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Sentiment and Topic Modelling Analysis of Museum Reviews in the Context of Traveller Types: The Case of Kazakhstan



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Abstract

Kazakhstan stands out as one of the key destinations in Central Asia, with a unique and diverse range of cultural and historical resources. Within these resources, museums are vital institutions where the region's rich heritage is displayed and shared with the public, fostering a deeper understanding of its cultural identity. In this context, the present study aims to conduct a comprehensive analysis of online reviews of museums in Kazakhstan by applying advanced text mining and machine learning techniques. The research seeks to uncover the sentiments and topics expressed by visitors regarding their experiences with museums in Kazakhstan. The methodology uses a combination of sentiment analysis, topic modelling and text classification to provide a nuanced understanding of the visitor feedback. The topics identified from the analysis are further categorised according to different traveller types, providing insight into how different groups of visitors engage with the museum offer. The results show that visitors are more likely to make statements about the exhibition, services, outside and experience topics. Furthermore, each traveller type focuses on different aspects of museums in their reviews. In light of these issues, it aims to improve the interaction between visitors and the destination and provide practical implications for museum management.

Keywords

Kazakhstan • Tourism • Museum • Text mining • Traveller types



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Sentiment and Topic Modelling Analysis of Museum Reviews in the Context of Traveller Types: The Case of Kazakhstan

Museums play a significant role in the development of the tourism sector in a destination (Mavragani, 2018; Vareiro et al., 2021). These structures play an instrumental role in the sharing and exhibition of the cultural and historical artefacts of cities and countries (Vaughan, 2001; Chen et al., 2012; Bideci and Albayrak, 2018). It is one of the most popular recreational activities particularly within cultural tourism (Lord, 2001). The act of visiting museums provides tourists with the opportunity to engage with historical artefacts and gain insights into the historical and cultural developments of the visited regions. This experience not only enhances their understanding of the region's history and culture but also facilitates greater cultural communication with the local community (Günay, 2012). In addition to the functions of exhibiting, preserving and transmitting the historical and cultural heritage of societies within a specific system, museums also serve the purpose of strengthening cultural memory. (Verbytska, 2023). In addition, museums have a positive impact on social cohesion, local economic development and the promotion of sustainable growth. (Tohmo, 2004; Brown, 2019; Pirnazarovna, 2024). Consequently, the role of museum management in the tourism industry is of significant importance and is an effective strategy for enhancing the destination image. (Sangchumnon et al., 2024; Jeong et al., 2012).

The advent of Web 2.0 has precipitated a paradigm shift in the manner in which individuals seek information regarding exotic destinations and meticulously plan their travels. This new development has enabled more effective and tailored preparation, aligning with the evolving needs and preferences of travellers. (Llodra-Riera, 2015). Consequently, there is an increasing demand for distinctive destinations, which is in turn being driven by advancements in technology, transportation, lodging, and other domains. In this context, one such unique destination is the Central Asian region. The region's cultural, geographical and recreational offerings collectively contribute to its growing appeal and the emergence of new tourism products in the market and offer unique experiences.

The region's nomadic culture, unique attractions and structures, and artefacts from the pre-Soviet, Soviet, and post-Soviet periods, as well as the contents of the museums, are notable for their rich cultural diversity. However, primarily due to economic and geographical constraints, Kazakhstan has been unable to fully capitalise on its cultural richness to meet the anticipated tourist demand, as evidenced by its ranking of 58th in terms of cultural diversity and 52nd globally in the 2024 World Travel and Tourism Development Index. In 2023, the country only attracted 4.56 million tourists, generating only 1.49 billion dollars in revenue (WEF, 2024). It is predicted that an augmentation in the quality and quantity of museum visitors, motivating individuals from disparate travel groups from diverse regions to visit museums in Kazakhstan, will elevate the country's standing in the field of tourism and further enhance the quality of tourism services.

In the context of Central Asian and global culture, Kazakhstan represents a destination of significant museological and archaeological significance. For instance, with over 175,000 artefacts on display, including ancient and medieval pieces relating to the history of Kazakhstan and Central Asia, the National Museum of the Republic of Kazakhstan in Astana is the largest museum in Central Asia. It also displays important articles from the nomadic culture of Kazakshtan. One of the most important of these artefacts is *The Golden Man* in the Halls of Gold section of this museum, which visitors pay close attention to. In addition, the Central State Museum of Kazakhstan in Almaty is one of the largest museums in Central Asia, housing

historical, archaeological and modern cultural and political artefacts. In this building, history, ethnography and Anthropology sections are significant units that attract the attention of tourists. The Kazakh Museum of Folk Musical Instruments is another attractive and unique museum that displays nomadic and special musical instruments and famous pieces of past singers and folk minstrels.(Visitastana, 2025 UNESCO, 2025). Despite having unique museums, there is no comprehensive study on online reviews about museums in Kazakhstan. For this reason, it was deemed necessary to conduct this study, especially to guide museum administrations to improve the service quality of related museums from the visitor's perspective.

In order to gain a macro view of the museum experience of Kazakhstan, this study employed text mining and machine learning methods to analyse the contents of online reviews about museums in the country. A review of the literature reveals an absence of studies conducted within the scope of text mining on the subject in Kazakhstan. Furthermore, studies conducted in the relevant field according to travel types are scarce in the existing literature about museums in this region. Related studies about museums in Kazakhstan mostly focus on the displayed artefacts, modernisation process, interior part of museums and historical perspective (Dyusalina et al., 2018; Kikimbayev, 2023; Kukeeva & Zhanseitova, 2016; Alliyassova et al., 2016). Furthermore, few studies from a marketing perspective were conducted, and it advises museum managers to use digital marketing tools to increase the marketing brand. (Gizatov et al., 2024). However, there are no comprehensive studies on what the feedback by visitors are directly for museums. For this reason, it is important to eliminate the problems of visitors and to increase the quality of service by museum management in Kazakhstan.

Conceptual Framework

The digital transformation that has occurred within the tourism sector has increased the sharing of information via online channels by customers. The advent of Web 2.0 technology has led to a notable increase in the number of individuals sharing their experiences of purchasing tourism services on these digital platforms (Noti, 2013). This sharing increases the e-WOM process, and for this reason, businesses try to make improvements by applying the data obtained from visitor reviews to areas such as marketing, management and finance (Chen and Law, 2016; Reyez-Menendez et al., 2020; Mukhopadhyay, 2023). It is evident that the dissemination of discourse and information about museums, which are widely regarded as one of the most notable attractions in travel, is becoming increasingly prevalent on digital platforms. (Agostino et al., 2021). Thanks to digital transformation, new technologies such as gamification and virtual reality have played an important role in improving visitor satisfaction in museums (Trunfio et al., 2020; Gumus & Cetin, 2023). These developments will increase the communication process between museums and visitors.

Tourism and travel websites provide users with the opportunity to share their experiences of museums, and various studies in this field investigate which issues users face constraints about particular issues during and before their museum experiences (Baleiro, 2023; Zanibellato et al., 2018; Potter et al., 2024; Cao et al., 2024). The positive and negative feedback from visitors in related areas helps potential visitors to manage their expectations and purchasing behaviour (Stoleriu et al., 2019). Online reviews are considered a valuable resource for visitors' travel planning, as they also include practical information such as pricing, crowd conditions, facilities and transportation topics (Papagiannis et al., 2023; Calheiros, 2017; Park and Liu, 2022; Baniya et al., 2021).

Consequently, the evaluations disclosed on digital travel platforms concerning museums by international visitors play a pivotal role in the advancement of administrative and promotional endeavours for both

museum administrations and the decision-making processes in destinations (Burkov and Gorgadze, 2023). It also assists museum administrations with particular issues such as visitor management, displaying forms of artefacts, promotions, education and restoration. Consequently, it enables museum administrations to enhance the quality of their services, promote local culture, and raise awareness of the museum brand (Köroglu et al., 2017; Alrawadieh, 2021; Palla et al., 2024). Furthermore, it has been demonstrated that the platform supports countries and regions in areas such as tourism planning, competitive analysis, the development of infrastructure and facilities related to museums and their environs, and enhances the overall image of the country (Köroglu et al., 2017; Alrawadieh, 2021; Palla et al., 2024). (Elenita, 2017; Corbos and Popescu, 2011; Jimenez, 2015; Elenita, 2017). Furthermore, an examination of the reviews made by tourists to museums on online travel platforms represents a crucial step in gauging consumer satisfaction (Elenita, 2017; Corbos and Popescu, 2011; Jimenez, 2015). It is conceivable that the satisfaction of visitors to museums may vary according to their country of origin (Burkov and Gorgadze, 2023; Goulding, 2013). The advent of digitalisation and technology, along with their proliferation in the tourism sector, has had a profound impact on the realm of museology (Su & Teng, 2018; Liao et al., 2020).

The advancement of techniques such as deep learning, machine learning and the optimisation of algorithms in this field are significant developments that facilitate the examination and analysis within the context of big data with greater precision. In particular, the manual identification of a substantial number of reviews is a process that is both time-consuming and susceptible to subjectivity (Nawawi et al., 2024). The inclusion of user reviews allows for a more nuanced understanding of the experiences and perceptions of visitors, as they can be expressed in their own words (Riva and Agostino, 2022). Furthermore, surveys may reduce the possibility of revealing the latent feedback from visitors during their museum visits and may affect subjective evaluations and reduce the accuracy. For this reason, automated text analysis methods are more objective and help to save time (De Graf et al., 2013). This approach can sometimes be more effective than surveys in identifying and revealing hidden issues within a dataset. Recent advancements in text mining techniques and the growing volume of online reviews have contributed to a surge in studies analysing the content of user comments about museums on digital platforms. In these studies, the contents of these open-ended reviews have been handled with different approaches, and the attitudes and behaviours of visitors towards museums have started to be revealed with relevant methods. However, such studies using text mining techniques are still few (Agostino et al., 2021).

Research indicates that the aspect that elicits the highest level of satisfaction among museum visitors is the uniqueness of the museum's content and the exhibits their artefacts (Huo et al., 2024). Furthermore, the quality and diversity of the services provided by museums are also regarded as a significant aspect by visitors (Kelpsiene et al., 2024). Given that museums encompass a range of functions, including education, entertainment, and opportunities for interaction with local communities, as well as the display and safeguarding of artefacts (Lee & Smith, 2015).

In light of the aforementioned circumstances, the facilities and content provided by museums at various levels gratify visitors, thereby fulfilling their needs. To illustrate, the study conducted in Greece with various tourist groups revealed that the diverse elements of museums, including exhibitions, staff, educational resources, pricing, and the quality of amenities, were frequently highlighted by tourists. Among these elements, the issue that has the greatest impact on satisfaction is the attitude of the staff employed in museums and the level of education of those responsible for managing the museums. Because museums

play an important role in increasing visitor knowledge levels and satisfaction (Mavragani & Lymperopoulos, 2013).

Consequently, the motivations of museum visitors are contingent on their attitudes, interests, and perceptions of museums (Aljahdali, 2016). One of the study which compared the visitor satisfaction level and different traveller types including solo, group and family travellers showed that solo travellers exhibited more sensitivity to price than groups and families. Furthermore, families place a premium on the convenience and functional benefits that museums offer, such as shopping (Moreno & Ritchie, 2017). Moreover, as museum visitors are often unaffiliated with any specific organisation and actively seek diverse experiences, research focusing on these groups provides critical insights that can inform the strategic marketing and management of museums (Moreno, 2021; Mencarelli et al., 2010). The level of satisfaction experienced by foreign visitors to museums is a significant topic, particularly in the context of electronic word-of-mouth (eWOM) marketing. A research has shown that the satisfaction experienced by foreign visitors during their museum visits significantly increases the likelihood of them recommending both the museums and the cities in which they are located to others in the future (Chan, 2019).

There are discrepancies between the attitudes and expectations of museum management and those of tourists visiting the museum, depending on the purpose of the visit and the type of tourist. While visitors anticipate the availability of shopping, pricing, and experience quality within the scope of museum services, museum administrations most likely tend to direct attention to elements related to the exhibition area and take action (Moreno et al., 2019). Consequently, the collaborative efforts of tourists and local authorities in the context of cultural tourism represent a crucial aspect of sustainable development (Moreno et al., 2021).

The study employs text mining and machine learning models to analyse the content of reviews of the museum in Italy using the latent Dirichlet allocation topic modelling method and both basic and latent topics related to museums in general were elucidated. Accordingly, the reviews are classified into three categories: cultural assets of the museum, tourist experiences, and museum services. According to the results, individuals who provided commentary in the language of the country predominantly utilised expressions pertaining to the substance of the museums, whereas in foreign language comments, it was evident that they made assertions concerning the services offered by the museums (Riva and Agostino, 2022).

In a comprehensive study examining visitor comments on museums in London, a structural topic modelling method was employed. The results indicated that while certain aspects, such as museum fees, toilets and queues, were perceived negatively, the location, food and child-friendly facilities were rated more positively (Alexander et al., 2018). In a further study on museums in London employing machine learning, the most frequently mentioned elements by visitors were found to be core offerings, peripheral services, ambience and personal experience (Huo et al., 2024).

Methodology

In this study, online user reviews on all museums in Kazakhstan on the Tripadvisor website were subjected to text mining analysis. As of August 2024, a total of 139 museums are listed on the Tripadvisor website (Tripadvisor.com, 2024). Nevertheless, 58 of the museums lack any reviews, while 20 of them have only one. Nevertheless, the eight museums appear to be duplicated. A total of 1795 reviews were identified for 139 museums. In consideration of the consistency of the data and the effectiveness of the museums, museums with a minimum of five reviews were included in the study. In this context, the research included 45 museums and 1729 total reviews. For handling the language translation issues, The Python langdetect

library first detected non-English reviews. After this phase, every non-english reviews were translated in English to prepare the sentiment analysis.

Following the extraction of the data, it was subjected to a series of processing steps. In this phase, the text set's uppercase letters were converted to lowercase, numbers were extracted, and English stopwords were identified. Additionally, regular expression tokenisation was employed. Furthermore, relative document frequency was employed to guarantee the semantic integrity of the words in the data set and to discount the influence of words that are used less frequently, with a range of 0.01 to 0.95 being maintained. This process allowed us to identify the relevant range, ensuring that the semantic integrity of the topic model would not be disrupted while simultaneously eliminating words that occur in almost all reviews, such as "museum." To facilitate the grouping of words and classification of reviews, the WordNet Lemmatizer was employed in the dataset. Following this, tokens were created and the corpus was made ready for analysis.

Following the completion of the preprocessing phase, a sentiment analysis was conducted on the processed corpus. Sentiment analysis is defined as the process of detecting and classifying emotional expressions in texts using natural language processing (NLP) and machine learning techniques. This analysis typically facilitates an understanding of the sentiments expressed by users by determining the emotional tone of texts (Hovy, 2015). In the context of sentiment analysis, a compound score was generated for each sentence using the VADER model. VADER is a lexicon-based approach to sentiment analysis that calculates the overall sentiment score of a text and determines whether the text is positive, negative, or neutral. Furthermore, it permits the measurement of the emotional intensity of the text. Consequently, users can adapt VADER by incorporating their own lexical lists and scoring systems (Hutto and Gilbert, 2014). This approach has been employed in numerous tourism studies, spanning from the hotel industry to destination attractions (see Cherdouh et al., 2022; Khumtaveeporn & Wattanasuwan, 2023).

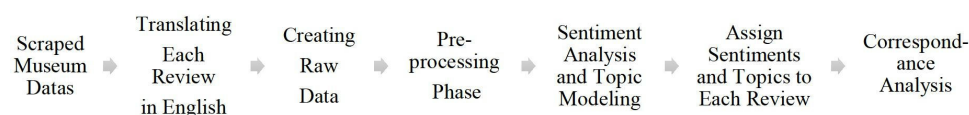
Following the completion of this stage, topic modelling was employed. Topic modelling is an unsupervised machine learning model that is also used for text mining. The process of topic modelling involves the automatic extraction of meaningful topics or themes from large sets of text data. This method facilitates the clustering and analysis of data by identifying the principal topics present within the texts. The objective of this process is to identify similarities and patterns within text collections, thereby facilitating a more comprehensive understanding of big data. In particular, when studying extensive datasets, manual analysis can prove to be both time-consuming and challenging. (Sutherland, 2020). In this context, the Non-Negative Matrix Factorisation method, a frequently employed technique in the domain of text mining, was implemented. This method is a highly effective technique for the analysis and interpretation of text data. The NNMF method assists in the identification of latent themes or topics by decomposing text documents into their constituent components. By expressing a document-term matrix as the product of two sub-matrices, NNMF elucidates the topics present in each document and the words used to represent written topics (Zhang et al., 2019). This approach facilitates the comprehension of the latent structures inherent within the textual data. The orange data mining program was employed for the analysis process at all stages (Demsar et al., 2013).

Following the topic modelling process, each sentence is assigned a probability value corresponding to the identified topics. The sentence with the highest probability value is then classified according to the relevant topic. Once this process was complete, the distribution of travel types and topics derived from the data set, along with the distribution of topics among the reviews made by visitors belonging to a specific travel type, were presented through the lens of correspondence analysis. This method is a technique employed

for the visual representation of categorical data, with the objective of elucidating the relationships between categories (Nowacki and Niezgoda, 2023). Consequently, the topics derived from the travel types were visualised using this method. The fundamental workflow chart for this study is presented in [Figure 1](#).

Figure 1

Workflow Chart of the Study

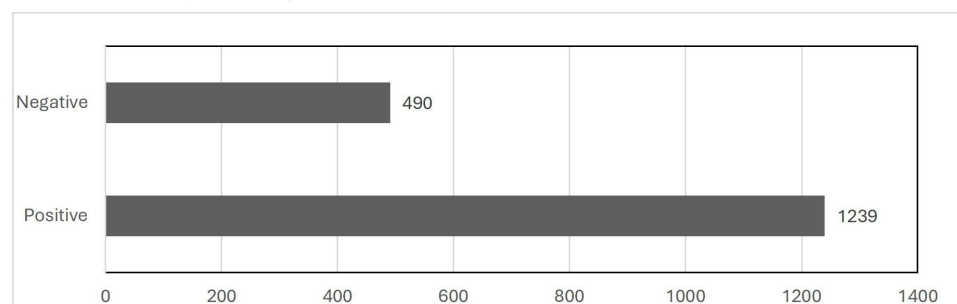


Findings

The reviews under consideration were subjected to sentiment analysis using the VADER method. The compound score for each review was then created and classified as positive or negative according to this score. Given the paucity of neutral compound scores in the research model, this score was optimised based solely on positive and negative sentiments. The categorisation of reviews in the dataset as either negative or positive was determined by the VADER algorithm, with values between -1 and 0 denoting negative sentiment and values between 0 and 1 denoting positive sentiment. The VADER algorithm defines a value of 1 as indicative of a positive sentiment, whereas values between 0 and -1 are defined as negative. The application of this process to the dataset resulted in its classification into two groups: 71% of the 1729 reviews were positive, while 28.34% were negative. As demonstrated in [Figure 2](#), the dataset under scrutiny predominantly contains favourable reviews, with a preponderance of positive sentiment.

Figure 2

Sentiment Classification of Reviews



Following the determination of the sentiments of each review, topic modelling was performed using the NNMF model for each review. During the topic modelling process, the topic coherence score and the semantic integrity of the words within the clusters were considered. As NNMF is an unsupervised machine learning method, the presence of a limited number of topics results in the most frequent words within the dataset being allocated to each group. This, in turn, hinders the discernment of semantic integrity and the classification of reviews. Conversely, an excessive number of topics may result in the inclusion of words that appear less frequently in the dataset, leading to a lack of clarity in the classification of texts. To address these challenges, a decision was made to identify four primary topics and 12 latent topics, with the objective of preserving the semantic integrity of the words within each topic and ensuring the distribution probabilities of words within topic clusters. The obtained topics were then titled and ordered according to their semantic meaning and probabilistic distribution.

The related analysis shows that most visitors commented on the exhibitions and the internal structure of the museums. In this context, the initial topic was identified as the exhibition. The subjects that were mostly expressed in this group were musical, paintings, indoor, and history topics that constituted “exhibition” topic.

Second, it can be observed that visitors to the museum use expressions that not only reflect the interior of the museum but also the destination and the external structure of the museum. In this way, the topic was revealed as a location and the buildings therein, and the primary title was thus designated as “outside.”

Another issue that has been identified by those who have visited museums is the words used to describe the services that museums offer. As evidenced by other studies on the subject, museums provide many services. In the dataset under consideration, it was observed that the terms “price and payment,” “shopping,” “staff attitudes,” and “guiding” were used to express the “services” topic provided by the museum.

Additionally, it was observed that visitors also frequently cited the quality of their experience as a key topic in their reviews. The research findings also indicate that visitors expressed statements related to their experiences. Within this context, it has been observed that visitors shared their impressions from museum visits and made statements regarding recommending it to others and their intention to revisit. In this regard, the topics of “impression” and “revisiting intention” have been frequently articulated, forming the topic of “experience”.

In this regard, the following tables illustrate the topics obtained with the NMF model, together with the tokens that constitute these topics and the distribution of these tokens within the relevant topic. In addition, the section on the latent topic distribution is presented at the top of the topics above the tokens of each cluster. This section illustrates the general distribution of the topics throughout the dataset. The tables present the primary topics identified from the visitor reviews, with the subtopics and associated words presented in the subsequent rows.

As illustrated in [Table 1](#), the initial topic derived from the dataset using the Non-negative Matrix Factorization (NMF) algorithm is displayed. The relevant table illustrates the contents of the words about exhibition pieces by the museums, as well as topics related to the museum’s internal structure and design. An initial observation of the first topic reveals a higher frequency of expressions related to music among visitor mentions. Within the initial segment of the primary theme, individuals employed terminology related to music in their descriptions of their visiting experience. Furthermore, The second sub-topic in the exhibition part characterises the utilisation of words related to painting, indoor and history. As illustrated by [Table 1](#), the words related to music in this sub-topic constitute 9.72% of all 12 sub-topics in all reviews, as indicated by the LTD score. Additionally, visitors have made statements regarding the paintings they saw in the museums and the culture and history of Kazakhstan. Furthermore, it has been noted that words related to the museum’s internal structure, such as the display methods of the exhibits and the layout, are expressed. Consequently, the exhibition topic has been classified as musical, paintings, indoor and history latent topics.

Table 1*Exhibition*

Main Topics:		Exhibition						
Latent Topics:	Musical		Paintings		Indoor		History	
Token1	instrument	0,0315	painting	0,0692	hall	0,03478	history	0,04222
Token2	musical	0,031	art	0,03104	display	0,0283	kazakhstan	0,03871
Token3	different	0,0282	sculpture	0,01881	jewellery	0,02802	culture	0,03312
Token4	kazakh	0,0203	collection	0,01839	floor	0,02753	learn	0,01885
Token5	traditional	0,0201	soviet	0,01799	complex	0,02548	gold	0,01751
Token6	wooden	0,0178	kazakh	0,01768	room	0,0234	man	0,01688
Token7	music	0,0176	contemporary	0,01555	live	0,021	interesting	0,01646
Token8	impress	0,0161	piece	0,0151	place	0,01965	ancient	0,01453
Token9	laid	0,015	gallery	0,01475	living	0,01818	dedicated	0,01384
Token10	art	0,0146	artist	0,01389	entrance	0,01723	karlag	0,01266

The second table appears to be related to the external aspects of the museums, with “outside” identified as the primary topic. This primary theme is further subdivided into two latent themes. The initial category encompasses terms associated with the museum’s geographical location, such as city, beauty, bus, located, and area. This is designated as a “location” due to its correlation with the geographical positioning of museums and their accessibility. The second theme is labelled “buildings” because it consists of words that pertain to the museum’s external structure and architectural design.

Table 2*Outside*

Main Topics:		Outside		
Latent Topics:	Location		Buildings	
Latent Topic Distribution (LTD):	LTD	0,0776	LTD	0,0704
Token1	city	0,0629	architecture	0,0418
Token2	beauty	0,0385	place	0,0262
Token3	park	0,0276	building	0,0254
Token4	located	0,0232	astana	0,0194
Token5	bus	0,0231	soviet	0,01931
Token6	place	0,0214	see	0,0179
Token7	area	0,0154	modern	0,0176
Token8	village	0,0146	interesting	0,0151
Token9	walking	0,0133	great	0,0145
Token10	region	0,0133	kazakhstan	0,0129

The third table, which pertains to the facilities and services provided by the museums, is thus designated “Services.” As was observed in the primary category of services, it incorporates terms such as “ticket,” “tenge,” “cheap,” “fee,” and “entrance,” which is the rationale behind the designation of the initial latent category as “price and payment.” The second group is labelled ‘shopping’ due to a higher distribution of words such as “shopping,” “gift,” and “item” within that cluster. The third group consists of words related to staff and their behaviours, such as ‘staff’ and ‘helpful’. Consequently, it is deemed appropriate to designate this group

as “staff attitudes.” The final group, designated “guiding service,” pertains to words associated with the guidance provided by the museum, including “guide,” “english,” “entrance,” and “audio.”

Table 3

Service

Main Topics:			Service					
Latent Topics:	Price and Payment		Shopping		Staff Attitudes		Guiding Services	
Latent Topic Distribution (LTD):	LTD	0,0404	LTD	0,0608	LTD	0,0659	LTD	0,0592
Token1	kzt	0,0263	shopping	0,0393	staff	0,0411	guide	0,0224
Token2	ticket	0,0228	russian	0,039	helpful	0,0339	english	0,022
Token3	tenge	0,0208	item	0,038	complex	0,033	entrance	0,0196
Token4	cheap	0,0205	gift	0,0259	asked	0,0231	tenge	0,0192
Token5	spend	0,019	cafe	0,0232	guide	0,0223	hour	0,0188
Token6	fee	0,0181	cost	0,0196	information	0,0184	ticket	0,0177
Token7	free	0,0158	paid	0,0175	help	0,0152	audio	0,0175
Token8	entrance	0,0157	opened	0,0175	visitor	0,0146	country	0,0173
Token9	information	0,015	fee	0,0163	expect	0,0135	learn	0,0168
Token10	name	0,0144	asked	0,0162	enter	0,0133	room	0,0154

The fourth table presents a series of positive practices that visitors have reported during their museum visits. In their reviews, visitors have employed words such as “fascinating,” “nice,” and “spacious” to express their level of satisfaction with the museums. Furthermore, some visitors have employed stronger expressions such as “great,” “highly,” and “recommended” in their reviews, which are thus classified as “revisit intention.” The comprehensive categorisation of these expressions under the overarching theme of “experience” provides a comprehensive framework for understanding visitor perceptions.

Table 4

Experience

Main Topics:			Experience	
Latent Topics:	Revisit Intention		Impression	
Latent Topic Distribution(LTD):	LTD	0,087	LTD	0,1063
Token1	great	0,0403	fascinating	0,0664
Token2	amazing	0,0303	nice	0,0409
Token3	highly	0,0273	spacious	0,0304
Token4	recommended	0,0166	beauty	0,03
Token5	interesting	0,0164	astana	0,0229
Token6	stunning	0,0155	item	0,0222
Token7	place	0,0145	presented	0,0216
Token8	thanks	0,0139	karaganda	0,0206
Token9	people	0,0131	huge	0,02
Token10	helpful	0,0127	gulag	0,0196

As demonstrated in [Figure 3](#), an illustrative review is provided from the dataset. The statements in this review are divided into tokens in accordance with the criteria established during the preprocessing phase.

The distribution of phrases across the 12 topic clusters is illustrated according to the aforementioned tokens. As demonstrated in the accompanying example, expressions related to music are utilised with increased frequency, thus indicating a propensity to congregate more closely within Topic 1, which has a probability distribution score of 0.951753. Consequently, the review is classified and labelled as belonging to topic 1, which is designated as “musical.” It is evident that visitors tend to mention numerous topics in their reviews due to the multifaceted nature of museum experiences. In this particular instance, the visitor predominantly employed tokens related to musical artefacts and contents in their review. The probability score assigned to the review indicates its classification within the musical category. The compound score, determined using the VADER algorithm, was 0.571.

Figure 3

A Sample Review Showing the Probabilities of the and Topic Distributions and the Compound Score

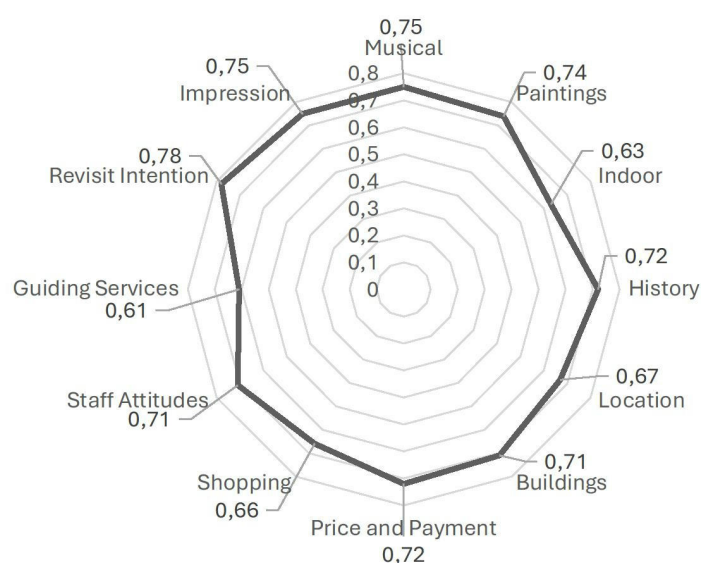
Review:	Musical history The musical instruments museum is located in one of the prettiest buildings in Almaty, a fairytale wooden house from the early 20th century resting in Panfilov Park. The museum displays an array of musical instruments of traditional Kazakhs.										
Rating:	4										
Date:	2023										
Topic 1:	0.951753										
Topic 2:	0										
Topic 3:	0										
Topic 4:	0										
Topic 5:	0										
Topic 6:	0										
Topic 7:	0										
Topic 8:	0										
Topic 9:	0										
Topic 10:	0										
Topic 11:	0										
Topic 12:	0										
compound:	0.5719										
Type:	Friends										
Language:	ENG										
Tokens & Tags:	musical	history	musical	instrument	located	building	almaty	wooden	house	20th	century
	panfilov	park	display	musical	instrument	traditional	kazakh				

Once the topics had been identified, the mean compound scores for each topic were determined. The compound scores associated with the revealed topics and their distributions are presented in [Figure 4](#). Accordingly, the topic with the highest positive compound score is "revisit intention," followed by "impression" and "musical". It is noteworthy that the presence of more positively expressed reviews related to "experience" and "impression" naturally indicates the higher compound scores for these two groups. Furthermore, in Kazakhstan, the topics of "musical", "paintings", and "history" have been the subject of more positive expression by visitors. Furthermore, the unique artefacts exhibited in Kazakhstan's museums, including those of history, musical instruments, paintings, and other pertinent displays, were met with a favourable and positive response from visitors. However, with regard to the exhibitions, the interior design, in terms of the arrangement and presentation of the exhibits in the museums, has a lower compound score than other latent topics within the exhibition main topic.

A subsequent examination of the name of the "outside" topic reveals that the scores are comparable to the overall average compound score. Conversely, the latent topic of "location" exhibits a slight decline, falling below the average. Of particular note are elements such as parks, transportation, and buses, which fall

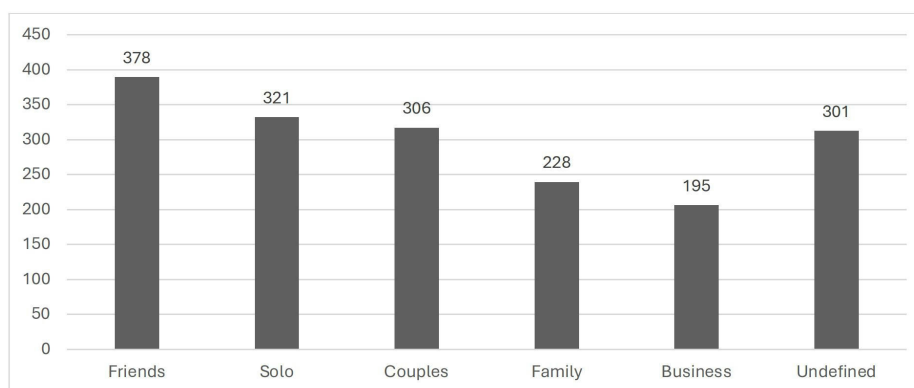
within this category and demonstrate a potential need for further development in these areas. Additionally, with respect to the services offered by museums, it is observed that positive sentiment is conveyed less frequently in relation to guiding and shopping services. Conversely, the categories of "staff" and "price and payment" have been evaluated favourably. This discrepancy may be attributed, at least in part, to the policy of free admission to certain museums and the relatively modest costs associated with visiting. Additionally, the staff topic of "helpful" has garnered predominantly positive feedback. In this context, visitors predominantly describe staff attitudes in positive terms. However, issues have been reported regarding the quality of guiding services, particularly in relation to translation, labelling and the provision of information in multiple languages.

Figure 4
Spider Chart of the Mean Compound Scores of Per Topic



After this stage, correspondence analysis is implemented in order to reveal the clusters between topics and traveller types. As illustrated in [Figure 5](#), the distribution of traveller types in the dataset is presented. The findings indicate that most museum visits are made by friends. Conversely, solo travellers, couples, families and business travellers follow this type, respectively. It is noteworthy that a proportion of the reviews did not specify their travel type, which consequently did not contribute to the associated analysis.

Figure 5
Frequency Distribution of Traveller Types of Museums.



As illustrated in Figure 6, the resultant clusters indicate the correlation between traveller typology and the subjects of their reviews. This analysis enables the identification of the traveller types with a higher propensity for composing reviews on specific topics within the dataset. The application of correspondence analysis elucidates the interrelationships between the discussed topics according to the different types of travel. In the reviews published on the Tripadvisor website, visitors indicate the means by which they travelled to the locations they visited. The website then classified these travel types into the following categories: business, couples, family, friends, and solo. Users are then enabled to select the category that best aligns with their travel experience. The alignment analysis subsequently demonstrates which of the 12 topics generated through topic modelling are more frequently addressed by participants of each travel type.

At this juncture, it is evident that the group categorised as "friends" has engaged in discourse on subjects such as shopping, location, and history with greater frequency and in greater detail in their reviews. Conversely, individuals categorised as "solo travellers" appear to prioritise historical and artistic artefacts in museums, encompassing the subject of exhibitions. A similar tendency was observed among couples who also shared their experiences regarding the exhibits in museums. A notable observation is the increased engagement exhibited by families and friends, who demonstrate a closer alignment with exhibition topics in comparison to solo and couples travellers, and to a greater extent than business travellers.

In relation to the expression of intention to revisit, it has been observed that families, solo travellers and couples have referenced this more frequently than other groups. These groups were also found to be concentrated in proximity to the exhibition topic. Consequently, the presentation of local and distinctive artefacts of Kazakh culture assumes significant importance in fostering revisit intentions among these groups. The topic of impressions was also found to be closely related to the intention to revisit, and this relationship was observed to be consistent across different traveller groups, including couples, solo travellers and families.

As previously stated, the services provided by the museum are categorised into four distinct groupings. As illustrated in Figure 4, these subjects were arranged in a distinct sequence. Each of the four subjects was associated with a distinct category of traveller. As previously mentioned, friends are more likely to mention shopping experiences during their visit. Conversely, staff attitudes are positioned near solo and couples. With regard to other service topics, guiding was identified by both business and family groups as containing the greatest number of negative elements in the dataset according to compound scores. It is recommended that museum management consider ways to enhance guiding services to meet the needs of these two traveller types. The issue of cost and payment emerges as a salient concern for business travellers. The discourse on fees and museum entry is also relevant in this context. When considering the income level of business travellers, it is notable that they expressed positive sentiments regarding the cost of museum tickets and other associated fees.

The NMF results identified a second topic based on building and location, which was labelled 'outside'. The building theme is situated in close proximity to both couples and individuals. Conversely, the building is situated in close proximity to nearly every exhibition topic. Consequently, most visitors consider the building topics in conjunction with the exhibition topics. However, it is important to note that the location is positioned far from the building topic. Consequently, the majority of visitors rarely provide reviews on the location, with the exception of their acquaintances.

Figure 6*Correspondance Analysis of Traveller Types and Topics*

Conclusion and Recommendation

Museums represent an indispensable component of any destination offering tourism services, and they are one of the most important factors attracting millions of tourists from different parts of the world. As has been extensively documented, museums play a pivotal role in enhancing the destination image, fostering local economies, providing educational opportunities for visitors, and strengthening the bond between local communities and regional cultures.

It has been demonstrated that reviews on museums on digital platforms such as Tripadvisor constitute a substantial dataset that offers insights into visitor experiences and perceptions. These reviews highlight the strengths and weaknesses of museums, thereby providing potential visitors with guidance and offering managers the opportunity to enhance service quality (Çolak and Karakan, 2024). In academic discourse, such user feedback assumes a pivotal role in studies of tourist behaviour and satisfaction. An understanding of visitors' experiences and emotional connections is fundamental to the development of effective marketing strategies and exhibition designs for museums. The employment of natural language processing methodologies in the context of text mining facilitates the identification of implicit yet significant elements within visitors' expressions as captured by surveys. This approach enables the acquisition of more specific information from the survey questions, thereby assisting museum administrations in directing their efforts towards specific areas of focus.

The increasing accessibility of technological resources, the pervasive use of social media, and the enhancement of other tourism-related prospects have precipitated a surge in the number of individuals

visiting unique destinations. Additionally, destinations within the Central Asian region are becoming significant tourist attractions due to the offerings of their natural and cultural attractions. Kazakhstan, a prominent destination in this region, plays a notable role, particularly in terms of its cultural heritage and the museums that showcase these values. This study employs text mining and machine learning techniques to analyse online user reviews of museums in Kazakhstan on the Tripadvisor website. The objective of this study was to identify the key topics and their sentiment positions for each traveller type. The primary analysis of sentiment was conducted using the VADER method, which resulted in the calculation of a compound score for each review. This approach was undertaken with the objective of elucidating the intensity and direction of sentiment on the topics to be derived from topic modelling with the Non-negative Matrix Factorisation (NNMF) method.

The results of the study demonstrate that reviews of the contained museums can be broadly classified into four main categories: "exhibition", "outside", "services" and "experience". These categories are further subdivided into several fundamental classifications. The "exhibition" category encompasses subjects such as musical instruments displayed in museums, traditional elements related to music classified under "musical", as well as paintings exhibited and topics of Kazakh culture. Furthermore, historical events, figures, and artefacts classified under "history" are also covered. Additionally, consumers have identified the interior design of museums and the presentation of exhibits as significant topics, and these are therefore categorised under the heading of "indoor". Visitors' feedback regarding the museum's location and the external architectural design has been collated and is addressed under the "outside" category.

The services provided by museums and utilised by consumers can be fundamentally categorised into four groups. These include the attitude of the museum staff, the guiding services, the pricing and payment for tickets and purchased items, as well as the shopping opportunities available within the museums. A further salient aspect pertains to the notion of "experience", which is understood to reflect the individual perceptions and impressions of visitors. In this context, visitors have articulated their sentiments through the concepts of "impression" and "revisit intention" in their reviews.

Following the identification of the topics, text classification was conducted, and the sentiment states of the topics were determined based on the obtained compound scores. In consequence, within the category of exhibitions, expressions related to music, history, and paintings constitute the most positive group. In this context, visitors expressed satisfaction with the content of the exhibits presented in museums in Kazakhstan. The exhibits reflect nomadic culture, Kazakhstan's diverse geographical micro and macrohistories, and developments during the Soviet and post-Soviet periods. These influences have shaped the content of the museums in various ways, facilitating the display of diverse artefacts. However, the internal structure of the museums emerged as a topic that elicited more negative sentiments compared to the other three groups related to these exhibits during our research. It can be reasonably deduced that the level of visitor satisfaction could be significantly improved by implementing enhancements such as optimised lighting and improved way finding within museum interiors, coupled with an increase in the quality and depth of the exhibited content and artefacts.

Visitors also consider external factors in addition to the museum itself. Specifically, the location and architectural design of the building are of significance, as evidenced by the findings of our analysis. Conversely, the quality of museum services exerts a substantial influence on visitor satisfaction levels within museums in Kazakhstan. Within this conceptual framework, visitors expressed predominantly positive sentiments regarding the conduct of the museum personnel. However, the quality of the guiding service is

perceived more negatively than other aspects of museum services. It is imperative that museums prioritise the wider availability of technological resources related to guiding, as well as providing visual and auditory translation options and printed materials in various languages. The provision of information about the exhibits in multiple languages is of considerable importance. Conversely, reviews on shopping opportunities exhibited a comparatively lower level of satisfaction compared with the other two services. Consequently, it can be deduced that enhancing the structures, facilities, and contents related to shopping would result in an improved quality of service.

Another frequently discussed topic among visitors is their experience. In this regard, visitors offer both their impressions of the museum and their intentions regarding future visits. The majority of these expressions are derived from positive sentiments. The distinctive artefacts and content provided by the museums, the external structure of the museum, the opportunities afforded by its location, and the services offered by the museum emerge as significant factors influencing visitor satisfaction, as reflected in their comments.

A greater number of reviews from visitors in the friends group were observed in relation to the exhibition, the location of the museum, and the shopping opportunities available at the museum. Given that individuals within this demographic are typically younger or middle-aged, it can be noted that the provision of shopping options tailored to this age group may result in enhanced levels of satisfaction. Furthermore, an expansion of the facilities in the vicinity of the museum may have a beneficial impact on the frequency of visits by this group.

In conclusion, it appears that the visitor satisfaction levels achieved by museums in Kazakhstan are satisfactory overall. Nevertheless, the quality of services and the internal structure of museums could be improved to enhance visitor satisfaction even further. Such enhancements would serve to elevate Kazakhstan's tourism potential while also attracting visitors from a range of countries.

While offering significant insights into visitor sentiments and topic preferences regarding museums in Kazakhstan, this study contains certain limitations that should be acknowledged. First, the data was solely collected from TripAdvisor, which may not fully capture the diversity of visitor opinions available on other digital travel platforms or local travel forums. Second, the dataset comprises 1729 reviews from 45 museums, reflecting only those institutions with at least five visitor reviews, as this threshold was applied to ensure a minimum level of data reliability. However, this criterion naturally led to the exclusion of many smaller or less frequently visited museums, which may offer different visitor experiences that are not fully captured in this analysis. Additionally, the distribution of reviews is not uniform; a notable proportion of the data comes from a few museums with higher visibility—such as the Museum of Folk Musical Instruments—which may have influenced the overall thematic representation in the findings. For this reason, a complete list of all museums included in the analysis, along with their respective review counts, is provided in Appendix 1.

For this reason, future studies in this field may consider the use of diverse websites and platforms that enable visitors to share their opinions about museums. Furthermore, the employment of additional sentiment analysis, topic modelling and text classification methods and approaches could lead to the identification of novel types or structural types of topics and should apply review-level weighting techniques to mitigate the overrepresentation of high-volume museums and balance topic distributions accordingly. Additionally, examining sentiment and mentioned topics according to time may reveal visitor trends and preferences in museums for Kazakhstan. Moreover, the application of diverse algorithms and methods in the analysis of museum reviews on digital platforms can facilitate the extraction of more specific micro-information. This approach will facilitate a more nuanced understanding of visitor expectations and challenges,

paving the way for future studies that may employ sophisticated analytical methods such as two-gramme approaches, co-occurrence analysis, and network analysis.



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Appendix

Appendix 1

List of Museums and Number of Reviews

Name of the Museums	Number of Reviews
National Museum of Kazakhstan	371
Central State Museum of Kazakhstan	315
Museum of Folk Music Instruments named after Yihlasa	196
Музей Искусств Республики Казахстан им. Кастеева	88
President`s Centre of Culture & Museum	74
KarLag/Museum of Political Repression Victims'	72
Memory of the Dolinka Settlement	
Museum of the Baikonur Cosmodrome History	56
Museum of Archaeology of RSE Gylm Ordasy	48
Alzhir, Memorial Museum of Victims of Political Repression and Totalitarianism	37
Eastern-Kazakhstan Regional Architecture and Ethnographic Museum Reserve	33
House-Museum of E.I. Pugacheva	29
Karaganda Regional Museum	28
Museum Of Almaty	27
Saken Seifullin Museum	24
Regional History State Museum GKKP	23
Museum of Victims of Political Repression	23
Atyrau National History Museum	21
D.A. Kunayev Museum	20
Kazakhstan Military History Museum	19
Art Museum Nevzorovyh	17
The Museum of the First President of the Republic of Kazakhstan	16
Ecomuseum	14
Museum of Geology of the Republic of Kazakhstan	12
Karaganda Regional Museum of the Fine Arts	10
The Regional History Museum	10
Temirtausky City Local Lore and History Museum	9
Regional Local Lore and History Museum	9
Museum Old Oral	9
Mangystau Regional Local History Museum	9
Museum F.M. Dostoyevskogo	8
Pavlodar Regional Art Museum	8
National Museum of Abai	8
North Kazakhstan Regional History and the Local Lore Museum	8

Name of the Museums	Number of Reviews
Kulanshi	8
The Museum Complex Residence Abylai Khan	8
Arvest Art Gallery	8
Toy Museum	7
Military-Historical Museum	7
The Nature and Ecology Museum	6
Eastern-Kazakhstan Art Museum	6
Issyk State Historical and Cultural Reserve-Museum	6
Has Sanat	6
Ancient Taraz Archaeological Park and Museum	6
Academician E. Buketov's Memorial Museum	5
Geological Museum	5