 mentions	public transport: 4 mentions
noise: 16 mentions	river: 2 mentions
noisy: 13 mentions	humid: 2 mentions
traffic: 8 mentions	humidity: 2 mentions
view: 99 mentions	natural: 1 mentions
quiet: 6 mentions	park: 8 mentions
cool: 5 mentions	calm: 2 mentions
windy: 1 mentions	sunlight: 1 mentions
environment: 5 mentions	smoke: 1 mentions

# APPENDIX C. FULL LIST OF BIGRAMS AND TRIGRAMS

Figure C1. The top 20 Bigrams that appear most frequently in guest reviews

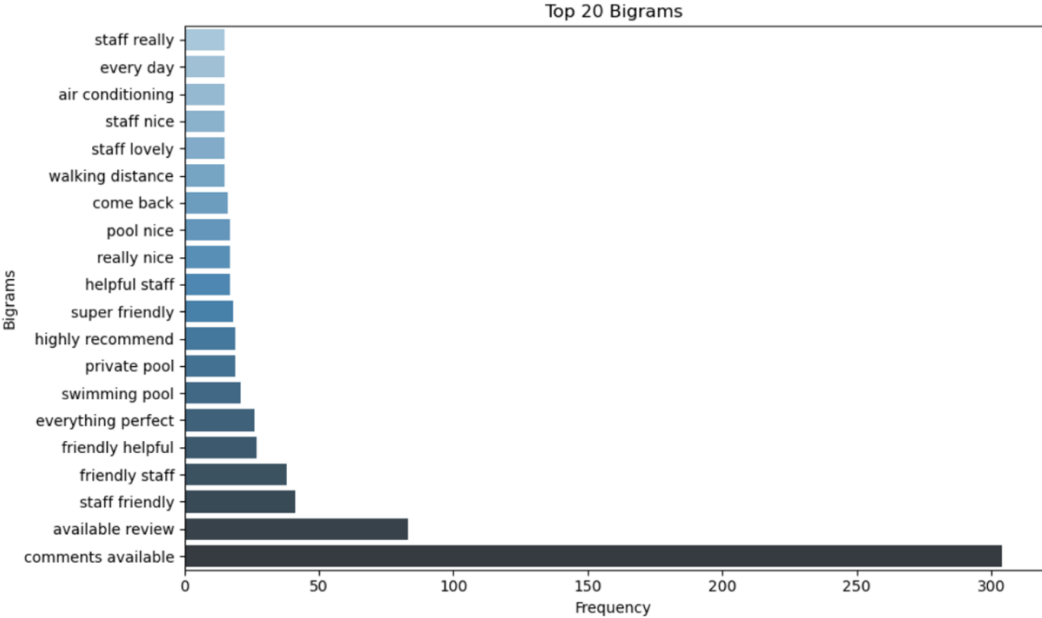


Figure C2. The top Trigrams that appear most frequently in guest reviews

