

Article

Online content analysis between bike related attributes and review content in case of Budapest

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Abstract: Active tourism, in our case bicycle tourism has been a proof of health benefits as well as responsible, sustainable way of transport. As tourist move around to see sights as well as gather experiences, this is a way to be efficient and green effective. This study aims to investigate bicycle tourism in cities, especially focusing on decision making as a bicycle tourist, when it comes to online bookings system, focusing on choosing a hotel. Method: we have used the several methods to analyze the reviews and ratings of hotels on Booking and TripAdvisor. We used hotels from Budapest only, focusing on bicycle tourism within the city. We investigated if there was any demand for bike related services when it comes to booking online. Our results show that there is significant relationship between choosing a hotel and the relevance of bike related services of the accommodation; however, it might not be the primarily decision making, and also following our hypothesis, online travel agents do not offer full package for bikers.

Keywords: active tourism; booking system; reviews; cycle tourism; bicycle tourism; cycling; e-WOM

1. Introduction

It has been in recent years great effort and incentives on construction bicycle roads not only in the cities but also on the countryside. Undoubtedly number of studies, including Mueller et al. (2015) state the positive health effects of cycling and other active method of transport not only in everyday life but also in tourism. Having proper infrastructure and safety requirements increases the number of people cycling and also bicycle tourism as such. Buehler and Dill (2016) suggest in their study that there is definitely a positive relationship between aspects of bike lane and cycling level. Also, bicycle roads play a major effect on cross-border relationships, over passing the barrier of borders, bringing people together, who are separated otherwise (Stoffelen, 2018). This is why we chose a city which is included in the Danube margin bicycle road and plays vital role as an acceptance place. If we mention the principles of bicycle infrastructure offline, we also would like to investigate the online factors of the same, thus investigating the relevance of bicycle related infrastructure online.

As much as the development of infrastructure has increased the likelihood of bicycle tourism, there are challenges to bridge over when it comes to using online booking systems. We raise the questions, whether bicycle tourist's expectations really meet with facilities offered online. Hamidi et al. (2019) state, that it could be a lack of studies focusing on active transport (AT), and also that there is also lack of information on this type of travel behaviour. Several post-COVID papers, for example the one

written by Cheng et al. (2023) warns about sport tourism which includes cycling is a new, but emerging area where people's need is also developing towards digital search thus digital sport tourism. As it is for online platform, it is a perfect way to surpass the traditional word-of-mouth (WOM) concept and emerge a more specified, product related WOM. Many researchers, including Jiménez-Castillo and Sánchez-Fernández (2019), Budka et al. (2022) suggest, that decision making is strongly influenced by e-WOM, online word-of-mouth. In fact, Akbari et al. (2022) do mention robot-based interactions as well, which is called r-WOM, our study however, does not focus on the latter one but the first one.

For our research we have considered analysing reviews provided by leading online travel agents and travel websites. In our study, Social Exchange Theory (SET), which was taken under consideration already in the seventies by Ekeh (1974), Turner (1991) indicating the likelihood of information flow about resources by individuals and groups. Nowadays, as it is for up-to-date information, online SET plays such an important role in decision-making, that according to San-Martín et al. (2020) newest statistics show that in tourism sale is the highest online when it comes to hotel reservations and fourth related to ticket booking. We also analyzed customer preferences when it came to choosing accommodation which has bike related services.

We also looked at the frequency of bike related services from the supplier's side. We analysed the listings of both booking websites, to see how important it is to list bike related services when it came to using the options the listings allow. We also analysed which are the preferred keywords by suppliers when it comes to emphasize bike related issues.

The questions we investigated were:

- (1) How relevant is from a supplier's point of view to state bicycle related services in their online listing?
 - (2) What are the limitations that they find when it comes to emphasize these services online?
 - (3) What are the main principles of services bikers look for in booking websites?
 - (4) How relevant is bike related services from the demand' point of view?
 - (5) How much does an online reservation site limits when searching for bike related services other than booking a hotel?
- H1: Statistical connection between the development of online travel agency websites and search results for cycling-related services.
 - H2: Statistical connection between the development of online travel agency websites and search results for cycling-related services.
 - H3: There is a statistical correlation between the presence of cycling-related services and the number of hotel bookings by cycling tourists.

2. Literature review

2.1. Bicycle tourism and segmentation

Bicycle tourism has been around ever since bicycle was invented, however it really emerged right from the 19th century as it has provided free independent way of travelling (Lamont, 2009). In Europe, right at this moment is really being wide-spread and high in popularity. In the UK, in 2007, the National Cycle Network has been

founded (Sustrans, 2007). Similar to this, the European Cyclists' Federation, Eurovelo was also founded. It is known as numbered, from 1–17 and it is over 90,000 km long (Eurovelo, 1995). In our study, the Eurovelo 6, which ends in Budapest is relevant, as we focus on cycling tourist, carrying their bike with them, visiting cities as the primarily motivation.

Bicycle tourism has been defined in various ways. Bicycle tourism is a type of travel and holiday activity, which involves bicycle as a mode of transport. When it comes to studies, there are several theories defining bicycle tourism. Simonsen et al. (1998) states, that bicycle tourist are those, who use bicycle significantly in their holidays, rather than just popping down the “corner shop”. Ritchie (1998) goes further and particularly mentions, that those, who live locally and use their bicycle for recreational purposes and those, who participate in racing, are not included in this segmentation. Richie et al. (2010) defines as either watching or participating in cycle event or independent cycling.

Sustrans (1999) defines as a recreational visit, which involves overnight stay, or a day away from home and the main motivation is leisure cycling. The same is described in Ho et al. (2014) stating, that biker's main purpose is cycling activity and their motivation is leisure, as well as being in nature, and their stay is from one day to multiple days. These are all separate people's definition, although they all agree, that those who considered cycle tourists also has to match the definition of tourist, which is the following:

UN Tourism (2008) describes tourist as: A visitor (domestic, inbound or outbound) is classified as a tourist (or overnight visitor), if his/her trip includes an overnight stay, or as a same-day visitor (or excursionist) otherwise.

One way to segment bicycle tourist is to define, how they use their bikes. There are bikers, who are seeking adventure and there are those who prefer recreational activities, like leisure and enjoyment. Müller et al. (2017) goes further and describes that with the lifestyle we are having and living nowadays, we do need to practice physical exercise or recreational activities. If we look at their interest, when it comes to motivation, there are those, who prefer nature and green environment, or there are others, who seek more culture, like museums, churches, buildings, historical sites. What is especially interesting in our studies, the segmentation of those who rent bikes and those who carry their own bikes. Many research mention bike sharing, as a modern way of urban cycling, indicating positive tourism effects (Chen et al., 2022; Dong et al., 2023; Zhang et al., 2023).

In our study we focus on travelers, who carry their own bikes, whether it is to travel all the way through with it or use other means of transportation to get to certain places then use the bicycle along the way. Those, who bring their own bikes to the trips, generally have more equipment related to the bikes to carry with them, like spare parts, tools etc. This refers to those as well who might not use their bikes all along the way. These bikers are also flexible more in planning their routes, as they can explore off the beaten path routes also, and tailor their experiences. Also, which is relevant in our research, when it comes to accommodations, they prefer those, which offer bike storage and facilities to perform bike maintenance.

2.2. The attributes of bicycle tourism—Factors influencing cyclists

While active tourism has been a potential motivation for tourists from the ancient Greek times, it always was influenced by several factors. Among them the most important factors include sustainability, well-being, safety, and infrastructure. Mueller et al. (2015) clearly state that people using active tourism as a way of physical activity (PA) do not consider air pollution and accidents as a putting off risk. This means, they have a stronger motivation to use it as a PA, rather than considering the health effects of pollution and accidents. Furthermore, stating bikers' behavior, there are several studies based upon the fact, that other than health benefits, infrastructure plays a vital part of their choices. Habib et al. (2014) clearly mention, that several investigations were carried out on biking choice, like the number of bike ownership and bike usage. They also state, that bike users are either utilitarian or recreational. They, however investigate utilitarian bikers, tending to fill also a research gap, using the perception of safety, bikeability and comfortability of bike usage. Carra et al. (2023) attempted setting up decision making on route prioritizing using Multi-Criteria Decision Methods (MCDMs) and GIS spatial analysis. Bicycle tourism has been known as a sustainable way of travel and tourism. Sustainability is also a key-factor in biker's motivation. Buongiorno and Intini (2021) have done a study on sustainable tourism in Apulia, where there is evidence, that in recent years, a significant number of overnight stays, an increasing number of local tour operators and a wide variety of itineraries proposed for the Apulian cycling tourism sector has emerged.

Furthermore, when it comes to sustainability, bicycle tourism, which is seen as a form of engaging into slow tourism activity, is in well developed countries a form of experiencing the territory as well as conserving an environmental and social dimension of life (Gazzola et al., 2018).

If we look at Budapest, Reményik et al. (2021) have written about over tourism in Budapest, urging solutions to reduce it, indicating, new, sustainable tourism products have to be introduced. Increasing people doing tours on bicycle as well as including Budapest as part of their long- distance trip is a way of doing it. This is another important factor in our research as it is vital to investigate whether Budapest has kind of supply to offer to attract bicycle tourists, like hotels focusing on bike related services.

Apart from being sustainable, another factor is that bicycle tourism often seen as a tourism product to enhance cross-border cooperation and destination expansion (Stoffelen, 2018; Timothy et al., 2014, 2016).

The desire of not only watch but also do sport while travelling has already appeared in the study of Green and Chalip (1998) referring to the increased bicycle tourists in New Zealand. This also further cited in experience- based research of Stamboulis and Skayannis (2003), who see this type of tourism to achieve experience during travelling.

2.3. Urban cycling

Urban cycling has been research as a multimodal transport behaviour, bike sharing and also sustainable way of getting around in cities. We, in our study focus on people using mainly their own bikes in cities, moreover we investigate Budapest as an

example. We also limit our study to the research of online travel agents offering bike related accommodation.

Our study focuses on urban cycling mainly. There is great effort to show, how bicycle routes have been developed in rural areas, and also effort has been made in urban areas. We all know the 21st century traffic jam problems, and we also know that great effort has been done in cities to decrease car usage and have more sustainable way of transport. Using bicycle as an alternative way of transport has been a great issue in many places. Banister (2008) states that sustainable mobility plays an essential role in turning cities into a sustainable one in the future. He not only describes cycling as a sustainable way of transport but helps solving parking issues

In Cunha et al. (2024) paper, which has compared 3 European cities, in terms of cycling, Lisbon came last, as having only 1.7% of cycling, whereas Munich is on top with 18%, Helsinki is in the middle with 11%. This is very interesting, as one would think due to the weather Lisbon is a paradise for using a bicycle, opposite to Helsinki, where in the winter bicycle usage decrease dramatically. In fact, Germany, the Netherlands and Japan are among the highest cycling countries with highest cycling cities (Goel et al., 2022). In these countries the percentage of going to work and non-work-related cycling are equal. In London, Paris and Vienna, without having cycling cultures, it tripled in the past 20 years, whereas in Sevilla for example, if we are only mentioning European cities, it became six times more (Pucher and Buehler, 2017). In Italy, in crowded tourist locations and to access these historical city centres, it is also looked over, that multimodal solutions especially combining bikes and public transport is an efficient way of reaching them (Romão and Bi, 2021). This also was analysed by Daniele et al. (2023) in Italy, emphasizing the importance of multimodal way of transport in cities, using bivariate probit method. In the Netherlands many bicycle roads have been built to easily access main rail and bus stations (Martens 2004). In China, people have unique bicycle roads, like The Great Wall in Beijing, a city bicycle tours in Shanghai and Suzhou, and adventure tours in Lhasa, Tibet and Sichuan province. Recently, many Chinese people have suffered from the negative consequences of their environment (e.g., lung cancer), and therefore, they desire to stay healthy and go more environmentally friendly, which is why also bicycle tourism is also increasing (Lu, 2010). Therefore, the government made great effort to introduce bicycle road networks and plans (Karki and Tao, 2016). Going back to European cities, in Greece for example there are bicycle tour days, when in Athens the inner city is closed to other means of transport. Our research city is Budapest, where in recent years there has been a great effort to increase the access of other means of transport by bike-sharing (Jaber et al., 2022). When it comes to bicycle users, the speed limit for transport on mixed traffic lanes is 50 km/h, as opposed to the Netherlands and Lisbon, although the advantage of Budapest along with Lisbon is that they recommend mandatory cycle lanes thus making it safer for bikers to use (Schröter et al., 2021). As it is for further type of bicycle tourism in cities, bike-sharing has been seen as a form of sharing-economy (Botsman and Rogers, 2010; Mateo-Babiano et al., 2016; Yang et al., 2021). Bike-sharing has been seen as an increasing number not only in bicycle use, but more importantly from our study's point of view, also private bicycle ownership (Castillo-Manzano et al., 2015; Fishman et al., 2014).

Multimodality, using more than one way of transport is another form of not using

cars in cities but bike-and- ride type of transport (Hamidi et al., 2019). Pritchard et al. (2019) also mention that in Sao Paulo, which was their geographical ground, there are major gaps from district to district, still, bike- and- ride not only works but also has a great job seeking and finding advantage. In Netherlands, Germany and Denmark to encourage people using this intramodality way in cities, there are huge bike parking next to public transport stations (Pucher and Buehler, 2008). We have seen a number of studies on bike and share but fewer in people carrying their own bikes, so we chose this for our research field. Our study is only focusing, but not limited to online travel agencies offering accommodation to bikers who are either a long journey using only bicycle or mixed transport.

2.4. Accommodation choice related to bicycle tourism

If someone goes to a foreign place, one of the crucial elements of a tourist's stay is finding somewhere to sleep. No wonder, some of the biggest online travel agencies mainly focusing on offering almost only accommodation, as they are aware that it is vital for somewhere to stay when away from home.

When it comes to choosing an accommodation, several factors influence a traveller to choose a certain kind of place to stay. Among these there are time and sensitivity content (Wong and Law, 2005), which means information quality is a sensitive issue (Emir et al., 2016), price (Law and Chung, 2003), e-WOM, and sustainability just to mention a few of them. Location, room types, services, or green practices are some of these key factors. Specifically in Budapest, according to Alreahi et al. (2023) it has been proven that implementing green techniques in hotels increases customer satisfaction and loyalty. All these factors are equally important however, we only focus on the factors influencing cyclist when booking hotels online.

As we investigated cyclists' behaviour when choosing accommodation, we have considered booking.com and TripAdvisor. We did not select any type, as Kovačić (2015) clearly states, that bicycle tourist accommodation can range from really inexpensive to upper class hotels. This is also described by Burns et al. (2015), that hotels, campgrounds and bed and breakfasts all are equally chosen by cyclist so they draw attention to also developing upscale accommodation, when it comes to developing cycling tourism. What is excellent in our study, that online booking systems investigated by us are equally stating hotels from all different ranges, so we do not have to worry about bringing together the different type of hotels searched by cyclists. In Croatia, it is also investigated, that not only their choice includes a wide range, but it is important for the hotel to include bike- related services (Kovačić et al., 2014). In China, Han et al. (2017) mention the importance of amenities in hotels related to bikers and that is missing especially in rural areas. This is an important factor in our studies, as we did our research on hotels and bike related services.

Lew (1998) indicated that alternative tourist activity, for example slow tourism, which includes bicycle tourism, is sometimes related to individual traveling, thus increasing the numbers of non-group or Free and Independent Travelers (FITs). This is especially significant in our research, as booking on TripAdvisor, and booking.com is mainly used by FITs, another key point to our study. We came to a conclusion that our research has little information previously, so we would like to not only investigate

accommodation choice, like in this study, but to do further research in the future.

3. Methodology

3.1. Online reviews and hotels method

As we mentioned before, Social Exchange Theory, SET has been described already way before internet was developed. Nowadays many studies indicate, that electronic word-of-mouth, e-WOM has been the main source in tourists planning their holiday and choosing accommodation. E-WOM has been researched in many aspects and also with considerable amount of method.

Richins (1983) says, that word-of-mouth is a way to communicate from people-to-people their experiences about either a business or some kind of product. When it comes to using the internet, people make sure that their opinion is read by others via internet sites. Dellarocas (2003) and Chatterjee (2001) indicate that e-WOM is used especially in travel related service providers, as consumers are unfamiliar with the product they are about to try. Consumer-generated content encompasses a variety of media forms and types of Web sites (Gretzel, 2006). One form in which content is created online is as consumer reviews and ratings (Gretzel and Yoo, 2008). In recent years a number of studies have been conducted based on reviews online. Kim and Perdue (2017) look at it from a sensory attributes' point of view, when it comes to making a decision on hotel's choice.

3.2. Online methods used for researching decision-making on hotel's choice

Akincilar and Dagdeviren (2014) looked at the decision making not from the OTA point of view but from the hotel's proper website. They used Analytic Hierarchy Process (AHP) and Preference Ranking Organisation Method for Enrichment Evaluations (PROMETHEE) to achieve the analysis of multi-criteria decision making. Agag and El-Masry (2016) looked also the decision- making using commitment–trust theory (KMV) and the Technology Acceptance Model (TAM), to see which factor influence customer more in choosing a hotel. Zhang et al. (2020) used the multi-stage multi-attribute decision making (MADM) to investigate the same, choosing hotels, taking into account the aspirations of different development speeds.

Many quantitative research has been done based upon the ratings of online travel agencies (OTA). Carrasco et al. (2017) also analysed multi-criteria decision making from a linguistic point of view, using TripAdvisor, Facebook profile and hotel's official blog, using SERVQUAL scale. Nie et al. (2020) were also using multi-criteria decision-making model for determine hotel selection from a linguistic point of view. They also performed sentiment analysis techniques driven by online textual reviews. Zhang et al. (2021) propose a fine-grained sentiment analysis approach to identify customers' preferences for hotels from online reviews, which can help improve hotels' services. Rianthong et al. (2016) went further and through numerical result, showed a hotel with a higher possibility of attracting more customers, with a higher average review rating, cheaper price, higher star rating, and higher net utility, is the ideal candidate to be ranking on top.

What is particularly interesting for our research is the study made by Fan et al. (2017), They used the PROMETHEE-II method in order to measure for ranking products based on online multi-attribute product ratings and product attribute weights provided by the consumer.

Peng et al. (2018) processed the probabilistic linguistic information formed by the ratings, applying the cloud model. All of these researchers used numerical ratings, which provided reference for customers when making decision in choosing a hotel.

Zhao et al. (2021) represented 4 case studies, using Probabilistic linguistic Term Set (PLTS) which integrates online ratings and reviews from multiple websites, taking into account that negative review always has a more impact on decision making than positive. PLTS was also used by Cui et al. (2022). They were focusing on the fuzziness of expressions online reviews have, emphasizing the importance of different terms they have. Negative review impact was also studied by Sparks and Browning (2011) in the relatively early stage of online reviews. Boo and Busser (2018) has collected reviews from hotels located in multiple destinations in order to identify both quantitative and qualitative aspects of text data. Ahani et al. (2019) did research using TripAdvisor ratings of hotels in the Canary Island, to determine customer's satisfaction and preferences and factors influencing those.

Due to COVID- related issues a new phenomenon of online reviews emerges related to employees. During COVID we have experienced employees leaving their jobs looking at opportunities elsewhere, and in recovery times new people approaching filling the gap left by others around 2020. Xia et al. (2023) did a study exactly on that, indicating not only services are affected by e-WOM but also human resources can be valued based upon reviews.

Several ways are also there to do study and analysis on reviews online. One very important from our point of view is the content of the review. Berezina et al. (2016) have shown in their studies how customer's satisfaction is reflected on review content. Their method was text-link analytics to see the link between perception, various attributes and satisfaction.

Another interesting fact is the influence of management's response to customer's negative review. Zhang et al. (2023) focus on service improvement prioritization driven by online reviews. This is very important from our study's point of views as we also looked at reviews of bike related services.

Xu (2021) did a study on how differently designed OTA platforms, in this case Expedia.com and booking.com especially closed-form evaluations and open-ended textual comments, affect customers' online review writing behaviours and reflect satisfaction. 12,000 hotel reviews were selected from the same hotels and latent semantic analysis (LSA) method was used.

Pantelaki et al. (2023) used Latent Class Analysis (LCA) to identify latent groups of bike tourists. When it comes to bike- tourism attributes, looking at gender-connected loyalty, it has been analysed by Han et al. (2017), using Structural Equation Modelling (SEM). Among his hypothesis, there are gender related connections to other attributes related to biking. He also used a Confirmatory Factor Analysis (CFA) prior to SEM. He came to the conclusion that attributes of a tourism product is critical in travellers' decision-making process and loyalty formation. Using several variable methods, Yang et al. (2021) analysed the relationship between tourist attraction and

bike sharing stations in Chicago which is a premier cycling city in North- America. They have collected date and reviews using TripAdvisor, which is particularly popular in the U.S.

Mateo-Babiano et al. (2016) did research in the Brisbane area on using GIS-based data and correlation and regression analyses. This was also about bike-sharing in both natural and built environment, looking at the length of the usage, and the purpose of the usage, which in this case was more leisure.

3.3. Our research and methodology

As sources of data, both Booking.com and TripAdvisor were utilized. During the data collection process, 343 accommodation services from TripAdvisor and 449 from Booking.com were examined, resulting in a total sample size of 792. The data collection was realized through an automated scraping procedure, during which the first 15 guest reviews of every available accommodation were gathered, thus forming a uniform database of $n = 11,880$ in terms of guest reviews. This also represents a limitation of the research. As a research constraint, the sample size can be mentioned, given that the algorithms of the accommodation search websites considered factors when displaying guest reviews such as relevance, time, reflection, etc. Moreover, while browsing accommodations often allows for it, the comment section typically does not offer targeted filtering options. Therefore, the number of items to be queried could only be limited quantitatively, which we determined to be the first 15.

As a first step, an examination was conducted to determine the proportion of keywords related to the topic of cycling within the entire comment data.

$$\text{Ratio} = \text{Number of keyword comments} / \text{Total comments}$$

The results show the following proportion of keywords related to cycling compared to all comments:

- “bike”: 1.47%
- “cycling”: 1.08%
- “bicycle”: 1.21%
- “cycle”: 1.31%

While these proportions may not seem high, cycling tourism is fundamentally considered a niche segment. In this context, the ratios indicate that there is a demand for cycling services and related information.

The second step of the research involved creating a collocation map. This map visually represents how keywords related to cycling frequently co-occur with other words in the comments. To achieve this, comments containing the cycling-related keywords were first filtered out. Subsequently, the collocation map was constructed using our own tokenization (**Figure 1**).

Tokenization is a fundamental step in text processing, during which the text is divided into smaller units, known as “tokens”. In this process, the text was split based on spaces, filtering out tokens that use characters other than letters (thus excluding punctuation, emoticons, etc.), and every token was converted to lowercase.

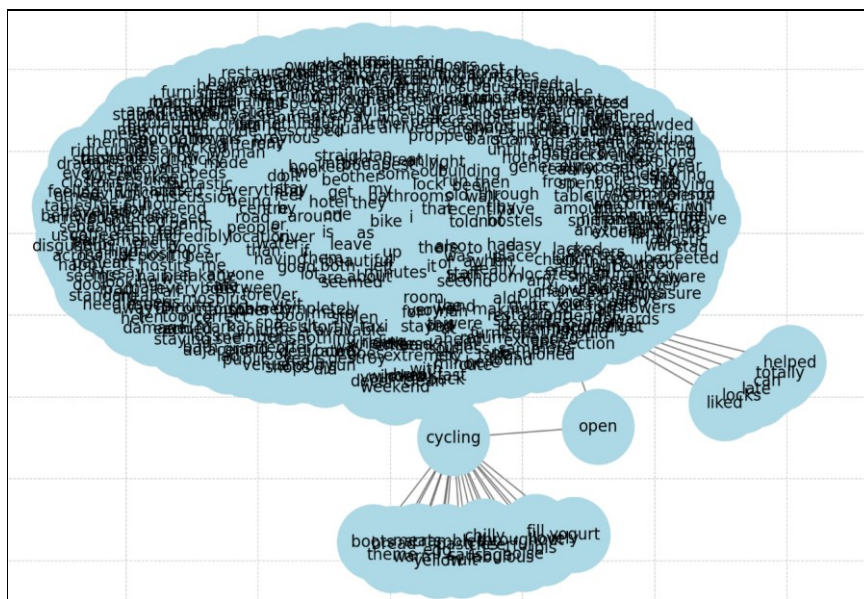


Figure 1. Vocabulary map with simple tokenisation, own compilation.

Based on the map, a primary finding is that the word “bike” frequently co-occurs with words such as “room”, “free”, “station”, and “path”. In the third step, using logical relationship analysis, we determined the context in which the top 4 related expressions are mentioned. The results indicate that tourists appreciate the ability to store bicycles in their rooms, the availability of complimentary bicycles, and the proximity of the accommodation to cycling stations or routes. Comments reveal that tourists value cycling services. The relationship between the words “room” and “free” with the cycling theme strongly suggests that guests prioritize the secure storage or rental of their bicycles at the accommodation. When guests specifically mention these services and related amenities, it implies that these services represent added value for them. Based on this data, it can be logically inferred that tourists actively seek and appreciate cycling services. Therefore, it can be asserted that if accommodations communicated these services more explicitly, it would likely enhance guest satisfaction, as there is a discernible demand for these services based on the map.

In the second phase of our analysis, we examined whether there is a statistical correlation between comments related to cycling and numerical ratings. To do this, we first created a binary variable indicating whether a given comment contains cycling-related keywords. We then conducted a correlation analysis between this binary variable and the numerical ratings. The results indicate only a weak correlation between comments on cycling topics and numerical ratings:

- location_score: -0.0056
- cleanliness_score: 0.0178
- equipment_score (service): 0.0291
- value_for_money_score: 0.0287

This suggests that comments related to cycling do not strongly correlate with numerical ratings. Based on the results, one can infer that while cycling services may be important to guests, this importance is not necessarily reflected in the numerical ratings. Other factors, such as price, cleanliness, or equipment, might have a more significant impact on numerical ratings. However, it’s crucial to note that this doesn’t

imply that cycling services don't enhance guest satisfaction, but rather that in this dataset, there isn't a strong statistical relationship between the two variables. Among the previously mentioned values, the correlation between equipment score (service) and comments on cycling topics is the strongest with a value of 0.0291. Although this is still considered a weak correlation, its relative strength suggests that such services distinctly appear in the ratings, emphasizing one evaluation criterion. Presumably, if there were an option for direct package search, both the correlation analysis and the results from the collocation map suggest that tourists would be able to choose more comprehensive, personalized service packages. This would certainly meet the needs of a specific group—cycling tourists—at a higher level, which is particularly important for maximizing profits in the tourism sector and ensuring satisfaction from the demand side. In the third phase of our analysis, we conducted a depth analysis. For the in-depth examination of guest reviews, we assigned categories, revealing the primary motivations. Based on this, it can be asserted that tourists with cycling needs consider three main aspects:

- **Safety and Storage:** Safe storage of their bicycles is crucial for cycling guests. This is evident from numerous feedbacks where guests positively comment on the ability to store their bicycles in separate storage areas or garages.
- **Comfort and Equipment:** Guests distinctly value services that make their cycling trips more comfortable, such as pumps, washing machines, maps related to cycling paths, etc.
- **Location and Transportation:** The third comment suggests that guests appreciate direct or nearby bicycle rental opportunities. In the majority of cases, reviewers leave positive feedback regarding cycling services. In many instances, secondary elements arise—which are particularly important from the research perspective—such as “pleasantly surprised that...” or “to our greatest surprise...”. These comments suggest that while they hoped for cycling-supportive options when making their reservations, they were not certain of their availability. This further underscores the relevance of recommendation or booking systems offering specific packages and services, at least for the type of tourism we examined.

In the fourth phase of the research, we shifted our focus to examining the supply side. We carried out this in four steps:

1) Frequency analysis:

To determine how many accommodations mention cycling services in their descriptions, we conducted a frequency analysis. Based on the results of the frequency analysis, keywords related to cycling services appear in the accommodation descriptions as follows:

- bicycle (in Hungarian, “kerékpár”): 1149 occurrences
- bicycle: 304 occurrences
- cycling: 264 occurrences
- bike (in Hungarian, “bicikli”): 59 occurrences
- bike: 9 occurrences, from this, we can observe that the descriptions contain references to bicycle options in an astonishingly high number, suggesting that accommodations deem cycling services as important in their descriptions.

2) Co-word analysis:

During the co-word analysis, our objective was to determine which words most frequently appear in proximity to a given keyword. This provides insight into the context in which the keyword is most commonly mentioned, shedding light on the themes or characteristics associated with it. In this case, the keywords will be expressions related to cycling services.

- Rental: 604 occurrences
- Service: 604 occurrences
- Available: 493 occurrences

The co-word map displays the relationships between cycling-related keywords and the top 3 associated words. On the map, the blue nodes represent the cycling-related keywords, while the red nodes represent the top 3 associated words.

The thickness of the edges reflects the frequency of the given word pair. The more frequently the words appear together, the thicker the edge. From this map, it is evident that the words “service”, “available”, and “rental” have strong connections to the cycling-related keywords.

The co-word map aids in visualizing which words frequently co-occur and the relationships between them. In this case, we can observe that the availability, type, and mode of cycling services are particularly emphasized in the descriptions of accommodations (**Figure 2**).

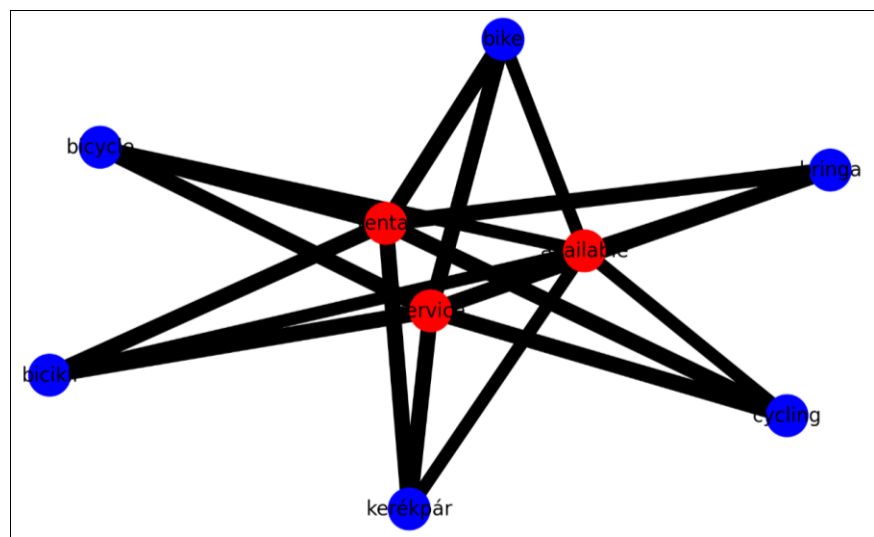


Figure 2. The co-word map, with the relationships between cycling-related keywords and the top 3 associated words, own compilation.

3) TF-IDF Methodology

TF-IDF (Term Frequency-Inverse Document Frequency) is a statistical method used to measure the importance of words in textual data. TF-IDF consists of two components: Term Frequency (TF) and Inverse Document Frequency (IDF). The product of TF and IDF determines the importance of words. A high TF-IDF value for a word indicates its significance in a particular document but its infrequent occurrence across all documents. With this method, frequently occurring yet insignificant words, such as stop words, receive a low TF-IDF value. As a result of the TF-IDF analysis, the most defining words in the descriptions are:

- apartment service—2042.02

- airport—1014.15
- free (in Hungarian, “ingyenes”)—870.27 Among the words with the highest TF-IDF values, there are none specifically related to cycling tourism. This suggests that the descriptions of accommodations might not emphasize cycling tourism or its services enough, possibly because they need to focus on detailing other services. This situation might arise because these platforms primarily target bulk offerings, leading to mass communication, which could be at the expense of specificity. The cycling tourism-related keywords and their TF-IDF values are as follows:
 - rental—88.19
 - bicycle (in Hungarian, “kerékpár”)—81.44
 - bicycle—43.21

The words “rental” and “bicycle” have relatively high TF-IDF values, suggesting their importance and relevance in accommodation descriptions. The results indicate that services related to cycling tourism, such as bicycle rental, play a significant role in accommodation descriptions. However, other words associated with cycling tourism, like “tour” or “route”, are not among the top TF-IDF values. This implies that these services or opportunities are less emphasized in the descriptions, reinforcing our assumption that providers are somewhat compelled towards mass communication.

4. Correlation analysis

To investigate a significant correlation, we created a variable named “bike related,” which aimed to account for the relevance of the description in the context of cycling tourism. We compared these with the numerical ratings, both the overall score ratings and the equipment ratings (**Figure 3**).

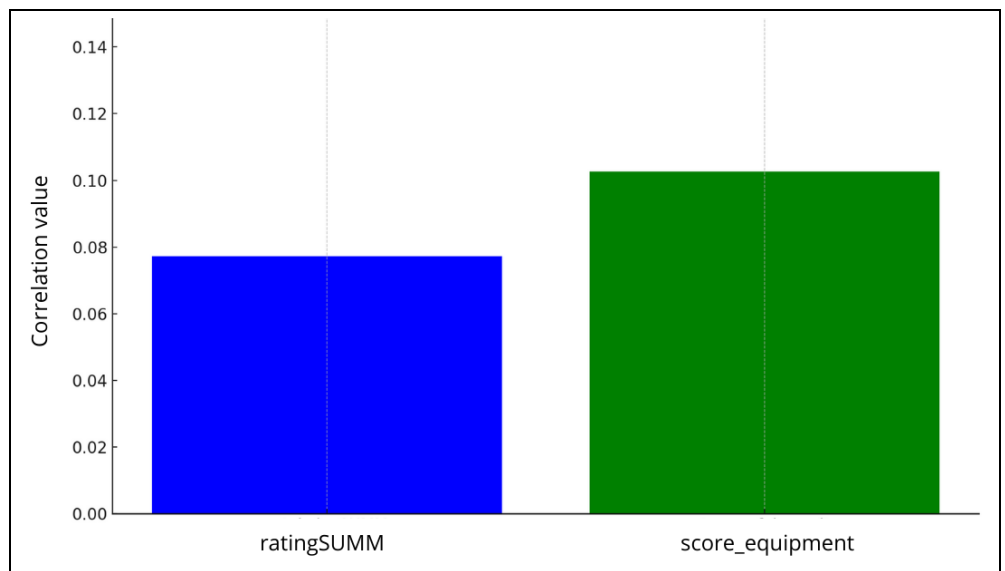


Figure 3. Correlation value between ‘bike related’ and rating columns, own compilation.

- For the correlation between “bike related” and “ratingSUMM,” there is a positive (correlation value of 0.0772) but weak relationship between accommodations

mentioning cycling services and the general ratings.

- For the correlation between “bike related” and “score equipment,” there is also a positive relationship (correlation value of 0.1026) between accommodations mentioning cycling services and the equipment ratings, albeit slightly stronger.

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- For the correlation between “bike related” and “ratingSUMM” there is a positive (correlation value of 0.0772, p -value < 0.001) but weak relationship between accommodations mentioning cycling services and the general ratings.
- For the correlation between “bike related” and “score equipment” there is also a positive relationship (correlation value of 0.1026, p -value < 0.001) between accommodations mentioning cycling services and the equipment ratings, albeit slightly stronger.

The representation indicates that the relationship between accommodations mentioning cycling-related services and the rating categories is fundamentally positive. The correlation between “ratingSUMM” and “bike related” is smaller than the correlation between “score equipment” and “bike related” This suggests that meeting specific needs -notably cycling services - has a more significant impact on ratings, implying that satisfying specific requirements is much more crucial than the general attributes of the accommodation. Based on this, we can conclude that mentioning cycling-related services in accommodation descriptions positively influences ratings, especially those related to equipment. This demonstrates that for tourists who have cycling-related needs on the demand side of the market, equipment matters more. It is therefore reasonable to assume that targeted package offers could be marketed to them, focusing on their touristic activities, rather than the nature of the accommodation itself. It is evident that specificity is essential for the supply side, emphasizing which can lead to higher ratings, recognizing the importance for guests, which is also reflected in their reviews. However, they seem compelled to convey these messages through mass communication.

5. Results and discussion

Based on the data, analyses, and results presented above—summarizing the findings from both the demand and supply sides, considering word associations, the quality and direction of guest reviews, logical connections, correlations, and TF-IDF ratios - we can state that our hypothesis is validated. Specifically, in the tourism sector, when examining online sales channels (in the case of Booking.com and TripAdvisor), in their current form, they are unable to meet the package offer needs of cycling tourists in the Budapest market. Instead, alternative solutions are required to present specific touristic products.

From the perspective of supplier’s providers, it is crucial to showcase bicycle-related services on their online platforms (A1). This importance is underscored by the significant appreciation and search activity of cycling tourists, as evidenced by the frequency of keywords related to these services in hotel booking site reviews. The data

analysis indicates that bicycle services, such as secure storage, complimentary bicycle use, or proximity to cycling routes, hold paramount importance for tourists(A4).

However, it should be noted that due to the limited filtering options on online platforms, cycling tourists face challenges in locating specific services of interest (A2). This limitation diminishes the efficiency of online booking sites in offering targeted services to cycling tourists.

The significance of bicycle-related services is evident not only on the demand side but also on the supply side from accommodation providers (A3). The frequent occurrence of cycling-related words such as “bicycle”, “bike”, and “cyclist” in the descriptions of accommodations, as identified through TF-IDF analysis, indicates that these services are deemed crucial by hotels. Moreover, the positive, albeit weak, correlation between the “bike related” variable and hotel reviews illuminates that mentioning these services has a favourable impact on the ratings of accommodations, particularly concerning their facilities (A1).

In the tourism sector, particularly when examining online sales channels, it is apparent that cycling tourism is an integral part of commercial communication because it is important for tourists (A4). It is advisable for accommodations and travel service providers to more emphatically communicate bicycle-related services, as these services not only influence guest search behaviors and satisfaction but also can enhance the ratings of accommodations. The scientific conclusion drawn from the data is that tailored offers for cycling tourism are of exceptional importance from both demand and supply perspectives, however we did not detect positive example to this (A5). The development of services and packages customized to special needs, along with more effective communication, can contribute to the success of the tourism sector and higher levels of guest satisfaction.

Based on the gathered data and analyses, which encompassed both demand and supply aspects, along with word associations, quality and direction of guest reviews, logical connections, correlations, and TF-IDF ratios, we can substantiate our hypotheses. In the context of online travel agencies (OTAs) operating in the Budapest market, specifically Booking.com and TripAdvisor, it appears that their current configurations do not adequately cater to the package offer needs of cycling tourists. This necessitates alternative solutions for showcasing specific touristic products.

Regarding H1, the limitation of online travel agencies in responding to the demand for cycling-related services is evident. The analysis suggests that while there is a notable mention of cycling services in accommodation descriptions, the existing structure of OTAs may not be optimized for highlighting these niche services effectively. This is particularly evident in the TF-IDF analysis, where cycling-related terms, despite being significant in accommodation descriptions, do not rank among the top terms, hinting at a potential underrepresentation in the platforms’ algorithms.

For H2, the research underscores the relative importance of searching for bike-related services during online booking for bicycle tourism. This is reflected in the frequency and co-word analyses, indicating that accommodations often mention cycling services, and these terms are closely associated with other relevant services. Moreover, the guest reviews exhibit a clear preference for cycling services, suggesting that such amenities are a significant factor in their accommodation choices.

H3’s assertion about the importance of bike services in hotel bookings is

substantiated through the depth analysis of guest reviews. Safety, storage, comfort, equipment, location, and transportation are highlighted as key considerations for cycling tourists. This implies that cyclists do not just casually appreciate bike services; these services are a critical factor in their accommodation choices.

While there is a distinct demand for cycling-related services among tourists, as shown by guest reviews and keyword analysis, this demand seems insufficiently addressed by current OTA platforms. The weak correlation between cycling-related comments and numerical ratings may indicate that other factors like price and general amenities play a more substantial role in overall guest satisfaction. However, the presence of cycling-related terms in accommodation descriptions and their importance to guests suggest a niche market that could be better served with more targeted offerings and specific package options. This would not only enhance guest satisfaction but could also open up new avenues for revenue and market differentiation in the competitive field of online travel and accommodation services.

6. Conclusion

The study aimed to investigate bicycle tourism in urban areas, specifically in Budapest. Our main objective was, based upon the questions we raised and also the hypotheses we stated, to analyze what are the key factors on cyclists choosing accommodation on online booking systems like TripAdvisor and also booking.com. We have identified and utilized the latent variables of bike related services offered by suppliers as well as searched for by demand side. We used comments appearing on the two booking sites. However, we have found that certain comments are deleted on booking.com, as they have a time limit, so as our study in that sense.

This study we found that several factors primarily affect the decision-making on choosing an accommodation on the booking systems mentioned above. Firstly, we investigated the keywords mostly used by bikers and found in comments 4 most common words: bike, cycling, bicycle and cycle. Even though they are small percentage in appearing in comments, we took it into an account that bicycle tourism is a small segmentation of other, so it is a relatively correct percentage. Secondly, we matched words used in relation with these keywords to set up a word correlation map as well as determine whether it is important for bikers to store bicycles in the room, or there is a bicycle station nearby. We also found that even if bike related services are important for tourists, it does not appear in numerical reviews, so we can say almost no correlation was found. In the third part of our research, we have proved that bikers do appreciate services offered by accommodations, and what is more important, it seems, that they were surprised about finding these services.

About the supply we have found, using correlation analysis that they do state in their description some bike related keywords like bicycle, cycling, bike, which matches the demand's needs as well. Our findings also indicated looking at the number of times they appear, that is very important for the supply to state these services, so there is a strong correlation. And those words are connected to the following words: rental, service and available. What we found however, using TF-IDF method, that it is important for suppliers to state bike related services but they don't emphasize enough when making a listing. According to our findings, the 3 most important words

are: apartment service, airport and free. Bike related words appeared less than tenth of the findings.

Finally, based on the study's findings some recommendations could be proposed for increasing and encouraging cyclists for booking accommodations, offering bike-related services. In order to achieve bikers, look for these accommodations demand should be encouraged emphasizing these services on every possibility offered by online platforms. As bikers do appreciate the storing of the bikes, as well as amenities related to bicycles, as well as renting of bikes nearby, we would investigate in our future studies the opportunities and possibilities to make it more visible online. We strongly recommend to use bike related keywords in the description of the hotel and also pictures related to this product. If hotels decide to dedicate themselves to this market, then the name, pictures and descriptions also should clearly include this. Should they put more emphasis on these, most certainly it would appear in TripAdvisor's as well as comments on Booking.com comments.

We do believe, that understanding the opportunities and limitations on online booking websites give a good platform to use later in analysing social media sites as well as destination websites, which we aim to research in our future studies, besides what was mentioned above. Other mean of research also could be done by surveying how people search online depending on their age, gender, and educational differences, similar to study done by (Geigner et al., 2023).

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